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Marked Reduction in Compliance with Central Line Insertion Practices (CLIP) When Accounting for Missing CLIP Data and Incomplete Line Capture

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Abstract

Adherence to central line insertion practices can significantly reduce infections and is used as a hospital benchmark for quality. However current national standards for CLIP compliance calculation do not include missing CLIP forms. We found adherence rates significantly decreased when accounting for all lines at one academic medical center.

Background

Insertion-related central line associated blood stream infections (CLABSIs) are preventable with adherence to evidenced based central line insertion practices (CLIP).^{1,2} Certain states have laws requiring public reporting of CLIP form adherence to the Centers for Disease Control and Prevention's (CDC) National Healthcare Safety Network (NHSN). Similarly, the Centers for Medicare/Medicaid Services includes CLIP in pay-for-reporting measures to facilitate quality improvement by identifying hospitals with gaps in adherence.^{3,4}

NHSN has monitored CLIP compliance since 2009. Compliance is currently defined as the proportion of CLIP forms documenting adherence to all CLIP elements ("all or nothing score") divided by the number of forms submitted.⁵ However, this approach assumes forms are submitted for all newly-inserted central venous catheters (CVCs). If significant proportions of CVCs are inserted without accompanying CLIP documentation, these procedures would be missed by NHSN. Therefore, compliance using the NHSN definition is incomplete. Our goals were to (1) assess the extent of missing CLIP forms, (2) assess the

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impact on compliance when missing forms are included in the denominator, and (3) assess accuracy of line-day capture after initiating electronic nursing CVC documentation.

Methods

This study captured a convenience sample of 100 intensive care unit (ICU) and 100 non-ICU adult patients with a CVC hospitalized at an academic medical center between November, 2011–October, 2012, with one or more CVCs. CVC documentation was assessed in physical and electronic charts by two physicians who visually inspected patients for CVC presence weekly. Visual inspection and charted data on insertion date, body site location, and line type were compared to nursing electronic CVCs assessment. Completed CLIP forms were reviewed for all hospital-inserted CVCs.

CLIP compliance was calculated as the number of CLIP forms documenting 100% adherence to all elements divided by (1) the total number of forms submitted or (2) the total number of newly-inserted CVCs, with and without associated CLIP forms. For the latter, missing forms were considered non-compliant. Comparisons were made using chi-squared analysis. Data were stratified by ICU/non-ICU location and CVC-type (peripherally-inserted central catheters (PICC) compared to others) due to the presence of a dedicated PICC-insertion team.

To assess accuracy of e-capture, each line was included in line-day assessments. This differs from NHSN where patients with one or more central lines contribute to a single line-day per patient-day. Manual capture of line presence was compared with electronic data using insertion and removal dates.

Results

Measuring CLIP Compliance

Among all CVCs inserted, 69% (164/238) had CLIP forms submitted. Form submission was twice as high among all PICC insertions compared to non-PICC insertions (92% (113/123) vs 44% (51/115), $p < 0.001$). Table 1 highlights the effect of denominator choice on CLIP compliance. When calculated using all inserted CVCs as denominator, CLIP compliance decreased by 31%. Reduction in compliance was greater for non-PICCs (56% vs 8% reduction, Table 1).

Accuracy of Captured Line-Days

Audit of electronic nursing assessment of lines by visual inspection compared to chart-confirmed insertion dates revealed 14% of line-days were missing (8%) or incorrect (6%), (Table 2). Common documentation errors included wrong side (left/right) followed by wrong body site location. Documentation errors were more than three-fold higher among non-PICC compared to PICC lines (27% vs 8%, $p < 0.001$). Missing line-days were twice as high in non-PICC compared to PICC lines (14% vs 6%, $p < 0.001$).

Discussion

Our study highlights the significant impact of accounting for all CVCs inserted when assessing CLIP compliance at one institution. As currently measured and reported by NHSN, CLIP compliance failed to capture 31% of lines lacking a submitted CLIP form. Among non-PICC lines, nearly half were missing CLIP forms. Evaluating adherence to best practices during central line placement requires accurate capture of all lines inserted and monitoring adherence to individual CLIP elements for each line placed. There is currently no mechanism to submit information on the number of missing CLIP forms in NHSN. Furthermore, non-compliance with CLIP form submission may be more common among those who are also non-compliant with best insertion practices. Failure to account for missing CLIP forms could introduce bias toward overestimating adherence to CLIP. By assuming non-adherence among missing CLIP forms, we identified the lower bound of compliance at our hospital and highlighted the need to improve CLIP form capture. If the magnitude of discrepancy between the current definition and this revised adherence definition is confirmed across other institutions, it would raise the importance of revising the definition to account for missing CLIP forms.

When stratified by line type, form submission and adherence to CLIP elements was two-fold higher among PICC insertions. PICCs had higher correct line-day documentation and lower missing line-days. These findings may reflect the impact of an operationally optimized, formal approach to insertion by a dedicated PICC team whereby CLIP form completion and insertion elements are included in a standardized protocol. By contrast, all non-PICC lines were placed by high turnover trainees who receive standardized insertion education but may be unaware of required documentation. We have since shown that embedding CLIP elements into an electronic procedure note can markedly increase CLIP form submission.⁶

We anticipated that implementation of nursing e-documentation would ensure nearly 100% capture of CVCs. However, despite daily automated nursing prompts, we identified 9% (ICU) and 8% (non-ICU) missing line-days. Consequently, failure to capture denominator-days resulted in overestimating our CLABSI rates, which were 8-9% lower than reported. Such overestimates can seriously impact hospitals since CLABSI rates are a nationally-recognized hospital quality measure.^{7,8} Hospital processes should verify and encourage complete documentation to ensure accurate CLABSI rates and compliance with best practices.

Limitations of this study include the small sample size at a single institution. Nevertheless, the sample was sufficient to showcase the effect of CLIP measures that do not account for missing forms, and resultant impact of inaccurately captured line-days on CLABSI rates.

NHSN's mandated CLIP adherence reporting represents an important opportunity to optimize patient safety. However, this quality measure depends upon accurate capture of all inserted CVCs. Identifying and addressing missing CLIP forms is an important part of ensuring best practice; percent missing CLIP forms should be included as part of this metric.

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HIGHLIGHTS

- National standards for CLIP compliance assessment do not include missing CLIP forms
- CLIP adherence greatly decreased when accounting for missing CLIP forms at one hospital
- CLIP compliance failed to capture 31% of lines that lacked a submitted CLIP form
- Compliance with CLIP form submission should be accounted for in quality metrics

Table 1

Effect of Denominator Choice on CLIP Compliance

	% Compliance with Insertion Practices [*] Using Submitted CLIP forms as Denominators	% Compliance with Insertion Practices ^{**} Using Inserted CVCs as Denominators	P-value
PICC	100% (113/113)	92% (113/123)	0.002
Non-PICC	98% (50/51)	43% (50/115)	<0.001
Total	99% (163/164)	68% (163/238)	<0.001

* Defined as all components of CLIP form compliant as per the CDC and NHSN CLIP module⁵

** Missing CLIP forms deemed noncompliant

Accuracy of CVC Lines and Line-Days in Daily Electronic Nursing Documentation Compared to Visual Confirmation and Chart Confirmation of Insertion Date

Table 2

	All	ICU	Non-ICU	ICU vs Non-ICU P-value	PICC	Non-PICC	PICC vs Non-PICC P-value
Total Patients	200	100	100	--	123*	94*	--
Total Lines	284	175	109	--	149	135	--
Total Line-Days**	2894	1428	1466	--	1972	922	--
Correct Line-Days	2465 (85%)	1231 (86%)	1234 (84%)	0.12	1792 (91%)	673 (73%)	<0.001
Incorrect Line-Days	184 (6%)	75 (5%)	109 (7%)	0.02	68 (3%)	116 (13%)	<0.001
<i>Wrong Side (R vs L)</i>	112 (4%)	50 (67%)	62 (57%)	0.31	64 (94%)	48 (41%)	0.01
<i>Wrong Body Site</i>	77 (3%)	29 (39%)	48 (44%)	0.04	4 (6%)	73 (63%)	<0.001
<i>Wrong Line Type</i>	1 (0%)	1 (1%)	0	0.31	0	1 (1%)	0.14
Missing Line-Days	245 (8%)	122 (9%)	123 (8%)	0.88	112 (6%)	133 (14%)	<0.001

* Some patients had multiple lines

** Each line contributes a line-day per calendar day (not per NHSN definition of line-day per patient-day)