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Improving Hand Hygiene Compliance with Point-of-Use Reminder Signs Designed Using Theoretically Grounded Messages

Signs are a common strategy for promoting hand hygiene (HH) compliance, and many multifaceted interventions include signs as one component of their bundles.[1,2] However, little is known about their independent effectiveness, and insufficient attention has been given to the characteristics of signs associated with the greatest impact. Recent studies from the psychology literature found signs grounded in health behavior theories to have the greatest potential to improve HH compliance.[3,4] We tested theoretically derived signs in acute care settings at 3 hospitals in general medical wards and intensive care units (ICUs) to determine whether signs—and variations in their messages—can independently affect healthcare worker (HCW) HH compliance.

Four distinct messages were designed using constructs from health behavior theories: personal (HCW) versus patient consequences,[3] gain versus loss framing,[5] and social norms/appeal to professional role.[6] Personal versus patient consequences and gain-framed versus loss-framed messages were combined in 2 of the signs. Signs were placed at the point of use near hand sanitizer dispensers in the wards/units to increase their potential as cues to action at the point of care.[7]

A small, 5-month, cluster-randomized trial of the signs was embedded in a prospective cohort study of HCW HH behavior. The cohort study began in March 2011 in 11 wards and ICUs in 3 geographically distinct hospitals. In February 2012, the signs were placed in 5 randomly chosen wards/ICUs. The remaining 6 control wards/ICUs did not receive signs. Randomization was conducted after matching the 11 wards on baseline HH compliance. A coin was flipped to determine the group assignment for each pair. The eleventh ward/unit was determined with a coin flip. The 6 signs with 4 different messages were displayed in each of the intervention wards/units. The 6 signs were dispersed evenly between the rooms (note that 2 of the messages were presented with alternative models and color schemes). Signs remained posted for 5 months. HH compliance was determined by direct covert observations at room entry and exit, as described elsewhere.[8] Observers also recorded which sign was displayed by the nearest hand sanitizer dispenser.

Entry and exit HH rates were calculated for each room during the baseline and intervention periods. Ward/unit-level changes in compliance rates were compared between wards/units assigned to signs versus no sign using a Wilcoxon rank-sum test to account for within-room correlation. A secondary individual-level analysis was performed using Poisson mixed-effects models with a random intercept. Last, we calculated entry and exit HH rates for each sign type during the intervention period. A Poisson mixed-effects model with a random intercept to account for within-room correlation was used to compare the signs.

In total, 13,195 HH opportunities were observed at baseline, and 3,517 opportunities were observed during the intervention period. Baseline entry and exit compliance was similar in control and intervention wards/units (see Table 1). After the intervention, intervention and control wards/units demonstrated similar improvements at entry (4.2% vs 7.5%; $P = .79$) and exit (5.1% vs 5.5%; $P = .54$). Findings using Poisson mixed-effects models were similar (results not shown).

Among specific HH signs, the patient consequence and gain-framed sign was associated with the highest absolute entry (51.2%) and exit (64.1%) compliance. However, in a Poisson mixed-effects model accounting for within-room correlation, no significant differences among signs was detected at entry ($P = .13$) or exit ($P = .61$).

Overall, in this 5-month, multicenter, cluster-randomized trial, point-of-use signs did not improve HH compliance compared with no signs. However, a sign using messages focused on patient consequences and gain-framed language demonstrated the greatest absolute compliance compared with other theoretically derived signs. This finding highlights

TABLE 1. Entry and Exit Hand Hygiene Compliance Data and Rate of Change between Baseline and Intervention Periods

	Entry compliance					Exit compliance				
	Baseline		Intervention period			Baseline		Intervention period		
	No. compliant/ no. observed	Rate (per 100)	No. compliant/ no. observed	Rate (per 100)	Change[a]	No. compliant/ no. observed	Rate (per 100)	No. compliant/ no. observed	Rate (per 100)	Change[a]
No signs	1,413/3,636	38.9	464/1,000	46.4	7.5	2,029/3,592	56.5	618/995	62.1	5.5
Signs	1,029/3,031	33.9	292/765	38.2	4.2	1,538/2,936	52.4	435/757	57.5	5.1

[a] Rate difference.

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the potential importance of the specific type of messaging strategy that is used.

In the psychology literature, theoretically derived signs have been associated with statistically significant improvements in HH compliance. However, one study took place on a college campus during an H1N1 outbreak,[4] and the other took place in a single hospital during a brief (2-week) period.[3] In our study, the effect of the signs was measured during a 5-month intervention period, among 3 geographically distinct hospitals in wards and ICUs, allowing for a more robust comparison of the effect.

Although the combined patient consequence and gain-framed sign showed the greatest HH compliance rates, results were not statistically significant. In part, this could be due to the busy hospital environment in which many things are vying for HCWs' attention. Therefore, the signs may not have produced a large enough "cue to action" amid all of the noise. Findings may also simply point to a lack of effectiveness of signs for improving HH compliance when used as a single intervention strategy. However, it is unlikely that signs will be dropped from HH improvement bundles due to their low cost and ease of implementation. Given this and the results of other studies in the literature, more attention should be paid to the messages on the signs.

There are multiple limitations of this study. We used direct observation as a measure of HH compliance, which has limitations, including a potential Hawthorne effect.[9] However, direct observation is still considered the gold standard for measuring HH compliance in both research and clinical settings. In addition, HCWs could have been exposed to the signs when floating to other wards/units, which may have diminished our ability to detect the impact of signs. However, we used point-of-use signs specifically as a cue to action with the goal of prompting HCWs to immediately perform HH after seeing the cue; therefore, the effect should be more pronounced in the intervention wards.

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