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Major Article

# The effect of incorporating covert observation into established overt observation-based hand hygiene promotion programs

Eunwoo Yoo BSN [b,c], Louella Ursua MSN [b], Romart Clark MSN [b], Jeongmin Seok BSN [b,c], Jaehyun Jeon MD [a,b,c,*], Hong Bin Kim MD, PhD [d]

[a] Department of Infectious Disease, Sheikh Khalifa Specialty Hospital, Ras Al Khaimah, United Arab Emirates
[b] Infection Prevention and Control Team, Sheikh Khalifa Specialty Hospital, Ras Al Khaimah, United Arab Emirates
[c] Seoul National University Hospital, Seoul, Republic of Korea
[d] Seoul National University Bundang Hospital, Seoul, Republic of Korea

*Key Words:*
Guideline adherence
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***Background:*** Covert observation (CO) is reliable for measuring hand hygiene compliance (HHC). However, the benefit of adding CO to overt observation (OO) is uncertain. We evaluated whether incorporating CO into an OO-based hand hygiene (HH) promotion program improves HH rate.

***Methods:*** Health care worker's HH activities were observed through 5 monitoring sessions (2 in phases 1 and 2 and 1 in phase 3) of simultaneous CO and OO. An intervention was applied—barrier identification interview—only in phase 2.

***Results:*** Overall HHC was 91.0% for OO, and 49.3% for CO. HHC in phase 1 was not changed by repeated CO (34.7% and 34.0%, $P = .70$). HHC based on CO increased to 66.9% in phase 2 after the application of an intervention ($P < .01$), but decreased to 57.5% in phase 3 ($P < .01$). HHC based on OO increased significantly between only the first and second sessions in phase 2 (90.8% and 94.5%, respectively, $P = .01$).

***Discussion:*** Although CO did not significantly change behavior, HHC with CO responded promptly to the application and cessation of a new intervention.

***Conclusions:*** CO reflects HHC change more reliably than does OO. However, it is uncertain whether CO will improve HHC.



Better hand hygiene compliance (HHC) is associated with lower health care–associated infection rates.[1] Although hand hygiene (HH) is a simple and cost-effective measure for preventing health care–associated infections, HHC is not sufficient in many health care settings.[2,3]

The World Health Organization has provided comprehensive guidelines on HH. Direct observation of HHC is an important element of the guidelines and can improve HHC.[4-6] Accordingly, accurate measuring of HHC is crucial for improving it. However, there is no standardized observation method for HHC monitoring. Furthermore, human error and several kinds of bias, including the Hawthorne effect, are commonly cited obstacles to direct observation.[7]

Direct covert observation (CO) of HH is considered the standard method for minimizing bias. Although CO effectively reduces bias, it can be time-consuming and is hard to maintain.[3] Additionally, there are limited data on whether CO can improve HHC without feedback.[8]

Several methods, such as video monitoring, electronic surveillance, and product volume tracking, have been established as reliable measures for HH monitoring.[8-11] However, there are significant costs associated with hospital-wide implementation of automated electronic covert monitoring methods.[8]

This study was designed to evaluate whether simultaneous CO and direct overt observation (OO) can improve and sustain HHC as a method of hospital-wide monitoring. Additionally, we validated whether CO reflects changes in HHC more reliably than OO.

* Address correspondence to Jaehyun Jeon, MD, Department of Infectious Disease, Sheikh Khalifa Specialty Hospital, PO Box 6363, Ras Al Khaimah, United Arab Emirates.
*E-mail address:* mdjjh75@gmail.com (J. Jeon).

Conflicts of interest: None to report.

Ethics approval and consent to participate: The institutional review board of the hospital and the research ethics committee of the Ministry of Health and Prevention in Dubai granted ethical and regulatory approval. This study was performed in accordance with the ethical standards noted in the Declaration of Helsinki and its later amendments. Based on the institutional review board's requirements, we did not identify staff observed during the observations by a unique identifier. Collected data (except for professional categories and departments) were encoded to ensure anonymity and confidentiality. Informed consent on disclosure of information was obtained from all covert observers.

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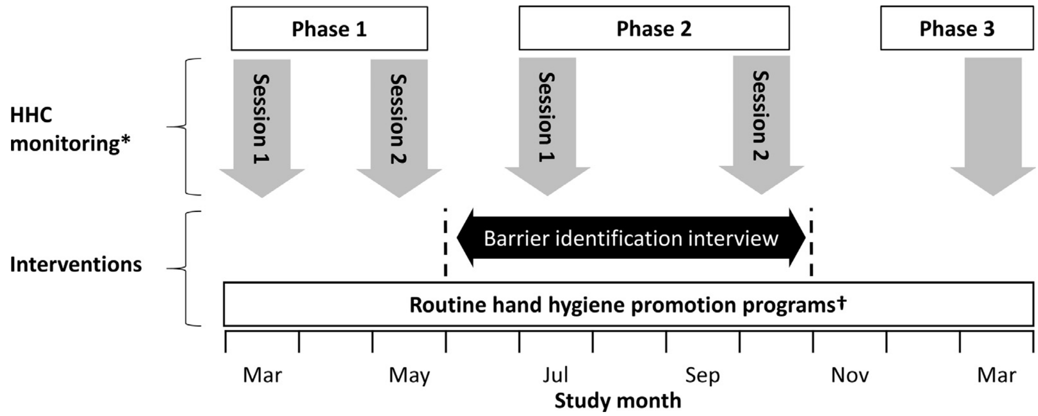


**Fig 1.** Study design. *HHC*, hand hygiene compliance.
*Covert observation was conducted simultaneously with overt observation during each 2-week session.
†Programs were composed of accessibility to hand hygiene resources, leadership commitment, education, administrative support, and feedback.

## METHODS

### *Study design*

We conducted a hospital-wide prospective interventional study from January 2017 to March 2018 in Sheikh Khalifa Specialty Hospital, a tertiary hospital serving a community in the Northern United Arab Emirates. Five sessions of CO were incorporated into the HH promotion program in 3 phases: 2 sessions in March and May 2017 for phase 1 as well as 2 sessions in July and October 2017 for phase 2 and 1 session in March 2018 for phase 3 (Fig 1). We evaluated whether CO improved HHC in phase 1. The purpose of phases 2 and 3 was to evaluate whether CO reflected changes in HHC better than OO. The month that CO occurred was shared with health care workers (HCWs); however, HCWs were not aware of the hour or day that CO was performed.

### *Setting*

All previously established HH promotion programs were maintained without any change during the study period. Sheikh Khalifa Specialty Hospital has implemented a multimodal intervention composed of accessibility to HH resources, leadership commitment, education, administrative support, overt HH monitoring, and feedback since 2014.

As part of the hospital's regular HH promotion program, each patient room was equipped with at least 2 alcohol-based handrubs (1 on the wall next to the entrance and another inside the room) and 1 sink for washing hands with soap and water. The infection control team provided regular lectures and face-to-face training as well as demonstration of correct HH techniques to all HCWs. The hospital provided reminders, including booklets, posters, badges, and brochures explaining proper HH. Leadership commitment, including involvement of executive staff in the promotion of HH, was maintained to motivate HCWs. Ongoing professional practice evaluations for physicians and nurses included personal HHC as an item. The infection control team and infection control link personnel monitored HH practices of HCWs with a structured protocol. Observers monitored HH practices of HCWs from the corner of each ward. Observers collected information on professional category, name, and department of HCWs and observed HH opportunities by time of day and department. They tried not to interfere with HCWs' daily practices. Hospital-wide HHC data and serial trends in rates were distributed to all staff via a bimonthly newsletter. The infection control team displayed posters containing HHC achievements on the storyboard of each department monthly. The infection control nurses and unit managers gave regular direct performance feedback to noncompliant HCWs.

### *Intervention*

A barrier identification interview, which had proved effective for HH promotion in a previous study, was used in phase 2 as an intervention for HHC promotion.[12] Directors and patient unit managers were deployed for the interview as coaches after receiving education and certification by the infection control team. Using a questionnaire, coaches actively engaged with noncompliant staff to identify personal and systemic barriers to HH. They did not give any other performance feedback or education. Based on the questionnaire, barriers were categorized as follows: hands being full of equipment, following another staff's lead, frequent entering of patients' rooms, wearing gloves, poor accessibility of alcohol-based handrubs, entering rooms for administrative work, lack of feedback on HH practice, distraction or forgetfulness, finding HH unnecessary, and skin irritation.

### *Observers*

Different groups of nonmedical staff participated in each of the 3 phases to avoid observer bias and maintain covertness. These groups were composed of allied HCWs, dietitians, administrators, and in-house supervisors of outsourced staff who were visiting patient units regularly for their daily work.

The trained observer candidates completed at least 2 lecture hours on the concept and technique of HH and methods of monitoring. In addition, a qualified training module, conducted separately to protect the identity of the COs, was provided. An infection control expert reviewed and approved the educational materials. The observers were validated using written tests before and after their education for certification. Trained observers were deployed for CO after certification.

### *Methods of observation*

Observers were allocated to each unit to avoid overlapping. HH practices during wash-in and wash-out (ie, entry and exit from patient room) opportunities were monitored. Observers did not spend more than 20 minutes in 1 place. A standard data form was used to record collected information. To reduce recall bias, observers wrote their observations on a piece of paper as soon as possible, using simple code, and then completed the reporting form.

The infection control team monitored the quality of the observations. To ensure reliable results, we allocated 2 or more observers to the same department during each step. If any data suggested bias toward certain departments or professions, the infection control team monitored those areas directly during rounding, and an additional observer was assigned to evaluate the reliability of the observations.

We did not disclose the result of COs to any staff during the study period. This study did not include HH practices during surgery preparation.

### *Outcome measures*

The main study measure, HHC, was defined as the number of HH episodes per number of HH opportunities. The main study outcome compared the change in HHC by CO and OO in each phase. Information was collected on professional categories (physicians, nurses, and others), patient units (intensive care unit [ICU] and non-ICU), and time of day (daytime and nighttime). The "other" group of professional categories included allied health care professionals and ancillary staff. Allied health care professionals included clinical pharmacists, laboratory technicians, physiotherapists, and radiology technicians. Ancillary staff included housekeeping and porters who had contact with patients. We defined daytime as 6 AM to 6 PM and nighttime as 6 PM to 6 AM.

### *Statistical analysis*

Nominal data, such as differences in HHC, were compared using $\chi^2$ tests. All data were analyzed using SPSS Statistics 25 (International Business Machines Corporation, Armonk, NY) for Windows (Microsoft Corporation, Redmond, WA). Results were considered statistically significant if the 2-tailed $P$ value was less than 0.05.

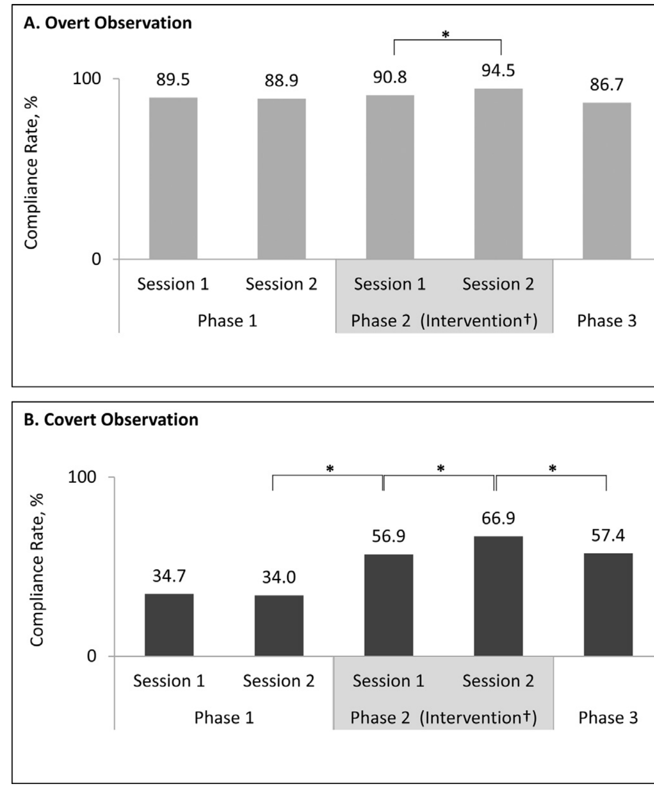


**Fig 2.** Hand hygiene compliance rate by type of observation in each session.
*Statistically significant difference ($P < .01$).
†Intervention: barrier identifying interview (see Intervention in Methods).

## RESULTS

### *Overt observations*

The number of observed HH opportunities during OO was 3,454 (1,369 opportunities in phase 1 as well as 1,408 opportunities in phase 2 and 677 opportunities in phase 3) (Table 1). Overall HHC during OO was 91.4%. HH rate in phase 1 was 89.2% and increased to 92.8% in phase 2 ($P < .01$). However, there was no significant increase in HHC between phases 2 and 3 (93.2% in phase 3, $P = .71$). Further analysis within each phase indicated that HHC increased significantly between only the first and second sessions in phase 2 (90.8%-94.5%, $P = .01$) (Fig 2). HH rate was no different between the first and second sessions of phase 1 (89.5% and 88.9%, respectively, $P = .75$). HHC during the first session in phase 2 was not significantly different from the second session in phase 1 (88.9% for the second session in phase 1 and 90.8% for the first session in phase 2, $P = .27$). The second session HH rate in phase 2 was no different than that of phase 3 ($P = .32$).

There was no difference between the number of opportunities at wash-in and wash-out (1,736 and 1,718, respectively, $P = .58$). However, the HHC of wash-out opportunities (92.6%) was higher than that of wash-in opportunities (90.3%) ($P = .02$). Nurses demonstrated higher HHC than the other professional groups (93.8% for nurses, 89.2% for others, and 88.9% for physicians, $P < .01$). There was no significant difference in HHC between physicians and others ($P = .86$). There was no difference in HHC between ICU and non-ICU (91.7% and 90.9%, respectively, $P = .40$). Overall HHC was 91.5% during the daytime and 90.8% during the nighttime ($P = .63$).

**Table 1**
HHC by phases

| Phases | | Overt observation (n = 3,454) | | Covert observation (n = 8,081) | |
|---|---|---|---|---|---|
| | | Opportunities, N (%) | HHC, % | Opportunities, N (%) | HHC, % |
| Phase 1 | Overall | 1,369 (100) | 89.2‡ | 3,475 (100) | 34.4† |
| | First session | 711 (51.9) | 89.5 | 1,765 (50.8) | 34.7 |
| | Second session | 658 (48.1) | 88.9 | 1,710 (49.2) | 34.0 |
| Phase 2 | Overall | 1,408 (100) | 92.8‡ | 2,799 (100) | 62.7† |
| | First session | 650 (46.2) | 90.8¶ | 1,185 (42.3) | 56.9* |
| | Second session | 758 (53.8) | 94.5¶ | 1,614 (57.7) | 66.9* |
| Phase 3 | Overall | 677 (100) | 93.2 | 1,807 (100) | 57.4† |

NOTE. Values sharing a common symbol (*, †, ‡, ¶) are significantly different from each other ($P < .01$). Hand hygiene compliance (%) is presented as hand hygiene performed/hand hygiene opportunities × 100.
*HHC*, hand hygiene compliance.

**Table 2**
HHC of covert observation by variables

| Variables | | Phase 1 | | Phase 2 | | Phase 3 | |
|---|---|---|---|---|---|---|---|
| | | opportunities N (%) | HHC % | opportunities N (%) | HHC % | opportunities N (%) | HHC % |
| Opportunity | Wash-in | 1,863 (53.6) | 31.5 | 1,463 (52.3) | 56.8 | 886 (49.0) | 51.8 |
| | Wash-out | 1,612 (46.4) | 37.7 | 1,336 (47.7) | 69.1 | 921 (51.0) | 62.9 |
| Professions | Nurses | 1,960 (56.4) | 36.0 | 1,491 (53.3) | 62.6 | 803 (44.4) | 60.0 |
| | Physicians | 395 (11.4) | 32.7 | 380 (10.8) | 49.7 | 336 (18.6) | 47.0 |
| | Others* | 1,120 (32.2) | 32.1 | 928 (36.0) | 68.1 | 668 (37.0) | 59.6 |
| Time of day | Daytime | 2,686 (77.3) | 28.3 | 1,883 (67.3) | 57.6 | 1,277 (70.7) | 50.0 |
| | Nighttime | 789 (22.7) | 54.9 | 916 (32.7) | 73.0 | 530 (29.3) | 75.3 |
| Ward | ICU | 827 (23.8) | 39.9 | 529 (18.9) | 56.0 | 279 (15.4) | 44.1 |
| | Non-ICU | 2,646 (76.2) | 32.6 | 2,270 (81.1) | 64.3 | 1,528 (84.6) | 59.9 |

*HHC*, hand hygiene compliance; *ICU*, intensive care unit.
*Clinical pharmacists, laboratory technicians, physiotherapists, radiology technicians, housekeeping/porters visiting patient units.

### *Covert observations*

The total number of HH opportunities observed during CO was 8,081 (3,475 opportunities in phase 1 as well as 2,799 opportunities in phase 2 and 1,807 opportunities in phase 3). Table 1 and Figure 2 describe HHC by phase and session, respectively. Overall, the HHC rate during CO was 49.3%, which was significantly lower than the overall rate during OO ($P < .01$).

HHC in phase 1 was 34.4%. Overall HHC in phase 2 significantly improved to 62.7% compared with phase 1 ($P < .01$). Further analysis indicated that HHC changed significantly in all sessions except between the first and second sessions in phase 1. HH rate was no different between the first and second sessions of phase 1 (34.7% and 34.0%, respectively, $P = .70$). HHC was 56.9% in the first session of phase 2, which was higher than the rate of the second session in phase 1 ($P < .01$). HHC was 66.9% in the second session of phase 2 and showed a significant increase from the first session of phase 2 ($P < .01$). HHC was 57.4% in phase 3 and significantly lower than that of the second session in phase 2 ($P < .01$).

### *Contributing factors to HHC*

Table 2 displays HHC by professional group, time of day, ward type, and HH opportunity. The HHC during wash-out opportunities was 54.5%, which was higher than that of wash-in opportunities (44.6%, $P < .01$). HHC of the 3 professional groups were not significantly different in phase 1 (physicians: 32.7%, nurses: 36.0%, and others: 32.1%, $P = .63$). In phase 2, others demonstrated the highest HHC, whereas the HHC of physicians was lower than that of the other 2 groups (physicians: 49.7%, nurses: 62.6%, others: 68.1%, nurses vs others: $P = .01$, and physicians vs nurses or others: $P < .01$). In phase 3, the HHC of others decreased ($P < .01$), and nurses and others demonstrated similar HHC (60.0% for nurses and 59.6% for others, $P = .87$). Nurses maintained their phase 2 HHC in phase 3 ($P = .24$). The HHC of physicians was lower than that of the other 2 groups in phase 2 (47.0% [158/336], $P < .01$) and did not change significantly from phase 2-3 ($P = .47$).

There were fewer HH opportunities during the nighttime than the daytime in all CO phases. HHC during the daytime was lower than that during the nighttime ($P < .01$). HHC was higher in ICU than non-ICU in phase 1 ($P < .01$). However, HHC was significantly higher in non-ICU than ICU during both phases 2 and 3 ($P < .01$).

## CONCLUSIONS

In a meta-analysis, audit and feedback were found to be reasonably effective tools for changing health care providers' behavior.[13] Contemporary studies have reported that CO is a useful tool for measuring actual compliance, and it is reasonable to expect that CO improves compliance through appropriate feedback.[3,14] Despite accumulating studies, whether CO directly improves HHC remains uncertain. In our study, repeated CO with advance announcement to HCWs did not lead to a significant behavioral change. These results suggest that we cannot expect direct positive effects of CO on HCWs who are exposed to appraisal by simultaneous OO. However, the data may be interpreted to indicate that adding CO to OO-based HH promotion programs does not increase the bias of OO. This interpretation is supported by previous findings that CO is less subject to human bias.[3,11,14]

CO measured greater opportunities than OO in this study. This result might have been related to the Hawthorne effect, as HCWs may have tried to avoid being observed during OO. Therefore, properly designed CO enables more reliable and efficient HHC monitoring than OO and is less disruptive to HCWs' routine practices.

In the present study, HHC based on CO changed promptly after the application and cessation of the intervention, whereas OO demonstrated a delayed response to the application of the intervention but no change to the cessation of the application. The results suggest that CO is a more sensitive method for reflecting the effect of HH promotion programs if it is incorporated into a situation that OO has demonstrated a delayed response. As far as we know, our results are the first to demonstrate a delayed response based on OO compared with CO.

CO revealed that HHC remained low despite the ongoing long-term HH promotion program at our hospital. The results of our study were similar to those of existing studies that reported a lack of long-term effects of HH promotion programs.[15,16] Our data suggest that the success of HH promotion programs can be hindered by OO-related overestimation of HHC, a bias reported in other studies.[3,17]

The HHC of physicians was not significantly lower than that of other professional groups in phase 1 of this study, which is not consistent with previous studies.[18,19] Low peer pressure by covert non-medical observers may account for this result. The results of a similarly designed study support our findings.[14] The HHC of physicians in phases 2 and 3 was consistent with findings of previous studies, which found higher rates of noncompliance and less improvement in the HH of physicians.[3,18,20] Distraction may explain the lack of improvement; physicians are busy and house staff shift changes are frequent.[18] Although we did not measure the workload of HCWs, higher HHC during the nighttime and in general wards suggests that workload negatively affected HHC. Many studies also identified higher workload as a factor associated with poor HHC.[21-23]

This study has several limitations. First, we did not control other contributing elements or bias by the interviewer during the barrier identification interview. Therefore, changes in HHC during phase 2 cannot be fully attributed to the new intervention. Second, underestimation of HHC was possible because of missing cases. HCWs may have washed their hands inside a patient's room using the alcohol-based handrubs installed at the bedside of each patient. However, monitoring wash-in and wash-out moments is known to result in overall rates of HHC similar to those found using more comprehensive monitoring.[24]

Incorporation of CO into already established HH promotion programs with OO does not increase the risk of bias and is a reliable tool for monitoring actual HH performance. CO did not change the behavior of HCWs in our study. However, our data suggest that CO is a more sensitive method for reflecting the effect of HH promotion programs. Accordingly, CO may be preferred for validation of the effectiveness of HH promotion programs, and this simultaneous (CO and OO) design can be applied in many clinical settings that demonstrate high compliance. Further study is needed to determine the cost-effectiveness of simultaneous CO and OO as well as CO-related bias and clinical impact.

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