



## Major Article

# Measuring and accounting for the Hawthorne effect during a direct overt observational study of intensive care unit nurses



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**Key Words:**  
Hawthorne effect  
Hand hygiene adherence  
ICU nurses  
Hand hygiene

**Background:** Because suspecting nurses could alter hand hygiene (HH) behavior when observed, the goal of this article was to describe how the Hawthorne effect (HE) was measured and accounted for in a direct observational prospective study.

**Methods:** Observations were made 8 h/d for 3–5 days in 5 intensive care units (ICUs) (4 hospitals) on a convenience sample of 64 ICU nurses in Texas. The HE was measured so if hand hygiene adherence rates of the first 2 hours were 20% higher than the last 6 hours, the first 2 hours would be dropped and an additional 2 hours would be added at the end of the observation period. Hourly rates were recorded during the observation period, using room entry and room exit.

**Results:** The difference between aggregated rates of the first 2 hours and last 6 hours was 0.56% (range, 0.02%–15.74%) and not significant. On 12 observation days, higher rates were observed during the first 2 hours. On 6 days, higher rates were observed in the last 6 hours, with difference in rates of 1.43% (day 1), 2.97% (day 2), and 1.42% (day 3).

**Conclusions:** The attempt at measuring and accounting for the HE showed little difference in HH rates throughout the observation period. Based on these results, necessity of the observer moving locations during HH surveillance after 10–20 minutes, because of a feared HE, might not be necessary.

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The Hawthorne effect was first recognized in studies by Mayo conducted at the Western Electrical telephone manufacturing facility at Hawthorne, Illinois, near Chicago between 1924 and 1933. In collaboration with his colleagues, they broke new ground in understanding the individual worker in relationship to their industrial job.<sup>1</sup>

Also called observational bias in health care, this phenomenon refers to the tendency of health care workers (HCWs) to alter their behavior when they become aware their behavior is being monitored.<sup>2–4</sup> Regarding hand hygiene (HH), the Hawthorne effect has been demonstrated to exist when comparing the hand hygiene adherence (HHA) rates of overt and covert studies on the same HCW population. In covert observation, there was 44.1% HHA, whereas in overt observation there was 74.4%.<sup>5</sup> The covert HHA rate by a student intern was 58%, and by overt observation of infection control preventionists it was 65%.<sup>4</sup> In measuring 2,808 hand hygiene opportunities (HHOs), the overall covert HHA rate was 29%, whereas the overt HHA rate was 45%.<sup>6</sup> Using a group of fifth year medical

students as covert observers, the HHA rate was 21% compared with a HHA rate of 47% by overt observation by the hospital epidemiology observers.<sup>7</sup> Calculating amounts of sanitizing gel being used when no observer was present and when an observer was visible, there was approximately a 3-fold increased use of the sanitizing gel when the auditors were present.<sup>8</sup>

A systematic review in 2014 reviewed 19 studies regarding their reporting of a Hawthorne effect. Most studies reported a Hawthorne effect but listed significant biases as a result of the complexity of the evaluation.<sup>9</sup> Many studies reporting on HHA rates list a possible Hawthorne effect in the limitations. Some researchers contend that the mere presence of an outsider in the observation area can influence the usual activity exhibited by the HCWs.<sup>10,11</sup>

Although there are many examples of measuring the rate difference between covert and overt observations, nowhere has it been found that the Hawthorne effect itself was measured in an overt direct observational study. The prevailing assumption in an overt observational study is that the longer an observer is present, the higher the HHA rates will be recorded as the knowledge is disseminated that an observer is present. The goal of this study was to compensate for any possible Hawthorne effects that might be observed, therefore reflecting a truer picture of the actual HHA rates of the intensive care unit (ICU) nurses.<sup>12</sup>

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Conflicts of interest: None to report.

## METHODOLOGY

This study was approved by the Institutional Review Boards of Walden University (no. 03-09-16-0327877) and Aspire IRB, Inc. (no. 0.29.NUR.2015C).

The prior sample size required for each of the 5 ICU data collection sites was 613 HHOs (557 plus a 10% margin for missing data). This allowed each ICU to be a stand-alone study. The following surveillance design was established because it was the quickest way to obtain 613 HHOs without putting undue stress on the 1 observer and the ICU nurses. Based on a literature average of 24 HHO per hour,<sup>13–17</sup> 20 HHOs per hour was chosen as the target sample for each hour. Observing 8 continuous hours per day for 4 days would generate a total sample size of 640 HHOs per each facility. For consistency, Monday through Thursday were selected as the observation days for each site. Friday could be added if an insufficient number of observations were obtained in the first 4 days. Diller et al reported no differences found in HHOs on weekdays or weekends.<sup>13</sup> More than the required HHOs were recorded at 3 facilities in 3 days, 1 facility in 4 days, and for 1 facility, all 5 days were necessary to gather the required number of HHOs. Data collection was done March 21, 2016–August 4, 2016. There were no outstanding differences between any of the hospitals or ICUs in architectural structure, management, or results of the nurses' overall behavior. Bed size ranged from <200 to >575, with an average of 29 ICU beds per ICU.

HHA was defined as washing of hands with soap and water or using alcohol sanitizer provided by the hospital. Room entry was counted as a single HHO, and room exit was considered a separate HHO. A binary response of yes, the nurse was adherent or no, the nurse was not adherence was recorded for each HHO. Because hourly rates were recorded, it was possible to obtain a more accurate picture of the hourly fluctuation of rates than as a single aggregated rate. At 1 hospital, Ecolab Inc. sanitizing gel (Ecolab, St. Paul, MN) was used with dispensers mounted on the outside frame of each patient's door with 100% HHA required despite their HH policy mandating 90% compliance. 3M Avagard Hand Hygiene Gel (3M, Maplewood, MN) was used at the other 4 ICUs with dispensers mounted on the outside frame of the patient's door and available also inside each patient's room. Four ICUs had a HH policy requirement of 100% compliance. All 5 of the ICUs had sinks available within each patient's room and sinks available at the workstations.

ICU nurses were approached each morning between 6:30 AM and 7:00 AM to ask for volunteers to participate in the dissertation study. The study was explained to them, and they were given an opportunity to ask questions before deciding to participate. They were requested to fill out a 15-question demographic questionnaire, which they were instructed to return by 3:30 PM. No personal information was collected. The questionnaire contained the demographic variables of age, sex, family income, year of graduation from nursing school, number of years of active nursing practice, hospital employee or agency nurse, areas of previous nursing practice, degree program, country where nurse was born, country nurse graduated from nursing school, ancestry, spiritual affiliation, and number of years of living in the United States. The main focus of the dissertation study was originally to investigate the association of these variables with the dependent variable of consistent HH adherence in the ICU nurses. When the results of the surveillance study were analyzed, the results obtained from the Hawthorne effect portion of the study were deemed important enough to warrant its own emphasis. The portion of the study dealing with the variables and the association to consistent HH is reported in the dissertation, and additional manuscripts are being prepared.<sup>12</sup>

The participants were informed that their participating would also involve the observer recording their HHOs as they entered and exited patient rooms. They were given a letter of informed consent

but were not required to sign because their filling out the questionnaire signified their willingness to participate. Each questionnaire was marked with a number, and this number was used as the identification number for the recording of individual nurse's HHOs. Each nurse received an identification badge with the identical number of his or her questionnaire.

The same observer (S.L.K.) conducted observation in all 5 ICUs. The observer is a Registered Nurse who has been certified in infection control and is an experienced observer in HH observations. Hourly HHO rates were collected on individual nurses from 7:00 AM until 3:30 PM on each day of observation. Because the use of the nurses' break room and bathroom was made available to the observer, break times were kept to a minimal of 5–6 minutes for bathroom breaks (1–2 per day as needed) and 30 minutes for lunch, 12:00–12:30 PM. The observer was positioned on a chair next to the wall in the hallway across from the rooms being observed, in full view of participating nurses. A total of 18 days (144 hours) of observation were completed.

HHOs were recorded on a paper form rather than using a tablet or computer because the availability of electrical outlets located near the observer could not be guaranteed. After all data had been collected, questionnaire answers and the HHO data were entered into IBM SPSS Statistics for Macintosh version 22.0 (IBM Corp., 2013, Armonk, NY) for data storage and analysis.

Room entry and room exit were chosen because they cover 87% of the World Health Organization's (WHO) My 5 Moments of Hand Hygiene.<sup>11</sup> Room entry can be aligned with moment 1 (before touching a patient), whereas room exit is aligned with moment 4 (after touching a patient) and moment 5 (after touching the surroundings).<sup>17</sup> Consideration was also given that if the WHO's My Five Moments of Hand Hygiene were used, the time spent in the patient's room observing one nurse (a potential cause for the Hawthorne effect) could not be used to observe multiple nurses entering and exiting other patient rooms. None of the data collection sites used electronic surveillance systems or video camera surveillance.

Because the nurses were being asked to participate, fill out a questionnaire, and agree to being watched, the nurses were aware from the very beginning of the shift their HH behavior was being monitored and recorded. It was speculated that if the nurses were trying to increase their HHA (through elective HHA behavior), that this artificial behavior could not be sustained, and after a couple of hours they would convert back to their inherent HH behavior.<sup>18</sup> Based on the hospital infection control experience of the observer, it was decided that if the HHA rate of the first 2 hours of the observation period was 20% higher than the combined rates of the last 6 hours, the data from the first 2 hours would be dropped and another 2 hours would be added to the end of the surveillance period, extending it from 3:30–5:30 PM. This would still provide the 8-hour observation period but would eliminate the artificially high HHA rate of the first 2 hours should it occur.

No incentives were offered to the ICU nurses by the observer. Three of the hospitals did offer credit for an internal program should the nurse agree to participate. Many of the nurses stated they would still have participated even if the hospital had not offered the credit.

## RESULTS

Through the use of convenience sampling, data were collected from 64 ICU Registered Nurses located in 5 ICUs in 4 Texas hospitals with 1,574 total beds and 144 total ICU beds.<sup>12</sup> A total of 3,620 HHOs were recorded from all ICUs: 2,320 positive and 1,300 negative HHOs (no HH was done) for an overall rate of 64.09% HHA rate. **Table 1** represents the percentage of time HHA percentage ranges were observed. For example, 19.44% of the time, or during 28 hours of observation, the nurses were observed to participate in a HH rate of 50%–59%. A minimum of 4 HHOs was recorded for 1 nurse, and

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