Nudging U.S. consumer willingness to pay for microplastic mitigation technology

Jacob Waugh[1,2], Katherine Westerman[1], Sonia Refulio-Coronado[1], Dr. Emi Uchida[1]

[1] *Department of Environmental and Natural Resource Economics, University of Rhode Island, Kingston, RI*

[2] *O'Neill SPEA, Indiana University, Bloomington, IN*

CONTEXT

Synthetic microfibers are one of the most prevalent sources of marine microplastic (MP) pollution, with much of this pollution linked to the laundering of synthetic-fiber based clothing.

With a growing number of sustainable laundry products (i.e., water filters, washing bags), consumers can reduce household microfiber emissions through various cost-effective, low effort products. **Currently, consumer adoption of such products remains low.**

Behavioral science literature establishes **informational nudges and message frames** as effective tools for promoting behavioral change across various domains, including environmental choices. Few studies exist linking nudges and microplastic-generating behaviors, and, to date, no known study applies nudge theory to laundering behavior in a microplastic context.

Out study deploys **information interventions** before a consumer is presented with a choice, measuring the effect of purely introducing new information and how **framing effects** enhance the effectiveness of information nudges.

PURPOSE

Objective: Understand how **informational nudges and message frames** affect consumer behavior and intentions towards sustainable laundry technology and willingness to pay for municipal wastewater treatment microplastic upgrades.

Primary Outcomes:

1) Consumer intent to purchase (ITP) sustainable laundry technology
2) Consumer willingness to pay (WTP) for sustainable laundry tech
3) Consumer willingness to pay, through taxes, for improvements to municipal wastewater microplastic removal

Secondary Outcomes: Self-reported environmental concern, environmental self-efficacy, and environmental responsibility; previous levels of environmental/microplastic knowledge

THEORY AND METHODS

We apply the **Theory of Planned Behavior** (Azjen, 1991), **Nudge Theory** (Thaler & Sunstein, 2009), and **Random Utility Theory** (McFadden, 1972).

To determine causal effect, we employ a **randomized controlled trial (RCT)** through an **online survey**. We designed the survey instrument in Qualtrics, and we will be using Prolific to recruit a nationally representative sample. Our RCT design includes one control and two treatment arms. We primarily analyze our data using discrete choice models: **a traditional logit for WTP and an ordinal logit for ITP** to accommodate Likert values**.**

$$WTP_i(yes = 1) = \propto + \beta_1 treatment1_i + \beta_2 treatment2_i + \beta_3 bid_i + \varepsilon_i$$

$$ITP_i(Agree, Strongly\ Agree = 1) = \propto + \beta_1 treatment1_i + \beta_2 treatment2_i + \varepsilon_i$$

SURVEY

Eligible respondents are **randomly and evenly assigned** to control, treatment 1, or treatment 2.

- **Treatment 1** - receives expanded information in Figure 1 (left), focusing on MP locations, dangers, sources, and mitigation behaviors.
- **Treatment 2** – receives the information in Figure 1 (right), adding supplemental statements of **government and industry action and a collective action message framing**
- **Control** – only receives MP definitions

Eligible respondents receive information about 3 sustainable laundry products (shown in Figure 2) based on real market products. **We then measure three key outcomes of interest:**

Outcome of Interest #1

- Each respondent indicates their **ITP for each product** (5-part Likert).

Outcome of Interest #2

- Respondents indicate **WTP for each product** with a **single-bounded dichotomous choice question.**

Outcome of Interest #3

- Next, we **measured consumer WTP, through property taxes, for MP improvements to local municipal wastewater treatment facilities.**
  - Single-bounded dichotomous choice contingent valuation question

"…Suppose the only way to achieve a 99% microplastics reduction by your local wastewater treatment facility is through a property tax increase. If the upgrades are implemented, your property taxes would increase one time by [RANDOM] US Dollars.

Would you be willing to pay an additional [RANDOM] US Dollars in property taxes to support this improvement?"

Figure 1. Treatment 1 infographic (left) and Treatment 2 infographic (right)

Microplastic Removal	98%	90%	30%
Compatibility	All washing machines	All washing machines	All washing machines
Installation	10 minutes, no tools needed	No installation needed	No installation needed

Figure 2: Information about sustainable laundry products. Products based on PlanetCare filter (left), GUPPYFRIEND Washing Bag (middle), and Cora Ball (right).

RESULTS

Design Survey → Submit to IRB → REVISE → IRB Approval → Local Pretest → REVISE → Sample Pretest → REVISE → Distribute Survey

Figure 3

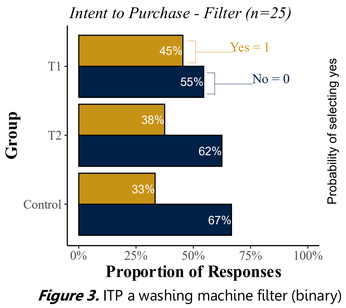

Figure 3. ITP a washing machine filter (binary) across treatment groups

Figure 4

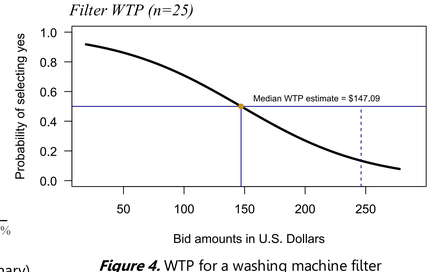

Figure 4. WTP for a washing machine filter (yes/no) for all eligible respondents

Table 1

SBDC CV Model for Filter (n=25)

Ind. Variables	DV: WTP, in USD β	SE
Group		
(Intercept)	3.022	1.569
Treatment 1	-0.961	1.252
Treatment 2	0.718	1.465
Bid		
	-0.019*	0.007

Note: Significance levels - * 0.05

Table 1. Logit output for filter WTP using sbchoice() R package

Figure 5

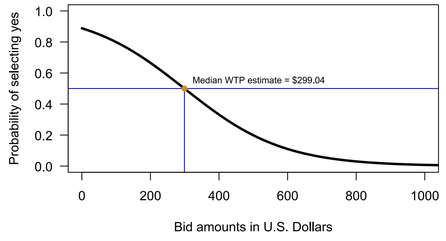

Figure 5. WTP for wastewater upgrades (yes/no) for all respondents

Table 2

SBDC CV Model for Wastewater Upgrades (n=32)

Independent Variables	DV: WTP, in USD β	SE
Group		
(Intercept)	2.685*	1.283
Treatment 1	-1.002	1.035
Treatment 2	-0.833	1.078
Bid		
	-0.007	0.006

Note: Significance levels - * 0.05

Table 1: Logit output for wastewater upgrades WTP using sbchoice() R package

NEXT STEPS

- Distribute larger pretest with larger sample (n=200) to further inform survey design and power calculations
- Revise survey instrument according to pretest results
- Distribute final survey instrument to nationally representative sample
- Analyze, analyze, analyze

REFERENCES

Azjen, I. (1991). The theory of planned behavior. *Organizational Behavior and Humnan Decision Processees, 50,* 179-211.

McFadden, D. (1972). Conditional logit analysis of qualitative choice behavior.

Thaler, R. H., & Sunstein, C. R. (2009). *Nudge: Improving decisions about health, wealth, and happiness.* Penguin.

ACKNOWLEDGEMENTS

This work is supported by the U.S. National Science Foundation under Award #2348968, REU Site: URI Plastic Initiative at the University of Rhode Island, and the Donald R. Wilson Jr. Family Foundation. Partial support for professional development activities was provided by EPSCoR Cooperative Agreement #OIA-2433276 and the RI Commerce Corporation through the Science and Technology Advisory Committee. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the funding partners.