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National Healthcare Safety Network laboratory-identified *difficile* event reporting: A need for diagnostic stewardship

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Background

Laboratory-identified (LabID) Clostridium difficile events are reported publically by the Centers for Disease Control and Prevention National Healthcare Safety Network as a patient safety metric that influences facility reputation and reimbursement.[1]In broad terms, each unique, positive C difficile test, taken after day 3 of hospital admission, constitutes a health care facility-onset C difficile infection (HO-CDI) LabID event. This metric does not incorporate chart review; therefore, it is less labor-intensive and potentially more objective, but influenced by test characteristics and behaviors.

Many microbiology laboratories in the United States use highly sensitive nucleic acid amplification tests to detect C difficile toxin A or B genes.[2] A positive test performed on an asymptomatic patient may represent colonization prevalent in a hospitalized population.[3] Delayed testing of a symptomatic patient, beyond the third day of hospitalization, can lead to misclassification of community-onset infection as HO-CDI. Facility knowledge of what HO-CDI events represent, coupled with interventions to promote appropriate and timely diagnostic testing – known as diagnostic stewardship (D.S.) – can address these issues.

We elucidate the proportion of reportable HO-CDI LabID events at our institution that represent true HO-CDI versus asymptomatic C. difficile colonization due to inappropriate testing or community-onset CDI with delayed testing.

Methods

This study was conducted at The Johns Hopkins Hospital, a 1,145-bed tertiary academic center in Baltimore, Maryland. Trained infection preventionists conducted prospective chart review for each HO-CDI lab ID event from January 2015 to June 2016. “True HO-CDI” was defined as clinically significant diarrhea (≥3 episodes in 24 hours) not present on admission, without laxatives administered in the preceding 48 hours. A second retrospective chart review was later conducted for “non-true HO-CDI” cases to verify reasons and to ascertain treatment of CDI (metronidazole or vancomycin) within 14 days of positive test. New Standardized Infection Ratios (SIRs) including only “true HO-CDI” in the numerator were calculated for each quarter, and compared with the publically reported HO-CDI SIR.[4]

A prioritization matrix was used to rank services according to potential “return on performance improvement investment” to direct future diagnostic stewardship interventions. A service which is not contributing many events to the HO-CDI, or a service where tests are mostly appropriate, would likely not be a top priority for intervention. Prioritization matrices are used in other healthcare domains such as lean sigma and clinical decision support for breast care.[5] Ranking of raw number of HO-CDI lab ID events (service contribution to the HO-CDI) was multiplied by ranking of percent inappropriate tests (a large proportion of inappropriate tests indicating significant opportunity for improvement). See table 1.

Results

There were 490 HO-CDI LabID events during 452,587 patient days; 284 (58%) were “true HO-CDI” whereas 206 (42%) were classified “non-true”: either inappropriate or delayed testing. Reasons for “non-true HO-CDI” included no significant diarrhea (94; 49.5%), laxative within previous 48 hours (78; 41%), and delayed testing (18; 9.5%). There were 16 (7.8%) charts, where retrospective chart review to ascertain specific reason for “non-true HO-CDI” was not possible. Of 172 patients with inappropriate testing, 159 (92%) were treated for CDI. For the “true HO-CDI” every quarter SIR was below 1, compared with 2 of 6 quarters for the publically reported HO-CDI. See figures 1a and 1b.

Discussion

We found that almost half of HO-CDI LabID events at our institution were not true healthcare facility-onset infections, but due to inappropriate or delayed testing. We recognize that HO-CDI LabID is a proxy for hospital-acquired infections, however, a discrepancy of this proportion is likely not consistent with the intent of the metric. We found “true HO-CDI” SIRs were substantially lower than the publically reported SIRs, demonstrating how decreasing inappropriate testing could have an impact on a facility’s HO-CDI SIR and on reported rates of HO-CDI. Another major finding of this study is that over 90% of patients with inappropriate testing and apparent *C. difficile* colonization were treated for CDI. This unnecessary antibiotic treatment places these patients at risk for disruption of the intestinal microbiome, other adverse events or progression to CDI[5].

Diagnostic stewardship interventions can be applied to *C. difficile* testing to ensure more appropriate testing. D.S. is an essential part of antibiotic stewardship, infection prevention,

and therapeutic decision-making.[6,7] Potential DS approaches for *C. difficile* testing include education and electronic medical record best practice alerts to help clinicians avoid ordering a test when patient has had a recent laxative, or does not have clinically significant diarrhea, thereby increasing the pre-test probability of detecting only true *C. difficile* disease. In this study, the prioritization matrix approach identified medicine as a top priority for reduction in inappropriate or delayed testing. Interestingly, psychiatry was the second priority: although it did not contribute many HO-CDI LabIDs, a large proportion represented inappropriate or delayed testing, and therefore could have a significant yield from minimal diagnostic stewardship intervention or good "return on performance improvement investment".

Revision of the HO-CDI LabID metric to include clinical data from chart review would likely increase specificity and more accurately measure true healthcare facility-onset *C. difficile* infection. Enhanced NHSN LabID risk adjustment for test method (NAAT, EIA, all others) might help account for increased sensitivity of NAAT. [8] Additional changes to the metric would be required if facilities were to adopt screening and use of contact precautions for asymptomatic *C. difficile* colonized patients.[9] In the absence of changes to the metric, inflation of the reported HO-CDI could become even more pronounced.

This study has limitations. It was conducted at one academic center and may not be generalizable to other settings. Charts were not available for retrospective review of 7.7% of "non-true HO-CDI" cases to determine the reason; however, it is unlikely that a specific category was systematically excluded. We did not include lack of diarrhea due to paralytic ileus in the HO-CDI definition. However, the simple definition used was conservative and more likely to classify inappropriate tests as appropriate rather than vice versa.

Facilities and jurisdictions seeking to improve reported HO-CDI LabID should investigate what proportion of these HO-CDI LabID events represent true infections and what proportion represent delayed tests or inappropriate tests of asymptomatic, colonized patients. This information will allow for focused improvement efforts that are appropriately targeted; infection prevention and antimicrobial stewardship interventions to prevent true *C. difficile* acquisition in the healthcare setting, and diagnostic stewardship interventions to decrease inappropriate and delayed *C. difficile* testing.

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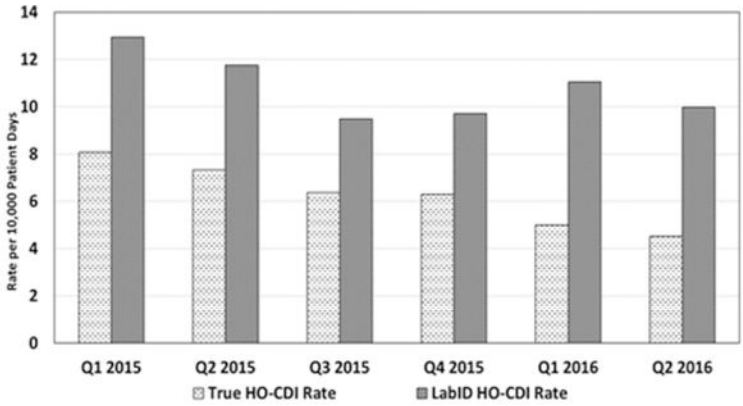

Figure 1a:
True HO-CDI Rate vs NHSN LabID HO-CDI Rate

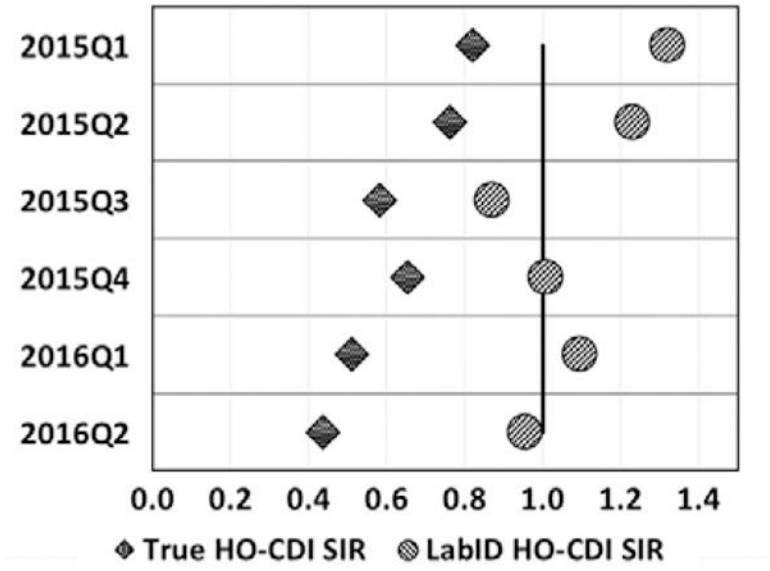

Figure 1b:
True HO-CDI SIR vs NHSN LabID HO- CDI Event SIR

Table 1.

The prioritization matrix identified Medicine as having greatest potential benefit from diagnostic stewardship efforts, followed by Psychiatry and Surgery (Table).

Service	A. # HO-CDI Lab ID events	B. Rank based on HO-CDI Lab ID events	C. % HO-CDI inappropriate or delayed C. diff tests	D. Rank based on % HO-CDI inappropriate or delayed C. diff tests	Prioritization Score (B multiplied by D)	Prioritization ranking
Medicine	160	2	62%	2	4	1
Psychiatry	6	6	67%	1	6	2
Surgery	181	1	23%	8	8	3
Pediatrics	30	5	43%	4	20	4
Neuro-Sciences	42	4	36%	5	20	4
Oncology	66	3	24%	7	21	5
Physical medicine rehabilitation	2	8	50%	3	24	6
OB/GYN	4	7	25%	6	42	7