Issue framing and public willingness to pay water and sewer rate increases

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Manuel P. Teodoro
University of Wisconsin-Madison
mteodoro@wisc.edu

Abstract

This study uses an embedded survey experiment to evaluate the effects of issue framing on willingness to pay water and sewer rate increases. Government-owned utilities require public support for financial resources, and so managers must communicate the value of their services to their customers. Water and wastewater utilities provide several benefits; little systematic evidence exists on which resonate with the public. In this study, respondents in a U.S. national survey were randomly assigned to one of four framing treatments in a question about support for a hypothetical rate increase: *reduced pollution, safer drinking water, better tasting drinking water*, and *low-income affordability*. Compared with the other treatments, the *safer drinking water* framing yielded 11.2% greater average willingness to pay a rate increase. Multivariate analysis shows that Republican partisans and women responded especially positively to *safe drinking water* framing. Results have important implications for utilities' outreach and public communications efforts.

1 | Introduction

This study uses an experiment embedded in a public opinion survey to evaluate the effects of issue framing on willingness to pay water and sewer rate increases. In much of the United States and elsewhere, water and sewer systems are owned and operated by public agencies, and so responsibility for water and sewer systems lies with elected officials, who are ultimately accountable to voters. To the extent that these utilities rely on service rates for financial resources, increased investments in utility capital and operations require public support for rate increases. Communicating the value of these critical systems to the public is therefore a perennial concern for utility leaders.

Although the significance of public support for water and wastewater systems is widely recognized, little systematic evidence exists on how to frame utility services in ways that garner support for rate increases. Water and sewer utilities can provide many benefits, including a cleaner environment, fire suppression, economic prosperity, safe drinking water, and more. How does consideration of these various benefits shape the public's willingness to pay more for water and sewer services? Can highlighting specific benefits associated with water and sewer services affect customer perceptions of value? In the language of public opinion research, how does the *framing* of water and sewer utilities shape public support for or opposition to potential rate increases?

Seeking to bring greater clarity and practical value to research on water sector communications, this study uses experimental data from a U.S. national public opinion survey to evaluate the effects of issue framing on support for water and sewer rate increases. Respondents were asked whether they would be willing to pay for "modest" water and sewer

rate increases in exchange for various benefits. Participants were assigned at random to one of four treatments that highlighted a different benefit of water and sewer services: 1) *reduced pollution*; 2) *safer drinking water*; 3) *better tasting and smelling drinking water*; or 4) *greater access and affordability*. Although each of these benefits is important, framing an appeal for a rate increase in terms of different benefits may yield different levels of support. Examining responses to these four randomized treatments allows evaluation of various frames.

Respondents who received the *safer drinking water* treatment reported 11.2% greater willingness to pay a rate increase, compared with the other conditions—a large, statistically significant difference. Multivariate statistical analysis of sub-populations finds that this framing effect varies significantly by partisanship and sex. The effects of the *safer drinking water* framing was significant and positive among Independents and Republicans, with weaker, statistically insignificant effects for Democrats. Women presented with the safe drinking water treatment responded with 12.7% greater support for rate increases, compared with just 6.1% for men. These results carry important implications for strategic communications in the water sector. Moreover, this study demonstrates the value of a scientific approach to utility communications.

This article begins with a brief overview of the literature on winning public support for water and sewer utility rate increases, and the much thinner scientific research on public attitudes about water rates. Discussion then turns to strategic framing as a means of shaping public opinion. Recent descriptive studies of support for water and sewer rate increases in the United States are used to generate a series of hypotheses about issue framing. Empirical analysis follows, employing an experiment embedded in a national public opinion survey. After presenting the main results, regression analysis is used to evaluate framing effects in light of

other demographic variables. The article concludes with a discussion of future research on strategic communications in the water sector, and the study's practical implications.

2 | Background: Strategic communications for water utilities

According to the U.S. Environmental Protection Agency's Safe Drinking Water Information System, more than 87 percent of the U.S. population that receives drinking water utility service is served by a government-owned community water system.[1] Among these government water systems, 94 percent are owned and operated by local governments. Government officials make decisions about investment, operations, and management of these systems. Managers of these government-owned utilities are public administrators who are hired by and responsible to elected or appointed officials.

With few exceptions, water and sewer utilities in the United States operate as enterprises whose main sources of revenue are user charges. Pricing decisions for local government water systems also are made by local government officials. When these utilities require additional revenue to support investments or operations, managers must seek approval for higher service rates from their governing councils or boards.[2] The tens of thousands of governments in the U.S. that provide water and/or sewer services vary widely in structure and organization; their rate-setting processes also vary considerably. Although each government's process is unique, rate setting in a municipal government water utility typically begins with the utility's managers developing a proposed rate schedule in consultation with the city's chief executive (a mayor or

[1] Data for the first quarter of 2021. Includes local, state, federal, and tribal governments.
[2] In a few states (Indiana, Maine, Pennsylvania, Rhode Island, and Wisconsin), pricing for some or all local government utilities also are subject to public utilities commission oversight.

city manager). Development of these proposals sometimes involves formally or informally gathering public input. Utility managers present these proposals to city councilmembers, who may approve, reject, or modify the rate proposal. For utilities operated by special districts, managers present rate proposals to their governing boards, who are either elected officials or appointed by other elected officials. These governing boards may approve, reject, or modify rate proposals.

The city councilmembers and boards who make final decisions about water and sewer rates are ultimately responsible to voters. Raising revenue for American local governments' water and sewer systems is therefore an inexorably political process that relies on public support. Research on the politics of water rates have linked local government utility pricing to institutional structures (Mullin 2008; Teodoro 2010), coalition-building (Brown and Hess 2016) and partisanship (Switzer 2020). Officials who are responsible for setting rates weigh the need for revenue against voter preferences for lower prices (Hansen, Eskaf, and Mullin 2021).

For this reason, water sector leaders have long recognized that securing rate revenue requires an active public communication strategy. More than seventy years ago, for example, St. Paul water department general manager Leonard Thompson observed:

> …as most water utilities have what amounts to a monopoly in their community, they do not require a competitive sales campaign, but one to make the people appreciate their product. It is of primary importance to convince the public that water is not only valuable but also hard to get and difficult to treat. Constant repetition of this idea is a promotional approach that will bear fruit (Thompson, Dodd, and Wise 1948, 844).

Published advice on communicating the value of water and sewer services to the public abounds. Over the past decade, at least eight articles offering advice on effective public

communication to secure rate increases have appeared in *Journal AWWA* alone (Davis, Elliott, and Snyder 2017; Economides, Tennyson, and Mulroy 2012; Goetz 2013; Kubick 2016; Mantz and Ori 2011; Payne 2020; Reinhardt and Hoag 2008; Smith, Campbell, and Snyder 2017). Although their suggested tactics vary, a common theme that emerges from these works is the idea that managers can win public support for rate increases by emphasizing the benefits that utilities provide, and so demonstrate utilities' value. In this regard, the recent literature counsels much the same strategy that Thompson, Dodd, and Wise offered in 1948.

Another signal feature of publications on winning public support for water rate increases is a near-universal reliance on case studies and anecdotes. Systematic evidence does not accompany the abundance of public communications advice on offer. For example, Payne's (2020) case study of a California special district's public communication campaign described creative graphics, open house events, bilingual publications, comparisons of rates across neighboring communities, "brand ambassador" training for district staff, and twenty public presentations, all aimed at "teaching customers about the value of water" (78). The district's board voted in favor of the utility's requested rate increase—a success that Payne attributes to an effective communications campaign. But which (if any) elements of the campaign drove that outcome is unclear. Case studies and isolated anecdotes cannot isolate the effects of various messaging, media, or public communications strategies on support for rate increases with any confidence. A body of systematic, generalizable research on the effects of various methods is needed in order for utilities communications to evolve from craft to science.

The author is aware of only one published study that systematically evaluates the relationship between public perceptions of water and/or sewer service and attitudes toward rate

increases. Zamenian, Abraham, and Mannering (2020) use a public opinion survey to fit a series of simultaneous regression models that estimate willingness to pay for a rate increase as a function of several demographic, attitudinal, and experiential variables. Particularly relevant for the present study, Zamenian, Abraham and Mannering's survey instrument frames its questions about support for rate increases with specific benefits: "to improve the quality of water," and "to improve the reliability of water service." Among other results, they find that respondents with higher levels of education are more likely to support rate increases for improved water quality, and that that tap water drinkers are more supportive of rate increases than are bottled water drinkers.

However, important aspects of Zamenian, Abraham and Manning's (2020) analysis limit its validity and generalizability. It is difficult to be confident in inferences about the appeal of different benefits associated with rate increases (i.e., quality versus reliability) in isolation because their questionnaire included items about both benefits. Moreover, although their analysis includes a host of demographic and economic variables, it does not include partisanship—a notable omission in a study involving attitudes toward public policy in the United States. Finally, sample bias and a narrow geographic area further limit the study's usefulness: Zamenian, Abraham and Manning's 405 respondents were drawn from a non-random, online convenience sample of participants from the Indianapolis, Indiana area. Although Zamenian, Abraham, and Manning (2020) represents an important step forward in understanding public support for rate increases, these problems limit the value of their findings for utilities managers seeking to craft effective communications strategies.

3 | Issue framing and support for water and sewer rate increases

As a step toward more systematic understanding of public attitudes toward rate increases, the present study analyzes the effects of issue framing on willingness to pay higher rates, using an experiment embedded in a national public opinion survey. Framing is the subject of a lively body of research on political communications, as voluminous studies demonstrate that "alternative definitions, constructions, or depictions of a policy problem" can significantly affect opinions about public policy (Nelson and Oxley 1999, 1041). For example, the issue of government spending may be described in very general terms ("Should government increase services and spend a lot?") or in more specific terms ("Should the government increase Social Security pension payments to retirees?"). When a person is exposed to public messaging, a particular depiction of a public policy issue can stimulate cognitive processes that change the issue's importance, valence, and status relative to the person's beliefs system (Jacoby 2000). Framing experiments are frequently deployed in psychology, economics, and political science research. The most recent work on framing in political communication research seeks to understand the cognitive mechanisms that drive observed framing effects (Carnahan, Hao, and Yan 2019).

Thus, this research is modest in its theoretical aims; the main concern in the present study is determining whether associating different benefits of utility service with rate increases results in different levels of willingness to pay. In order to provide useful guidance to utility managers and communications professionals, the goal in the present study is to understand *whether* framing affects attitudes toward rate increases, not necessarily *why* framing affects those attitudes.

Implicit in the literature on communicating the "value" of water and sewer services is the expectation that customers consider potential rate increases with a cost-benefit heuristic. That is, customers weigh the expected financial burden of a rate increase against the benefits that are expected to follow from that rate increase. Since costs are immediately observable in the form of higher bills, establishing the value of water and sewer services involves communicating the benefits of increased investment in utility capital and operations.

However, water and sewer systems generate a host of benefits. Some of these benefits accrue to individuals, such as safer or better-tasting drinking water. Other benefits are public goods that a community enjoys collectively, such as environmental protection or conservation. Some utility services, including low-income or senior citizen affordability programs, are altruistic insofar as they provide benefits to specific segments of the population. Although each of these many benefits may be important, the public is likely to weigh them differently when evaluating a potential rate increase. It is possible that framing water and sewer rate increases in terms of different types of benefits can generate different responses from the public. To investigate this possibility, the present study analyzes data from the U.S. Water Alliance's Value of Water (VOW) surveys.

3.1 | Data: the Value of Water Survey

Each year since 2015, the U.S. Water Alliance has conducted the VOW survey, a national poll that gathers data on public attitudes toward water and wastewater utilities. The U.S. Water Alliance is an advocacy organization that aims to "educate the nation about the true value of water and proactively advances policies and programs that manage water resources to advance a better quality of life for everyone" (U.S. Water Alliance, n.d.). Beginning in 2018, the VOW

questionnaire included an item about willingness to pay for a "modest" rate increase. For example, the 2020 VOW questionnaire asked:

> Suppose your water and wastewater service provider increased rates by a modest amount to pay for infrastructure and water quality improvements, including preventing pollution of local streams and rivers, protecting your area's drinking water supply, and improving wastewater service. Would you be willing or unwilling to pay a modest rate increase in order to improve your water and wastewater service?

Responses were recorded on a forced-choice, four-point Likert scale: *very willing, somewhat willing, somewhat unwilling,* or *very unwilling.* "Very willing" and "somewhat willing" responses were coded as supportive of rate increases, with "somewhat unwilling" and "very unwilling" coded as opposed to rate increases. As Table 1 shows, roughly 63-73 percent of respondents in the 2018-2020 VOW surveys were willing to support "modest" rate increases when presented with information about the benefits that utilities provide.

Table 1. Support for rate increases, 2018-2021 Value of Water surveys

Percent willing/unwilling to pay "modest" rate increase

	2018	2019	2020	2021*
Willing	**73.4**	**63.1**	**66.4**	**53.3**
Very willing	*35.6*	*29.0*	*27.8*	*24.5*
Somewhat willing	*37.9*	*34.1*	*38.6*	*28.8*
Unwilling	**18.7**	**20.9**	**25.5**	**33.7**
Somewhat unwilling	*8.7*	*10.4*	*13.1*	*12.1*
Very unwilling	*7.9*	*10.5*	*12.4*	*21.5*
Don't know/no answer	7.9	16.0	8.1	13.0
N	1,001	1,000	1,056	1,007

*Includes experimental treatments. See Table 2.

These relatively high levels of support likely reflect the generally positive framing of the question. Respondents are presented with multiple benefits of utility services ("preventing pollution of local streams and rivers, protecting your area's drinking water supply, and improving wastewater service").[3] With so many benefits weighed against a "modest" hypothetical rate increase, it is perhaps unsurprising that large majorities of respondents expressed willingness to pay in a survey setting. However, it is not clear which benefits associated with water and sewer utilities are important in the public's evaluation of prospective rate increases. Because the 2018-2020 VOW surveys primed respondents with several utility benefits, it is impossible to evaluate the extent to which each benefit contributes to public perceptions about the value of water. In this sense, each benefit that water and sewer utilities provide is a hypothesis about what contributes to public perceptions about value of water.

3.2 | 2021 Value of Water Survey Experiment

In order to understand how different benefits of water and sewer utilities shape support for rate increases, the author worked with U.S. Water Alliance staff to embed a framing experiment into the 2021 VOW survey alongside its usual battery of attitudinal and demographic items. Instead of asking a single question about willingness to pay rate increases that mentioned multiple benefits, the 2021 VOW survey asked:

> Suppose your water, wastewater, and stormwater service provider increased rates by a modest amount to __[TREATMENT]__. Would you be willing or unwilling to pay this rate increase?

[3] This wording likely reflects the U.S. Water Alliance's advocacy mission. The immediate goal of the VOW survey was not to gauge public opinion, but rather to demonstrate broad support for water and sewer systems.

Respondents were assigned at random to one of four treatments, each of which described a benefit that would follow from the rate increase: 1) *reduced pollution*; 2) *safer drinking water*; 3) *better tasting drinking water*; or 4) *greater access and affordability*. Table 2 shows the full language applied in each treatment. The treatments were developed in cooperation with U.S. Water Alliance staff. Responses were coded using the same forced-choice, four-point Likert scale employed in previous VOW surveys: *very willing, somewhat willing, somewhat unwilling,* or *very unwilling.* "Don't know" and "no answer" responses were dropped from the analysis.

Table 2. Experimental conditions

Suppose your water, wastewater, and stormwater service provider increased rates by a modest amount to [TREATMENT]. Would you be willing or unwilling to pay this rate increase?

Condition	Treatment frame
1. Reduced pollution	reduce pollution and make local streams and rivers cleaner
2. Safer drinking water	make your area's drinking water safer and healthier
3. Better tasting drinking water	make your area's drinking water taste and smell better
4. Greater access and affordability	ensure that everyone in your community has basic water and sewer service, and to prevent shut-offs for non-payment

The 2021 VOW survey was administered jointly from March 15-21 by commercial polling firms New Bridge Strategy and FM3 Research. Respondents were recruited from the firms' proprietary frame of registered voters in the United States. Participants were contacted by telephone and email, with data collected through a combination of telephone interviews and an online form. Additional respondents were drawn at random from the sampling frame until the target of 1,000 respondents was reached; the final sample was 1,007 responses. After eliminating cases that did not respond to the willingness to pay rate increase questions, the final

experiment included a total of 874 valid responses. Comparisons of treatment groups by sex, race, ethnicity, income, and partisanship found no significant differences, indicating that randomization was successful.

4 | Analysis

2021 VOW survey data were compared with 2018-2020 VOW results, and then analyzed in bivariate and multivariate frameworks to evaluate the effects of framing on willingness to pay increased rates.

4.1 | Comparison with 2018-2020 VOW surveys

Potential framing effects are immediately evident in the 2021 VOW's lower overall willingness to pay rate increases, compared with the 2018-2020 surveys. Since the past three years of VOW surveys include several benefits in the framing of their rate increase questions, the 2018-2020 surveys provide a useful baseline for comparison. An average of 67.6 percent of respondents were either very willing or somewhat willing to pay rate increases in the 2018-2020 VOW surveys, compared with just 53.3 percent in 2021—a statistically significant 14.3 percent drop ($z = 8.20$; $p<.001$). The right-hand column of Table 1 shows this drop in support, with an especially large 11.2 percent increase in respondents who were "very unwilling" to pay for rate increases ($z = 9.14$, $p<.001$). The 2018-2020 average results are not a true experimental control group because the data were collected at a different time. However, the marked changes in willingness to pay rate increases suggest the presence of a framing effect: the 2018-2020 VOW questionnaire framed rate increases as providing several benefits of water and wastewater utilities, whereas the 2021 questionnaire exposed each respondent to only one of four benefits.

Table 3. Willingness to pay frequency by treatment, 2021 VOW survey

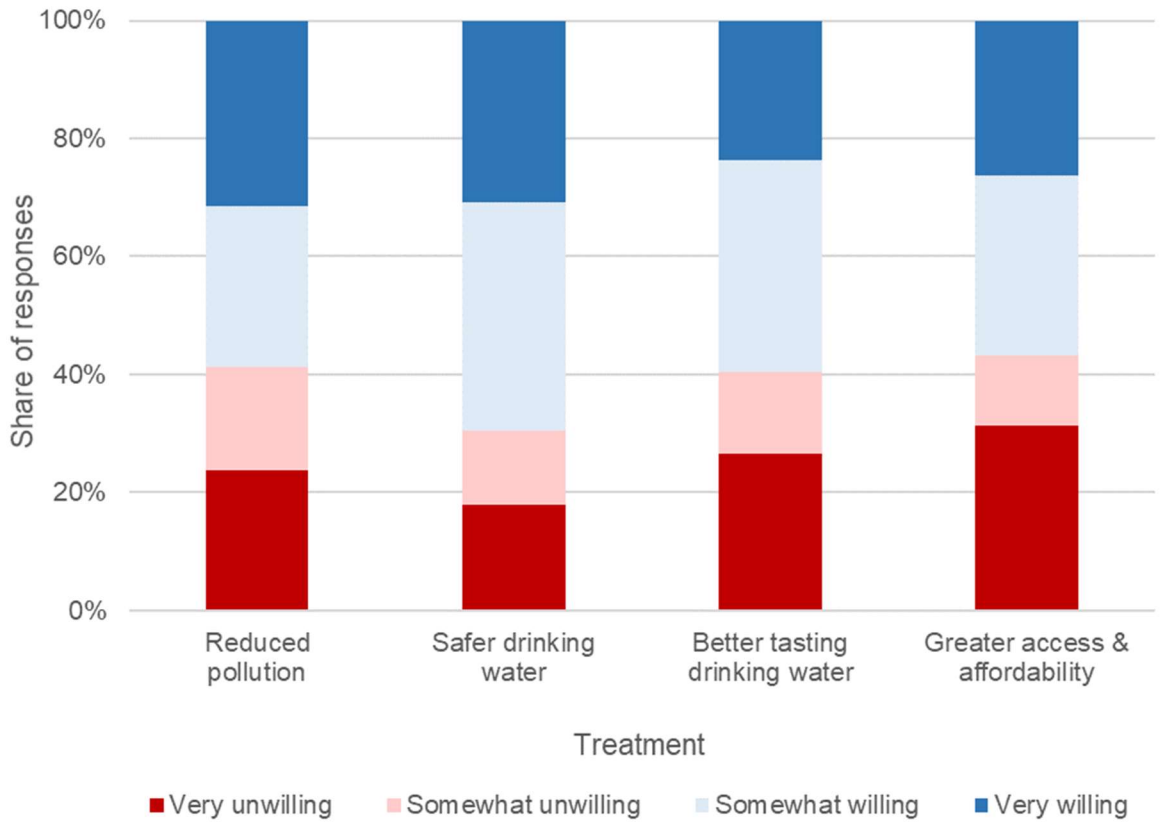
Treatment	Reduced pollution	Safer drinking water	Better tasting drinking water	Greater access & affordability
Categorical outcome (count)				
Very willing	70	71	48	58
Somewhat willing	61	89	73	67
Somewhat unwilling	39	29	28	26
Very unwilling	53	41	54	69
Total	223	230	203	220
Pearson X^2	20.24	(p =.017)		
Likelihood-ratio X^2	20.39	(p =.016)		
Kruskal-Wallis X^2	8.73	(p =.033)		
Binary outcome (%)				
Very/somewhat willing	58.7	69.6	59.6	61.3
Very/somewhat unwilling	41.3	30.4	40.4	38.7
Pearson X^2	9.35	(p =.025)		
Likelihood-ratio X^2	9.53	(p =.023)		
Kruskal-Wallis X^2	9.34	(p =.025)		

4.2 | Bivariate analysis

Table 3 reports response frequencies for each of the four treatment groups. The top part of Table 3 reports willingness to pay by categorical response, while the bottom part of the table divides responses into binary "willing" and "unwilling" categories. Table 3 also reports Pearson, likelihood ratio, and Kruskal-Wallis X^2 measures of association for the categorical and binary responses. Whether analyzed categorically or as binary outcomes, all three tests indicate statistically significant differences in frequency across treatment groups.

These results strongly suggest that framing water and sewer rate increases in terms of different benefits results in different levels of willingness to pay. Inspection of the results by category shows that the *safer drinking water* treatment generated markedly greater willingness to pay compared with the other three frames. Figure 1 shows the distribution of willingness to pay rate increases under each of the four treatments.

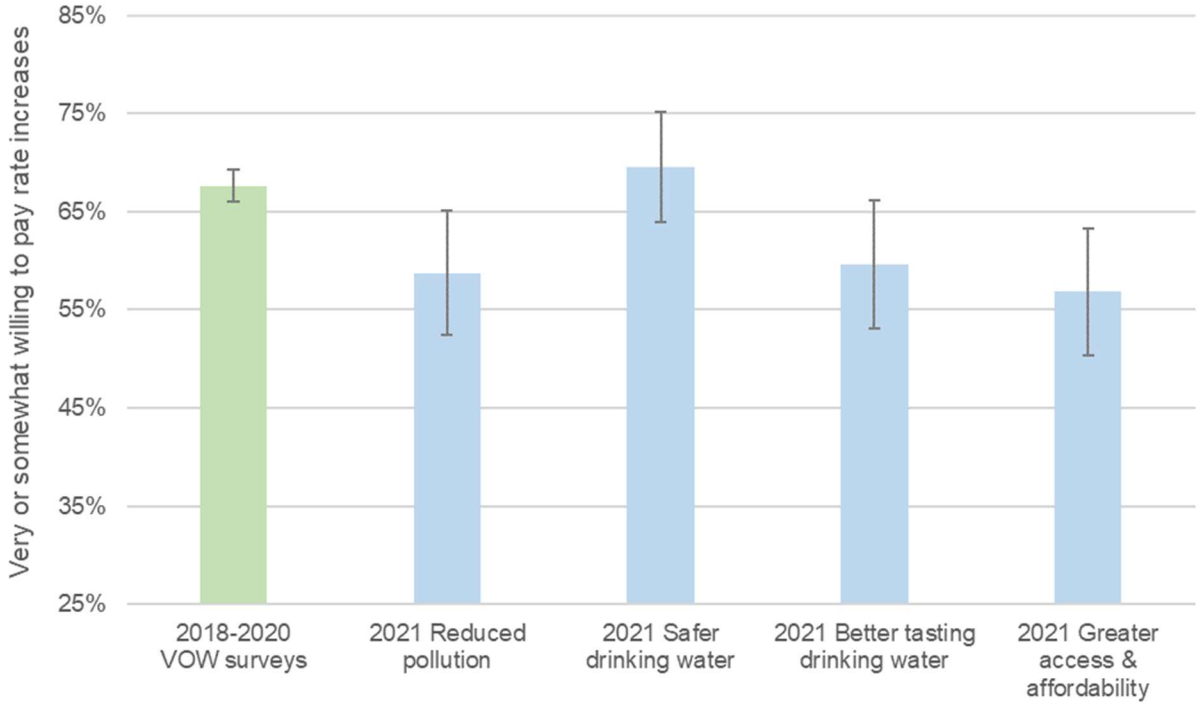
Figure 1. Willingness to pay, percentages by treatment group



Willingness to pay was very similar for the *reduced pollution* (58.7 percent very or somewhat willing [c.i. 53.3%, 64.1%]), *better tasting drinking water* (59.6 [c.i. 53.9%, 65.3%]), and *greater access and affordability* (56.8 [c.i. 51.3%, 63.4%]) treatment groups. By contrast, 69.6 percent [c.i. 64.6%, 74.6%] of respondents who received the *safer drinking water* treatment said that they were very

or somewhat willing to pay for a rate increase. In fact, most of the variation observed in experimental outcome is driven by the *safer drinking water* treatment: measures of association indicate no statistically significant difference across the other three treatments. Also notable is the sharp increase in respondents who were very unwilling to pay rate increases under the *greater access and affordability* treatment: 31.4 percent, compared with 22.6 percent under all other treatments ($z = 2.62$, $p = .009$).

Figure 2. Percent very or somewhat willing to pay, 2018-2020 VOW survey and 2021 treatment groups



Thin bars represent 95% confidence intervals.

Figure 2 shows the proportion of respondents who were very or somewhat willing to pay a rate increase in the 2018-2020 VOW surveys and under each of the treatments in the 2021 VOW survey. The 2021 *safer drinking water* treatment group's 69.6 percent willingness to pay is consistent with and statistically indistinguishable from the 2018-2020 VOW surveys. The other

three treatments yielded significantly lower overall support compared with the 2018-2020 VOW surveys. These findings suggest that the prospect of safer, healthier drinking water is the most important benefit underlying the willingness to pay rate increases observed in earlier VOW surveys.

4.3 | Multivariate analysis

Multivariate logistic regression analysis was used to estimate willingness or unwillingness to pay rate increases as a function of *safer drinking water* framing, while controlling for key demographic and socioeconomic variables. Randomization in the experimental design allows confident inference about treatment effects in the bivariate analysis presented earlier. However, multivariate analysis is a useful complement because it can demonstrate variation in treatment effects across demographic and socioeconomic groups. Although regression analysis can introduce bias when applied to experimental data, the risk of significant bias is minimal in large samples, and so multivariate analysis may be justified in experimental studies (Freedman 2008).

The present analysis focuses on the *safer drinking water* frame because it was the only one of the four treatments that generated significantly different overall support for rate increases. For purposes of simplicity, the dependent variable here is a binary outcome: "very willing" and "somewhat willing" responses were coded as one; "somewhat unwilling" and "very unwilling" responses were coded as zero.[4] The main independent variable of interest is the *safer drinking water* treatment, with the three other treatment conditions as the reference category.

[4] Estimates fitted with ordinary least squares (continuous linear) and ordered logistic (ordinal category) regressions yielded substantively and statistically similar results.

Table 4. Summary statistics

	Mean	Standard Deviation	Minimum	Maximum
Party identification	3.98	2.35	1	7
Female	.47	.50	0	1
Black	.08	.27	0	1
Hispanic	.04	.20	0	1
Annual income				
$30,000 or less	.10	.31	0	1
$30,001-$60,000	.17	.37	0	1
$60,001-$75,000	.14	.35	0	1
$75,001-$100,000	.13	.34	0	1
More than $100,000	.33	.47	0	1
N = 767				

Demographic variables include binary indicators for sex (1 = female, 0 = male), race (1 = Black/African-American, 0 = other race), and ethnicity (1 = Hispanic/Latino, 0 = non-Hispanic/Latino).[5] Annual household income is included with a five category indicator from the VOW questionnaire: $30,000 and under; $30,001-60,000; $60,001-$75,000; $75,001-$100,000; and greater than $100,000. Finally, partisanship is included with the seven-point scale commonly used in political research: 1 = Strong Democrat; 2 = Democrat; 3 = Independent leaning Democrat; 4 = Independent; 5 = Independent leaning Republican; 6 = Republican; 7 = Strong

[5] The 2021 VOW survey did not include separate items for race and ethnicity. Instead, the questionnaire captured racial/ethnic identity with a single categorical variable with indicators for *Hispanic/Latino, Black/African-American*, *White/Caucasian, Asian/Pacific Islander, Native American,* and *Other.* Only the Hispanic and Black identities were included in the multivariate models because they were the only categories where average willingness to pay rate increases varied significantly from the modal White/Caucasian category.

Republican. Table 4 provides a descriptive summary of these variables; after excluding cases with item-missing data, 767 responses were available for analysis.

Table 5. Models of willingness to pay for water and sewer rate increases

Logistic regression	Model A Odds Ratio (z-score)	p	Model B Odds Ratio (z-score)	p
Safer drinking water frame	1.62 (2.48)	.013	1.06 (0.13)	.893
x Party identification			1.06 (0.65)	.286
x Female			1.52 (1.07)	
Party identification	.72 (8.49)	<.001	.71 (7.77)	<.001
Female	1.78 (3.47)	.001	1.60 (2.46)	.014
Black	.51 (2.02)	.043	.52 (2.03)	.043
Hispanic	1.94 (1.19)	.236	1.92 (1.08)	.246
Annual income				
$30,000 or less	.62 (1.38)	.168	.62 (1.34)	.181
$30,001-$60,000	1.65 (1.62)	.105	1.65 (1.62)	.106
$60,001-$75,000	1.92 (2.05)	.041	1.92 (2.05)	.041
$75,001-$100,000	1.93 (2.04)	.041	1.94 (2.07)	.038
$100,000 or more	1.60 (1.71)	.087	1.59 (1.69)	.091
Log likelihood	-439.06		-438.23	
Wald X^2	112.64	<.001	114.37	<.001
N	767		767	

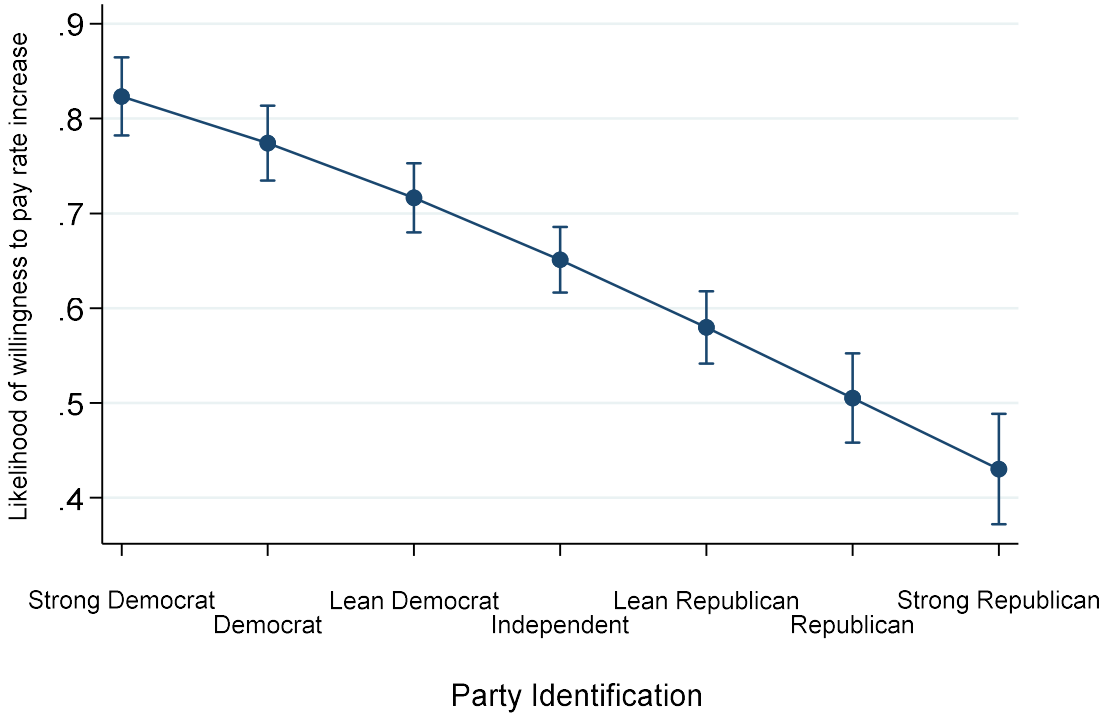
Cells contain odds ratios (z-scores in parenthesis) and p-values produced by logistic regression models with robust standard errors.

Two logistic regression specifications are reported here. Model A estimates willingness

to pay higher rates as a function of the *safer drinking water* framing and the social variables. Model B includes terms that interact the *safe drinking water* framing with the two social variables that demonstrated statistically significant conditional effects: partisanship and sex. Table 5 reports estimation results.

Generating an odds ratio of 1.62 in Model A, the *safe drinking water* frame remains a strongly positive predictor of willingness to pay for water and sewer rate increases. With all other variables at their means, Model A estimates a .736 likelihood [c.i. .671, .802] of willingness to pay higher water and sewer rates when framed in terms of safer drinking water, compared with an average likelihood of .633 [c.i. .590, .676] when framed with one of the other treatments.

Figure 3. Estimated willingness to pay rate increases by partisanship



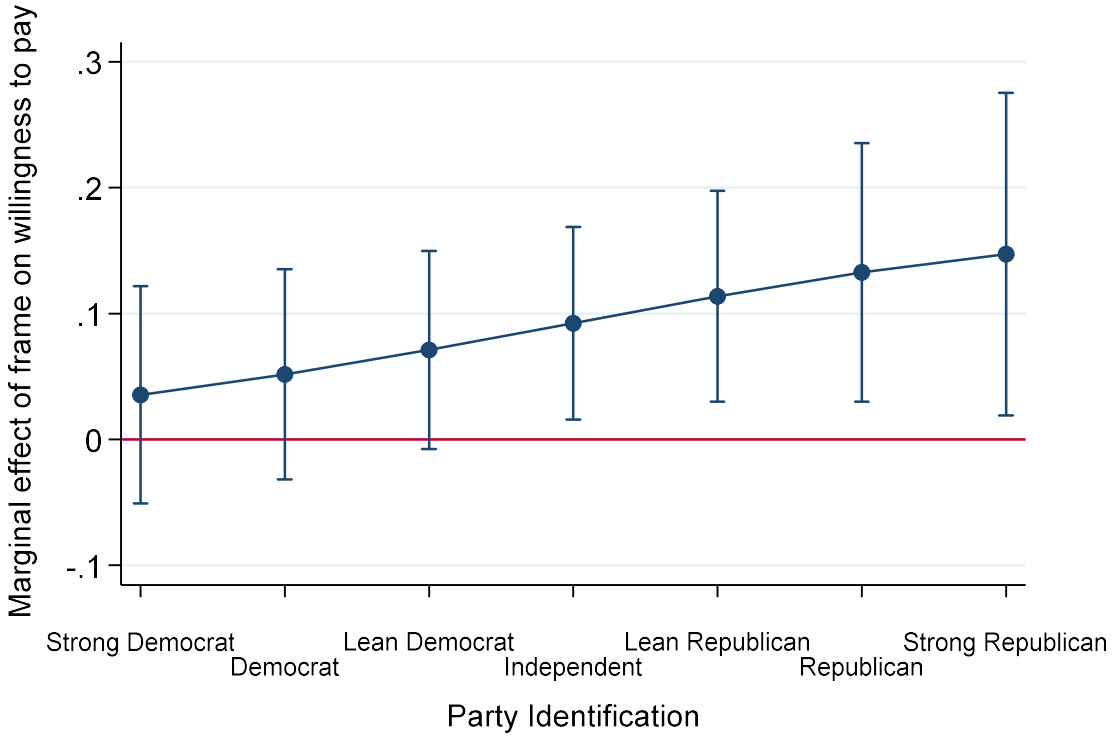
Estimates generated by Model A (see Table 5). Thin bars represent 95% confidence intervals.

Model A also reveals some significant social correlates of support for rate increases. Partisanship is a very strong predictor of willingness to pay, as Figure 3 shows. On average, a respondent who identifies as a Strong Democrat has a .823 [c.i. .782, .864] likelihood of supporting a rate increase, while a Strong Republican's estimated likelihood is .430 [c.i. .372, .488]. The effect of partisanship in this analysis may reflect ideology about government, rather than attitudes toward the value of water and sewer services specifically. Sex is a similarly strong correlate of willingness to pay rate increases, with an estimated average .697 likelihood of willingness to pay for women [c.i. .651, .742], compared with .583 for men [c.i. .539, .628]. Black respondents were significantly less willing to pay rate increases, with an estimated likelihood of .512 [c.i. .389, .637] compared with .644 [c.i. .612, .676] for respondents of other races. Perhaps unsurprisingly, average willingness to pay rate increases was generally higher at higher household income levels. Hispanic ethnicity did not significantly correlate with support for rate increases.

4.4 | Conditional framing effects: partisanship and sex

In order to test whether the *safer drinking water* framing effect varied across social dimensions, several models of willingness to pay were fitted with interaction terms for each of the social variables multiplied by the treatment frame indicator. This process revealed two variables that significantly conditioned the framing effect: party identification and sex. These interaction terms were retained in Table 5's Model B. Since interpreting multiplicative interaction effects in maximum likelihood estimation is complex and nonintuitive, these conditional effects are presented graphically following the suggestion of Brambor, Clark, and Golder (2006).

Figure 4. Marginal effect of *safer drinking water* frame on willingness to pay rate increase by partisanship

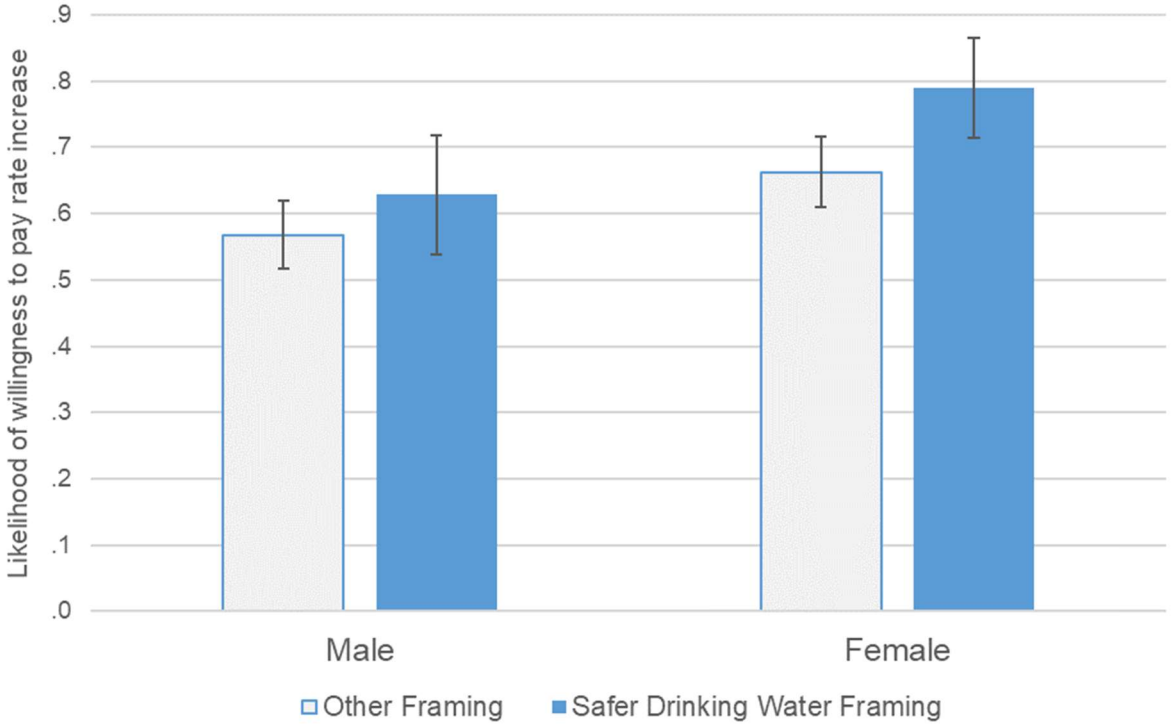


Marginal effects generated by Model B (see Table 5). Points represent expected change in likelihood of willingness to pay rate increase caused by the *safer drinking water* framing treatment. Thin bars represent 95% confidence intervals.

Figure 4 shows the marginal effect of the *safer drinking water* frame by partisanship; that is, the figure illustrates the expected change in likelihood of willingness to pay higher rates caused by the framing treatment for respondents with different party identification. These results show that the framing effect is negligible among Democrats and increases as partisanship shifts to Independent and Republican. The small, insignificant values at the left-hand side of Figure 3 indicate that Democrats do not respond clearly to the *safer drinking water* frame. However, the *safer drinking water* frame boosts likelihood of willingness to pay rate increases by a statistically significant .092 for Independents. The framing effect was even

stronger for respondents who identify as Republicans, raising the likelihood of supporting a rate increase by .147 for Strong Republicans. It is possible that this party-contingent effect reflects greater concern for drinking water among Republicans than among Democrats. However, in light of Model A's results, a more plausible explanation is that Democrats are more predisposed to support rate increases regardless of framing, and so any framing effects are probably stronger for Independents and Republicans than for Democrats.

Figure 5. Willingness to pay rate increase by sex and *safer drinking water* framing



Estimates generated by Model B (see Table 5). Thin bars represent 95% confidence intervals.

Sex also conditions the effect of the *safer drinking water* frame, as shown in Figure 5: the framing effect was significantly stronger for female respondents than for male respondents. According to Model B, the *safer drinking water* frame treatment increased the likelihood of supporting a rate increase by .127 [c.i. .033, .221] for women. By comparison, for men the *safer*

drinking water frame raised willingness to pay by a statistically insignificant .061 [c.i. -.043, .164]. This gendered difference in response to a health framing aligns with past research showing that women exhibit moderately but consistently greater concern for health-related environmental risks than men do (Bord and O'Connor 1997; Xiao and McCright 2012).

5 | Discussion

This study deployed an experiment in a national public opinion survey as a step toward better understanding the ways that Americans value of water and sewer services. The experiment evaluated four ways of framing the benefits of water and sewer services with randomized treatment conditions: *reduced pollution, safer drinking water, better tasting drinking water*, and *low-income affordability*. Compared with the other three treatments, the *safer drinking water* frame generated significantly stronger support for hypothetical water and sewer rate increases. Multivariate regression modeling finds that the *safer drinking water* framing effect persists after adjusting statistically for sex, race, ethnicity, income, and partisanship. Further analysis shows that the *safer drinking water* frame was especially effective in increasing support for rate increase among Republican partisans and women. When viewed in light of past VOW surveys, the results of the present experiment strongly indicate that health and safety concerns are a key heuristic for the public when weighting the prospect of higher utility rates.

5.1 | Limitations and directions for future research

In addition to its substantive findings, the present study demonstrates the value in a scientific approach to public communications in the water sector. Until now, little systematic evidence existed on how to communicate the benefits of water and sewer systems in ways that

can build popular support for rate increases. But although this study may be the first word on experimental analysis of water sector communications, it certainly is not the last. The present findings are rather the beginnings of an ongoing effort toward more refined and comprehensive research on effective public communications for water and sewer utilities. Future inquiries should improve and extend upon this study's design.

A clear limitation of the present study its limited range of frames. Water and sewer systems provide several benefits beyond the four tested in this experiment. Future experiments could test the effects of framing rate increases in terms of flood control, economic development, firefighting capacity, energy efficiency, wildlife protection, or any number of other benefits associated with water and sewer utilities. Framing effects also may vary regionally, with some benefits perceived as more valuable in some places than in others. Although national-level studies are valuable for establishing baseline expectations and broad understanding of public opinion, results from local framing experiments may yield divergent results that could be more valuable for utility managers seeking to communicate with their own customers about rate increases. Another key limitation of the present study is the way that the VOW survey frames the cost side of its value proposition. In describing a hypothetical rate increase as "modest," the questionnaire subtly encourages the respondent to minimize the impact of the price change on household finances. This bias does not undermine the validity of the present experiment because it is uniform across all four treatments. However, the overall willingness to pay found in the VOW surveys probably is biased upward; real customers confronted with the prospect of real rate increases may not respond so favorably. For this reason, future experimental studies should combine benefit framing conditions with varying rate increase frames (e.g., $5, $10, or

$20 monthly). Experiments deployed in communities that are contemplating real (as opposed to hypothetical) rate increases could prove especially valuable in gauging the impact of framing on public support.

Beyond messaging and framing, research on water sector communications would benefit greatly from more rigorous, randomized experiments on the effects of everything from branding to consumer confidence report design to outreach media (direct mail, radio/television announcements, targeted online advertising, etc.). The cumulative evidence that emerges from such experiments can form a sound scientific foundation from which water sector leaders can develop public communication strategies.

5.2 | Implications and applications

Prices for water and sewer utilities in the United States—and in much of the rest of the world—are set by elected officials through democratic processes. Public perceptions about the value of these services are thus important for effective utility management, since communicating the value of water to the public is vital to utility success. In bringing experimental methodology to bear on effective framing of rate increases, the present study carries some clear implications for utility managers and communications professionals.

First, the present findings indicate that emphasizing the public health and safety benefits of water and sewer utilities' work is more likely to win support for rate increases than are other benefits of utility service. That drinking water safety resonates strongly with the public is perhaps unsurprising; the finding that other benefits are *less* effective in evoking support for rate increases is the more immediately useful result. Although utilities provide many important benefits for their communities, the cognitive limitations inherent in public messaging (Wright

1973) mean that efforts to inform and persuade the customers about the value of water should focus on a limited range of benefits. The present study indicates that emphasizing the benefits of safe, healthy drinking water can be more effective in winning support for rate increases than messages focused on water pollution, aesthetics, or access and affordability. To the extent that utility investments in infrastructure and operations are connected to the utility's public health mission, public messages that accentuate those connections in making the case for a rate increase may be the most effective. Health and safety appeals may be especially useful in securing support from women and women's organizations, and in messaging to American communities where voters or governing boards are predominantly Independent or Republican.

More generally, this article shows how experiments can help managers understand which messages resonate most with their customers. Utilities that have the resources to devote to public communications research in the communities that they serve will gain more valid and useful information from randomized experiments than from conventional survey methods or case studies of other utilities. Compared with these conventional approaches, randomized experiments allow utility communications professionals to infer with greater confidence whether and how their messaging strategies shape customer perceptions. Such experimental evidence can help utility leaders deploy communications efforts efficiently and effectively.

DATA AVAILABILITY

Data for this study were provided by the U.S. Water Alliance. Data files and analytical scripts are available from the author upon request, pending permission from the U.S. Water Alliance.

CONFLICT OF INTEREST

The author has no conflicts of interest to declare.

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