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Legislation by Agenda-Setting: Assessing the Media's Role in the Regulation of Bisphenol A in the U.S. States

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Starting in 2008, debate about potential hazardous effects from exposure to bisphenol A (BPA) migrated from the pages of scientific journals to the U.S. media, regulatory authorities, and state legislatures. In the context of deep scientific conflict about the existence of adverse health effects attributable to BPA, this article asks why it was the case that some state legislatures considered or adopted legislative bans on products made from BPA, whereas others did not. Drawing on existing theories of agenda-setting and policy change via punctuated equilibrium as well as a well-defined methodology (event history analysis), evidence of agenda-setting is presented. Particularly, it is argued that routine and high-impact health coverage was significantly related to the chance that a state legislature considered legislation banning products made with BPA. This was indirectly, but importantly, related to the actual adoption by state legislatures of legislative bans on products made with BPA.

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INTRODUCTION AND THEORETICAL FRAMEWORK

Since 1997, some scientists and environmental groups have expressed concerns about the consequences for human health posed by the common chemical bisphenol A (BPA), which is widely used to harden plastics in bottles and create effective sealants in jars. From 1997 to 2008, concerns about this chemical were primarily restricted to the pages of scientific journals and a small circle of regulatory authorities, scientific researchers, industry representatives, and social movements. In 2008, however, the controversy spread to European and North American media agendas with impressive speed and force. In the wake of this explosion of media interest, nine American states (Massachusetts, Vermont, Minnesota, Wisconsin, Washington, Maryland, Maine, and New York), four national governments (Canada, Denmark, the United States, and France), and the European Union have issued substantial regulatory prohibitions on the use, manufacture, sale, or import of products made from the chemical, primarily polycarbonate baby bottles. It is argued here that media coverage played an important role in shaping the legislative process across the U.S. states. Although there is a well-established literature that examines the diffusion of policies across U.S. states, these studies have tended to ignore the effects of within-state media coverage, emphasizing instead the demographic characteristics of individual states (Berry, 1990), networks of professional policy entrepreneurs (Mintrom, 1997), or, at best, levels of national media coverage (Hays, 1997). However, there are good empirical and theoretical reasons to think that within-state media coverage should play a role as well.

This article begins by presenting a theoretical framework for why we would expect within-state media coverage to have shaped the legislative process. Then it reviews the scientific debate about the potential hazards from exposure to BPA with the goal of establishing the case that there is no scientific consensus that humans are at risk of adverse health effects at current levels of exposure. Then it introduces a statistical methodology that is well suited to test the hypothesis that media coverage shaped the legislative process and details the control variables and data-collection procedures. Last, it presents the results of two model fittings that establish that media coverage—particularly critical, high-impact newspaper coverage—shaped the diffusion of legislative bans on products made from BPA in U.S. states by spurring the consideration of legislation in prolonged, multiyear processes.

One finds some direct empirical evidence for the starting hypothesis in Brewer and Ley (2011), who conducted a survey of residents of Milwaukee, Wisconsin, in the wake of a high-profile advocacy campaign about BPA by

the *Milwaukee Journal-Sentinel*. The survey found that newspaper use was significantly related to self-reported behaviors aimed at avoiding exposure to BPA. Newspaper coverage, it seems, was able to concern citizens sufficiently to change their behavior.

One finds theoretical justifications for this hypothesis in the voluminous literature on agenda-setting. The power of the mass media to impact what citizens deem to be important (the agenda-setting power) is very well documented, particularly for issues that citizens do not experience in a direct fashion, such as environmental issues (Behr & Iyengar, 1985; Erbring, Goldenberg, & Miller, 1980; McCombs & Shaw, 1972). Moreover, there is equally strong evidence that newspaper coverage can influence what politicians deem to be important issues. In his study of national-level agenda-setting dynamics, Soroka (2002) distinguished between the media, public, and the government's agenda, arguing that the news media could directly influence the policy agenda, because politicians use the news media as a source of information of what constitutes an issue or problem. In addition, Cook, Tyler, Goetz, and Gordon (1983) and Protess et al. (1987) found evidence that increased coverage of an issue can make it more salient for elites, even in the absence of effects on mass opinion. At the municipal level, Mead (1994) found evidence that the local newspaper was a major factor in pushing municipal government reform onto the policy agenda over a prolonged period.

Other evidence suggests that this dynamic occurs specifically in the domain of U.S. state legislatures as well. For example, Bybee and Comadena (1984) found that newspapers were among the most frequently used sources for information by legislators in Indiana. Herbst (2002) found that legislative staff regularly relies on the news media as a source of information and as a proxy measure of public opinion, suggesting an indirect route for media influence. Another study of the Louisiana state assembly found that nearly all legislators surveyed felt newspapers served as a source of information for their legislative activity, regardless of whether they thought newspapers provided balanced and accurate coverage (Kral, 2003, p. 46). These trends are reflected in a quantitative analysis of the relationship between the media agenda and the state policy agenda: Tan and Weaver (2009) found moderate to high correlations between the number of stories dedicated to any given issue in a state's newspapers and the number of legislative bills introduced in that session. Thus, media coverage can increase the salience of any given issue for citizens, but it can also increase the salience of any given issue for politicians. There is evidence of this at the state level.

But this body of evidence does not, in and of itself, explain policy change. For that, it is necessary to adduce a theory of policy change via a process of

punctuated equilibrium developed by Baumgartner and Jones (2009).¹ This model suggests that specialists and insiders construct “policy images” out of both factual and emotive elements that buttress a policy monopoly and contribute to stability and stasis in any given policy field. This policy image—a concept operationalized by measuring both the quality and quantity of media coverage—is crucial to the stability of the policy monopoly because it is almost the only contact that most citizens have with the respective policy.

Specialists, experts, and others with an economic interest in the nature of public policy in a particular area are the dominant makers of public policy in that area. Because the interested share preferences, or at least share understandings concerning the basic dimension of conflict, the paradox of voting does not arise. The policy system is stable because those participating share values. (Baumgartner & Jones, 2009, p. 19)

However, this stability—or equilibrium—is only ever partial. When that policy image—the quality or the quantity of media coverage—changes substantially, that policy monopoly breaks down.

In the process of agenda-setting, the degree of public indifference to given problems changes dramatically. Since this is the structure on which policy sub-systems are based, it should not be surprising if periods of agenda access are followed by dramatic changes in policy outputs. Indeed, this is precisely why policy entrepreneurs fight so doggedly either to push their issue toward the public agenda or to ensure that it not arrive there. (p. 20)

Three studies of the role of media coverage in the fields of technology and environmental health support the argument that changing levels and content of media coverage can play an important role in shaping policies. Scheberle (1994) found that a dramatic and sudden spike in national media interest about the health effects of radon exposure was necessary to force formal action by national legislators, whereas in the case of asbestos, a sustained and constant period of media coverage forced the issue onto the formal agenda. Nisbet and Lewenstein (2002) found that in the 1970s, newspapers

¹This model of policy change via punctuated equilibrium was developed primarily in contrast to previous models of policy change that emphasized stasis or incremental changes (e.g., Wildavsky, 1964). The relationship between the use of punctuated equilibrium in political science and Wildavsky’s theory of budgetary incrementalism is analogous to the relationship between punctuated equilibrium’s role in evolutionary biology, where it is contrasted to the previous theory of phyletic distinction, which posited steady, slow, and gradual evolution (Eldredge & Gould, 1972).

covering biotechnology predominantly emphasized its contribution to “progress,” although there was also a cluster of stories raising questions about the ethics and public accountability toward such technology. This pattern contributed to a growing trend by local authorities to try to regulate biotechnology (p. 378), as well as a reaction by scientists, seeking to form a consensus around the importance of scientific autonomy in research. But in the latter half of the 1990s, the policy image of biotechnology shifted again in reaction to announcements about risks of gene therapy and possible ecological consequences from genetically modified foods. This change in policy image contributed to changes in policy at the national level including to the repeated introduction of legislation that would ban human cloning. Last, Pralle (2006) related a dramatic increase in Canadian coverage of domestic pesticide use between 1999 to 2002 to an explosion in municipal bylaws controlling pesticides from 2002 to 2005.

Thus, existing policies that seem to be stable and resistant to change are not the way they are because of aggregated preferences. They are made that way by those actors that have a compelling interest in the outcome of any given regulatory processes. However, when the composition of those who are aware of the regulatory process in any given policy field changes, that is, when public attention is aroused by media coverage, the actors involved begin to make different decisions. New majorities can emerge and seemingly stable policy subsystems can change quite quickly.

Last, there also exists good evidence to suggest that the public carries an intrinsic skepticism toward technological and scientific innovations in general that could be triggered simply by an increased salience of a scientific debate about the risks posed by BPA. For example, Mazur (1981) identified moderate correlations between the level of coverage given toward fluoridation and nuclear power and opposition to these technologies. He postulated that even balanced coverage of scientific disputes can persuade voters to adopt a precautionary approach.

I have suggested that the quantity of coverage of a technical controversy can have as much an effect on public attitudes as the semantic content of the stories that are presented. The public takes seriously any suggestion that a technology may be risky, particularly if the suggestion is repeated often enough. (Mazur, 1981, p. 114)

This is supported by recent work on risk perception, which describes the way in which risks perception is governed by affect, rather than reason. As a result of evolutionary forces and brain structure, this research suggests that there is an intrinsic bias to fear human-made risks more acutely than natural risks (e.g., risks posed by extreme weather events; Ropeik, 2010).

The theoretical framework presented here can account for two major characteristics of the diffusion of bans on products made with BPA. On one hand, it can account for the expansion of the issue first from a small community of scientists, environmental activists, chemical firms, and regulators at the Food and Drug Administration (FDA) to state legislatures. As social movements and scientists were concerned about regulatory inaction, they looked to expand the venue in which this conflict was taking place. In this they were aided by newspapers which capitalized on the preexisting scientific conflict and made it a genuine public issue (on the need for conflict to generate an issue, see Cobb & Elder, 1971). Second, it can help explain why some states adopted legislative measures at different points in time, namely, because levels of media coverage in each state differed.

It is important to emphasize that nothing in this conceptual framework precludes the news media as serving as an intervening variable between important, politically relevant actions (e.g., lobbying by environmental groups) and regulatory outcomes. However, it does imply—and supportive evidence is provided next—that, at minimum, politically interested actors must transform the policy image (i.e., change the quantity and quality of news coverage) essentially to spur state legislators to action. This implies raising the attention of disinterested, unknowing, or apathetic citizens via news media coverage and changing the tone of media coverage, making it less sympathetic to existing policy insiders. The theoretical framework presented here conceptualizes high levels of critical media coverage as a necessary, perhaps not a sufficient, tool on the road to policy adoption in a U.S. state.

In the following analysis, the hypothesis is tested that media coverage shapes policy change by examining the impact that raw levels of media coverage, levels of critical health news, and levels of “high-impact” feature stories had on the life of BPA as a political issue through the U.S. state legislatures. However, first, the case is made that something other than a scientific consensus drove policy.

SCIENTIFIC DEBATE OVER HAZARDS OF BPA

Concerns about BPA are part of a widespread debate over so-called endocrine disruptors, which are synthetic compounds that have been accused of having adverse effects on animal and human health, particularly in regards to human reproductive systems (Colborn, Dumanoski, & Myers, 1997). In 1997, Professor Frederick vom Saal and colleagues published the results of a study that reported that exposure to very low doses of

TABLE 1
Exposure Estimates to Bisphenol A

<i>Age category w per day</i>	<i>Micrograms/Kg/B</i>	<i>x-fold <TDI (50 micro- grams/kg/bw/day)</i>	<i>x-fold <NOAEL (5,000 micro- grams/kg/bw/day)</i>
0-4month-old infant	1.6	31	3100
6-12-month-old infant	0.8	62.5	6250
4-6-year-old child	1.2	41.6	4160
60 kg adult	0.37	135	13500

Note. Source: European Commission. Scientific Committee on Food. (2002). bw = body weight.

BPA contributed to increased prostate glands in mice (Nagel et al., 1997), launching a heated scientific debate which remains unresolved today.²

However, claims that BPA is hazardous to human health have been disputed within scientific communities for several important reasons. Although there is plenty of evidence to suggest that BPA can cause adverse effects at levels far above what humans are exposed to, there are serious questions about the reliability of evidence that suggests there are adverse effects at environmentally relevant levels of exposure. Most regulatory agencies accept a tolerable daily intake level for humans of 50 micrograms of BPA per kilogram of body weight per day. This is derived from two multigeneration, multidose studies commissioned and supervised by the European Food Safety Authority (EFSA) and financed by the chemical industry (Tyl, Myers, Marr, & Sloan, 2008; Tyl et al., 2002). Based on those studies, the EFSA settled on a dose of 5 mg of BPA per kilogram of body weight per day (kg/bw/day), below which there were no observable adverse effects. Then, adopting a variation of the precautionary principle, it reduced that limit by a factor of 100, resulting in a tolerable daily intake level of 50 micrograms/kg/bw/day. This level and these studies remain a benchmark in the worldwide regulation of BPA. The U.S. FDA, Food Standards Australia New Zealand, and the United Kingdom Food Services Authority all accept this level, whereas Health Canada adopts a slightly more conservative and precautionary approach, settling on a tolerable daily intake level of 30 micrograms/kg/bw/day.

It is evident from Table 1 that human exposure to BPA is far less than the levels deemed by regulatory agencies as safe. Thus, virtually the entire debate around the potential for effects hazardous to humans has centered

²There are far more than 1,000 studies about BPA indexed in the PubMed database.

on the question of whether there are observable, adverse effects below these tolerable daily intake levels. This “low-dose” hypothesis remains heatedly controversial within toxicology and the scientific community remains divided.³ Scientists are divided on fundamental questions of experimental science: the validity of industry-funded science, the way in which causation is assessed, the validity of animal-based findings for human risk assessment, the meaning of null findings and the danger of publication bias. Nagel et al. (1997) observed increased weights of mouse prostate glands at levels of 2 micrograms/kg/bw/day, and this finding serves as a bedrock for the scientific argument for hazardous effects from contemporary exposure to BPA. However, from the point of view of regulatory agencies, and most other toxicologists, the studies purporting to show hazardous effects at low levels have been seen as flawed or not persuasive for several reasons. The EFSA’s most recent assessment sums up the state of the science surrounding BPA thusly:

EFSA was asked to evaluate a dietary developmental neurotoxicity study in rats (Stump et al., 2010) and recent scientific literature (2007–2010) in terms of relevance for the risk assessment of BPA. The impact of these studies on the current TDI [Tolerable Daily Intake] of 0.05 mg BPA/kg/bw/day as set by EFSA in 2006 was assessed. . . . Overall, based on this comprehensive evaluation of recent toxicity data, the Panel on food contact materials, enzymes, flavourings and processing aids (CEF) concluded that no new study could be identified, which would call for a revision of the current TDI. . . . The Panel noted that some studies conducted on developing animals have suggested other BPA-related effects of possible toxicological relevance, in particular biochemical changes in brain, immune-modulatory effects and enhanced susceptibility to breast tumors. These studies had several shortcomings. At present the relevance of these findings for human health cannot be assessed. . . . A minority opinion is expressed by a Panel member and presented in an Annex to this opinion. (European Food Safety Authority, 2010)

Even if the reader is not yet convinced that the scientific evidence underlying the claim that contemporary exposure to BPA poses hazardous risks to humans is inconclusive at best, then it is hoped that one will at least be persuaded that the rhetoric characterizing this position far outstrips the scientific evidence. On one occasion, vom Saal argued that “the science is clear and the findings are not just scary, they are horrific. When you feed a baby out of a clear, hard plastic bottle, it’s like giving the baby a birth control

³The European Food and Safety Authority convened a high-level scientific meeting in June 2012 to discuss the status of the scientific debate.

pill” (University of Missouri, Columbia, Division of Arts And Sciences., 2005). On a later occasion, he claimed that “this is the global warming of biology and human health” (as cited in Neimark, 2008). This alarmism has been reflected in the news media. In 2007, the *Globe and Mail* published a two-page feature on the scientific debate, featuring a demand by the executive director of Environmental Defence that Health Canada take steps to ban the chemical before its risk assessment was complete and emptying his house of polycarbonate bottles (Mittelstaedt, 2007). On December 8, 2010, the same newspaper published a story referring to a non-peer-reviewed report from a coalition of American environmental groups that found traces of BPA on receipts and cash bills. The paper darkly wrote in the first sentence, “There’s a new reason other than fear of germs to wash hands after handling paper money: It contains traces of bisphenol A, the estrogen-like chemical Health Canada has declared toxic” (Mittelstaedt, 2010).

There is a deep scientific conflict over whether BPA causes harmful effects to humans at levels at which we are currently exposed. Regulatory agencies have almost unanimously dismissed the existing concerns as unreliable and not proven. Therefore, something other than scientific consensus has driven regulatory policy in U.S. states. The claim here is that media coverage is partially, but importantly, responsible for shaping regulatory outcomes in the U.S. states.

THE EVOLUTION OF BPA AS A POLITICAL ISSUE IN THE UNITED STATES

Between 1997 and 2005, the debate about BPA was restricted almost entirely to the scientific community, a few environmental organizations in the United States and regulatory authorities in the National Toxicology Program (NTP) and the FDA. Between those years, the number of peer-reviewed studies increased substantially, with no corresponding increase in regulatory activity. However, this started to change in 2005, and the issue expanded out of this narrow scientific and regulatory circle. First, state legislatures started to take up the issue in that year, with California debating legislation in 2005 and Minnesota and Maryland in 2006. Second, the *Wall Street Journal* published a series of five news articles in 2005, one of which focused on the scientific debates around BPA. Third, the NTP began a 3-year process of formally evaluating the risks to human health posed by BPA.

Although the issue had migrated from the scientific to the regulatory arena after 2005, the circle of actors remained small; it had no prominent place on the public agenda. But the simmering conflicts between scientists,

regulators, and environmental groups made it possible for the conflict to migrate to the news media. The year 2008 was a turning point in this regard. First, the NTP issued a draft brief on its assessment of potential hazards from BPA on April 14, 2008, and reported “some” concern about effects from exposure to BPA on the development of fetuses and infants. This made a minor impact on the media agenda; nine stories in this study’s data set appeared following the announcement, including a front-page story in the *Washington Post*. Second, and more dramatically, four days later Health Canada published its own risk assessment of BPA, declaring it to be “toxic” according to the provisions of Canadian legislation and proposing controversial risk management strategies, including that polycarbonate baby bottles be banned. This made a much larger impact in American newspapers, in part because Canada’s decision had a substantial impact on the marketplace. Wal-Mart indicated it was withdrawing bottles made from BPA from sale in the United States, and Nalgene, one of the most popular makers of polycarbonate plastic bottles ceased production of those products. Twenty-two stories appeared in American newspapers in the two days following Canada’s decision and the resulting changes by retailers. Third, the *Milwaukee Journal-Sentinel* began an in-depth advocacy campaign in 2008, publishing more than 40 stories over the course of the year. Later, in September, a study published in the *Journal of the American Medical Association* (Lang, Galloway, Scarlett, & Henley, 2008) attracted substantial media attention (19 stories on September 17, 2008). This was a cross-sectional survey of American blood samples that detected the presence of BPA in 93% of the American population, with the highest concentrations in those suffering from heart disease, diabetes, and liver problems. Although its cross-sectional nature could not in any way assess causation, this subtlety eluded most journalists. For example, the subsequent headline of the *Washington Post* read, “Study Links Chemical BPA to Health Problems” (Layton, 2008). However, the increased media coverage in 2008 was not equally high across all U.S. states; BPA entered the media agenda in particular states at particular points in time. These changes, it is argued here, changed the calculations of legislators in individual states. In the absence of FDA action on an issue that was suddenly high on the media’s agenda, legislators in some states at particular points in time had strong political incentives to act, whereas others did not.

METHODOLOGY AND DATA

One way to test formally whether within-state media coverage of BPA was related to the legislative process is via event history analysis. This is a

well-established statistical method with roots in epidemiology, medicine, public health, and engineering processes where the object of interest is the start of some process until the onset of some other event (usually death, failure of a machine process, or the onset of some condition; J. M. Box-Steffensmeier & Jones, 2004, pp. 1–7). The technique has been adapted for use in political science to map factors that influence the rate and adoption of particular policies across the 50 American states (Berry, 1990). For example, Haider-Markel (2001) examined the diffusion of bans on same-sex marriage and Chamberlain and Haider-Markel (2005) examined the spread of “lien” laws as a deterrent to hate crimes across the U.S. states. Hays (1997) used event history analysis to argue that the level of media coverage about living wills increased the probability that a state would adopt such legislation in any given year. Similarly, Brace, Hall, and Langer (1998) examined the factors that contributed to court cases being filed challenging legislative restrictions on abortions following the *Roe v. Wade* decision.

These models are estimated to assess whether independent variables of interest have a significant impact on what is known as the “hazard rate.” For discrete data (as is here the case), the hazard rate is simply a ratio of the probability that a unit failed in any discrete period (in this case a legislative year) to the probability that a unit would survive up to the same period. To express this colloquially, the rate of failure (dying) for humans in the 100th year of life is quite high; half of 100-year-olds might die in their 100th year. But the probability of any given human surviving to 100 is quite low. The hazard rate of failure (death) for humans in the 100th year of life is the ratio of the failure rate in that year to the probability of survival to that point. Of course, calculating the hazard rate of any given process is usually only a starting point for any analysis. Usually, one is interested in assessing whether any configuration of independent variables has any discernible impact on the hazard rate.

In this case, we fit a Cox proportional hazards model to the data to examine the role that media coverage played in the spread of debate on policies about BPA. It is important to emphasize that the Cox model is not a parametric model. That is to say, it makes no claims to estimate how long a process might take until the event of interest happens; rather, it assesses the change in hazard rates that independent variables can bring about. To put this in the language of the current study: A Cox model of proportional hazards could tell us the ratio of risk that Democratic states have in experiencing the event of interest (a ban on BPA) compared to Republican states, but it could not tell us that the time to adoption of legislation for Democratic states was four years, whereas for Republican states it was six years.

It is worth pointing out that there are distinct legislative pathways that are apparent in the diffusion of bans on products made with BPA

TABLE 2
Distribution of Legislative Processes

	<i>Counts</i>
No events	14
Consideration without adoption	14
Debate in more than one session leading to adoption	8
Adoption in one session	1

(see Table 2). In 14 states, there were no legislative activities, whereas in another 14, the state legislature considered legislative bans at least once, without ever adopting a ban. Eight state legislatures considered a legislative ban in one sitting, with the legislature later adopting a ban. Last, in one state, the state legislature adopted a ban in one sitting without ever having considered a ban in a previous sitting.

Two substantive questions arise from this observation. First, did news media coverage contribute differently to legislatures considering (but not adopting) legislative bans? One might hypothesize, for example, that high levels of critical news media coverage might spur a legislature to consider a legislative ban on products made on BPA but that other factors might be more important in dictating whether the state legislature would actually adopt that ban. For example, in the state of Oregon, the legislature has repeatedly considered banning products made with BPA on several occasions, but not adopted a ban, in part because of opposition by that state's fruit industry, which relies on the use of BPA to properly seal jars. Thus, media coverage might be related to the chance that a legislature considered legislation, but it might not be related to the risk that a legislature would adopt a ban. Second, media coverage might play different roles depending on the sequence of events. One could imagine a legislative process within a state that is started by high levels of critical media coverage. For example, one could imagine an environmental organization generating publicity, spurring a legislator to action, introducing legislation banning products made with BPA. However, one could also imagine an attentive legislator taking notice of the scientific debate before any state newspaper and who, acting out of sincere policy convictions, subsequently introduced legislation. In the former case we would expect higher levels of media coverage prior to the first legislative consideration, whereas in the latter, we would expect low or no levels of media coverage.

Moreover, even if media coverage were not related to first legislative considerations, it could also plausibly be the case that media coverage might matter more in sustaining multiyear legislative attempts, rather than in initiating them. Consider cases such as Illinois, where legislation banning

polycarbonate baby bottles was introduced in 2008, debated again in 2009, reintroduced in 2010, and debated again in 2011, without ever being adopted. Regardless of whether the news media played a role in initiating that process, it might be the case that the process was sustained in later years by high levels of media coverage to the issue. For example, one could imagine an innovative legislator taking steps to introduce the legislation; generating publicity; and, because of the attention it garnered, subsequently reintroducing the bill the following year. Or one could imagine the same legislator introducing the bill, failing to get publicity, and deciding not to pursue the legislation in search of higher profile issues.

In the terminology of event history analysis, this complex political process exhibits both repeated events (state legislatures can consider or adopt legislation in several sittings sequentially) and competing risks (state legislatures can do nothing, consider legislative bans, or actually adopt legislation). Fortunately, event history analysis has developed sufficiently to provide methodological tools to evaluate these types of questions (see, in particular, Box-Steffensmeier & Zorn, 2002; Jones & Branton, 2005).⁴

Case Selection

In the case of the American states, 37 states are analyzed over the period 2005 to 2011. Thirteen states were eliminated because there was no suitable daily newspaper within the state contained in the Lexis-Nexis database (e.g., Delaware and Vermont), or there were no data on the environmentalism variable (e.g., Alaska and Hawaii). Then, state-year combinations were created for each year in which the state legislature sat and could potentially have passed legislation regarding BPA. Although most state legislatures meet annually, some meet biannually; for those states, years where the legislature did not sit were deleted.

Legislation Proposing to Ban Products Made with BPA

The dependent variable in the study is the rate at which states adopted or considered legislation banning products made from BPA. Using data from the National Council of State Legislatures, which tracks legislation on environmental health initiatives, the progress of BPA legislation in the states was gathered (National Council of State Legislatures, n.d.). The author searched the database for bills responding to the search strings

⁴For those interested in the technical details, the data set is doubled to account for competing risks. There each state-year combination is represented twice. To account for repeating events, a conditional interevent counting process developed by Prentice, Williams, and Peterson (1981) and advocated by Box-Steffensmeier and Zorn (2002) is implemented.

“Bisphenol A,” “BPA,” and “Bisphenol-A” for legislation in the states from 2005 to 2011. For each year, it was noted whether there was no legislative activity, a consideration without an enactment, or an enactment of legislation banning products made with BPA. Thus, there was no distinction made between a session where a brand new bill was introduced or whether a bill from a previous session was carried over. What mattered was whether the legislature considered legislation without enacting it. Last, some bills focused only on prohibiting products meant for children (baby bottles and toys), and other bills focused on receipt paper, whereas other bills made no distinction. For the purposes of this study, the only outcome of interest was that there was a bill that considered banning products made from BPA enacted or considered in any given session.

News Coverage

The primary independent variable of interest is within-state news coverage. To gather this, a search was conducted in all daily newspapers in each state contained in the Lexis-Nexis database. To be included in the data set, stories had to be 150 words long and either mention the phrase “Bisphenol A” twice or mention the search string in the headline or the lead of the news story. These measures were introduced to prevent frivolous and irrelevant stories such as news digests or passing references to BPA from being included. The stories selected represent a census of nontrivial newspaper coverage in American daily newspapers indexed in Lexis-Nexis from the period 2004 to 2010. The number of newspaper stories for each state published in each period was normalized by dividing the number of stories by the number of newspapers. Then an undergraduate student coded each newspaper story along two variables, topic and tone.⁵

⁵We achieved intercoder reliability in the following way. The author developed a coding scheme provided to and discussed with the student. The initial pilot sample received low reliability scores (0.46 for tone and 0.49 for topic, $N = 20$, all statistics here are Cohen’s Kappa). We discussed problems and revised the coding scheme, achieving much better results for topic on the second round (0.86 for topic) but still low results for tone (0.49, both $N = 20$). We revised the coding scheme for tone again, providing clearer directions for distinguishing stories critical of BPA from simply neutral accounts of developments in the story. Again, we achieved a low—albeit improved—score for tone (0.52, $N = 20$). It was apparent that all but two of the stories in this subsample had been coded correctly. The author further clarified ways for the student to distinguish “critical” from “neutral” stories, and a final sample was taken, which resulted in identical coding. Cohen’s Kappa was 1 ($N = 25$). In addition to the restrictions adopted at the search string stage, the undergraduate coder also marked news stories that could only be deemed as irrelevant. These were stories that were not caught by either of the restrictions just noted but were still irrelevant to the debate at hand. An example of stories excluded under these criteria was a story about BPA-free products as gift ideas.

TABLE 3
Number of News Stories by Tone and Year

	2004	2005	2006	2007	2008	2009	2010
Critical of BPA	3	6	8	45	173	67	88
Neutral	1	1	3	22	46	11	16
Dismissive of concerns about BPA	0	0	0	4	16	3	0
	4	7	11	71	235	81	104

Note. BPA = Bisphenol A.

Most of the coverage was critical of BPA, but it involved a wide range of topics (see Tables 3 and 4). Two clusters are evident: One cluster of news stories included those that report on regulatory or political activity about steps to regulate BPA. These types of news stories reported on legislation moving through stages of debate, or on legislative initiatives by legislators or the regulatory initiatives by the FDA. A second cluster focused on possible negative effects posed by BPA. These stories included reporting on the publication of peer-reviewed studies about the potential negative effects, activity by social movements to demonstrate or highlight negative effects, or stories about commercial responses, including manufacturers offering BPA-free products because of fears of adverse effects.

In the foregoing analysis, we test hypotheses about relationships between three different types of news coverage and legislative outcomes. First, we examine the relationship between absolute levels of news coverage about BPA, with no regard for topic or tone, and legislative outcomes. We test this hypothesis because of previous research findings previously noted that the high prominence of news coverage, regardless of quality, can evoke deep-seated popular fears about technological innovations (see Mazur, 1981). Second, the relationship between routine critical news stories about

TABLE 4
Topics of News Stories About Bisphenol A by Year

	2004	2005	2006	2007	2008	2009	2010
Critical peer-reviewed studies	1	5	5	13	30	16	
Social movement activity about negative effects	0	0	0	11	6	8	23
Industry activity responding to concerns	0	0	0	11	42	7	7
Industry activity denying concerns	0	0	2	0	4	6	0
Government activity regarding regulation	1	0	1	25	93	8	42
Political activity regarding regulation	0	1	2	4	28	32	15
Other	2	1	1	7	32	4	6

possible adverse health effects from exposure to BPA and legislative outcomes is tested. This is examined for two reasons. First, according to Baumgartner and Jones, the quality of news coverage is as important to the policy image as quantity of coverage. It might be the case, therefore, that it is not absolute levels of routine news coverage about BPA, which are linked to outcomes, but levels of a particular type of news coverage. Given that there is a clear cluster of news stories that deal with the health and safety of BPA, we assess whether it is levels of routine, critical health coverage that impact the legislative outcome. Second, by restricting news coverage to encompass only news stories that are critical in tone and deal only with adverse health effects, we avoid a possible problem with endogeneity. Because many of the cases under consideration involve multiyear legislative processes, if all news stories are included, the risk exists that news stories reporting on a bill's passage in 1 year will be counted toward the legislative outcome the following year.

Last, there also exists the possibility that the legislative process could be influenced by high-impact news stories rather than by a series of routinely generated, low-impact news stories. Story length can communicate a great deal of information about the salience of an issue, with longer stories communicating greater importance. For example, Pritchard (1986) found that newspaper story length was inversely related to the chances that a prosecutor would negotiate a plea bargain, whereas Peter (2003) found that the number of stories, weighted by prominence, was importantly related to the salience of European integration in a cross-national comparison. Although the Lexis-Nexis database does not contain any consistent and reliable information on the position of any story in the newspaper (e.g., front page, Life section, etc.), it does contain reliable information on the word length of each story. Thus, in addition to the health news variable just introduced, the content analysis coded a news story as a "high-impact" story if it was 1 standard deviation longer (359 words) than the average word length (697 words). Thus, high-impact stories were longer than 1,056 words. To control for the number of newspapers that are included in the data set, each variable is normalized by dividing by the number of newspapers in the Lexis-Nexis database. Moreover, to avoid problems with causal inference, all news stories are lagged by 1 year; that is to say, a story that is published in the calendar year in 2008 counts only toward the outcome of the 2009 legislative calendar (see Mills, 2011, p. 93).

Table 5 lists standard descriptive statistics for the continuous and discrete variables in the analysis; it immediately reveals one challenge the distribution of news stories presents. Namely, a significant portion of the cases had no news stories about the issue, whereas only a small fraction had any news coverage. As a consequence, hypotheses about relationships between three news variables are tested first by converting news variables

TABLE 5
Descriptive Statistics

<i>Variable</i>	<i>Cases</i>	<i>Null cases</i>	<i>Missing values</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>
Professionalism	500	0	0	0.10	0.75	0.43	0.19
Environmentalism	500	0	0	0.07	0.63	0.21	0.12
Regional	500	468	0	0	0.50	0.02	0.08
All news	500	292	0	0	7.40	0.77	1.34
Critical health news	500	344	0	0	3.00	0.26	0.52
High impact health news	500	458	0	0	1.00	0.03	0.14
Partisanship	500 (51) ^a						

^a% Democrat.

into dichotomous variables. This does not allow for the testing of hypothesized linear relationships between news and outcome, that is, as news coverage increases, the chance of legislative action increases. Rather, this allows one to test whether any level of news coverage compared to no news coverage increased the chance of legislative action. Given the lopsided distribution of cases where there was no coverage compared to where there was coverage, this is an important assessment.

Environmental Sentiment

Although the issue of the potentially toxic effects of BPA on human health may seem to be only tangentially related to traditional environmental issues of ecosystem protection and species preservation, it remains the case that BPA has manifested itself primarily as an environmental issue. In the United States, the Environmental Working Group was active on the issue. It is worth testing, therefore, whether the salience of environmentalism was also an important variable that distinguished those jurisdictions that adopted a ban from those that did not. Here, a measure of environmentalism is used that was developed by Mazur and Welch (1999). They assigned a score to each state (save Alaska and Hawaii) on an index derived from four measures: the size of the membership of three environmental organizations, the rating of the state's congressional delegation by the League of Conservation Voters, the percentage of respondents saying the government spends "too little" on the environment over a period of 20 years, and a rating of state policy on 50 different environmental policies.

Partisanship

Most legislatures that adopted bans on products made with BPA were controlled by the Democratic party, moreover, environmental issues tend to be

promoted by those on the left of the political spectrum. Therefore, the model includes a variable for the partisan composition of the legislature for the relevant period, drawn from information contained in the U.S. census (U.S. Census Bureau, 2011). This variable could take on a value of “Democrat” if both houses of the legislature were controlled by that party in that year or “Non-Democrat” if there was any other configuration.⁶

Professionalism

A common finding in the literature on policy diffusion across the American states is that states with professional legislators (e.g., a high level of compensation with full-time staff support) tend to exhibit a greater willingness to adopt policy innovations (Kousser & Cain, 2004, p. 168). Accordingly, this model integrates the dominant variable for measuring the professionalism of a legislature, a measure developed by Squire (2007) that accounts for salary, staff support, and demands on the legislator’s time.

Regional Diffusion

One of the more robust findings in the literature on policy diffusion across U.S. states is the impact of neighboring states on policy adoption (see Mooney, 2001). The models introduced in the next section introduce a variable that captures what proportion of any given state’s neighbors had adopted a ban to control for this effect.

RESULTS AND ANALYSIS

As a first-pass analysis, the graphs in Figure 1 suggest important initial evidence of a relationship between media coverage and the legislative process. The first depicts the absolute, normalized number of stories per newspaper prior to legislative sittings with various outcomes. The second graph shows the levels of routine, critical health news coverage, and the last shows levels of high impact, critical health coverage. In each graph, coverage is grouped by different types of legislative events (an initial consideration, a later consideration, a ban with no prior event or a ban with a prior event). For each type of event, coverage is compared between states where the event did occur to where it could have occurred but did not occur. The reader will notice that for nearly every type of legislative outcome and for every type of news coverage, coverage was higher prior to legislative sessions where events occurred compared to legislative sessions where nothing occurred.

⁶Nebraska was coded as “non-Democrat” because it has a non-partisan legislature.

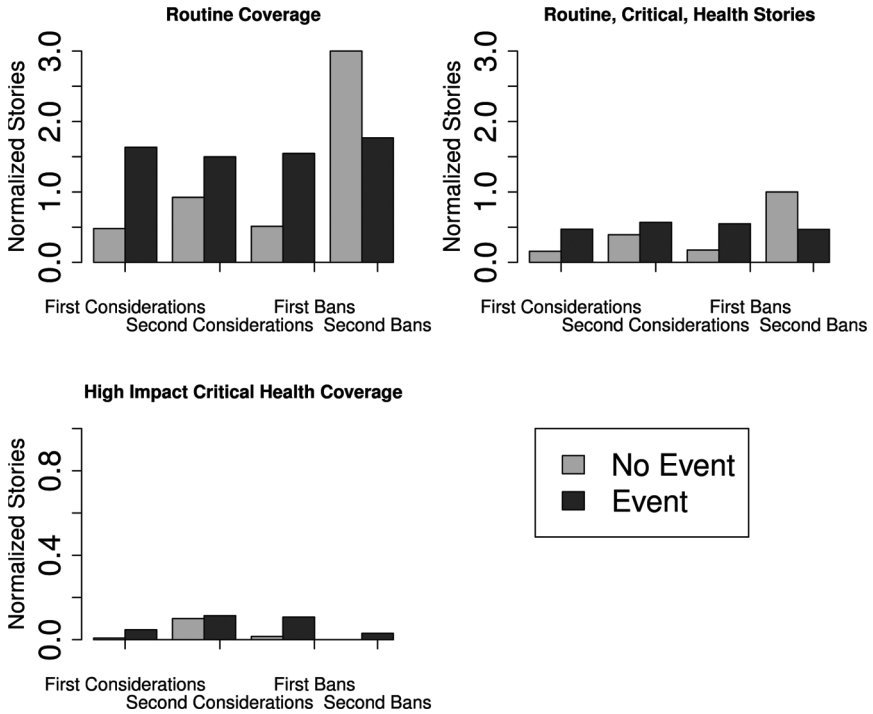


FIGURE 1 Average number of three types of news stories—all news stories with no regard for content, routine, critical health stories and high impact, critical health stories—by different legislative outcome. *Note.* Values marked by gray bars are the normalized number of stories appearing prior to legislative sessions where the legislature was at risk of experiencing that particular legislative outcome, but it did not occur. Values marked by black bars are the normalized number of stories appearing prior to legislative sessions where the same outcome *did* occur.

This is highly suggestive of agenda-setting effects; however, these relationships do not control for any confounding variables. To do this, we fit a multivariate Cox proportional hazards model as just discussed. First, we examine the relationship between news coverage and first and second legislative considerations. Results are reported in Table 6.⁷ In the first column, no distinction is made between first and later events. The coefficients in this column could be considered to represent the “average” effect of the independent

⁷The analysis that follows adopted the following modeling strategy. First, univariate models were fit with each variable of interest just identified. Variables that had *p* values greater than .25 were excluded. Then a multivariate model was fit with the remaining variables. Last, models were assessed for linearity, conformity with assumptions, and any interactions between variables.

TABLE 6
Modeling the Repeating Events Nature of Legislative Considerations

	<i>Pooled</i>	<i>First</i>	<i>Second</i>
Professionalism	-0.29 (0.81)	-1.97(2.41)	0.71 (0.70)
Environmentalism	2.97*** (1.08)	4.75*** (1.10)	
Categorical critical health news	0.43 (0.46)	0.58 (0.77)	0.92 (0.75)
Categorical high impact health news	0.77*** (0.29)	1.16 [†] (0.62)	0.68*** (0.26)
Categorical allnews	0.74 (0.52)	0.74 (0.50)	-0.35 (1.09)
Partisanship		-0.62 (0.58)	
Regional diffusion			3.18* (1.33)
<i>N</i>	250	199	51
Wald	31 on 5 <i>df</i>	53 on 6 <i>df</i>	13 on 5 <i>df</i>
	<i>p</i> < .001	<i>p</i> < .001	<i>p</i> < .05
<i>R</i> ²	0.09	0.14	0.12
	Max 0.69	Max 0.56	Max 0.92

Note. Robust standard errors in parentheses.

[†]*p* < .10. **p* < .05. ***p* < .01. ****p* < .001.

variables on the hazard rate, without distinguishing the order of events in any way. This initial fitting suggests positive relationship levels of high-impact news coverage and environmentalism in state public opinion. On average, a legislature was 2.1 times as likely to consider legislation when there was a high-impact news story published prior to a legislative session compared to legislative sessions where there had been no high-impact news story.

The next two columns report the coefficients for two separate models. The first is fit only to cases at risk of experiencing the first occurrence of a legislative consideration, whereas the second is fit only to cases at risk of experiencing a second or later legislative consideration.

Disaggregating the legislative events by chronology reveals only a slightly different pattern. On average, a state was 3.2 times more likely to consider legislation for a first time when there was a high-impact story published in the previous calendar year, although this finding was only significant at the .1 level (*p* = .06). High-impact coverage was strongly and significantly related to the chance a legislature would consider legislation a second time; states were 1.9 times more likely to consider a second piece of legislation following any high-impact coverage compared to when there was no high-impact coverage. Neither of the two other news variables were related to the legislative outcome.⁸

⁸Following the comprehensive analysis, the exact models were fit above replacing the categorical news variables with continuous variables. This did not significantly change the results; the only major change was that high-impact news coverage did not have a significant, linear relationship with the risk of a second consideration.

TABLE 7
Modeling Competing Risks of Legislation

	<i>Considerations</i>	<i>Bans</i>
Professionalism	-0.29 (0.81)	
Environmentalism	2.97* (1.08)	4.50 (2.93)
Categorical health news	0.43 (0.46)	
Categorical high impact health news	0.77* (0.29)	
Categorical all news	0.74 (0.52)	
Partisanship		-1.23 (1.08)
<i>N</i>	250	250
Wald	31 on 5 <i>df</i>	5 on 2 <i>df</i>
	<i>p</i> = .00	<i>p</i> = .09
<i>R</i> ²	0.09	0.02
	<i>Max</i> 0.69	<i>Max</i> 0.18

Note. Robust standard errors in parentheses.

†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001.

Next, we turn from considering distinct relationships dependent on sequence to distinguishing distinct relationships based on outcome. Namely, we consider that media coverage was a contributor to one of two possible, competing events: that a legislature considered legislation banning products made from BPA, and a legislature actually enacted such legislation. The data are presented in Table 7. Again, high-impact news coverage was significantly related to the risk that a legislature would consider legislation, but there was no relationship between any news variable and the chance that a legislature would actually adopt a ban on products made from BPA.

This is not to suggest that media coverage did not matter for state legislatures actually adopting bans, but it suggests that media coverage mattered indirectly. Returning to Table 2, fully eight of the nine legislative prohibitions on products made from BPA in the data set were adopted after the state had previously considered such legislation. This suggests that even if newspaper coverage was not directly related to the adoption of legislation, it influenced the legislative process partially by initiating and certainly by sustaining multiyear legislative processes. Although not all of these multi-year processes culminated in the adoption of a legislative ban, there was only one bill adopted without that state previously having considered such legislation. In short, news coverage played an important role creating a necessary, but not sufficient, condition for the adoption of legislation banning products made from BPA.

These are important findings for several reasons. First, they should be interpreted as supporting Baumgartner and Jones's theory of policy change by punctuated equilibrium following changing policy images. Given the fact

that the only news variable to show an effect on the legislative process was one that only counted news coverage of a particular subject matter reflects the central tenet of their theory that quantity and quality are central components of a policy image. This also suggests that Mazur's hypothesis that raw levels of media coverage—without regard for quality—might be sufficient to evoke primal concerns about technology is not supported, at least in regard for how media coverage is related to policy developments. In that arena, quality of media coverage is as important as quantity of coverage. Going further, these data also suggest that not all news stories are equal; the presence of high-impact critical health stories seems to matter more than the presence of routine, shorter critical health stories. The literature on media effects does not commonly account for the impact of news story length, but this suggests that it should become more common. Electronic databases usually contain information on word length and on position in the newspaper; these could be integrated in future analyses of the impact of newspaper coverage on agenda and policy change.

However, one dynamic of this issue, somewhat beyond the scope of the event history analysis just presented, does not actually fit with predicted outcomes of Baumgartner and Jones's theory. In particular, policy change via punctuated equilibrium should exhibit short and rapid bursts of policy change followed by a return to stasis. The case of BPA regulation certainly exhibits the short and rapid bursts of policy change but does not really follow the return to stasis as posited. Rather, because the initial burst of interest in 2008 has lingered, interest has declined, to be sure, but it would not be fair to characterize the issue as having returned to stasis. Instead, the FDA acceded to an industry request in 2012 to ban BPA from polycarbonate baby bottles, while continuing to reiterate that it remains safe for human exposure. The issue also periodically attracts significant media attention. For example, in the fall of 2012, a new cross-sectional survey of American children found a correlation between children's obesity and blood levels of BPA (Zhao et al., 2012).

Second, this case presents serious challenges for regulators in the tricky field of the regulation of hazardous substances. Our societies do not handle information about potentially hazardous substances very well; "chemophobia" is a very real problem. The distribution of topics in Table 4 shows that newspapers in the United States tend to concentrate on straightforward reporting of the regulatory process and allegations about potential adverse effects by scientists and environmental groups. In this regard, newspaper coverage probably reflects the *vox populi*. In some ways this is laudable, but there is a cost attached with this. Humans do not perceive risks terribly well, and excessive media coverage can hamper more sober assessment of the risks, costs, and benefits of any given technology. Certainly in the case of BPA it appears that media

coverage drove state legislators in many states to act in the absence of really credible scientific evidence that a risk to human health existed. Media coverage of potentially hazardous substances can seriously complicate the process of risk assessment and management.

CONCLUSION

A review of the scientific evidence from industry, public researcher, and regulatory bodies revealed that there simply was no scientific consensus about the existence of threats to human health at current levels of exposure to BPA. Instead, informed by findings from the mass media effects literature, the policy agenda-setting literature and previous research that emphasized how the increased salience of technological innovation can provoke intrinsic fears, this article used event history analysis to model the diffusion of both legislative considerations and legislative bans on products made with BPA across the U.S. states. After coding newspaper coverage about BPA according to topic, tone, and story length, it found that increased levels of high-impact newspaper coverage about potential negative health hazards was weakly related to the chance that a state would introduce legislation for a first time but strongly and significantly related to the chance that a state would introduce legislation banning products made with BPA a second time. This is partial evidence that newspaper coverage played a role in initiating multiyear legislative processes and strong evidence that it played a role sustaining those processes. Although newspaper coverage was not directly related to the chance that a state would adopt a ban, the fact that eight out of nine legislative bans in the data set only occurred after legislation had been previously considered suggests that the media played an important, indirect role in creating conditions necessary, if not sufficient, for the adoption of legislation. In sum, there is evidence that agenda-setting effects were shaping the varied regulatory outcomes of BPA in the U.S. states between 2005 and 2011. Although this is mostly concurrent with Baumgartner and Jones's theory of policy change via punctuated equilibrium, the failure of the BPA issue to quickly stabilize is not predicted by that theory. Last, these results should be taken as evidence of the important role that media coverage and practices plays in the regulation of toxic substances, particularly in the absence of scientific consensus.

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