Impact of information nudges on willingness to pay to remove microplastics from drinking water: Evidence from an online randomized experiment

Annalise Wabler[1,2], Sonia Refulio-Coronado[1], Katherine Westerman[1], Emi Uchida[1]
[1]Department of Environment and Natural Resource Economics, University of Rhode Island
[2]School of Environment and Natural Resources, Ohio State University

Background

- The average person consumes up to five grams of microplastics a week, primarily though drinking water[1].
- Some filters are effective in removing microplastics, but it is unknown how much people use them and what influences their willingness to pay for them.
- **Knowledge has proven to influence willingness to pay** and pro-environmental behaviors related to microplastics in previous studies[2].
- This will be one of the first studies to examine the impact of a nudge in the context of reducing personal exposure to microplastics.

Research Question

How does information about microplastics influence willingness-to-pay for water filters that remove them?
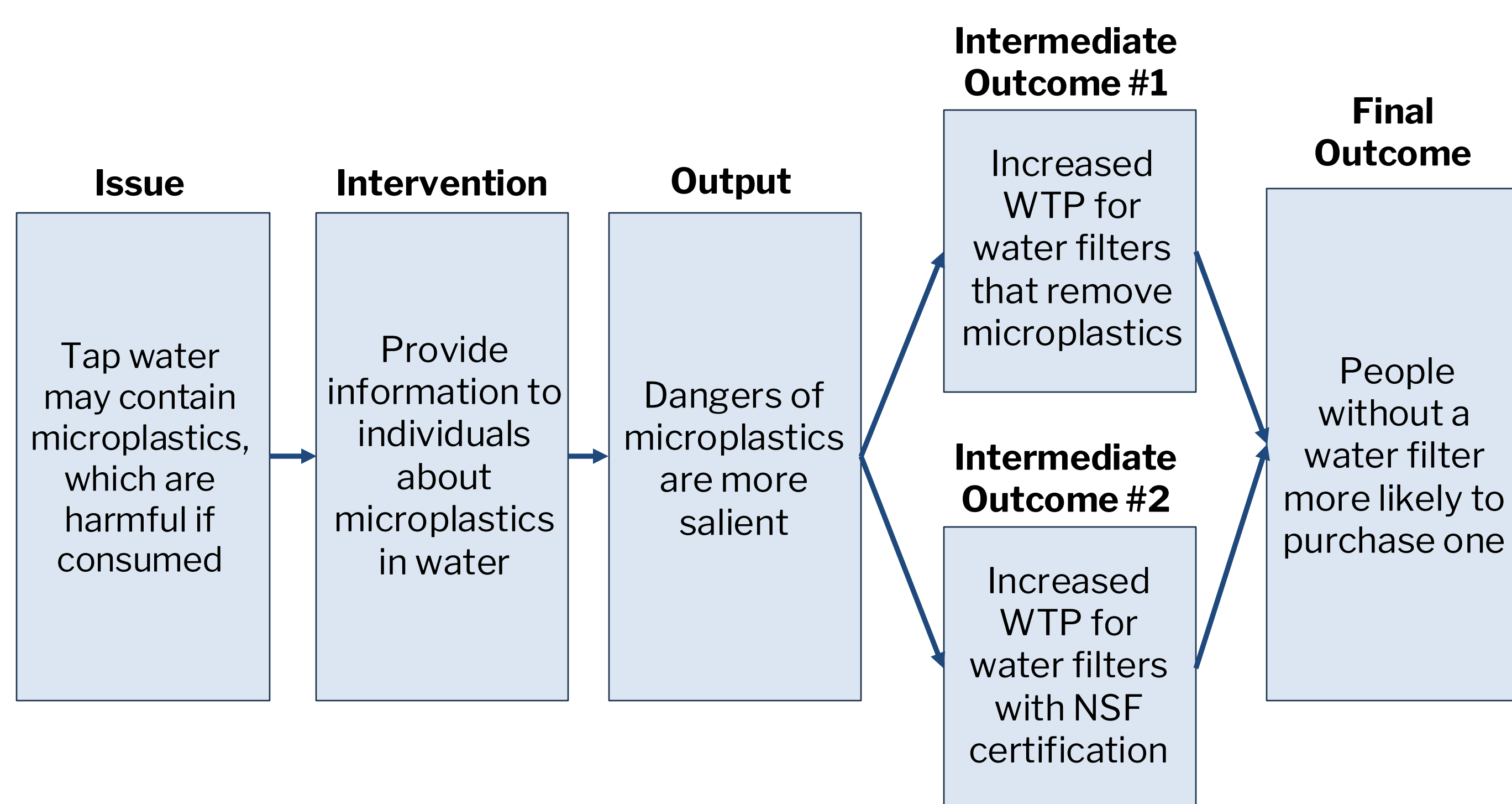
Theory of Change

Fig. 1 – Theory of Change framework. Demonstrates the reasoning behind conducting our experiment as a means toward addressing the issue of microplastics in drinking water (WTP = willingness to pay).

Methods

- Participants are recruited through Prolific for a survey designed and administered in Qualtrics.
- There are **two** parts to this survey:
  1. Randomized Control Trial
  2. Discrete Choice Experiment

Part 1: Randomized Control Trial

- Respondents' primary water source is recorded. If they do not already have a microplastic-removing water filter, they are randomly assigned to treatment and control groups.

Control Group

Receives a simple definition of microplastics

Treatment Group

Receives an infographic about microplastics, their health effects, and how many they may be consuming based on their primary water source [1][3].

Methods

Control group receives only this information

Information at bottom is personalized by water source

You might be drinking plastic.

Microplastics, teeny tiny pieces of plastic, are in most drinking water. Without the right filter, you are likely consuming plastic.

Microplastics are tiny pieces of plastic litter, often shed from larger items. Some are even too small to see without a microscope.

Health effects of consuming microplastics include male and female **infertility**, **cancer**, and **slowed metabolism**.

"Microplastic" by Oregon State University is licensed under CC BY-SA 2.0

What this means for you:

You indicated your water filter is **not** optimized to remove microplastics. The average person consumes up to 5 grams of microplastic every week, primarily through drinking water, meaning **you could be consuming a credit card's worth of plastic each week**.

Sources: Haleem et al., 2024; Senathirajah et al., 2021
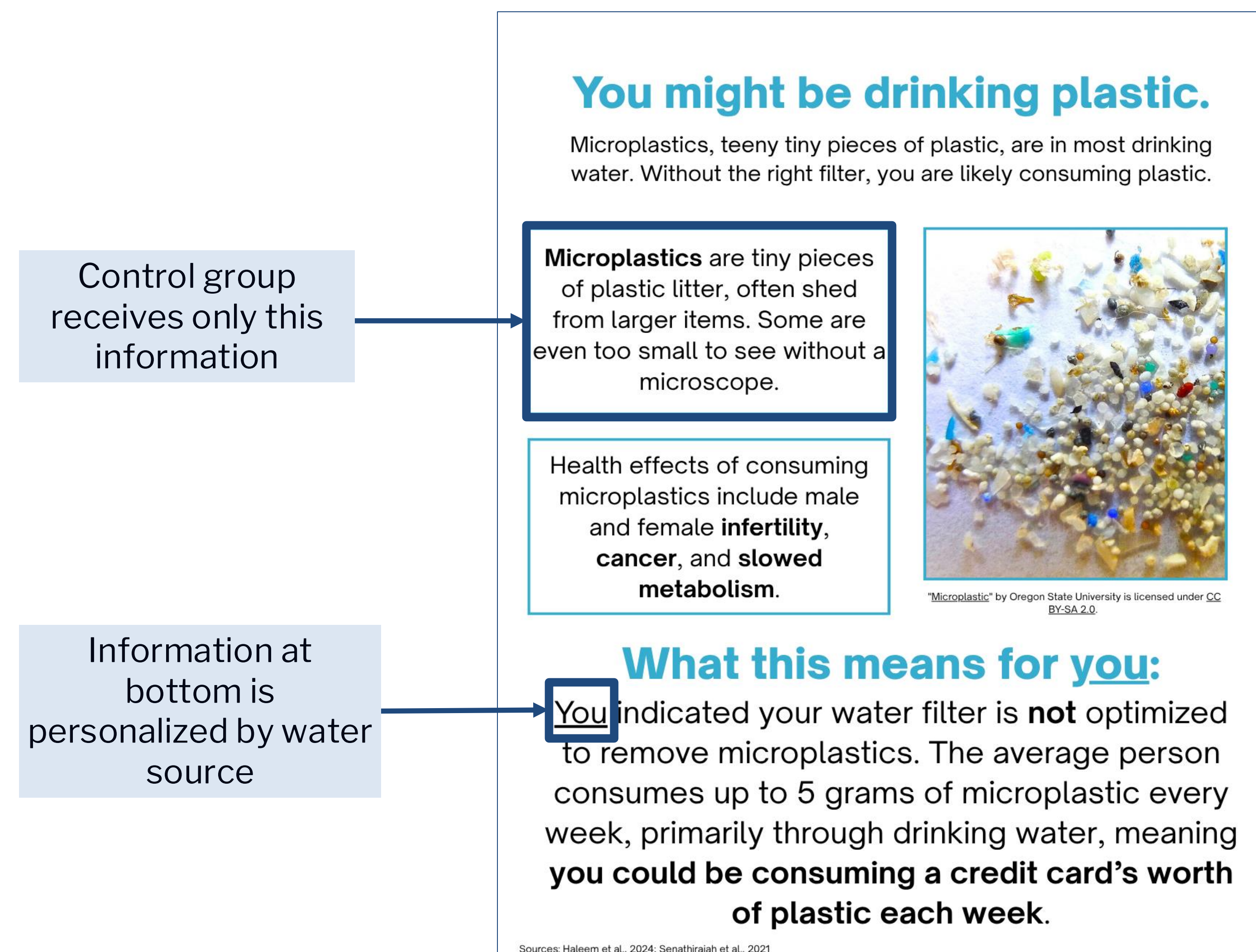
Fig. 2 – Infographic for population with water filter.

- This information is a type of **nudge,** an intervention designed to change people's behavior without restricting their choices[4].
- We measure the impact of this infographic on willingness to pay for water filters that remove microplastics using a Discrete Choice Experiment.

Part 2: Discrete Choice Experiment

Attributes	Levels
Type	Faucet
	Dispenser
	Pitcher
Price	$15
	$25
	$40
	$55
	$70
	$80
MP removal	No
	Yes
NSF certified	No
	Yes

Respondents are randomly assigned to one of six blocks (generated using Stata's dcreate package) which prompt them to choose between two water filters which vary by four **attributes** (Fig. 3).

Each block contains five **choice sets** (Fig. 4).

Fig. 3– Filter attributes and their possible values.

Characteristic	Filter A	Filter B	Neither
Type of filter	Dispenser	Pitcher	
Removes microplastics?	Yes	Yes	I would not purchase either filter
Certified?	No	Yes	
Price	$80	$40	

Fig. 4 – A choice set from the survey.

- Discrete choice experiment was designed given assumptions from Random Utility Theory[5].

- The representative utility function, which represents the observed utility a decision maker receives from each attribute and the information treatment effect, is expressed below.

$$V_{ij} = \propto + \beta_1 type_i + \beta_2 price_i + \beta_3 MPremoval_i + \beta_4 NSFcert_i + \beta_5 MPremoval \times treatment + \varepsilon_{ij}$$

- We interact attribute variables with treatment variable to estimate the impact of the information treatment on utility for each attribute.

Expected Results

- We hypothesize higher willingness to pay for water filters that remove microplastics among the treatment group.

- We hypothesize a similar, but smaller increase in willingness to pay for water filters *certified* to remove microplastics.

Future Work

Remainder of this study:
1. Finish pretest (send to roughly 200 participants)
2. Send surveys to full sample size (minimum 600 participants)
3. Run conditional & mixed logit regressions in RStudio to determine difference in willingness to pay between treatment and control groups
   - **Conditional logit**:
     - Preliminary
     - Assumes everyone has same preferences (heterogeneity)
   - **Mixed logit**:
     - Accounts for different preferences from different demographic groups (age, gender, income, etc.)
4. Compare demographic and attitude/knowledge data from population with MP-removing water filters and population without

Future studies:
- This study examines participants' *stated* preferences.
- If intervention works → *revealed* preference study
   - Do these preferences hold in a real purchasing environment?

Policy applications: (if intervention is successful)
- Information = cheap and non-controversial policy measure
- Reason to adopt: reduce individuals' exposure to microplastics through drinking water
- Can serve as a good complement to more effective traditional fiscal policy measures[6].
   - Combined to reduce cost while maintaining effectiveness

Acknowledgments

References

[1] Senathirajah, K., Attwood, S., Bhagwat, G., Carbery, M., Wilson, S., & Palanisami, T. (2021). Estimation of the mass of microplastics ingested – A pivotal first step towards human health risk assessment. *Journal of Hazardous Materials, 404*, 124004. https://doi.org/10.1016/j.jhazmat.2020.124004
[2] Garcia-Vazquez, E., & Garcia-Ael, C. (2021). The invisible enemy. Public knowledge of microplastics is needed to face the current microplastics crisis. *Sustainable Production and Consumption, 28,* 1076–1089. https://doi.org/10.1016/j.spc.2021.07.032
[3] Haleem, N., Kumar, P., Zhang, C., Jamal, Y., Hua, G., Yao, B., & Yang, X. (2024). Microplastics and associated chemicals in drinking water: A review of their occurrence and human health implications. *Science of The Total Environment, 912,* 169594. https://doi.org/10.1016/j.scitotenv.2023.169594
[4] Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness.* Yale University Press.
[5] McFadden, D. (1974) Conditional Logit Analysis of Qualitative Choice Behavior. Frontiers in Econometrics, 105-142.
[6] Carlsson, F., Gravert, C., Johansson-Stenman, O., & Kurz, V. (2021). The use of green nudges as an environmental policy instrument. *Review of Environmental Economics and Policy, 15*(2), 216–237. https://doi.org/10.1086/715524