

Does Physician Leadership Influence Followers' Hand Hygiene Compliance?

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The aim of this study was to determine factors influencing the hand hygiene compliance of a physician. We found a strong correlation between a leader's (staff member's or fellow's) and a follower's (resident's) hand hygiene compliance. Followers' appropriate hand hygiene compliance was significantly associated with the compliance of the leader ($P = .01$).

Keywords. compliance; departments; gender; hand hygiene; resident.

Health care–associated infections (HAIs) lead to increased patient mortality, duration of hospitalization, and cost of treatment. When effectively implemented, comprehensive intervention can reduce the risk of HAI to 55%–70% [1]. The promotion of proper health care worker hand hygiene (HH) is the most effective method of infection prevention; however, the current HH compliance rate of health care workers is near or below 50% [2].

There are diverse causes that influence health care worker noncompliance with HH guidelines. Environmental factors include the location or type of hand sanitizer dispensers, health care worker psychosocial characteristics, and inadequate knowledge of HH methods [3, 4]. Physician compliance with HH is commonly inferior to that of other types of health care workers [2, 4]. According to a previous study, the majority of physicians felt that HH required a conscious decision, not an automatic process. This implies that physicians would benefit from interventions that motivate them to wash their hands [5].

Since 2010, we have been monitoring the HH compliance of all health care workers and providing regular feedback. Because of the low HH compliance rate of physicians, we began reporting

department performance rankings on a quarterly basis and educating departments with low HH performance. Despite these efforts, the HH compliance of physicians did not improve. Therefore, we assumed that there may be influences at the departmental level such as peer pressure or leadership influence.

Previous studies have suggested that role modeling or peer pressure can influence the HH compliance of physicians [5, 6]. In this study, we examined the effect of leaders' HH compliance on followers and assessed the differences in physicians' HH compliance among determining factors of performance, such as department or year of residency.

METHODS

Study Design

This study was conducted in the Soonchunhyang University Seoul Hospital: a 734-bed, acute care, referral hospital. This study was approved by the institutional review board and hospital ethics committee. The infection control team consisted of 5 infection preventionists. Since 2010, we have maintained an HH monitor team with 24 members across various departments. Every quarter, approximately 3000 health care worker HH observations are made by infection preventionists and the HH monitor team. We followed HH monitoring methods by directly observing HH, as per the World Health Organization (WHO) guideline [7]. A health care accreditation process takes place in the study hospital every 4 years. To minimize external influence, we collected physician HH compliance from January 2015, which was after the most recent health care accreditation, to June 2018.

To maintain the validity of the observation, we trained HH monitoring personnel on appropriate monitoring methods via educational videos; precautions to take during observation were also conveyed in the monthly meetings. The monitoring personnel were expected to be qualified enough to score at least 80/100 on the test. Furthermore, all the personnel were required to re-take the test annually to maintain their competence. To minimize the risk of the Hawthorne effect, the monitoring personnel could be either an individual from another department or an individual working in the department. The monitoring staff was not expected to observe for more than 20 minutes in 1 place. Lastly, the monitoring staff would not observe a health care worker more than 4 times during the quarter.

The HH compliance rate was calculated by dividing the number of observed HH actions by the total number of opportunities. The opportunities for HH consisted of the WHO's 5 moments for HH (before patient contact, before aseptic task, after body fluid exposure risk, after patient contact, and after contact with patient surroundings). Appropriate HH

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(AHH) compliance rates were calculated based on the 6-step technique, modified from the WHO recommendation:

Step 1: rub palms together; step 2: rub the back of both hands; step 3: interlace fingers and rub hands together; step 4: interlock fingers and rub the back of fingers of both hands; step 5: rub thumb in a rotating manner followed by the area between index finger and thumb for both hands; step 6: rub fingertips on palm for both hands. [8]

In the study, we measured HH compliance and AHH compliance because the data regarding both types of compliance are useful for education. This distinction is intended to emphasize the significance of the step-by-step protocol outlined by the WHO recommendation.

Definition

A leader was defined as a medical specialist, including a faculty member or fellow, and a follower was defined as a resident. In the study institution, medical staff (professors, fellows, and residents) round together twice a day. In some departments, fellows round with residents without faculty present, especially during evening rounds. We classified physicians into 3 departments. These included (1) medical departments such as internal medicine, emergency medicine, pediatrics, family medicine, anesthesia, rehabilitation, neurology, neuropsychiatry, and dermatology; (2) surgical departments such as urology, obstetrics and gynecology, general surgery, plastic

surgery, neurosurgery, orthopedic surgery, otolaryngology, and ophthalmology; and (3) other departments such as radiology and dentistry.

Statistical Analysis

Statistical analysis was performed using SPSS software (version 23.0; IBM Corp., Armonk, NY) and R (version 3.3.1; <https://www.r-project.org/>). We compared HH compliance with AHH compliance between leader and followers using a Spearman correlation analysis. To elucidate the effects of leadership on followers, we conducted a generalized estimating equation (GEE) using gender, departments, and degree of residency; HH compliance of leader; and internship in the study hospital. A post hoc analysis was performed, and a Bonferroni correction method was used to counteract the problem of multiple comparisons. A total of 445 data sets were generated for the analysis, which was calculated using repeated measures of 246 residents. Each data set represents the HH and AHH compliance of the resident belonging to each specialty, and the data were collected during 4 years. Compliance of leadership was estimated as the average of the year and department using HH and AHH for each leader.

RESULTS

Hand Hygiene Compliance in Leaders and Followers

During the study period, a total of 3007 HH opportunities among 178 leaders and 2539 opportunities among 264 followers were observed. Among the WHO's 5 moments for

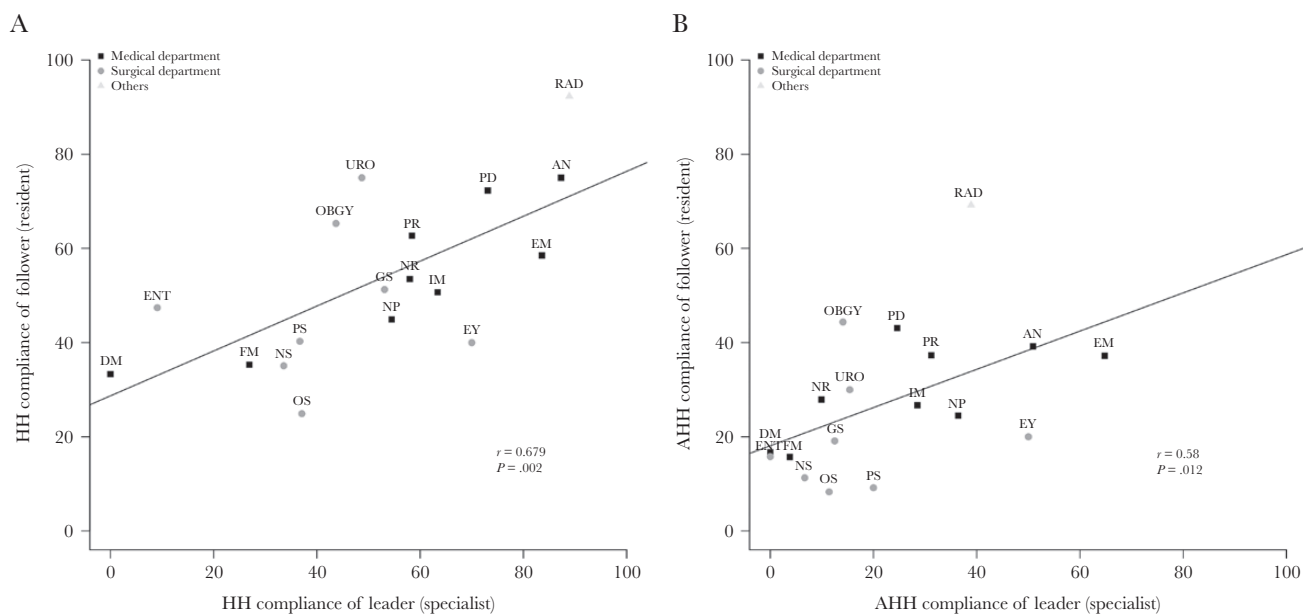


Figure 1. Relationship of hand hygiene and appropriate hand hygiene compliance between leaders and followers. A, Relationship of HH compliance between leadership and followers. B, Relationship of AHH compliance between leadership and followers. Abbreviations: AHH, appropriate hand hygiene; AN, anesthesia; CS, cardiac surgery; DM, dermatology; DT, dentistry; EM, emergency medicine; ENT, otolaryngology; EY, ophthalmology; FM, family medicine; GS, general surgery; HH, hand hygiene; IM, internal medicine; NP, neuropsychiatry; NR, neurology; NS, neurosurgery; OBGY, obstetrics & gynecology; OS, orthopedics; PD, pediatrics; PR, rehabilitation; PS, plastic surgery; RAD, radiology; URO, urology.

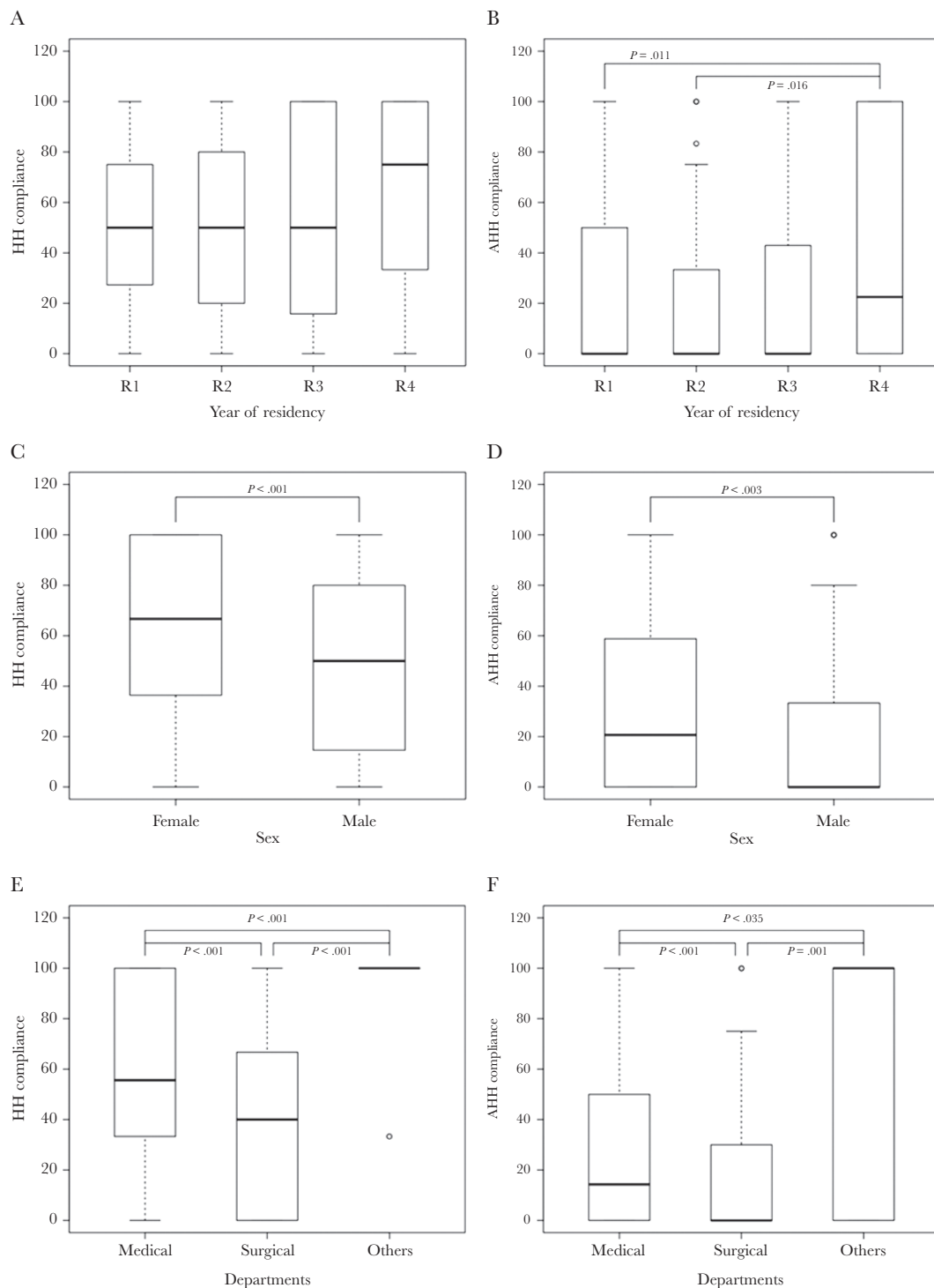


Figure 2. Difference of hand hygiene and appropriate hand hygiene compliance according to year of residency, gender, and departments. A, HH compliance according to year of residency. B, AHH compliance according to year of residency. C, HH compliance according to sex. D, AHH compliance according to sex. E, HH compliance according to departments. F, AHH compliance according to departments. In the box and whisker plot, the median value is indicated by the thick line. The top and bottom of the boxes indicate the first and third quartiles, respectively. The upper (or lower) whisker extends from the top of the box to the highest (or lowest) value within 1.5 times the interquartile range, defined as the distance between the first and third quartiles. Abbreviations: AHH, appropriate hand hygiene; HH, hand hygiene.

HH, after patient contact (34.4%, 1910/5546) was most commonly observed, followed by before patient contact (33.3%, 1839/5546) and after contact with patient surroundings (22.7%,

1259/5546) ([Supplementary Figure 1](#)). In the leader group, the compliance rate of HH was 59.6% (1792/3007) and the AHH compliance rate was 25.8% (775/3007). In the follower group,

the compliance rate of HH was 51.8% (1315/2539) and the AHH compliance rate was 26.8% (681/2539) (Supplementary Table 1). There was a strong correlation between leaders and followers of HH compliance ($r = .679$, $P = .002$) and AHH compliance ($r = .58$, $P = .012$), respectively (Figure 1).

Factors Influencing Hand Hygiene Compliance

In a GEE analysis, female gender, HH compliance of leader, and departments were significantly associated with followers' HH compliance. The follower's AHH compliance was significantly associated with year of residency, female gender, AHH compliance of leadership, and department (Supplementary Table 2).

Differences in hand hygiene compliance according to year of residency, sex, and departments are shown in Figure 2. HH compliance was higher in residency (R) 4 (median, 75%) than in R1, R2, or R3 (median, 50%), without statistical significance. Appropriate HH compliance was also significantly higher in R4 (median, 22.5%) than in R1 or R2 (median, 0%; $P = .01$ [R1]; and median, 0%; $P = .02$ [R2], respectively). Female gender had a higher HH compliance (median, 67% vs 50%; $P < .001$) and AHH compliance (median, 21% vs 0%; $P = .003$) compared with male gender. Medical departments had higher HH compliance (median, 57% vs 42%; $P < .001$) and AHH compliance (median, 28% vs 15%; $P < .001$) compared with surgical departments.

DISCUSSION

We found a strong correlation between leaders' and followers' HH compliance within the same departments. Especially, followers' AHH compliance was significantly associated with their leaders' compliance. This suggests that leadership plays an important role in HH performance of followers. In addition, female gender, senior year of residency, and medical departments were associated with significantly higher HH compliance.

Among health care workers, nurses have the most frequent contact with patients. Physicians' HH opportunity is relatively small compared with nurses' and is mainly concentrated during rounding [9], when they are usually grouped to meet patients in wards. The degree of HH performance of the group is determined by whether the first person in the rounding group performs HH [6]. Additionally, if a peer or a higher-ranking person in the same room did not perform HH, physicians were much less likely to perform HH [10]. In our study, after adjusting for factors that influence HH performance such as gender and department, we found that the leader's HH compliance influences followers.

There was a difference in HH compliance between departments, with relatively lower rates in surgical departments and higher rates in medical departments; the highest HH compliance rates occurred in the radiology and dentistry departments. Physicians working in radiology or dentistry often have close contact with patients in a closed space, which

may be a driving factor for them to thoroughly and frequently wash their hands; this is known as the Hawthorne effect.

In the present study, followers' HH compliance was significantly higher among senior residents than among others. Senior residents may have received more HH education, and as a result can be effective in the delivery of HH education. This study also identified HH compliance differences among practices and workloads based on the grade of residency. Gender differences in HH compliance were consistent with previous studies, with females showing significantly higher HH compliance [4].

Our study has some limitations. First, the numbers of observations for some departments, such as dermatology and dentistry, are insufficient relative to others. Second, GEE analysis of the WHO's 5 moments for HH could not be performed due to a limited number of observations for each follower in each year. Third, the relationship between leader and follower HH cannot be entirely interpreted by role modeling of the leaders. There could be other additional explanations, such as peer pressure or social norms, that may exist for different medical specialties. This issue should be investigated in future studies.

Low physician HH compliance is a major challenge to solve. This study shows that improving a leader's behavior can be an effective strategy. Leaders should be aware that their HH behavior impacts the behavior of followers. Future studies could be conducted to develop an intervention to improve physicians' HH compliance.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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