

**Brief Report: Framing Flu Prevention – An Experimental Field Test of Signs  
Promoting Hand Hygiene During the 2009-2010 H1N1 Pandemic**

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## Abstract

*Objective.* During the 2009-2010 H1N1 flu pandemic, many institutions installed alcohol-based hand sanitizer dispensers in public settings in an effort to prevent the spread of the virus. Yet, usage of these dispensers remained low.

*Methods.* Point-of-use reminder signs were designed to emphasize four theoretically-grounded health beliefs: perceived susceptibility, social norms, consequences of the behavior framed as gains, and consequences of the behavior framed as losses. From October 2009 to March 2010, 58 sanitizer dispensers in public buildings were randomly assigned to have one of the four signs placed next to it, and dispenser usage was continually monitored.

*Results.* All signs were associated with greater sanitizer usage compared to no sign. The gain-framed sign was associated with greatest usage (66% over no sign). Signs emphasizing susceptibility to H1N1 were associated with the lowest usage (41% over no sign). Although usage declined over time and closely mirrored trends in public interest about H1N1, the influence of the signs were not dependent on degree of public interest.

*Conclusion.* This experimental field study shows how simple, theoretically-grounded signs can serve as cues to action in promoting the adoption of preventive behaviors. Gain-framed signage is particularly effective in promoting hand hygiene in a flu pandemic. (202 words)

*Keywords:* message framing, gain/loss framing, hand washing, health behavior, H1N1

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In June 2009, the World Health Organization declared an H1N1 flu pandemic. By October 2009, it was an emergency in the United States. Institutions attempted to combat the spread of H1N1 by informing people about preventive measures they could take, such as frequent hand washing and limiting exposure to others while sick. As vaccinations were not widely available until late in the pandemic, these were the crucial preventive actions people could take.

Many institutions placed alcohol-based hand sanitizer dispensers in public areas. Alcohol-based hand sanitizer is effective in killing viruses including H1N1 (Grayson et al., 2009) and use of such product has been tied to reduction in respiratory illnesses such as influenza infections (Aiello et al., 2010; White et al., 2003). However, usage of such preventive actions is often low. For example, the only published study of sanitizer usage during the H1N1 pandemic observed less than 20% of people using a dispenser placed in a hospital foyer (Murray et al., 2009).

For such behaviors that are simple to perform yet not routinely adopted, strategically-placed environmental cues to action may be effective in promoting adherence, particularly when a perceived health threat is already present (Janz, Champion, & Strecher, 2002). The potential for cues to action to motivate health behavior was proposed in the original Health Belief Model (HBM; Hochbaum, 1958), yet it has been one of the least investigated aspects of the HBM (Janz et al., 2002). Visual reminders – such as signs placed near the point of use – are one way of providing cues to action, as they are known to have a small but sustained effect on hand hygiene (Naikoba & Hayward, 2001). However, point-of-use reminders have not typically emphasized

theoretically-grounded information that may improve their effectiveness (Jenner, Jones, Fletcher, Miller, & Scott, 2005). Instead, signs frequently offer bland admonishments – such as the ubiquitous “Employees must wash hands” – or display visual instructions of how to wash one’s hands correctly.

### **Constructs Emphasized in Point-of-Use Signs**

Most theories of health behavior include a set of common constructs that are thought to promote preventive health behaviors such as sanitizer use: perceived susceptibility, social norms, and attitudes towards the behavior (Noar & Zimmerman, 2005). Perceived susceptibility, a construct in the HBM (Hochbaum, 1958; Rosenstock, Strecher, & Becker, 1988) and Protection Motivation Theory (Rogers, 1983), represents a person’s perception of risk for acquiring a health condition. It is assumed that without a sense of being at risk, people are not likely to take preventive action. Although little research has examined perceived susceptibility and its association with hand hygiene, meta-analyses in other preventive health domains such as vaccination show a strong positive relationship between perceived susceptibility and adherence (Brewer, Chapman, Gibbons, Gerrard, McCaul, & Weinstein, 2007).

Social norms, a component of the Theory of Planned Behavior (Ajzen, 1991), refers to a person’s perception that a behavior is endorsed by and frequently practiced by an important social reference group. Signs emphasizing social norms have been effective in promoting simple-to-adopt environmental behaviors such as recycling towels in hotel rooms and not stealing from national parks (Cialdini, Demaine, Sagarin, Barrett, Rhoads, & Winter, 2006; Goldstein, Cialdini & Griskevicius, 2008). In the context of hand hygiene, Judah and colleagues (2009) found that a message displayed in highway restrooms that emphasized a norm of hand washing – “Is the person next to you washing with soap?” – was the most effective of the messages they tested,

improving adherence by 12.1% compared to no message. Thus, evidence exists that emphasizing a social norm of hand hygiene may be an effective motivator in the context of a point-of-use message.

Lastly, one's attitude towards a health behavior – and in particular, one's awareness of its likely health consequences – is theorized to promote behavior (Ajzen, 1991; Rogers, 1983; Rosenstock, Strecher, & Becker, 1988), yet less than 25% of hand hygiene posters provide information about the health consequences of hand hygiene (Jenner et al., 2005). Furthermore, research on health message framing suggests that *how* the consequences of a health behavior are described should also matter in promoting a behavior (Rothman & Salovey, 1997). For example, a message promoting hand hygiene can emphasize either the positive consequences of adherence (a gain-framed message, such as “Wash your hands and stay healthy”) or the negative consequences of non-adherence (a loss-framed message, such as “Don't wash your hands and get sick”). Rothman and Salovey (1997) suggested that behaviors that prevent the onset of an illness will be best encouraged when the consequences of adoption are gain-framed rather than loss-framed. Drawing from research showing the advantage of gain-framed over loss-framed messages in promoting illness prevention behaviors other than hand hygiene (see Rothman, Bartels, Wlaschin, & Salovey, 2006 for review), it was predicted that emphasizing the health consequences of hand sanitizer use in a gain-framed manner should be particularly effective in promoting usage.

### **The Present Study**

Point-of-use reminder signs were developed that emphasized each of these common constructs in health behavior theories: perceived susceptibility to H1N1, social norms regarding hand hygiene, health consequences of hand sanitization framed as gains, and health

consequences of hand sanitization framed as losses. These signs were placed next to sanitizer dispensers on a university campus and unobtrusive measurement of product usage was the primary outcome. This setting was ideal, as young adults were at high risk for contracting H1N1 (Centers for Disease Control and Prevention [CDC], 2010) and the dispensers were in high-traffic areas next to elevators where contact with contaminated surfaces was likely.

## **Method**

### **Materials**

Four signs were professionally designed and printed on 7 by 8 ½ inch foam board (see supplementary materials). The perceived susceptibility headline read “Germs are out to get you. Get them first!”, the social norms headline read “Everybody is doing it. Are you?”, the gain-framed headline read “Stay healthy this season. Sanitize your hands”, and the loss-framed headline read “H1N1. Getting it is as easy as passing me by.” Each sign also contained a “fact box” with more detailed information reinforcing the theme. For example, the perceived susceptibility sign reminded people of the high levels of contamination on elevator buttons (Reynolds, Watt, Boone & Gerba, 2005), and the social norms sign stated that most college students follow hand hygiene recommendations (cf. Anderson et al., 2008; Drankiewicz & Dundes, 2003).

### **Procedure**

Sixty-five alcohol-based hand sanitizer units were selected for measurement, based on their location next to elevators in high-traffic public areas (i.e. lecture buildings, the library, cafeterias). Over the duration of the study, a research assistant twice weekly unlocked and weighed the hand sanitizer bottle in grams using a digital scale.

**Baseline assessment period.** To control for preexisting levels of usage among the various dispenser locations, baseline measurements commenced in late September 2009 and continued for four weeks.

**Sign period.** In late October 2009, 58 dispensers were randomly assigned one of the four signs. Signs were affixed on the walls immediately next to the dispenser. Every three weeks, these dispensers were randomly assigned a different sign that had not already been placed at that location, so by the end of the study period (mid-March 2010) each location had been assigned to all 4 sign conditions in a random order. During the sign period, seven dispensers remained as a no sign control. Usage was not recorded from mid-December to late-January as the University was closed to the public.

## Measures

**Sanitizer usage.** Usage was operationalized as grams of sanitizer used per day. A single estimate of baseline usage was created for each dispenser by dividing the total amount of sanitizer used by the number of days in the baseline period. Each of the measurements during the sign period was converted into this metric by dividing the difference from the previous measurement by the number of days elapsed since the last measurement.

**Public interest in H1N1.** Public interest in H1N1 was indexed by the volume of Google web searches in the Cleveland metropolitan area for the term “H1N1” (e.g., “H1N1 symptoms”, “H1N1 flu”, “H1N1 virus”) during each week from September 2009 through March 2010. Volume of Google web search queries have been shown to be a valid way of documenting geographic and temporal trends in health issues that match other objective indicators, such as physician visits for flu symptoms (Ginsberg et al., 2009).

## Analytic Plan

Generalized estimating equations (GEE; Liang & Zeger, 1986), an extension of the generalized linear model for regressions involving repeated outcomes, was used to model sanitizer usage across time as a function of baseline usage and sign condition. Predictors in this GEE model included (a) baseline usage, to account for pre-existing differences (i.e., due to location) and (b) 4 dummy-coded variables representing each of the sign conditions, with the reference group being the dispensers that received no sign. Both baseline and sign period usage were log-transformed to reduce skewness and to make resulting coefficients easily convertible into percent change values using the formula  $100(e^{\text{coefficient}} - 1)$ .

## Results

### Manipulation Checks

To ensure the signs differed in their intended constructs, 37 participants from the University community rated the signs on a number of dimensions on a 1 (“not at all”) to 7 (“extremely”) point Likert scale. As predicted, the gain-framed and loss-framed sign similarly described the “effects of using hand sanitizer on your health”,  $t = .41$ , ns, and these framed signs were rated significantly higher on this item than the other two signs,  $t = 2.87$ ,  $p < .01$ . The gain-framed sign was significantly more likely than the other signs to tell that “using hand sanitizer will have good effects on your health”  $t = 2.23$ ,  $p = .03$ . The loss-framed signs were significantly more likely than the other signs to tell that “not using hand sanitizer will have bad effects on your health”,  $t = 6.78$ ,  $p < .001$ . The social norms sign was marginally more likely than the other signs to “make you feel that people around you would want you to use hand sanitizer”,  $t = 1.97$ ,  $p = .056$ . The perceived susceptibility sign was marginally more likely than the other signs to “make you feel like you are at risk for catching the H1N1 flu”,  $t = 1.73$ ,  $p = .09$ . Importantly, there were no significant differences among the four signs in how easy they



were to understand,  $F(3, 38) = 2.33, p = .08$ . However, two items (anxious, afraid;  $\alpha = .91$ ) formed an index of negative affect, and significant differences emerged,  $F(3, 38) = 18.84, p < .001$ , with the loss-framed and perceived susceptibility signs eliciting significantly more negative affect than the gain-framed and norms signs,  $p$ 's  $< .01$ .

### **Influence of Signs on Overall Sanitizer Usage**

Table 1 shows results of the GEE analyses on overall sanitizer usage, and Figure 1 displays trends over time in sanitizer usage. Although all signs resulted in significantly greater usage than no sign, they were not equally effective. Dispensers with the gain-framed signs had the greatest usage of all, with 66.4% more use than dispensers with no signs ( $p < .001$ ). Loss-framed signs were associated a 58.4% increase in use over no sign ( $p < .001$ ). The social norms signs (44.3% increase) and the perceived susceptibility signs (40.6% increase) were associated with somewhat lower increases in usage compared to the gain-framed and loss-framed signs, but both led to significantly more usage than no sign at all (both  $p$ 's  $< .01$ ).

The gain-framed sign was predicted to be particularly effective in promoting hand sanitizer usage. Consistent with this prediction, dispensers with gain-framed signs received 12.5% more usage than dispensers in the other sign conditions combined, a significant difference ( $p = .029$ ). Although the gain-framed sign performed somewhat better than the loss-framed sign, this difference was not statistically significant ( $p = .40$ ). Interestingly, the worst-performing sign was the perceived susceptibility sign, which had 9.7% less usage than dispensers in the other sign conditions combined ( $p = .059$ ).

### **Usage Trends over Time**

Usage of sanitizer dropped consistently over time, closely mirroring temporal trends in public interest in H1N1 (see Figure 1). To examine whether the influence of any of the signs on

sanitizer usage may have depended on the concurrent level of public interest in H1N1, an additional GEE analysis predicted sanitizer usage at each assessment by baseline usage, sign condition, as well as terms representing the interaction between each sign condition and the corresponding volume of H1N1-related Google web searches for that week. None of these interaction terms significantly predicted sanitizer usage ( $p$ 's > .10), indicating the signs had a consistent influence on usage over time, not significantly moderated by temporal trends in public interest.

### **Discussion**

In a widespread health scare such as the H1N1 pandemic, people are often keenly aware of the actions they can take to protect themselves. Yet, adherence to these behaviors can be troublingly low. This study showed that the relatively simple strategy of placing theoretically-grounded cue-to-action reminder signs at the point-of-use significantly promoted usage.

The worst-performing sign emphasized people's susceptibility to contamination. This finding is important, as a prior study conducted during the non-pandemic summer months of 2008 (Judah et al., 2009) found that a message emphasizing the contamination that exists in restrooms ("Don't take the loo with you – wash with soap") was among the more effective messages promoting hand washing. Although greater perceptions of susceptibility are known to increase preventive health behaviors in other domains (cf. Brewer et al., 2007), this study shows that emphasizing susceptibility in point-of-use signs is not the most effective message during a pandemic flu season when people are already inundated with information about susceptibility. Furthermore, it is possible that the greater negative affect elicited by the perceived susceptibility sign may cause people to avoid the information presented, particularly in a pandemic.

The best-performing sign took a different approach by reminding people about the positive health consequences of using sanitizer. Gain-framed messages are typically more effective than loss-framed messages for promoting illness prevention behaviors, but this prediction has never been tested in the context of hand hygiene. Although the advantage of gain-framed signs over loss-framed signs was not statistically significant, both framed signs emphasized the health consequences of using sanitizer. Given that most hand hygiene posters are either not explicitly framed to emphasize health consequences or contain loss-framed messages (Jenner, et al., 2005), findings suggest that cueing people with the positive consequences of hand hygiene may be an especially promising strategy.

Results are also consistent with Judah and colleagues (2009) finding that messages emphasizing social norms of hand washing performed better than messages emphasizing susceptibility. However, Judah and colleagues did not test any explicitly framed messages describing the health consequences of hand hygiene. Thus, taken with Judah and colleagues (2009) findings, this study supports the use of gain-framed messages in promoting hand hygiene.

### ***Limitations and Future Directions***

This “cues to action” intervention occurred during the peak of the H1N1 pandemic in the United States. Thus, findings show how point of use signs can promote preventive health behaviors among a population identified as high-risk at a time when public adoption is most critical. Additional research is needed to identify the best ways to promote hand hygiene behavior outside the context of a flu pandemic.

A notable strength of this study was the use of unobtrusive measurements of hand sanitizer usage as a way to gauge the effectiveness of the four signs. However, because individuals’ usage of the dispensers was not assessed, it is not known *who* was using the

dispensers. College students were at a generally greater risk for contracting H1N1 due to the social environment of a college campus (CDC, 2010), but it is not known how much of the usage observed in this study was by young adults or other specifically high-risk populations.

Furthermore, the aim of this study was not to demonstrate the superiority of a specific theory in promoting hand hygiene behaviors, but rather to identify the constructs common among health behavior theories that would most effectively motivate hand hygiene during a pandemic. Self-efficacy – or the belief that one can successfully perform a given behavior – is another common construct in health behavior theories, but signs emphasizing self-efficacy were not created for this study because using sanitizer is a relatively simple health behavior to perform.

The best-performing sign, the gain-framed sign, increased usage by over 65% compared to no sign. To put this into context, usage during the peak of the public concern over the pandemic (late October 2009) was approximately 60% greater than it was during the waning months of public concern (early December 2009). This suggests that strategically-placed cues to action such as reminder signs used in this study (see supplementary materials) can have as potent of an effect on adoption of preventive health behaviors as the awareness that arises from widespread public concern about a health threat. While more complete tests of theoretically-guided interventions for promoting flu prevention in a pandemic are sorely needed, simple cues to action can help bridge the gap between the public's concern over a health threat and their actual adoption of preventive behaviors.

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**Table 1.**

*Generalized Estimating Equations (GEE) Predicting Hand Sanitizer Usage Over the Sign Period by Baseline Usage and Type of Reminder Sign*

Predictor	Coeff	SE	95% CI	% increase over no sign
Baseline usage	0.88**	0.09	.71 - 1.06	--
Susceptibility sign	0.34*	0.13	.09 - .59	40.6%
Norms sign	0.37*	0.13	.11 - .62	44.3%
Gain sign	0.51**	0.13	.25 - .76	66.4%
Loss sign	0.46**	0.13	.21 - .71	58.4%

*Note:* \*  $p < .01$  \*\*  $p < .001$ . Wald  $\chi^2(5) = 137.67$ . Total number of usage assessments during sign period  $N = 1826$ . Total number of dispensers assessed  $N = 65$ .



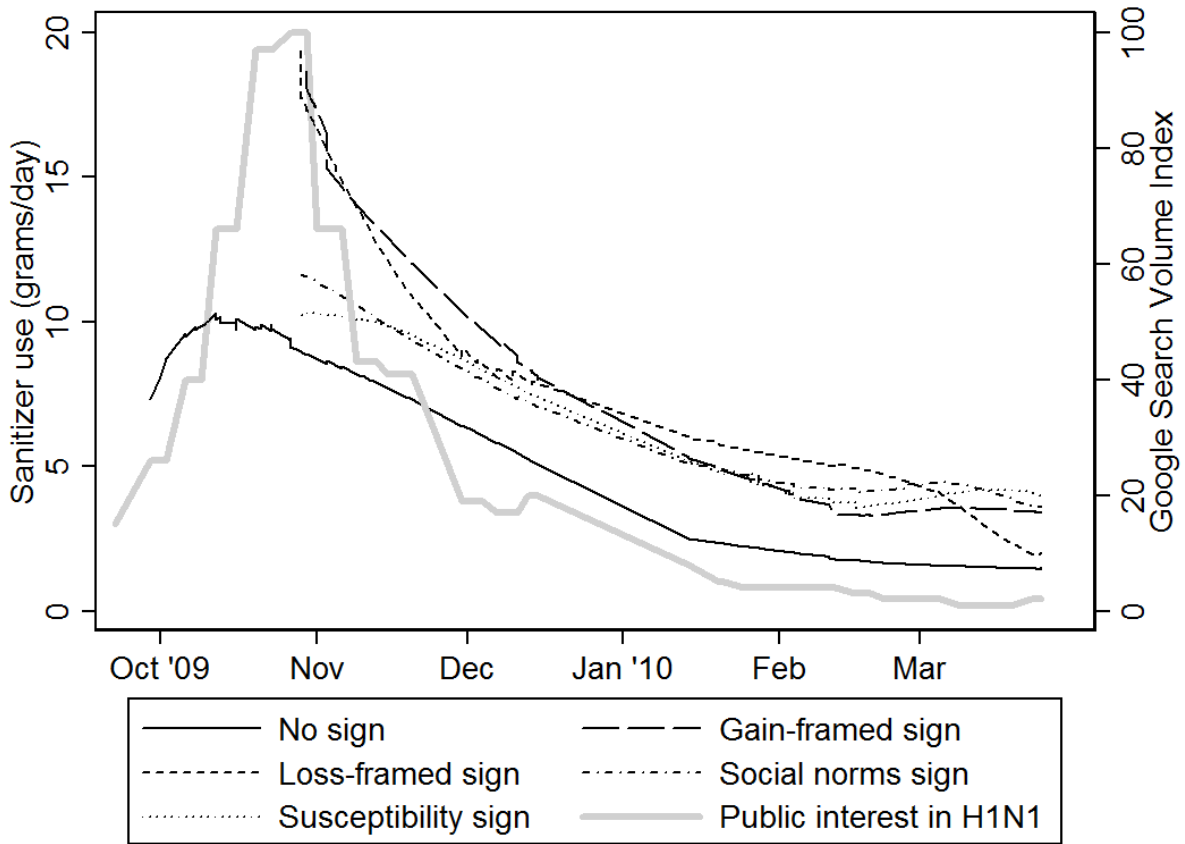


Figure 1. Trends in hand sanitizer use (left axis) and public interest in H1N1 (right axis) by time and sign condition. Public interest represents normalized Google web search volume over study period, scaled so 0 = lowest weekly volume and 100 = peak weekly volume.

Supplementary Materials

*Susceptibility Sign*

**GERMS ARE OUT  
TO GET YOU.  
GET THEM FIRST!**



**FACT** →

***Elevator buttons  
have 17 times more  
germs than the  
average toilet seat***

**HAND SANITIZERS KILL  
99.99% OF GERMS IN AS  
LITTLE AS 15 SECONDS.**

**H1N1...  
Don't Be One!**

*Social Norms Sign*

**Everybody is  
doing it.**

**ARE YOU?**



**FACT** →

***Most college students  
are keeping their  
hands clean to avoid  
getting the flu.***

***HAND SANITIZERS KILL  
99.99% OF GERMS IN AS  
LITTLE AS 15 SECONDS.***

***H1N1...  
Don't Be One!***

*Loss-Framed Sign*

**H1N1.  
GETTING IT IS AS EASY AS  
PASSING ME BY.**



**FACT** →

*Not using hand  
sanitizer can increase  
your chances of  
catching the flu*

**HAND SANITIZERS KILL  
99.99% OF GERMS IN AS  
LITTLE AS 15 SECONDS.**

**H1N1...  
Don't Be One!**

*Gain-Framed Sign*

**Stay Healthy  
This Season**  
*IT'S EASY—SANITIZE YOUR HANDS!*



**FACT** →

*Using hand sanitizer  
can help keep you  
healthy this flu season*

**HAND SANITIZERS KILL  
99.99% OF GERMS IN AS  
LITTLE AS 15 SECONDS.**

**H1N1...  
Don't Be One!**