Framing Private Vaccination Behavior as a Public Good
A Randomized Trial of Self- and Other-Framed Influenza Vaccination Appeals

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Abstract

Previous research indicates that altruistic framed appeals increase vaccination rates and that collectivistic subjects in public goods games are more cooperative. We hypothesized that other-framed influenza vaccination appeals would increase vaccination intentions for collectivists, while self-framed appeals would increase vaccination intentions for individualists. Subjects ($N = 1079$) were recruited from Amazon's online mTurk platform for four separate versions of our framing manipulation. Study 1 is a meta-analysis of all four versions. In each version, subjects were presented with either a self- or other-framed vaccination appeal addressed from a community health clinic. The self-framed appeal motivated vaccination as a way to protect oneself from the flu, while the other-framed appeal motivated vaccination as a way to protect one's friends and family from the flu. We then asked subjects about their willingness to wait in line for a flu vaccination, and subjects were surveyed on their degree of individualism and collectivism. Other-framed appeals were marginally significantly better at increasing wait time than self-framed appeals, but no interactions between appeal and individualism/collectivism were significant. Study 2 analyzed one version included in the meta-analysis ($N = 411$), which included two additional conditions (a combination of both appeals & no appeal), two additional outcome variables (likelihood to receive a flu vaccination, and their willingness to pay for a vaccination), and eight control measures. There was a positive interaction of self-framed appeals and vertical individualism on vaccination likelihood. There was no significant difference between self-framed & no appeal, or combined appeals & no appeal. These findings suggest that public health organizations might encourage higher vaccination rates by using other-framed appeals alone instead of combined appeals or self-framed appeals, unless targeting populations high in vertical individualism.

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Introduction

On September 28th, 2015, Dr. Paul Genecin, the director of Yale Health, sent out an email to the Yale community encouraging everyone to get their annual flu shot. His bolded message: **10 minutes could save you a week in bed**. Whether intended or not, this sentence is attempting to motivate its recipients with an appeal to self-preservation: you should get a flu shot because you will be miserable if you get sick with the flu.

Emailing the entire Yale community is a power that few on campus wield, and the power should be used wisely. Few recipients of campus-wide emails read an entire message; many only take a cursory glance. Some may even immediately delete a message without reading it at all. When Dr. Genecin sent out that email, he had only a few seconds to motivate everyone in the Yale community to go to a flu clinic and get their flu shot, and only a few words to convince them of this public health necessity. But did he use the optimal wording? Is appealing to self-preservation the best way to motivate people to get their flu shot or to perform any other private health behavior? We argue that reframing private health behaviors (such as a decision to get vaccinated) as public goods (e.g. "10 minutes could save you from causing your friends and family to spend a week in bed") may be a far more effective strategy than merely appealing to self-preservation, especially for those who are strongly collectivistic (i.e. prioritize in-group goals over individual goals).

One previous study found that vaccination decision frames that stress altruism increase vaccination intentions, but this study did not characterize for which types of people these altruistic or free-riding appeals might work best (Hershey et al. 1994). Studies of the public goods game (PGG) show that subjects with high collectivism scores cooperate significantly more often than subjects with lower collectivism scores (De Cremer & Van Lange 2001). Given these

results, our study explores whether other-framed vaccination messages might work best for those who have high collectivism scores and whether self-framed vaccination messages might work best for those who have high individualism scores. This could have practical implications for tailoring vaccination appeals to the degree of collectivism in the target population. For example, while the U.S. is highly individualistic, many countries in Asia and Africa are strongly collectivistic (Parks & Vu 1994). In low-income nations, where vaccination rates are often low and collectivism is often very high, implementing these cooperative frames in public health messaging could be particularly impactful.

Section I discusses influenza epidemics in the United States and their massive but preventable human and economic costs. Section II delves into framing literature, establishing the basics about how framing the content of messages can change perceptions of the situations the messages describe. Section III discusses framing in the context of vaccination appeals. Section IV explains how the private health decision to get the flu vaccination and its effects on others can be modeled as a public goods game. Section V discusses why people might cooperate in a public goods game and how to encourage cooperation in order to optimize social welfare. A special emphasis will be placed on studies that have used framing with public health messaging and health decisions. Section VI discusses how we can pinpoint the individuals for whom cooperative frames might be most effective. Section VII summarizes current public health flu vaccination messaging and the types of appeals it uses. Section VIII explains the motivations behind choices not to get the flu vaccine. Section IX describes the methodology, results, and discussion of Study 1. This study is the meta-analysis of four versions of our experiment, comparing self and other-frames in vaccination appeals and their interaction with individualism and collectivism. Section X describes the methodology, results, and discussion of Study 2, an

analysis of only the fourth and final follow-up version of our experiment, which provides additional conditions, outcome variables, and control variables. Section XI explores the limitations of our work, explains the implications for further academic research, and considers the practical applications of this work in public health communications. Section XII provides a brief summary of recommendations for public health officials.

LITERATURE REVIEW

Section I – The Dangers of Influenza and the Hope of Vaccinations

Approximately 41,000 people each year die of influenza-related causes in the United States (Dushoff et al. 2006). Precise mortality data from the last ten years is not available due to the CDC's limited surveillance system and the under-identification of flu on death certificates ("Estimating Seasonal Influenza-Associated Deaths…," 2015). Its lethal effects are especially felt by those with the weakest immune systems, such as those under 2 and over 65 years old ("People at High Risk…," 2015). But influenza sickens far more people, causing between 16 to 64 million US citizens (5-20% of the population) to fall ill every year ("Seasonal Influenza Q&A," 2015). This causes, by one estimate, 3.1 million hospitalized days, $16.3 billion in lost earnings, and a total economic burden of $87.1 billion in the United States per year (Molinari et al., 2007). Vaccinations are the key weapon against influenza. A randomized evaluation of direct and indirect costs due to influenza estimated an annual economic savings of $46.85 per person vaccinated (Nichol et al., 1995). If an additional 30% of the U.S. population were vaccinated, this would save more than $4.5 billion per year. Although vaccines do not have perfect efficacy and some influenza illness will always occur, it is clear that raising vaccination rates could significantly decrease this economic burden.

Influenza is an illness that the United States should have under control. Effective vaccines are available at local pharmacy stores and retail clinics nationwide for free (for all adult & child Medicare & child Medicaid/CHIP beneficiaries ("Your Medicare Coverage…," n.d.; Centers for Medicare and Medicaid Services, 2014)) or moderate-cost (under $15 for the uninsured (Flu Shot Prices, n.d.)). Neither a doctor's prescription nor long-term planning is necessary: simply walk into your neighborhood pharmacy and you can walk out vaccinated a few minutes later. Despite this relative convenience, the vaccination rate for many adults is under 50%. In particular, U.S. adults age 18-49 have atrociously low vaccination rates: for the 2014-15 flu season, only 31.2% of adults in this age range received a flu vaccination by the end of flu season (Ward et al., 2015). Vaccination rates are somewhat higher for those between 6 months to 17 years old (49.9%) and those between 50-64 years old (45.5%) and considerably higher for adults 65 years old and over (69.9%). For adults between ages 18-49 and between ages 50-64, women are more likely than men to have received an influenza vaccination in the past 12 months. Vaccination rates are correlated with socioeconomic status as well: only 45.4% of adults with incomes under the poverty line received vaccinations in 2013, compared to more than 55% of adults with incomes over 200% of the poverty line (National Center for Health Statistics, 2015).

One potential cause of low vaccination rates is that unlike every other major vaccination, a new influenza vaccination is required every year. Public health officials have only a few weeks to vaccinate the public from the time that the new seasonal flu vaccination is released until the first signs of epidemic flu infection start to emerge, usually in October ("What You Should Know," 2016). And because the pandemic often lasts until May, individuals who choose not to be vaccinated can be at risk for up to seven months. Vaccination rates increase only slightly over

the duration of flu season, from 39% to 46% for adults, on average ("National Early Season Flu," 2015). In addition, the effectiveness of the flu vaccine fluctuates each season. When vaccine manufacturers have greater success matching the actual circulating viruses, vaccine effectiveness is significantly greater (Belongia et al., 2009). Vaccine effectiveness, measured by outpatient medical visits due to laboratory-confirmed influenza, has varied from 10% to 60% over the last 10 years ("Seasonal Influenza Vaccine," 2016).

There continues to be confusion among many adults about whether they should get the flu vaccine. Before 2009, the Advisory Committee on Immunization Practices (ACIP), which advises the CDC on vaccination policy, recommended the vaccine for: 1) those between 6 months to 18 years of age; 2) higher risk persons such as the elderly and those with compromised immune systems; and 3) those who come in contact with higher risk persons. Only after the H1N1 pandemic of 2009 did ACIP change their recommendations, recommending universal annual flu vaccination for all U.S. citizens (CDC, 2010). This has made it much simpler to determine if you should get the flu vaccination: it's always a yes. But vestiges of unclear vaccination appeals and misinformation make it difficult to spread updated information. A 2009-10 study conducted by the RAND Corporation showed that 28% of U.S. adults think that they do not need the flu vaccine (Harris et al. 2011). And this belief is true: many adults do not "need" the flu vaccine to survive. With healthy immune systems, catching the flu will only cause moderate sickness. For most, this means at worst, a day or two off work. But herein lies the biggest misunderstanding about the importance of flu vaccination: although many adults may not "need" the flu vaccine for themselves, by not getting vaccinated, they are at risk of spreading the flu virus, thus potentially causing other members of their community to get sick, including those who may be at higher risk for severe health complications. It is these adults, who do not

disbelieve the science of vaccinations, but instead see little motivation to get their vaccination and don't see the impact of their private health behavior on others, that public health officials are not reaching.

Section II – Framing, in general and in health

Framing the same information in different ways can influence the perception and processing of that information. Levin, Schneider & Gaeth (1998) constructed a typology for the various types of framing, dividing research into valence, attribute, and goal framing.

First, valence framing varies choices in terms of gain or loss, measuring willingness to take a risk. Differentially framing the same probabilities as either gains or losses can alter the perception of those probabilities and reverse preferences (Tversky & Kahneman, 1981). In one experiment, subjects were asked to choose between a risky bet and a sure outcome. With matched probabilities, subjects were more likely to choose a small sure gain over a chance for a large gain, but were more likely to choose a chance for a large loss over a sure small loss. Loss aversion has been repeatedly demonstrated in many different task domains, including monetary gains (Tversky & Kahneman, 1981; Miller & Fagley, 1992; Schneider, 1992), saving lives (Tversky & Kahneman, 1981; Kühberger, 1995; Larrick et al., 1992; Levin & Chapman, 1990), and time (Paese, 1995). Valence framing has also been studied in health decision-making tasks. Rothman and Salovey (1997) established a framework for framing in heath messages, finding that behaviors that maintained health and prevented illness (e.g. tooth brushing or exercise) would be best motivated by gain frames, while behaviors that detected illness (e.g. mammograms) would be best motivated by loss frames. Another study on gain/loss framing for vaccination appeals found that a loss-framed message (e.g. "By (vaccinating/*not vaccinating*)

your child (you will be able to/*fail to*) protect your child…") increased intentions for mothers to obtain an MMR vaccine for their child and increased perception of the vaccine's efficacy (Abhyankar et al., 2008). Similarly, another study found that intentions to obtain the HPV vaccine increased among undergraduate women after a loss-framed pamphlet was read vs. a gain-framed pamphlet, but only for those women at higher risk for HPV (had multiple sex partners or did not often use condoms) (Gerend & Shepherd, 2007). A meta-analysis of gain- and loss-framed health messages, however, found that gain frames only worked to encourage prevention behaviors, but framing had no effect when examining prevention attitudes or intentions, or detection behavior, attitudes, or intentions (Gallagher & Updegraff, 2012). Specifically, they found that gain frames increased prevention behaviors for physical activity, skin cancer, and smoking, but were not significant for diet, obesity, oral health, or safe sex.

Attribute framing focuses on "the evaluation of object or event characteristics" according to Levin, Schneider & Gaeth's typology. For example, Levin & Gaeth (1988) measured evaluations of beef framed either as 75% lean (positive) or 25% fat (negative), finding significantly better ratings for positively framed beef. This effect is robust and replicated in numerous other domains, including when allocating funds to research teams (Duchon et al., 1989), and when evaluating toasters (Beach et al. 1996), previous basketball performance (Levin 1987) and surgery options (Wilson et al., 1987).

Goal framing alters the "perceived consequence of a behavior" according to the typology. For example, it invokes the positive goals of a gain vs. the consequences of a loss. In one study, subjects who read about the negative consequences of not performing a breast self-examination (BSE) were more likely to self-report performing BSE 4 months post-hoc than subjects who read about the positive goals of performing BSE (Meyerowitz & Chaiken, 1987).

Section III – Framing in vaccination appeals

It is clear that small alterations of word choice (framing) can create large differences in behavior. When applied to vaccination contexts, frames are potential tools to increase vaccination behavior, but previous study results are conflicting and inconclusive. Hendrix et. al (2014) found that parents' intentions to get the measles-mumps-rubella (MMR) vaccination for their children significantly increased when presented with messages emphasizing either the benefits to their child or the benefits to their child and society (there was no significant difference between these conditions; additional information about benefits to society did not increase or interfere with the effect of benefits to child). There was no significant increase in intentions to vaccinate when only societal benefits were mentioned (relative to the control condition). Another study found that men were not significantly more likely to indicate interest in the human papillomavirus (HPV) vaccine when receiving a message explaining its benefits to both males (self-protection) and female sexual partners (other-protection), in comparison to only a self-protection message (Gerend & Barley, 2009).

Vietri et al. (2012) assigned detailed hypothetical vaccination scenarios to subjects, finding that when risk to self increased in the scenario, intention to get vaccinated also increased. In addition, when others in the hypothetical community had higher vaccination rates, subjects' intentions to get vaccinated decreased. Betsch, Böhm and Korn (2013) found that providing information about the individual benefit of herd immunity ("The more people are vaccinated in your environment, the more likely you are protected without vaccination") results in significantly lower vaccination intentions than providing information about the public benefit of herd immunity ("If you get vaccinated, you protect others who are not vaccinated"). Nyhan et al. (2014) tested four different vaccination messages types: "1) correcting misinformation [on MMR

vaccine links to autism], 2) presenting information on disease risks, 3) using dramatic narratives, and 4) displaying visuals to make those risks more salient or accessible." None of the messages, versus an unrelated control message, caused subjects to self-report significantly different intentions to vaccinate their future children for MMR. Consequently, across these studies, we see no consistent effect of framing on vaccination decisions.

Section IV – Influenza vaccination behavior as a public good

A private health behavior, such as choosing to receive a vaccination, affects the larger community to which that individual belongs. When a person gets vaccinated, they not only reduce the chance that they will get sick, but they also reduce the chance that they will pass on the sickness to others in their community. Depending on the transmissibility of the seasonal flu virus, during an average flu season, a primary carrier of influenza will infect anywhere from 0.9 to 2.1 (M=1.3) other individuals with the flu (Chowell et al., 2008). When this number, known as the *basic reproductive number* (R_0), is above 1, a pandemic occurs. Vaccination is our most potent bulwark against a devastating flu pandemic. Vaccinations not only decrease the incidence of influenza infection and its related medical complications (Bridges et al., 2000, Ohmit et al., 2006), but also create the herd immunity necessary to bring R_0 under 1 and prevent the possibility of a pandemic. The CDC's stated goal of vaccinating 80% of US citizens is sufficient to create enough herd immunity to prevent future flu pandemics (Plans-Rubió, 2012). This makes it clear that an individual's private health decision to get a flu vaccination can contribute to or detract from the public good. If everyone were maximally concerned with social welfare, the United States could possibly boast perfect or near perfect vaccination rates. This, of course, does not happen. To shed light on how private health behaviors can be understood in a public

goods framework, the public goods game (PGG) (Hardin, 1968) — a methodological tool from game theory and experimental economics — provides a theoretical lens on cooperation.

PGGs can help conceptualize and measure cooperative behavior in a controlled lab setting and can help explain the incentives behind the choice not to receive a vaccination. The game starts with a group of people, each of whom receives an individual endowment of tokens. Each person then anonymously (typically) decides how many of their tokens to contribute to a public pot. The tokens in the public pot are multiplied by some amount and then divided evenly among all subjects, regardless of the size (or absence) of their personal contribution. The main dilemma of the game is that it is always in the player's self-interest to defect and not contribute to the public pot, while it is in the group's interest for each player to contribute.[1] This causes many players to defect and choose not to contribute to the public pot, which results in sub-optimal payoffs for everyone playing the game. If everyone contributed all of their endowment, then all of the money would be multiplied and everyone would earn their maximum possible payout. But because of the tension between self-interest and the public good, no one earns that maximum. There is, however, some hope: multiple studies have shown that players are often "irrational" and do not purely follow their self-interest. Instead, many cooperate at least some of the time (Ledyard, 1995; Zelmer, 2003; Herrmann & Gächter, 2009; Chaudhuri, 2011; Rand et al., 2014).

[1] If 1<multiplier<N. If the multiplier is less than 1, social welfare is destroyed (because the money is devalued when contributed). If the multiplier is greater than the number of people playing the game, a player would gain money even if no other players contributed.

Section V – Cooperation in public goods games

Failure to cooperate in real-world PGGs (as in flu vaccination) is referred to as a "tragedy of the commons" and it is clear why: in practice, it is difficult to ensure cooperation despite it being in the collective interest to do so (Hardin 1968). Therefore, in order to increase the overall payoff for everyone, it is essential to learn why some players cooperate by contributing to the public pot and to understand how to encourage that cooperation. In terms of flu vaccinations, public health officials must understand how to encourage adults who don't individually "need" a vaccination to contribute to the public good of herd immunity.

Studies using PGGs show us that this cooperation can be encouraged by emphasizing the collective benefit through framing. Labeling the public pot as the "community box" and describing contributors as "cooperators" and non-contributors as "free-riders" in the game instructions led to significantly increased voluntary contributions (Rege & Telle, 2004). This framing may make subjects more optimistic about the probability that others will adhere to a norm of cooperation. Framing the actions of others as a positive externality ("token invested in public good generates a gain for each member of the group") generated higher average contributions than framing actions of others as a negative externality ("token invested in private good generates a loss for the other members of the group") (Willinger & Ziegelmeyer, 1999). Another study framed the behavior in a PGG game as "give" (how much of the endowment to contribute to the common resource – the standard design) vs. "take" (no endowment; how much to take from the common resource) and found that subjects keep more for themselves under a "give" frame than under a "take" frame. In addition, when collective identity (vs. individual identity) was made salient, individuals took less for themselves in the "take" task (Brewer & Kramer, 1986). In another "give" vs "take" framed PGG game, subjects were told whether group

members were highly or marginally cooperative in a previous trial. In the "take" condition, subjects refrained from taking when others had not taken in the previous round, feeling responsible to match the cooperation of others. In the "give" condition, however, subjects gave more when others had *not* given much in the previous round, feeling responsible to allocate to the public good when others had contributed little (Fleishman, 1988). Additionally, in a prisoner's dilemma, a 2-player PGG (Rapoport & Chammah, 1965), framing the dilemma as the "community game" also significantly increased cooperation in comparison to when it was framed as the "Wall Street game" (Ross & Ward, 1996; Liberman et al., 2004). Though the psychology of a PGG and a prisoner's dilemma are different, the similar incentive structures and framing effects suggests that these results are relevant to the present experiments.

Thus, we can see that when PGGs are framed such that the collective benefit is emphasized, subjects are more like to cooperate.

Section VI – Individual Differences in Public Goods Games

Framing in PGGs is an important situational variable that can predict cooperation, but there are also significant individual differences that drive cooperative behavior. One of these differences is the degree of individualism and collectivism, which can be described at both the individual and societal level. Triandis (2002) describes collectivism as a broad range of personality traits: "giving priority to in-group goals over self goals, being self-effacing, defining your self-image as aspects of the group image, and when attributing the speech of other group members, focusing on the context of their speech rather than its exact content." Individualism is composed of the opposite traits: giving priority to self goals over in-group goals, focusing on uniqueness of self, and remaining emotionally distant from in-groups. Snow et al. (1986) argue

that the most effective framing manipulations in real world decisions are aligned with and amplify held beliefs or values. In the present experiment, we hypothesize that using a frame that is connected to personal beliefs about social-mindedness and personal responsibility should create the optimal impact on vaccination intentions. More specifically, other-framed appeals may be most effective among people who are collectivistic, and self-framed appeals may be most effective among people who are individualistic.

Individual difference measures of individualism and collectivism have been found to predict cooperative behavior in a PGG. De Cremer and Van Lange (2001) found that players rating high on a social value orientation scale contributed significantly more to the public pot in a PGG. When players are put into homogenous PGG groups based on their degree of individualism/collectivism and the PGG is played multiple times in a row (a "repeated game"), groups with high collectivism maintain higher contributions and significantly higher overall payoffs than groups with high individualism (Burlando & Guala, 2005). Individualism and collectivism differences can also be explored at the level of culture. Parks and Vu (1994) find that people from Vietnam (a very collectivistic culture) show significantly greater cooperation in a PGG than people from the United States (one of the most individualistic countries in the world). Similar results were found when Japanese adults and Chinese adults played the PGG, compared to American and Australian adults, respectively (Ishii & Kurzban, 2008, Chen & Li, 2005). Hofstede et. al (2010) found that individualism dominates in high-income and "Western" nations, while collectivism dominates in low-income and "non-Western" nations.

Section VII – Self & Other Appeals in Public Health Messaging

Individual differences in individualism and collectivism and the effectiveness of framing manipulations are not often systematically exploited in public health campaigns. Only a few psychological studies of public health campaigns have been undertaken to understand the ways that public health officials construct messages to promote health behaviors, and these results are too few to warrant general conclusions.

A field study of a measles vaccination public health campaign in the Philippines found that messages about the benefits of vaccination (preventing measles and related health complications) were less effective than those explaining the logistics of vaccination (the need for a child to be vaccinated before 12 months) (Zimicki et al., 1994). Combining field and lab studies, a meta-analysis of some characteristics of public health campaign messaging found that including an enforcement message (coercing people with implicit threat of fines & other punishments if health behavior does not change) and sharing new information not known by the public (e.g. new behavior promoted to prevent a particular illness) each significantly increase the effect size of behavior change. Neither directly promoting a health behavior instead of a service that promotes a health behavior, nor including real stories from role models had a significant effect (Snyder & Hamilton, 2002).

Many public health organizations release public health messaging campaigns with carefully constructed content, but have not tested the efficacy of these messages experimentally. We completed a broad survey of influenza vaccination appeals by public health organizations to gain an understanding of current real-world practices. The CDC's main slogan for their 2015 flu outreach contains both a self- and other-framed vaccination appeal: "This season, protect yourself – and those around you – by getting a flu vaccine" ("Influenza (Flu) Print Materials ,"

2015). The NY State Department of Health's general vaccination flyer includes similar language, encouraging citizens to "protect yourself and your family from serious and sometimes deadly diseases" ("Stay Healthy," 2015). Some but not all posters from the US Department of Veterans Affairs include self- and/or other-framed appeals, including phrases like "I should get a flu shot to protect myself AND the ones I love," and "protect your community" ("Public Health: Influenza Posters," n.d.). For most of these posters and the top "flu posters" on Google Images, however, other-framed appeals are almost never present in the slogan that appears in the largest text. And even when they do, without testing them experimentally, we cannot be certain that readers are processing the altruistic messages. The randomized experiments summarized earlier forced their subjects to read the messages they displayed, but posters in public spaces cannot force people to read them. For these reaons, comparisons of this previous research to real-world public health campaigns must be conservative.

In the present study, we therefore address this gap in the literature by experimentally testing the effectiveness of self and other frames used by real-life public health organizations to increase vaccination intentions.

Section VIII – Value-Aligned Public Health Messaging

Despite the best efforts of public health officials, many individuals do not ever get their flu vaccination. A RAND survey of unvaccinated adults asked subjects why they did not get their vaccine (Harris et al., 2011). Negative perceptions towards flu vaccinations comprised 28% of justifications: "I don't believe in flu vaccines" (14%), and "I might get sick/suffer side effects" (14%). Self-serving thinking or lack of knowledge explained 28% of responses ("I don't need it"). Lack of motivation or time comprised another 16% ("I didn't get around to it"). Only 7% of

unvaccinated adults cited issues of cost and availability. Among parents surveyed about their reasons for not vaccinating their children for flu, 54% were not worried about their children getting seasonal influenza, 60% cited the availability of medications to treat it, and 51% were worried about vaccine side effects (Leo et al., 2010). Gerend, Shepherd, & Lustria (2013) found that using information about perceived barriers can help tailor more effective vaccination appeals. Young adult women who were assigned to a tailored message specific to their indicated concerns about the HPV vaccine reported significantly greater intention to vaccinate than those assigned to a non-tailored message. Meta-analyses for other public health efforts, including anti-smoking and healthy eating campaigns, found that tailoring messages toward perceived barriers in these domains had similar positive effects on behavior change (Noar et al., 2007; Krebs, Prochaska & Rossi, 2010; Lustria et al., 2013). Our hypothesis is influenced by this positive research on tailoring messages: we hypothesize that vaccination appeals that align with one's degree of individualism/collectivism will be most effective in increasing vaccination intentions.

EXPERIMENT

Section IX – Study 1: *Meta-Analysis of Socially-Framed Vaccination Appeals*

In the present study, we test whether framing influenza vaccination appeals as public goods would affect a subject's degree of willingness to wait in line for a vaccination provided for free by a community clinic. We hypothesized that an other-framed appeal would increase wait time for subjects high in collectivism, while a self-framed appeal would increase wait time for subjects high in individualism. In Study 1, we conducted a meta-analysis ($N = 1079$) of four versions of our framing manipulation.

Meta-analysis

Subjects

1079 subjects were recruited from Amazon's Mechanical Turk platform and responded to our surveys online. Subjects were: 100% from the United States, 51% male, 73% white, mean age: 34 [range: 18-73], median income: $25-35k. Each subject received $0.30 for completing the survey, and an additional bonus of up to $0.90 depending on choices made during the survey. All mTurk subjects were high reputation workers, who had received above 95% approval ratings on previous completed tasks.

Materials

All subjects were introduced to our hypothetical flu vaccination situation:

Imagine that it is the beginning of flu season. Below you will see a message from your community health clinic about flu vaccination:

We would like to inform you that flu season is now approaching. Our clinic is committed to keeping the area "flu free" – so this year we are organizing vaccination clinics where we will give flu vaccinations at no charge.

This introduction was adapted from the email sent by Dr. Paul Genecin of Yale Health to the Yale community. We used a real virus (not "strain L" like Hershey et al. (1994) or an unnamed virus like Betsch et al. (2013)) in order to mimic real-life decision making as closely as possible.

In each version, subjects were randomly assigned into the "self" or "other" condition, where subjects saw a self- or other-framed appeal. These appeals differed slightly between versions (see Appendix A); version 4 is presented here:

[Self appeal // Other appeal]:

The flu vaccine can prevent you from [*getting the flu // spreading the flu to your community*]. *And even if you do get the flu, the vaccine will make you less likely* [*to get the worst symptoms and make your sickness last for fewer days* // *to spread it*].

If you don't get the flu vaccine, the US Department of Health estimates that you could cause [*yourself* // *three of your friends and family members*] *to get extremely sick and spend a week in bed.*

Take responsibility for [*your health* // *the health of your community*].

The number of friends and family members ("three") is derived from the basic reproduction number of a moderate flu season (R_0=1.45; see Section IV) extrapolated out to three nodes in an individual's social network (1.45^3=~3; e.g. I can get my friend sick, who could get their friend sick, who could get their friend sick). This was an intuitive guess: you might know your friends of friends of friends, but it is unlikely you would know anyone four or more degrees out. Valence and goal framing effects are kept constant across conditions, with the first paragraph of each message framing the benefits (positive valence & goal) of getting the flu vaccine, and the second paragraph framing the harms of not getting the vaccine (negative valence & consequence).

One outcome variable was consistent across all four versions of the study:

Wait Time: All participants were told that there is often a wait at their community health clinic and were asked to respond to a question eliciting their willingness to wait in line for a flu vaccination ("wait time"). Participants answered on an 8-item non-continuous Likert scale, from 0 minutes to 3 hours.

This variable was selected because of its ecological validity; lines are often long at flu vaccination clinics, especially when the vaccination is given out for free, as is true in our hypothetical situation. We wanted a measure that not only determined whether or not someone would be willing to get a vaccination (subjects answer "0 min" if they are not willing to get a

vaccination), but also how much time they would be willing to sacrifice. Wait time fulfills these requirements.

As an individual difference measure, all subjects were surveyed for degree of individualism and collectivism using the Individualism and Collectivism Scale (ICS; Triandis & Gelfand, 1998). The ICS involves 16 statements describing four aspects of collectivism and individualism: horizontal collectivism, vertical collectivism, horizontal individualism, and vertical individualism. There were 4 statements for each aspect. Each statement was responded to on a 9-item Likert scale from "Never" to "Always." (e.g. horizontal collectivism: "I feel good when I cooperate with others.").

Results

The ICS components demonstrated acceptable reliability: horizontal collectivism (4 items, $\alpha = 0.72$), vertical collectivism (4 items, $\alpha = 0.79$), horizontal individualism (4 items, $\alpha = 0.73$), and vertical individualism (4 items, $\alpha = 0.75$). For each scale, a mean was calculated and used in further analyses.

For interactions with a self-framed appeal, vertical individualism is used instead of horizontal individualism because of its focus on winning and selfish competition (vertical), instead of a libertarian sense of self-dependence (horizontal). Vertical collectivism was strongly and significantly correlated with horizontal collectivism, $r(1075) = 0.579$, $p < .001$. In addition, horizontal individualism was moderately and significantly correlated with vertical individualism, $r(1075) = 0.281$, $p < .001$. Vertical collectivism, however, was also weakly and significantly correlated with both horizontal individualism ($r(1075) = 0.088$, $p = .0037$) and vertical individualism ($r(1075) = 0.2282$, $p < .001$). Due to these unexpected associations, we used

horizontal collectivism instead of vertical collectivism in interaction with the other-framed appeal.

Random-effects meta-analysis of flu vaccination wait time found no significant interaction between the presentation of an other-framed appeal and degree of horizontal collectivism, effect size 0.017 percentage points, 95% CI [-0.161, 0.195], $Z = 0.19$, $p = 0.851$ (see Figure 1). There was also no significant interaction between the presentation of a self-framed appeal and degree of vertical individualism on wait time, effect size 0.029 percentage points, 95% CI [-0.123, 0.182], $Z = 0.37$, $p = 0.708$ (see Figure 2). Examining simple effects, however, showed that subjects who saw an other-framed appeal had a marginally significant greater wait time than subjects who saw a self-framed appeal, effect size 0.208 percentage points, 95% CI [-0.026, 0.442], $Z = 1.74$, $p = 0.081$ (see Figure 3).

Horizontal collectivism alone had a significant positive effect on wait time, effect size 0.314 percentage points, 95% CI [0.223, 0.406], $Z = 6.75$, $p < .001$. Vertical collectivism alone also had a significant positive effect on wait time, effect size 0.153, 95% CI [0.072, 0.233], $Z = 3.71$, $p < .001$. Finally, vertical individualism alone had a significant positive effect on wait time, effect size 0.103, 95% CI [0.028, 0.178], $Z = 2.68$, $p = .007$.

Discussion

A meta-analysis of four versions of our manipulation found that subjects who saw other-framed appeals were marginally more likely to indicate a willingness to wait longer in line for a flu vaccination than subjects who saw self-framed appeals. This means that other-framed appeals are at least marginally more effective than self-framed appeals at increasing vaccination intentions. Although this does not affirm our main hypothesis (that appeals that are aligned with

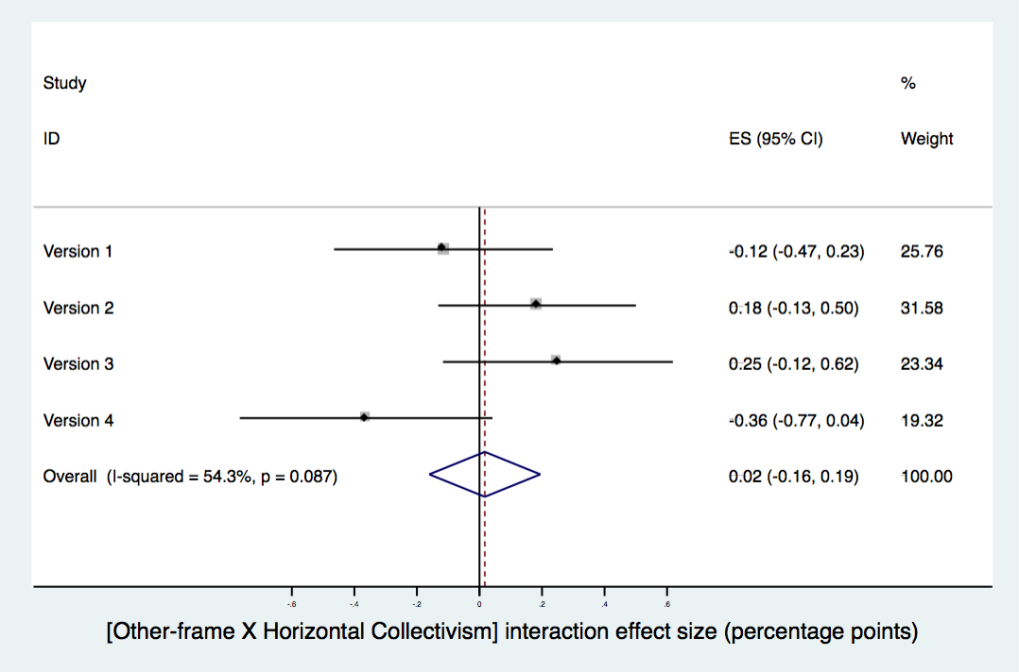


Figure 1. Effect size (ES) for interaction between other-framed appeal and horizontal collectivism on wait time for each version of the experiment in Study 1. Error bars indicate 95% confidence intervals (CI). The size of the grey square surrounding the study-specific estimates indicates the weight placed on each study in the meta-analysis.

one's degree of individualism/collectivism would be most effective), it is still an important indicator to organizations like Yale Health and the CDC that their use of self-framed appeals in public health communications may not be the most effective type of appeal to increase vaccination intentions. These results do not tell us about actual vaccination behavior, but until similar studies on this behavior are completed, public health organizations may be better off spending money on influenza posters and advertising campaigns that contain an other-framed appeal.

One hypothesis is that the marginal effect of other-framed appeals might be explained by construal level theory. This theory states that events can be thought of either as here and now (concrete), or psychologically removed "in time, in space, in social distance, [or] in hypotheticality" (Trope & Liberman, 2010). The self-framed appeal might make a subject think

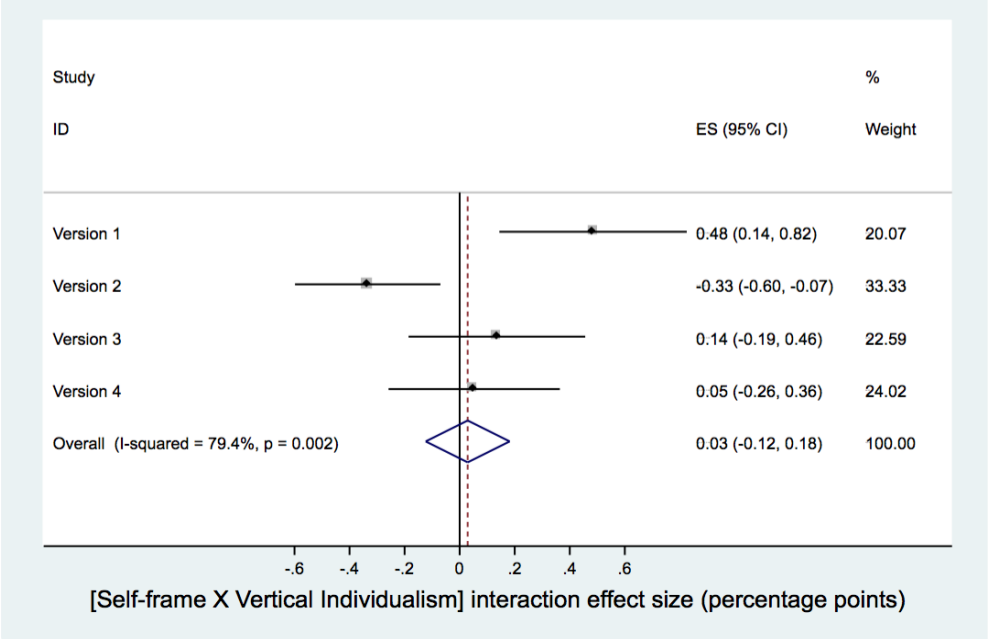


Figure 2. Effect size (ES) for interaction between self-framed appeal and vertical individualism on wait time for each version of the experiment in Study 1. Error bars indicate 95% confidence intervals (CI). The size of the grey square surrounding the study-specific estimates indicates the weight placed on each study in the meta-analysis.

of an amorphous amount of other people that might get them sick (abstract: larger social distance, more hypothetical), while the other-framed appeal might make a subject think of three particular friends and family members to whom the subject could spread the flu (concrete). To test this hypothesis, an additional trial using a similar mTurk population ($N = 203$) was conducted. Subjects were randomly assigned to the same vaccination appeals (self-frame, other-frame), but then subjects were asked only to complete the Behavioral Identification Form (Vallacher & Wegner, 1989). This is a set of 25 questions assessing individual preferences in identifying actions as a high-level construal (abstract) or low-level construal (concrete). A one-way ANOVA[2] found no significant difference between conditions in subjects' construal level, $F(3,199)=1.01$, $p=0.388$. This rejects our construal hypothesis.

[2] ANOVA, and not independent samples t-test, was used because two additional conditions discussed in Study 2 were also included.

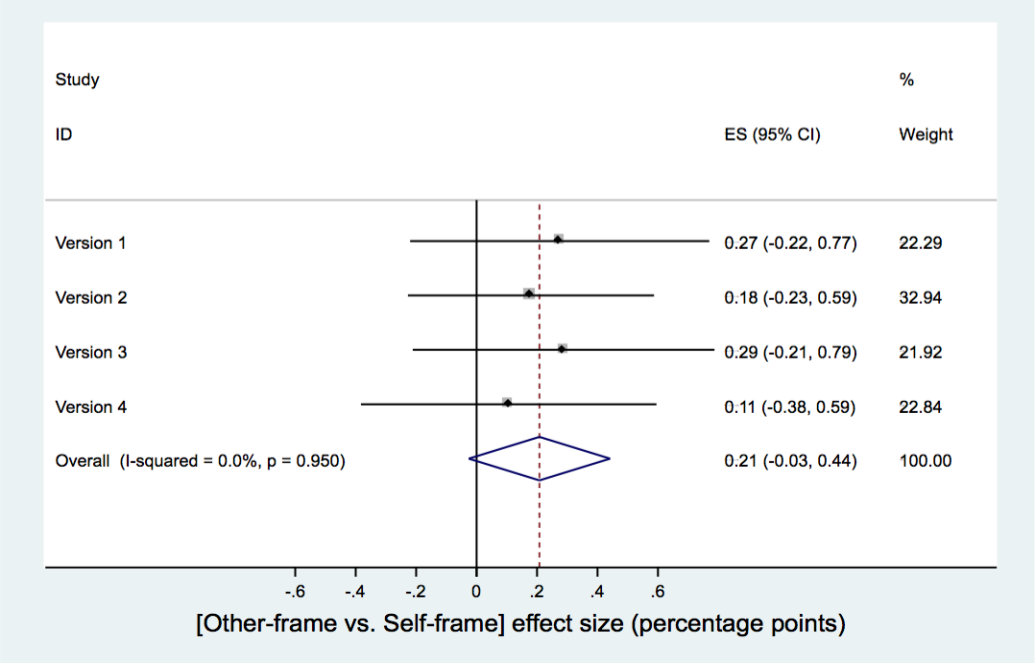


Figure 3. Effect size (ES) for other-framed appeal vs. self-framed appeal on wait time for each version of the experiment in Study 1. Error bars indicate 95% confidence intervals (CI). The size of the grey square surrounding the study-specific estimates indicates the weight placed on each study in the meta-analysis.

There were no significant interactions between self-framed appeals and vertical individualism, or between other-framed appeals and horizontal collectivism on wait time. This means that the degree of individualism or collectivism did not predict wait time responses based on appeal type. These results reject our main hypothesis, which conjectured that subjects who saw an appeal that was aligned with one's level of individualism (self-framed appeal) and collectivism (other-framed appeal) would report higher vaccination intentions. It is possible that, in this fast-paced online context where decisions do not affect real-life health decisions, subjects pay less attention to stimuli that conform with their outlook on life, leading to decreased thought about the harms of the flu, decreasing motivation to wait in line or pay for a flu vaccination. This is not, however, an argument that is supported by the literature on the alignment of personal values with framing (Snow et al., 1986; Snow et al., 2014).

Because we only saw one marginal effect, it is also possible that our appeals were not fully processed or paid attention to by our online mTurk sample. mTurk subjects work through many surveys very quickly because each one pays so little (our top payout was $1.20). But a study of mTurk data quality found that limiting the survey to only high-reputation mTurk workers (at least 95% approval ratings) produced the highest-quality survey data, without needing additional attention check questions such as the mandatory transcription required of all subjects at the beginning of our task (Peer, Vosgerau, & Acquisti, 2014). With both high-reputation mTurk workers and the additional attention check transcription, it is unlikely that mere laziness by subjects is the explanation for our marginal results.

It is also possible that people have stronger alternative motivations for their choice to get vaccinated. Significant determinants of vaccination intentions include: social and cultural values, previous vaccination experiences, negative perceptions of vaccines in general, and mistaken beliefs about side effects, among others (Harris et al., 2011, Nagata et al., 2013). Self-framed appeals, and to a lesser extent, other-framed appeals, might do little to alter these other powerful motivations. Perhaps longer and more compelling appeals that emphasized personal stories would be more likely to truly capture the minds of our subjects and cause them to imagine the effects that their private vaccination behavior could have on their family and friends.

There were also unforeseen weak correlations between vertical collectivism and both vertical individualism and horizontal individualism. Another study that used the ICS did not find significant correlations between individualism items and collectivism items (Coon & Kemmelmeier, 2001). These interactions were unexpected and an indicator that our subjects may have an inconsistent set of internal goals, or that subjects were not fully engaged in the task or

did not understand the individualism and collectivism scale items. The high degree of scale reliability, however, makes this lack of understanding unlikely.

A high horizontal collectivism score significantly predicted higher wait times. People who self-report high levels of horizontal collectivism may have greater patience for waiting in lines because of their own decreased emphasis on competition and winning. Vertical collectivism was also predictive of wait time. Subjects who are high in vertical collectivism emphasize the value of taking care of family members and sacrificing for their parents and children, making it likely that they would be more willing to wait in line for a vaccination if their decision helped their family members (Triandis, 2002). Vertical individualism also significantly predicts higher wait times, likely because subjects who are high in vertical individualism are selfishly interested in protecting their health in any way possible. These results suggest that there are two different routes to vaccination motivation: through appeals to individualism, and through appeals to collectivism. This is a sign that the intentions of our vaccination appeals are on the right track, regardless of their actual efficacy.

Section X – Study 2: ***Covariates, Alternate Outcome Variables, and Additional Conditions***

Study 2 analyzes the final version of the manipulation (version 4) alone. Given insignificant results from Study 1 (which retroactively included relevant data from version 4), two additional outcome variables and eight control measures were included to further examine any potentially unmeasured interactions with self- and other-framed appeals.

In addition, two new conditions were added: 1) a condition presenting the self-framed and other-framed appeals combined together ("both" condition); and 2) a control condition with no additional appeal ("none" condition). Because the effect of the other-framed appeal was only

marginally more impactful than the effect of the self-framed appeal, we were interested in exploring whether the effects of the self- and other-framed appeals might be additive, where combining both appeals would create significantly greater effects on vaccination intentions. This strategy is derived from some previously mentioned examples of public health messaging, including the CDC's 2015 flu outreach slogan ("Influenza (Flu) Print Materials," 2015). In addition, previous studies have shown mixed success when combining self and other-framed appeals (Gerend & Barley, 2009; Hendrix et al., 2014). We hoped to provide additional insight on this uncertainty. Because it is possible that neither the "self" nor "other" condition significantly increase vaccination intentions, a control condition of no appeal was also added.

Subjects:

411 subjects were recruited from Amazon Mechanical Turk took an online survey. 5 subjects began the survey but did not complete the entire survey, and their responses were discarded from analysis. Therefore, 406 subjects (100% from the United States, 52% female, 74% white, mean age: 34 [range: 18-65], median income: $25-35k) completed the entire survey and were included in analysis. Each subject received $0.30 for completing the survey, and an additional bonus of up to $0.90 depending on choices made during the survey. All mTurk subjects were high reputation workers, who had received above 95% approval ratings on previous completed tasks.

Materials

Two additional outcome variables were included:

- *Vaccination Likelihood:* Subjects were asked "*How likely are you to get your flu vaccine?*" and answered on a 7-item Likert scale from "extremely unlikely" to "extremely likely."
- *Willingness to Pay (WTP): Subjects were asked to indicate how much they were willing to pay for a flu vaccination if the community clinic did not provide the vaccination free of charge. This WTP was collected by number text entry.*

These outcome variables were added they are used more often in the literature (vaccination likelihood: Zimet et al., 2010; Vietri et al., 2012; and willingness to pay: Bishai et al., 2007; Prosser et al., 2004; Brown et al., 2010)), and we did not find significant results with our ecologically valid outcome variable ("wait time") in versions 1-3. These outcome variables were also easy to collect in an online survey format and allowed for near-"zero" answers (subjects could respond "Extremely unlikely" or willing to pay $0, respectively).

Scales and tasks for the collection of control variables were administered in version 4. We hypothesized that the vaccination appeal manipulations would result in significant differences in wait time, vaccination likelihood, and WTP. But to ensure that these differences were not attributable to confounds, the following scales were used as controls:

- *Appraisal of Self-Care Agency Scale-Revised (ASAS-R)* (Sousa et al., 2010): Subjects were asked to answer 3 questions about their agency to perform health behaviors to promote their own health. Each question was answered on a 5-item Likert scale from "strongly disagree" to "strongly agree" (e.g. "As circumstances change, I make the needed adjustments to stay healthy"). This scale is included as a control for varying

baseline likelihood to perform personally beneficial health behaviors, such as getting a flu vaccination.

- *Value of Time (VOT)* (adapted from Borisova & Goodman, 2003): Subjects were asked a single question about the lowest wage they would accept if unemployed. An 8-item Likert scale was provided from $5/hour to $40/hour. This question is included as a control to ensure that any differences in wait time were not attributable to a subject having a different value of time.
- *Demographic Survey:* Included questions about sex, age, race, education level, income.
- *Flu Vaccination Access:* This question asked subjects how difficult it was to find a place to get their flu vaccination and then go get the vaccine, answered on a 7-item Likert scale from "Extremely difficult" to "Extremely easy."
- *Daily In-Person Contacts*: This question asked subjects how many people they had an in-person conversation with on a normal day, collected by number text entry.
- *Household Number:* This question asked subjects about the number of other people that stay or live in their home, answered on a 11-item Likert scale from "0" to "10 or more."
- *Perceived Flu Risk*: This question asked subjects how likely they thought they were going to get the flu if they did not get the flu vaccine ("perceived flu risk"), answered on a 7-item Likert scale from "Extremely unlikely" to "Extremely likely."
- *Flu Knowledge*: All subjects then answered 7 true-false questions to measure knowledge of commonly known information about the flu ("flu knowledge," e.g. "The flu is more likely to be spread during certain times of the year.").

In the first three versions of the study, basic information about the epidemiology, symptoms, and methods of spreading flu were presented before the vaccination appeals. To analyze the

effect of flu knowledge on the outcome variables, all initial flu information was removed in version 4.

Results

WTP ($p<.001$) had a significantly right skewed distribution. To normalize the variable, it was log-transformed. Perceived flu risk had a bimodal distribution, so it was analyzed using a median split. The ASAS-R scale (3 items, $\alpha = 0.59$) demonstrated marginal reliability. Its mean was calculated and used in further analyses. For the seven flu knowledge questions, we calculated a single value for the sum of correct answers.

Framing and outcome variable effects:

Using a two-way MANOVA, we found no significant difference in any of the outcome variables (wait time, likelihood, or WTP) based on the subject's condition (none, self, other, or both), $F(3, 391) = 0.14$, $p = .937$, Wilk's $\Lambda = 0.999$. Follow-up regressions find no significant effect on wait time ($b = -.013$, $t(390) = -0.04$, $p = .969$)., vaccination likelihood ($b = .114$, $t(390) = 0.25$, $p = .806$)., or WTP ($b = .116$, $t(390) = 0.46$, $p = .644$).

There was a significant difference in outcome variables by an interaction between self-framed appeal and vertical individualism, $F(3, 195) = 6.19$, $p < .001$, Wilk's $\Lambda = 0.913$. By post-hoc multivariate regression, the interaction of self-framed appeal and vertical individualism significantly predicted vaccination likelihood, $b = 0.490$, $t(196) = 2.48$, $p = .014$. The interaction of self-framed appeal and vertical individualism did not significantly predict wait time or WTP. There was no significant difference in outcome variables by an interaction between other-framed appeal and horizontal collectivism, $F(3, 195) = 1.45$, $p = 0.229$, Wilk's $\Lambda = 0.978$.

Covariates

Some of the covariates significantly predicted the outcome variables. In all of the subsequent regressions, the following variables were controlled: perceived flu risk, flu knowledge, difficulty to get the flu vaccine, the number of daily in-person interactions, value of time (VOT), self-care agency (ASAS-R), gender, age, education, income and number of people that stay or live in their home.

For wait time, there was a significant positive effect of perceived flu risk ($b = 0.871$, $t(387) = 6.94$, $p < .001$) and flu knowledge ($b = 0.220$, $t(387) = 5.02$, $p < .001$). For vaccination likelihood, there was a significant positive effect of perceived flu risk ($b = 1.861$, $t(387) = 9.22$, $p < .001$), flu knowledge ($b = 0.501$, $t(387) = 7.09$, $p < .001$), and level of education ($b = 0.218$, $t(387) = 2.41$, $p = .016$). For WTP, there was a significant positive effect of perceived flu risk ($b = 0.699$, $t(387) = 5.86$, $p < .001$) and flu knowledge ($b = 0.234$, $t(387) = 5.60$, $p < .001$).

For the flu knowledge covariate, only 13% of its variance could be explained by measured variables. Significant effects on flu knowledge included a marginally significant positive effect of the presence of the other-framed appeal ($b = 0.313$, $t(387) = 1.69$, $p = 0.092$), a significant negative effect of self care agency ($b = -0.240$, $t(387) = -2.39$, $p = 0.017$), and a significant positive effect of perceived flu risk ($b = 0.886$, $t(387) = 6.59$, $p < .001$). For the perceived flu risk covariate, less than 15% of its variance could be explained by measured variables. Significant effects on perceived flu risk included a significant negative effect of male gender ($b = -0.101$, $t(387) = -2.05$, $p = .041$), a significant positive effect of number of people living in your household ($b = 0.033$, $t(387) = 2.17$, $p = .031$), and the previously cited effect of flu knowledge.

Discussion

The interaction of self-framed appeal and vertical individualism significantly predicted vaccination likelihood, but not the other outcome variables. This means that for subjects in the "self" condition, those with greater vertical individualism were more likely to indicate willingness to get a flu vaccination. This is consistent with our hypothesis that subjects who were more individualistic would report higher vaccination intentions when presented with a self-framed appeal. This hypothesis, however, is only confirmed for vaccination likelihood and not for wait time or WTP. It is likely that subjects who are high in vertically individualism are motivated by the self-appeal because it aligns with their held beliefs or values, but this might only be useful in motivating the person to go get the flu vaccination. Subjects high in vertical individualism are very competitive and focused on winning, so they might not be as willing to wait in line or part with their money. But this postulation is not supported by our data: vertical individualism did not significantly predict wait time ($b = 0.009$, $t(392) = 0.19$, $p = .851$) or WTP ($b = 0.013$, $t(392) = 0.27$, $p = .784$). The inconsistency in the interaction of self-framed appeal and vertical individualism in predicting the outcome variables means that our current study does not fully reveal the motivations of people high in vertical individualism. Because the outcome variables measure a variety of domains (time, money, & probability), this makes it likely that our measurements are accurately representing the vaccination intentions of subjects.

For the interaction of other-framed appeal and horizontal collectivism, there was no difference in the outcome variables. This does not support our hypothesis that collectivist subjects would report higher vaccination intentions when presented with an other-framed appeal. Collectivistic subjects might look to the attitudes of friends and family in deciding their

vaccination decisions, decreasing the perceived importance of the opinion of public health officials, which decreases the potential impact of the other-framed appeal. It is possible that individualistic subjects are more highly motivated by the self-framed appeal, perhaps not out of respect for authority figures, but out of a motivation to have better health than others by using all available information to avoid the flu.

There was not a significant difference across the outcome variables by condition. There was not a marginal effect of "other" over "self" for any of the outcome variables, unlike in the meta-analysis. For this version, therefore, we will focus on the lack of significant difference between the other three conditions: "self," "both" (a combination of self- and other-framed appeals) and "none" (no appeal). First, this means that self-framed appeals were equally as effective as no appeal. This shows that self-framed appeals, often employed by public health organizations, may not be useful appeals in broad public health campaigns, like many public health organizations have done in the past. Given the interaction effect with vertical individualism, however, self-framed appeals are effective when targeted to the right sub-population high in vertical individualism. Otherwise, the meta-analysis effect showing that other-framed appeals are more effective (at marginal significance) than self-framed appeals should take precedence, and other-framed appeals should be used instead of self-framed appeals.

Second, these results suggest that combining self- and other-framed appeals is not additive, but instead is no different than presenting no appeal at all. Combining appeals may cause information overload, where subjects are overwhelmed with the quantity of information being presented to them. This effect has been seen in numerous health decision contexts (Internet health information: Cline & Haynes, 2001; parental decision for circumcision: Ciesielski-Carlucci, Milliken, & Cohen, 1996; cancer treatment information for patients: Kim, Lustria, &

Burke, 2007). In each case, overload reduced the ability for patients to make beneficial decisions about their health by blanketing them in information and data. Though our vaccination appeals are far less imposing than the literature surrounding cancer treatment, the null difference between "none" and "both" could still be an effect of information overload.

It is also possible that subjects could start to ignore the longer "both" appeals because receiving so much information about the risks of flu makes them too scared. Witte's Extended Parallel Process Model states that when an individual receives a fear appeal, one common response is to act to control the fear, either by "denial ['I could never get the flu'], defensive avoidance ['Getting the flu would be too scary, I don't want to think about it'], or reactance ['Those Yale experimenters are just trying to manipulate me, I'm going to ignore them']" (Witte & Allen, 2000). This same response could be occurring in our sample, decreasing the impact of the combined "both" appeal. It is, therefore, critical that the CDC and other public health organizations question their decisions to include both self- and other-framed appeals on their posters and in their messaging. These results suggest that, until more conclusive studies using real-life vaccination behavior are completed, using an other-framed appeal alone seems to be the most promising option public health messaging.

Perceived flu risk and flu knowledge were both strongly significant predictors of wait time, vaccination likelihood, and WTP. These are both examples of alternate motivations for flu vaccination decisions. Perceived flu risk is likely predictive of vaccination intentions because having a high baseline level of perceived risk makes you feel like your health is more in danger. This fear of danger is strongly motivating, causing subjects to self-report greater likelihood to get a vaccination, and to wait longer and pay more for that vaccination. Flu knowledge might make you more aware of the potential risks of the flu virus on your health, motivating you to get your

flu vaccination. It could also be an indicator of someone who has spent time reading about public health concerns and knows how the flu vaccination can help both themselves and others. These effects were highly correlated: people who had high perceived flu risks also had high flu knowledge. This makes sense, given the similar arguments of increased realization of the risks of flu. It is easy to imagine how understanding more about the flu may increase your perceived risks of flu. In addition, the presence of an other-framed appeal had a marginally significant positive effect on flu knowledge. This could indicate that the other-framed appeal, and not the self-framed appeal, helped educate people on the flu, or made them pay slightly more attention to the questions being asked. Since our measured variables explained less than 15% of the variance of both perceived flu risk and flu knowledge, there are still significant other unknown predictors of these two variables.

Section XI – Limitations & Future Research

This experiment is limited in its real-world applicability. Subjects are asked to imagine a hypothetical scenario, although one they are faced with every year, and asked for hypothetical willingness to wait for a flu vaccination, willingness to pay for a flu vaccination, and likelihood to go get a flu vaccination. It is possible that intended flu behavior could be an unreliable predictor of real-life vaccination behavior, when the health of the individual is actually at risk. One study of flu vaccination intentions and behaviors in college students found that of the 25% of students who reported an intention to get their flu vaccination, only 27% of those students actually followed through and received the vaccination (Bronchetti, Huffman, & Magenheim, 2015). The present experiment could be greatly improved by measuring actual vaccination behavior in response to randomized vaccination appeals. For the next flu season starting in Fall

2016, plans are underway to present a research collaboration to Yale Health to implement a randomized controlled trial of self- and other-framed vaccination appeals. This would involve emailing self- and other-framed vaccination appeals to members of the Yale community at the beginning of flu season. Follow-up surveys would be sent to subjects asking them to self-report if they received a flu vaccination. If possible, Yale Health will also verify these de-identified self-reports using data from their flu clinic attendance records. This will provide an important real-world application of our experiment's methodology and theory. In doing so, it can also test whether intentions and willingness to get a vaccination are reliable predictors for actual vaccination behavior.

This experiment is also limited in its subject scope. All subjects were from the United States, a country with very high levels of individualism (Hofstede et al., 2010). Future studies should expand these trials to subjects in low-income nations where collectivism levels are often much higher.[3] This could both create more widely applicable conclusions, as well as test if other-framed vaccination appeals are more effective in countries where there are much higher levels of community orientation and group goal-setting.

It is also possible that short vaccination appeals via emails are not the most impactful ways to promote flu vaccination. Because subjects can so easily delete, ignore, or mindlessly skim through email messages, more robust and attention-grabbing mediums might be more effective. TV commercials and dynamic web advertisements might be better suited for these public health campaigns. In addition, research in low-income nations indicates that text messages and radio advertisements, and not email, can be key forms of communication for public health appeals (Déglise, Suggs, & Odermatt, 2012; Githinji et al., 2014; Allain et al., 2008; Paluck &

[3] For example, Kenya has a score of 25/100 vs. US 91/100 on the Hofstede 6-D scale, a scale measuring levels of individualism at the country-level (higher score = greater bias towards individualism).

Green, 2009). Optimizing these vaccination appeals for viewing on mobile phones is likely to be an essential piece of future public health campaigns.

Because perceived risk and flu knowledge were such large predictors of vaccination intentions, it is critical that future studies focus on these variables. Vaccination appeals that educate individuals about the flu, especially the risks of infection, are likely to greatly increase vaccination intentions. This education, however, might be difficult to convey in a single email or poster, so the use of more sustained public health campaigns might be most impactful. A regression of effects on perceived flu risk finds that variables in this experiment could only explain 15% of risk variability. Identifying other drivers of individual's perception of flu risk would be useful in designing alternate appeals that increase perceived risk without creating counter-productive fear-appeal responses.

A future qualitative study would be immensely helpful in understanding how individualists and collectivists differ in their motivations to get a vaccination. Interviews with subjects, coupled with a survey of individualism and collectivism, could help uncover motivations that are not otherwise collected in a survey-only experiment, like our own. Questions should particularly probe how relationships with family members and friends affect attitudes towards flu vaccination.

Flu vaccination is one of many issues in health where private health behaviors can be considered as public goods. This research on optimizing public health appeals and targeting them using individual difference measures should be expanded to other health behaviors, such as other types of vaccinations, blood donation, healthy eating, and STD screening.

Section XII: Recommendations for Public Health Officials

Other-framed appeals may be more effective than self-framed appeals in public health campaigns, unless the campaign is targeting participants who are known to be high in vertical individualism, wherein self-framed appeals may be more effective. Combined self- and other-framed appeals may not be more effective than no appeal at all. Until more conclusive studies examining real-life vaccination behavior are completed, public health organizations should revise the current practice of using self-framed vaccination appeals and instead explore the use of other-framed appeals.

Appendix A: Survey Instrument

[mTurk ID input]

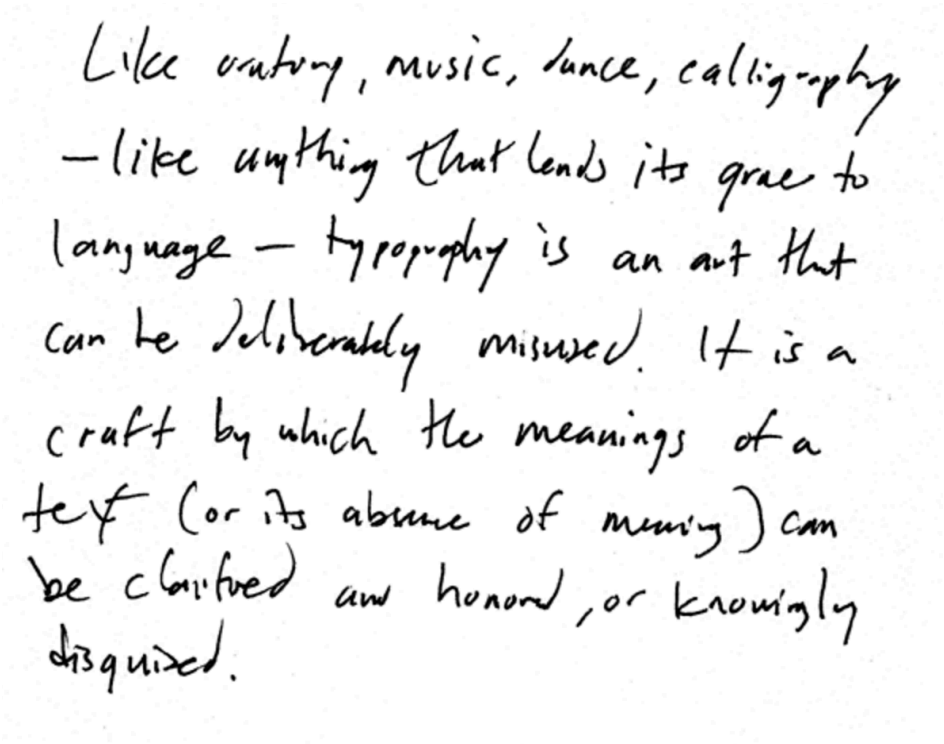
To begin, please **enter your Amazon Mechanical Turk Worker ID here:**

(Please see below for where you can find your Worker ID.)

Your Worker ID starts with the letter A and has 12-14 letters or numbers. It is NOT your email address. If we do not have your correct Worker ID we will not be able to pay you.

[Transcription – Attention Check]

To begin, please type the following paragraph into the box below:



[Statement from community clinic – vaccination appeals]: Version 4

Imagine that it is the beginning of flu season. Below you will see a message from your local health clinic about flu vaccination:

We would like to inform you that flu season is now approaching. Our clinic is committed to keeping the area "flu free" - so this year we are organizing vaccination clinics where we will give

flu vaccinations **at no charge.**

[None] — Version 4 Only

[Self // Other]

Version 1

If you get the flu vaccine, you could cause [*yourself // your friends and family*] *to get extremely sick and spend a week in bed.*

Version 2

If you don't get the flu vaccine, you could cause [*yourself // your friends and family*] *to get extremely sick and spend a week in bed.*

Take responsibility for [*your health // the health of your community*].

Version 3

If you don't get the flu vaccine, the US Department of Health estimates that you could cause [*yourself // three of your friends and family members*] *to get extremely sick and spend a week in bed.*

Take responsibility for [*your health // the health of your community*].

Version 4

The flu vaccine can prevent you from [*getting the flu // spreading the flu to your community*]. *And even if you do get the flu, the vaccine will make you less likely* [*to get the worst symptoms and make your sickness last for fewer days // to spread it*].

If you don't get the flu vaccine, the US Department of Health estimates that you could cause [*yourself // three of your friends and family members*] *to get extremely sick and spend a week in bed.*

Take responsibility for [*your health // the health your community*].

[Both] — Version 4 only

The flu vaccine can prevent you from getting the flu and spreading the flu virus to your community. And even if you do get the flu, the vaccine can make you less likely to get the worst symptoms and will make you less likely to spread it.

If you don't get the flu vaccine, the US Department of Health estimates that you could cause yourself and three of your friends and family members to get extremely sick and spend a week in bed.

Take responsibility for your health and the health of your community.

[Wait time]
The clinic sometimes gets busy and there can be a line to get your flu vaccination.

How much time would you be willing to wait in line to get the flu vaccination?
(if you are not willing to wait in line, please select 0 minutes)

0 minutes	5 minutes	10 minutes	20 minutes	30 minutes	1 hour	2 hours	3 hours
○	○	○	○	○	○	○	○

[Vaccination Likelihood]
How likely are you to get your flu vaccine?

Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
○	○	○	○	○	○	○

[WTP]

If the community clinic did not provide the flu vaccination free of charge, how much would you be willing to pay to get a flu vaccination? $____

[Flu Knowledge Questions]
The flu is more likely to be spread during certain times of the year. **True** / False
The best way to prevent the flu is to eat healthy. True / **False**
The flu is spread through coughing. **True** / False
Diarrhea is a symptom of the flu. True / **False**
It is necessary to get a flu shot every year to stay immunized. **True** / False
If you get the flu vaccine, it protects others from getting the flu. **True** / False
If you get the flu vaccine, it protects you from getting the flu. **True** / False

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[Perceived flu risk]

If you don't get the flu vaccine, how likely do you think you are to get the flu?

Extremely unlikely	Moderately unlikely	Slightly unlikely	Neither likely nor unlikely	Slightly likely	Moderately likely	Extremely likely
○	○	○	○	○	○	○

[Flu vaccine access difficulty]

How difficult is it for you to find a place to get your flu vaccine, and then go get your vaccine?

Extremely difficult	Moderately difficult	Slightly difficult	Neutral	Slightly easy	Moderately easy	Extremely easy
○	○	○	○	○	○	○

[Daily in-person contact]
On a normal day, how many people do you have an in-person conversation with**?**

[Household Number]
How many other people stay or live in your home? (excluding yourself, so if you live alone, select "0")

0	1	2	3	4	5	6	7	8	9	10 or more
○	○	○	○	○	○	○	○	○	○	○

[ASAS-R]

As circumstances change, I make the needed adjustments to stay healthy.

I routinely take measures to insure the safety of myself and my family.

I often lack energy to take care of myself in that way that I know I should.

strongly disagree	disagree	neutral	agree	strongly agree
○	○	○	○	○

[Value of Time]

If you were not employed, what is the lowest wage (in US dollars per hour) it would take for you to accept a job?

5	10	15	20	25	30	35	40
○	○	○	○	○	○	○	○

[Individualism and Collectivism Scale]

Horizontal Individualism
I'd rather depend on myself than others.
I rely on myself most of the time; I rarely rely on others.
I often do "my own thing."
My personal identity, independent of others, is very important to me.

Vertical Individualism
It is important that I do my job better than others.
Winning is everything.
Competition is the law of nature.
When another person does better than I do, I get tense and aroused.

Horizontal Collectivism
If a coworker gets a prize, I would feel proud.
The well-being of my coworkers is important to me.
To me, pleasure is spending time with others.
I feel good when I cooperate with others.

Vertical Collectivism
Parents and children must stay together as much as possible.
It is my duty to take care of my family, even when I have to sacrifice what I want.
Family members should stick together, no matter what sacrifices are required.
It is important to me that I respect the decisions made by my groups.

[Demographic Survey]

Gender: Male / Female
Age: ___ years
Race:

- White/Caucasian (Anglo/Euro) American
- Black or African American
- Asian or Asian American
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander
- Hispanic/Latino
- Multicultural

Education:

- Less than a high school degree
- High School Diploma

- Vocational Training
- Attended College
- Bachelor's Degree
- Graduate Degree
- Unknown

Income

- Under $5,000
- $5,000-$10,000
- $10,001-$15,000
- $15,001-$24,000
- $25,001-$35,000
- $35,001-$50,000
- $50,001-$65,000
- $65,001-$80,000
- $80,001-$100,000
- Over $100,000

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