Validation of Selected Healthcare-Associated Infection (HAI) Reporting in Connecticut Hospitals

FINAL REPORT

John Snow, Inc.

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INTRODUCTION

Over the past decade, U.S. hospitals have collaborated with the Centers for Disease Control and Prevention (CDC) and the Centers for Medicare and Medicaid Services (CMS) to improve the quality and safety of patient care. Preventing healthcare-associated infections (HAIs), which impact thousands of patients and their families each year, is a top national priority. Steps can be taken to control and prevent HAIs in a variety of settings. Measuring the scope of the HAI problem and monitoring trends over time is critical to the prevention effort.

CDC's National Healthcare Safety Network (NHSN), the nation's most comprehensive medical event tracking system, is currently utilized for tracking HAIs and other related measures by more than 23,000 U.S. healthcare facilities.[1] NHSN provides stable and timely data to guide prevention efforts aimed at protecting patients. In recent years, Medicare payments to hospitals have been tied to HAI reporting via NHSN. Consequently, CDC and CMS have emphasized that accurate and complete reporting through strict adherence to the NHSN definitions is critical.

The processes involved in gathering data from a variety of sources within the hospital, confirming HAIs, reviewing data for accuracy and adherence to standardized terminology, and inputting data into the online NHSN system are labor intensive and time consuming. Data tabulation and entry is subject to errors, and significant institutional variation has been observed in collecting and reporting infection rates. CDC recently raised concerns that some of the decisions about what infections should be reported to NHSN are being made by individuals who may choose to disregard CDC's protocol, definitions, and criteria or who are not thoroughly familiar with the NHSN specifications.[2] While such issues are not considered widespread, the economic incentives for under-reporting HAIs have underscored the need to independently audit reporting practices and data, so that the public can have confidence in the system.

[1] 2015 National and State HAI Data Report. https://www.cdc.gov/hai/data/archive/2015-HAI-data-report.html

[2] Adherence to the Centers for Disease Control and Prevention's (CDC's) Infection Definitions and Criteria is Needed to Ensure Accuracy, Completeness, and Comparability of Infection Information. https://www.cdc.gov/nhsn/cms/cms-reporting.html

CDC has recommended that states use available resources to validate the completeness and accuracy of HAI reporting, recognizing that the definitions are complex and the intensity of HAI surveillance can vary between facilities. External validation is also considered an important educational opportunity for a hospital's Infection Prevention and Control Department as it is a way to measure their adherence to mandated reporting requirements.

In response to these concerns, the Connecticut Department of Public Health (DPH) funded consultants from John Snow, Inc. (JSI) to implement a detailed validation of 2017 HAI reporting in acute care facilities. This report provides final details of the findings.

METHODS

The validation approach included components described in the *National Healthcare Safety Network (NHSN) External Validation Guidance and Toolkit* for 2017. [3] Eight acute care facilities in Connecticut were selected by the DPH for inclusion based on the ranking methodology described in the Toolkit using 2016 data. After the selection process, one facility merged with another, such that the 2017 HAI data were completely integrated in NHSN. As a result, DPH instructed JSI to over-sample the combined facility by reviewing twice the usual number of cases. The final chart review population, therefore, was equal to eight acute care facilities.

JSI validated the data for the following HAI events in all seven facilities:

a. Central Line-Associated Blood Stream Infections (CLABSI)
b. Catheter-Associated Urinary Tract Infections (CAUTI)
c. Surgical site infections: colon surgery (COLO)
d. Surgical site infections: abdominal hysterectomy (HYST)

Due to resource constraints, the LabID event *Clostridium difficile* infection (CDI) was validated for four hospitals, including the over-sampled facility.

The acute care hospitals were notified on April 6, 2018 concerning the upcoming validation and received instructions for securely submitting their laboratory data files to JSI. Each facility sent a data file securely to JSI, which contained all positive blood cultures and urine cultures from 2017 and included patient location, admission date, organisms identified, etc. In addition, the facilities also shared reported CLABSI and CAUTI events for 2017; up to 20 of these per facility were randomly selected for medical record review. An additional 40 patients were selected as unreported "candidate" CLABSIs and CAUTIs, including an

[3] https://www.cdc.gov/nhsn/pdfs/validation/2017/2017-nhsn-ev-guidance.pdf

oversampling for neonatal intensive care unit patients (NICUs) for CLABSIs when present. Denominator files of colon surgeries (COLO) and abdominal hysterectomy (HYST) were also shared and used to select cases for review. In order to be able to identify CLABSI, CAUTI and SSI events reported to NHSN by the facilities, JSI received a list of these infections from the DPH HAI Program. For the four facilities undergoing CDI validation, data files of positive *Clostridium difficile* tests were also submitted and compared to DPH files of CDI events.

Hospitals received the list of selected patients for review, with the goal of up to 60 per facility for each type of infection. Medical record access was arranged for on-site or remote reviews, including creating electronic data privacy agreements and other security requirements. Medical record reviews were completed between June and December 2018. One hospital was visited by the JSI reviewers for on-site record reviews; the six other facilities were validated using remote access to medical records and communication of information and documents. As recommended by CDC, all reviewers were blinded to the event status (i.e., whether or not the patient was reported to have an infection) of the cases during the review. At the completion of the reviews, feedback discussions were held with the infection preventionists concerning any discrepancies. Complicated cases were referred to CDC's NHSN support team for specialty input. Once agreement was reached, a summary report of the findings was shared by JSI with the hospital team. A brief online survey was used to gather information about surveillance methods, decision-making processes and training.

RESULTS

A sample of 417 records were reviewed to validate CLABSI reporting, including 97 patients with reported CLABSI events. Table 1 provides the details of the findings for CLABSI reviews in the 7 facilities.

Table 1. Findings for Central Line-Associated Bloodstream Infection (CLABSI) in Seven Acute Care Facilities

Hospital	Total Cases Reviewed	Reported Events Reviewed	Missed events	Over-reported events
A	60	20	1	0
B	48	8	0	0
C	44	4	0	0
D	120	40	0	1
E	53	13	0	0
F	44	4	0	0
G	48	8	0	0
TOTAL	**417**	**97**	**1**	**1**

Five of the seven facilities had no errors in CLABSI reporting. Only one CLABSI case was missed, due to an apparent malfunction of the data mining software. In multiple hospitals, the date of event was inaccurately determined in a few reported CLABSIs because the software focuses on the positive blood culture date, rather than the appearance of symptoms required for some types of CLABSIs. One over-reported CLABSI event did not count because the positive blood culture was related to a urinary tract infection.

The validation of CAUTI reporting involved reviewing 438 patients, 112 of whom had been reported as CAUTI events in NHSN (see Table 2). Five facilities had no missed or over-reported CAUTI events identified in 2017. Only two CAUTI reporting errors were identified involving two hospitals; both were missed cases. The data mining software generated a small number of errors in the date of CAUTI events, similar to the problem mentioned above for CLABSI. This minor discrepancy has minimal impact, however, since it would only effect the repeat infection timeframe used to assess subsequent urinary tract infections that might occur in a long admission.

Table 2. Findings for Catheter-Associated Urinary Tract Infectious (CAUTI) in Seven Acute Care Facilities

Hospital	Total Cases Reviewed	Reported Events Reviewed	Missed events	Over-reported events
A	60	20	0	0
B	52	12	0	0
C	50	10	0	0
D	120	40	1	0
E	53	7	1	0
F	50	10	0	0
G	53	13	0	0
TOTAL	**438**	**112**	**2**	**0**

The validation reviews also included surgical site infections (SSIs) that developed in patients following two types of surgical procedures defined in NHSN --- colon surgery (COLO) and abdominal hysterectomies (HYST). As shown in Table 3, 408 colon surgery patients were reviewed, 110 of whom had been reported with an SSI in NHSN (see Table 2). There were 13 missed events and one reported COLO event did not meet the definition. Two facilities had no missed or over-reported COLO events identified in 2017. Three cases were corrected in terms of the level of SSI reported.

Table 3. Findings for Colon Surgery Infections (COLO) in Seven Acute Care Facilities

Hospital	Total Cases Reviewed	Reported Events Reviewed	Missed events	Over-reported events
A	60	20	5	0
B	54	14	4	0
C	50	10	2	0
D	89	30	0	0
E	54	14	2	0
F	49	10	0	1
G	52	12	0	0
TOTAL	**408**	**110**	**13**	**1**

The validation of HYST reporting included 354 cases and 34 reported infections, as shown in Table 4. Only one missed event was identified, with six facilities having no errors identified in this type of HAI.

Table 4. Findings for Abdominal Hysterectomy (HYST) in Seven Acute Care Facilities

Hospital	Total Cases Reviewed	Reported Events Reviewed	Missed events	Over-reported events
A	51	11	0	0
B	44	4	0	0
C	41	1	0	0
D	88	8	1	0
E	43	3	0	0
F	43	3	0	0
G	44	4	0	0
TOTAL	**354**	**34**	**1**	**0**

Once the record reviews for these four HAIs had been completed, JSI used the remaining personnel resources to focus on the NHSN LabID event for *Clostridium difficile* infection (CDI) in four facilities. After auditing 300 cases, including 252 that were reported CDI events, four missed events were identified, involving two facilities (see Table 5). At one facility, the review identified a possible defect in the data uploading process because several cases that had been entered as events failed to be transferred into NHSN. Two facilities had no errors and there were no over-reported events identified.

Table 5. Findings for (CDI) in Four Acute Care Facilities

Hospital	Total Cases Reviewed	Reported Events Reviewed	Missed events	Over-reported events
D	125	111	1	0
E	68	55	3	0
F	52	44	0	0
G	55	42	0	0
TOTAL	**300**	**252**	**4**	**0**

The overall validation findings across the state are shown in Table 6 by type of HAI included in the audit. The majority of the missed events were COLO infections (13 of 21, 62%). All of the other HAIs were found to have a small number of errors. The calculated sensitivity rates for the individual HAIs were 98.9%

for CLABSI, 98.3% for CAUTI, 89.4% for COLO, 97.1% for HYST and 98.4% for CDI. Across the 1917 cases reviewed, the combined sensitivity of the HAI reporting was 96.6%.

Table 6. Statewide Findings for HAI Validation by Infection Type

Infection Type	Total Cases Reviewed	Reported Events Reviewed	Missed events	Over-reported events
CLABSI	417	97	1	1
CAUTI	438	112	2	0
COLO	408	110	13	1
HYST	354	34	1	0
CDI	300	252	4	0
TOTAL	**1917**	**605**	**21**	**2**

An online surveillance survey was completed by each facility's Surveillance Coordinator, incorporating 15 selected questions from the NHSN Toolkit for External Validation. These focused on training in NHSN, denominator counting methods, and decision-making for evaluating events. Most facilities have instituted automated systems for counting device days used in calculating CLABSI and CAUTI rates. Infection Preventionists (IPs) are responsible for the majority of event reporting, with a few reporting that the facility's epidemiologist makes the final decision. All facilities denied receiving pressure from physicians or administrators to not report a qualifying HAI. Data-mining software is being used by all seven facilities to capture CDI events and all correctly limit CDI reporting to unformed stool specimens only. Two incorrect answers were received regarding what is used for CDI denominator data, which should capture all admissions and patient days.

DISCUSSION

The most recent CDC national report of HAI trends shows an 11% reduction in CLABSI and a 7% reduction in CAUTI between 2015 and 2016.[4] While it is encouraging to witness these positive trends, many view them with caution because the data are self-reported by hospitals who have both financial and public relations incentives to minimize the infection rates. Nonetheless, the 96.6% overall sensitivity for the

[4]

combined Connecticut facilities across the five HAIs validated is extremely reassuring. The small number of mistakes demonstrate strong surveillance methods and good familiarity with the complicated NHSN definitions. Several other additional findings in the areas of HAI data, surveillance methods and validation process are described below:

HAI data ---

- Sensitivity of the HAI reporting for four of the five events validated was over 97%; reporting completeness for COLO events (89% sensitivity) would benefit from specific attention for better infection identification.
- Dates of CLABSI and CAUTI events were off by one or two days due to the emphasis of surveillance software on the date of the positive culture, which is inconsistent with the definitions when fever or other symptoms establish the date.
- Infection preventionists do not report being pressured by physicians or administrators to under-report infections, despite the current negative financial implications of HAIs.
- The process for making determinations on potential events is thorough and typically includes consulting with the NHSN expert support team.

Surveillance Methods ---

- Hospitals have made the financial investment into data mining software for HAI surveillance, with several products currently being utilized (e.g., Theradoc, Medmined, Epic's ICON and VECNA).
- Device days for central lines and urinary catheters are being electronically collected in all but one of the CT facilities included, with spot-checking and other quality checks of the data.
- The infection preventionists play a primary role in most aspects and the data are frequently checked for accuracy.
- In one facility, the data transfer process had failed to upload several CDI events, which were only identified by the validation; there is a need to spot-check this step of reporting to be sure all intended events are successfully included in NHSN.

Validation Process ---

- Electronic medical records of various types are in use, facilitating remote reviews for some hospitals but also posing new technical and operational challenges to gain access.

Coordination involves multiple departments to sign agreements, establish access with passwords, request the list of patients to be uploaded, be oriented to the EMR system, and implement security keys. When tight time limits are placed on the access, repeating these steps is necessary, which sometimes makes the logistics of remote reviews surprisingly demanding and time-consuming.

- Security measures that have recently been applied to hospital EMR systems are a serious impediment to external data validation. Many facilities now limit the auditor's view of records (for both remote and on-site audits) to a large pdf file, sometimes involving thousands of pages to search, often with minimal bookmarks and reams of repetitive material.
- Compared to CLABSI and CAUTI, SSI validation is more labor-intensive and time-consuming, since there is a 30-day post-operative period to track during which data from ambulatory settings (i.e., surgeon's office visits) is essential.
- The NHSN definition of superficial SSI is not culture-based, since the definition includes a physician diagnosis, the presence of purulent drainage and other signs or symptoms (i.e., pain or tenderness; localized swelling; erythema; or heat). Searching for these terms in a voluminous pdf file is long, tedious process.
- The ability of external auditors to properly audit for SSI reporting has been hampered and this limitation must be acknowledged; future validations must properly anticipate these costs and weigh them thoughtfully.

Based on the validation activities in Connecticut, knowledge of the NHSN definitions appears to be very high and routine surveillance methods are quite comprehensive in these seven hospitals. The diligent efforts of all parties involved in training, implementing, monitoring, and evaluating the HAI surveillance are clearly producing high quality results for the majority of the HAI types included. Future planning for external HAI validation should be informed by our recent experiences and factor in the additional costs for complete SSI reviews. When surveillance software is used, the identified flaws regarding date of event assignment and event uploading failure should be regularly monitored and corrected as needed.