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Message Matters: Application of the Theory of Planned Behavior to Increase Household Hazardous Waste Program Participation

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MESSAGE MATTERS: APPLICATION OF THE THEORY OF PLANNED BEHAVIOR TO INCREASE HOUSEHOLD HAZARDOUS WASTE PROGRAM PARTICIPATION

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Message Matters: Application of the Theory of Planned Behavior to Increase Household Hazardous Waste Program Participation

by

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Abstract

Removing household hazardous waste (HHW) from the municipal solid waste stream is important to protect health, safety and the environment. Communities across the U.S. separate HHW from regular trash for disposal with hazardous waste, however nationally, participation rates are low with only five to ten percent of households estimated to participate in any given collection. This two-part study used the Theory of Planned Behavior (TPB) to understand individuals' beliefs and attitudes toward HHW collections, and to develop a print message intervention to increase participation. In Study 1, respondents (N = 983) completed a survey administered to homeowners in the Connecticut River Estuary region. Correlational and regression mediation analyses showed that the TPB significantly predicted self-reported attendance at an HHW collection. Despite wide use of the TPB in studies designed to predict intention and behavior, application in behavior change interventions is not common. Thus in Study 2, an experiment was conducted in which the sample comprised of survey respondents and non-respondents (N = 2,409) was randomly assigned to receive one of the following intervention print message treatments: (1) only factual information about the HHW collections; (2) factual information plus positive attitudes toward HHW collection participation; (3) factual and normative messages about HHW participation; and (4) factual, attitudinal and normative messages. The control condition was single-family households in the region that received neither the survey nor treatment. Results of the experiment were mixed. The information-only card showed a 15% participation rate while the card that provided information and appealed to both attitudes and norms, showed a 22.5% participation rate, compared to the control group with 8.7% participation. Two conditions hypothesized to show significant increases in participation, an

information and attitude message card and an information and normative message card did not significantly differ from the control. The results of this research imply that direct-mailed print messages with program information and appeals to both attitudes and norms can be an effective tool for motivating HHW collection participation. The electronic version of this dissertation is at OhioLink ETD Center, www.ohiolink.edu/etd

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Chapter I: Introduction

The current research was undertaken in an effort to understand individuals' reasons for participating, or not participating, in household hazardous waste (HHW) collections at a regional facility and to experiment with print messages to influence participation by invoking a theoretical model of behavior. Study 1 used a survey to measure variables in the Theory of Planned Behavior (Ajzen, 1991) in order to identify reasons why the behavior (HHW collection participation) is not undertaken, and to identify possible variables that could be manipulated to change behavior. In Study 2, these variables were manipulated in a field experiment with an intervention to increase HHW program participation. The following introduction presents background information on household hazardous waste.

What Household Hazardous Waste Is and Why It Is an Issue of Concern

Many of the common products we use at home contain ingredients that make them hazardous, posing a threat to health, safety and the environment. Once these hazardous household products are no longer used or wanted and waste remains, they are referred to as household hazardous waste (HHW). As defined by the U.S. Environmental Protection Agency (EPA), the federal agency that regulates solid waste and hazardous waste under the Resource Conservation and Recovery Act (RCRA), household hazardous waste refers to the "leftover household products that contain corrosive, toxic, ignitable or reactive ingredients" (2011).

Examples of HHW categories include cleaning products, pesticides, automotive products, workshop and painting supplies, and miscellaneous products (such as batteries, driveway sealer, mercury thermometers) (U.S. EPA, 1997) (see Table 1). While HHW is defined by its hazard properties, there is not a standard list of waste materials that comprise HHW.

Table 1
Household Hazardous Waste

HHW categories	Examples
Household maintenance items	Paint, thinners, furniture stripper, adhesives and glues
Household batteries	Mercuric oxide, lithium
Personal care products	Nail polish and remover, hair spray
Cleaners	Drain openers, tub and tile cleaners, oven cleaner, bleach
Automotive-maintenance products	Grease, oil, brake fluid, antifreeze
Pesticides, pet supplies and fertilizers	Bug repellent, ant baits, flea powder, rat poison
Hobbies/other	Pool chemicals, lighter fluid
Pharmaceuticals	Prescribed drugs

Note. This is not an all-inclusive list of HHW. Wastes accepted at HHW collections can vary in composition by town, region and state. Reprinted with permission from "Household Hazardous Waste Reduction," by United States Environmental Protection Agency, 2007, www.epa.gov/region5/waste/solidwaste/p2pages/pdfs/tb-hhw.pdf

As with stored hazardous household products (HHP), contact with HHW stored in the home can adversely affect health and safety through exposure (Bunge, 1985; Galvin & Dickey, 2008). Human exposure can be accidental or intentional. Of 66 cases reviewed by a Pediatric Fatality Review team, "exposures causing death in children ≤ 5 years of age were mostly coded as 'Unintentional-General,' while those in ages over 12 years were mostly 'Intentional.' Often, the Reason Code did not capture the complexities of the case" (Bronstein, Spyker, Cantilona, Rumack, & Dart, 2012, p. 920).

HHP and HHW exposures can occur through several pathways: ingestion, inhalation and (skin and mucous membrane) absorption (Galvin & Dickey, 2008). The American Association of Poison Control Centers (AAPCC) tracks data from U.S. poison control centers. In the *2011 Annual Report* of the AAPCC, human exposures recorded by poison control centers spanned the ages. The number of calls regarding children less than one to five years old was 1,144,693 while

141,121 exposures were 6–12 years old; and 158,875 were 13–19 years old. An additional 4,461 calls were regarding children of unknown age. Adults age 20 years and older were fewer, comprising 871,550 of the centers' calls. The AAPCC data indicate that the greatest number of exposures occurred in individuals who were five years old and under (Bronstein et al., 2012). A long-term (1990–2006) analysis of household cleaning product injuries indicated that young children accounted for well over the majority of exposures (72.0%), primarily by substance ingestion (62.7%) and were treated in emergency rooms during this time frame (McKenzie, Ahir, Stolz, & Nelson, 2010). This could possibly be due to HHP and/or HHW accessibility.

Accessibility to children (within reach and insufficiently-secured), deteriorating containers and other improper methods of storage are issues of concern when storing HHW in the home, garage and workshop. HHW that is improperly stored in food containers such as milk or juice jugs, soda bottles or coffee cans, can increase the chance of accidental ingestion.

Containers of corrosive/caustic material can deteriorate, as with drain opener that contains sodium hydroxide or lye. The metal container corrodes over time and if handled without gloves can burn skin. Solvents and fertilizers can also deteriorate containers thereby increasing potential exposure to these materials (Wolf & Kettler, 1997).

The *2011 Annual Report* presents a list of the top 25 substance categories for which poison control centers received calls regarding human exposures. Of these categories, several are of interest to this current research because they are categories of wastes commonly brought to household hazardous waste collections. They are: cosmetics/personal care products, household cleaning substances, various pharmaceuticals, pesticides, chemicals and hydrocarbons (see Table 2). Whether or not these categories comprise products in use (HHP) or product wastes (HHW)

that are stored at home, the table demonstrates that human exposures to these substance categories are high.

Non-human (animal) exposure calls made to American poison control centers occur as well. In 2011, 72,689 of the calls involved dog exposures (90.56% of the calls) (Bronstein et al., 2012). For example, spilled antifreeze (which can contain the toxic ingredient, ethylene glycol) can be lethal when ingested by pets (Galvin & Dickey, 2008).

Health, Safety and Environmental Issues Associated With HHW Disposal

Disposal of HHW in the trash. HHW that is disposed in the trash is a problem due to its hazardous characteristics (Conn, 1989; Galvin & Dickey, 2008; U.S. EPA, 1986, 2006). It can harm sanitation workers through chemical exposure (Galvin & Dickey, 2008; U.S. EPA, 2006). This can occur from direct contact or from conditions such as the mixing of incompatible substances or compaction of aerosol cans with contents under pressure. Fires that occur in trash trucks have been attributed to HHW (Mitchell, Demichelis, & Dorian,1988).

Table 2

Partial List of Top Human Exposure Substance Categories That Are HHP or HHW

Substance (Major Generic Category)	All substances substances	% a	Single substance exposures	% b
Analgesics	322,016	11.73	209,909	10.04
Cosmetics/Personal Care Products	218,269	7.95	211,253	10.10
Cleaning Substances (Household)	192,771	7.02	172,740	8.26
Sedative/Hypnotics/Antipsychotics	168,416	6.13	65,689	3.14
Antidepressants	107,528	3.92	44,961	2.15
Cardiovascular Drugs	102,766	3.74	49,671	2.38
Topical Preparations	102,692	3.74	100,448	4.80
Antihistamines	94,159	3.43	67,169	3.21
Pesticides	89,445	3.26	83,757	4.01
Cold and Cough Preparations	74,995	2.73	54,970	2.63
Alcohols	74,484	2.71	27,311	1.31
Vitamins	70,195	2.56	61,126	2.92
Stimulants and Street Drugs	66,540	2.42	41,137	1.97
Antimicrobials	65,856	2.40	54,989	2.63
Hormones and Hormone Antagonists	60,234	2.19	41,440	1.98
Gastrointestinal Preparations	50,414	1.84	39,754	1.90
Anticonvulsants	49,607	1.81	21,566	1.03
Chemicals	39,906	1.45	34,370	1.64
Hydrocarbons	39,422	1.44	37,194	1.78
Dietary Supplements/Herbals/ Homeopathic	35,565	1.30	28,558	1.37
Fumes/Gases/Vapors	32,986	1.20	30,341	1.45

Note. [a] Percentages are based on the total number of substances reported in all exposures (N = 2,745,684). [b] Percentages are based on the total number of single substance exposures (N = 2,090,698). Adapted from "2011 Annual report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 29th Annual Report," by A. C. Bronstein, D. A. Spyker, L. R. Cantilena, B. H. Rumack, and R. C. Dart, 2012, *Clinical Toxicology,* pp. 911-1164. 2012 by American Association of Poison Control Centers. Reprinted with permission.

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Household hazardous waste that is disposed in the trash ends up in landfills and incinerators along with other municipal solid waste. HHW is a contributing source in hazardous landfill leachate (Galvin & Dickey, 2008; Reinhart, 1993; Robertson et al., 1987; Slack, Gronow,

& Voulvoulis, 2005). In King County, WA, 150 HHW chemicals were identified in the leachate from County landfills. Researchers qualified this claim by recognizing that the time between landfilling material and leachate formulation can involve complex changes in chemical composition (Savage & Sharpe, 1987). Incineration of HHW in municipal solid waste incinerators can add heavy metals to concentrated residual ash (Conn, 1989; Galvin & Dickey, 2008).

Disposal down a drain. Some people dispose of HHW by flushing it down a drain. This can lead to several problems, including pipe corrosion, noxious fumes re-entering the home and septic system damage. For homes tied to septic systems or public wastewater treatment plants, HHW can cause problems by killing helpful bacteria in systems that break down waste (Conn, 1989; Galvin & Dickey, 2008; Robertson et al., 1987). Moreover since wastewater treatment plants cannot sufficiently treat most HHW and render it harmless, the chemicals are simply passed into the environment (U.S. EPA, 1999).

Direct disposal into the environment. Direct disposal of HHW into the environment can introduce toxins to ecological systems and pollute drinking water supplies. For example, when HHW is poured on the ground it can pollute surface water through runoff from the land, and enter the food chains of aquatic species (Conn, 1989; Robertson et al., 1987). Used motor oil poured on the ground can contaminate groundwater and pollute drinking wells through infiltration (Association of State and Territorial Solid Waste Management Officials [ASTSWMO], 2000; Robertson et al., 1987).

There are numerous pathways through which HHW can threaten human and environmental health. With the prevalence of HHW in our homes and communities, it is important to divert HHW from the MSW stream through special HHW collections, thereby

reducing the risk that improperly managed waste poses to humans, animals and the environment. Household hazardous waste management and solid waste management in general, are undertaken primarily for public health protection (Ross, 2011).

Amount of HHW in the Municipal Solid Waste Stream

While the EPA has been tracking the nation's municipal solid waste generation and disposal for decades, it does not separately track or report HHW generation and disposal (Offenhuber et al., 2012; U.S. EPA, 2011a). Industry estimates are that HHW that is annually disposed in the U.S. comprises about one percent by weight of the municipal solid waste (MSW) stream (Bernheisel, 2001; Galvin & Dickey, 2008). Given that on an annual basis approximately 249 million tons of MSW enters the waste management system in the U.S. (U. S. EPA, 2011b), this small percentage of HHW is potentially equivalent to about 2.5 million tons of material. This estimation of HHW does not include other potential disposal outlets such as disposal into drains and subsequently wastewater treatment facilities or connected bodies of water, or disposal directly into the natural environment. Nor does the estimate include that which is stockpiled in homes.

Many states, regions, towns and cities promote household separation of HHW from the MSW stream, offering residents the opportunity to bring items to HHW collections for proper waste management licensed chemical waste handlers. This focus on HHW segregation from the MSW stream came about in part from an increased awareness of the issue due to improvements in hazard detection (through landfill monitoring and waste characterization studies) and from exposure and injury to materials sorters and equipment (Winn, 2001).

Household Hazardous Waste Collection

Although household hazardous waste contains hazardous ingredients, it is federally regulated as solid waste (under RCRA, Subtitle D) rather than hazardous waste (RCRA, Subtitle C) (U.S. EPA, 1993). This means that HHW can be disposed in the municipal solid waste stream with other household-generated solid waste (Galvin & Dickey, 2008; U.S. EPA, 1986). A reason for this exclusion is because "regulating every household is simply too impractical" (U.S. EPA, 1993, p. 2). That is, the enforcement of proper household disposal of products with corrosive, toxic, ignitable or reactive ingredients would be difficult and resource intensive.

Despite the federal exemption, many states choose to separate HHW from solid waste and manage it as hazardous waste. The first HHW collection was held in Kentucky in 1981 and collections are now held in all 50 states, having risen out of state and local governments' concerns over health and environmental risks associated with improper HHW storage and disposal (Galvin, 2008; Margai, 1999).

The U.S. EPA supports HHW collection to separate it from the MSW stream. In a 1988 memorandum by J. Winston Porter, Assistant Administrator for the Office of Solid Waste and Emergency Response to Waste Management Division Directors in all EPA regions, EPA supported HHW collection programs because

> they (1) promote citizen awareness regarding proper handling of HHW; (2) reduce the amount of HHW in the municipal solid waste stream which ultimately is taken to municipal solid waste combustors or landfills; (3) limit the amount of HHW which is dumped down a drain and ultimately discharged to a publicly-owned treatment works (POTW), or is dumped indiscriminately; (4) remove a greater amount of HHW from the home, thereby reducing potential safety hazards; and (5) help to reduce the risk of injuries to sanitation workers. (U.S. EPA, 1988)

This demonstrates that despite regulatory exemption of HHW as a hazardous waste, the EPA recommends its collection and management to protect health, safety and the environment (U.S. EPA, 1990).

States' inclusion of universal wastes with HHW. Households and Conditionally Exempt Small Quantity Universal Waste Generators (CESQUWGs) (businesses generating less than 220 pounds of RCRA hazardous waste including UW), are exempted from the universal waste (UW) regulations put in place by the U.S. EPA in 1995 (CA DTSC, 2010; U.S. EPA, 2006). UW includes universally or "widely generated" wastes such as batteries, pesticides and mercury-containing devices (such as thermostats) (Galvin & Dickey, 2008). The purpose of these regulations, which are optional for states, was to make it easier for states to collect the materials from businesses by easing the hazardous waste requirements under RCRA (Galvin & Dickey, 2008). Given that households are exempted from UW federal regulations, household-generated batteries, pesticides and mercury are viewed as HHW, except in some states like CA and MN. These states have exceeded federal requirements regarding HHW; adopted UW regulations; and required the collection of UW materials from households (CA DTSC, 2010). These stringent state regulations prohibit households from disposing of these materials in the MSW stream. Thus, in a state that exceeds federal regulations for HHW and UW management, an HHW collection becomes a destination for state-mandatory disposal of certain HHW items (see Table 3).

Table 3

Examples of Materials Collected in States That Adopted Universal Waste Regulations

Materials classified as Universal Wastes	States in which the materials are classified as UW
aerosol cans	California, Colorado
antifreeze	Louisiana, New Hampshire
ballasts (contain mercury)	Maine, Maryland, Vermont
barometers	New Hampshire, Rhode Island
cathode ray tubes	Maine, New Hampshire, Rhode Island
electronics	Arkansas, California, Colorado, Connecticut, Louisiana, Michigan, Nebraska, New Jersey
oil-based finishes	New Jersey
paint and paint-related wastes	Texas
hazardous waste pharmaceuticals	Michigan

Note. Reprinted with permission from "Why Universal Waste Regulations Are Different in Some States," by United States Environmental Protection Agency, 2006, http://www.epa.gov/epawaste/hazard/wastetypes/universal/statespf.htm#why

Single-day HHW collection events. HHW collections are typically voluntary events and take various forms, from single day events to limited material collections (such as "ABOPs" for collection of antifreeze, batteries, oil and paint), mobile facilities, curbside collection and permanent HHW facilities. While single day events are the most widely-used method of HHW collection (Isaacs, 2001), the trend since the 1990s has been toward permanent HHW facilities (Galvin, 2008; Merrill, 1997) that afford more opportunities during the year for residents to dispose of HHW.

Single-day HHW collections refer to events that are held at accessible locations such as store or school parking lots or solid waste transfer stations. Commonly, they are held on Saturdays, once or twice a year in the spring and/or fall. At these events, licensed chemical waste handlers are hired to set up sorting tables with bins and drums behind tables, an eye-wash station, a lined roll-off dumpster for non-hazardous materials, 1-2 queue lanes defined by cones

and an off-loading area on taped poly-sheeting, with tent coverage for sun and weather protection and other features such as chairs for volunteer attendants. Materials are off-loaded from vehicles by the handlers and sorted, segregated by hazard class and packaged with labeling and paperwork for transport to disposal facilities (Bruning & O'Donnell, 2008). Single-days can be crowded with long waiting lines due to the infrequency of collection; however, this is a popular collection method especially where permanent HHW facilities do not exist.

Permanent or fixed HHW facilities. Permanent facilities have nearly the same event set-up as one-day collections, with the benefit of a permanent hazardous materials storage building to temporarily store collected hazardous materials on-site in separated compartments until they can be shipped (see Figure 1). There is a national trend away from single-day collections toward permanent HHW facilities because costs can be lowered at permanent facilities while offering more opportunities for residents to deposit their HHW at a collection (Larscheid, 1997; Nightingale & Lewry, 2008). Contractor site set-up and break-down costs are decreased, given that they can store materials on-site at a permanent facility (Larscheid, 1997). Even more important, rather than paying for shipping of partially-filled 55-gallon drums, communities benefit from the permitted option of having drums remain in the permanent facility containment structure for up to 90 days thereby allowing for the shipping of full drums which minimizes costs (Bruning, 2008; Larscheid, 1997). To minimize risk, the storage compartments have ventilation, explosion-proof lighting, secure locks and placards to label contents. In northern climates, permanent facilities are closed in winter, when cold weather prohibits collections and temporary material storage due to lack of insulation (Galvin, 2008). It is commonly believed, although not empirically proven, that the fixed location and consistency of operation make it easier for residents to become familiar with the facility through regular,

standardized operations and greater awareness through regular advertising and word-of-mouth (Metzner, 1999). This process of collecting HHW from households to divert it from the MSW stream and other disposal practices is based on the premise that exceeding federal regulations and providing more stringent management of HHW (i.e., in hazardous waste incinerators and landfills) will aid in lessening its threat to public health and the environment. HHW program success depends first however, on household resident participation in HHW collections.

Figure 1. Permanent household hazardous waste facility storage building, Essex, CT. Photo by J. Ehle/Meyer. Reprinted with permission from Connecticut River Valley Council of Governments (River COG), Essex, CT.

HHW collection participation. With the most prevalent community HHW collections occurring at permanent HHW facilities or as single-day collections, this requires that an individual who wishes to participate must drive to a central location for material drop-off. This takes several steps on the part of the individual: s/he must know the dates and times of the HHW collection, identify HHW in the home that is acceptable at the facility, possibly complete a pre-visit form, load the vehicle, drive to the facility, likely wait in line and "check in" at the facility to demonstrate resident status by showing ID and/or complete a form, and possibly provide cash payment for attendance. Then the materials are off-loaded by the chemical waste handlers and any unacceptable materials (such as radioactive or biological materials or non-hazardous products such as latex paint) are left in the vehicle, possibly with advice given on alternative disposal. This participation process therefore requires a high-level of individual involvement and can be considered a high-cost activity in terms of time and effort.

Participation in HHW collections may be low due to the high level of individual involvement. Even though HHW collections have been in place since the early 1980s, the estimated national average for collection participation is only five to ten percent of households per collection (Bruning, 2008; U.S. EPA, 1993). This clearly indicates that the majority of households are not attending HHW collections, despite the aforementioned public health and environmental threats from improper disposal. Many HHW program managers seek to increase participation to increase diversion of HHW from the waste stream and other disposal practices.

Research investigating factors related to HHW program participation is largely limited to data obtained on the presence of HHW stored in the home and individuals' knowledge and attitudes about HHW and collections. There is a paucity of literature focusing on HHW collections and program participation.

Increasing HHW participation is a worthy goal particularly given the range and amount of materials. The question is how to motivate participation in HHW collections. To promote higher rates of HHW collection participation, behavioral theory-based community interventions are needed. The next chapter reviews the literature concerning an empirically strong behavioral theory, the Theory of Planned Behavior (Ajzen, 1991). This theory is positioned in the broader context of literature on environmentally-responsible behavior.

Chapter II: Review of the Literature

This chapter presents an overview of literature on constructs associated with human behavior relative to the Theory of Planned Behavior (TPB) (Ajzen, 1991), a dominant behavioral theory that provides the theoretical basis for this study. Community-based social marketing (CBSM) provides a method and tools for affecting behavior change. CBSM can in turn benefit from explicit application of the TPB in formative research, persuasive message development and evaluation of program effectiveness (Hardeman et al., 2002; Stead, Tagg, MacKintosh, & Eadie, 2005).

Knowledge

Knowledge has traditionally been viewed as a pre-requisite to behavior (Vining & Ebreo, 1990) and as such, a "knowledge-deficit" can be a barrier to behavior (Schultz, 2002). For example, a lack of knowledge about a household hazardous waste program and procedural information can be a major impediment to participating in a collection program. In terms of recycling, correlations between recycling information and recycling behavior have been demonstrated in the literature (Nixon & Saphores, 2009; Seacat & Northrup, 2010; Vicente & Reis, 2008). Knowledge is a "strong predictor of recycling" (Sidique, Lupi, & Joshi, 2010, p. 164). Yet while detailed information is needed for decision making (Kennedy, Beckley, McFarlane, & Nadeau, 2009), organizations often rely on the use of information to motivate behavior (McKenzie-Mohr, 2011). Researchers have realized there are "disassociations between knowledge and behavior" (Ajzen, Joyce, Sheikh, & Cote, 2011, p. 101) and knowledge may not be enough of a motivating factor for an individual to perform a behavior (Ajzen et al., 2011; Hungerford & Volk, 1990; Kennedy et al., 2009; McKenzie-Mohr, 2011; Schultz, 2002; Tabanico & Schultz, 2007). Ajzen et al. (2011) contend that subjective information or beliefs

(either accurate or inaccurate) are what determine one's intentions and behavior. They suggest that organizations attempting to motivate behavior (such as through educational campaigns) should first identify what the beliefs are and discern how they affect intention and behavior. Efforts can then be directed toward dispelling or supporting those beliefs in an intervention to motivate behavior (Ajzen et al., 2011).

Theory of Planned Behavior Constructs

Beliefs. Beliefs are convictions about what is perceived to be true. Fishbein and Ajzen (2010) define beliefs as "subjective probabilities" (p. 221). In the TPB, these include beliefs regarding the outcome from a behavior (behavioral beliefs); beliefs that "particular referents" think the individual ought to perform a behavior (injunctive normative beliefs), beliefs regarding whether the referents are undertaking the behavior themselves (descriptive normative beliefs); and beliefs regarding "factors that can facilitate or impede performance of a behavior" (control beliefs) (Fishbein & Ajzen, 2010, p. 221). Beliefs, whether or not they are accurate, influence our attitudes.

Attitudes. Although attitudes can affect a person's intention and actual behavior (Ajzen & Fishbein,1980) the correlation between attitudes and behavior is often weak (Ajzen & Fishbein, 1980; Bechtel & Churchman, 2002; Dunlap & Van Liere, 1978; Kollmuss & Agyeman, 2002; Wall, 1995; Winter & Koger, 2004). Surveys that solicit responses on broad or generalized attitudes weakly predict specific behaviors (Myers, 1999). Research indicates that the strength of the correlation between attitudes and behavior improves with greater specificity (McKenzie-Mohr, Nemiroff, Beers, & Desmarais, 1995; Myers, 1999; Oskamp et al., 1991; Wall, 1995). For example, attitudes specific to recycling have been shown to correlate with recycling behavior (Gamba & Oskamp, 1994; Guagnano & Howenstein, 1993; Schultz et al.,

1995; Vining & Ebreo, 1990; Werner & Makela, 1998). Specific attitudes toward recycling also correlated with recycling intention (Cheung, Chan, & Wong, 1999; Taylor & Todd, 1995).

Subjective norms. Subjective norms are an individual's perceptions about whether or not important others (e.g., family, friends, neighbors), also called referents, think s/he should perform a behavior (Fishbein & Ajzen, 2010). Research has shown mixed results for the predictive power of subjective norms on behavioral intentions (Nisbet & Gick, 2008), with this variable demonstrating the weakest power of the TPB variables in predicting intention to perform a behavior (Armitage & Conner, 2001; Wankel & Mummery, 1993). In a meta-analysis, Armitage and Conner (2001) examined whether or not the way subjective norms were measured could explain the predictive weakness of subjective norms. They found that researchers' typical use of a single item measurement resulted in lower predictive ability. It could be improved with measurements that included both perceived injunctive norms (i.e., norms indicating what we "ought" to do based on perceptions of approval of the behavior by others) and descriptive norms (Cialdini, 2003). Descriptive norms are based on individuals' perceptions of what behaviors people normally do (Cialdini, Reno, & Kallgren, 1990; Fishbein & Ajzen, 2010). Fishbein and Ajzen (2010) stated that in their original conception of the term "subjective norms" in the Theory of Planned Behavior, this referred only to injunctive norms. In further consideration of norms, Fishbein and Ajzen (2010) recognized that people also feel normative pressure to conform to the behaviors of others. They contend that the influence of descriptive norms can help to explain why injunctive norms, alone, weakly predict intention and behavior (Fishbein & Ajzen, 2010). Research has demonstrated that the combined use of injunctive and descriptive norms can strongly influence behavior, particularly if the norms complement rather than contradict each other (Nolan et al., 2008; Schultz et al., 2007; Cialdini, 2003; Cialdini et al., 1990). An example

of a contradictory message would be presenting the injunctive norm that an individual should recycle while at the same time presenting the descriptive norm that very few people actually do recycle. This tells the individual that s/he ought to, but not many others do.

Perceived behavioral control. Fishbein and Ajzen (2010) define perceived behavioral control (PBC) as, "the extent to which people believe that they are capable of, or have control over, performing a given behavior" (pp. 154, 155). Further, they indicate that PBC comprises the constructs of self-efficacy and control (Fishbein & Ajzen, 2010). These can be congruent or conflicting. For example, an individual may believe that identifying materials to bring to a household hazardous waste collection is an easy thing to do (high perceived self-efficacy), yet believe there are too many responsibilities that compete with being able to attend a Saturday HHW collection (low control).

The inclusion of PBC in the Theory of Planned Behavior has increased its predictive power for intention and behavior (Cameron, 2009). In a meta-analysis of 185 independent studies, researchers found support for the influence of PBC on intention and behavior, with PBC adding 6% to prediction of intention (Armitage & Conner, 2001). While an individual may hold favorable attitudes toward a behavior and believe there is normative pressure to act, low PBC can impede the formation of favorable intentions to perform the behavior (Fishbein and Ajzen, 2010).

Intention. Fishbein and Ajzen (2010) define intention, the proximal antecedent to behavior in the Theory of Planned Behavior, as an individual's "readiness" to perform a behavior. Intentions have been shown to be strongly predictive of the behavior when intentions are measured just before a behavior is anticipated, such as participation in an event (Bechtel & Churchman, 2002; Kaiser, Hübner, & Bogner, 2005). However for varying reasons, such as

competing responsibilities or opportunities, individuals may not follow through on their intentions. Lacking the necessary skills to perform a behavior and experiencing environmental constraints, can also explain why intentions are not always acted upon (Fishbein, Hennessy, Yzer, & Douglas, 2003).

The TPB indicates that attitudes, subjective norms and perceived behavioral control impact behavior through intention, while additionally, PBC can also have a direct influence on behavior. In terms of PBC, Ajzen (1991) and Fishbein and Ajzen (2010) state that intentions translate into behavior only when individuals have actual control (knowledge, skills and resources) and can overcome barriers to action.

The Theory of Planned Behavior

The TPB, an extension of the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980), has been very widely applied and has demonstrated empirical strength in predicting individuals' intentions and behavior (Armitage & Conner, 2001; Kaiser et al., 2005; Kollmuss & Agyeman, 2002; Oreg & Katz-Gerro, 2006). It has mostly been applied in the public health field toward applications such as smoking cessation, sexual behavior, and nutrition (Hardeman et al., 2002).

The TRA and TPB are rational choice theories that assume that people think about the potential outcomes of a behavior before they decide to act (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). They also assume that decisions are motivated by self-interest (Abrahamse & Steg, 2011). Accordingly, an individual's behavior can be predicted by the strength of one's intention to perform the behavior. The TRA indicates that intention is determined by two constructs: attitudes and subjective norms toward the specific behavior. Attitudes are based on behavioral beliefs about possible outcomes of the behavior and evaluation of the outcome

(Fishbein & Ajzen, 2010). Beliefs are formed about people, places and things, based on observation, obtained information or inference (Fishbein & Ajzen, 2010). If an individual believes the outcome will be positive, the attitude toward the behavior is likely favorable. The theory proposes that intention is also determined by subjective norms which refer to "a person's perception that important others prescribe, desire, or expect the performance or nonperformance of a specific behavior," which may or may not be correct (and is therefore considered to be subjective) (Fishbein & Ajzen, 2010, p. 131). The theory shows that subjective norms are based on normative beliefs about significant others' approval. If an individual perceives that others who are important to him think that he should undertake the behavior, the individual may be more likely to do so (Ajzen & Fishbein, 1980) (see Figure 2).

The TRA assumes that people voluntarily choose to perform or not perform a behavior. It does not take into account other factors that can compel behavior or restrict an individual's motivation and perceived ability to perform the behavior (Ajzen, 1991). Because "many goals and behaviors are not under complete volitional control," Ajzen modified the TRA to include the construct of perceived behavioral control (PBC) thus creating the Theory of Planned Behavior (Fishbein & Ajzen, 2010, p. 18) (see Figure 3). PBC is defined as one's confidence in his ability and control over performing a behavior and is based on control beliefs, which are beliefs regarding factors that may make it easy or difficult to perform the behavior (Ajzen, 1991; Fishbein & Ajzen, 2010). Ajzen argued that behaviors that are not under complete volitional (actual) control could still be predicted to influence both intention and behavior, so long as the PBC was realistic (Fishbein & Ajzen, 2010). Armitage and Conner (2001) state that in circumstances where volitional control is low, perceived behavioral control can still motivate individuals to act on their intentions. Consequently, PBC is useful in predicting behavior. For

example, participation in a household hazardous waste collection involves time spent identifying acceptable materials in the home, loading a vehicle with the materials, driving to a collection facility and spending time in line for eventual material off-loading. If limited time is a barrier to participation yet an individual believes s/he has the ability to include it in the schedule and intends to participate, then s/he may participate.

The construct of perceived behavioral control differs from locus of control (Rotter, 1966) which is a more general, consistent perception of one's internal versus external control over outcomes (Ajzen, 1991; Myers, 1999). Locus of control refers to an individual's perception that a "reward [is] contingent on his own behavior or independent of it" (Rotter, 1966). An individual with an internal locus of control perceives that his behavior affects outcomes while an individual with an external locus of control attributes outcomes to influences beyond himself (Ajzen, 1991; Myers, 1999). Ajzen presented PBC as a construct that is synonymous with perceived self-efficacy, which is defined as "belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). This is a personal judgment of how competent one feels in their abilities to successfully complete a behavior (Ajzen, 1991; Myers, 1999).

To summarize, the TPB posits that a specific behavior can be predicted from one's intention to perform the behavior which is in turn influenced by attitudes specific to the behavior (that are based on behavioral beliefs), subjective norms (based on normative beliefs) and perceived behavioral control (based on control beliefs) regarding the behavior. Favorable attitudes plus strong perceived norms and beliefs about behavioral control can form strong intentions to perform a behavior (Ajzen, 1991; Nisbet & Gick, 2008). In the TPB, intentions

mediate the relationship between attitudes, subjective norms, PBC, and the performance of a behavior (Bamberg & Möser, 2007). See Figures 2 and 3.

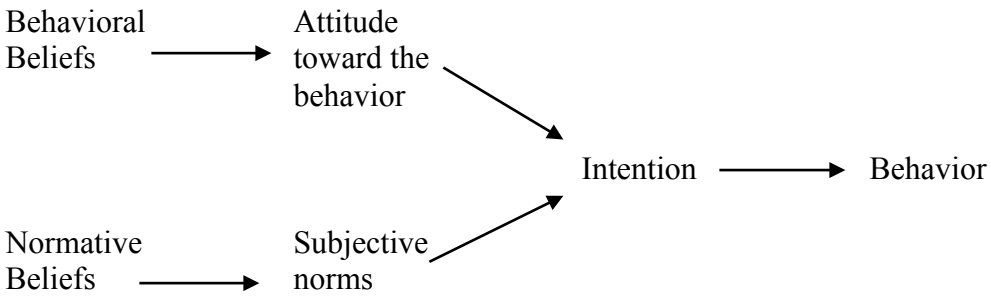

Figure 2. Theory of reasoned action. From *Understanding Attitudes and Predicting Social Behavior* (1st ed) (p. 8), by I. Ajzen and M. Fishbein, 1980, Upper Saddle River, NJ: Pearson Education. Copyright 1980 by Pearson Education, Inc. Reprinted with permission.

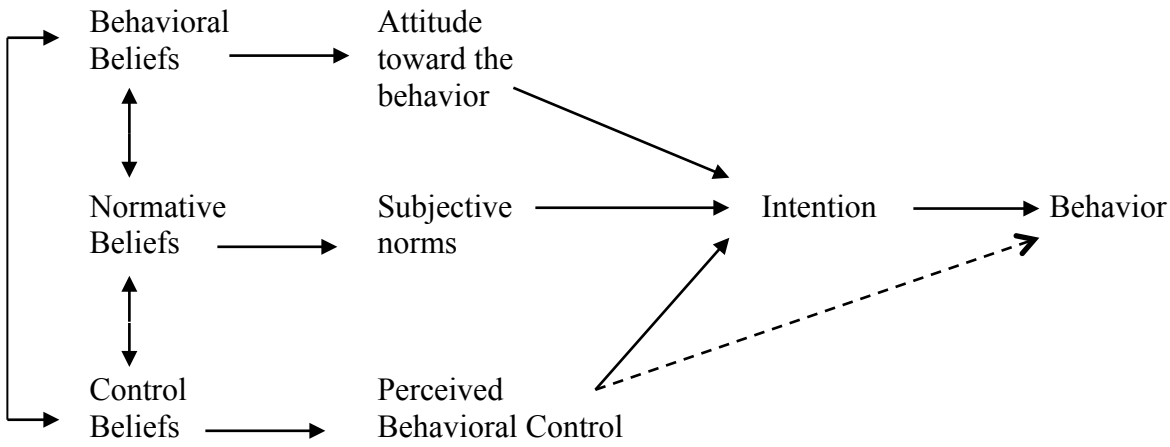

Figure 3. Theory of planned behavior. Reprinted from "The Theory of Planned Behavior," by I. Ajzen, 1991, *Organizational Behavior and Human Decision Processes, 50,* p. 182. Copyright 1991 by Elsevier. Reprinted with permission.

Empirical Tests of the Theory of Planned Behavior

Tests of the Theory of Planned Behavior to predict individuals' intentions and behavior, have reached across the disciplines, investigating health issues such as breast cancer screening

(Rutter, 2000) and returning to work after long-term sickness (Brouwer et al., 2009); transportation issues, such as car travelling intentions (Kerr, Lennon, & Watson, 2010: Parker, Manstead, Stradling, Reason, & Baxter, 1992); leisure choices (Icek & Driver, 1992) and environmental issues such as recycling behavior (Tonglet, Phillips, & Read, 2004), park visitor and conservation behaviors (Hughes, Ham, & Brown, 2009; López-Mosquera, Garcia, & Barrena, 2014). There are estimated to be hundreds of studies on application of the TPB to predict intention and behavior. Frequently in studies, intention is used as a proxy for behavior.

Meta-analyses of TPB studies to predict intention and behavior. There have been several meta-analyses of TPB studies. In terms of examining the theory's usefulness in predicting intention, Godin and Kok (1996) reviewed 58 health-related studies and found that the TPB accounted for 66.2% of the variance in intentions to perform behaviors. Sutton (2007) summarized findings of meta-analyses of the TPB from 1991 – 2002. They found that the TPB accounted for 35 – 50% of the variance in predicting intention (R = 0.59 – 0.71). Armitage and Conner (2001) performed a meta-analytic review investigating 185 empirical tests of the theory, investigating studies across many behavioral domains that were published through 1997. They found that the TPB accounted for 39% of the variance in intention (Armitage & Conner, 2001).

While the TPB is an empirically strong theory (Armitage & Conner, 2001), it has demonstrated stronger predictive value for intentions than it has for behavior. In their meta-analysis, Armitage and Conner (2001) found that the TPB accounted for 27% of the variance in behavior. Godin and Kok (1996) reported that the TPB accounted for 34% of the variance in health behaviors. Sutton (2007) reported 26 - 35% variance in behavior (R = 0.51 – 0.59). The indication of these findings confirms Armitage and Conner's conclusion that the TPB is more

useful in predicting intention (35 – 66% of the variance) than it is in predicting behavior (27% - 35%).

TPB application in interventions to change behavior. Despite its strength in the prediction of intentions and behavior, the TPB has not been as widely used for developing interventions aimed at changing behavior (Fishbein & Ajzen, 2010; Conner & Armitage, 1998; Hardeman et al., 2002; Sniehotta, 2009; Sutton, 2007). Fishbein and Ajzen (2010) contend that the TPB is useful for formative research to understand individuals' beliefs when developing behavior change interventions and they call for greater application of the TPB in intervention studies. While application of the TPB can be useful in formative research (such as identifying salient beliefs to target in an intervention), its usefulness in development of an intervention itself, is less obvious. A reason the TPB has not been widely applied for interventions is at least in part because "the theory does not specify techniques to modify hypothesized cognitive determinants of intention and behavior" (Sniehotta, 2009, p. 268).

Interventions, which are applied strategies or treatments to change behavior, include antecedent and consequent approaches. Antecedent approaches are interventions that occur before the behavior and include oral or written commitments, prompts or modeled behavior, while consequence approaches occur after the behavior and include providing feedback, rewards and penalties (Dwyer, Leeming, Cobern, Porter, & Jackson, 1993). Hardeman et al. (2002) found very few studies wherein TPB constructs were explicitly identified in interventions and even fewer that demonstrated effectiveness in changing individuals' intentions or behavior (Hardeman et al., 2002; Sniehotta, 2009).

Subsequent to the published findings of Hardeman et al. (2002), Stead et al. (2005) reported on a longitudinal TPB intervention to reduce speeding in Scotland called "Foolsspeed."

They found empirical strength for the TPB, with results showing that the TPB explained 47 – 53 % of the variance in intentions to speed and 33 – 40% of the variance in reported speeding behavior. Four years later, the TPB predicted 27% of intention and 22% of variance in reported behavior (Stead et al., 2005).

Of studies applying the TPB, most are correlational rather than experimental (Sniehotta, 2009). Sniehotta undertook an experimental test of the TPB to motivate use of the university's sports and recreation facilities. Scottish undergraduate students (N=579) were surveyed and then randomly-assigned to receive online communications messages addressing salient TPB beliefs (a behavioral belief intervention; normative belief intervention; or control belief intervention). While each of the interventions increased intention, results showed that only the control belief intervention significantly ($p < .001$) and with small effect, increased the desired behavior (Sniehotta, 2009).

Further research is needed on applications of the TPB to interventions such as those promoting environmentally-responsible behavior. The TPB can be useful for obtaining data on individuals' beliefs, attitudes, perceptions and intentions to determine possible internal barriers to a behavior. Once internal barriers and external barriers (program availability; driving distance to a drop-off facility) have been identified, a community-based social marketing (CBSM) strategy can be developed to address and reduce barriers to the promoted behavior. CBSM offers tools and techniques to motivate behavior, thereby potentially serving as a useful approach to applying the TPB to interventions designed to modify behavior.

Social Marketing

Social marketing offers a means of motivating voluntary behavior for personal and societal well-being through application of marketing principles (Andreasen, 1994). Whereas the

goal of traditional marketing is to increase sales of products and services, in social marketing the goal focuses on selling or "influencing" behavior that is not limited to behavior change, in that it can apply to maintaining an existing desired behavior (such as staying drug-free) (Andreasen, 1994). In promoting ideas regarding social issues and to motivate behavior, social marketing serves as a program planning process (Grier & Bryant, 2005). It has been widely applied in the public health domain (Andreasen, 2006; Takahashi, 2009) in which programs attempt to influence various behaviors such as smoking, exercise, drunk-driving, contraceptive use and many other health and safety issues. High visibility, successful program examples include VERB™, a physical activity program for "tweens" created by the Centers for Disease Control and TRUTH™, a smoking cessation campaign targeting teenagers (Grier & Bryant, 2005).

Other health behavior-related programs include the "Road Crew," a social marketing program developed in rural Wisconsin to address drunk driving and decrease car crashes, was put in place to provide a ride service to those in need who had consumed too much alcohol. In the first year of the Road Crew, 19,575 rides were provided and alcohol-related car crashes had decreased by 17% (Grier & Bryant, 2005). In Texas, a "Special Supplemental Program for Women, Infants, and Children" (WIC) program was established to reposition the WIC program from being perceived as a welfare program to a temporary assistance health program in an effort to increase enrollment by those in need. Based on formative research (i.e., through observation, interviews, focus groups and surveys), a comprehensive social marketing program was built "that included policy changes, service delivery improvements, staff and vendor training, internal promotion, public information and communications, client education and community-based interventions" (Grier & Bryant, 2005, p. 328). The program grew from 582,819 participants in 1993 to 778,558 in 1998 (Grier & Bryant, 2005).

Social marketing programs to benefit the environment have had a shorter history (McKenzie-Mohr, Lee, Schultz, & Kotler, 2012) and are fewer than those in public health. Early promoters of applying social marketing principles to environmental issues included Geller (1989) and Maibach (1993). In an extensive academic literature search on social marketing and environmental behavior articles between 1971 and 2006, Takahashi (2009) determined there was a dearth of articles on social marketing of environmental behaviors. This trend began to change in 2000 with the introduction of community-based social marketing (CBSM) by McKenzie-Mohr and Smith in 1999 (Takahashi, 2009).

Community-based social marketing. CBSM has its roots in social marketing however this practice incorporates social psychology principles and is applied at the community level often with direct contact with people rather than communication through mass media channels as is commonly done in social marketing (McKenzie-Mohr, 2011). The three foundational aspects of CBSM are: (1) careful selection of the behavior to be addressed; (2) identification of barriers and benefits to the behavior; and as mentioned already, (3) matching the most appropriate behavior change tools (e.g., commitment, prompts) to overcome the barriers (McKenzie-Mohr, personal communication, November 9, 2012; McKenzie-Mohr et al., 2012; Tabanico & Schultz, 2007).

In selecting behaviors in CBSM, the first step is to identify the behaviors that are of most importance to the issue at hand (to have the greatest impact) and to identify how sectors under consideration behave related to the issue (McKenzie-Mohr et al., 2012). Different practices have different barriers to action. To best identify barriers and benefits, the behavior that is selected should be indivisible meaning that the action cannot reasonably be further divided into other behaviors, and it should be considered an "end state," in that the goal is the final action [for

functioning] (e.g., installing the low-flow showerhead that was purchased) (McKenzie-Mohr et al., 2012, p. 6). In terms of household hazardous waste, taking materials to an HHW facility is considered an end-state behavior (McKenzie-Mohr et al., 2012).

The emergence of CBSM appears to have met with tremendous acceptance for application in promoting environmentally-responsible behaviors (Takahashi, 2009), as in the previously presented research by Schultz and Tabanico (2008), Nolan, Schultz, & Knowles (2009) and McKenzie-Mohr et al. (2012). On-line resources such as McKenzie-Mohr's (2011) *Fostering Sustainable Behavior* at www.cbsm.com provide regularly updated examples of applied CBSM and discussion threads for list-serve members, and a recent publication, *Social Marketing to Protect the Environment: What Works?* (McKenzie-Mohr et al., 2012), provide examples of applications to waste management, water conservation, emissions reduction and other issues. While there have been numerous studies employing CBSM, there are relatively few empirical tests explicitly identified as CBSM studies in the scholarly literature.

Applications of CBSM. Research examining the effectiveness of CBSM in fostering behavior change has many descriptive studies and fewer empirical tests. The literature to date suggests that CBSM is a useful approach to motivating behavior. Stitzhal, Fife-Ferris, & Tonnon (2005) report on a CBSM program in Bellevue, WA to increase the amount of used motor oil brought in by do-it-yourself oil changers (DIYs) to a retail store collection site. The promotional campaign included in-store prompts such as: entry door and window decals; buttons worn by clerks; posters; shelf-talkers (informative labels); and stickers on motor oil cases. The store at which the intervention took place had a 40% increase in used oil collection, while the two automotive supply stores in Bellevue that served as the control, experienced only 1% and 13.5% increases in oil collection (Stitzhal et al., 2005; Stitzhal & Holmes, 2001). In a program

designed to increase used motor oil recycling in three California counties, Tabanico and Schultz (2007) found that researching barriers to participation, providing residents with normative messages, free oil containers to recycle oil, and including pledge stickers (written commitment) on free oil funnels, served to successfully achieve the desired effects of increasing used motor oil collection (Tabanico & Schultz, 2007). Haldeman and Turner (2009) saw a 7% increase in the recycling rate and 24% increase in the weight of recyclable materials in a Maryland county subsequent to implementing a CBSM program that included the distribution of collection containers and securing commitments to recycle by going door-to-door (Haldeman & Turner, 2009). Personal contact plus the use of commitments, particularly public, written commitments can be strong motivators for behavior (McKenzie-Mohr, 2011). Providing collection containers also makes the behavior more convenient (McKenzie-Mohr, 2011).

Based on the ideas in CBSM, Nolan et al. (2009) also implemented promotional campaigns to properly dispose of used motor oil and filters in a two-phase study. First they identified patrons at several automotive parts supply stores in San Diego, CA who were DIY oil changers (N = 120) and asked them to read state-sponsored messages designed to motivate individuals to properly dispose of their used motor oil and filters. The participants then completed a questionnaire. Individuals whose questionnaire responses indicated they always properly dispose of their used motor oil comprised 87% of the sample. These individuals had a strong intention and sense of personal responsibility to properly dispose of the materials in the future. The remainder stated they either poured the oil on the ground (5%) or in the trash (8%). Through an internal analysis comparing dumpers (N = 11) and "good citizens" (N = 109), the researchers found that dumpers had low perceived behavioral control and a lack of motivation that appeared to be due to the perceived inconvenience of proper disposal, while those who

stated they properly disposed of oil and filters had a strong intention and sense of personal responsibility to properly dispose of the materials in the future (Nolan et al., 2009). The dumpers appear to perceive that the inconvenience of proper oil and filter management serves as a barrier, thereby limiting their ability or control over the behavior.

Having identified barriers to proper disposal of used oil and filters, researchers then performed a laboratory-based study with introductory psychology college students (N = 106). The students were provided a message to read and then took a survey to determine their perception of consequences and harm posed by improper disposal of used oil and filters. A "disrupt-then-reframe" (DTR) technique was used in the altered message. The DTR approach involves inserting a disruption such as a 'non-sequitur,' and then providing the message. The purpose of using this technique is to lower the person's resistance to the message so that he is more receptive to it (Nolan et al., 2009). The DTR message for this study was, "Typically, there will be a collection center in less than 47,520 inches from your home—that's ¾ of a mile. It's convenient!" (Nolan et al., 2009, p. 1044). This unusual way of presenting the distance in inches to make the point that the facility is close-by, attracts the attention of the reader. The DTR message resulted in significantly greater intentions than the state-sponsored messages had in phase one, which were also designed to motivate individuals to properly dispose of their used motor oil and filters. In CBSM, identifying barriers (such as perceived inconvenience) to a behavior constitutes an important part of the formative research that can be used to inform a communications campaign to address the perceived barrier.

The CBSM approach likely resonates with household hazardous waste (HHW) program planners who have focused on changing attitudes instead of focusing on behavior as the outcome, or who have spent time and money on informational campaigns with little return on

investment in terms of behavior change (Tabanico & Schultz, 2007). Used motor oil is considered household hazardous waste, one of many automotive product wastes that can be diverted from the municipal solid waste stream rather than disposed in the trash. These CBSM studies hold promise for increasing program participation in HHW collections, where a wide array of waste materials is collected.

Application of the Theory of Planned Behavior to CBSM can provide guidance to researchers and program planners regarding the constructs to address in formative research, and in the construction of behavior change interventions (Fishbein & Cappella, 2006). In turn, interventions can be potentially developed with greater surety.

Household Hazardous Waste Studies

While a few studies can be found in the literature that focus on the application of community-based interventions to increase collection of selected HHW products (such as used motor oil and pesticides), there is a paucity of literature focusing on HHW collections and program participation. Research investigating factors related to HHW program participation is largely limited to data obtained on the presence of HHW stored in the home and individuals' knowledge and attitudes about HHW and collections.

Knowledge. Knowledge about HHW and HHW collections is a crucial factor in HHW program participation. Scudder and Blehm (1991) surveyed a random sample of 472 in Larimer County, CO, to assess their knowledge regarding hazardous household products and HHW. When responding to an open-ended question on the topic, nearly 40% could not identify a single toxic household product or state the effects of improper disposal of HHW. In Tampa, FL, where Harper (1998) surveyed lower- and middle-income African American single family household owners (N = 262), over 95% of respondents did not know about HHW collections in the area.

Williams (2009) examined 372 Harris County (TX) residents' knowledge and attitudes regarding HHW management through a random mail survey. Most respondents (57.4%) were not aware of an ABOP (antifreeze, batteries, oil, paint) facility in the county. An even greater percentage of respondents (75.4%) were unaware of other HHW collection/disposal programs in Harris County. A "knowledge deficit" can be a barrier to a behavior (Schultz, 2002, pp. 69, 70). For individuals to participate in HHW collections they must know what HHW is and when and where HHW collections are offered.

Attitudes. Studies that included research on individuals' attitudes toward the collection of HHW showed they held favorable dispositions. Williams (2009) found that 39% held favorable attitudes toward HHW collections and were "very willing" to participate in collections, 28.8% were "willing" and 20.4% were "somewhat willing" to participate. In a study by the Massachusetts Department of Environmental Quality Engineering (MA DEQE), a random digit telephone survey of 504 Massachusetts residents indicated that 82% of respondents were in favor of bringing their HHW to single-day (temporary) HHW collections and 70% indicated favorable attitudes toward bringing HHW to a regional site (Tuthill, Stanek, Willis, & Moore, 1987).

The research indicates that people's attitudes regarding participation in HHW collections depend, at least in part, on the travel distance to a collection site. They state they are willing to travel a short distance, demonstrating that convenience of location matters. The survey of Harris County, TX, residents indicated that 42% of the 372 respondents were willing to drive up to five miles to a permanent HHW facility while 30.6% were willing to drive up to ten miles. Beyond ten miles, the percentages greatly dropped (Williams, 2009). Wolf and Kettler (1997) found that while the county held annual, single-day HHW collections and lacked a permanent HHW facility, 57% of respondents stated they would prefer to be no more than five miles away if one

was built, while 22% stated they would drive 10 miles and 12% stated up 15 miles. Thus the greater the distance, the lower the intention to participate. Metzner (1999) examined travel time to a permanent HHW facility in New Haven, CT that served a number of communities. He found a correlation between distance of the community from the facility and actual household participation rates. Municipalities within 5 to 15 minutes driving times had household participant rates between 4.0–5.9% while those located 15 to 30 minutes from the facility had participation rates between 1.4–2.6%. Metzner's research on actual participation rates confirmed what was found through self-reported attitudes: attendance is more likely if the facility is perceived to be close by.

In summary, research has demonstrated that a lack of knowledge about HHW and HHW collections constitutes an internal barrier. People must know where an HHW facility is, when it is operating and what materials are accepted. Unfavorable attitudes toward HHW collection participation were indicated with regard to travel distance beyond 5–10 miles or 5–15 minutes. Perceived inconvenience can be an internal barrier to the behavior. The physical location of an HHW facility is something external and beyond the control of the individual, thus facility location can also constitute an external barrier to the behavior particularly if transportation is a personal limitation. These reported barriers provide possible reasons why HHW collection participation is generally low across the country.

The Current Study

The current study examined the usefulness of Theory of Planned Behavior as a theoretical framework for a community-based social marketing study. In this two-part study, the TPB was used in formative research through a direct mail aimed at understanding individuals' reasons for participation, or lack thereof, in HHW collections, and it was applied in a field

experiment to test an intervention with print communications messages designed to persuade individuals to participate in HHW collections.

Chapter III: Study 1: Survey Research Methodology

Study Purpose

Study 1 was undertaken (a) to determine if the Theory of Planned Behavior (Ajzen, 1991) would be a useful theoretical framework for understanding individuals' reasons for participating in HHW collections, (b) to identify possible barriers to participation in HHW collections, and (c) to inform the development of print communications to test in an experiment to increase program participation in HHW collections. On March 18, 2008, approval from the Antioch University New England Internal Review Board (IRB) was received to proceed with this research.

Case Study Site Selection

The Connecticut River Estuary Region was selected because: (1) the HHW collection participation rate in the region has averaged 6.5% since it began operation (2004-2007; see Table 4), which is in-line with the estimated national average of 5-10% (Bruning, 2008) of households participating in HHW collections whereas other Connecticut HHW facilities have on average a participation rate of 3% (T. Metzner, personal communication, November, 2008); (2) Middlesex County, of which the Estuary Region is a part, closely reflects the socio-demographics of the state with the exception of race (see Table 4); (3) only procedural information messages (collection dates, times, location, acceptable materials) have been provided in the Estuary Region since the facility opened in 2004, rather than persuasive messages to motivate participation in HHW collections.

Table 4

Estuary Region HHW Facility Participation Rate by Number of Households

HHW Collection Year	Participation (number of households)	Percentage of households in region (est. 24,926 HH)
2007	1,598	6.4%
2006	1,563	6.3%
2005	1,689	6.8%
2004	1,642	6.6%

Note. From Connecticut River Estuary Regional Planning Agency (2008).

Table 5

Socio-Demographics of Middlesex County and Connecticut – Census 2010

Demographic Characteristic	Middlesex County (includes Estuary Region)	State of Connecticut
Population (2010)	165,676	3,574,097
65+ years (2011)	15.9%	14.4%
Females (2011)	51.1%	51.3%
White (2011)	90.3%	82.3%
Black	5.0%	11.1%
Asian	2.6%	4.0%
Hispanic or Latino	5.0%	13.8%
White, non-Hispanic	86.1%	70.9%
High school graduates (age 25+) (2006-2010)	92%	88.4%
Bachelor degree or higher (age 25+) (2006-2010)	37%	35.2%
Homeownership (2006-2010)	75.8%	69.2%
Households (2006-2010)	66,975	13,592,18
Median household income (2006-2010)	$74,906	$67,740
Land area (2010)	369.30 sq. mi.	4,842.36 sq. mi.

Note. United States Census Bureau (2010)

Informational brochures and fliers were historically placed at several central locations such as the CRERPA office, town halls and transfer stations, and on town and CRERPA websites, providing procedural instructions for participating in HHW collections. However, behaviorally-motivating messages had not been tested in the region prior to this study.

Sample

Household residents were randomly-selected from the nine-town Connecticut River Estuary Region which is part of Middlesex County in southeastern Connecticut (see Figure 4). The Estuary Region is 1 of 15 planning regions established under state law. An inter-local agreement exists in the region through CRERPA, which permits residents of the nine-town region (in which there are 24,926 households) to bring their HHW to the HHW facility in Essex, CT. Power analyses to determine appropriate sample size follow later in this chapter.

In the current study, the randomly selected households belonged to homeowners paying taxes in the nine towns in the Estuary Region. This selection was accomplished through access by the planning agency to an on-line Computer Aided Mass Appraisal (CAMA) database that exists at the Connecticut Office of Policy and Management. This database serves as a grand list of homeowners (with individuals' names and addresses) for property tax assessments.

This database was used to ensure that the individuals who received the intervention (survey plus message card), (1) owned homes in the region and (2) were the adults who pay the taxes, not other family or household members. Through random selection of participants from the grand list of homeowners, each household had an equal chance of being selected thereby helping to ensure the representativeness of the sample. The households in the sample were owner- occupied, single-family dwellings in the nine towns comprising the district: Chester, Clinton, Deep River, Essex, Killingworth, Lyme, Old Lyme, Old Saybrook or Westbrook, CT.

Contact was made through direct-mail, and mailings were addressed to individual homeowners by name. Typically this included the names two tax-paying individuals, both of whose names were on the mailing labels. Correspondence was addressed to "Estuary Region resident."

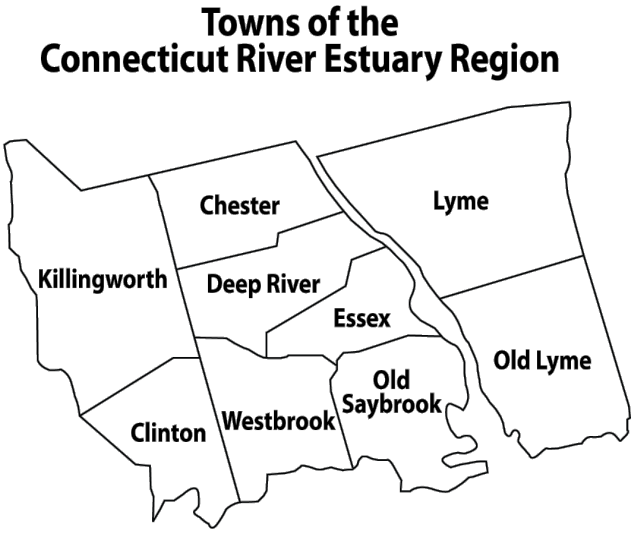

Figure 4. Reprinted with permission from Connecticut River Valley Council of Governments (River COG), Essex, CT.

Hypotheses

The hypotheses for Study 1 were based on predictions derived from the Theory of Planned Behavior (Ajzen, 1991). According to the Theory of Planned behavior, intention to engage in a particular behavior is predicted by attitudes toward the behavior, subjective norms and perceived behavioral control. Intention to engage in the behavior predicts actual behavior. Perceived behavioral control is also theorized to affect behavior directly. Note that the behavior, participation in an HHW collection, refers to self-reported attendance at HHW collections during the 2007 season.

The hypotheses (Figure 5) were directly derived from the Theory of Planned Behavior. For each hypothesis, the unit of analysis is the household, identified from household taxpayers in the CAMA database.

H1. Attitudes toward household hazardous waste collection participation will significantly predict individuals' intention to participate in an HHW collection
H2. Subjective norms will significantly predict intention to participate in an HHW collection
H3. Perceived behavioral control (PBC) will significantly predict individuals' intention to participate in an HHW collection
H4. Perceived behavioral control (PBC) will significantly predict individuals' participation in an HHW collection
H5. Intention to participate in an HHW collection will significantly predict participation in an HHW collection
H6. The impact of attitudes, subjective norms and perceived behavioral control on behavior will be mediated by intention to perform the behavior

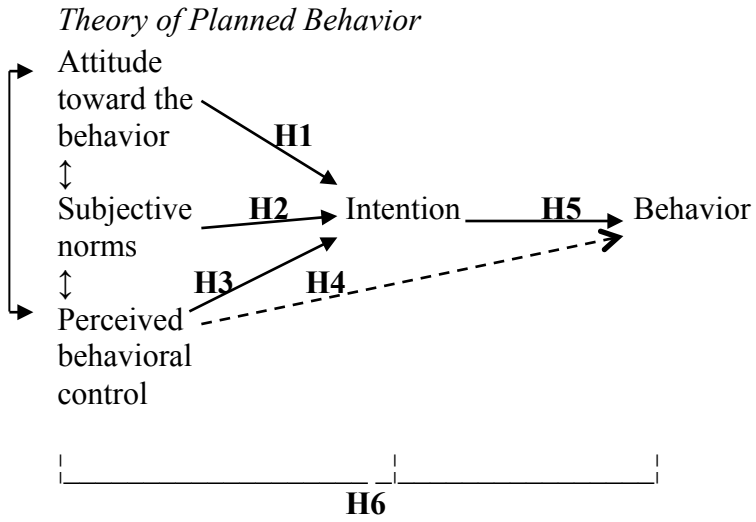

Figure 5. Study 1 hypotheses-H6. The impact of attitudes, subjective norms and PBC on behavior will be mediated by intention to perform the behavior. Adapted from "The Theory of Planned Behavior," by I. Ajzen, 1991, *Organizational Behavior and Human Decision Processes, 50,* p. 182. Copyright 1991 by Elsevier. Reprinted with permission.

Power Analyses

To determine the minimal sample size needed for this research, Cohen's power analysis method (1980) was used. To achieve power of .80 assuming a small effect size (r = 0.10) at a

level of confidence of $\alpha = 0.05$, at least 783 participants would be needed. With support from the Connecticut River Estuary Regional Planning Agency, a larger sample (nearly 10% of the region's 24,926 single-family households) was selected to increase the likelihood that the minimum number of needed participants would be achieved, and to yield more representative data. The survey was sent to 2,409 households or 9.67% of the households in the region. For a proportionate distribution of sampled households across towns (stratified random sample) (see Table 6).

Table 6

Proportionate Distribution of Households Receiving HHW Survey

Municipality	**Single-family Households (HHs)**	**Number of HHs receiving intervention (9.67% of HHs)**
Chester	1,285	124
Clinton	4,630	448
Deep River	1,532	148
Essex	2,394	231
Killingworth	2,027	196
Lyme	977	94
Old Lyme	4,262	412
Old Saybrook	5,013	485
Westbrook	2,806	271
Total	**24,926**	**2,409**

Survey Instrument

To obtain self-reported data from Estuary Region homeowners, a survey was developed using "Constructing a TPB Questionnaire: Conceptual and Methodological Considerations" as a guide (Ajzen, 2006). The survey questions were designed to assess perceived internal and external barriers to participating in HHW collections at the Estuary Region facility. Questions

were also elicited on respondents' knowledge about HHW and the facility. Demographic questions were also asked. See Appendix C for the survey instrument.

The survey procedure followed a modified Tailored Design Method (TDM) (Dillman, 2007). The TDM is typically comprised of 3-5 mail contacts: (1) a pre-notice letter sent prior to the survey; (2) the survey with a cover letter and token incentive; (3) a thank you and reminder post-card; (4) a replacement survey to those who did not return completed surveys; and (5) a final survey and cover letter sent to non-respondents via a different mode such as USPS Priority Mail (Dillman, 2007). It was necessary to modify the Tailored Design Method in this study due to limited financial resources. The procedure in the current study involved two direct-mail contacts: a pre-survey notice letter mailed the last week of April, 2008, alerting the individuals that an important survey and an enclosed incentive would arrive in the mail in about a week. One week later, the two-page survey was mailed with first-class postage to the individuals. In addition to the survey itself, this mailing contained a signed cover letter, a $1 bill and a self-addressed, stamped envelope. These additional materials have been recommended by Dillman (2007) as a means of enhancing survey return rates. The survey was mailed the beginning of May, 2008, which was the start of the spring household hazardous waste collection season (May to November).

The $1.00 bill was enclosed as an incentive to complete the survey. The rule of reciprocity applied here as well because the gift, in Dillman's words, "promotes trust—the study sponsor has given something that the potential respondent can keep, thus creating a sense of reciprocal obligation" (Dillman, 2007, p. 21). In this case, the obligation is returning a completed survey.

"Who presents your message can have a dramatic effect on how it is received," (McKenzie-Mohr, 2011, p. 98). With the importance of "credibility of source" (McKenzie-Mohr, 2011) in mind, demonstration that the Connecticut River Estuary Regional Planning Agency was the organization leading the survey research was accomplished using CRERPA letterhead for the survey cover letter. The cover letter included a personal signature and title of Antioch University New England student researcher to also inform household residents that the purpose of the study was for research to better understand reasons why people do and do not participate in Estuary Region household hazardous waste collections.

On the survey, 26 questions were included to gather data on participants' knowledge of household hazardous waste, the facility, and collections in the region; attitudes and beliefs toward household hazardous waste collection participation including perceived barriers to participation, subjective norms, and perceived behavioral control; intention to participate in a collection this season; and demographics. Please see Appendices A, B, and C for the pre-notice letter, cover letter and survey. The survey questions had a multiple response format: multiple choice, fill-in-the-blank, dichotomous scale or statements with a 7-point semantic differential scale (ranging from -3 to 3). Ajzen and Fishbein (1980) recommend using a "bipolar evaluative dimension" for attitude measures (pp. 55-56). The negative and positive numerical scale was used to underscore less favorable to favorable options. An example from the survey follows:

Your participation in a household hazardous waste collection helps to protect the environment.

disagree: ____:____:____:____:____:____:____:agree

-3 -2 -1 0 1 2 3

See Table 7 for descriptions of scale items for TPB variables (attitudes, subjective norms, perceived behavioral control and intention). While each item was measured on a 7-point scale,

ranging from -3 to +3, the responses were re-coded on a 1-7 scale in the interpretation of these items. For each TPB variable, the results were averaged, with the resulting scores potentially ranging from 1 (lowest possible scores on a TPB variable) to 7 (highest possible scores on a TPB variable).

The survey was two pages, printed single-sided, rather than two-sided printing in order to improve chances that the second page would not be missed by the recipient. To ensure that the response could be associated with the address to which the survey was mailed, a numerical code was written on the back of each survey to correspond with the mailing list for reference in this study.

Validity. Validity indicates the degree to which a scale "measures what it purports to measure in the context in which it is to be applied" (Nunnelly & Bernstein, 1994, p. 112). As previously stated, Ajzen's work (2006) served as a guide for constructing the survey questions on TPB variables. To support the content validity of the survey instrument, several household hazardous waste consultants were invited to review the survey including the Estuary Region HHW coordinator, a board member of the North American Hazardous Materials Management Association and a member of CT HazNet, a state group facilitated by CT Department of Environmental Protection. A small focus group was also conducted to help determine if the survey items were appropriate. Eighteen individuals, two per town, were randomly selected from the telephone book and phoned to invite the "home owner" to participate in a focus group at the Connecticut River Estuary Regional Planning Agency office which is centrally-located in the region. They were offered $20 to attend a one-hour session at 7 p.m. on a Wednesday. This monetary offering was made so that individuals might select to attend for the incentive rather than a bias toward or against, HHW collections. Of the 18 invitees, only four individuals

attended the focus group. The focus group consisted primarily of participants reviewing the survey items. The survey was given a favorable response for its general clarity and brevity, with only minor wording changes to the survey to enhance the clarity of a couple of questions. One substantial change to the survey was a re-wording of "income level" to "household income." The suggestions were incorporated into the final draft of the survey.

Table 7

Survey Variables and Corresponding Questions or Statements

Variable	Question/Statement
Attitude toward the behavior (i.e., HHW collection participation (3 survey items)	How important is it to you that HHW products are treated differently from regular trash? (very unimportant -3 to 3 very important) In your view, HHW collections are services that are: (worthless -3 to 3 worthwhile) Your participation in a HHW collection protects the environment. (disagree -3 to 3 agree)
Subjective norms (3 survey items)	Your family thinks your participation in a HHW collection is important. (disagree -3 to 3 agree) Do you think your neighbors bring their HHW to a collection? (very unlikely -3 to 3 very likely) Other people who are important to you think your family ought to participate in a HHW collection. (disagree -3 to 3 agree)
Perceived Behavioral Control (4 survey items)	How easy or difficult is it for you to identify acceptable materials for the HHW collection? (difficult -3 to 3 easy) How easy or difficult do you think it is to unload material once at the HHW collection? (difficult -3 to 3 easy) For you, transportation to a HHW collection on a Saturday, sometime between May through October is: (difficult -3 to 3 easy) Personal obligations on Saturdays make it difficult for you to attend a HHW collection (disagree -3 to 3 agree)
Intention (3 survey items)	As you generate HHW at home, you will plan to bring it to a HHW collection. (very unlikely -3 to 3 very likely) You intend to participate in a HHW collection this season (May-October 2008). (very unlikely -3 to 3 very likely) You will participate in a HHW collection this year. (very unlikely -3 to 3 very likely)

Note. Based on 7-point semantic differential scales for theory of planned behavior variables.

Confirmatory factor analysis of TPB measures. To further establish the construct validity of the survey, participants' survey responses on the three sets of TPB items (the "Attitudes" items, "Norms" items and the "Perceived Behavioral Control," items) were investigated with a confirmatory factor analysis using the model depicted in Figure 6. To determine how well the model fit the data, two widely used fit indices were used: the Tucker-Lewis Index (TLI) and the Root Mean Square Error of Approximation (RMSEA). For TLI, values greater than .90 generally indicate acceptable fit (Browne & Cudeck, 1993). For RMSEA, values below .01 indicate an excellent fit, values between .01 and .05 indicate good fit, and values between .05 and .08 indicate adequate fit. The values of these "goodness of fit" indices, as well as the factor loadings, are depicted in Figure 6. As the figure indicates, values of TLI (.91) and RMSEA (.06) both suggested that the model adequately fit the data. The Confirmatory Factor Analysis also indicates that the individual scale items loaded high on the factor that each item was hypothesized to measure. Consistent with the expected outcome, the results provided further evidence for the validity of the survey items that assessed Attitudes, Norms and PBC.

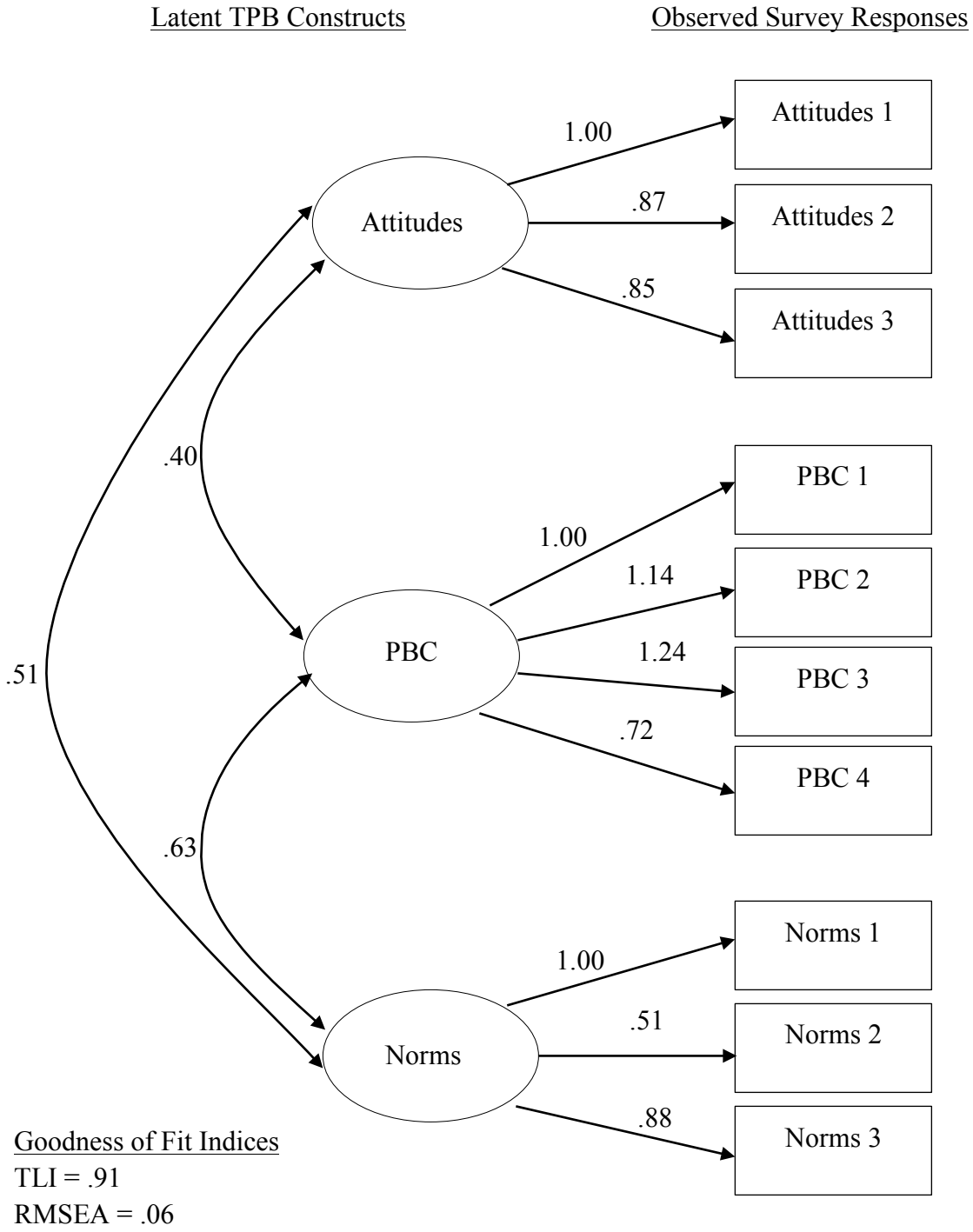

Figure 6. Confirmatory factor analysis of survey items. Survey items assess TPB constructs. The values of the regression coefficients in the figure are unstandardized.

Reliability. The internal consistency of the survey was assessed by examining values of Cronbach's (1951) coefficient alpha (α), a widely used measure of reliability. With semantic differential scales, high internal consistency was expected among survey items that comprised each construct. Specifically the reliability of the survey items for attitudes, subjective norms, perceived behavioral control and intention was examined. Values of Cronbach's alpha should normally be in the .60 - .90 range (Aron, Aron, & Coups, 2009) and ideally, α = .70 - .90 (Nunnally & Berbstein, 1994). As Table 8 indicates, the reliabilities for attitudes, subjective norms and perceived behavioral control were all approximately at the lower end of acceptable reliability. Thus while .60 corresponds to a "moderate" reliability (Robinson, Shaver, & Wrightsman, 1991), it is not considered ideal. The Cronbach's alpha for Intention is also presented in Table 8 and fell well within the acceptable range (α = .87), demonstrating high internal consistency among the three survey items related to this construct.

Table 8

Cronbach's Coefficient Alpha

Theory of Planned Behavior Variables	Cronbach's Coefficient Alpha (α)
Attitudes toward the behavior	.61
Subjective norms	.60
Perceived behavioral control	.60
Intention	.87

Survey Distribution and Return

The survey was distributed by direct mail that was First-class posted and personally addressed to the homeowner individual or couple residing (depending if one or two of the owners were on the Grand List of taxpayers) at each randomly selected address. Finnegan, Loken, & Howard-Pinney (1987) found that direct mail is useful in building knowledge and awareness, particularly at the start of an education campaign. Danaher and Rossiter (2011)

found that this traditional marketing communication channel holds value in terms of receivers' perceived "trust and reliability of information" and persuasiveness (p. 34), more so than telephone, cell phone or email. Of the 2,409 participants who received the survey, 76 were returned and marked as "UTF," or unable to forward. The amount of completed, usable surveys that were received was 983. This corresponds to a 41% response rate. The data were then entered into a spreadsheet. The accuracy of the data entry was verified by randomly selecting entries and comparing these with the original completed survey; nearly 1/3 of the data was checked in this manner. Further, the data was electronically "scrubbed" by visually inspecting the spreadsheet for any remaining errors such as, "11" where "1" would have been the appropriate number.

Preliminary analyses. Data was logged into a Microsoft Excel spreadsheet and descriptive statistics were computed to determine the means, standard deviations, simple frequency distribution and range of scores for each survey item. Descriptive statistics are presented in Chapter IV: Survey Results.

Chapter IV: Survey Results

Overview of Analyses

Descriptive statistics from the survey are presented in this chapter. Pearson correlations are provided showing relationships among the TPB constructs (attitudes, subjective norms, perceived behavioral control, intention and behavior). The results of the multiple regression analyses are also presented. These were undertaken in accordance with the mediation analysis described by Baron and Kenny (1986) to determine if intention mediated the effects of attitudes, subjective norms and perceived behavioral control on behavior, as predicted by the Theory of Planned Behavior (Ajzen, 1991).

Descriptive Statistics

Presence of chemical consumer products in homes. A section of the survey solicited data on the presence of chemical consumer products in the home. This approach was taken because individuals may perceive that they do not have HHW and do not need to attend an HHW collection. In the survey the question was asked, "Which of these chemical consumer products do you have at home? (Please check all that apply." Nineteen product types (drain opener, disinfectant spray, paint thinner) were provided plus an "Other: (fill in blank)" option. The most frequently cited chemical consumer products in respondents' homes were household bleach (96%), windshield washer fluid (83%), bug spray (78%), furniture polish (77%), gasoline and toilet bowl cleaner (both 75%) (see Figure 7).

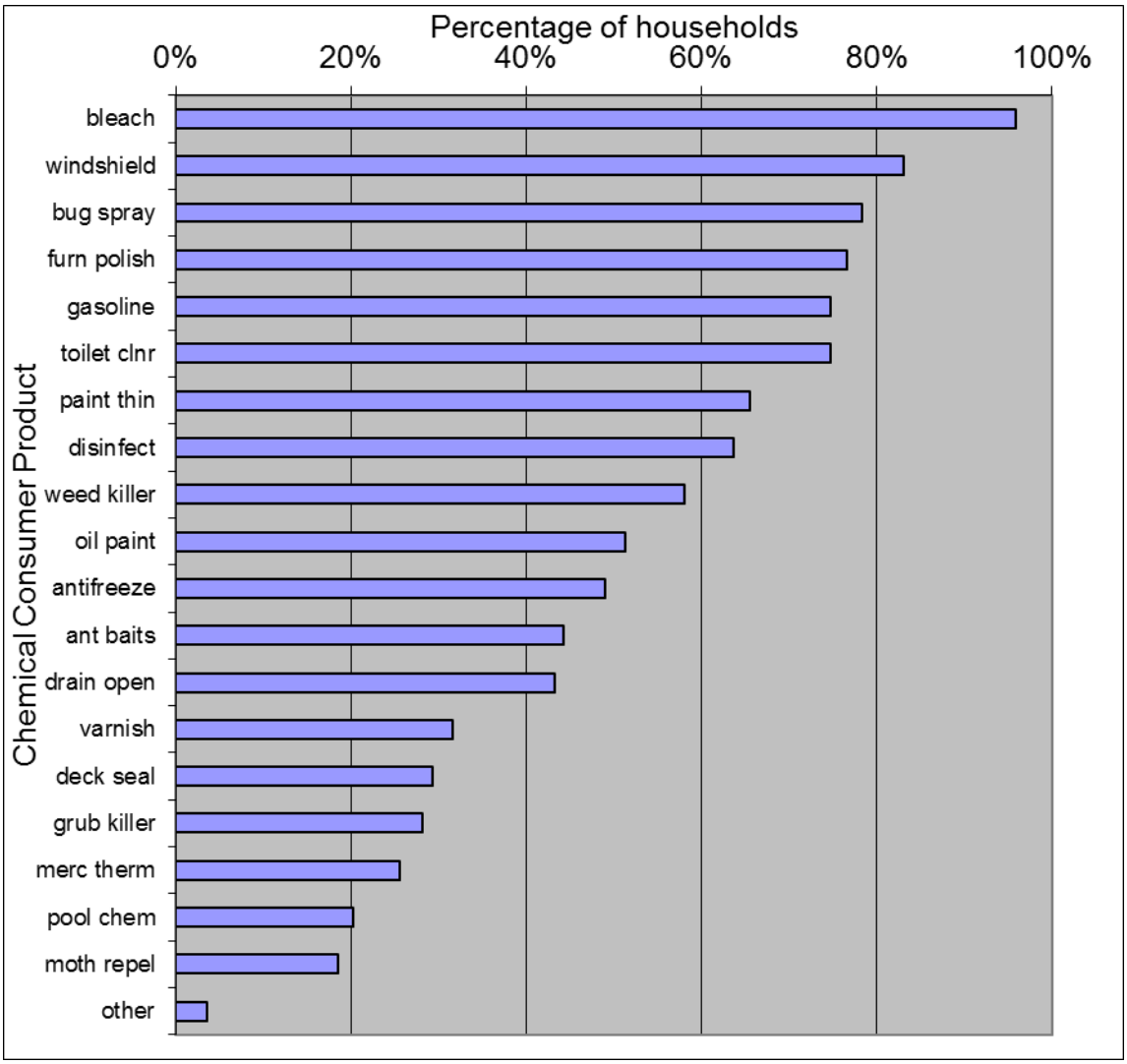

Figure 7. Chemical products in Estuary Region homes based on survey responses.

HHW disposal. Participants were also asked to indicate, "What do you currently do with unwanted, left-over chemical products? Check all that apply." Product categories were provided (i.e., household cleaners, paint-related products, automotive products, pesticides), as were five disposal options (store at home, dispose in trash, collection center, return to store, give away/donate). Table 9 summarizes the responses. The majority of respondents reported that cleaners (56.1%) and pesticides (46.7%) were stored at home. The next most frequent responses

were trash disposal for cleaners (32.5%) and collection center disposal for pesticides (34.2%). The majority of respondents selected collection center disposal for paint-related products (52.6%) and automotive products (44.7%).

Table 9

Household Hazardous Waste Disposal Practices

Product category	Disposal method	Freq	Percent
CLEANERS	Store at home	473	56.1%
	Dispose in trash	274	32.5%
	Collection center	214	25.4%
	Return to store	1	0.1%
	Give away	15	1.8%
PAINT-RELATED	Store at home	409	48.5%
	Dispose in trash	140	16.6%
	Collection center	443	52.6%
	Return to store	2	0.2%
	Give away	18	2.1%
AUTOMOTIVE	Store at home	339	40.2%
	Dispose in trash	115	13.6%
	Collection center	377	44.7%
	Return to store	20	2.4%
	Give away	24	2.8%
PESTICIDES	Store at home	394	46.7%
	Dispose in trash	146	17.3%
	Collection center	288	34.2%
	Return to store	0	0.0%
	Give away	15	1.8%

HHW collection program knowledge. Survey recipients were asked a number of questions regarding their knowledge about the HHW collection facility. Results of the survey indicate that 90% of respondents knew the HHW facility location, 68% knew the directions to get there, 50% knew which materials are accepted at the facility (while 32% knew which are considered unacceptable), 33% knew the days of operation in 2008 and 27% knew the hours. It

appears that operational information (days and hours the facility is open and operating) was not well-known in this sample.

A question was included on the survey asking respondents to estimate the percentage of households in the region participating in the regional HHW program. Thirty-seven percent indicated 0-10%, which in fact reflects the average percentage (6.5%) of households participating in the collections. Twenty-three percent of respondents estimated that 11–20% of the households participated, and the remaining 40% provided estimates ranging from 25–96%.

Past attendance at HHW collections. The survey included a question asking if respondents had attended the 2007 HHW collection. Thirty-three percent of respondents (N = 329) reported they had participated in one or more HHW collections in the region in 2007.

Distance to the HHW facility. Respondents reported residing at the following distances from the HHW facility by selecting survey options: 0–5 miles (30%), 6–10 miles (32.5%), 11–15 miles (22%), 15+ miles (8%). The majority (84.5%) live within 15 miles of the facility. The remaining respondents were unsure of the distance (6.1%) or did not provide a response (1.4%).

Demographics

Demographic questions that were included in the survey included gender, age, race, education, income and distance from the household hazardous waste facility. Respondents' knowledge of the Estuary Region HHW facility was also examined. Survey respondents were almost exclusively white (N = 983; 96.6%). This sample underrepresents minority populations in the region. Respondents were 58% female. Frequencies for gender and ethnicity are indicated in Table 10.

Respondents ranged in age from 20–80+ with a median age of 57 (SD = 13.7). The greatest numbers of survey respondents were between 41 and 70 years of age. More specifically,

22% of respondents identified themselves as '41-50.' Those who checked '51 to 60' comprised 23% and '61-70' was identified by 20% of the respondents. The age range closest to this set was '71 to 80,' with 14% of individuals. The remaining age categories ranged from 0% (ages 0– 20) to 9% (ages 31–40). In terms of household income, 28% of the participants reported income levels of $50,000 to $99,999 with the next two largest income categories being $100,000+ (31%) and 'Decline to Say' (20%). A household income of up to $49,999 was reported by 14%. In general, participants were well-educated. Thirty-five percent of survey respondents hold a college degree, of which 9% hold a two-year degree and 26% hold a four-year degree. Thirty percent of respondents have graduate degrees. Fourteen respondents checked more than one box for Education. Income could not adequately be compared given 20% of survey respondents declined response.

Table 10

Descriptive Statistics for Gender and Ethnicity

Frequencies		Freq (Percent)	County population
gender			
	male	407 (42.1%)	48.9%
	female	560 (57.9%)	51.1%
ethnicity			
	Caucasian	918 (96.6%)	90.3%
	African American	4 (0.4%)	5.0%
	Asian	7 (0.7%)	2.6%
	Hispanic	12 (1.3%)	5.0%
	Native American	7 (0.7%)	
	Other	2 (0.2%)	

Note. Sample and county population data may vary due to sample isolation for single-family household tax payers.

Descriptive Statistics for Theory of Planned Behavior Variables

Descriptive statistics for each of the TPB variables are indicated in Table 11 and summarized in Table 12. For all TPB variables (except the behavior variable given it had a binary response), the normality of the variables was checked and all fell into acceptable ranges, without problems of skewness or kurtosis, except for "Attitudes," which indicated non-normality (see Discussion section).

Table 11

Descriptive Statistics for Individual Survey Items Testing Theory of Planned Behavior

Variable	Question/Statement	*M*	*SD*
Attitude toward the behavior (i.e. HHW collection participation (3 survey items)	1. How important is it to you that HHW products…are treated differently from regular trash? (very unimportant 1 to 7 very important)	6.28	1.27
	2. In your view, HHW collections are services that are: (worthless - 1 to 7 worthwhile)	6.28	1.51
	3. Your participation in a HHW collection protects the environment. (disagree 1 to 7 agree)	6.67	0.84
Subjective norms (3 survey items)	1. Your family thinks your participation in a HHW collection is important. (disagree 1 to 7 agree)	6.03	1.27
	2.Do you think your neighbors bring their HHW to a collection? (very unlikely 1 to 7 very likely)	4.03	1.51
	3. Other people who are important to you think your family ought to participate in a HHW collection. (disagree 1 to 7 agree)	5.39	1.36
Perceived Behavioral Control (4 survey items)	1. How easy or difficult is it for you to identify acceptable materials for the HHW collection? (difficult 1 to 7 easy)	5.21	1.62
	2. How easy or difficult do you think it is to unload material once at the HHW collection? (difficult 1 to 7 easy)	5.39	1.56
	3. For you, transportation to a HHW collection on a Saturday, sometime between May through October is: (difficult 1 to 7 easy)	5.37	1.88
	4. Personal obligations on Saturdays make it difficult for you to attend a HHW collection (disagree 1 to 7 agree)	3.47	2.12
Intention (3 survey items)	1. As you generate HHW at home, you will plan to bring it to a HHW collection. (very unlikely 1 to 7 very likely)	6.08	1.28
	2. You intend to participate in a HHW collection this season (May-October 2008). (very unlikely 1 to 7 very likely)	5.92	1.42
	3. You will participate in a HHW collection this year. (very unlikely 1 to 7 very likely)	5.73	1.47

Table 12

Descriptive Statistics for Theory of Planned Behavior Variables

	Mean (SD)
Means	
Attitudes	6.42 (0.92)
Norms	5.15 (1.10)
PBC	5.09 (1.28)
Intention	5.84 (1.32)

Attitudes. Respondents' attitudes toward HHW collection participation were very favorable, with 81% selecting "Very important/worthwhile" in response to "Your participation in HHW collection helps the environment." In response to "How worthwhile is HHW collection?" the "Very important/worthwhile" ranking was selected by 71%. The same ranking was selected by 65% in response to, "How important is it to treat HHW differently from other trash?"

Subjective norms. Three survey items investigated respondents' perceptions of referents' views on their participation in HHW collections. The questions were: "Your family thinks your participation in a HHW collection is important;" "Do you think your neighbors bring their HHW to a collection?" and "Other people who are important to you think your family ought to participate in a HHW collection." On the semantic differential scale, 52% of respondents believe that their families think HHW collection participation is important and 30% responded that these important others think their families should participate in an HHW collection. Only six percent perceived that their neighbors participate in HHW collections.

Perceived behavioral control. Considering perceived behavioral control in terms of ease or difficulty in participating in HHW collections and control, three areas were investigated: ease in identifying acceptable materials, ease in unloading the materials and control over attending an HHW collection due to personal obligations. Respondents' capability in identifying

acceptable materials was lowest for those who ranked participation the most difficult. This may be due to lack of knowledge regarding HHW. Ease of unloading materials at the collection was also perceived to be difficult. This demonstrates a lack of familiarity with the collections because the individual does not physically unload the materials at an HHW collection. S/he is asked to stay in the vehicle while the chemical waste handler offloads the material.

Intention. Respondents' intentions to participate in upcoming HHW collections at the facility were favorable. Respondents indicated they were "very likely" to "bring HHW to a collection" (52%) and intended to "participate in an HHW collection this season" (48%) or "this year" (41%).

Summary of Descriptive Statistics

In summary, survey respondents were primarily Caucasian individuals, ages 41-70, with a high level of education, moderate to high household income levels and living within 15 miles of the regional HHW facility. All of the respondents had hazardous household products, many of which would eventually become household hazardous waste if not used up.

Most of the respondents (90%) stated they knew of the facility, however many (33%) lacked knowledge of its days of operation. The majority conveyed strong favorable attitudes indicating that HHW separation from regular trash and HHW collection participation to benefit the environment are very important and worthwhile. The distribution of self-reported attitudes was skewed toward the positive end of the response scale showing a "ceiling effect" that perhaps reflects a social desirability bias (Aron et al., 2009).

Results for subjective norms included an intriguing effect. When family members and important others were perceived to show a lack of support for HHW participation, the survey respondent's perception was high for neighbor participation. Conversely, when the referent

others were supportive of HHW collection participation, respondents perceived that neighbors participate less in collections than they do. This may indicate a "false uniqueness effect" that can occur when people think of their "moral behaviors" as unusual (Myers, 1999, p. 61).

A low perceived behavioral control may indicate that there are control beliefs that participation in an HHW collection is not easy and/or convenient. This could be because participation in HHW collections is a "high cost" activity in terms of the knowledge needed to participate, materials gathering, driving to the facility, and time on-site. These factors can unfavorably affect intention and serve as barriers to participation.

Preliminary Test of the Theory of Planned Behavior

Pearson correlations were calculated to determine the association between TPB variables (attitudes, subjective norms, perceived behavioral control and intention) and the primary dependent variable, self-reported participation at a previous HHW collection. The resulting correlations are presented in Table 13.

Table 13

Intercorrelations Among Primary Variables

Measure	1	2	3	4	5
1. Attitudes	1.00				
2. Norms	.369*	1.00			
3. PBC	.264*	.395*	1.00		
4. Intention	.459*	.525*	.445*	1.00	
5. Self-reported attendance at HHW collection	.092*	.234*	.289*	.347	1.00

Note. Asterisks indicate statistically significant correlations, $p < .05$ (two-tailed). All correlations are Pearson Correlation Coefficients.

The hypotheses were directly derived from the Theory of Planned Behavior, wherein attitudes, subjective norms and perceived behavioral control were anticipated to significantly predict individuals' intention to participate in an HHW collection. Intention was expected to significantly predict actual participation in an HHW collection. As hypothesized, attitudes ($r = .49$, $p < .05$), norms ($r = .52$, $p < .05$) and PBC ($r = .44$, $p < .05$) were all significantly correlated with intention. Moreover, attitudes ($r = .09$, $p < .05$), norms ($r = .23$, $p < .05$), PBC ($r = .29$, $p < .05$) and intention ($r = .35$, $p < .05$) were significantly correlated with self-reported attendance at an HHW collection. Thus, the three TPB variables, as well as intention, were all significantly positively correlated with self-reported attendance at HHW collection. This finding offers preliminary support for the TPB.

Regression Mediation Analyses

To provide a more rigorous test of the Theory of Planned Behavior, a series of regression analyses were conducted that allowed testing of whether intention mediated the relationship between attitudes, norms, and perceived behavioral control and attendance at an HHW collection. To determine if intention mediated the effects of attitudes, subjective norms and perceived behavioral control (PBC) on behavior as presented in the TPB, multiple regression analyses were performed according to the mediation analysis described by Baron and Kenny (1986). A series of three regression equations were done to test mediation. First, the dependent variable, behavior (self-reported attendance at HHW collections from May, 2007, through October, 2007) was regressed on the independent variables (attitudes, norms, PBC). In this regression, behavior should have been predicted by these variables. Second, the potential mediator, intention, should have been predicted by the independent variables. Third, when behavior was regressed on the independent variables (attitudes, norms, PBC) and the potential mediator. The effect of the independent variables (attitudes, norms, PBC) on the dependent variable should be weaker (either reduced to zero for complete mediation or significantly decreased—demonstrating partial mediation), while the mediator should remain a significant predictor of behavior. In all of the regressions, predictors were simultaneously entered into the regression equation.

The results of the regression analyses are presented in Table 14. A visual representation of the same mediational model is shown in Figure 8. In the first regression, attitudes, norms and PBC were used to predict behavior. Overall, the percentage of variability in behavior that was explained by attitudes, norms and perceived behavioral control was .095. Individually, norms ($\beta = .144$, $p < .05$) and perceived behavioral control ($\beta = .225$, $p < .05$) were statistically

significant predictors, with PBC demonstrating the greatest strength. Attitudes were not determined to be a statistically significant predictor (β = -.019, p = n.s.). For the second regression, attitudes, norms and perceived behavioral control were used to predict intention. The percentage of variability in intention that was explained by attitudes, norms and perceived behavioral control was .405. As expected, all predictors were statistically significant. Attitudes (β = .275, p < .05), norms (β = .320, p < .05), and perceived behavioral control (β = .246, p < .05) were all predictors of intention.

For the final regression, attitudes, norms, perceived behavioral control, as well as intention, were used to predict behavior (self-reported attendance at HHW collections). The percentage of variability in behavior that was explained by intention, attitudes, norms and perceived behavioral control was .146. Full mediation would have been demonstrated if attitudes, norms and perceived behavioral control were no longer significant predictors of behavior, while intention would remain as a statistically significant predictor. The pattern of results was partially consistent with mediation. As expected, norms (β = .050, p = n.s.) were no longer a significant predictor of behavior in the final regression, indicating that intention fully mediated the effect of norms on behavior. Also as expected, intention significantly predicted behavior (β = .284, p < .05). This demonstrated that the effects of norms on behavior were consistent with the Theory of Planned Behavior. Partial mediation was observed for perceived behavioral control. Specifically, while perceived behavior control was a significant predictor of behavior (β = .158, p < .05), it was weaker as a predictor than in the first regression equation (recall that β = .225 in the first regression). Thus, the effect of perceived behavioral control on behavior was partially mediated by intention. Finally, the results for attitudes were not

consistent with the TPB. Contrary to expectations, attitudes (β = -.084, p < .05) were negatively related to behavior in the final regression and remained statistically significant.

In sum, the results of the mediation analysis were partially supportive of the TPB. Intention fully mediated the effect of norms on behavior, and intention partially mediated the effect of perceived behavioral control on behavior. However, the effect of attitudes on behavior (which was not significant) was not mediated by intention.

Table 14

Regression Analyses of Mediational Model

1. Regression with attitudes, norms, and perceived behavioral control (PBC) as predictors, and attendance at HHW as criterion.

Predictors	Standardized coefficient	t-value	sig
1. Attitudes	-.019	-0.46	n.s.
2. Norms	.144	3.38	**
3. PBC	.225	5.39	**

2. Regression with attitudes, norms, and perceived behavioral control (PBC) as predictors, and intention as criterion.

Predictors	Standardized coefficient	t-value	sig
1. Attitudes	.275	10.15	**
2. Norms	.320	11.29	**
3. PBC	.246	8.98	**

3. Regression with attitudes, norms, perceived behavioral control (PBC) and intention as predictors, and attendance at HHW as criterion.

Predictors	Standardized coefficient	t-value	sig
1. Attitudes	-.085	-2.08	*
2. Norms	.050	1.13	n.s.
3. PBC	.158	3.75	**
4. Intention	.284	6.19	**

Note. * = $p < .05$, ** = $p < .01$. The Dependent Variable = Self-report of attendance at an HHW collection (N = 650).

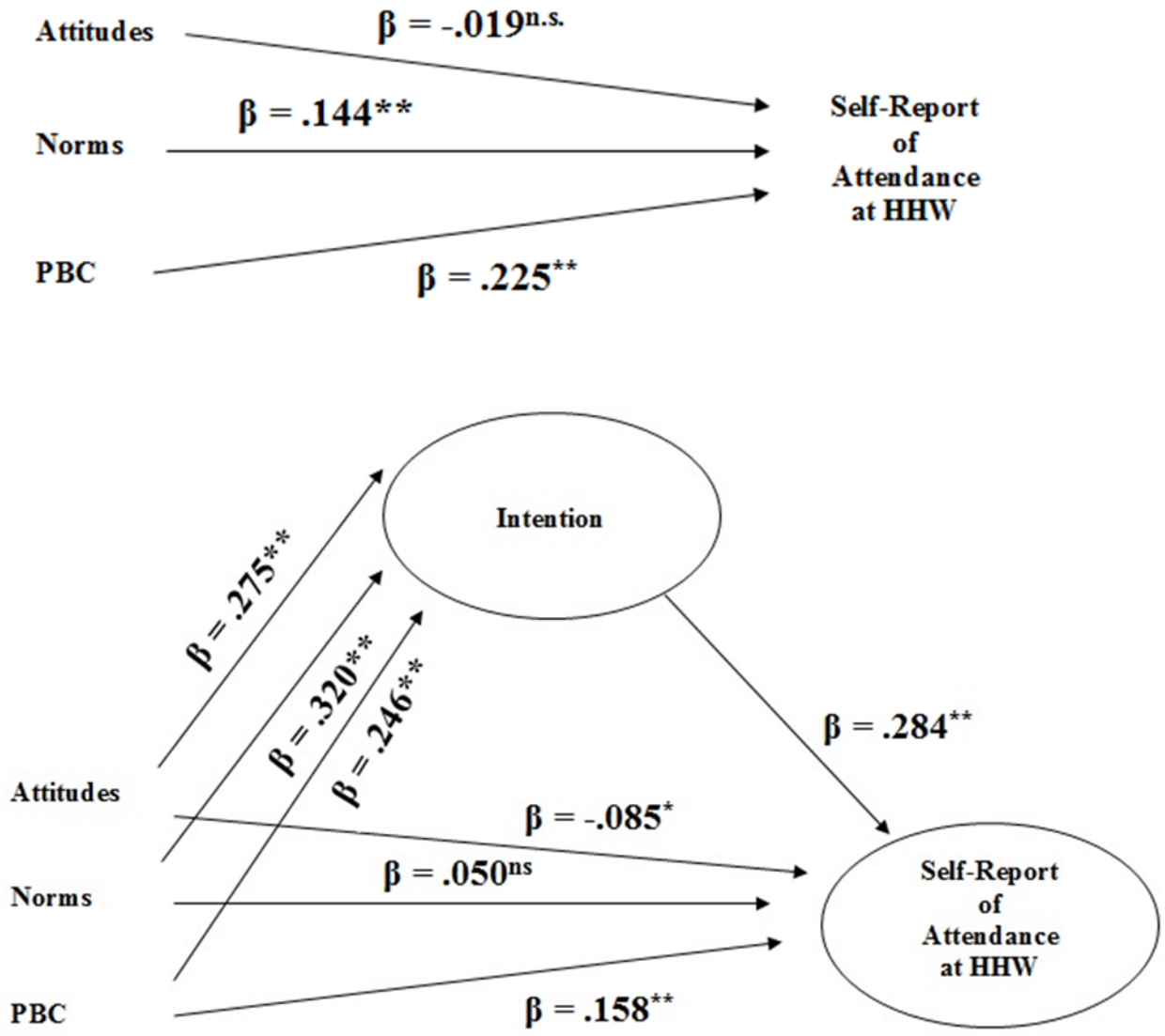

Figure 8. Regression analyses of mediational model (standardized regression coefficients). The dependent variable reflects self-reported attendance at an HHW collection (N=650) as a dichotomous variable. All regression coefficients are standardized and asterisks indicate statistically significant predictors (* = $p < .05$; ** = $p < .01$).

Summary of Correlational and Regression Analyses

As hypothesized, the survey items were significantly inter-correlated and correlated with intention, and intention was significantly correlated with self-reported attendance at an HHW collection. Attitudes, subjective norms and perceived behavioral control were significantly

correlated with self-reported attendance at a collection. Regression analyses were performed to see if intention mediated the relationship between attitudes, norms and perceived behavioral control, and self-reported attendance at an HHW collection. The results were partially supportive of the Theory of Planned Behavior.

The survey in Study 1 is correlational and therefore limited in its ability to make causal inferences between Theory of Planned Behavior variables and actual behavior. To test the usefulness of the TPB for an intervention to motivate participation in household hazardous waste collections, a field experiment was performed in Study 2 testing conditions based on this theory.

Chapter V: Study 2: Experimental Methodology

Overview of the Experiment

The purpose of this field experiment was to test an intervention comprising four conditions. The experimental conditions were four different print communications messages developed with the goal of seeing which was most effective at increasing Connecticut River Estuary Region household participation in HHW collections. Since this intervention was modeled on the Theory of Planned Behavior, the field experiment also permitted testing of the TPB by examining the results of the intervention and its possible effect on actual behavior at HHW collections. Behavioral theory is useful in creating interventions to bring about behavior change (Fishbein & Cappella, 2006) and by providing a guideline for developing messages (Witte, 1995).

Experimental Procedure

The sample in Study 2 is the same randomly-selected sample that received the survey in Study 1: 2,409 households in the nine-town Connecticut River Estuary Region. Proportionate distribution of the four message cards was accomplished with a stratified random sample. In this treatment-control experiment, the control group was the 22,517 Estuary Region households that did not receive the intervention (survey plus message cards). The Dependent Variable in Study 2 was the behavior: observed participation in a collection (yes, attended or no, did not attend) at the regional HHW facility. The Independent Variable was the intervention that was comprised of four different conditions.

In developing social marketing messages it is necessary to first formulate the communication campaign goals and identify the target audience (Kotler & Armstrong, 2008;

Witte, 1995). In Study 2, the communications goal was identified: to motivate single-family homeowners, segmented geographically by those living in the nine-town Connecticut River Estuary Region to participate in HHW collections at a regional facility. With the purpose of persuasive messages being to change existing beliefs, develop new beliefs, or reinforce current beliefs (Witte, 1995), the messages in this experiment addressed control beliefs, attitudinal beliefs and normative beliefs—constructs in the Theory of Planned Behavior. Each treatment condition emphasized a TPB construct (see Table 15).

To influence control beliefs, Condition 1 focused on perceived behavioral control. The message presented only procedural information (who, what, where, when, how), to test the efficacy of an information-only message, and stated that participation is quick and easy. Conditions 2 – 4 also included this procedural information so that a lack of knowledge of facility operating days and hours and acceptable and unacceptable materials, did not constitute a barrier to the behavior.

To affect attitudinal beliefs, Condition 2 presented favorable attitudes toward the proper disposal of HHW at collections rather than HHW disposal in the trash, down the drain or directly into the environment. Given that the majority of survey respondents in Study 1 (81%) indicated that environmental protection is important to them, this campaign message content was intended to reinforce this existing belief.

Table 15

Experimental Design

Condition	Dependent Measure
Control Condition Estuary Region residents who did not receive the intervention (survey plus message cards)	Actual participation* in HHW collection (yes or no)
Condition 1: Perceived Behavioral Control Message on card that emphasizes perceived behavioral control (PBC) (procedural information) only Rounds 1 & 2: "Put HazWaste in its Place" (what to bring, where, when) "Quick and easy."	Actual participation in HHW collection (yes or no)
Condition 2: PBC + Attitude Message on card that emphasizes perceived behavioral control (PBC) (procedural information) plus attitudes Round 1: "Good for the environment. Good for you." (fact on used motor oil groundwater & drinking water contamination) Round 2: "Your participation helps to protect the environment." (facts on harmful effects of improper disposal to air, water, land, animals)	Actual participation in HHW collection (yes or no)
Condition 3: PBC + Norms Message on card that emphasizes perceived behavioral control (PBC) (procedural information) plus subjective norms Round 1: "Everyone's doing it" (testimonials) Round 2: "Family Matters" (& testimonials)	Actual participation in HHW collection (yes or no)
Condition 4: PBC + Attitudes + Norms Message on card that emphasizes perceived behavioral control (PBC) (procedural information) plus attitudes and subjective norms (See Rounds 1 and 2 above)	Actual participation in HHW collection (yes or no)

Note. *Based on completion & return of CRERPA participant form while on-site at collection, indicating name/address. CRERPA, the Connecticut River Estuary Regional Planning Agency, manages the region's HHW collections.

Condition 3 addressed subjective norms with the message directed at raising the sample's low normative belief regarding HHW collection participation by friends and neighbors (as indicated by the survey results in Study 1). The message indicated that others in the region participated in HHW collections, and testimonials were provided from residents who participated

in prior HHW collections. The text also indicated that "family matters" showing that these important others favor participation in HHW collection. Each of the TPB constructs (perceived behavioral control, attitudes and norms) was included in Condition 4.

The print messages were pre-tested at two Solid Waste Transfer Stations in the Estuary Region through intercept interviews of residents bringing their solid waste and recyclables to the facilities. Minor modifications were made to the text to enhance the clarity of the message wording as a result of these interviews.

Hypotheses

The following hypotheses were based on the assumptions that (1) a lack of information can be a barrier to behavior (Schultz, 2002), thus the provision of basic information (what, when, where, how) was needed on each message card as previously stated, and (2) the Theory of Planned Behavior would be useful for an intervention to motivate participation in household hazardous waste collections.

The field experiment tested conditions based on the TPB. It was anticipated that all of the message cards based on TPB constructs would demonstrate increased HHW program participation relative to the control group. Thus, because the theory shows perceived behavioral control can directly motivate behavior, it was anticipated that Condition 1: PBC-only card would show a significant participation increase. With motivational messages added to Condition 2 (PBC + attitudes) and Condition 3 (PBC + norms), it was anticipated that these messages would also show significant participation levels. Lastly, the condition wherein the TPB variables were combined (PBC + attitudes + norms), was expected to be most effective condition at motivating participation in an HHW collection. That is, it was anticipated there would be a demonstrated

increase in participation from this recipient group over those in the other three conditions and the control group.

The hypotheses for this field experiment were:

H1. Conditions based on TPB constructs (Condition 1: PBC-only; Condition 2: PBC + Attitudes and Condition 3: PBC + Subjective Norms), will demonstrate significantly higher participation in HHW collections than the control.

H2. Condition 4, with its combined TPB variables (PBC+A+SN) will significantly increase participation above the control and above the other Conditions, PBC-only, PBC+A, or PBC+SN).

Each of the participants (N=2,409) received two rounds of one of the conditions described above, in a stratified random sample. The cards were each created on one-third of white card stock paper, printed front and back (with an arrow indicating it was double-sided) in two colors (black and red) and designed with minimal graphics (see Appendices D & E). The Round 1 cards informed participants of the Fall, 2008 collection dates and of the re-opening of the facility in May (this is a seasonally-operated facility). Round 2 message cards were sent to the sample in April 2009 so that each individual received the same treatment condition, worded differently than in Round 1 (see Appendices D & E) to more explicitly present the messages. Round 2 cards included collection dates for the spring, summer and fall, 2009 collections. No additional mail contact was made with participants subsequent to the Round 2 direct mailing. The timeline for the intervention was approximately one year. Within this time frame, the experiment took place over a period of 7 months (see Table 16).

Table 16

Intervention Timeline

April 29, 2008	May 5, 2008	October 6, 2008	May 6, 2009
Survey Pre-notice letter mailed to sample (N=2,409 households)	Survey and incentive ($1 bill) mailed to sample (N=2,409)	Message cards (Round 1) mailed to sample (N=2,409)	Message cards (Round 2) mailed to sample (N=2,409)
<----------Study 1---------->		<----------Study 2---------->	

Note. The intervention is the survey and message card intervention comprised of four conditions.

Observation Procedure

For the dependent measure, HHW collection participation was confirmed from standard attendance forms that are required of each participant and administered by the managing entity, the Connecticut River Estuary Regional Planning Agency (CRERPA). These forms are used by CRERPA to track participation by town in order to bill the appropriate town (based on per household participation). The forms were collected from CRERPA to obtain names and addresses of collection participants for the duration of the study. For each HHW collection held at the facility the forms were retrieved and the names and addresses were entered into a spreadsheet, coded by town and the HHW collection(s) attended. The HHW collection participants who had completed the standard form on their day(s) of attendance were then compared with the list of individuals who received the intervention in this study. The message

card condition each individual/household was exposed to could be determined by comparing the address of the HHW participant for the study sample.

HHW collections were held from May 3, 2008 through November 1, 2008. The field experiment did not cover the entire 2008 HHW collection season; the observations were recorded for three collections in 2008 (October 11, October 25, and November 1). The 2009 collections were held from May 16, 2009 through November 7, 2009. Observations were made during the entire 2009 HHW collection season.

Power Analyses

Hardeman et al. (2002) found that in a study examining the effect sizes of several TPB-based interventions to change behavior, results varied greatly, ranging from small to medium and large effect sizes. And "when reported, half of the interventions were effective in changing behavior, and two-thirds in changing intention, with generally small effect sizes, where calculable" (Hardeman et al., 2002, p. 123). According to an a priori power analysis for the current study, a sample size of 1,090 is necessary to achieve a power of .80 for the overall Chi-square test assuming a small effect size (w = .10), α = .05, and 3 degrees of freedom (Cohen, 1992). To detect an increase that at least doubles the HHW collection participation from 6.5% to 13% with 80% power, n = 356 would be needed in each of the experimental conditions, for a total sample size of N=1,424 (Lenth, 2006). This was easily accomplished with the study sample (N = 2,409) resulting in 603 cards for each of the four experimental conditions (see Table 17).

Table 17

Proportionate Distribution of Message Cards

Municipality	Single-family Households (HHs)	Number of HHs receiving message cards (9.67% of total HHs)	Number of each card type (4 conditions)
Chester	1,285	124	31
Clinton	4,630	448	112
Deep River	1,532	148	37
Essex	2,394	231	58
Killingworth	2,027	196	49
Lyme	977	94	24
Old Lyme	4,262	412	103
Old Saybrook	5,013	485	121
Westbrook	2,806	271	68
Total	**24,926**	**2,409**	**603**

Chapter VI: Study 2: Experimental Results

This chapter presents the results of the field experiment to determine whether the intervention inspired by the Theory of Planned Behavior, increased attendance at HHW collections. Restated, the hypotheses for this field experiment were as follows:

H1. Conditions based on TPB constructs (Condition 1: PBC-only; Condition 2: PBC + Attitudes and Condition 3: PBC + Subjective Norms), will demonstrate significantly higher participation in HHW collections than the control.

H2. Condition 4, with its combined TPB variables (PBC+A+SN) will significantly increase participation above the control and above the other Conditions (PBC-only, PBC+A, or PBC+SN).

Chi-Square Test for Independence

To test whether four messages received by the sample in this study (N=2,409) increased attendance at an HHW collection, a 5 (Control, PBC, Attitudes, Norms, Attitudes + Norms) x 2 (Attendance: Yes, No) Chi-Square Test for Independence was performed in which attendance at an HHW collection was treated as the Dependent Variable (see Table 18). This overall Chi-Square test was significant, χ^2 (4, N = 24,926) = 160.4, $p < .001$. This indicates that the experimental manipulation influenced attendance. The overall effect size for the intervention was small (*Cramer's V* = .08).

In comparing the conditions to determine if Condition 1: perceived behavioral control-only increased attendance, a 4 (PBC, Attitudes, Norms, Attitudes + Norms) x 2 (Attendance: Yes, No) a Chi- Square Test for Independence was also performed, χ^2 (3, N = 2,409) = 205.4, $p <$ .001 (see Table 19).

Table 18

Chi-Square Test for Independence

Condition	Attendance at HHW Collections		
	Yes	No	Total
Control[a]	1,764 (8.7%)	18,344 (91.3%)	20,108
1 - PBC only[b]	89 (15.0%)	505 (85.0%)	594
2 - PBC + attitudes[ac]	61 (10.4%)	528 (89.6%)	589
3 - PBC + norms[bc]	70 (11.7%)	528 (88.3%)	598
4 - PBC+ att + norms[d]	141 (22.5%)	487 (77.5%)	628
Totals	2,125 (9.4%)	22,801 (90.6%)	24,926

Note: Values outside parentheses indicate frequencies for each cell. Values inside parentheses indicate percentages for each cell. Conditions that do not share common superscripts indicate significantly different participation rates ($p < .05$).

Support for the Hypotheses

H1. (stating that Condition 1: PBC-only; Condition 2: PBC + Attitudes and Condition 3: PBC + Subjective Norms would demonstrate significantly higher participation in HHW collections than the control), was weakly supported. The PBC-only message card showed a significantly greater level of participation ($p < .001$) relative to the control with 15% participating in an HHW collection, while the participation rate for those who did not receive any intervention - in Estuary Region households during the same time period - was 8.7% (See Table 19). However, participants in Condition 2 (PBC + Attitudes), did not have a significant increase (10.4% vs 8.7%) in participation relative to the control group ($p = .18$). Those participants in

Condition 3 (PBC + Norms) were significantly more likely to attend a HHW collection (11.7%) than those in the control condition (8.7% ; $p = .01$). Thus with exception of Condition 2 (PBC + Attitudes) the results of H1 were consistent with expectations.

The results for H2 were consistent with the hypothesized effect on attendance at an HHW collection at the Estuary Region HHW facility. As hypothesized, Condition 4 (PBC + Attitudes + Norms) showed a significantly greater level of participation ($p < .001$) relative to the control group. Specifically, 22.5% of those who received Condition 4, the PBC + Attitudes + Norms card, participated in an HHW collection at a rate that was more than twice the participation rate for those who did not receive the an intervention (8.7%). Participants in Condition 4 also showed significantly higher rates of participation (all p's < . 001; see table 19) compared to those in Condition 1 (15% participation), Condition 2 (10.4%), and Condition 3 (11.7% participation). Thus Hypothesis 2 was fully supported.

Table 19

Follow-Up Tests Contrasting Individual Experimental Conditions

Contrast	χ^2	df	p-value	phi
1. Control vs. PBC	27.3	1	<.001*	.04
2. Control vs. PBC + Attitudes	1.8	1	.18	.01
3. Control vs. PBC + Norms	6.2	1	.01*	.02
4. Control vs. PBC + Attitudes + Norms	136.6	1	<.001*	.08
5. PBC vs. PBC + Attitudes	5.7	1	.02*	.07
6. PBC vs. PBC + Norms	2.8	1	.10	.05
7. PBC vs. PBC + Attitudes + Norms	11.1	1	<.001*	.10
8. PBC + Attitudes vs. PBC + Norms	0.6	1	.46	.02
9. PBC + Attitudes vs. PBC + Attitudes + Norms	32.1	1	<.001*	.16
10. PBC + Norms vs. PBC + Attitudes + Norms	24.8	1	<.001*	.14

Note. Asterisks indicate statistically significant differences, $p < .05$.

Chapter VII: Comparison of Experimental Results With Survey Results

Overview of Analyses

This chapter presents behavior (attendance at an HHW collection) observed in Study 2 and relates this to survey results from Chapter 1. That is, where Study 1 reflected self-reported behavior, this chapter presents similar analyses with actual, observed behavior. Descriptive statistics are presented in this chapter. Pearson correlations are provided showing relationships among the TPB constructs (attitudes, subjective norms, perceived behavioral control, intention and actual behavior). The results of multiple regression analyses are also provided. These were undertaken in accordance with the mediation analysis described by Baron and Kenny (1986) to determine if intention mediated the effects of attitudes, subjective norms and perceived behavioral control on behavior, as predicted by the Theory of Planned Behavior (Ajzen, 1991).

Descriptive Statistics

Past attendance at HHW collections. It was examined whether self-reported participation in a 2007 HHW collection from Study 1 was associated with participation in a 2008 or 2009 collection in Study 2. Of the 329 respondents (33%) who said they participated in one or more collections in 2007, 72 (22%) were observed participating in a 2008 or 2009 collection.

Distance to the HHW facility. The majority of survey respondents (85%) selected survey options that indicated they lived within 15 miles of the HHW facility. There was a significant difference in actual attendance by distance to the HHW facility χ^2 (5, N=983) = 12.5, p=.03 (see Table 20; also Appendix K).

Table 20

Participation in HHW Collection as a Function of Distance to Facility

Distance to Facility	Number of survey Respondents	Number of respondents attending collection	Percentage Attending
0-5 Miles[a]	298	60	20.1%
6-10 Miles[ab]	320	56	17.5%
11-15 Miles[bc]	217	27	12.4%
Over 15 Miles[c]	74	6	8.1%
Unsure of Distance[bc]	60	5	8.3%
No Response[abc]	14	2	14.3%
Total	983	156	15.9%

Note. There were significant differences in attendance rates as a function of distance to the facility, χ^2 (5, N = 983) = 12.5, p =.03. Groups which do not share common superscripts were significantly different from one another, $p < .05$.

Demographics. Examined were possible systematic demographic differences among those survey respondents who attended HHW collections, relative to those who did not attend an HHW collection. The data showed no significant differences in attendance rates for the following demographic characteristics: gender, race, education, or annual household income. There was a significant difference in attendance rates as a function of age, χ^2 (8, N=983) = 17.1,

p = .03 (see Table 21; also Appendix G). Note that demographics tables are only presented in the text for correlations with significance.

Table 21

Participation in an HHW Collection as a Function of Age

Age	Number of Survey Respondents	Number of Respondents Attending Collection	Percentage Attending
0-20[ab]	3	1	33.3%
21-30[ab]	11	1	9.1%
31-40[ab]	90	12	13.3%
41-50[a]	215	18	8.4%
51-60[b]	230	42	18.3%
61-70[b]	197	37	18.8%
71-80[b]	134	26	19.4%
80+[ab]	43	5	11.6%
No Response[b]	60	14	23.3%
Total	983	156	15.9%

Note. There were significant age differences in attendance rates, χ^2 (8, N = 983) = 17.1, p =.03. Groups which do not share common superscripts were significantly different from one another, $p < .05$.

Test of the Theory of Planned Behavior

Pearson correlations were calculated to determine the association between TPB variables (attitudes, subjective norms, perceived behavioral control and intention) and the dependent variable of actual participation at HHW collections. The resulting correlations are presented in Table 22.

The hypotheses were directly derived from the Theory of Planned Behavior, wherein attitudes, subjective norms and perceived behavioral control were anticipated to significantly predict individuals' intention to participate in an HHW collection. Intention was expected to significantly predict actual participation in an HHW collection. As hypothesized, attitudes (r = .49, $p < .05$), norms (r = .52, $p < .05$) and PBC (r = .44, $p < .05$) were all significantly correlated with intention. Moreover, intention was significantly correlated with attendance at an HHW collection (r = .10, $p < .05$). However, attendance at an HHW collection was not significantly correlated with attitudes, norms and perceived behavioral control. This indicates that those who attended HHW collections differed on the TPB variables relative to those who did not attend HHW collections. This is further demonstrated visually by examining the mean responses on the TPB measures as a function of those who attended and those who did not attend (see Figure 9). Note that while there is consistency in the direction of change, none of the differences between attendees and non-attendees, depicted in Figure 9, was statistically significant.

Table 22

Inter-Correlations Among Primary Variables

Measure	1	2	3	4	5
1. Attitudes	1.00				
2. Norms	.369*	1.00			
3. PBC	.264*	.395*	1.00		
4. Intention	.459*	.525*	.445*	1.00	
5. Attendance at HHW collection	.061	.061	.057	.102*	1.00

Note. Asterisks indicate statistically significant correlations, $p < .05$ (two-tailed). Inter-correlations between Attendance at HHW collections and remaining variables reflect Point-Biserial correlations. The other inter-correlations are Pearson Correlation Coefficients.

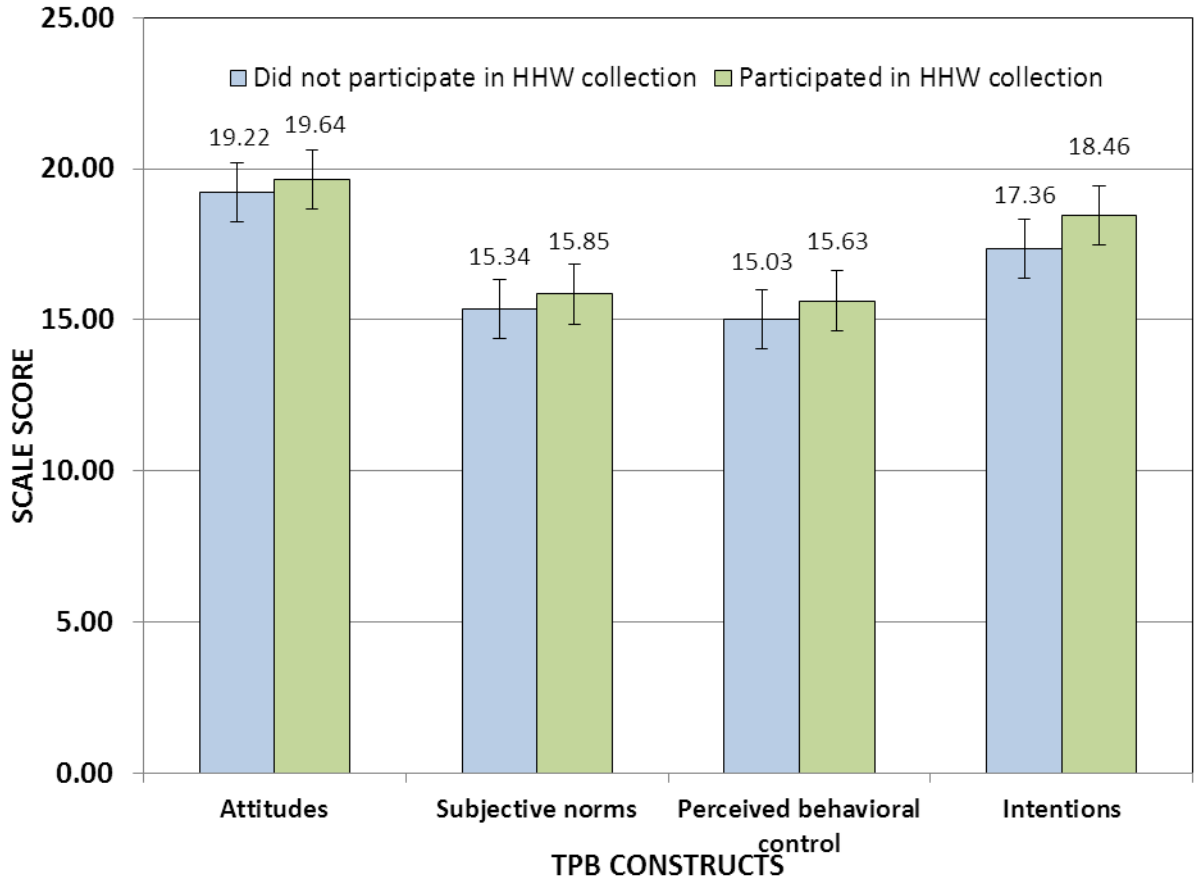

Figure 9. Mean TPB survey responses as a function of participation in HHW collections. Error bars reflect 95% confidence intervals. There were no statistically significant differences.

Regression Mediation Analyses

A series of regression analyses was again conducted to determine whether intention mediated the relationship between attitudes, norms, and perceived behavioral control and actual attendance at an HHW collection. To determine if intention mediated the effects of attitudes, subjective norms and perceived behavioral control (PBC) on behavior as presented in the TPB, multiple regression analyses were performed according to the mediation analysis described by Baron and Kenny (1986). As with the regression mediation analyses in Chapter 1 with self-reported 2007 behavior, three regression equations were done to test mediation with the dependent variable, behavior (actual attendance at HHW collections between May, 2008 and November, 2009) regressed on the independent variables (attitudes, norms, PBC). In this regression, behavior should have been predicted by these variables. Second, intention, the potential mediator, should have been predicted by the independent variables. Third, when actual behavior was regressed on the independent variables and the potential mediator, the behavior should have been predicted by these four variables. The effect of the independent variables on the dependent variable should be either reduced to zero for complete mediation or significantly decreased, demonstrating partial mediation), with the mediator remaining a significant predictor of behavior. In all of the regressions, predictors were simultaneously entered into the regression equation.

Attendance was treated as a dichotomous variable (yes or no) in these analyses. Thus, the mediational model by necessity included both logistic and linear regression. This is appropriate as described by MacKinnon & Dwyer (1993; also see Herr, 2006), who provided a solution so that linear and logistic regression can be used together in the same model. They recommend that a means of addressing this problem is to "make the scale equivalent across equations by

standardizing regression coefficients prior to estimating mediation" (p. 150). The procedure was performed to standardize the regression coefficients so that they were all in a common metric and can be compared. This did not alter the statistical significance of the predictor variables and so it did not result in a substantively different interpretation of results in the mediation analysis.

The results of the regression analyses are presented in Table 16. A visual representation of the same mediational model is shown in Figure 10. These results indicate that the mediation analyses did not support the Theory of the Planned Behavior. Specifically, in the first regression, in order for full mediation to actually be demonstrated, each of the independent variables (attitudes, norms & PBC) should be significant predictors of the ultimate dependent variable (attendance at an HHW collection). As Table 16 indicates (see Regression 1), attitudes did not significantly predict attendance (β = .118, p = .31). Similarly, neither norms (β = .072, p = .44) nor PBC (β = .103, p = .19) were significant predictors of HHW collection participation. Thus, the first regression indicates that none of the TPB variables significantly predicted attendance at an HHW collection. Since none of these predictors was significant in the initial regression as is required to demonstrate mediation, the mediational hypothesis was not supported.

Table 23

Regression Analyses of Mediational Model (actual behavior)

1. Logistic regression with attitudes, norms, and perceived behavioral control (PBC) as predictors, and attendance at HHW as the criterion.

Predictors	Standardized coefficient	sig
1. Attitudes	.059	.31^{ns}
2. Norms	.044	.44^{ns}
3. PBC	.072	.19^{ns}

2. Linear regression with attitudes, norms, and perceived behavioral control (PBC) as predictors, and intention as the criterion.

Predictors	Standardized coefficient	sig
1. Attitudes	.194	<.01**
2. Norms	.232	<.01**
3. PBC	.173	<.01**

3. Logistic regression with attitudes, norms, perceived behavioral control (PBC) and intention as predictors, and attendance at a HHW collection as the criterion.

Predictors	Standardized coefficient	sig
1. Attitudes	.019	.70^{ns}
2. Norms	.003	.96^{ns}
3. PBC	.038	.50^{ns}
4. Intention	.149	.04*

Note. * = p < .05, ** = p < .01

The dependent variable reflects actual attendance at an HHW collection (N=940).

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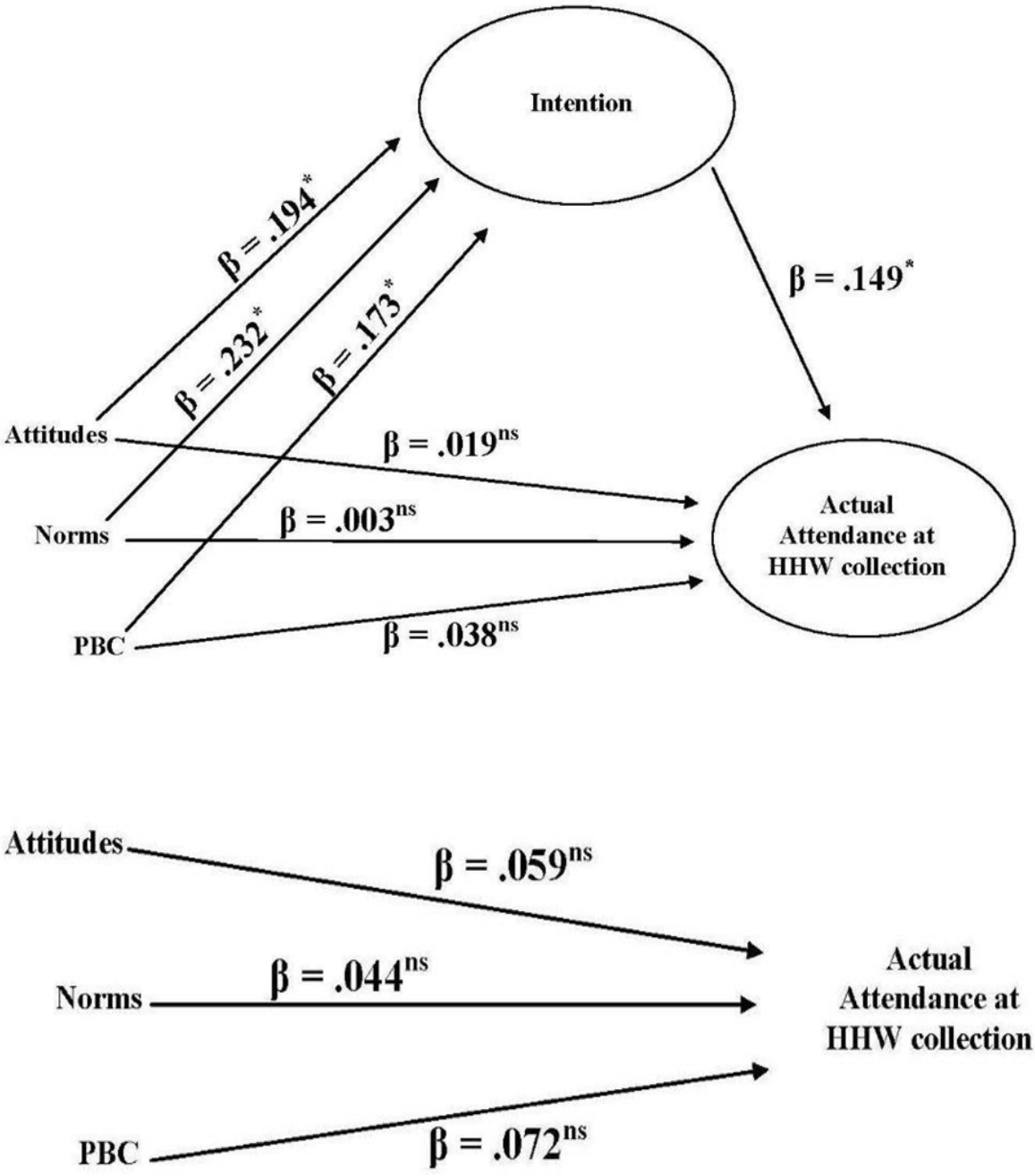

Figure 10. Regression analyses of mediational model. The dependent variable reflects actual attendance at a HHW collection (N=940) as a dichotomous variable. All regression coefficients are standardized and asterisks indicate statistically significant predictors ($p < .05$).

Summary of Correlational and Regression Analyses

The survey items were significantly intercorrelated and correlated with intention, and intention was significantly correlated with attendance at an HHW collection. Attitudes, subjective norms and perceived behavioral control were not significantly correlated with attendance at a collection. Thus in comparing responses to TPB survey variables between HHW collection participants and non-participants, significant differences in the variables were not observed.

Regression analyses were performed to see if intention mediated the relationship between attitudes, norms and perceived behavioral control, and attendance at an HHW collection. The regression of the predictor variables on attendance at an HHW collection did not demonstrate statistical significance, thus the mediational model did not support the Theory of Planned Behavior in the current study. The survey in Study 1 is correlational and therefore limited in its ability to make causal inferences between Theory of Planned Behavior variables and actual behavior. In testing the usefulness of the TPB for an intervention to motivate participation in household hazardous waste collections, the field experiment performed in Study 2 tested conditions based on this theory, with some success. However, attendance at an HHW collection was not significantly correlated with attitudes, norms and perceived behavioral control. Nor was the theory supported in regression mediation analyses.

Chapter VIII: Discussion

The purpose of this research was to assess if the Theory of Planned Behavior would be a useful theoretical framework for formative research examining individuals' reasons for attending or not attending household hazardous waste collections in the Estuary Region (Study 1). This study was used to inform and test print communications messages in a field experiment to motivate HHW program participation (Study 2) as part of a community-based social marketing program in the Estuary Region. The study did this with four experimental conditions based on the TPB constructs.

The literature search revealed few prior research studies on household hazardous waste collection program participation, although several were available that addressed a specific HHW product (such as used motor oil). More often, the research on HHW collection focused on individuals' knowledge and attitudes about hazardous household products and HHW generation and disposal. While people stated favorable attitudes toward HHW collection, several barriers were identified. A lack of knowledge was demonstrated by difficulty in identifying HHW and little knowledge about HHW collections, implying low perceived behavioral control. An additional barrier identified in the research was the perception that few others participated in HHW collections in the region, suggesting a low social norm. Yet a third barrier, inconvenience, posed a perceived difficulty for those who did not live close to an HHW collection site. Research had indicated that many were willing to drive up to 5–10 miles or 5–15 minutes and this study added further support for this finding.

Effective interventions identified in the literature included several behavior change tools such as prompts, interpersonal communication, brochures and the use of public commitments (Dwyer et al., 1993), used in community-based social marketing programs (McKenzie-Mohr,

2011). In terms of the Theory of Planned Behavior, the literature search showed that the TPB is useful in predicting about 35–50% of the variance in intention and 26–35% of variance in behavior however the theory has not been widely applied to interventions and provides little guidance on interventions.

The current study contributed to our understanding of people's attitudes and perceptions regarding HHW collections and filled a gap with much-needed research that applied the Theory of Planned Behavior in a community-based social marketing process to develop and experimentally field-test, an intervention to increase HHW collection participation. It is hoped that the results of this study will enhance our understanding of this complex phenomenon.

Study 1: Survey

In Study 1 of the current research, a simple random survey was used to examine homeowners' knowledge, beliefs and attitudes regarding HHW collection participation. The hypotheses for the survey were directly derived from the Theory of Planned Behavior. Specifically it was hypothesized that attitudes, subjective norms and perceived behavioral control would significantly predict individuals' intention to participate in an HHW collection, and intention to participate in an HHW collection would significantly predict self-reported participation in an HHW collection. Also, that PBC would predict the behavior. Further, it was hypothesized that the impact of attitudes, subjective norms and PBC would be mediated by intention to perform the behavior, as presented in the theory. Correlational and regression mediation analyses were performed to determine the relationship between TPB variables and self-reported attendance at HHW collections at the Estuary Region facility. These analyses showed that the TPB significantly predicted self-reported attendance at an HHW collection.

Despite wide use of the TPB in studies designed to predict intention and behavior, application in behavior change interventions is not common.

Study 2: Experiment

To test the usefulness of the TPB for a community-based social marketing intervention to motivate participation in HHW collections, a second study was done in the form of a field experiment to test print message conditions inspired by this theory. The first hypothesis was that the conditions (Condition 1: Perceived Behavioral Control only; Condition 2: PBC combined with attitudes, and Condition 3: PBC combined with subjective norms), would demonstrate higher participation in HHW collections than the control. This hypothesis was supported for Condition 1 (p = <.001), but not supported for Conditions 2 and 3 (p's = n.s.). That is, Condition 1 (PBC) showed a participation rate of 15% of households, while the overall participation rate for households in the control group was 8.7% of households. This aligns with the Theory of Planned Behavior that shows a direct effect of PBC on behavior. This is not surprising given that a central finding in this study was a general lack of knowledge regarding HHW collections in the region. A knowledge-deficit can be a barrier to behavior (Schultz, 2002) and while the location of the HHW facility was known by most respondents, the survey indicated that the knowledge level dropped off with regard to directions to the facility, days and hours of operation and acceptable/unacceptable materials.

The second hypothesis in this study was that the condition with all three combined TPB variables (PBC, attitudes and norms) would demonstrate the greatest participation above the control. The hypothesized effect on participation at the HHW facility was supported in the experiment (p = <.001), with 22.5% of those who received the PBC + attitudes + norms card having participated in an HHW collection. This is more than double the participation rate for the

region during the study time period, indicating that the experimental manipulation influenced behavior. The current study showed support for the TPB with its combined variables of PBC, attitudes and norms that appear to have worked synergistically to motivate behavior.

The Theory of Planned Behavior was further tested with correlational and regression mediation analyses using actual behavior that was observed in Study 2. The results showed intercorrelation among the TPB variables however these variables were not significantly correlated with the behavior of actual attendance at an HHW collection. Nor was the mediational hypothesis supported. Therefore the TPB was not supported when actual behavior replaced self-reported behavior.

Other findings were a significant difference in attendance rates as a function of age, χ^2 (8, N=983) = 17.1, p = .03. The study also showed a significant difference in attendance by distance to the HHW facility: χ^2 (5, N = 983) = 12.5, p = .03. This finding supports prior studies demonstrating that the distance people were willing to travel from home to a facility was less than 15 miles (Harper, 1998; Williams, 2009). A barrier to participation may thus be distance to a collection (perceived inconvenience). Research on recycling corroborates this finding, showing that participation rates can increase if the barrier of having to transport materials to a facility is eliminated (Schultz, Oskamp, & Mainieri, 1995; Sidique et al., 2010).

Limitations of the Research

The following are several limitations to this research. While the study involved a randomly-selected sample, which is a method of sampling that helps to ensure good representation of the population, the Computer Aided Mass Appraisal (CAMA) database was used to acquire names and addresses. Because only tax-paying homeowners are listed in the CAMA database, a segment of the population, those not owning homes and/or renting, was

excluded from the sample. This excludes households that may be in different socioeconomic groups.

The survey used in Study 1 was newly developed for the current research, with a new set of measures. Therefore it has not been previously tested and construct validity of the new measures could not be established a priori. Confirmatory factor analysis of survey items assessing TPB constructs did however provide evidence for the validity of the items.

The internal consistency of the items for each variable was examined using Cronbach's alpha (α). While the Cronbach's alpha for intention (α=.87) was closest to the preferred .90, the reliabilities for attitudes, subjective norms and perceived behavioral control met the minimum acceptable level of α = .60. For future studies, the internal consistency reliability of these measures should be improved.

In Study 1, the survey return rate was 41% possibly suggesting a response bias. The bias could have been self-selection by those living near the regional HHW facility. Of the survey respondents (N = 983), 85% reported living within fifteen miles of facility, while 8% of respondents comprised those whose homes were over 15 miles from the facility. Proximity to the facility may have enhanced familiarity and/or perceived relevance (attendance may be deemed possible given the facility is close-by) which could have inspired response. This is also reflected in the significant difference in attendance, post-intervention (Study 2, the field experiment) by distance to the facility.

With regard to communications messages, they should contain attention-getting information that is focused and memorable, and delivered by a credible, respected entity (McKenzie-Mohr & Smith, 1999). This study used attention-getting words and simple, clear graphics. The region's planning agency served as the credible source. Thus a limitation could

be that the message cards were insufficiently tested to see if they were "memorable." An improved design or catchier phrase could have persuaded more individuals to attend HHW collections. The cards were also two-color. With additional funding, a more vibrant four-color card could have been produced for each of the conditions. This was not the case.

Both the survey in Study 1 and message cards in Study 2 were direct-mailed to the sample. A limitation of this research study is that it is unknown how many individuals actually opened the mail or read the survey or message card. This is a challenge with the use of direct mail as a communication channel. Where contact with individuals can be confirmed with telephone surveys for example, it can be difficult to confirm with direct mail. In using a modified Tailored Design Method (TDM) (Dillman, 2007), a pre-survey notice letter was mailed to the sample to alert individuals that a survey and enclosed incentive would arrive in the mail in a week. This was intended to increase the likelihood that individuals would pay greater attention to receiving the survey. However due to limited time and resources for this study, the full TDM approach that employs three to five mail contacts, was not possible. This would have included an additional "thank you" and reminder post-card following the survey, and a replacement survey sent to those who did not respond to the first round. This approach could have increased recipient involvement, however confirmation that individuals opened and read the materials would still have been greatly challenging.

The communications channel (direct mail) selected for experimental messages in Study 2 may also be a limiting factor in this study. Finnegan et al. (1987) found that direct mail is useful in building knowledge and awareness, particularly at the start of an education campaign. Danaher and Rossiter (2011) found that this traditional marketing communication channel holds value in terms of receivers' perceived "trust and reliability of information" and persuasiveness

(p. 34), more so than telephone, cell phone or email. However, it is still not the most effective communications channel to influence behavior change. Personal contact has demonstrated higher motivational efficacy, albeit with lesser audience reach (Ryan, 2009; Schultz & Tabanico, 2008; Werner, 2003).

Chapter IX: Conclusion

Given its demonstrated and potential harm to health, safety and the environment, and its prevalence in our society, household hazardous waste necessitates proper waste management. An effective waste management practice is individuals' separation of HHW from the regular trash and its delivery to HHW collections where it is managed by licensed chemical waste handlers. HHW collections have grown in popularity and are now held in all 50 states, demonstrating vast recognition of the need to clear homes of chemical products with hazardous constituents such as pesticides, cleaners and automotive products. However, low participation rates for HHW collections nationally, and in the current research study region, are indicative of a problem. There is demonstration of a need and an opportunity to further engage citizens to use this waste management option where available.

The bulk of the research has been on individuals' knowledge and attitudes regarding HHW and collection sites. Research on materials collection has focused on isolated products such used motor oil or on product categories, such as pesticides. However, HHW collections usually accept a number of materials with hazardous constituents, either at permanent HHW facilities or single-day collections. Individuals' participation in multi-material HHW collections, and interventions to increase participation, are not adequately addressed in the literature. The current study represents survey research on perceived barriers and benefits to HHW collection participation, and a field experiment that tests print communications to motivate participation. Also, the Theory of Planned Behavior was tested for its usefulness in both the survey and the intervention. While extensive examination of the TPB has been done, this theory has not been

widely used in behavior change interventions. The current research therefore also contributes to this body of knowledge and provides evidence of its usefulness in print communications messages.

The findings of this two-part study demonstrated mixed results. In Study 1, correlational and regression mediation analyses were performed to determine the relationship between TPB variables and self-reported attendance at HHW collections. These showed that the TPB significantly predicted self-reported attendance at an HHW collection. However upon further examination with observed behavior in Study 2, attendance at an HHW collection was not significantly correlated with attitudes, norms and perceived behavioral control. Nor was the theory supported in regression mediation analyses, bringing into question the usefulness of the TPB in predicting behavior.

For its use in an intervention, the TPB was supported: the field experiment with print message cards in Study 2 demonstrated significant participation resulting from the message combining the TPB variables and the message providing necessary information only (related to perceived behavioral control). This research suggests that further investigation is warranted on the use of the TPB in community-based social marketing messages. Further, this small-scale field test of the messages provides support for implementation on a region-wide scale. Because the diversion of HHW from the municipal solid waste stream depends upon resident participation in HHW collections, the findings of this study might be useful in the region's efforts to build participation.

Further research is sorely needed to increase participation in HHW collections, nationally. Studies examining interventions that are implemented in a true field experiment and with observed behavior would tremendously benefit the HHW field. The current study lays the

groundwork for future research into theory-application to community-based social marketing programs that aim to promote HHW program participation.

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Appendices

Appendix A

Pre-Notice Letter

April 29, 2008

Dear Estuary Region resident:
A few days from now you will receive in the mail a request to fill out a brief questionnaire for an important research project being conducted by the Connecticut River Estuary Regional Planning Agency and a student researcher at Antioch University New England. It concerns the Estuary Region residents' opinions of participation in regional household hazardous waste collections.
I am writing in advance because we have found that many people like to know ahead of time that they will be contacted. The study is an important one that will help the Regional Planning Agency and Estuary Region town administrators understand why individuals do or do not participate in these special waste collections.
Thank you for your time and consideration. It is only with the generous help of people like you that our research can be successful.
Sincerely,
Amy Cabaniss
Antioch University New England

P.S. – I will be enclosing a small token of appreciation with the questionnaire as a way of saying thanks.

Appendix B

Survey Cover Letter

Dear Estuary Region resident: May 5, 2008

I am writing because we need your help as we undertake a study of Estuary Region residents' opinions of household hazardous waste collection participation. My name is Amy Cabaniss and I am a student researcher at Antioch University New England, working in association with the Connecticut River Estuary Regional Planning Agency (CRERPA) in Old Saybrook. Please consider assisting us by filling out the enclosed survey.

The purpose of this study is to better understand reasons why people do and do not participate in Estuary Region household hazardous waste collections. We will use the results of the survey to inform and test communications messages for their effectiveness in motivating household hazardous waste collection participation. We are asking a random sample of Estuary Region residents to fill out the form and you have been selected. There are no risks to you for taking part because the answers you provide are confidential and will be used only in summaries in which no individual's answers can be identified. It takes about 10 minutes to complete the enclosed survey. You need not be an expert on this topic. We hope you will help us by sharing your opinions. In thanks for your assistance, I have enclosed a small token of our appreciation.

Taking part is voluntary.

Choosing to continue and complete the survey will be taken as consent to have your data included in this study. If you fill out the survey, we ask that you answer as many questions as you can. If you choose not to fill out the survey, there will be no penalty and it will not affect the availability to you of HHW collection or other solid waste management services. Should you choose not to respond to this survey, please let us know by returning the blank questionnaire in the enclosed, stamped envelope.

If you have questions about the survey, please contact Janice at CRERPA, 860-388-3497, or leave a name and number so that your call can be returned. If you have questions about your rights as a volunteer, please contact:

Dr. George Tremblay, Director of Research
Department of Clinical Psychology
Antioch University New England
40 Avon Street
Keene, NH 03134
george_tremblay@antiochne.edu
(603) 283-2190

Thank you for your help with this important study. It is only with the generous help of people like you that our research can be successful. *Please promptly mail* the completed survey form in the enclosed, stamped envelope to: CRERPA, P.O. Box 778, Old Saybrook, CT 06475.

Please retain this cover sheet of explanation. It is not necessary to return it with the survey.

Very sincerely,
Amy Cabaniss

Appendix C

Survey

Estuary Region Household Hazardous Waste Collection Survey

Dear Estuary Region resident,
Thank you for helping us by completing this brief survey. Your responses are very important us.

1. Which of these chemical consumer products do you have at home? (Please check all that apply.)
□ bleach □ furniture polish □ toilet bowl cleaner □ drain opener □ disinfectant spray
□ bug spray □ ant baits □ moth repellent □ weed killer □ grub killer □ antifreeze
□ windshield washer fluid □ gasoline □ varnish □ oil-based paint □ paint thinner
□ deck sealant □ pool chemicals □ mercury thermometer □ other: _____

2. What do you currently do with unwanted, left-over chemical products? (Please check all that apply.)

consumer product	store at home	dispose in trash	collection center	return to store	give away/donate
household cleaners	□	□	□	□	□
paint-related products	□	□	□	□	□
automotive products	□	□	□	□	□
pesticides	□	□	□	□	□

3. Your town is one of the 9 towns to join the Estuary Region Household Hazardous Waste Facility to collect chemical products such as those listed above. Were you aware of the existence of this facility?
□ yes □ no (*if no→ skip to number 6*)
4. What do you know about the Household Hazardous Waste (HHW) Facility? (Please check all that apply.)
□ facility location □ directions to facility □ days of operation in 2008 □ hours of operation in 2008
□ satellite collection dates □ satellite collection locations □ acceptable materials □ unacceptable materials
5. How many times did you attend a household hazardous waste collection in the region in May-October 2007?
Number of times: _____
6. What percentage of Estuary Region households would you guess participated in HHW collections in 2007?
Participation rate guess: _____%

For each of the following statements, please mark one check mark "√" in the blank space that most closely demonstrates your level of disagreement (-3 to -1), neutrality (0), or agreement (1 to 3).

7. How important is it to you that household hazardous waste products (such as those listed in Question #1 above) are treated differently from regular trash?
very unimportant: ____:____:____:____:____:____:____:very important
-3 -2 -1 0 1 2 3
8. In your view, household hazardous waste (HHW) collections are services that are:
worthless: ____:____:____:____:____:____:____:worthwhile
-3 -2 -1 0 1 2 3
9. As you generate HHW at home, you will plan to bring it to a HHW collection.
very unlikely: ____:____:____:____:____:____:____:very likely
-3 -2 -1 0 1 2 3
10. Your participation in a HHW collection helps to protect the environment.
disagree: ____:____:____:____:____:____:____:agree
-3 -2 -1 0 1 2 3
11. You intend to participate in a HHW collection this season (May – October, 2008).
very unlikely: ____:____:____:____:____:____:____:very likely
-3 -2 -1 0 1 2 3

12. How easy or difficult is it for you to identify acceptable materials for the HHW collection?
difficult: ____:____:____:____:____:____:____:easy
-3 -2 -1 0 1 2 3

13. How easy or difficult do you think it is to unload material once at the HHW collection?
difficult: ____:____:____:____:____:____:____:easy
-3 -2 -1 0 1 2 3

14. Your family thinks your participation in a HHW collection is important.
disagree: ____:____:____:____:____:____:____:agree
-3 -2 -1 0 1 2 3

15. Do you think your neighbors bring their HHW to a collection?
very unlikely: ____:____:____:____:____:____:____:very likely
-3 -2 -1 0 1 2 3

16. Other people who are important to you think your family ought to participate in a HHW collection.
disagree: ____:____:____:____:____:____:____:agree
-3 -2 -1 0 1 2 3

17. For you, transportation to a HHW collection on a Saturday, sometime May through October, is:
difficult: ____:____:____:____:____:____:____:easy
-3 -2 -1 0 1 2 3

18. Personal obligations on Saturdays make it difficult for you to attend a HHW collection.
disagree: ____:____:____:____:____:____:____:agree
-3 -2 -1 0 1 2 3

19. You will participate in a HHW collection this year.
very unlikely: ____:____:____:____:____:____:____:very likely
-3 -2 -1 0 1 2 3

Please tell us something about you. Your responses are confidential and will be used only in summaries in which no individual's answers can be identified.

20. What type of building best describes your home? (Please check one.)
□ single family home □ duplex □ apartment □ mobile home

21. About how far do you live from the Estuary Region HHW Facility (near the CRRA Transfer Station, Essex)?
□ less than a mile □ 1-5 miles □ 6-10 miles □ 11-15 miles □ over 15 miles □ unsure

22. Where do you obtain information on household hazardous waste collections in your area? (Please check all that apply).
□ local newspaper □ regional newspaper □ town website □ town hall □ other _____
□ transfer station □ CRERPA □ radio □ word-of-mouth □ does not apply

23. What is your gender? □ male □ female
24. What is your age? _____
25. How do you describe your racial background?
□ White or Caucasian □ Black or African American □ Asian American □ Hispanic or Latino
□ Native American □ other _____

26. What is the highest level of school you have completed?
□ less than high school □ high school □ some college □ 2 year-college graduate
□ 4 year-college graduate □ graduate school □ other: _____

27. What is your household gross annual income?
□ $0-$24,999 □ $25,000-$49,999 □ $50,000-$64,999 □ $65,000-$99,999 □ $100,000-$124,999
□ over $125,000 □ unsure □ decline response

Thank you for your time and assistance.
Your participation in this survey is greatly appreciated.

Appendix D

Intervention - Message Cards: Round 1 – September, 2008 (Side 1)

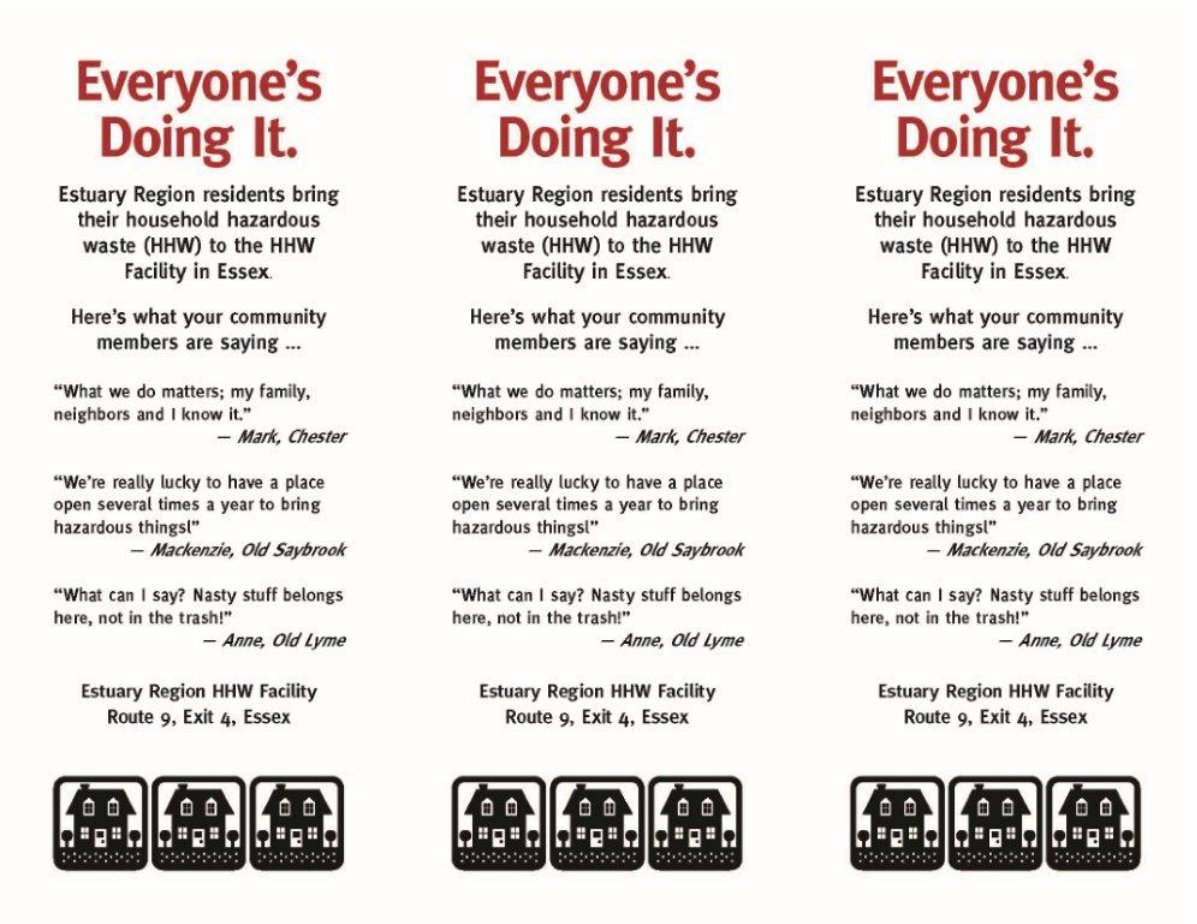
Note: Cards were double-sided and cut so that each was 1/3 of the card stock page to fit in a standard envelope.

a. Attitudes **b. Perceived behavioral control** **c. Attitudes + Norms**

Appendix D (continued)

Message Cards: Round 1 (Side 1) - Norms Card

Note: Cards were double-sided and cut so that each was 1/3 of the card stock page to fit in a standard envelope. The Norms card displays 3 duplicates for printing purposes only.



d. Norms

Appendix D (continued)

Message Cards: Round 1 (Side 2)

Note: Cards were double-sided and cut so that each was 1/3 of the card stock page to fit in a standard envelope.

What to Bring

Household cleaners and disinfectants, bug spray, furniture polish, gasoline, weed killer, oil paint, antifreeze, drain opener, varnish, deck sealant, grub killer, mercury thermometers, solvents, arts & crafts supplies, transmission fluid, fluorescent bulbs, chemistry kits, rat poison, pool chemicals and more.
Questions? Contact CRERPA. Call 860-388-3497 or e-mail: info@crerpa.org

Where to Go

HHW Facility, Essex
Directions from Route 9, Exit 4

Driving north: straight off exit ramp; cross over RR tracks; pass CRRA transfer station; HHW facility up hill on left.

Driving south: left off exit ramp; at light, go right; cross over RR tracks, pass CRRA transfer station; HHW facility up hill on left.

When to Go

Fall 2008 Collections

Join community residents on selected Saturdays, 9 a.m. – 1 p.m.
September 13, 27
October 11, 25
November 1

Quick and Easy

ID required
No fee
They off-load, then you're on the road!

ESTUARY REGION HAZWASTE FACILITY

What to Bring

Household cleaners and disinfectants, bug spray, furniture polish, gasoline, weed killer, oil paint, antifreeze, drain opener, varnish, deck sealant, grub killer, mercury thermometers, solvents, arts & crafts supplies, transmission fluid, fluorescent bulbs, chemistry kits, rat poison, pool chemicals and more.
Questions? Contact CRERPA. Call 860-388-3497 or e-mail: info@crerpa.org

Where to Go

HHW Facility, Essex
Directions from Route 9, Exit 4

Driving north: straight off exit ramp; cross over RR tracks; pass CRRA transfer station; HHW facility up hill on left.

Driving south: left off exit ramp; at light, go right; cross over RR tracks, pass CRRA transfer station; HHW facility up hill on left.

When to Go

Fall 2008 Collections

Join community residents on selected Saturdays, 9 a.m. – 1 p.m.
September 13, 27
October 11, 25
November 1

Quick and Easy

ID required
No fee
They off-load, then you're on the road!

What to Bring

Household cleaners and disinfectants, bug spray, furniture polish, gasoline, weed killer, oil paint, antifreeze, drain opener, varnish, deck sealant, grub killer, mercury thermometers, solvents, arts & crafts supplies, transmission fluid, fluorescent bulbs, chemistry kits, rat poison, pool chemicals and more.
Questions? Contact CRERPA. Call 860-388-3497 or e-mail: info@crerpa.org

Where to Go

HHW Facility, Essex
Directions from Route 9, Exit 4

Driving north: straight off exit ramp; cross over RR tracks; pass CRRA transfer station; HHW facility up hill on left.

Driving south: left off exit ramp; at light, go right; cross over RR tracks, pass CRRA transfer station; HHW facility up hill on left.

When to Go

Fall 2008 Collections

Join community residents on selected Saturdays, 9 a.m. – 1 p.m.
September 13, 27
October 11, 25
November 1

Quick and Easy

ID required
No fee
They off-load, then you're on the road!

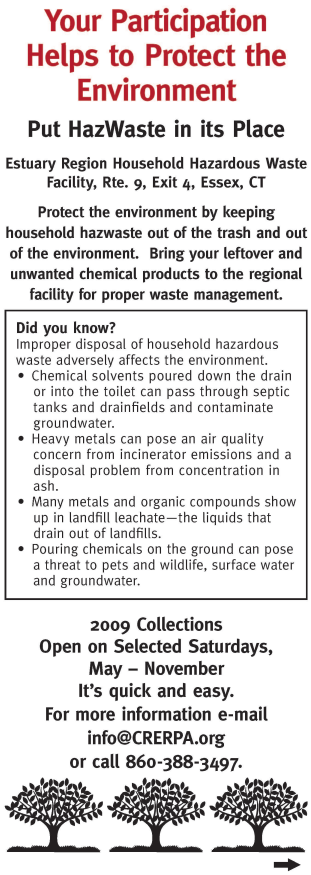
ESTUARY REGION HAZWASTE FACILITY

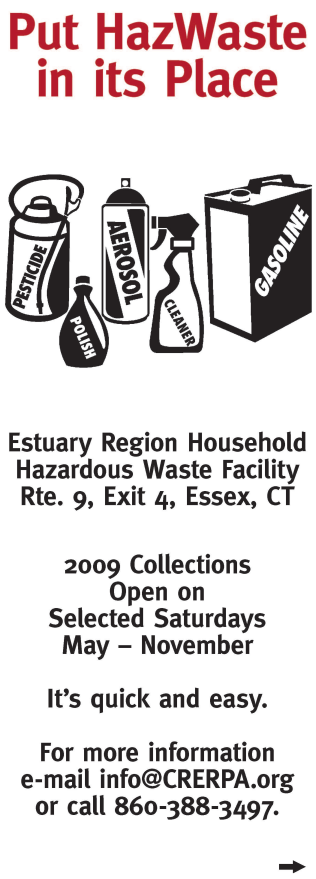
e. Perceived behavioral control

Appendix E

Message Cards: Round 2 – April 2009 (Side 1)

Note: Cards were double-sided and cut so that each was 1/3 of the card stock page to fit in a standard envelope.



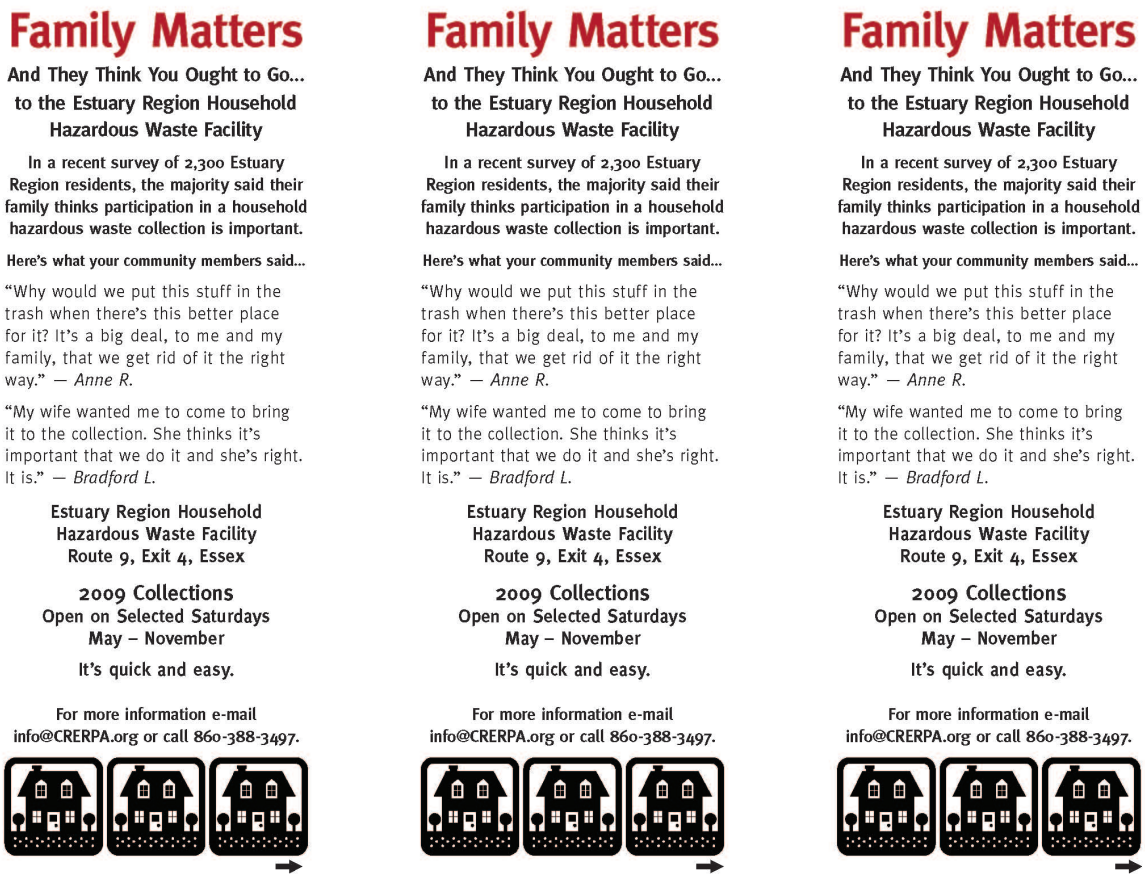


a. Attitude **b. Perceived behavioral control** **c. Attitude + Norms**

Appendix E (continued)

Message Cards: Round 2 (Side 1) - Norms Card

Note: Cards were double-sided and cut so that each was 1/3 of the card stock page to fit in a standard envelope. The Norms card displays 3 duplicates for printing purposes only.



d. Norms

Appendix E (continued)

Message Cards: Round 2 (Side 2)

Note: Cards were double-sided and cut so that each was 1/3 of the card stock page to fit in a standard envelope.

What to Bring

Household cleaners and disinfectants, bug spray, furniture polish, gasoline, weed killer, oil paint, antifreeze, drain opener, varnish, deck sealant, grub killer, mercury thermometers, solvents, arts & crafts supplies, transmission fluid, fluorescent bulbs, chemistry kits, rat poison, pool chemicals and more. Questions? Contact CRERPA. Call 860-388-3497 or e-mail: info@crerpa.org

Where to Go

Estuary Region Household Hazardous Waste Facility, Essex
Directions from Route 9, Exit 4

Driving north: straight off exit ramp; cross over RR tracks; pass CRRA transfer station; HHW facility up hill on left.

Driving south: left off exit ramp; at light, go right; cross over RR tracks, pass CRRA transfer station; HHW facility up hill on left.

When to Go

2009 Collections

Join community residents on selected Saturdays, 9 a.m. – 1 p.m.
May 16
June 6, 20
July 11
August 8, 29
September 12, 26
October 10, 24
November 7

Quick and Easy

ID required.
No fee to participate.
There is little to no wait. You stay in the car—they off-load, then you're on the road.

What to Bring

Household cleaners and disinfectants, bug spray, furniture polish, gasoline, weed killer, oil paint, antifreeze, drain opener, varnish, deck sealant, grub killer, mercury thermometers, solvents, arts & crafts supplies, transmission fluid, fluorescent bulbs, chemistry kits, rat poison, pool chemicals and more. Questions? Contact CRERPA. Call 860-388-3497 or e-mail: info@crerpa.org

Where to Go

Estuary Region Household Hazardous Waste Facility, Essex
Directions from Route 9, Exit 4

Driving north: straight off exit ramp; cross over RR tracks; pass CRRA transfer station; HHW facility up hill on left.

Driving south: left off exit ramp; at light, go right; cross over RR tracks, pass CRRA transfer station; HHW facility up hill on left.

When to Go

2009 Collections

Join community residents on selected Saturdays, 9 a.m. – 1 p.m.
May 16
June 6, 20
July 11
August 8, 29
September 12, 26
October 10, 24
November 7

Quick and Easy

ID required.
No fee to participate.
There is little to no wait. You stay in the car—they off-load, then you're on the road.

What to Bring

Household cleaners and disinfectants, bug spray, furniture polish, gasoline, weed killer, oil paint, antifreeze, drain opener, varnish, deck sealant, grub killer, mercury thermometers, solvents, arts & crafts supplies, transmission fluid, fluorescent bulbs, chemistry kits, rat poison, pool chemicals and more. Questions? Contact CRERPA. Call 860-388-3497 or e-mail: info@crerpa.org

Where to Go

Estuary Region Household Hazardous Waste Facility, Essex
Directions from Route 9, Exit 4

Driving north: straight off exit ramp; cross over RR tracks; pass CRRA transfer station; HHW facility up hill on left.

Driving south: left off exit ramp; at light, go right; cross over RR tracks, pass CRRA transfer station; HHW facility up hill on left.

When to Go

2009 Collections

Join community residents on selected Saturdays, 9 a.m. – 1 p.m.
May 16
June 6, 20
July 11
August 8, 29
September 12, 26
October 10, 24
November 7

Quick and Easy

ID required.
No fee to participate.
There is little to no wait. You stay in the car—they off-load, then you're on the road.

e. Perceived behavioral control

Appendix F

Participation in HHW Collection as a Function of Gender

Gender	Number of Survey Respondents	Number of Survey Attending Collection	Percentage Attending
Male	407	67	16.5%
Female	560	88	15.7%
No Response	16	1	6.3%
Total	983	156	15.9%

Note. There was no significant gender difference in attendance rates, χ^2 (1, N = 983) = 0.07, p =.79.

Appendix G

Participation in HHW Collection as a Function of Age

Age	Number of Survey Respondents	Number of Respondents Attending Collection	Percentage Attending
0-20[ab]	3	1	33.3%
21-30[ab]	11	1	9.1%
31-40[ab]	90	12	13.3%
41-50[a]	215	18	8.4%
51-60[b]	230	42	18.3%
61-70[b]	197	37	18.8%
71-80[b]	134	26	19.4%
80+[ab]	43	5	11.6%
No Response[b]	60	14	23.3%
Total	983	156	15.9%

Note. There were significant age differences in attendance rates, χ^2 (8, N = 983) = 17.1, p =.03. Groups which do not share common superscripts were significantly different from one another, $p < .05$.

Appendix H

Participation in HHW Collection as a Function of Race

Race	Number of Survey Respondents	Number of Respondents Attending Collection	Percentage Attending
Asian	7	0	0.0%
Black	4	2	50.0%
White	914	147	16.1%
Hispanic	10	1	10.0%
Native American	5	1	20.0%
Multiracial	4	0	0.0%
Other	2	0	0.0%
No Response	37	5	13.5%
Total	983	156	15.9%

Note. There were no significant race difference in attendance rates, χ^2 (7, N = 983) = 6.45, p =.49.

Appendix I

Participation in HHW Collection as a Function of Educational Background

Education	Number of Survey Respondents	Number of Respondents Attending Collection	Percentage Attending
Did Not Complete High School	7	0	0.0%
High School Degree	151	21	13.9%
Some College	142	24	16.9%
2-Year College Degree	86	8	9.3%
4-Year College Degree	257	41	16.0%
Graduate Degree	301	55	18.3%
Other	30	3	10.0%
No Response	23	4	17.4%
Total	997	156	15.6%

Note. 14 participants checked more than a single response. There were no significant differences in attendance rates as a function of educational background, χ^2 (7, N = 983) = 6.81, p =.44.

Appendix J

Participation in HHW Collection as a Function of Annual Household Income

Income	Number of Survey Respondents	Number of Respondents Attending Collection	Percentage Attending
Up to $49,999	142	26	18.3%
$50,000-$99,999	278	44	15.8%
$100,000+	308	44	14.3%
Declined to Say	194	29	14.9%
Did Not Know	9	1	11.1%
No Response	52	12	23.1%
Total	983	156	15.9%

Note. There were no significant differences in attendance rates as a function of income, χ^2 (5, N = 983) = 3.51, p =.62.

Appendix K

Participation in HHW Collection as a Function of Distance to Facility

Distance to Facility	Number of Survey Respondents	Number of Respondents Attending	Percentage Attending
0-5 Miles[a]	298	60	20.1%
6-10 Miles[ab]	320	56	17.5%
11-15 Miles[bc]	217	27	12.4%
Over 15 Miles[c]	74	6	8.1%
Unsure of Distance[bc]	60	5	8.3%
No Response[abc]	14	2	14.3%
Total	983	156	15.9%

Note. There were significant differences in attendance rates as a function of distance to the facility, χ^2 (5, N = 983) = 12.5, p =.03. Groups which do not share common superscripts were significantly different from one another, $p < .05$.

Appendix L
Permissions

Permission Letter Table 2

Subject: RE: request permission

Date: Mon, 25 Nov 2013 09:17:08 -0500

From: Bailey@aapcc.org

To: **********

Ms. Cabaniss

Thank you for contacting AAPCC with your request. Please consider your request approved on the condition that both tables are cited appropriately in your doctoral dissertation.

Regards

Elise

Elise Bailey, MSPH

Director, National Data Services

American Association of Poison Control Centers

515 King Street, Suite 510

Alexandria, VA 22314

o: (703) 894-1858

f: (703) 683-2812

Email: bailey@aapcc.org

Appendix L (continued)

Permission for Tables 1, 3

From: Singer.Joshua@epa.gov

To: Amy Cabaniss

Subject: RE: UW

Date: Thu, 17 Apr 2014 18:51:39 +0000

Amy:

You may use the tables. Please cite U.S. EPA as the source.

Thank you.

Josh Singer

U.S. EPA, Region 5

phone: 312-353-5069

singer.joshua@epa.gov

Appendix L (continued)

Permission Letter for Table 4, Figures 1, 4, Appendices D, E-Message Cards
(Formerly Connecticut River Estuary Regional Planning Agency)

Connecticut
River
Valley
Council of Governments
September 12, 2014

Re: Permission for use of CRERPA or RiverCOG logo, data and graphics
Dear Ms. Cabaniss,
Chester, Clinton, Cromwell,
Deep River, Durham, East Haddam,
East Hampton, Essex, Haddam,
Killingworth, Lyme, Middlefield,
Middletown, Old Lyme,
Old Saybrook, Portland, Westbrook

We're pleased to hear that you are nearing the completion of your dissertation. The work that you did as part of your research has been of great benefit to the region.

In response to your request for permission to use CRERPA or LCRVCOG data, graphics, specifically Figure 1, Table 4, and the message cards in the appendix, within the dissertation, you are able to reprint those items and any other data associated with LCRVCOG that was used in the research.

We wish you luck.

Jean Davies

Interim Director

Appendix L (continued)

Permission Letter for Figures 3, 5

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Content to be included is:
P. 8 Figure 1-1 Theory reasoned action applied to health seeking behavior(Factors determining a person's behavior)

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