TITLE: Beyond the medicine cabinet: Public perceptions of the risks of pharmaceuticals and personal care products to aquatic systems and related disposal behaviors

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EFFORT: 2.3 months

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OBJECTIVES: This research project was created in response to the Ohio Sea Grant’s Strategic Plan and Funding Priorities, in which pharmaceutical and personal care products are identified as a main funding priority. The specific objectives of this research are to: (i) Assess the Ohio public’s risk perceptions, beliefs, knowledge, and concern pertaining to the effects of pharmaceuticals and personal care products (PPCPs) on the health of aquatic environments, and to analyze the relationship of these variables to the disposal practices identified in Obj. 2, (ii) Identify and quantify the methods by which people commonly dispose of PPCPs, (iii) Document knowledge of and the barriers to proper disposal of PPCPs, and (iv) Provide evidence-based recommendations for public outreach and education on the subject of PPCPs in aquatic systems and improved opportunities for the proper disposal of these products.

METHODOLOGY: To gather this information, an internet survey company (Qualtrics) will be used to recruit a panel of online respondents living within Ohio’s Lake Erie watershed. Quotas will be used to recruit a sample that roughly approximates the age, gender, income and education levels of people living in this area, with a particular focus on those living in population centers (and served by a municipal water system). In addition, as minority populations have traditionally been very underrepresented in environmental and risk perception studies (Rivers, Arvai, & Slovic, 2010), additional survey participants will be recruited through purposive sampling. In this latter case, surveys will be distributed at a random selection of churches, community groups, and neighborhood associations; the PI will collaborate with the Alliance for the Great Lakes to identify locations for this in-person survey distribution. Finally, as recent research has also suggested that the volume of tourism in an area can affect the discharge of pharmaceuticals in the environment (Mandaric et al., 2017), purposive sampling of randomly selected seasonal facilities and sites, i.e., campgrounds and summer rentals, will be used to additionally augment the information from permanent Ohio residents.

The survey data will allow us to analyze the relationship between these variables using a standard regression-based statistical analysis, with PPCPs disposal behaviors as the dependent variable. We will additionally be able to test hypotheses relating to the relationship between independent and dependent variables, i.e., H1: Individuals with a pro-environmental value orientation will be more likely properly dispose of PPCPs; H2: Individuals who are aware of the negative consequences of PPCP, and are willing to take personal responsibility for acting, will be more likely to properly dispose of PPCPs. Ultimately, these survey results will point to important (i) gaps in knowledge, (ii) threat perceptions and concern, and (iii) barriers to proper disposal techniques to inform the development of informational and behavioral interventions.

Online and in-person surveys are a standard and commonly accepted method to gather data about public risk perceptions, attitudes, and self-reported behaviors; the data gathered will be analyzed using multiple regression analysis in order to determine the relative importance (explanatory power) of these factors in determining the variation in individual and household PPCP disposal practices. Survey costs include participant incentives.
RATIONALE: The environmental risks of pharmaceutical and personal care products (PPCPs) are well-documented (Dohle, Campbell-Arvai, & Arvai, 2013; Kümmerer, 2009), and attention has recently turned to the specific implications of PPCPs for the health of aquatic environments (Ebele, Abdallah, & Harrad, 2016) and—specifically—their capacity to interfere with the functioning and productivity of the Great Lakes ecosystems (Blair, Crago, Hedman, & Klaper, 2013). Pharmaceuticals are known to enter aquatic systems through a number of pathways, including in direct runoff from agricultural operations, through the improper disposal of these products by individuals, or via human waste (Glassmeyer et al., 2009; Kümmerer, 2009). Personal care products enter aquatic systems through the latter pathways (Ebele et al., 2016). While water treatment facilities have the capacity to deal with a variety of aquatic pollutants, many PPCPs remain in the discharged effluent (Kostich, Batt, & Lazorchak, 2014). While one solution is to improve technologies and processes to remove and dispose of all PPCPs at the downstream (water treatment) end of the process, there is considerable interest directed at motivating the proper disposal of pharmaceuticals and personal care products by individuals and households (Glassmeyer et al., 2009). These upstream efforts would additionally serve to reduce the fraction of PPCPs that enter surface water through leakage from septic fields (i.e., are not subject to treatment in municipal water facilities) (Wu, Witter, Spongberg, & Czajkowski, 2009). Work on the concentrations of PPCPs in Lake Erie waters suggests that this topic is of vital importance to the health of the lake (Metcalfe, Miao, Koenig, & Strufer, 2003; Wu et al., 2009).

While past studies have shown that citizens express concern about the negative effects of PPCPs in aquatic and terrestrial environments (Bound, Kitsou, & Voulvoulis, 2006; Glassmeyer et al., 2009), the limited behavioral research that exists suggests that—for most individuals—disposal through plumbing remains the most common methods of disposal (as compared to landfill or pharmaceutical recycling programs) (Bound & Voulvoulis, 2005; Kotchen, Kallaos, Wheeler, Wong, & Zahler, 2009). This gap between attitudes and behaviors suggests an opportunity to learn more about public awareness of the issue, perceived and actual barriers to the proper disposal of PPCPs, and the nature and extent of the public’s motivation to engage with the issue more broadly. This information can then be used to develop more effective and targeted informational and behavioral interventions designed to increase awareness and concern about PPCPs, and to reduce the volume of PPCPs that reach both local water treatment facilities and, ultimately, Lake Erie.

Background Information: The Theory of Planned Behavior (TPB) (Ajzen, 1980) is a popular model of human behavior that has been used in a variety of environmentally relevant contexts to understand consumer behavior and to uncover ways to motivate more sustainable behaviors and choices. In this theory, behaviors are associated with (i) the positive and negative beliefs (or ‘attitude’) about the outcome of the behavior, (ii) beliefs about the expectations of friends and family (referred to as subjective norms) and (iii) perceptions of the barriers to (or ease of) the behavior in question (Ajzen, 1980, 1985). The TPB has been used to successfully explain and predict both behavioral intentions and actual behaviors in a variety of contexts (Notani, 1998), (Armitage & Conner, 2001), including those related to environmental sustainability, e.g., recycling, water conservation, and choice of local and organic foods (Chen & Tung, 2010; Han & Hansen, 2012; Vermeir & Verbeke, 2008; Zepeda & Deal, 2009).

This theory can also help to identify specific opportunities for informational and behavioral interventions, (Ajzen, 2011; Bamberg, Ajzen, & Schmidt, 2003; Fishbein & Ajzen, 2005). Researchers interested in, for example, encouraging water conservation could provide information to increase the number of favorable beliefs about water conservation, i.e., the specific environmental benefits, or seek to reduce the number of unfavorable beliefs, i.e., that water conservation will reduce one’s quality of life. The intervention could also address perceived barriers to water conservation, i.e., that it won’t make a difference (Ajzen, 2011; Bamberg et al., 2003; Hanss & Bohm, 2013).

Building on the success and efficacy of past TPB-based studies and interventions, this study proposes to use the model to inform the development of an online survey instrument to assess the beliefs, norms, and perceived barriers related to the proper disposal of PPCPs. In order to develop a more in-depth understanding of the role of specific beliefs and norms in motivating and supporting disposal-related behaviors, the TPB model will be augmented with insights from work on risk perceptions and personal norms. The model of PPCP disposal behavior that results from this survey, i.e., illustrating the relative strength of specific attitudinal beliefs, norms and perceptions in motivating this behavior, will serve as the basis for the development of related informational and behavioral interventions to reduce the improper disposal of PPCPs.
Risk Perceptions

Past research on risk perceptions, and in particular the affect heuristic, additionally suggests that the subjective perceptions of risks held by lay individuals can be very different than the objective assessments provided by government agencies and subject matter experts (Slovic, 1987; Slovic, Peters, Finucane, & MacGregor, 2004). This phenomenon is attributed in part to the role of affect in lay assessments of risk, where affect is the instantaneous appraisal of the ‘goodness’ or ‘badness’ of a particular object or process (Slovic, 2000). This ‘affect heuristic’ suggests that a product that is perceived to be beneficial may be associated with positive affect and have reduced risk perceptions as compared to a product that is not perceived to be beneficial and results in negative affect (Finucane, Alhakami, Slovic, & Johnson, 2000). As a result of this relationship, products or processes for which people associate positive beliefs (and positive affect) have a lower perceived risk than products or processes for which people have negative beliefs (and negative affect). These relationships suggest that the improper disposal of PPCPs may, in part, be the result of the positive affect and reduced risk perceptions associated with these products (Dohle, Campbell-Arvai, & Arvai, 2013), although this relationship has not been tested directly. Thus, this study proposes to include additional question items about risk perceptions and affective evaluation of PPCPs to augment the attitudes and beliefs questions associated with most TPB studies. Insight about affective evaluations and the nature of the affect heuristic in decision-making will provide further input into the development of an effective communication campaign for proper PPCP disposal and handling, i.e., by enhancing the negative affect associated with the improper disposal of these products.

Personal Norms

Behaviors that benefit the environment are also thought to be the result of an awareness of the negative environmental consequences of a behavior, as well as a sense of personal responsibility for these consequences (de Groot & Steg, 2009; Schwartz, 1977). Researchers have used this form of motivation to increase the adoption of a variety of environmentally beneficial behaviors, e.g., the use of public transit, avoidance of plastic bags, and the use of reusable water bottles (de Groot, Abrahamse, & Jones, 2013; van der Linden, 2015; Wall, Devine-Wright, & Mill, 2007). Further, adding intrinsic motivation to the Theory of Planned Behavior has resulted in greater success in understanding and motivating these behaviors (Harland, Staats, & Wilke, 1999). Overall, past research has shown that increasing awareness of the negative consequences of, and enhancing a sense of personal responsibility for, behaviors that harm the environment, i.e., the improper disposal of PPCPs, are important ingredients in public education and engagement campaign to increase the uptake and performance of environmentally beneficial behaviors (Steg & Vlek, 2009). Thus, this study proposes to include additional survey items about risk perceptions and affective evaluation of PPCPs in aquatic systems, and (ii) personal norms and assessments of personal responsibility associated with the (im)proper disposal of PPCPs, with the ultimate goal of developing a more effective public engagement and behavior change campaign.

Project Summary

The environmental risks of pharmaceutical and personal care products (PPCP) are well-documented, and attention has recently turned to the specific implications of PPCPs for the health of aquatic environments, and—specifically—their capacity to interfere with the functioning and productivity of the Great Lakes ecosystems. While one solution is to advance the technologies and processes available to remove and dispose of all PPCPs at the downstream (water treatment) end of the process, there is considerable interest directed at motivating the proper handling and disposal of pharmaceuticals and personal care products by individuals and households. While surveys have shown that citizens express concern about the negative effects of PPCs in aquatic and terrestrial environments, the limited behavioral research that exists suggests that—for most individuals—disposal through plumbing and the solid waste stream remain the most common methods of disposal (as compared to pharmaceutical recycling programs). This gap between attitudes and behaviors suggests an opportunity—and a need—to learn more about (i) public knowledge and beliefs about the presence of PPCPs in aquatic environments (and the paths they take to get there), (ii) perceived and actual barriers to the proper disposal of PPCPs, and (iii) perceptions of the risks of PPCPs to aquatic environments and to human health. This study, through the deployment of an online and in-person survey to Ohio residents within the Lake Erie watershed (with an additional focus on traditionally underserved populations and seasonal visitors), is ultimately designed to support the development of more effective and inclusive informational and behavioral interventions to increase knowledge, awareness and concern about PPCPs in aquatic environments, and—ultimately—to reduce the volume of PPCPs that reach Lake Erie. To this end, I have letters of support from the Alliance for the Great Lakes and The Ohio State Extension (Lake County Extension Office) expressing a commitment to use the information from this study to develop improved public engagement and outreach on the issue.