Variation in Hand Hygiene Improvement After Implementation of an Electronic Hand Hygiene Monitoring System During the COVID-19 Pandemic

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REVISED ABSTRACT

Background: Electronic hand hygiene (HH) monitoring systems have many potential advantages but there are limited data on wide-scale implementation of these systems.

Methods: We deployed an electronic HH monitoring system in over 2,100 acute and critical care rooms across 9 hospitals in an academic health system. Badges with a Bluetooth beacon were issued to over 7,000 healthcare workers. Deployment began in early 2020 and was interrupted by the pandemic. The rollout of interventions to improve HH adherence was managed at the hospital level. Healthcare-associated infections (HAIs) were determined by the infection prevention team using standard CDC definitions. Hospital-level HH adherence rates were compared to a composite SIR including SIRs for CLABSI, CAUTI, hospital-onset MRSA bloodstream infections and hospital-onset *Clostridiodes difficile* infections.

Results: Between January 2020 and September 2022, there were over 42 million hand hygiene opportunities. Overall HH adherence improved from 42% to 64%, with significant variation by hospital (4 improving by >25% and 3 by < 5%). Hospitals whose implementation was most delayed showed the least improvement. Preliminary analysis found no relationship between hand hygiene improvement and the SIR composite aggregated by calendar year.

Conclusions: Despite the challenges of large-scale implementation of an electronic HH system during a pandemic, we demonstrated an overall improvement in HH adherence. The wide variation in improvement among hospitals was due to timing of implementation, variation in the dedicated hospital-specific project management resources and leadership engagement. In addition to technology, successful implementation of electronic HH systems requires dedicated resources and culture change. Pandemic-related staffing challenges, disruption of standard HAI prevention efforts and intensive device utilization confounded our ability to show a relationship between HH adherence and HAI rates.

BACKGROUND

- Optimizing hand hygiene (HH) is fundamental to infection prevention
- Electronic HH systems have many advantages
  - Can collect large amount of data
  - Less subject to observer bias
  - Can provide immediate feedback
- Emory Healthcare installed an electronic HH monitoring system, with implementation coinciding with the COVID-19 pandemic

STUDY OBJECTIVES

- To measure the improvement in HH adherence rates after implementation of an electronic HH system
- To evaluate the impact have improved HH rates on healthcare-associated infection (HAI) rates

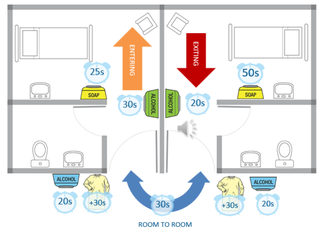
METHODS

TECHNOLOGY

Badge Reel:
- Contains Bluetooth beacon
- Battery

Sensor:
- Detects Bluetooth badge and HH product use
- Communicates with adjacent sensors

Ultrasound proximity sensor:
- Detects motion in/out of room
- Speaker for providing voice reminder



Compliance based on
- Detection of Bluetooth signal from badge
- Crossing threshold recognized by motion sensor
- Performance of hand hygiene using dispensers in or outside room based on timing algorithm*

* Some variation in timing algorithm from unit to unit

STUDY DESIGN

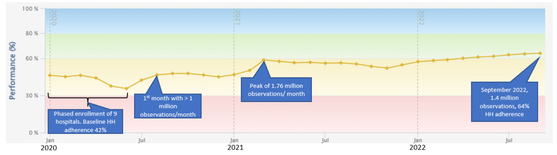
- Measured HH adherence data on hospital and unit level
- Measured HAI rates using standard CDC/NHSN definitions
- Examined relationship between HH and HAI rates/standardized infection ratios (SIRs) at hospital and unit levels]
  - Pearson correlations and unadjusted regression lines were fitted

STUDY POPULATION

- Nine hospitals in the Emory Healthcare system
  - HAI rates available in 7
- 2,100 acute care and ICU rooms
- Over 7,000 staff and providers monitored

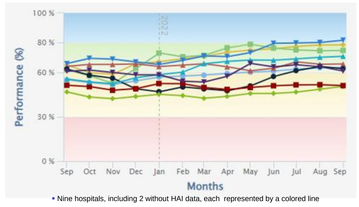
RESULTS

SYSTEM-LEVEL HH PERFORMANCE JAN 2020-SEPT 2022



- 42 million HH opportunities recorded by electronic system in this time period

HOSPITAL-LEVEL HAND HYGIENE PERORMANCE SEPT 2021-SEPT 2022

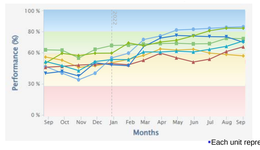


Nine hospitals, including 2 without HAI data, each represented by a colored line

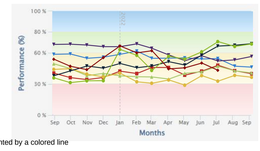
September 2022
- Overall 64% performance
- Hospital range 50%-82%

UNIT-LEVEL HAND HYGIENE PERORMANCE SEPT 2021-SEPT 2022

Acute Care Units Hospital C



ICUs at Hospital F



Each unit represented by a colored line

- Unit to unit variation of 30% present at several hospitals
  - Units with highest leadership engagement had most improvement

TRENDS IN HAI RATES BY HOSPITAL

Hospital	Beds	Sept 22 HH %	Overall % Improvement	CLABSI	CAUTI	MRSA	CDIFF
A	<100	74	36				
B	<100	77	29				
C	>300	68	28				
D	>300	75	27				
E	100-300	63	12				
F	>300	50	5				
G	>300	45	3				

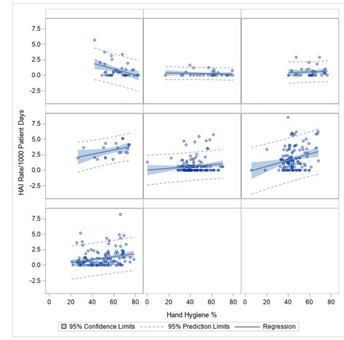
SIR = 1.0 ····· January 2020

- Hospitals with earlier implementation had most improvement
- No clear association of HH and HAI over time

RESULTS

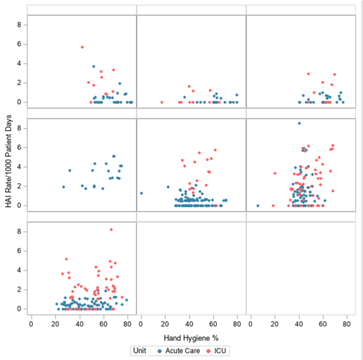
IS THERE AN ASSOCIATION BETWEEN UNIT-LEVEL HH AND HAI RATES?

Fitted regression lines for 7 hospitals with HAI rates



- Each point represents a unit for a 3-month period
- Only hospital A showed an association of increase HH and decreased HAI.

DOES CORRELATION BETWEEN HH AND HAI RATES DIFFER BY UNIT TYPE?



- Each dot represents and acute care unit or an intensive care unit for a 3 month period

Pearson Correlation (p-value)

All units	0.11 (0.01)
Acute care units	0.06 (0.23)
ICUs	0.15 (0.07)

CONCLUSIONS

- Implementation of an electronic HH system improved overall HH adherence by 22%
- There was wide variation in HH improvement on the hospital and unit level
  - Most improvement with unit level leadership engagement and hospital-level resources
- Improved HH adherence not associated with decreases in HAI across system
- Confounding by pandemic and related staffing challenges needs further analysis