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Bisphenol A : how media and special interest groups influenced the ban on BPA

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Bisphenol A: How media and special interest groups influenced the ban on BPA

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Dedicated to Eaden

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Description of Project

Recently, there has been great dispute about the effects of bisphenol A (herein referred to as BPA) leaching into baby bottles. This led to Canada being the first country to ban BPA in baby bottles in April of 2008 (CBC, 2008). This decision elicited criticism from the USA Food and Drug and Administration (FDA) but according to Health Ministry Tony Clement, “it is better to be safe than sorry” (CBC, 2008). It is this uncertainty of the effects due to the exposure of BPA that has fueled an interest for the topic of this paper. The purpose of this paper is to do a policy analysis in regards to BPA and the effects of industry sponsored research, specialty groups and the role of the media (newsprint). The next section of this paper looks at the methodology employed to identify sources, followed by a detailed look at how policy analysis is conducted in Canada and the key research findings on BPA from special interest groups coupled with the role that the media played in the decision to ban BPA in Canada. The last section describes the relevance and implications of the role played by these sources in public health and the future significance that these findings will have on public health practice, policy and research.

Introduction

BPA is a chemical produced for use primarily in the production of polycarbonate plastics and epoxy resins with many applications including use in certain food and drink packaging such as water and infant bottles, compact discs, impact-resistant safety equipment and medical devices (Center for the Evaluation of Risks to Human Reproduction, 2008). First synthesized in 1891, BPA came into use as a synthetic estrogen in the 1930's but it was not until the 1940's and 1950's that growing demand for polycarbonates made BPA one of the highest-volume chemicals in commercial production (Gross, 2007; 2008; Environmental Working Group, 2008). Since there was no requirement for companies to prove the safety of BPA, 70 years following its introduction, there was an explosion of BPA-based plastics to encompass products as wide-ranging as bicycle helmets, water coolers, and baby bottles (Environmental Working Group). Experiments conducted in the 1980s found the lowest dose of BPA to be 50 micrograms/kilogram body weight/day and regulatory bodies assume that dividing this number by 1,000 it becomes a safe human exposure dose (Gross, 2007); a safety standard which has remained in place even in the face of new studies stating the low-dose toxicity of BPA (Environmental Working Group). The US EPA set a new safety standard (reference dose) for BPA which was based on crude high-dose BPA studies showing reduced body weight of exposed animals in 1988 and this level was reaffirmed in 1993 even though this level was 1,000 times lower than amounts found to affect animals in industry sponsored studies (Environmental Working Group).

On March 13, 1996, the Food and Drug Administration (FDA) released a memorandum stating that through contaminated canned foods, adults were exposed to 11 micrograms and infants to 7 micrograms daily, and the following year, Fred vom Saal released the first study that showed how fetal exposure to environmentally relevant parts-per-billion doses of BPA can alter the adult reproductive system in mice (Gross, 2007). In May of 1999, Consumer Reports found that BPA leached from baby bottles when heated, but the FDA still asserted the safety of BPA for bottle-fed infants (Environmental Working Group, 2008).

One of the highest volume of chemicals used today, BPA is ubiquitous in the environment and can be detected in the majority of individuals examined (Rubin et al., 2009). Measurements conducted recently by the Centers for Disease Control (CDC) revealed detectable levels of BPA in urine samples from 92.6% of more than 2500 participants of the cross sectional National Health and Nutrition Examination Survey (NHANES) (Rubin et al., 2009). Included in the study were children between the ages of 6 to 12 years of age who showed the highest levels of exposure (Rubin et al., 2009). The population with the highest expected exposure level per body weight to BPA is from children from birth to 6 years of age, although the NHANES study did not include samples of this age group (Rubin et al., 2009).

It has been proven that the highest estimated daily intake of BPA in the general population occur in infants and children with an estimated intake of 0.028 to 0.18 $\mu\text{g}/\text{kg}$

bw/day (Center for the Evaluation of Risks to Human Reproduction, 2008). The reason for such a high intake of BPA for infants and children is because they eat, drink and breathe more than adults on a pound for pound basis (Center for the Evaluation of Risks to Human Reproduction, 2008). A 2003-2004 National Health and Nutrition Examination Survey (NHANES) conducted by the CDC found detectable levels of BPA in 93% of 2517 urine samples from people six years and older (National Toxicology Program, 2008). These findings are concerning because BPA has the potential to affect human development and/or reproduction (Center for the Evaluation of Risks to Human Reproduction, 2008).

As a result, Health Canada conducted a screening assessment of BPA with a primary focus on its impacts on newborns and infants up to 18 months. They determined that exposure of BPA for this particular group came from polycarbonate baby bottles exposed to high temperatures, and the migration of BPA from cans into infant formula (Government of Canada, 2008a). Though the assessments concluded that BPA exposure for newborns and infants are below levels that cause any effects, the uncertainty raised by some studies relating to the potential effects of low levels of BPA caused the Government of Canada to protect infants and young children by imposing the BPA ban in 2008. The ban was enacted on the importation, sale and advertising of polycarbonate baby bottles, and by developing and implementing codes of practices to reduce levels of BPA in infant formula (Government of Canada, 2008a).

With the publishing of Dr. vom Saal's study in 1997 on the effects of low levels of BPA to the prostate (Environmental Working Group, 2008), there have been hundreds of studies conducted on the effects of BPA. Polyzou et al. (2008) examined the leaching out of BPA from six major brands of popular baby bottles. This study found that the amount of leaching from heated bottles lies within the realm of harm in animal studies and is a significant health concern. Polyzou et al. also found that preliminary evidence suggests that the amount of BPA released from a new bottle over 24 hours at 80°C is similar to the amount released at room temperature by bottles that have been washed 60 to 100 times. BPA has been shown to strongly bind with estrogen-related receptors and as a result, it may off-set the hormonal balance required for healthy human development (Polyzou et al.). Recent studies have also affirmed that BPA can alter brain chemistry and structure, behavior, reproductive systems, and the immune systems in different animals (Polyzou et al.). BPA has been shown to disrupt hormone action within cells by competitively displacing naturally occurring hormones at low doses (Polyzou et al.). Low doses of BPA have also been shown to have a greater negative effect on fertility than relatively high doses of pesticides and can also stimulate the release of the hormone prolactin, activating breast cancer cells (Polyzou et al.). It was recently documented by an expert panel of the U.S. National Toxicology Program that BPA exposure of fetuses and of children could have behavioral and neural system impacts (Polyzou et al.).

Epidemiological studies have shown that there is a relationship between blood levels of BPA, obesity, polycystic ovary syndrome, circulating androgens and repeated miscarriages (Welshons et al., 2009). Recent studies have also shown that BPA has rapid

access to the fetus after maternal exposure, facilitated by accidents of metabolism and may lead to increased levels of BPA in the pregnant female as well as accumulation in the fetus (Welshons et al). The length of which BPA stays in the fetal circulatory system suggests a depot or an enterohepatic circulation of BPA and that fetal exposures level exceed maternal levels (Welshons et al).

Methodology

To determine the current literature published in relation to health effects of BPA, Web of Science database was used. Once on the Lakehead University library homepage, Article Databases was selected under Find and “W” was selected for Web of Science under the alphabetical listing. Once in the database, “BPA” combined with “health effects” were used as search words and 81 results were revealed. From the 81 results, 27 dealt with toxicology, 19 with environmental sciences, 14 with public, environmental & occupational health, 9 with endocrinology & metabolism, and 9 with reproductive biology. Abstracts from all 81 journal articles were read to see if the article could be used for the research paper. The articles that dealt with toxicology, endocrinology and metabolism, and reproductive biology were the criteria uses to determine the usefulness of the article for the purposes of this paper. From there, specific journals were accessed using ‘E-Journals’ from the Lakehead University library webpage. In finding journal articles focusing on the role of the media in health reports, both CBCA and Proquest Nursing & Allied Health Source was utilized from the Lakehead University Article Databases. Words used while conducting the search included but not limited to, “BPA”, “health effects”, “baby bottles”, “estrogen disrupter”, “xenoestrogen”, and “prenatal

exposure” and this yielded about 32 results. This was done to ascertain a general consensus on the role that media played in the development of policy analysis, and in particular in relation to BPA. It was determined that for the purposes of this paper, ‘media’ would be used to specify only print media (in this case, The Toronto Star and The Globe and Mail); and as a result of technology, this included articles on the web pages of the two papers. Articles relating to BPA from the Globe & Mail and the Toronto Star were accessed through Canadian Newsstand Major Dailies from the Article Databases from the Lakehead University library homepage. Once accessed, each newspaper was searched using the phrase ‘BPA,’ ‘health effects’ and the search was narrowed to the year 2008-2009. The year for the search was narrowed to 2008-2009 because of the quantity of information that would be obtained. Also, because the ban placed on BPA by Health Canada occurred in 2008, there was a greater chance of both media sources having more articles written on that particular subject during that particular timeframe. For the purposes of this report, 31 newspaper articles were obtained from the Globe and Mail from the search engine and found to be appropriate for this paper while 11 articles were found from The Toronto Star. For each paper, the articles were analyzed to see its placement in the paper.

For the purpose of this paper, special interest group is defined as a person, or group advocating for or against the proposed ban on BPA. In the search for special interest groups and the roles played in the ban of BPA, Google was used as a primary search engine using search phrases as follows, “special interest groups and BPA”, “BPA ban advocates”, “BPA ban proponents”, and “BPA in news.” From these searches and the journal articles, The Environmental Working Group (EWG) was consistently mentioned

as a major advocate for the ban on BPA while the American Chemistry Council (ACC) was strong in their stance that BPA should not be regulated or banned. As a result of the constant appearance of these two groups, they became the main focus of special interest groups for this paper. In finding industry research work, journal articles found on the effects of BPA at times cited research conducted by the ACC and most print media found also cited industry research. On the American Chemistry Council's webpage under the Plastics Division, there is a section dedicated to Polycarbonate/BPA Global Group which has links to all industry sponsored research articles. Once obtained, the journal articles advocating for the ban/increased regulation on BPA or for no ban/no increased regulation on BPA were analyzed by reviewing of the general themes in all the articles.

Results

There have been hundreds of studies conducted on the effects of BPA from all parts of the world. The original debate regarding potential effects of BPA showed that there were negligible effects and hence the lowest observed adverse effect level (LOAEL) of 50 μ g BPA/kg BW/day being reached in the 1980s. Since then, studies have shown that at levels below LOAEL, BPA is has the ability to cause effects mainly due to its ability to mimic estrogen (Brontos et al., 1995). While high levels of BPA were found in adult urine (Rubin et al., 2009), studies have shown that highest level of exposure occurs at prenatal (Ikezuki et al., 2002) and during infancy (Vanderberg et al., 2007). BPA has been detected in amniotic fluid, neonatal blood; placental cord blood and human breast milk (Rubin et al., 2009). While some studies have demonstrated that exposure to BPA can lead to an individual's susceptibility of various diseases, of grave and disturbing

concern is the linkage between BPA and various forms of cancer. The following sections look at three general themes found in sources calling for greater regulation and research into the effects of BPA and in industry sponsored research.

Research – Call for greater regulation on BPA

Endocrine Activity

BPA was shown to stimulate the reproductive system of female rats and was thought to be an “environmental estrogen” long before it was used in polycarbonate plastics and resins in the early 1950s (vom Saal et al., 2007). Xenoestrogens (environmental estrogens) are chemical compounds that have been shown to have estrogenic properties and recent studies have shown that BPA is indeed a xenoestrogen (Brontos et al., 1995). Xenoestrogens bind to estrogen receptors and have the ability to mimic estrogenic actions thus having the potential to have adverse effects on human health (Steinmetz et al., 1997). Though some results have shown that BPA is a weak environmental estrogen, effects of BPA are influenced by species, strain, dose and time of exposure (Fernandez et al., 2009). In addition to being able to elicit the same response from the body as that of estrogen, BPA can antagonize the effects of estrogen, androgens, or thyroid hormone, act through non-genomic pathway, and influence enzyme activity or receptor expression (Fernandez et al., 2009). The importance of BPA being a xenoestrogen is that it affects the function of Gonadotropin-releasing hormone (GnRH). GnRH is critical for normal mammalian reproductive function as it stimulates the synthesis and release of hormones (Fernandez et al.). GnRH secretion acts on gonadotropes to stimulate synthesis and

release of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), both of which are essential to the female reproductive system (Fernandez et al.). Fernandez et al. in their study found that neonatal exposure to high and low doses of BPA affected puberty onset without affecting body weight in Sprague-Dawley rats and that similar conclusions have also been reached by other studies.

Reproductive & Developmental Effects

Since the calculation of the safe reference dose of 50µg BPA/kg BW/day in the 1980s, data from many animal studies have revealed significant effects of exposure to doses of BPA below the calculated safe levels particularly in response to fetal, neonatal or perinatal exposure (Rubin et al., 2009).

In a study conducted on Sprague-Dawley rats by Fernandez et al (2009), it was demonstrated that exposure to BPA altered pituitary function in infantile rats, which lowered basal and gonadotropin-releasing hormone (GnRH)-induced luteinizing hormone. Keeping in mind that GnRH is critical for normal mammalian reproductive function, it was shown that BPA dose-dependently accelerated puberty onset and altered estrous cyclicity (Fernandez et al.). The study concluded that neonatal exposure to BPA, whether high or low, altered reproductive parameters and hypothalamic pituitary function in female rats (Fernandez et al.). The one flaw with the study was that the animals used, Sprague-Dawley rats, have been described as possessing a low sensitivity to estrogenic compounds (Fernandez et al.). Crain et al. (2008) also stated that exposure of pregnant

mice to BPA leads to the resultant female offspring having an increased incidence of aneuploidy, which occurs when there are an abnormal number of chromosomes, which is a leading cause of miscarriage, congenital defects and mental retardation in humans.

Sprague-Dawley offspring's exposed in utero to BPA showed an increase in body weight for both males and females (Rubin et al., 2009). What was disturbing was that in females, the effect was dose-dependent; as the lower exposure dose increased body weight in the offspring, the higher exposure dose did not, and females born to mothers exposed to the lower dose of BPA were heavier in adulthood than those born to mothers exposed to the higher dose (Rubin et al.). Surprisingly, adult animals exposed to BPA show effects that are reversible when exposure ceases while the same cannot be said for perinatal or neonatal exposures (Fernandez et al., 2009).

An association of perinatal BPA exposure with more severe pathologies including pre-neoplastic and neoplastic lesions in male prostate and female mammary gland and perinatal BPA exposure has been linked to early changes in the uterus, vagina, and ovary (Newbold et al., 2009). There has yet to be a study that has examined the potential for low doses of BPA to cause potential carcinogenic alterations in these same tissues (Newbold et al.). The importance of low-dose studies is vital because those levels are experienced by the general human population and thus requires further research (Newbold et al.).

Once born, exposure of BPA to infants can come in the form of breast milk and/or infant formula (liquid or powder). To determine the concentration of BPA in breast milk, a study was conducted on 101 healthy mothers living in Shizuoka, Japan three days after giving birth (Kuruto-Niwa et al., 2007). Colostrums' was collected from the entire sample study and a mean of concentration of free BPA ranging from 0.3 to 18.9 ng/ml was found (Kuruto-Niwa et al.). The levels of BPA in colostrums' were independent of the age of the mothers suggesting that BPA does not accumulate in the body for a long period of time (Kuruto-Niwa et al.). Due to BPA being somewhat lipophilic in nature, Vandenberg et al. (2007) have detected BPA in breast milk at various ranges in healthy women. Kuo et al. (2004) set out to determine the concentration of BPA in infant formula by means of gas chromatography. They determined that BPA is ubiquitous in regular powdered infant and follow-up formulas and that the varying concentrations of BPA is an indication of the ability of BPA to find its way into food via miscellaneous pathways and at different stages of powdered milk production (Kuo et al.). Biles et al. (1997) also set out to determine the migration of BPA from cans to liquid infant formula. They did so by looking at cans from the four major manufacturers of infant formula in the United States with the variety of formulations ranging from those fortified with nutrients such as iron to products intended for consumption by different age groups (Biles et al.). Results showed the highest amount of BPA to be 13.2 ppb and the lowest was 0.1 ppb but actual levels of BPA consumed would be lower because directions on the labels call for a 1:1 dilution (Biles et al.). On top of the leaching that occurs in baby food, there is the leaching of BPA from baby bottles as well (Cao et al., 2008).

To date, the reported effects of perinatal exposure include: altered time of puberty, prostate changes, altered mammary gland development, changes in the uterus and ovary, alterations in brain sexual dimorphisms, changes in brain steroid receptor levels, changes in behaviour including reports of hyperactivity, increased aggressiveness, altered sexual behaviour, and increased susceptibility to drugs of addiction (Rubin et al., 2009).

Carcinogenic activity

Recent studies in rodents have shown that there is a possible link between BPA and breast cancer (Crain et al., 2008). In utero exposure to BPA at doses as low as 2.5 µg/kg per day developed precancerous lesions and perinatal exposures at higher doses lead to the development of carcinomas (Crain et al.). To test the effects of BPA exposure on breast cancer, Yang et al. (2009) performed bio-monitoring of BPA in breast cancer patients and controls. Study subjects for this study were breast cancer patients who had visited Seoul National University Hospital between 1994 and 1997 and were diagnosed with breast cancer for the first time and the hospital controls were those who had visited the same hospital and were worried about breast cancer (Yang et al.). After age-matching, the 152 subjects (82 controls and 70 cases) were given well designed questionnaires reflecting the environmental factors including lifestyle, and 5ml of peripheral blood taken from all of the subjects before breakfast (Yang et al.). BPA was detected among 50.8% of all test subjects but when levels were compared between patients and controls, the median value of BPA was higher in patients than in the controls but this trend was found not be statistically significant (Yang et al.). When comparing BPA levels to the breast cancer-related factors, no significant association was found (Yang et al.). In trying to determine the findings, serum levels of BPA for the study

subjects were compared to that of subjects in an European study and the median levels were found to be lower; thus indicating a somewhat lower-exposure population for Korean women (Yang et al.). Yang et al. concluded that though they could not find statistical difference between the average levels of BPA in the cases and controls, they recommend larger scale studies to avoid any false negative results.

The National Toxicology Program (NTP) evaluated the carcinogenic activity of BPA using a chronic feed study of Fischer 344 rats and results indicated that adult exposure may increase the incidence of hematological and testicular malignancies (Keri et al., 2007). The carcinogenicity of BPA occurs through four modes of action: estrogenic endocrine disruption, promotion of tumorigenic progression, genotoxicity, and developmental reprogramming that increases susceptibility to other carcinogenic events (Keri et al.).

Industry Sponsored Research

With conflicting reports of the harmful effects of BPA, the Environmental Protection Agency (EPA) asked the National Toxicology Program (NTP) to review the evidence of BPA (Gross, 2007). If the findings from the NTP review showed compelling evidence indicating that the current risk-assessment was out-dated, it would mean substantial financial implications for the chemical industry's portfolio (Gross). The NTP panel's initial review in 2001 stated that there was credible evidence that low doses of BPA can cause effects on specific endpoints but that the effects had not been "conclusively established" (Gross). Not liking these findings, the American Plastics Council (APC)

commissioned a review from the Harvard Center for Risk Analysis (HCRA); historically, it needs to be noted that the HCRA had received funding from all the major BPA producers and their trade groups (Gross). Not surprisingly, the findings of the HCRA report stated that “the weight of the evidence for low-dose effects is very weak” and this was hailed as a comprehensive review by independent experts (Gross).

Endocrine Activity

The study released by Cagen et al. (1999) focused on the effects of BPA on male sexual development by looking at CF-1 mice through measurement of sex-organ weights, daily sperm production, epididymal sperm count and testis histopathology in the offspring of female mice exposed to low doses of BPA. The study stated that while there was a decrease in the number of pups born per litter to the BPA group when compared to the controls; this was not significant as litter size was within the normal range of historical controls (Cagen et al.). The study also found that there was no effects for BPA on testes histopathology or on daily sperm production, sperm count or on prostate weights and that as a result, previous conclusions reached by Nagel et al (1997) and vom Saal et al. (1998) on the low dose hypothesis of BPA is wrong and that BPA should not be considered as a selective reproductive or developmental toxicant (Cagen et al.).

So far in the United States, eight states have banned BPA in children’s products and in the process, the chemical industry has used fear tactics claiming that all canned food would disappear from store shelves if BPA bans were passed and have tried to

manipulate the legislative process in state campaigns like California (Janssen, 2010). According to Janssen, \$5 million was reportedly spent by the chemical industry to defeat the California bill banning BPA along with industry groups such as the American Chemistry Council and the Grocery Manufacturer's Association who have attempted to convince legislators and the public that the science on BPA toxicity is unclear, and that there are no credible studies showing that BPA is harmful. The chemical industry's assertion that BPA is safe is based on the following: academic studies on BPA need to be disregarded since Good Laboratory Practices were not used; studies of BPA in which mice and rats were used need to be disregarded upon the claim that rats and mice metabolize BPA differently than humans; and that the only one research that looked at low-dose studies used unorthodox, unrealistic, and non-repeatable methods (Janssen).

Reproductive & Developmental Effects

Gray et al. (2004) released a study that examined the weight of evidence in relation to potential developmental and reproductive toxicity of BPA. The study was commissioned by the American Plastics Council to the Harvard Center for Risk Analysis (HCRA) in 2000 due to reports that there were potential developmental and reproductive toxicity of BPA at doses well below the LOAEL of 50 mg per kg-day (Gray et al., 2004). Focus was placed on potential male reproductive effects but other endpoints that may be possibly associated with hormone-like effects were examined by reviewing relevant scientific literature published as of April 2002 (Gray et al.). In relation to the evidence for low-dose reproductive and developmental effects, the study looked at 19 studies that

satisfied their inclusion criteria (exposure as low as 5 mg per kg-day) and the panel concluded that there was no corroboration of positive findings for an association between BPA exposure and any effects on rats (Gray et al.). The study draws on conclusions reached by Ty et al in 2002 in which it was reported that BPA does not behave like estrogen as a result of delayed vaginal patency among treated animals which is opposite of what would be expected following estrogen exposure (Gray et al.). The study went on to conclude that very low oral doses have not been reliably established in multiple strains of species and as a result, there is little confidence that such effects of low doses would affect humans; and that BPA does not have the same high dose carcinogenic effects that would cause it act as a low-dose estrogen active agent (Gray et al.).

In the study reported by Tyl et al. (2002), 30 CD Sprague-Dawley rats were administered BPA in concentrations of 0, 0.015, 0.3, 4.5, 75, 750, and 7500 ppm for 3 offspring generations. The study found that at 750 ppm and 7500 ppm, there was reduced body weights and body weight gains with slight female renal and hepatic pathology but that overall reproductive organ histopathology and function were unaffected (Tyl, et al., 2002). It was found that there was no effect on mating, fertility, gestational indices, ovarian primordial follicle counts, and estrous cyclicity at all of the doses of BPA that was administered and that as a result, BPA should not be considered a selective reproductive toxicant (Tyl et al.).

Carcinogenic Activity

In 1982, the National Toxicology Program (NTP), released a technical report on the carcinogenesis bioassay of BPA in which 1,000 or 2,000 ppm of BPA was fed to 50 F344 rats of either sex; 1,000 or 5,000 ppm to groups of 50 male B6C3F1 mice; and 5,000 or 10,000 ppm to groups of 50 female B6C3F1 mice for 103 weeks (NTP). The report stated that there was an increase of leukemia at increased incidence in dose of both sexes but when a Cochran-Armitage test was applied; neither the trend nor the increase in the high-dose group was significant by life table analyses which adjusted for survival differences among groups (NTP). Interstitial-cell tumours of the testes were found to be statistically significant in low-dose male rats, but the researchers deduced that since these lesions normally occur at high incidences in aging F344 male rats, that this observation was not significant (NTP). The study went on to state that while there was a significant increase in leukemia in male and female rats, it is not suggestive that exposure to BPA may be associated with increase in hematopoietic cancers, and thus the evidence is not convincing as these lesions occur at high incidence in aging F344 rats (NTP). The study concluded that there was no convincing evidence that BPA was carcinogenic for F344 rats or B6C3F1 mice of either sex (NTP).

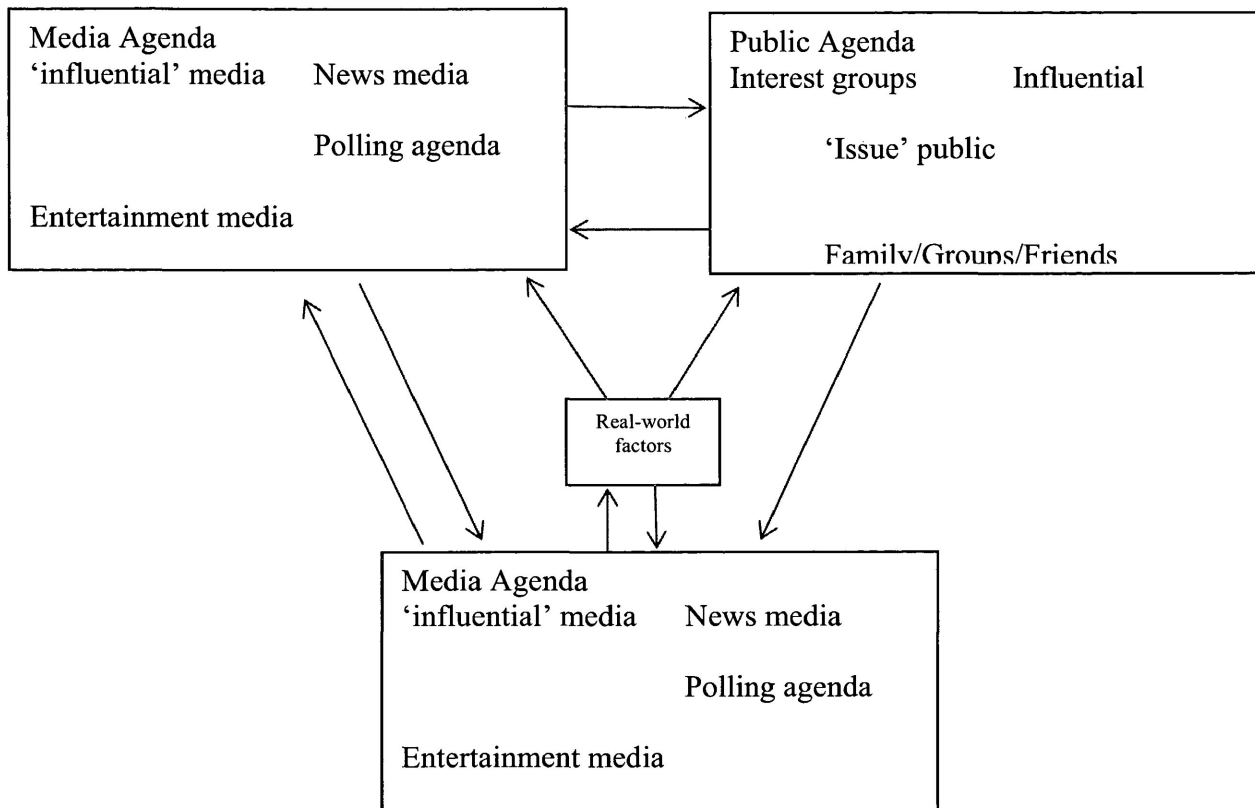
Haighton et al.(2002) concluded that based on the results of an NTP study, the lack of activity of BPA at non-cytotoxic concentrations, the lack of genotoxic activity of BPA in GLP-assay and the results of metabolism studies showing that BPA is rapidly glucuronidated, all prove that BPA has no carcinogenic potential. The study was

conducted through a review of metabolic data, genetic toxicity studies, long-term toxicity and carcinogenicity studies, and estimates of consumer exposure (Haighton et al.).

Policy Analysis and the influence of the media

The internet abounds with public interest and news media web sites that discuss growing consumer alarm related to widespread prevalence of BPA, known human exposure, concern regarding increased risk for vulnerable populations, along with numerous documented medical alterations related to endocrine-disrupter effects (Erler & Novak, 2009). In the case of Health Canada, the decision to ban BPA was based on the findings of the assessment by scientists that BPA exposure to newborns and infants is below levels that may pose a risk even though the gap between exposure and effect is not large enough (Health Canada, 2008). Policy analysis represents the efforts of actors inside and outside formal political decision-making processes to improve policy outcomes by applying systematic evaluative rationality (Dobuzinskis et al., 2005).

There are five stages of the policy cycle; agenda-setting, policy formulation, decision-making, policy implementation and policy evaluation (Wiersma, 2009; Howlett & Ramesh, 1995). In the agenda-setting stage, the manner and form in which there is recognition of problem(s) will determine how the issue will be addressed by policy makers (Wiersma).



The above figure illustrates the hypothesized relationships between the media, public, and policymakers (Soroka, 2002). The policy formulation stage is the process of defining, considering, and accepting or rejecting options (Howlett & Ramesh, 1995). This process follows no particular process and can be contentious (Howlett & Ramesh). The decision making process follows and is done by elected officials (Howlett & Ramesh). The fourth step is the policy implementation and is the process by which programs and or policies are carried out; in essence, it denotes the translation of plans into practice (Howlett & Ramesh). The fifth and final stage is that of policy evaluation (Howlett & Ramesh).

The critical factor conditioning policy advising found inside and outside the Canadian state is the predominance of British Westminster parliamentary institutions and relationships at the federal and provincial levels and as a result lacks the checks and balances associated with the US style of government, which established competing branches of government (Dobuzinskis et al., 2005). As a result, Canadian governments do not have to contend with strong judicial reviews that may take decades to pass (Dobuzinskis et al.). Another component to the Canadian governance structure is that of federalism (Dobuzinskis et al.). While it was originally thought by the country's founders to allocate residual powers to the federal government, unanticipated changes and key court decisions have ensured that the provinces steadily accrued increasingly more responsibility for delivering and designing programs, including shared jurisdiction with the federal government in almost every policy domain (Dobuzinskis et al.). As a result, many policy initiatives took place in the context of 'peak-bargaining' among federal, provincial and territorial governments and were conditioned by the structure of the parliamentary system which resulted in federal-provincial-territorial committee meetings for premiers and the Prime Minister in specific policy domains and a myriad of working committees and subcommittees of officials (Dobuzinskis et al.). Discerning Canada's policy analytical style through the lens of federalism produces an image that is disorderly, unproductive and lacks co-operation among the federal, provincial, and territorial counterparts (Dobuzinskis et al.). As a result, the policy analytical style in Canada is one of increasing distrust and rivalry between different orders of government, particularly since the federal government steadily reduced the real value of transfer

payments to provincial governments and the tradition of supporting shared-cost programs in many different policy sectors since the 1960s (Dobuzinskis et al.).

In Canada, the emergence of an 'attentive public' (which includes citizens and interest groups) that monitors the 'sub-government' of principal state and non-state actors have actively shaped public policy and existing programs and have been a key to the development of the governance context of Canadian policy-making (Dobuzinskis et al.). A less public, less expensive and more effective method currently employed by the Canadian government is to opt for more selective and low-key consultations, working with representatives of interest from specific sectors and constituencies with use of e-consultation which has served to efficiently distribute information to and from groups and citizens (Dobuzinskis et al.).

The majority of research on policy agenda has been performed in the USA where policy agenda is determined by committee meetings, bill introductions, and presidential papers; but in Canada, the system is entirely different (Soroka, 2002). The system in Canada is a cabinet-centered parliamentary system with extraordinarily strong party discipline which ensures that committees play a small role, the potential for bill introductions is severely restricted, and the majority of important policy discussions takes place unrecorded behind closed doors (Soroka). For the issue of BPA, the risk assessment conducted in consultation with industry and other stakeholders was a means of gaining knowledge on the subject area in order to determine the next course of actions to take (Health Canada, 2008). Though Health Minister Tony Clement had initially scheduled to unveil tips on

how to use baby bottles properly, after a grueling five hour dry run with officials in Clements office, the Prime Minister's office and the Privy Council, the bureaucratic arm of the Prime Minister's Office, the government decided to move forward with a baby bottle ban (Schmidt, 2010).

In looking at the effects the mass media has on policy makers, a four-level cascade model of successive media effects is employed (Kepplinger, 2007). The first level includes public actors (politicians, businesspeople, speakers of interest groups); the second level is composed of the media which report and comment on the public actors activities; the third level contains the readers, listeners, and wider audiences; and the fourth level includes politicians or businesspeople who realize their ideas and intentions through laws and decrees (Kepplinger). While this model is not entirely wrong, it fails to consider the direct influence of the media on politicians (Kepplinger).

In deciding to ban BPA, a risk assessment of bisphenol A was done in consultation with industry and other stakeholders, followed by a 60 day public comment period on whether to ban the importation, sale and advertising of polycarbonate baby bottles which contain BPA (Health Canada, 2008). The decision by Health Canada to ban BPA in polycarbonate baby bottles though historical was secured after the intervention of senior Conservative political officials (Schmidt, 2010). Tony Clement, Health Ministry at the time, called the decision to list BPA as a toxic substance a prudent decision since government scientists concluded that BPA exposures to newborns and infants was below

levels that may pose a risk, but that the gap between exposure and effect is not large enough (Schmidt, 2010). From documents obtained from Health Canada, the two-week period leading up to the announcement gives an indication of a less definitive picture about the decision to ban the additive in baby bottles, showing some unease within Health Canada about this precautionary approach to BPA (Schmidt). This approach allows policy-makers to make discretionary decisions in situations where there is evidence of potential harm, such as BPA and reproductive disorders and cancer, in the absence of complete scientific proof (Schmidt). Internal documents show that nine days prior to the announcement, Tony Clement was not planning to announce the ban, but did so after having a high-level meeting involving officials from the health minister's office and the Prime Minister's office; his decision was changed when the bureaucratic arm of the Prime Minister's office decided to move forward with the baby bottle ban (Schmidt). Documents also show that the decision was not well received by Canada's chief public health officer, who later claimed that the proposal to ban BPA in bottles was probably reasonable and that he was fine with not extending the ban to infant tin cans (Schmidt).

While the media plays an important role in the public perception on the topic of BPA and health, it needs to be understood that special interest groups work behind the scenes to persuade government officials into certain course of actions. After the proposal to ban plastic baby bottles made from BPA, an influential coalition of public health and environmental advocates were advocating for a stricter ban on BPA to protect pregnant women as well as infants (Mittelstaedt, 2008). The coalition groups want the government ban to include banning BPA from all food packaging including cans with the assumption

that mothers are ingesting it through food and inadvertently exposing their fetuses to the chemical (Mittelstaedt). The coalition urging the federal government for stricter bans on BPA consists of 22 groups; Learning Disabilities Association of Canada, Canadian Environmental Law Association, and the Canadian Association of Physicians for the Environmental and Breast Cancer Action Montreal to name a few (Mittelstaedt). The chemical companies that make their living from the production of BPA also have a stake in the ban. As judged from the review commissioned by the NIH in 2003 that was conducted by industry consultants, the review excluded all scientists who had significant expertise in BPA and concluded that BPA is safe; a position that the FDA stood by years after it was revealed that the consultants had ties to the BPA industry (EWG, 2008).

Those involved in the policy process are divided into the following groups: elected officials, appointed officials, interest groups, research organizations, and mass media (Howlett & Ramesh, 1995). Elected officials have control over the information which can be withheld, released, and manipulated in a manner that bolsters its preference and weaken the case of those opposed to it (Howlett & Ramesh). While policy making is an action taken by the government, modern politics has made it possible for special interest groups to play a significant role in the process (Howlett & Ramesh). One of the most important resources of interest groups is knowledge: specifically, information that may be unavailable or less available to others (Howlett & Ramesh). Since policy-making is a highly information-intensive process, those with information may normally be expected to play an important role (Howlett & Ramesh). Government and opposition politicians

often curry the favour with interest groups to secure the information required for effective policy-making or for attacking their opponents (Howlett & Ramesh).

The Role of Special Interest Groups

As the media increasingly covered the findings on the effects of BPA, the chemical industry stepped up its attacks on those studying endocrine disruption (Gross, 2007).

As previously stated, modern politics has made it possible for special interest groups to play a significant role in the policy analysis process (Howlett & Ramesh, 1995). A staunch advocate for the ban on BPA is the Environmental Working Group (EWG).

Environmental Working Group (EWG) is a non-profit organization founded in 1993 and aims to protect the most vulnerable of the human population by persuading politicians to rethink science and to strengthen regulation (EWG, 2007). EWG consists of scientists, engineers, policy experts, lawyers and programmers and receives funding from grant revenue (58.2 %) and individuals (34.9%) (EWG). In 2006, EWG commissioned a study looking at a group of four mothers' and their daughters' blood and urine and found that each was contaminated with an average of 35 consumer product ingredients (EWG). This would be the first of many such studies commissioned by the EWG in regards to BPA and in their quest to raise more awareness over its effects. After the release of the report commissioned by NTP to the Center for the Evaluation of Risks to Human Reproduction (CERHR), EWG wrote a letter in February of 2007 to Dr. David Schwartz, director of the National Toxicology Program, concerning the management of CERHR by

the private consulting firm, Sciences International, which has historic ties to the chemical industry (EWG). The letter went on to state the serious conflict of interests and ethical concerns in hiring a contractor that has financial ties with the chemical industry and that as a result, would lead to failure to disclose key information in the BPA review that may affect the expert panel's assessment of the chemical and follows with the failure of SI to investigate study funding sources, and failure to disclose key study limitations (EWG). The letter brought attention to the NIEHS-sponsored workshop in which 42 leading scientists looked at the effects of BPA at low doses and how CERHR is poised to make a decision relating to BPA without review the document (EWG).

In March 2007, EWG released its study on BPA in canned foods and found that in a single serving, one in three cans of infant formula had enough BPA to expose an infant to BPA levels more than 200 times the government's traditional safe level (EWG, 2007). In August 2007, EWG wrote a letter to infant formula manufacturers asking them to publicly disclose the type of epoxy lining used in their steel and non-metal containers for powdered and liquid formula, the results of any test that may have been conducted and any analysis that has been conducted on infant exposure to BPA from consumption of their products (EWG).

In their quest to use the power of public information to protect public health and the environment, EWG has commissioned studies on BPA, wrote letters to manufacturers of infant baby formula, and various federal groups to ensure that proper steps are being

taken when it comes to determining the true toxicity of BPA and what measures need to be put in place to protect the general population.

BPA in the Media

Opinions on the role of the mass media in the policy process range from those who regard it as pivotal to those who describe it as marginal (Howlett & Ramesh, 1995). The role of the media in the policy process lies in the fact that in reporting problems, they combine the roles of passive reporter with active analyst as well as an advocate of a solution (Howlett & Ramesh). News programs do not just report on a problem but often go to great lengths in locating a problem not otherwise obvious, defining its nature and scope, and sometimes suggesting solutions (Howlett & Ramesh). News reporters and editors are news-makers, in the sense that they define what is worthy of reporting and the aspects of the case that need highlighting (Howlett & Ramesh). Thus policy issues that may be presented as an interesting story tend to be viewed by the public as more important than would have otherwise been the case (Howlett & Ramesh).

Mass media are a leading source of health information for the general public and for health professionals, and their choice of coverage can ultimately drive public policy and healthcare decisions (Bomlitz & Brezis, 2008). Bomlitz and Brezis state that there is a bias that exists in the reporting of health information. A report on a novel health hazard is perceived with disproportionately greater sensitivity than existing health risks and construed with disproportionately greater concern than known health risks (Bomlitz &

Brezis). They state that the bias first acts on journalists and editors who sense emerging threats as 'newsworthy' and finally on health professional and policy makers who follow the public agenda set by the mass media (Bomlitz & Brezis). Furthermore, they stated that the more established the information about a health topic, the less likely it is to be perceived as worth covering; and that strong evidence obtained by a systematic review of repeated confirmatory observations is less likely to be reported by the mass media (Bomlitz & Brezis).

Koper et al. (2007) state that the general public obtains much of its information about science and technology from the popular media and for this reason, media reporting has the capacity to shape public perceptions of safety and efficacy of a particular treatment, thereby influencing patterns of use. In their findings, Koper et al. stated that newspapers failed to report conflict of interest in terms of funding for research; 77% of medical journal articles disclose funding information while 13% of newspaper articles report such information. This information is significant as information pertaining to funding arrangements, particularly the role of the funding body, can reveal conflicts of interest indirectly (Koper et al.). In terms of tone used, newspaper articles tend to be more negative than reports of the same trials in the medical literature and popular media reporting is significantly more polarized than the reporting in scientific journals (Koper et al.).

Based on 2008 statistics obtained by NADbank (NADbank, 2008) (newspaper audience database), The Toronto Star has a total weekly readership of 2,144,300 (49% of Toronto

population) while The Globe and Mail has 23% of the entire Toronto population (The Toronto Star, 2008). As a result, the Toronto Star reaches 23% of men and 20% of women while The Globe and Mail reaches 9% and 8% respectively (The Toronto Star). In terms of adults aged 25-54, The Toronto Star reaches 17% of this population while The Globe and Mail reaches 8%; and where well-educated readers are concerned, The Toronto Star reaches 25% of readership with The Globe and Mail reaching 15% (The Toronto Star).

At times called the fourth branch of government, the mass media serve a number of functions within the context of government policy making (Fischer, 1991). Communication researchers have analyzed mass media political functions and developed 10 possible media functions in the policy process: anticipating problems in advance of public officials, alerting the public to problems on the basis of official warnings, informing the public of the stakes that the competing groups had in solving problems, keeping various groups and the public abreast of competing proposals, contributing to the content of policy, deciding the tempo of decision making, helping lawmakers decide how to vote, altering the public of how policies are administered, evaluating policy effectiveness, and stimulating policy reviews (Fischer).

In setting the agenda, the manner and form in which problems are recognized are important determinants of how they will be addressed by policy makers (Wiersma, 2009). A political agenda is the lists of issues to which political actors pay attention; determining the agenda is a necessary precondition for almost any kind of political decision and over

the decades, much work suggests that mass media can play a critical role in setting political agenda (Walgrave et al., 2008). Discussion among agenda-setting scholars state that ultimately, newspapers lead in affecting the political agenda because of their much more in-depth and complete coverage, and thus are more able to affect policy makers (Walgrave et al.). Credibility of the medium plays a role as well; reliable and respected news outlets have more impact as opposed to marginal and dubious news sources and in many countries, newspapers are considered by politicians as more respectable news outlets as opposed to TV (Walgrave et al.). It is also believed that politicians are more affected by newspapers than TV because of the flexibility and easier processing of paper material (Walgrave et al.). In a study conducted by Walgrave et al. in Belgium, they found that mass media does lead the political agenda to some extent based on coverage and that issue attentiveness in newspapers seems to lead issue attentiveness by policy makers.

For both The Globe & Mail and The Toronto Star, the majority of the articles found were dated for the year 2008, which was around the same time that the US House of Representatives Committee on Energy and Commerce launched an investigation into the use of BPA in the lining of metal cans that contain infant formula (Environmental Working Group, 2008). A report was released by a coalition of environmental and public health groups in February of 2008 stating that BPA leaches out of baby bottles (Environmental Working Group). In the research conducted for the purpose of this paper, the first thorough article obtained was dated on April 15, 2008, when the Government of Canada decided to place a ban on BPA while in the US; congress was

calling on the FDA for a reassessment on the safety of BPA (Environmental Working Group). While no public opinion pool could be found to determine the role that the public played in affecting the ban placed on BPA in Canada and in the eight states that have placed the ban on BPA, lobbyists such as EWG and newspaper articles were instrumental in bringing new information to light and thus forcing governments to take the necessary steps needed to protect the public. When the State Assembly in Sacramento voted in favour to ban BPA, it was due to the work of the EWG, the Breast Cancer Fund and Physicians for Social Responsibility/Los Angeles who sponsored the legislation and eventually saw the ban passed (Environmental Working Group, 2010).

The Globe & Mail

For the purposes of this paper, 30 articles regarding BPA were analyzed to see what was written in regards to BPA being a xenoestrogen, the effects of BPA in terms of reproductive development, and the possible carcinogenic activity of BPA. Of the 30 articles, 21 were published in the National News section (Section A) of the paper and only 2 of the 21 stories were actually on the first page of the paper. The first article published on the first page was on April 15, 2008 titled “Canada first to label bisphenol A as officially dangerous,” and the second was on September 17, 2008 titled “Bisphenol A poses disease risk for adults.” The other 9 articles were all located in the Globe Life section (Section L) with 5 of the 9 articles making the cover of that section.

From the search conducted, the first article published by The Globe and Mail in regards to BPA was on Jan. 11, 2008. The article states that a study conducted in the U.S. has found BPA to be more toxic and dangerous in children than in adults because children lack the capacity to detoxify BPA unlike adults (Mittelstaedt, Jan. 11, 2008). The author touched upon the fact that BPA has the ability to mimic estrogen and this is what many researchers suspect is linked to sex hormone imbalances like prostate and breast cancer (Mittelstaedt, Jan. 11, 2008). Dr. vom Saal, a leading authority on BPA, was quoted as saying that every time a baby consumes baby formula, they are being exposed to significant amounts of BPA (Mittelstaedt, Jan. 11, 2008). Health Canada is then quoted as making a statement that “it is too early ... to state whether we have a concern or not with infant formula or baby bottles which contain BPA (Mittelstaedt, Jan. 11, 2008). Contrary to the findings by Dr. vom Saal and his team, a spokesperson for Mead Johnson, Gail Wood, was quoted saying that “the preponderance of valid scientific literature right now upholds the position that BPA and the levels found in the food chain of humans is absolutely safe (Mittelstaedt, Jan. 11, 2008). To further advocate for the position that BPA is not toxic, the American Chemistry Council has argued that injection result studies aren’t applicable to humans because people are thought to have most of their exposures from oral sources and thus nearly 200 studies studying the effect of BPA through injecting young or pregnant rodents are not valid in their conclusions that BPA is toxic (Mittelstaedt, Jan. 11, 2008). The article concluded that Health Canada has yet to decide to either accept or reject the position on the dosing controversy (Mittelstaedt, Jan. 11, 2008).

The following article published also in January discusses the attempt of Health Canada to determine how much BPA is leaking out of polycarbonate baby bottles and infant formula cans in order to assess the safety of BPA (Mittelstaedt, Jan. 19, 2008). From here, the article delves into several retailers pulling polycarbonate water bottles pending Health Canada's review while also stating that a congressional committee in the US announced plans to investigate the use of BPA in baby formula (Mittelstaedt, Jan. 19, 2008). That same month, Mittelstaedt writes about the ability of BPA to leach from bottles into drinks by means of sterilizing polycarbonate baby bottles (Mittelstaedt, Jan. 30, 2008). This article speaks of research conducted at the University of Cincinnati where researchers tested both new and old scratched bottles and found that the age of the container did not influence how much BPA was leached in an hour due to the addition of hot water (Mittelstaedt, Jan. 30, 2008). Here also, the author makes mention of the health concerns linked to BPA, those increased rates being of prostate cancer, earlier onset of puberty in girls, and declining sperm counts (Mittelstaedt, Jan. 30, 2008).

In February, Mittelstaedt published another article detailing research findings conducted by Environmental Defence stating that 3 brands of polycarbonate baby bottles sold in Canada leached detectible amounts of BPA but that the plastic industry continue to insist that the small amount of BPA leaching from bottles should not be a worry to parents (Mittelstaedt, Feb. 8, 2008). The article states that the major controversy over BPA is whether or not the minute doses of the chemical constitute a health threat and the plastic industry insists that the chemical is harmless (Mittelstaedt, Feb. 8, 2008). While the debate ensues, executive director of Environmental Defence is urging parents to avoid

polycarbonate bottles and to shift to glass or plastics labeled BPA-free (Mittelstaedt, Feb. 8, 2008). The article then continues to explain how the molecular shape of BPA allows it to occupy estrogen receptors and that BPA is not only used in making bottles, but is also applied in DVDs, helmets, dental sealants and epoxy resins lining the insides of food cans (Mittelstaedt, Feb. 8, 2008).

An article published on April 5, 2008 deals with studies supporting the use of BPA, studies that were funded by the plastic industry. Mittelstaedt states the flaws with each of the 3 studies cited in the article. The first study has been criticized because it consisted of feeding BPA to a strain of rats not overly sensitive to estrogen and failed to include a test that would have revealed that the rodents weren't appropriate for investigating hormone-mimicking chemicals such as BPA; the second study is awaiting publication; and the third subjected test animals to extremely high doses of BPA and was submitted to Health Canada mainly because it was part of the historical research record on the chemical (Mittelstaedt, Apr. 15, 2008). While these studies were funded by the major manufacturers of BPA, out of the approximately 160 non-industry-funded studies on low-dose BPA exposures, 90% of them have detected harmful effects (Mittelstaedt, Apr. 5, 2008). In the April 15, 2008 article, Health Canada officially called BPA a dangerous substance, thus making it the first regulatory body in the world to reach such a determination and thus taking initial steps towards controlling exposures to it (Mittelstaedt, Apr. 15, 2008). Three days later, an article was published in The Globe & Mail stating that a study had found that many genes in non-cancerous breast cells exposed to trace amounts of BPA began acting in a way that closely resembled the gene

activity in highly aggressive breast tumors that led to an increased likelihood that women would die of the disease (Mittelstaedt, Apr. 18, 2008). While many animal experiments have found that fetal or early exposure to BPA cause lesions that may lead to increased susceptibility to mammary gland tumors later in life, there has yet to be evidence strong enough to conclude that the chemical is also a human carcinogen (Mittelstaedt, Apr. 18, 2008). What the study found was that already cancerous breast cells exposed to BPA proliferated and this strengthens the case that BPA and cancer could be connected by showing that the chemical has profound effects on the genes in breast cells that do not yet show cancerous tendencies (Mittelstaedt, Apr. 18, 2008). The article then went on to discuss in detail how the experiment was conducted: non-cancerous cells from women who already had breast cancer and subjecting them to estrogen and progesterone along with trace amounts of BPA and from this, researchers found that the hormones and BPA left unique fingerprints on genes inducing some to turn on or off (Mittelstaedt, Apr. 18, 2008). While these findings suggest that small amounts of BPA can cause harm, an article written on July 25, 2008 cited a study conducted by the European Union's top food safety body that concluded that humans metabolize BPA and thus tiny amounts of the chemical leave the body quickly enough not to cause any harm (The Globe and Mail, Jul. 25, 2008). While many studies have been criticized for not using test subjects comparable to that of humans, an article on Sept. 4, 2008 looked at low level amounts of BPA on monkey brain development (development which is similar to that of humans) and found that exposure to BPA was able to block the formation of some types of synapses in the brain, the proper development of which is considered crucial for remembering thoughts and experiences (Mittelstaedt, Sept. 4, 2008). Again,

manufacturers of BPA criticized the findings of the study stating that while the monkeys were exposed to BPA through injections, most human exposure occurs through the diet (Mittelstaedt, Sept. 4, 2008), a response that has been consistent since the issues of BPA and its potential health effects started to be raised.

In the Sept. 17, 2008 article, new research linked BPA to heart disease and diabetes in adults (Mittelstaedt, Sept. 17, 2008). The study, based on the typical ranges of BPA found in American adults, found that individuals with higher exposures to BPA had 2.9 times the odds of having cardiovascular disease and 2.4 times the odds of having adult-onset diabetes when compared with those with lower exposures (Mittelstaedt, Sept. 17, 2008). What is interesting about these findings is that now, it eliminates the thought that exposure to BPA poses no risk to adults (Mittelstaedt, Sept. 17, 2008).

Toronto Star

Like The Globe and Mail, the first article on BPA in The Toronto Star was published on Jan. 31, 2008. The article explains research conducted at the University of Cincinnati which showed that boiled water placed in polycarbonate drinking bottles lead to concentrations of BPA being released at rates up to 55 times than water left at room temperature (Ubelacker, Jan. 31, 2008). The author mentions how research has also shown BPA to affect reproduction and brain development in animal studies and that there are concerns that BPA could contribute to some breast and prostate cancers as well as infertility in people (Ubelacker, Jan. 31, 2008). The following article was published on

Feb. 8, 2008, and dealt with findings that popular baby bottles sold in Canada had significant levels of BPA in them (Oliveira, Feb. 8, 2008). The ability for low levels of BPA to alter cell function due to its ability to mimic estrogen was discussed along with increasing evidence that BPA can be linked to thyroid problems and different kinds of cancer including breast cancer in women (Oliveira, Feb. 8, 2008). Following this article, there was nothing published about BPA until April 16, 2008. This article focused in particular about the release of 15 chemicals by Health Canada that could place them on an action list leading to chemicals being banned outright (Welsh, Apr. 16, 2008). The article then delved into how public outcry has caused major retailers to pull BPA water and baby bottles, among other products, off their shelves (Welsh, Apr. 16, 2008). The following article on Apr. 19, 2008 dealt with the announcement by Health Minister Tony Clement stating that the government of Canada would soon be banning baby bottles containing BPA as a precautionary action, an action that according to some was unwarranted as trace levels of BPA from consumer products are well below any level that could cause harm to adults or to children (Welsh & Champion-Smith, Apr. 19, 2008).

The Sept. 4, 2008 article stated that prolonged exposure to BPA had the potential to affect the brain's ability to create neurological connections needed for learning and memory at low doses to adults (Javed, Sept. 4, 2008). The article went into some detail about the study and how African green monkeys were exposed to the standard reference dose that has been deemed to be safe for human adults and the results that at low levels, BPA reduced the density of synaptic activity in the brain (Javed, Sept. 4, 2008). The following article stated how research conducted in the U.S. raised questions about

whether BPA was harmful or not and how the FDA defends the assessment that BPA is safe (Tanner, Sept. 17, 2008). While 90% of Americans have traces of BPA in their bodies, the FDA says that the levels of exposure are too low to pose a health risk even to infants and children (Tanner, Sept. 17, 2008). The article stated that the research did a health survey of 1,500 adults and found that those exposed to higher amounts of BPA were more likely to report having heart disease and diabetes and that the FDA stands by its assertion (Tanner, Sept. 17, 2008). While the FDA does not agree with a ban on BPA, the Oct. 18 article reported Canada as the first country to limit the use of BPA by declaring it a toxic substance (Javed, Oct. 18, 2008).

Comparison of The Globe and Mail to The Toronto Star

Looking at the number of articles alone, it becomes apparent that The Globe and Mail had a higher number of articles dealing with BPA than The Toronto Star. Reasons accounting for the discrepancy in numbers could be due to editor's interest or on the audience to which the each newspaper is targeting. One fact that became strikingly clear from the beginning was that the majority of the Globe and Mail articles were all by the same reporter leading to consistency of information/facts on the subject. Another difference between the two newspapers was that while The Toronto Star was quick to state the research findings and at times mention how the study was conducted, The Globe and Mail articles always went into depth how the research was conducted before stating the results. The Globe and Mail articles were also very consistent in always addressing opposing views that BPA is indeed harmful at low levels.

In examining at articles relating to BPA from both The Globe and Mail and The Toronto Star, The Globe and Mail articles were much more thorough, presented both sides of the argument (if certain levels of BPA were safe or not), and conveyed the arguments in such a way that the reader was left to come to his/her or opinion on the matter. The Toronto Star articles were fleeting in giving specifics about research studies and tended to mention only briefly the opposing side of low levels of BPA being safe.

Looking at the demographics in terms of readership, the Toronto Star may reach more people but where the subject of BPA is concerned, The Globe and Mail readership will be more informed and will be able to make their own decision in regards to health effects related to BPA. The level of detail given in each of The Globe and Mail articles was more in depth, cites research for and against the use of BPA while The Toronto Star did none of this. The Toronto Star readership on the other hand, may come away with the opinion that BPA has the potential to cause health problems (mainly heart attacks, breast and prostate cancers) and but will not be well informed about both sides of the issue. While each paper targets a particular demographic (age, sex, socio-economic standings, etc.), what needs to be consistent is the information being given to the public on the possible health effects related to BPA. While The Globe and Mail did a wonderful job of giving all the facts to the readers so that they in turn can make a well-informed decision, the Toronto Star was vague and barely contains minimal information in each article.

Implications and Recommendations

BPA is a chemical that we come into contact with every day. The process by which cans are heated to sterilize food, the presence of acidic or basic food or beverages in cans or polycarbonate plastics and repeated washing of polycarbonate products have all been shown to result in an increase in the rate of leaching of BPA (vom Saal & Huges, 2005). In addition, studies conducted in both Japan and the United States have demonstrated that BPA accounts for most estrogenic activity that leaches from landfills into the surrounding ecosystem (vom Saal & Huges). Ongoing research on the health effects of BPA leads to suggestions for collaborations and cooperation between investigators to improve efficiency and timeliness in filling the information gaps (Bucher, 2009). Related to research, the following issues need to be better addressed: the need to better understand sources of human exposures; and the need to compare metabolism of BPA and understand how it changes with age (Bucher). There has been extensive literature showing that fetuses and neonates are generally more vulnerable to BPA exposure than adults, and as such, it is important to determine the effects of BPA on body weight that can be attributed to perinatal exposure and those that result from adult exposure (Rubin et al., 2009). Experimental data from animal models of human reproduction have shown that BPA can have serious effects on the female reproduction system and since the reproductive physiology of humans and other mammals are similar, one can predict that human female reproductive disruption can occur after exposure to BPA (Crain et al., 2008). To determine the actual effect of BPA on female reproductive system, the

following should be examined in great detail; studies of early life exposures with sufficient follow-up to understand links to adult onset of disease, national and international coordination of samples and data, and establishment of an interdisciplinary consortium to improve research, policies and education (Crain et al.).

The U.S. Environmental Protection Agency (EPA) conducted a risk assessment on BPA based on research conducted in the 1980s while the most comprehensive review of the scientific literature was done in 1998 by the European Union at a time when a few of the 115 low-dose BPA studies had been published (vom Saal & Hughes, 2005). The gap between these two risk assessments and the current literature available leads to the conclusion that a new risk assessment for BPA needs to be done. From the initial risk assessment conducted in the 1980s by the EPA, the current 'low dose' for BPA is 50 mg/kg/day but recent studies have shown that BPA can have adverse effects lower than the current reference dose. Regulatory agencies need to acknowledge that there is now overwhelming evidence for adverse effects of one of the highest-volume chemicals below the previously predicted "safe" daily dose for humans and should conduct a new risk assessment on the safety of BPA (vom Saal & Hughes).

As previously mentioned, low dose studies of BPA conducted with Sprague-Dawley rats cannot be relied upon too heavily as these types of test subjects are highly sensitive to low doses of BPA (vom Saal & Hughes, 2005). The issue is that government funded studies are reporting that there is indeed a low-dose effect of BPA while studies funded by the plastic companies are reporting otherwise. Of 98 government-funded studies, 94

report significant effects of low doses of BPA, while none of the eight industry-funded studies report significant effects of the same low doses (vom Saal & Hughes). In 2003, over 6.4 billion lb of BPA were manufactured and if regulatory agencies were to determine that the actual LOAEL for BPA was below that of the current reference dose of 50 μ g/kg/day, then the 15 corporations that manufacture BPA would be affected economically (vom Saal & Hughes). Since alternatives exist to BPA, corporations that manufacture products made from BPA would not be affected (vom Saal & Hughes). While potential economic impacts need to be considered, the implications for human health cannot be ignored.

Significance to public health practice, policy, & research

There have been negative trends associated between BPA and human health that has led to recent research and debate over BPA. Early sexual maturation in females, an increase in neurobehavioral problems such as attention deficit hyperactivity disorder (ADHD) and autism, an increase in childhood and adult obesity and type 2 diabetes, regional decrease in sperm count, prostate and breast cancers are some examples of such negative trends (vom Saal et al., 2007). Recent analysis of the NHANES dataset has revealed that higher levels of urinary BPA were associated with diabetes and cardiovascular disease (Rubin et al., 2009). A recent case-control study reported that blood levels of BPA are related to ovarian disease in women (vom Saal & Hughes, 2005).

While many studies have concluded that widespread exposure to BPA poses a threat to human health, there are contradicting reports and studies from individuals or groups associated with or funded by chemical corporations (vom Saal & Hughes, 2005). An example of this is illustrated by the study prepared by the Harvard Center for Risk Analysis that was funded by the American Plastics Council (APC) which concluded that “the weight of the evidence for low-dose effects is very weak” (vom Saal & Hughes).

In 2003, a forecast of \$121.4 billion was spent on health care, with an average of \$3,839 being spent per person (CIHI, 2004). The amount spent on healthcare is dependent on the health status of a population and the potential increase of heart disease, type 2 diabetes, and breast and prostate cancer due to low-level exposures to BPA may create a need for greater spending on health care down the line (CIHI, 2004). In Canada for 2009, an estimated number of 22,700 women will be diagnosed with breast cancer and 5,400 will die from breast cancer (Canadian Cancer Society, 2009). For men, an estimated 25,500 will be diagnosed with prostate cancer and 4,400 will die from it for 2009 (Canadian Cancer Society). Heart disease is a major cause leading to death in Canada and annually approximately \$18.5 billion is spent on this portion of our health care (Heart Health Education Centre, 2009). Obesity, high blood pressure and diabetes are some factors that increase an individual’s chance of developing heart disease (Heart Health Education Centre).

While understanding the effects of BPA will take more thorough research, the role of the media in the formation of policy needs to be observed. Dentzer (2009) in her commentary

to The New England Journal of Medicine stated that journalists reporting on health care developments deliver public health messages that can influence the behaviour of individuals receiving that message. She goes on to state that too frequently what is conveyed about health by many other journalists is wrong and misleading and that the distortion is attributable to ignorance or an inability to interpret and convey the nuanced results of clinical studies (Dentzer). Another contributing factor is the uncertainty about journalist's proper role: is their job to describe the bigger picture or to simply report what is new (Dentzer)? Dentzer states that when journalists ignore complexities or fail to provide context, the public health message they convey is inevitably inadequate or distorted and as a result, the news media needs to become more knowledgeable and to ensure that they are delivering to the public accurate, complete, and a balanced message about health (Dentzer). Dentzer interestingly states that there are journalists who believe that their role is to report the "news", basically that which is new and that these journalists tend to cover the findings of a new clinical study without much reference to previous relevant studies (Dentzer). As a result, there is a failure to put new developments and research findings into context for readers or viewers and as such produces an environment where journalists become little more than headline readers or conduct interviews that amount to a "hit and run" version of journalism (Dentzer). In wanting a story to be featured or accepted by an editor, journalists sometimes feel the need to play carnival barkers by hyping a story to draw attention to it (Dentzer). What can be concluded is that the mass media has a responsibility when reporting health news as they have the potential to affect the policies that are made.

Given their resources, reach and potential leverage of elite and public opinion, the Canadian media plays an important part in Canadian policy networks, but the media is apparently disaggregated and uncoordinated, negotiating highly differential access to the policy sphere depending upon personal political capital, economic constraints of ownership and the news culture within their organization (Dobuzinskis et al., 2005). The issue is that now policy research and advocacy have effectively been combined in political journalism and sets a trap that constrains the media's access to information, types them as high-risk in adversarial politics, and reinforces a gap between communications professionals and policy analysts in the public service (Dobuzinskis et al.). The combination of industry-sponsored research, special interest groups and the media all played key pivotal roles in ban of BPA in Canada. Currently in the US, such a ban or higher regulatory plan has not been put in place for BPA mainly because of the governmental regime and the power of the American Chemistry Council and their lobbyists. This stark contrast to the Canadian ban goes to show the extent to which media, special interest groups and industry-sponsored research can have on public health policy, practice and research. In the case of Canada, having had access to decades of research (those calling for higher regulation of BPA and those opposed), it was decided that BPA would be listed as a toxic substance, until the Privy Council moved for a ban. It was never revealed as to what pressures were applied for the drastic change, but one can only assume that public opinion which is influenced by the media was a major factor in the decision to ban BPA. This said, the combination of special interest groups and the media were instrumental in the ban of BPA in Canada, but a word of caution must be noted here. Though banned, this decision should only aid public health policy, practice

and research to be more proactive in research and analysis such that future government policies will be made on informed and proven science.

Conclusion

There can be no doubt about the important roles that the media, special interest groups and industry sponsored research have had on the Canadian's government's decision to ban BPA in baby bottles in Canada. As previously stated by Howlett & Ramesh in 1995, governments have made it possible for the policy analysis making process to be influenced by special interest groups. The Environmental Working Group have been proponents of the ban by the Canadian government as a result of years of research that have proven the effects that BPA can have at low doses, contrary to research findings by industry sponsored research. The disturbing trend was noted by vom Saal and Claude Huges that 90% of government studies found significant effects of BPA at doses below the EPA lowest adverse effect level and not a single industry study found any effect (Gross, 2007). The majority of the industry funded studies either used a rat strain with very low sensitivity to estrogen or misinterpreted failure to find effects with positive controls (Gross). The media in all of this is pivotal to ensuring that the public is made aware of what is taking place by means of radio, television, internet or newspaper print articles. There is no dispute that the mass media are crucial links between the state and society, a position that permits them to strongly influence the preferences of the government and the society on public problems and solutions to them (Howlett & Ramesh, 1995).

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