USING BIOVIGIL TECHNOLOGY TO IMPROVE HAND HYGIENE COMPLIANCE AND AWARENESS

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BIO∜IGIL®

Executive Summary

Decades of research have well established the causal relationship between hand hygiene and healthcareacquired infections (HAIs).

Every patient interaction starts with a hand hygiene opportunity (HHO) that offers an opportunity to demonstrate a commitment to safety and the quality of care that the patient and family members can see immediately. Furthermore, HHOs provide an opportunity to reduce the liabilities and costs resulting from HAIs.

A mid-size hospital has more than 10,000 HHOs every day. Effectively measuring and controlling a process of this magnitude requires the assistance of technology.

BioVigil is an innovative system specifically designed to provide healthcare workers with a hand hygiene reminder at the point of care as well as a means to reassure patients that hand hygiene protocols are being followed. Hand hygiene compliance (HHC) rates of more than 97% are achieved and maintained with the BIOVIGIL system. BioVigil implementations demonstrate:

Awareness functionality via a red, yellow, and green light system, engaging patients and family members in the HHC process to reduce anxieties regarding HAI risks

Hand hygiene **reminders** are critical to achieving high compliance rates (a 34% difference in HHC rates has been observed with use of reminders)

High HHC rates (97% or more) can be **achieved** and **maintained**

BIOVIGIL contributes to a decrease in HAI rates by **15% or more**

Potential cross-contamination events can be identified and addressed in real time

Four Components of BioVigil system:



Badge & User Key



Base Station



Room Entry/Exit Sensors



Software Application

Using BioVigil to Improve HHC

There are four core system functions (the four R's) that every HHC system should have: the ability to **Record** data, **Report** it, **Remind** healthcare workers to sanitize hands, and **Reassure** patients and their family members that proper hand hygiene has been observed. For more on the four R's, **download a free white paper**.

The BioVigil system incorporates each of these four core functions, and it is the **Reminder** and **Reassurance** functions in particular that have the potential to transform the culture and behaviors associated with HHC. In turn, these functions will reduce risk, lower infection rates, increase patient satisfaction, and raise compliance rates to over 97%.

The BioVigil **Reminder** function analyzes the workflow pattern of healthcare workers as they move to and from patient care areas. BioVigil evaluates this pattern against the user's recent hygiene event history and the unit manager's policy settings to determine if a new hygiene event is warranted. If the user has not already performed hand hygiene, the BioVigil badge will provide an audible reminder to the worker to prompt for a hygiene event. In this manner, BIOVIGIL can intervene at the point of care to promote good hand hygiene practices when they matter most. This point-ofcare reminder function is necessary to maintain high compliance rates in a busy environment.

The BioVigil **Reassurance** function provides patient awareness to the state of a user's attention to hand hygiene protocol. A green badge reassures the patient that a care provider has recently performed hand hygiene.

Additionally, BioVigil provides a mobile validation platform to register hand hygiene events without the need to visit an instrumented dispenser. An on-board chemical sensor detects the presence of alcohol to establish that a care provider has recently sanitized his or her hands.

The Four R's:

- **Remind** the healthcare worker upon every entry & exit of a designated patient area
- **Record** 24/7 seamless data capture (user, room, hand hygiene event data)
- **Reassure** coworkers, patients, and family members of actual HHC status
- **Report** aggregate and individual HHC data into easy to read reports & dashboards

How It Works

The BioVigil system addresses the four R's with the following system functions:

- **1** Care providers wear a BioVigil badge, each with personal user identification.
- 2 The badge detects when a user moves to and from a patient care area by interacting with BioVigil room sensors. These battery-operated devices are easily installed on the ceiling without the need for special installation wiring or networking.
- 3 After entering or exiting a room, if necessary, the badge, via an audible tone, will prompt the user to perform hand hygiene. Additionally, the badge will display a yellow or red light to indicate that attention to hand hygiene is warranted.
- 4 Validating a hand hygiene event with the badge will turn the hand symbol on the badge green. After applying hand sanitizer, a care provider presents their hands to the badge to register the presence of alcohol, which generally takes about one second. Alternatively, the proximity and time relative to a sink can also be used to register sink and soap hand washing hygiene event.

5 Data is stored on the badge. At the end of a shift when the badge is returned to the BioVigil base

station, data is sent to the cloud-based BioVigil data applications where it is then available for reporting and analytics.

In this manner, a rich data set is automatically collected regarding workflow patterns and hand hygiene activity. The BioVigil system does not require any IT system or server integration; an internet connection for each BioVigil base station is all that is necessary.

High Impact Results

FACT 1: BioVigil drives best-in-class compliance with HHC rates averaging over 97%.

Primarily due to the application of the Reminder function, BioVigil can quickly modify HHC behavior and drive high levels of compliance. Figure 1 in Appendix A illustrates HHC results across five sites where a 96% to 98% compliance rate was maintained over 800,000 observations.

FACT 2: The BioVigil Reminder and Reassurance functions are a critical factor in increased compliance.

BioVigil data illustrates how users are less likely to perform hand hygiene when the reminder function is not active. In one case, compliance behavior rates were observed to immediately drop from 97% to 63.7% when the reminder function was suspended. See Appendix A, Figures 2a and 2b for more details on research supporting this finding.

Furthermore, patients will ask care providers about the BioVigil badge if the light isn't green, which will help validate the importance of the visual Reassurance function regarding hand hygiene to the care provider.

Fact 3: BioVigil helps hospitals monitor high-risk patients and prevent cross contamination.

An increased potential for cross contamination occurs when care providers move between patient care areas without performing hand hygiene. Even with the BioVigil system in place, between 2% and 5% of room entries occur under this condition. BioVigil recognizes these events at the point of care and intervenes with an accelerated warning sequence. In 95% of such cross-contaminated entry situations, BioVigil data indicates that users performed hand hygiene within 20 seconds of entering the second room. This behavior is particularly notable in C. difficile situations in which BioVigil can be used

to help prevent cross contamination in real time by prompting users for a sink hygiene event. BioVigil data also analyzes behavior after a transmission has occurred to support outbreak investigations by providing additional training and educational measures. See Appendix A, Figures 4 and 5 for supporting data sets.

Fact 4: Increasing hand hygiene compliance reduces HAIs

Numerous studies have consistently shown a favorable relationship between increased HHC and reduced HAIs (see Appendix A, Figure 6). One BioVigil client reported a 15% reduction in HAIs during a 120-day trial implementation across three units with 181,080 observations logged and an overall compliance rate of 96%. There are of course other factors that contribute to HAI transmissions and no single countermeasure can eliminate all HAIs. However, BioVigil is a highly visible and effective tool that underscores and drives an increased focus on patient safety, HAI reduction, and patient satisfaction with every interaction.



Conclusion

Employment of the BioVigil system has demonstrated best-in-class HHC rates, reduction of cross-contamination, and reduction of HAIs.

Data clearly show the impact that BioVigil can have on sustaining high rates of hand hygiene compliance.

As technology-enabled HHC systems for hospitals become the standard of care, patient safety will be favorably impacted and HAIs will be reduced. Furthermore, every patient interaction starts with a hand hygiene event that represents a chance to reassure patients that there is a continuous commitment to their safety and quality of care.



About BioVigil

BioVigil is the market leader in hand hygiene solutions. Headquartered in Ann Arbor, MI, BioVigil's patented technology enables hospitals to sustain 97% hand hygiene compliance and reduce Healthcare Acquired Infections with a gentle reminder system that increases patient engagement. At the center of the solution is BioVigil's Data Suite which delivers actionable insights for hospitals to optimize workflow. These insights are available on demand or in easy to understand reports. http://biovigil.com

Appendix A

Figure 1: Hospitals achieve hand hygiene compliance averaging a rate of 97% when using the BioVigil system.

The following chart shows five sites where nearly 800,000 hand hygiene events were observed by BioVigil. When the badge is in use with visual and auditory reminders in place, the average compliance rate is 97%

Implementations	Site 1	Site 2	Site 3	Site 4	Site 5	Average
Total Compliant Events Observed	131,006	174,704	346,825	135,423	11,337	159,859
Total Non-Compliant Events Observed	2,374	6,376	8,072	2,804	521	4,029
Total Observations	133,380	181,080	354,897	138,277	11,858	163,898
HHC Rate	98.22%	96.48%	97.72%	97.97%	95.60%	97%

Figure 2a: The reminder function increases compliance.

When the badge's reminder sequence was on, the HHC rate was over 96%, with the vast majority of hygiene events occurring within less than 45 seconds upon entry or exit of a monitored patient room.



Figure 2b: When the audible reminder is off, compliance decreases.

With the reminder sequence turned off (and no audible reminder to complete hand hygiene), compliance rates fell to 63.7%. As soon as reminders are turned back on, compliance almost immediately rebounds, demonstrating the value of a reminder sequence in the HHC process.



50%

25%

0%

<15s

Reminder Sequence OFF

HHC was 63.7%. If user does not hygiene immediately after exit, they are likely to forget



Figure 3: BioVigil helps analyze hand hygiene behavior in a C-Diff room.

In one analysis, user behavior was analyzed retrospectively in a C. diff room. In this study, users were NOT specifically prompted for a sink hygiene event upon exit from a C. diff room but were still prompted to perform hand hygiene. Over the course of three days, 26 healthcare workers exited the room 178 times but only performed a sink hygiene event on 28% of those occasions. On 32% of exits, the user registered an alcohol hygiene event. These data further highlight the importance of reminders to drive consistent HHC behavior.



Figure 4: BioVigil helps analyze cross contamination.

Building upon the previous example, when the patient next door (in room 1235) contracted C. diff., a cross-contamination analysis was conducted to identify instances in which a care provider moved between rooms without specifically performing a hand hygiene event at a sink. A total of 30 cross-contaminated room entries were identified among nine badged users. These data support additional training and educational measures to improve patient safety.

Potential C. Diff. Cross-Contamination from Room 1234 to Room 1235 9/16–9/19 (30 Cross-Contaminated Entries)



Figure 5a: BioVigil increased rates of HHC reduces HAIs.

A large academic medical center did a 120 day implementation of the BIOVIGIL system in three units, including a neuro ICU, a pediatric unit, and a med-surg unit in which there were 181,080 observations of hand hygiene opportunities, and overall worker compliance was over 96%.

The hospital tracked the number of HAIs over those same units and time period and found a 15% reduction in HAI rates. During the introductory phase, badge usage was limited to primary care nursing; infection rates would likely be reduced even more if badge usage was expanded to physicians and other staff.

Length of implementation	120 days
Units included	Neuro ICU, pediatric unit, and a med-surg unit
Number of HHO's observed	181,080
Average worker compliance	96%
Reduction in HAI's during this implementation	15%

Figure 5b: WHO Research Review Supports BIOVIGIL finding that increased HHC decreases infection rates.

The World Health Organization (WHO) recently identified 39 international studies that demonstrate that increased HHC leads to a decrease in infections. The full research review is available on the WHO website¹ but the following table lists a sample of the studies reviewed by the WHO.

Country/Year	Setting	Change in HHC	Corresponding Decrease in Infections	Reference
USA 2009	Hospital-wide, 7 acute care facilities	From 49% to 98%	Significant reduction of MRSA rates from 0.52 to 0.24 episodes	Lederer JW et al (23)
USA 2010	2 acute hospitals	From 65% to 82%	51% decrease in hospital-acquired MRSA cases	Carboneau C et al (20)
China (Taiwan) 2011	Hospital-wide	From 43.3% to 95.6%	8.9% decrease in HAIs and a decline in the BSI caused by MRSA and extensively drug-resistant Acinetobacter baumannii*	Chen Y-C et al (18)
Saudi Arabia 2013	Hospital-wide	From 38% to 83%	Significant reduction of MRSA infections (from 0.42 to 0.08), VAP (from 6.1 to 0.8), CLA-BSI (from 8.2 to 4.8), catheter-associated UTI (from 7.1 to 3.5)	Al-Tawfiq AA et al (24)