Where Did All The Nalgene Bottles Go?
Media Agenda-Setting In The Regulation of Bisphenol A

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I. Introduction And Theoretical Framework

Since 1997, some scientists and environmental groups have expressed concerns about the consequences for human health posed by bisphenol A (BPA), a chemical widely used to harden plastics in bottles and seal foods in jars. Until 2008, concerns about this chemical were restricted almost entirely to the pages of scientific journals and newsletters of environmental organizations. In 2008, however, the issue burst onto European and North American public and political agendas with impressive speed and force. For example, in Canada, the Globe and Mail has published 141 news stories since 2005 on BPA (the National Post, by contrast, only 5). In Wisconsin, the Milwaukee Journal-Sentinel went further and launched a campaign inspired by principles of advocacy journalism, paid for laboratory tests to assess the toxicity of BPA, adopted an explicit position vis-à-vis the threat to human health and dedicated a lengthy series of news stories specifically to BPA. In the wake of this explosion of media interest, seven American states (Massachusetts, Vermont, Minnesota, Wisconsin, Washington, Maryland and New York), three countries (Canada, Denmark and France) and the European Union had issued substantial regulatory prohibitions on the use, manufacture, sale or import of the chemical. This paper argues that one important factor explaining the varied adoption of regulatory prohibitions on BPA is the level of media coverage toward the issue in the respective jurisdiction.

Agenda-setting theories are among the most widely developed and widely accepted theories of political power in general and media power specifically (see Bachrach and Baratz 1962; McCombs and Shaw 1972). While agenda-setting theories of media effects were initially preoccupied with how the level of media coverage dedicated to a particular issue seemed to influence whether members of the public believed that issue to be important or not, the agenda-setting framework has been substantially expanded. For example, Soroka made two important contributions – both of which will be important in this paper. First, he distinguished causal relationships, disentangling the public's, media's and the government's agenda different. On occasion, the media lead the public and the state's agenda, but on other occasions the causal flow would work in the other direction. Second, these causal flows were, in large part, determined by the characteristics of the issue type. Media agenda-setting effects would be most evident on sensational issues – issues that have a distant relationship to people's everyday lives.

However, in addition to these innovations that show that when people sometimes deem an issue to be important, the media or the government may also follow and vice versa, Baumgartner and Jones have developed a theory of agenda setting that also explains *policy* and not just agenda change. Their punctuated equilibrium model of policy change suggests that regulatory and legislative regimes in policy fields remain stable governed by policy monopolies of insiders, but that when the policy image changes (i.e. its visibility or its coverage in the public sphere) the policy monopoly is shattered, they policy subsystem is opened to new actors and policies change quite quickly.[1] For example, they note two different (quoted in Baumgartner and Jones 2009).

Central to Baumgartner and Jones' theory of agenda setting and policy change is the interaction between policy images and political venues. Policy images are nothing

[1] The Baumgartner and Jones model of policy change via punctual equilibrium was developed in contrast to previous models of policy change that emphasized stasis or incremental changes (see Wildavsky 1964)

more than how a policy is understood and discussed. In order to construct policy monopolies, specialists construct positive policy images composed of both empirical and emotive and symbolic elements. Most citizens save for the most interested understand and evaluate that policy based on that policy image. Media coverage of the issue is central to Baumgartner and Jones' theory of agenda setting and policy change. "The media help link all the other venues together, for they are the privileged means of communication, the way by which disjointed actors keep tabs on each other and on what they consider the 'public mood' (Baumgartner and Jones 2009, 107). While Baumgartner and Jones focus on the shift in two particular aspects of media coverage: quantity and tone, this paper focuses strictly on the quantity of media coverage dedicated to the potential effects of BPA, in large part because media coverage overwhelmingly adopted endorsed the claim that BPA posed potential health effects.

Venues are simply the political body authorized to make decisions in any given policy area. Depending on the rules and the power balances in any given venue, political actors may seek. For example, the United States' system of checks and balances at both the federal and state level opens up possibilities for actors to find the branch of government where they have the best chance at winning (the legislative, executive or the judicial). Canada's parliamentary system, however, with a strong executive government diminishes opportunities for this kind of strategy, although, there may be greater opportunities for choosing between the municipal, provincial or federal levels.

Theories of agenda-setting and policy change have already been applied to other instances of the regulation of potentially hazardous substances in Canada. For example, Harrison and Hoberg (1991)highlight the key role that policy entrepreneurs played in creating divergent agendas in the case of human exposure to household radon in Canada and the United States. Environmental activists' capacity to get the issue of possible health effects of radon on the media agenda created a lasting issue, forcing the federal government to lower risk assessments and undertake a public information campaign providing consumers with information about the issue. The absence of policy entrepreneurial activity in Canada meant that radon never became an issue and Health Canada retained its view that there was no need to take action. Moreover, Pralle (2006) has argued that Canadian environmental movements capitalized on court decisions allowing municipalities to ban pesticides to add municipal politics to their more traditional federal and provincial venues.

This paper applies an existing, well-developed theory of policy change (punctuated equilibrium by agenda-setting and agenda change) to explain the varied pattern of the adoption of bans on BPA. The primary purpose of the paper is to make the case that the level of media coverage accorded to BPA played an important in explaining policy change. There are four sections. First, the paper summarizes the scientific debate on BPA with the aim of persuading the reader that, at minimum, the claims that BPA in the marketplace poses risks to human health is seriously overstated. The purpose here is to make the case that something other than scientific consensus influenced government decisions. Second, it introduces two versions of the statistical technique event history analysis that has been used previously to model the variable diffusion of policies in different jurisdictions and to gain inferences about causal relationships. This section also summarizes the case selection, data collection and the operationalization of relevant variables. Third, it summarizes and evaluates event history analysis of the cross-state and

cross-national comparisons. Fourth, and finally, the paper discusses some of the ramifications for politics and political science suggested by these findings.

II. Scientific Literature Regarding Bisphenol A

While the author is certainly no toxicologist, there are good reasons to suspect that the scientific justifications for banning BPA are limited. In fact, not a public health or food safety regulatory agency in the world has recommended taking that step, save for Health Canada, which did so under circumstances that lead one to suspect that political concerns overrode scientific concerns (see below).

The scientific argument that BPA might have hazardous consequences for humans is related to the prominent issue of endocrine disruptors. Endocrine disruptors are synthetic compounds that have been accused of having adverse effects on animal and human health, particularly in regards to reproductive systems (Colborn, Dumanoski, and Myers 1996). However, the researcher who first and most prominently raised concerns that pharmaceutical for human health is most closely associated with Prof. Frederick vom Saal at the University of Missouri. In 1997, he and colleagues published the results of a study that purported to claim that exposure to very low doses of BPA contributed to increased prostate glands in mice (Nagel et al. 1997), launching a vigorous scientific and public debate. The impact these original studies is evident from figure 1, which graphs the number of published articles on the topic indexed in the PubMed database of medical and scientific literature.

[FIGURE 1 ABOUT HERE]

However, claims that BPA is hazardous to human health have been disputed within scientific communities for several important reasons. First, there exist mostly only animal studies, and very few studies of the toxicity of BPA on humans.[2] In general, ascertaining how toxic a chemical might be for humans based on animal studies can be a very difficult affair for the obvious reason that species can differ in how they process substances. Ascertaining risk of hazardous substances to humans is therefore an inexact science. Second, many studies that show negative health consequences to mice and rats injected the test animals with BPA by injection or by silicone implants that directly released the substance into the bloodstream. The relevance of this for human health is in serious dispute, however, as humans ingest BPA only orally and, when we do so, we process the vast majority of BPA via the liver, combine it with sugar molecules and excrete it via urine.[3] Third, in part because humans' capacity to absorb and safely excrete

[2] One exception to this was a study that appeared in 2009 and caused substantial concern in the European Union (Lang et al. 2008). That study was a cross-sectional analysis of the presence of BPA in human urine and the prevalence of obesity, heart disease and diabetes. In respose to that study, the EFSA noted that while the samples would accurately reflect exposure to BPA in the 24 hours prior to the sample being taken, this could not constitute a causal relationship between exposure to BPA and the development of diabetes and heart disease because those conditions develop over many years; humans digest and excrete BPA via the liver and then the urine very quickly. It may well have been the case that those who suffer from heart disease and diabetes process BPA less successfully than healthy adults. Thus, the causal arrow may have run in the opposite direction (European Food Safety Authority 2008).

[3] The National Toxicology Program in the United States (an interagency program responsible to the

BPA, and in part because it is only ever indirectly ingested, actual human exposure to BPA is widely seen as *far less* than any level where adverse effects have been seen in animal studies. While the Tolerable Daily Intake (TDI) set by regulatory agencies varies (0.03 milligrams per kilogram of body weight (mg/kg/bw) in Canada to 0.05 mg/kg/bw in Europe), these are derived from a single source: two multi-generation, multi-dose studies commissioned and supervised by the European Food Safety Authority and financed by the chemical industry.[4] Those studies argued that, below 5 mg /kg/bw, there no hazardous effects on rodents could be seen (also referred to in toxicology as the No Adverse Effects Level (NOAEL)). The European Food Safety Authority relied on that 5 mg/kg/bw limit and, exercising precaution, reduced it by a standard uncertainty factor of 100 to account for potential differences in how rodents and humans process BPA and arrived at a TDI of 0.05 mg/kg/bw/day, or 50 micrograms /kg/bw/day (500 mg / 100 = 0.05 mg = 50 micrograms /kg/bw/day). Table 1 lists exposure estimates from a report by the European Commission and Table 2 lists exposure estimates for Canadian infants from formula. While there are other exposure estimates, from other regulatory bodies, it should be clear from these that human exposure to BPA is far less than the TDI adopted by the European Union and Health Canada.

[INSERT TABLE 1 ABOUT HERE]

[INSERT TABLE 2 ABOUT HERE]

What is more under debate is whether similar effects can manifest themselves at very low doses, disappear at medium level doses and then reappear at very high doses. This phenomenon known as a non-monotonic dose-response curve and it is a very tricky phenomenon within biology and toxicology (Sharpe 2010, 3). Figure 2 displays what a dose-response curve substance might look like versus an orthodox dose-response curve more widely accepted.

[INSERT FIGURE 2 ABOUT HERE]

As of yet, there is no plausible biological mechanism identified that would account for a non-monotonic dose-response curve for BPA and this was cited by the National Toxicology Program's expert panel as one reason for its conclusion of very low levels of concern about the adverse effects of BPA (Chapin et al. 2008b, 354).

These are the bulk of the reasons that have led every regulatory agency in the world to maintain that any kind of regulatory action is necessary. According to the most recent opinion of the European Food and Safety Authority:

> In reviewing the recently published studies on BPA the Panel concluded that while some oral studies did report

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Department of Health and Human Services) oversees the testing of inorganic substances. In a summary of published research, it discussed this aspect of the metabolism of BPA, determining that oral routes of ingestion should be a critical component of all studies designed to assess adverse effects on humans (Chapin et al. 2008a).

[4] Tyl et al. (2002) examined three generations of mice and seven different doses of BPA, while a later study (Tyl et al. 2008) was a two-generation, seven-dose study that also used a positive control of a substance known to produce adverse reproductive and developmental effects.

> differences between controls and treated animals at lower dose levels than the currently accepted overall No-Observed-Adverse-Effect Level, none of these effects were sufficiently well demonstrated to be used as pivotal effects for the risk assessment and to justify a revision of the TDI. Therefore, the Panel concluded that the NOAEL of 5 mg/kg bw/day, based on the results of a comprehensive three-generation study in rats and established in the SCF evaluation of 2002, remains valid and in the Panel's view is further supported by the NOAEL of 5 mg BPA/kg bw/day, based on liver effects, established in a recent two-generation reproductive toxicity study in mice (European Food And Safety Authority 2006, 46).

Similarly, regulatory agencies in the United Kingdom, Germany, Australia, and Austria have all explicitly come to the conclusion that the levels of exposure to BPA pose no risk to human health (Food Standards Australia New Zealand ; Federal Institute For Risk Assessment 2010; Austrian Society For Health And Nutrition Sciences ; Bedford 2010). Even Health Canada, despite the fact that it banned BPA in polycarbonate baby bottles notes that: "Based on the overall weight of evidence, Health Canada's Food Directorate has concluded that the current dietary exposure to BPA through food packaging uses is not expected to pose a health risk to the general population, including newborns and young children. This conclusion has been re-affirmed by health agencies in other countries, including notably the United States, the European Union and Japan" (Health Canada 2008a).

The only break in this regulatory consensus is the 2008 summary examination by the National Toxicology Program of published studies of BPA. In its reviews of the potential hazards of inorganic substances, the NTP uses a five-point scale including negligible concern (the lowest level), minimal concern, some concern, concern and serious concern. In its 2008 report, the NTP argued that it had negligible concern for adverse health effects for adults and mostly minimal concern for health effects on infants or fetuses. However, it also said it had "some" concern for developmental and behaviour effects for fetuses and infants. This phrase – "some concern" – couple with the authority of the National Toxicology Program contributed to substantial media coverage and is also cited by Health Canada's risk screening assessment that justified the decision to ban baby bottles in 2008 (Health Canada 2008b).

However, later the NTP was criticized for making this classification on limited evidence. For example, in response to this finding from the NTP, researchers affiliated with the Environmental Protection Agency later conducted a large-scale study of the effects of BPA on neurological and behavioral characteristics of rats (Ryan et al. 2010). That study involved three groups of rats: a control group of rats with no treatment; a positive control group of rats exposed to doses of a powerful estrogenic chemical used in birth control (ethinyl estradiol) and lastly rats exposed to BPA at doses below, at and above levels at which doses were said to have been said caused low-dose effects but which are 40-fold above the median exposure levels among American adults (Ryan et al. 2010, 134). The study found that the positive control did indeed have numerous adverse

neurological and behavioral effects, while neither the control group, nor the group exposed to BPA displayed any significant effects.

That study led one toxicologist to comment on the debate regarding BPA as follows:

> The results from Ryan et al. (2009) are unequivocal and robust and are based on a valid and rational scientific foundation. They tell us that, in vivo in female rats, bisphenol A is an extremely weak estrogen—so weak that even at levels of exposure 4000-fold higher than the maximum exposure of humans in the general population there are no discernible adverse effects, whereas the potent estrogen ethinyl estradiol (EE; the positive control) caused major adverse effects at doses used in earlier contraceptive pills and that were associated with increased risk of thromboembolism in women (Sharpe 2010, 1).

Even Health Canada's own evaluation of the dataset that led the NTP to state that it had "some" concern about the effects of exposure to BPA on neurological development reveals serious concerns about the quality of the evidence underlying this claim. The final risk assessment evaluated the evidence on this point on four criteria: the rigor, statistical power, consistency of findings and the biological plausibility of the argument that neurodevelopmental effects might be caused by extremely low doses of exposure. For each category, Health Canada deemed the accumulated evidence as "limited" (Health Canada 2008b, 73).

Even if the reader is not yet convinced that the scientific evidence underlying the fear that contemporary exposure to BPA is a threat to human health rests on flimsy evidence, then hopefully, the reader will at least be persuaded that the rhetoric characterizing the debate far outstrips the scientific evidence for potentially adverse effects. For example, 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 pill" (University of Missouri. College of Arts and Sciences. 2000). On a later occasion, he claimed that: "This is the global warming of biology and human health" (quoted in Neimark 2008). This alarmism has been reflected in the news media.[5] On April 7, 2007, the Globe and Mail published a 2-page feature on

[5] The author is preparing a content analysis to evaluate not just the level, but the substance, of newspaper coverage of BPA in Canada. While results are forthcoming, it is apparent that when newspaper coverage did address the scientific debate, several themes dominated. First, the difficulty of ascertaining adverse health effects of humans from animal studies was rarely brought up. Second, the sheer number of studies that purported to demonstrate adverse effects on animals was emphasized as evidence of the problem, without regard to the quality of those studies or the phenomenon of publication bias where scientific researchers and journals have strong incentives to publish positive results and limited incentives to publish null findings. Third, stories emphasized the decisions of consumers, who inevitably chose to avoid products with BPA when confronted with stories framed to emphasize potential hazards. Fourth, industry-funded scientific studies that did question the notion that BPA in the marketplace posed risks to human health were often written in such a way so as to emphasize the possibility that private financing should cause doubt as to their validity. The one category of news stories (often editorials) that did explicitly question the notion that BPA caused any harm emphasized the environmental movement's tendency to overstate risk and to assert an antipathy to

the scientific debate, featuring the president of Environmental Defence's demand 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 Globe and Mail published results of a study that found traces of BPA on receipts and cash bills. Citing a non-peer reviewed report from a coalition of environmental groups in Washington state and without any regard for the complex causal process that must be established between exposure and adverse effects, the paper darkly wrote in the first sentence of the story that: "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).

Given this state of scientific evidence, the varied regulatory positions on this issue remain to be explained. To reiterate, seven American states and three countries have chosen to ban the production, sale or consumption of BPA to some degree while others have chosen not to do so. Reiterating the thesis put forward in the introduction, this paper argues that one explanatory factor in which American states and which countries adopted bans is the level of media coverage given to the issue, contributing to rapid policy changes in those jurisdictions where the issue expanded and the policy image changed quickly.

III. Methodology and data

Event history analysis is a well-established statistical method with roots in epidemiology, medicine, public health and engineering processes where researchers were primarily interested in studying the time from 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). Event history models are estimated to assess whether particular independent variables of interest have a significant impact on the duration times until the onset of the event of interest. The technique has been adapted for use in other social sciences, including in political science. In particular it has been used to map factors that influence the diffusion and adoption of particular policies across the 50 American states across time (Berry and Berry 1990). For example, Hays and Glick 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 (1997). Similarly, Brace et al. (1998) examined the factors that contributed to court cases being filed challenging legislative restrictions on abortions following the Roe v. Wade decision. Event history analysis presents a well defined and codified methodology that can aid in assessing whether level of media coverage is significantly related to the adoption of BPA bans.[6]

There are two broad categories of event history analysis: continuous and discrete time analysis. Both are necessary to answer the question here. Continuous time analysis takes as its dependent variable the duration time in each case from the start of the observation period to the end of the observation period. In this case, one models the duration times for each case and assess whether certain independent variables contribute to the likelihood that the duration time until the event occurs is shorter or longer. In this case, continuous time analysis is best suited to the cross-national comparison as

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science on its part.

[6] Guidance for the modeling strategies described below is taken almost exclusively from *Event History Moedelling: A Guide For Social Scientists* (M. Box-Steffensmeier and S. Jones 2004).

governments are empowered to issue decisions on hazardous chemicals either by legislation or regulation at virtually any time during the calendar year. However, in the United States in general, and in the case of BPA in particular, the decisions by individual states to ban or not ban the chemical were taken by the state legislature. However, many state legislatures only meet once per year for several weeks at a time. Thus, it makes no sense to model the duration time until the event occurs because one major factor that would influence how long it has taken for any individual state to ban the chemical is what point in the year the legislature met. The alternative strategy in this case is to treat each state and year combination as an observation in the dataset and to treat each observations as a binary dependent variable with a value of "0" in the case that the observation did not experience the event under consideration and a "1" in the case that it did experience the event. The following section describes the case selection strategies and the operationalization of variables of interest for the cross-state and the cross-national comparisons.

Case selection

In the case of the American states, 48 states are analyzed over three years. Because there are no good data on the strength of environmental opinion in Alaska and Hawaii (see below), these two states were eliminated. The states were examined over a three-year process. The dates marking each 12-month interval varied on whether or not the state adopted a ban or not. For those states that adopted a ban, the time period was the three-year period prior to the adoption of that ban. For all other states, the time period was June 26, 2007 through to June 26, 2010 (the date at which the last ban on BPA was adopted, in New York state). Two states (Minnesota and Connecticut) adopted bans in the second year of the process (2009) and therefore exited the dataset after that point. Five states (Vermont, Wisconsin, New York, Washington State and Maryland) adopted bans in the final year, 2010.

In the case of the cross-national comparison, case selection was somewhat more difficult. Three countries (Canada, Denmark, France) have adopted bans on BPA and one international organization (European Union). For the purpose of testing the agenda-setting hypothesis, this paper ignores the EU ban on the grounds that it happened after all three countries had already banned the chemical and because such a decision is likely the result of processes much more complex than simple agenda-setting. While much could be written on the internal decision-making procedures of national governments and the European committee that lead to this decision, there remains much to be learned by only examining the interaction between national media agendas and national decisions. Case selection was also complicated by the need to find countries that had daily, national newspapers indexed in the same database and also had reliable national public opinion data for gauging the strength of environmentalism. In the end, 10 countries were selected. In addition to the three countries that did adopt a ban on BPA, Germany, the United Kingdom, Ireland were added. None of these countries adopted a ban on BPA. This dataset, while not a randomly selected set of countries, does allow sufficient variation on the dependent variable and have information on necessary independent variables.

Adoption of Bans Of BPA

Web searchers and communication with the American Plastics Council were used to determine which states had banned BPA (St. John 2010). A state was considered to have banned BPA if both chambers passed legislation and the governor of the state signed that legislation. Massachusetts was the only exception to this, as the governor's administration there banned BPA via regulation. In each case, the date chosen for the adoption of the ban was the date the second chamber voted on the legislation (the day the governor adopted the regulation in the case of Massachusetts).[7] The dates used for each state's bans are in Table 5.

In the cross-national comparison, the date adopted for the ban was the vote by the second chamber to ban BPA in the case of France and Denmark and the date of the first ban on polycarbonate baby bottles by Canada's federal government. Because the cross-sectional comparison models duration time to adoption of a ban, these cases start on January 1st, 2005 and proceed until November 15, 2010, the day that the European Union issued a continent-wide ban.

Salience of Environmentalism

Both models introduce a control variable for the strength of environmental sentiment in the respective jurisdiction. There are two reasons for this. First, at least in the Canadian case, the decision to ban BPA was taken in a time frame when the environment was a highly salient issue (some public opinion polls put made the environment the most important issue). It might be the case, therefore, that it was not necessarily the level of media coverage, but the importance of environmental issues to voters at the time that pushed governments to adopt a ban. Moreover, in the case of the United States, those states that adopted a ban on BPA also tend to boast strong environmental movements and legislation. Second, while the issue of the potentially toxic effects BPA on human health may seem to be only tangentially related to traditional environmental issues of ecological protection and species preservation, it remains the case that BPA has manifested itself primarily as an environmental issue. In Canada, high levels of media coverage are attributable to intense lobbying and publicity activity by the organization Environmental Defense. 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.

In the case of the cross-state comparison, this task is complicated difficulty of gauging public opinion in the various states, a difficulty stemming strictly from the prohibitive costs of conducting 50 public opinion surveys to construct representative samples of opinion in each state (Lax and Phillips 2009). As an alternative, therefore, this paper introduces a measure of environmentalism developed by Mazur and Welch (1999). They assign 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, lastly, a rating of state policy on 50 different environmental

[7] There were no cases where both legislative chambers adopted a ban but where the respective governor declined to sign the legislation. The date of the second legislative vote was chosen because this was the event most likely to have been influenced by the level of media coverage.

policies. The score each state earned is introduced into the cross-state comparison as a measure of the importance of environmentalism in each state.

Assessing the salience of environmentalism is far easier to introduce for the cross-national comparison. The Eurobarometer survey routinely conducts public opinion surveys in each member country of the European Union and often asks respondents to list the top two issues facing that country. While these questions are not asked in every round of the survey, they are asked at least once a year. To obtain comparable Canadian data, this paper uses answers to the "most important problem" question from the Focus Canada series of quarterly public opinion surveys. Results are taken only from quarters that match the Eurobarometer surveys.[8] Finally, because the European surveys asked respondents to list the top two issues facing their country, while the Canadian survey only asked for a single response, the data were all indexed to their 2005 levels, well before there was any significant public interest in the BPA. Technically then, the public opinion variable for each country measure how salient environmental concerns were in each country compared to 2005, and not absolute levels of concern. Figure 3 displays the indexed values of environmental salience in the seven countries compared.

[FIGURE 3 HERE]

Quantity of News Coverage

In the cross-state comparison, "bisphenol A" was used as a search term in all daily newspapers in each state contained in the Lexis-Nexis database.[9] The number of newspaper stories for each state and each time period were divided by the number of newspapers contained in the search, making the variable an average number of news stories per newspaper. The news stories were grouped into three 12-month periods working backward either from the day a state adopted a ban on BPA or from the end date of the observation period, June 26, 2010. Stories were grouped into a 12-month period because of the rhythm of annual legislative sessions in American legislative sessions.

In the cross-national comparison, the same search strategy was adopted except for the periods. Rather than grouping news stories into a series of 12-month periods, each country's media was searched starting from January 1, 2005 to the end of the observation period, November 15, 2010 (the date on which the EU adopted a ban on BPA).[10]

Partisanship

Because all states that banned BPA were controlled by the Democratic Party (House, Senate and Governor) and because environmentalism is often – although not exclusively – promoted by those on the left of the political spectrum, the model for the cross-state comparison includes a variable for the partisan composition of the legislature for the relevant time period, drawn from information contained in the United States

[8] The Environics Focus Canada series is publicly available from the Canadian Opinion Research Archive (http://www.queensu.ca/cora).

[9] Bisphenol A was chosen as the search term instead of "BPA" because initial examination of news stories suggested that it was standard journalistic practice to always spell out the substance's name at least once in every article. Moreover, "bpa" can also refer to "barrels per annum", commonly used in reports about oil production.

[10] It is worth emphasizing that all non-English languages relevant to this study (Dutch, German, French and Danish) all use the same spelling, enabling searches with the equivalent term.

census (U.S. Census Bureau 2011). No variable was included for partisanship in the cross-national comparison because there was no evidence that there was a left-right distinction between those governments that adopted a ban and those governments that did not. In fact, in the cross-national comparison, all governments or parliaments that adopted a ban were dominated by conservative parties.

IV. Analysis

Cross-State Comparison

Before describing the results, it is necessary to describe two slight modification introduced here. Box-Steffensmeier and Jones suggest that when using discrete time periods (as with years between legislative sessions) traditional logistic regression can be used to assess the impact of various independent variables have on the odds that the event of interest happens in any given time period. However, to do so it is necessary to account for the passage of time or duration dependency (2004, 74-75). One way to do this when there are is a small number of cases is to include a temporal dummy variable in the model. In this case, dummy variables for 2008, 2009 and 2010 are introduced for each state and coded either "1" or "0". These variables have the effect of capturing the impact of time above and beyond any discernible impact of the variable of interest (the quantity of news media coverage). Second, because logistic regression paradoxically fails when the outcome of the dependent variable (ban or not ban) can be perfectly predicted by an independent variable, this analysis must make use of alternative is to use a method known as penalized likelihood logistic regression. This slightly modifies the way in which coefficients for the independent variables are calculated which reduces the bias that can arise in small samples or in cases where complete separation is evident (Heinze and Schemper 2002).[11]

Table 3 summarizes the event history analysis for the cross-state comparison. Controlling for both time, environmental sentiment and partisanship, it suggests that the that the number of news stories in the 12-months preceding state bans was significantly higher (in a statistical sense) than in 12-month intervals where there was no ban. Neither the partisan composition of the state government nor environmental sentiment have any significant effect. Moreover, variable for the year does show a significant effect at 2010, which is not surprising, given that two states adopted bans in the year 2009 and that five more did so in 2010. The reason that partisanship does not have effect in the model, even though only Democratic states adopted bans, is because only a small fraction (7 of 27) Democratic states actually did so.

To explicate this more clearly, Figure 4 describes the probabilities a Democratic state might adopt a ban derived from the model fit to the data at hand. These probabilities are plotted against the number of news stories per 12-month interval and broken down by year. Based on the model fit to the data, the probabilities increase each year – which reflects precisely what happened. Moreover, the shape of the curve changes slightly in 2010. In 2008 and 2009, the model fit to the data suggests that states might adopt a ban in those years only at very high levels of media coverage. But in 2010, the

[11] This is the phenomenon of complete separation. See Field (2009, 275-277) and Zorn (2005). Whenthis occurs, standard logistic regression can lead to inflated, or infinite, estimates of the coefficients and the standard errors. In this case, failure (or not adopting a ban can be perfectly predicted by whether a state legislature was of mixed or Republican composition.

model reveals a flattening at the lower levels of media coverage. This is in fact, precisely what happened. In 2009, Minnesota and Connecticut adopted a ban with an average of 10.5 and 12 newspaper stories per newspaper in the 12 months prior to their decisions. In 2010, however, states such as Washington, Vermont, Wisconsin, Maryland, Massachusetts and New York adopted bans at lower levels of media coverage (1, 5, 4, 4, 1.3, 3.1).

[INSERT FIGURE 4]

There is one outlier in this dataset. In 2010, the media in the state of Oregon dedicated a substantial amount of attention to BPA (13 news stories per newspaper over 12 months) and correspondingly the Democratic House of Representatives responded by adopting a ban on BPA. This ban came close to being adopted by the Senate, but lobbying by the Oregon business community, particularly that state's fruit growers and grocers that rely on BPA in the packaging of their products, opposed the ban publicly.

In sum, the comparison of media agendas over a three-year period in the American states suggests that in Democratic states at least, those states that did adopt a ban had statistically significant higher levels of media coverage than those that did not.

Cross-National Comparison

Turning to the cross-national comparison reveals additional evidence that is of the same process. In contrast to the previous analysis which fit a logistic regression model to the data, this comparison fits a Cox regression model with two independent variables that vary over time: the salience of environmentalism in public opinion compared to 2005 and the number of news stories per newspaper about BPA in the same time periods. As noted above, the primary reason for doing so was that national governments are freed from the temporal constraints of adopting policies to a far greater extent than American states are; governments are often empowered by regulation to adopt bans and national legislatures are in session for greater periods of time than are American state legislatures. Technically speaking, the dependent variable in this model is a measure of the rate at which the event of interest happens.

Figure 5 charts the evolution of newspaper coverage in the 10 countries in the comparison. Canada, Denmark, France and Germany are described separately – the rest are averaged. The Canadian case stands in that it shows the greatest *and* the earliest spike in media interest. Similarly, Denmark's newspaper agenda – the second country to ban BPA – stands out as the second – and the second largest – spike in media interest. However, the picture becomes somewhat clouded after that; Germany experienced an earlier spike than did France but coverage then dropped off, while the French news media appear to increase coverage to greater levels monotonically. Of those countries, however, only France adopted a ban. This pattern reflects the policy agenda across Europe at the time. Denmark's decision to adopt a ban contributed to considerable concern among European member states. In light of that decision, the European Commission asked for an urgent reappraisal of BPA by the EFSA, which duly responded in October 2010 that there was no cause for concern (European Food Safety Authority 2008).

The model includes two independent variables – quantity of news coverage and the salience of environmentalism. The coefficient for news stories is positive (0.287), suggesting that in the time period immediately prior to any one of the three bans being

adopted (Canada – April 2008; Denmark – March 2010 ; France – May 2010) news coverage in the country that adopted the ban was significantly higher than in the other countries at the same time. Although that coefficient does not reach the level of statistical significance, this does not undermine the argument presented here. In large part, this is an artifact of the smaller sample size which is a result of leaving out three countries (Switzerland, Australia and New Zealand) for which no reliable public opinion data comparable to the Eurobarometer or the Focus Canada data can be found. There are 68 observations in this model. Table 7 summarizes the event history model, dropping the environmental salience variable, including Switzerland, Australia and New Zealand (increasing the sample size to 98). One will note the coefficient describing the relationship between the level of news coverage and the rate at which bans were adopted is nearly identical (0.27). However, because of the larger number of observations included, the coefficient has a p-value of 0.09.

Analyzing the evolution of the news agendas in the 10 industrialized countries suggests a reasonably clear relationship between the level of news media coverage about BPA and those countries that banned the chemical. This apparent relationship is supported by a statistical analysis that suggests that in the periods that countries adopted a ban, news media coverage was significantly higher at the same time than in those countries that did not. There is evidence in both a cross-national and a cross-state comparison that the quantity of newspaper coverage dedicated to BPA in jurisdictions that banned BPA was significantly higher prior to adopting the policy, than in jurisdictions.

VI. Discussion

These findings support the importance of the evolution of media agendas for explaining policy change, but they say little about the importance of venues, which is an important element in contemporary theories of agenda-setting and policy change. In part this is the case because of an arbitrary decision by the researcher to test for the relationship of media coverage first. In part this is the case because, on first glance, it appears that there are no apparent relationships between political venues and the path of policy diffusion. BPA bans have been adopted in majoritarian (Canada, France) and proportional (Denmark) legislative systems; federal (Canada) and non-federal (Denmark and France). In future, more holistic analyses may reveal important dynamics about the relationship between venues and policy diffusion. For example, it may be the case that environmental movements have chosen to target state legislatures, rather than the United States Congress because they felt they have greater influence in those environments. Moreover, in the Canadian context, future research may reveal that the responsiveness of the federal government to demands by environmental groups may have been exceptional – rather than the rule – given the minority parliament that obtained at the time.

It is worth pointing out the apparent differences in the relationship between partisanship and the adoption of bans between the United States and other countries. At the state level, there clearly is a partisan flavour to the issue. Only Democratic states adopted bans (although only a minority of states held by the Democrats). At the international level, only conservative-dominated parliaments adopted bans. This may reflect the fact that the environment is politicized along the left-right divide in the United States far more than in Europe, where it is possible that environmental concerns have

become so widespread such that they now transcend partisan distinctions. This remains strictly conjecture at this point.

It should also be emphasized that the evidence presented above regarding the influence of the media on the diffusion of this particular policy should not be construed as an argument for a strictly monocausal relationship. There is no question that other causal factors at play here. The clearest example is the role that environmental movements have played in lobbying governments, raising public awareness, mobilizing supporters and even conducting research to buttress their cases. Even if we move beyond media coverage to other causal links, it remains the case that environmental movements used the media as a primary conduit to exert influence. This says something important about capacities for outsiders to exert influence and the characteristics of contemporary journalism (see below) that the news media can successfully serve as an outlet for non-elite actors.

These findings raise at least three substantive concerns for political scientists. First, the Canadian experience on this issue suggests a very different pattern of policy-making in the field of the regulation of toxic hazardous chemicals than has previously been the case. Harrison and Hoberg's comparative study of how Canada and the United States responded differently to the risks posed by different chemicals suggested a common theme; that is to say, that in Canada, policy-making was marked primarily by a closed system of elite actors (Harrison and Hoberg 1994). The United States, by contrast, was characterized by a more open system with significant roles to play by the environmental movement, courts, state and corporate actors. The way that the media set the agenda in Canada, suggests a more open policy regime. In part this is attributable to the string of minority governments between 2004 and 2011 that made policy makers particularly sensitive to any issue on the media agenda that might jeopardize the standing of the government of the day. However, it also reflects an evolution in Canadian policy-making that stretches back even further. Scholars of Canadian public administration have pointed that the relationship between the state and the civil service has been transformed. Whereas under most post-war governments the civil service was seen as a source of technical expertise and policy advice, the bureaucracy has increasingly come to be seen as an obstacle to democratic decision-making. Advice in Canada has increasingly come from a more fragmented roster of political actors including interest groups. In the BPA case, environmental groups such as Environmental Defence exerted a tremendous impact via their visibility in the news media at the expense of the technical expertise within Health Canada.

Framed in this way, this evolution is primarily of interest to scholars of political science and public administration. That is to say, this trend is one to be noted and taken into account in future examinations of Canadian decision-making. There is however a normative case to be made here, and this is the second finding of which political scientists should take note. That is to say: this case throws up the question of whether Canadian decision-makers are getting the best policy advice possible in an environment where the civil service is sidelined to the benefit of whatever social movement, lobby group or special interest can capture the media's agenda, even where that relevant actor is something seen as benevolent as the environmental movement? Few political scientists would believe that a purely rational decision-making process is ever possible. Politics is an intrinsically affective and conflict-ridden activity. Moreover, there is substantial

evidence that individuals themselves are cognitively incapable of correctly identifying risks. The anthropologist Mary Douglas and the political scientist Aaron Wildavsky developed a cultural explanation for why individuals find some things riskier than others. They argued that our perception of risk was strongly influenced by what we valued in terms of social ordering (i.e. whether we valued individual or communitarian; hierarchical or egalitarian orderings) (Douglas and Wildavsky 1982). This cultural theory of risk perception has been tested with insightful conclusions. For example, respondents see the risk of mandatory vaccines for the human papilloma virus (HPV) differently in part because of their views on gender roles and female sexuality (Kahan et al. 2010).

However, despite the affective and conflictual nature of politics, scientific methods – however imperfect – have evolved to give us reliable insights into the risks associated with various substances and social activities. While in this case some scientists have vigorously and loudly claimed that they have found the potential for serious adverse effects to human health, many other scientists – including nearly all of those in global regulatory agencies – have not been persuaded. Yet, the news media in Canada, France, Denmark and certain US states have steamrolled over those scientific objections and accepted the accusation by the former camp without serious regard for the dominant opinion.

If we view this case on its own, there is perhaps only minimal cause for concern. If we view it alongside a longer historical trend to sideline scientific expertise, then perhaps this episode takes on a darker hue. There is a common observation that conservatives have politicized the role of science in the policy process. For example, American and Canadian bureaucracies have been under tremendous pressure in recent years to minimize their public statements regarding the scientific evidence undermining climate change. One author has gone so far as to posit a "Republican War On Science" (Mooney 2009). Colin Leys has argued that the shift from a social democratic-liberal policy environment to a neo-liberal policy environment is partially yet importantly characterized by a new attitude towards evidence (Leys 2006). For Leys, the rise of "grey literature", the decline of Royal Commissions and the corporate funding of science at public universities pave the way for what he calls neo-liberal democracy and the "cynical state".

If, however, as this case suggests, it is also the case that the news media and elements of the environmental movement are equally capable of generating substantial hysteria about a common household chemical and steamrolling the technical expertise within bureaucracies, then perhaps we should raise some louder alarm bells about the status of science in contemporary politics. Perhaps then Susan Jacoby's warning about the "Age of American Unreason" are prescient and pressing (Jacoby 2008).

Lastly, this case poses some hard questions for contemporary practices of science journalism. This is a serious problem for how societies perceive and regulate risky activities and substances. In the first place, the news media are extraordinarily influential institutions. However, the norms and practices that govern contemporary journalism are deeply inadequate to convey the complexities of scientific debate. Newsroom resources are declining in general and science journalism has not been spared these cuts. A 1994 survey of Canadian newsrooms found only 18 dedicated science journalists in the 105 English-Canadian newspapers, and most of these had no special training (Saari, Gibson,

and Osler 1998). One research project currently under peer-review conducted a survey of journalists who had written stories on pharmaceutical innovations in Canada and found that most considered that they had an above-average understanding of the scientific process but less than half of the survey response were aware that scientific journals require authors to publicly declare any competing financial interests (Buist 2011).

While the problems afflicting science journalism in Canada are legion, there are three that stand out in this case. The first and most important was simply the tendency to sensationalism, ascribing a great deal of importance in news coverage to unproven is the inability by journalists to recognize publication bias within scientific journalism, that is, the strong financial and professional incentive by researchers and peer-reviewed journals to publish positive results, leaving crucial null findings unpublished (Dolgin 2009). The second was a knee-jerk reaction against industry-funded science. The chemical industry played an important role in this case study in funding – although not necessarily supervising – important clinical trials that regulatory bodies subsequently relied on to set standards for safe exposure to BPA. The most important cases in this regard were two multi-generation studies by Tyl et al. (2002; 2008). While the public interest is well served by a heightened scrutiny of industry-financed research, it is also crude to suggest that all of it is hopelessly tainted. For one thing, industry often has the financial capacity and the will to fund large-scale, robust studies necessary to ascertain complex causal relationships. Public laboratories often lack these resources. Moreover, the argument that industry funded research is always tainted often ignores the reality that public researchers have their own interests that may cloud their judgment (e.g. prestige, status, laboratory funding or the unwillingness to correct previous mistakes). Lastly, science journalism often misses the fallibility and the partiality of scientific knowledge, seizing on the importance of one isolated finding, yet failing to recognize the importance of replicating research findings or the difficulty assessing the external validity of laboratory findings (e.g. establishing that a laboratory finding holds also in the real world. In the case of BPA, Canadian science journalists missed crucial steps in the scientific process to establishing the case that there were adverse effects. For example, they missed the importance of the reproducibility of results, the gap between actual human exposure and the consensus within scientific communities as to where harm actually might occur and they missed the dangers of publication bias that can distort the picture created in peer-reviewed literature.

VII. Conclusion

This paper started with the observation that Canada adopted a ban on BPA in baby bottles before any other country and that Denmark, France and several American states joined in this ban. A review of the scientific evidence from industry, public researcher and regulatory bodies revealed that there simply was no scientific consensus that could justify such strict action. Drawing on agenda-setting theories of media influence on the political process, it tested the hypothesis that the level of media coverage could be an explanatory factor in the varied outcome. Using event history analysis, a statistical analysis meant to shed light on policy diffusion, it provided evidence that media coverage was higher in jurisdictions that adopted a ban on BPA, prior to them doing so. This paper argues that this finding has consequences for empirical observations

about Canadian public administration, normative concerns about the status of science in contemporary politics and concerns about contemporary practices of science journalism.

FIGURES AND TABLES

Figure 1: Scientific Interest In Bisphenol A

Number Of Articles Responding To Search String 'Bisphenol A' in PubMed

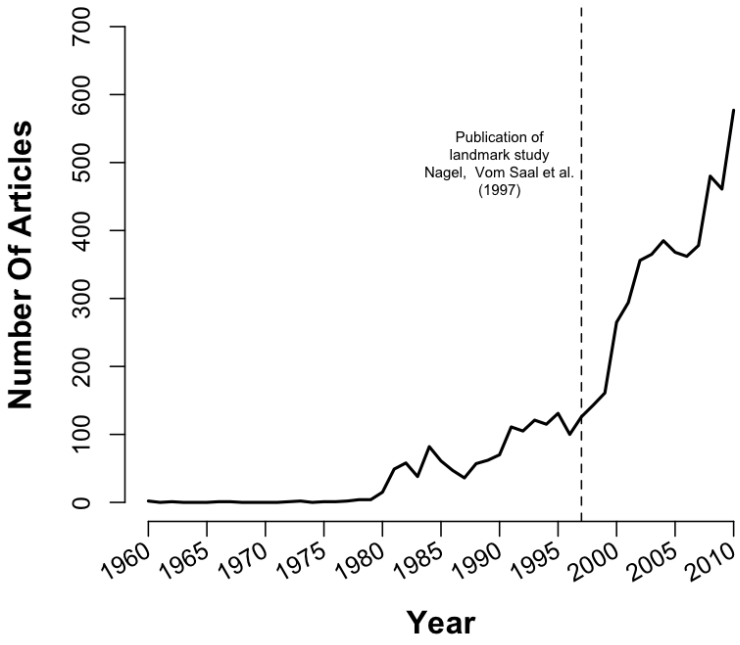

Figure 2: Hypothetical Non-Monotonic And Linear Dose-Response Curves

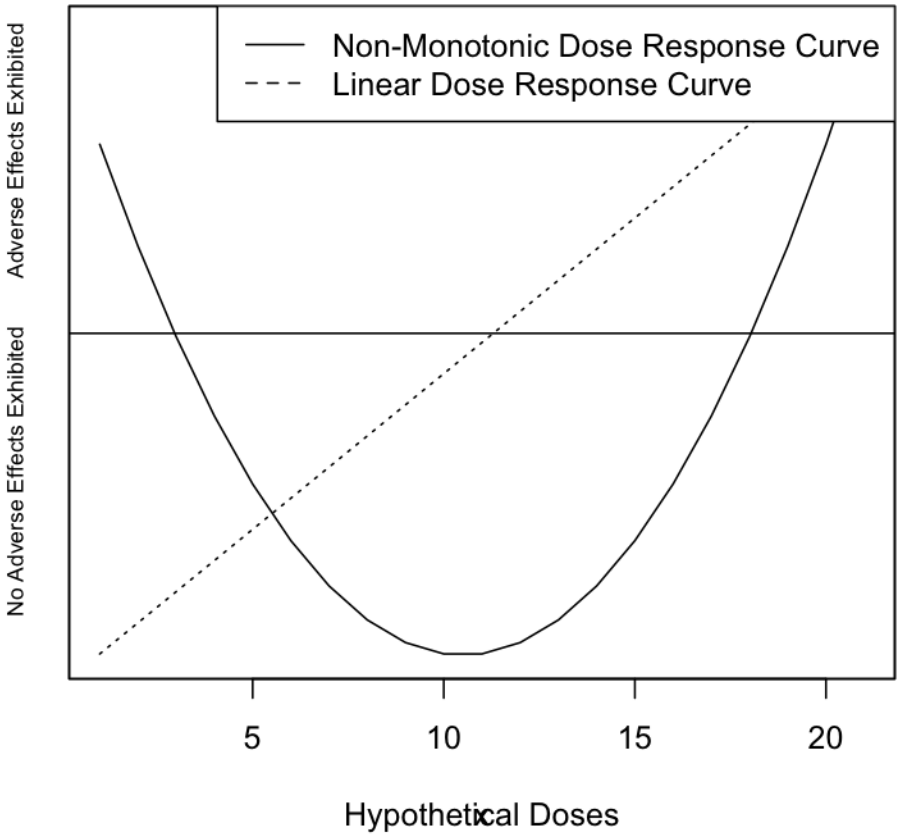

Figure 3: Percent of Respondents Calling Envionment Most Important Issue, Indexed To 2005

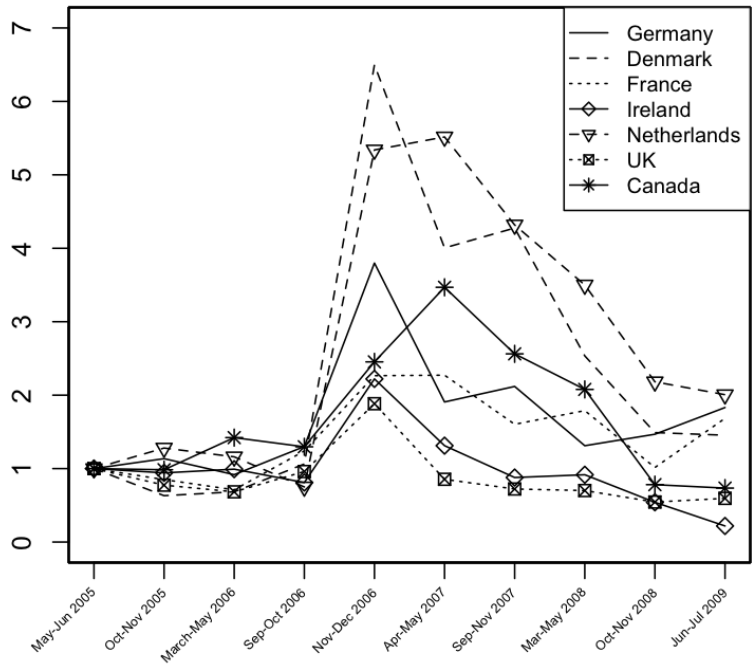

Figure 4: Probabilities of Adopting BPA Ban By News Coverage, Democratic States

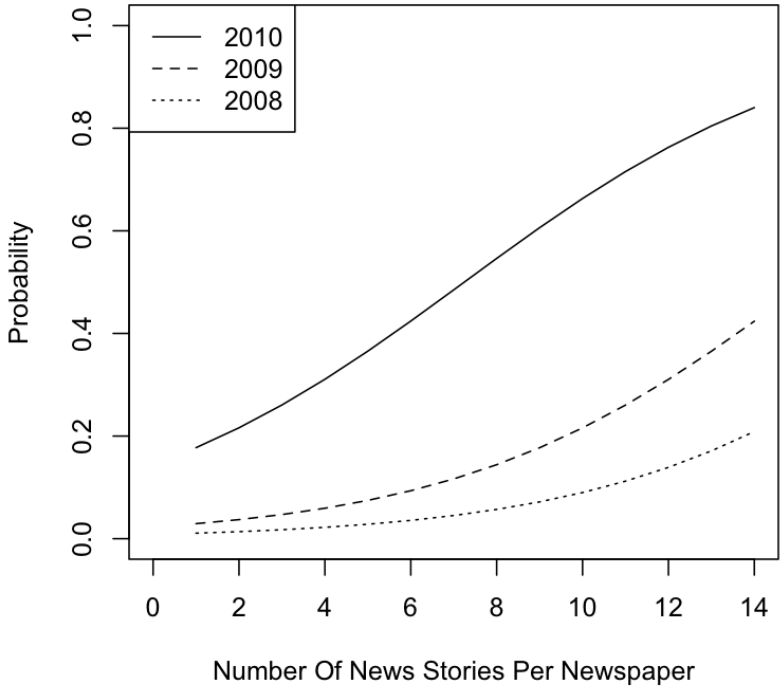

Figure 5: Newspaper Coverage of Bisphenol A In 10 Industrialized Countries, 2005-2010

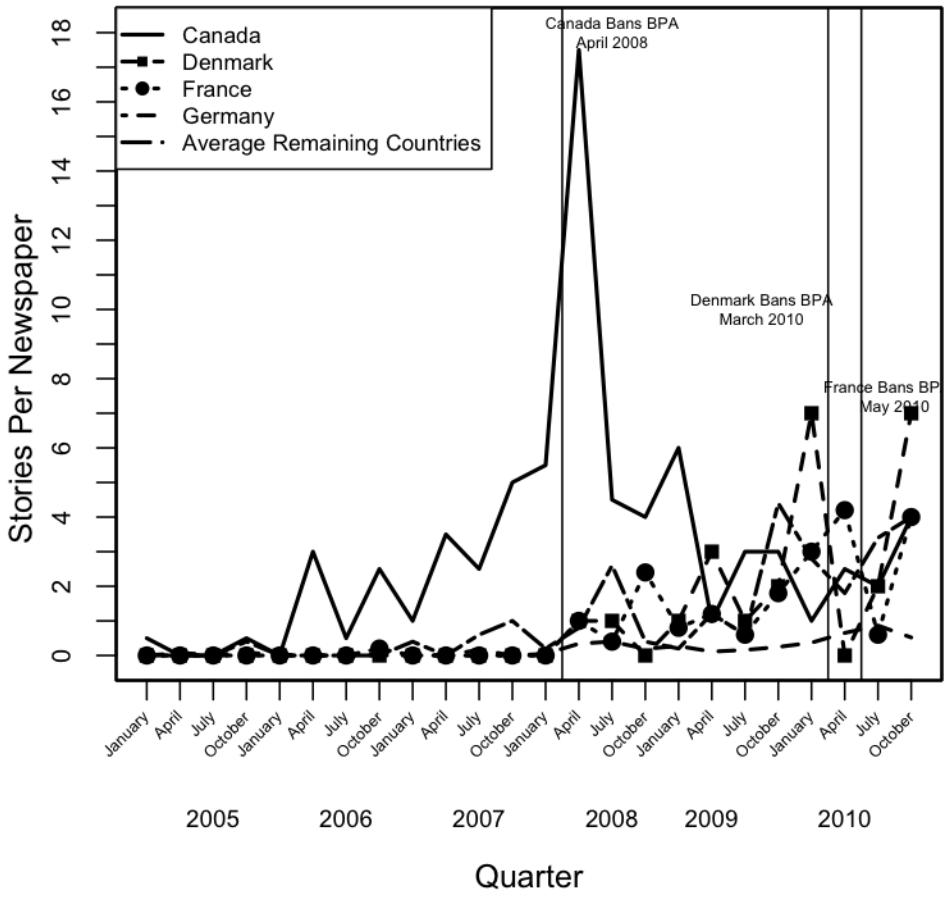

Table 1: Exposure Estimates To BPA micrograms/kg/bw per day	
0-4 month-old infant	1.6
6-12 month-old infant	0.8
4-6 year old child	1.2
60 kg adult	0.37
Source: European Commission. Scientific Committee on Food. 2002	

Table 2: Probably Daily Intake By Infants From Formula	
0-1 months	1.35
2-3 months	1.31
4-7 months	1.02
8-12 months	0.55
12-18 months	0.46
Source: Bureau of Chemical Safety Food Directorate. Health Products and Food Branch 2008, 5	

Table 3: Event History Model Of Cross-State Comparison of News Coverage and Bans of BPA				
	Estimate	**Std. Error**	**z-value**	**p-value**
(Intercept)	-7.7169	1.9208	-4.017	5.88e-05 ***
Partisanship (Mixed)	-0.8084	0.7816	-1.034	0.3010
Partisanship (Republican)	-0.1735	0.5579	-0.311	0.7558
News Stories	0.2457	0.1227	2.002	0.0453 *
Year 2009	1.0253	1.5554	0.659	0.5098
Year 2010	2.9918	1.4273	2.096	0.0361 *
Environmentalism	3.9267	2.5103	1.564	0.1178
Significance Codes: *** p> 0.001, ** p> 0.01, *p>0.05, . p>0.1				

Table 4: Cases In The Cross-State Dataset Over Tim		
Year ending	Number Of States In Dataset	States Adopting A Ban
June 26, 2008	48	0
June 26, 2009	46	2
June 26, 2010	41	5
Total Observations	142	

Table 5: Dates Of Bans In US States	
Minnesota	May 8, 2009
Connecticut	June 4, 2009
Washington	January 26, 2010
Maryland	February 25, 2010
Wisconsin	March 8, 2010
Vermont	May 24, 2010
New York	June 26, 2010
Media coverage was grouped by 12-month intervals working back from these dates.	

Table 6: Summary Of Multivariate Cox Regression Model Of News Coverage On Survival Time					
Variable	**Coefficients**	**Exponentiated Coefficients**	**Standard Error**	**z-score**	**p-value**
News	0.2764	1.3183	0.2285	1.209	0.227
Salience of Environmentalism	-0.6456	0.5243	2.7129	-0.238	0.812
Rsquare= 0.086 (max possible= 0.146)					
Likelihood ratio test= 6.13 on 2 df, p=0.04661					
Wald test = 2.18 on 2 df, p=0.336					

Table 7: Summary Of Univariate Cox Regression Model Of News Coverage On Survival Time					
Variable	**Coefficient**	**Percent increase in chance of event occurring per unit change in "news"**	**Standard Error of the coefficient**	**z-score**	**p-value**
News Stories	0.2872	1.3327	0.1712	1.677	0.0935 .
Rsquare= 0.081 (max possible= 0.126)					
Likelihood ratio test= 8.29 on 1 df, p=0.003982					
Wald test = 2.81 on 1 df, p=0.0935					
Score (logrank) test = 10.92 on 1 df, p=0.0009505					
Significance Codes: *** p> 0.001, ** p> 0.01, *p>0.05, . p>0.1					

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