

Encouraging Residential Water Conservation Using Behavioral Science

Colin Kuehl
Assistant Professor
Northern Illinois University

Prepared for:
California Water Efficiency Partnership
March Plenary Meeting
March 14th, 2019



Northern Illinois
University



WBP Research Group
UC Santa Barbara Water Use, Behavior, and Policy

How can use messaging to best encourage individuals to voluntarily conserve water?*

How can use messaging to best encourage individuals to voluntarily conserve water?*

Overview

How can use messaging to best encourage individuals to voluntarily conserve water?*

Overview

Voluntary Demand Management

How can we use messaging to best encourage individuals to voluntarily conserve water?*

Overview

Voluntary Demand Management
The IMB Model

How can we use messaging to best encourage individuals to voluntarily conserve water?*

Overview

Voluntary Demand Management

The IMB Model

Testing our Approach

The Water Management Toolbox



1. Increase Supply
2. Reducing Demand:
 - Change the price
 - Change the laws



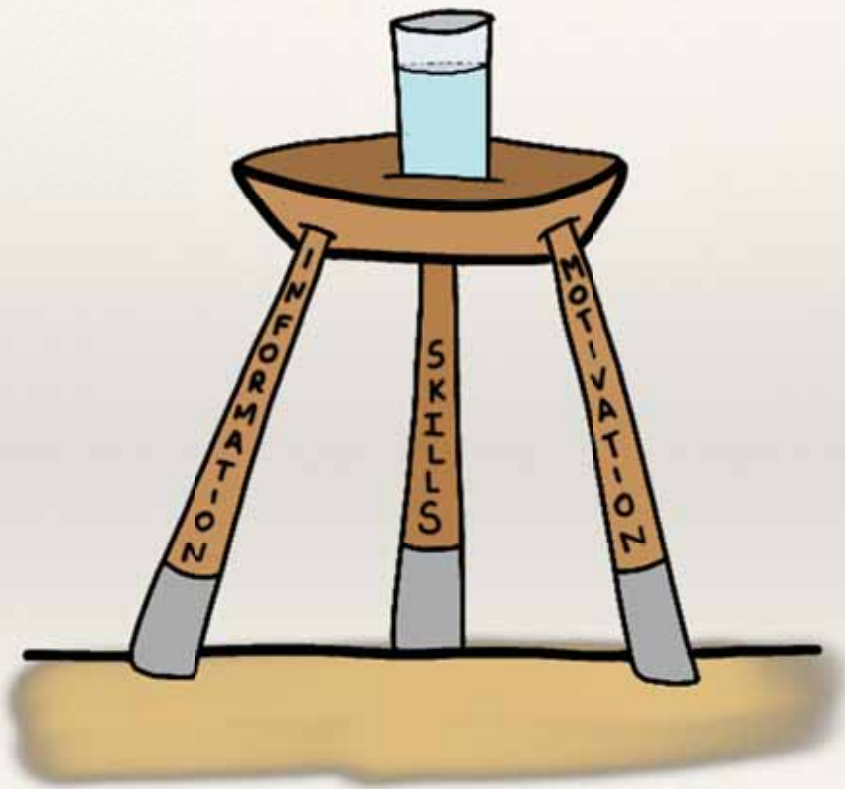
The Water Management Toolbox



1. Increase Supply
2. Reducing Demand:
 - Change the price
 - Change the laws
 - **Message Effectively**



What does behavioral science say?

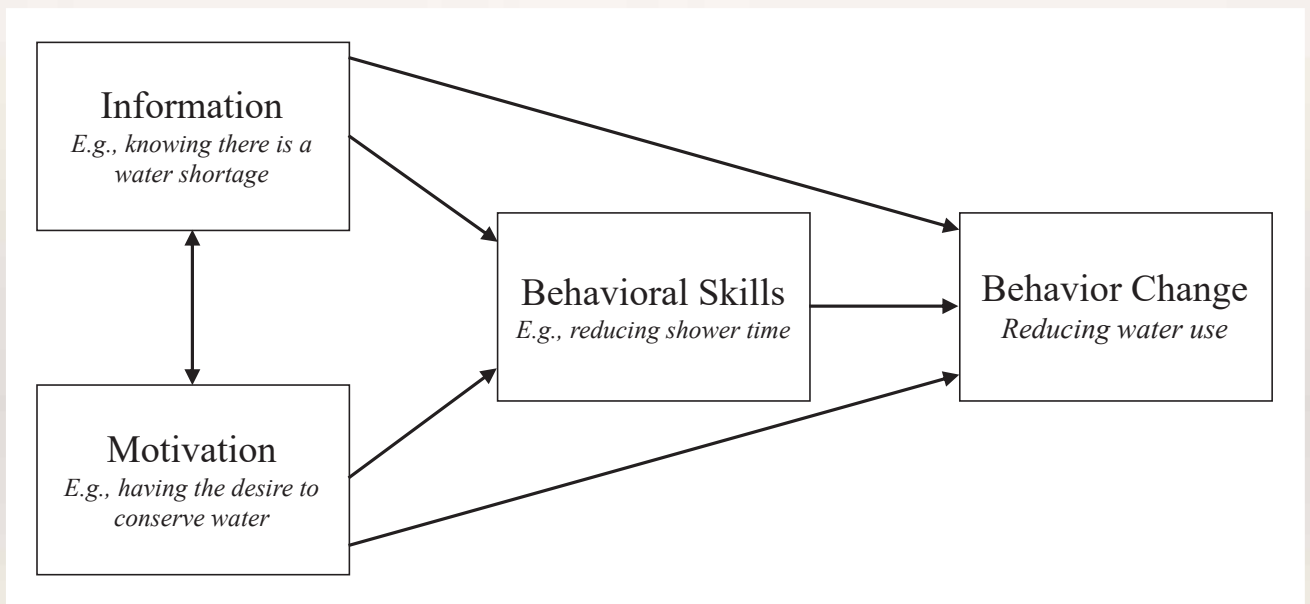


The Information, Motivation, Behavioral Skills(IMB) Model

- ❖ Information - individuals' knowledge of the problem
- ❖ Motivation - individuals' reason for engaging in a target behavior
- ❖ Behavioral Skills- individuals' objective and perceived ability to engage in a target behavior

The IMB Model of Behavior Change

(J. D. Fisher & Fisher, 1992)

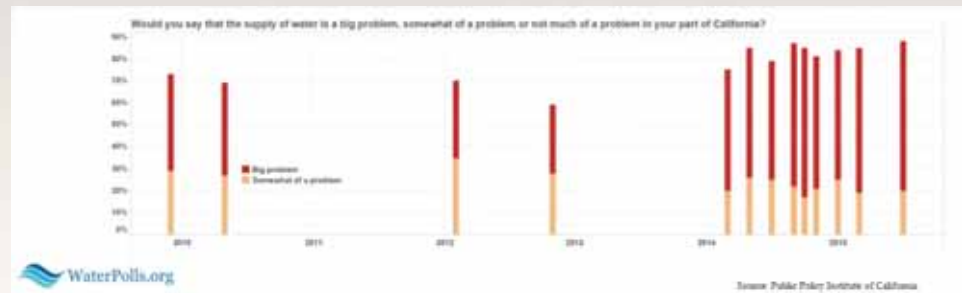


Information



An individuals' knowledge of the problem and its consequences

Knowledge of environmental problems is usually insufficient for behavior change



Motivation

- ❖ individuals' reason for engaging in a target behavior
- ❖ Examples:
 - ❖ Social Norms
 - ❖ Identity



Motivation - Social Norms

Interventions that provide information on relevant behaviors of others.

- ❖ Perceptions of which behaviors are typically performed by a relevant peer group



As we enter the summer months, we thought that you might be interested in the following information about your water consumption last year:
Your own total consumption June to October 2006: 52,000 gallons
Your neighbors' average (median) consumption June to October 2006: 35,000 gallons
You consumed more water than 73% of your Cobb County neighbors.

Example of a social norm message in water conservation. From Ferraro and Price (2013)

Motivation - Identity

Making a behavior relevant to an identity



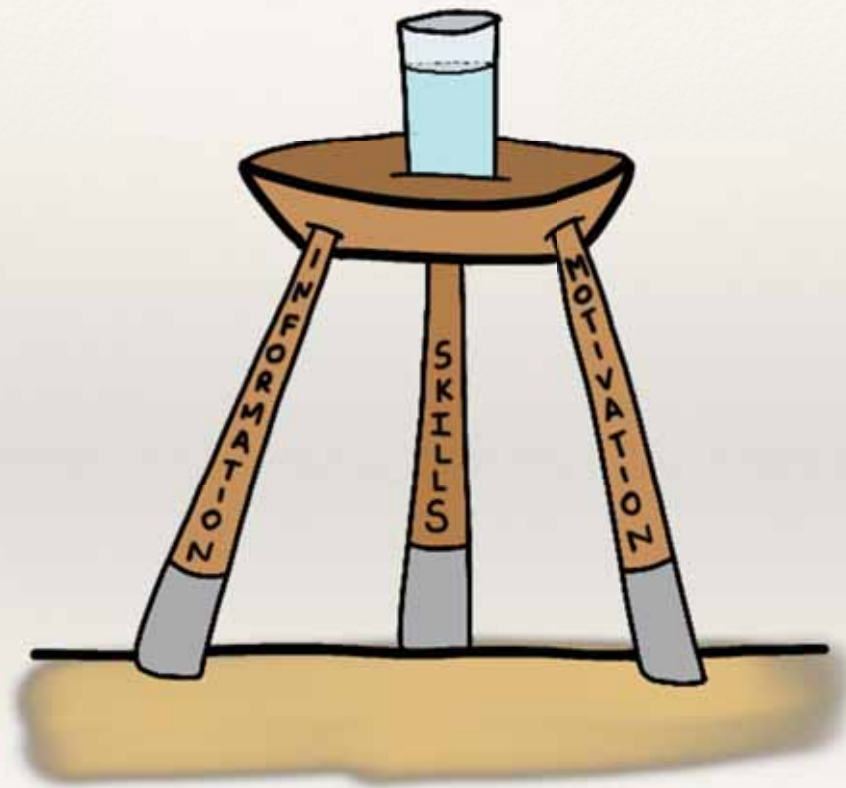
Tiefenbeck, et al. 2013

Behavioral Skills

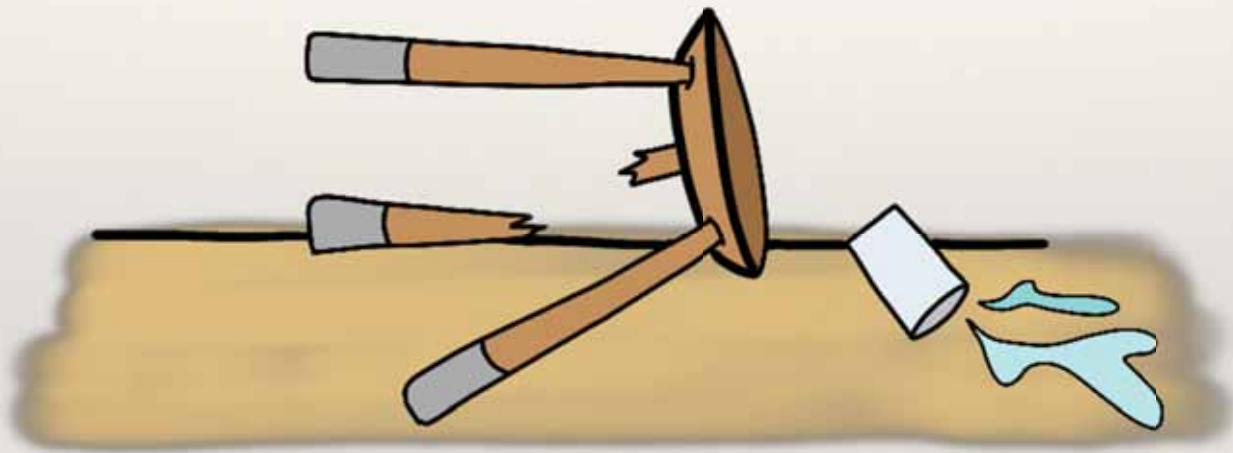
- ❖ Individuals' objective and perceived ability to engage in a target behavior
- ❖ Specific behavior changes
 - ❖ Not information on the problem(information)
 - ❖ Or the need to do something about it (motivation)



IMB Model



IMB Model



*Each component is necessary, but not sufficient

IMB Approach to Designing Interventions

Elicitation – Design & Implementation -Evaluation



Testing the IMB Model

Field Experiment: IMB and Water Use Behavior

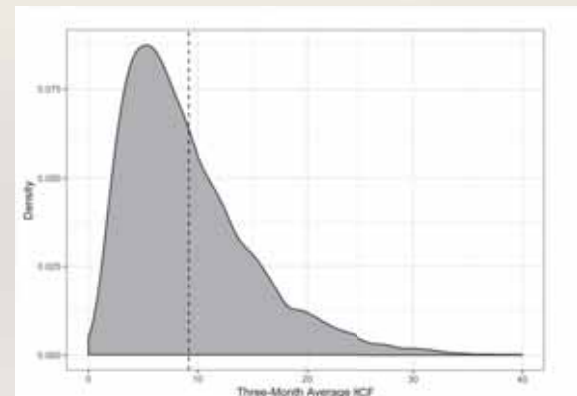
Elicitation – Design & Implementation -Evaluation

- Context
 - November 2018 -January 2019
 - Suburban California Water District
 - Among highest conservation rates during the drought
 - Focus groups revealed:
 - High levels of information
 - Most had already adopted water saving techniques
 - Resistance to further efforts to encourage conservation

Field Experiment: IMB and Water Use Behavior

Elicitation – **Design & Implementation** -Evaluation

- Single Family Residences
 - 2-27 Avg HCF(June, July, August)
- Form of Messaging
 - - Magnet
 - - Postcard (two weeks later)
- Outcome Measure: Change in HCF



Field Experiment: IMB and Water Use Behavior

Elicitation – **Design & Implementation** -Evaluation

Customers randomly assigned to one of four groups.

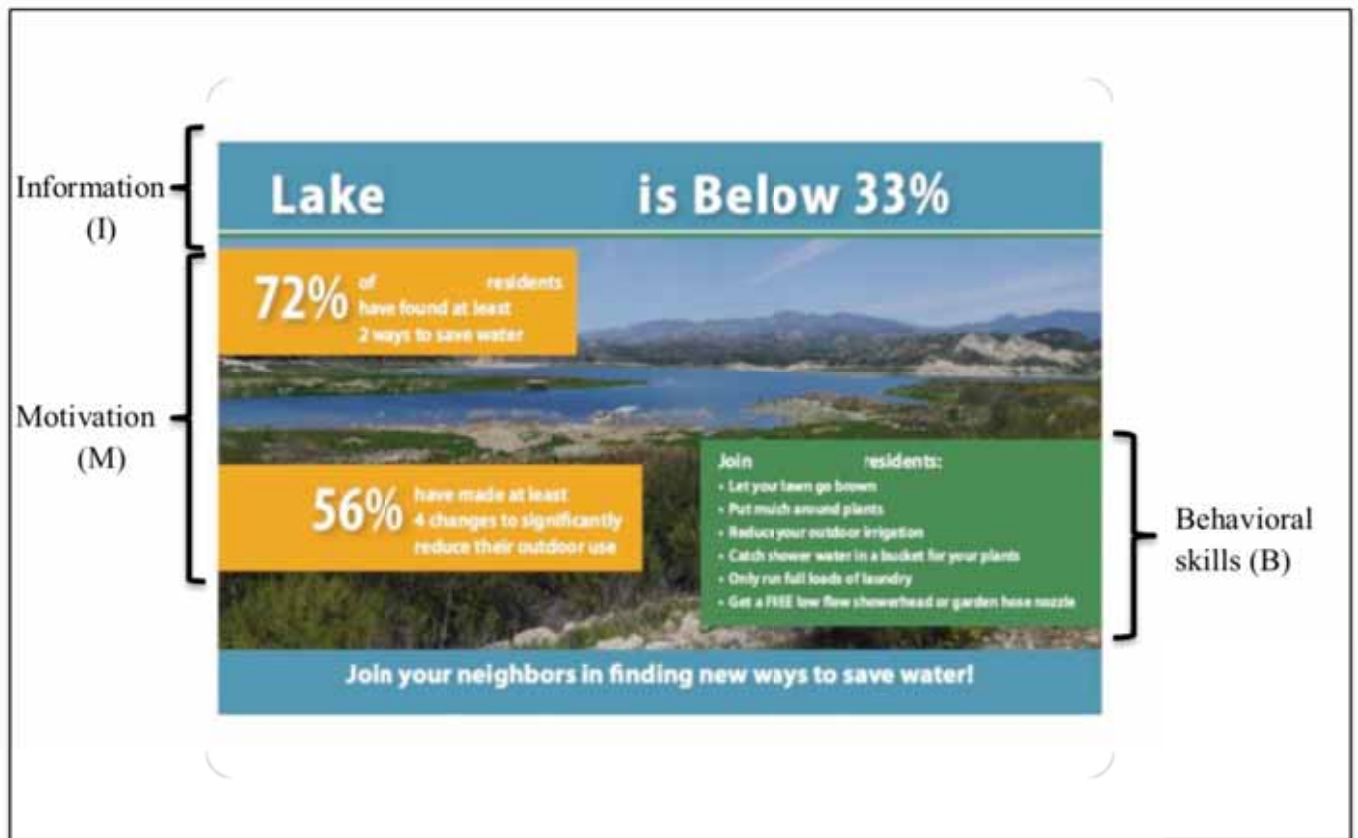
- 1) I: information only
- 2) M: information + motivation
- 3) IMB: information + motivation + behavioral skills
- 4) Control: No contact from the researchers

2500 per group

Hypotheses

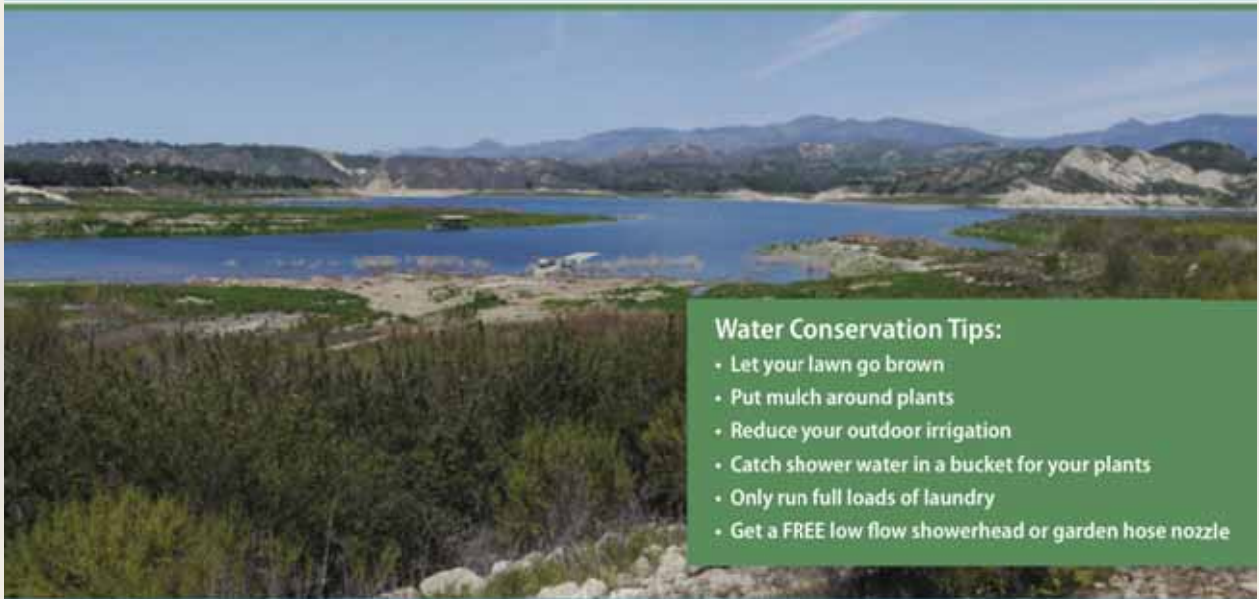
	Control	IMB	IB	IM
Control				
IMB	IMB < Control			
IB	IB < Control	IMB < IB		
IM	IM < Control	IMB < IM	No prediction	

IMB



IB

is Below 33%



Water Conservation Tips:

- Let your lawn go brown
- Put mulch around plants
- Reduce your outdoor irrigation
- Catch shower water in a bucket for your plants
- Only run full loads of laundry
- Get a FREE low flow showerhead or garden hose nozzle

Find new ways to save water!

IM

is Below 33%

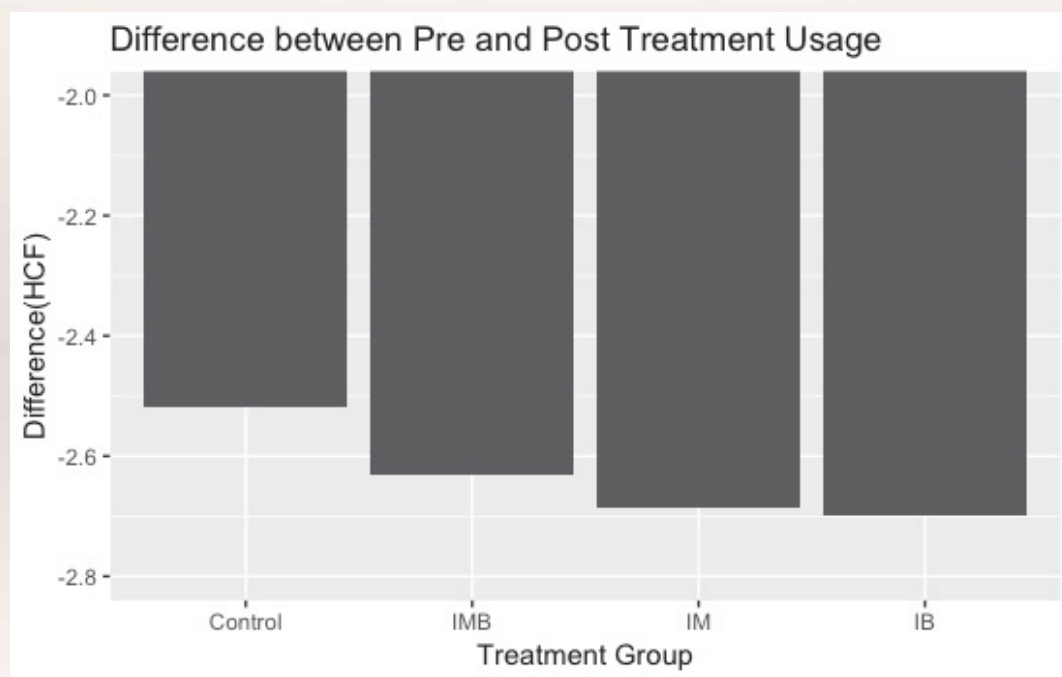
72% of residents
have found at least
2 ways to save water

56% have made at least
4 changes to significantly
reduce their outdoor use

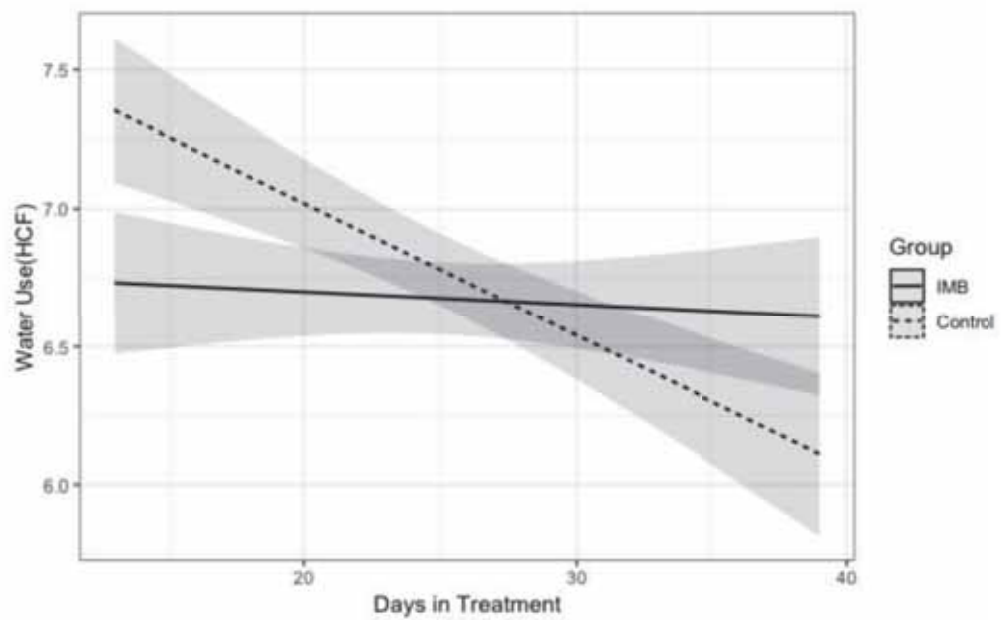
Join your neighbors in finding new ways to save water!

Field Experiment: IMB and Water Use Behavior

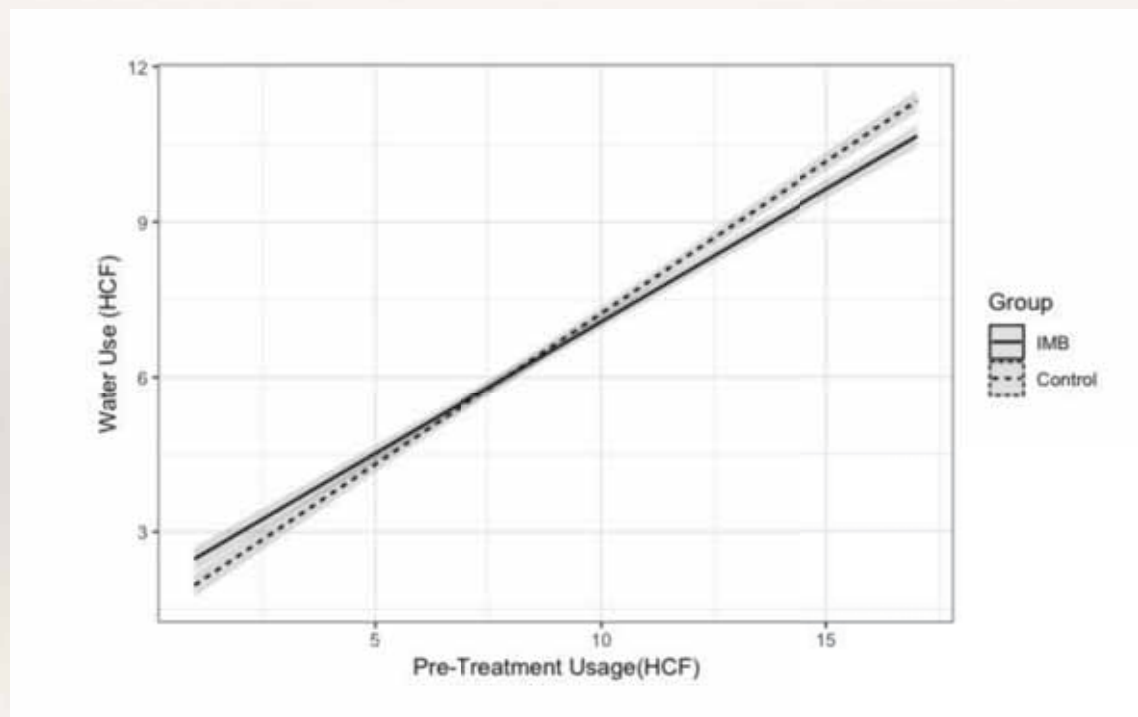
Elicitation – Design & Implementation -**Evaluation**



Diminishing Effects



Differing Effects by Usage



Field Experiment: IMB and Water Use Behavior

Elicitation – Design & Implementation -**Evaluation**

- ❖ Users who received treatments conserved more water than control
- ❖ The effect of IMB was greater than IM or IB (Depending on statistical model and subset used)
- ❖ Effect size was small (less than 2%) and lasted on average about 3 weeks.
- ❖ Hypotheses “passed” a hard test

Voluntary Behavior Change

- ❖ Limitations
 - ❖ Relatively Potential Reductions (2-5%)
 - ❖ Meaningful Effects have Short timeframe
- ❖ Benefits
 - ❖ Cheap- already in contact with residents
 - ❖ Quick - does not require significant investment

Future Research

- ❖ Differing forms of motivation, information, behavior skills
- ❖ Differences between high vs low usage users
- ❖ Length of effects using smart meters
- ❖ Spillover to electricity use

Take-Aways

- ❖ Add voluntary behavior change to your conservation toolbox
- ❖ Effective messaging contains information, motivation, and behavioral skills
 - ❖ Information is not enough
- ❖ Randomized field experiments



Questions?

Our Team

Colin Kuehl

Northern Illinois University
ckuehl@niu.edu

Phil Ehret

CoBro Consulting/ See Change Institute
phillip@sechangeinstitute.com

Heather Hodges
UC Santa Barbara



Sarah Anderson
UC Santa Barbara

Cameron Brick
University of Cambridge

Supplemental Slides

Table 3. ANCOVA Analyses of Treatment Effects

	November Reading			December Reading		
	Model A	Model B	Model C	Model A	Model B	Model C
Intercept	1.92* (0.78)	3.16* (1.57)	3.24* (1.58)	2.55*** (0.18)	3.11*** (0.30)	2.43** (0.36)
IMB Treatment	0.21 (0.21)	-2.67 (2.19)	-3.36 (2.21)	-0.10 (0.11)	-1.33** (0.41)	-0.94 (0.51)
IM Treatment	0.097 (0.21)	-0.98 (2.15)	-0.96 (2.20)	-0.17 (0.11)	-0.57 (0.41)	0.042 (0.51)
IB Treatment	0.041 (0.22)	-1.10 (2.22)	-1.01 (2.24)	-0.16 (0.11)	-0.76 (0.41)	0.026 (0.51)
Baseline Use (HCF)	0.46*** (0.014)	0.46*** (0.014)	0.51*** (0.031)	0.55*** (0.007)	0.55*** (0.007)	0.59*** (0.014)
Days in Treatment	0.000 (0.023)	-0.017 (0.047)	-0.039 (0.047)	0.032*** (0.006)	-0.054*** (0.011)	-0.048*** (0.011)
IMB*Days in Treatment		0.087 (0.065)	0.075 (0.066)		0.049** (0.016)	0.043** (0.016)
IM*Days in Treatment		0.027 (0.065)	0.037 (0.066)		0.016 (0.016)	0.010 (0.016)
IB*Days in Treatment		0.034 (0.066)	0.039 (0.067)		0.024 (0.016)	0.015 (0.016)
Parcel Size (Acres)			-0.254 (0.172)			0.015 (0.046)
Dwelling Size (ft ²)			-0.000 (0.000)			0.000 (0.000)
IMB* Baseline Use			0.019 (0.044)			-0.074*** (0.020)
IM* Baseline Use			-0.153*** (0.044)			-0.062*** (0.020)
IB* Baseline Use			-0.091* (0.043)			-0.068*** (0.020)
IMB* Parcel Size			0.315 (0.232)			0.019 (0.057)
IM* Parcel Size			0.109 (0.226)			-0.005 (0.052)
IB* Parcel Size			0.23 (0.21)			-0.034 (0.068)
IMB* Dwelling Size			0.001 (0.000)			0.000 (0.000)
IM* Dwelling Size			0.001 (0.000)			0.000 (0.000)
IB* Dwelling Size			0.000 (0.000)			0.000 (0.000)
R ²	.230	.230	.237	.420	.421	.421
N	3395	3395	3395	9980	9980	9980

Note: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Standard errors in parenthesis. Reference group is control group.

Balance Table

	Baseline Water Use	Parcel Size	House Size	November Water Use	November Days in	December Water Use	December Days in	N
IMB	9.18	.499	1549	7.30	3.36	6.66	25.1	2500
IM	9.09	.591	1575	7.38	3.32	6.53	25.1	2491
IB	9.23	.467	1587	7.39	3.40	6.63	24.8	2499
Control	9.23	.513	1562	7.19	3.20	6.79	25.0	2497