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Am J Infect Control. Author manuscript; available in PMC 2015 August 01.

Published in final edited form as:
Am J Infect Control. 2014 August ; 42(8): 847–851. doi:10.1016/j.ajic.2014.04.020.

Compliance with Prevention Practices and their Association with Central Line-Associated Blood Stream Infections in Neonatal Intensive Care Units

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Abstract

Background—Bundles and checklists have been shown to decrease CLABSIs, but implementation of these practices and association with CLABSI rates have not been described nationally. We describe implementation and levels of compliance with prevention practices in a sample of US Neonatal ICUs and assess their association with CLABSI rates.

Methods—An online survey assessing infection prevention practices was sent to hospitals participating in National Healthcare Safety Network CLABSI surveillance in October 2011. Participating hospitals permitted access to their NICU CLABSI rates. Multivariable regressions were used to test the association between compliance with NICU specific CLABSI prevention practices and corresponding CLABSI rates.

Results—Overall, 190 Level II/III and Level III NICUs participated. The majority of NICUs had written policies (84%-93%) and monitored compliance with bundles and checklists (88% - 91%). Reporting ≥ 95% compliance for any of the practices ranged from 50%- 63%. Reporting ≥ 95% compliance with insertion checklist and assessment of daily line necessity were significantly associated with lower CLABSI rates ($p<0.05$).

Conclusions—Most NICUs in this national sample have instituted CLABSI prevention policies and monitor compliance, although reporting compliance ≥ 95% was suboptimal. Reporting ≥ 95%

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compliance with select CLABSI prevention practices was associated with lower CLABSI rates. Further studies should focus on identifying and improving compliance with effective CLABSI prevention practices in neonates.

Introduction

Central line-associated bloodstream infections (CLABSIs) are associated with increased morbidity (including neurodevelopmental delay), mortality, and increased healthcare costs in the neonatal intensive care unit (NICU) population.[1, 2, 3] When compared to other populations, neonates have among the highest rates of CLABSIs[2] potentially due to intrinsic immunodeficiency, the need for prolonged duration of central line (CL) use, [4] and the lack of antibiotic- or antiseptic-impregnated catheters for this population.[5] Adherence to insertion and maintenance bundles and use of checklists have been demonstrated to decrease CLABSI rates in NICUs in both single and multicenter studies.[6, 7] However, rates of implementation and compliance with checklists and bundles in NICUs nationwide are not well described. In addition, the association of compliance with checklists and specific insertion and maintenance bundle practices with neonatal CLABSI rates has not been assessed at a national level.

In this study, we describe existing CLABSI prevention practices and compliance with these practices in a national sample of NICUs, and assess the association of compliance with CLABSI rates reported to the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN). [8] The objectives of this study were [1] to describe CLABSI prevention practices as defined by self-reported use of select insertion and maintenance bundle practices and insertion checklists in a sample of NICUs across the United States and [2] to determine the association of compliance with individual and combined practices with corresponding NICU CLABSI rates derived from existing NSHN surveillance data. We hypothesized that there would be variability in compliance with CLABSI prevention practices among NICUs and that higher compliance with use of bundles and checklists would be significantly associated with lower CLABSI rates.

Methods

Study Design and Eligible Study Hospitals

This analysis was part of a multicenter study, Prevention of Nosocomial infections and Cost Effectiveness Refined (P-NICER- R01NR010107) in which all non-veteran hospitals that were enrolled in NHSN in 2011 were eligible to participate. The P-NICER study aimed to assess the impact of intensity of infection control processes and state mandated reporting on device-associated and organism-specific healthcare-associated infection (HAI) rates in adult, pediatric and neonatal ICUs across the U.S.[9] To be eligible to be included in this NICU specific analysis, sites had to have a NICU within their hospital, complete the survey described below, and agree to join the PNICER NHSN Research Group. The latter agreement provided the study team access to the hospital's device-associated infection rates from 2006 through mid-2012, as available. The NHSN is the CDC's national public health surveillance system for monitoring HAIs and participating hospitals use standardized definitions based on clinical and laboratory data, rather than on ICD-9 codes.[8] NICUs were

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excluded from final analysis if there was a discrepancy between unit level as reported in the PNICER survey compared to their classification within NHSN. All procedures were reviewed and approved by institutional review boards (IRB) at Columbia University Medical Center, CDC, and the RAND Corporation.

Survey of CLABSI specific infection prevention practices

An online survey, (adapted from previous research), [10,11] assessing Infection Prevention and Control (IP&C) practices was sent to eligible hospitals.[9] A modified Dillman technique was used for recruitment and e-mail follow-ups, which occurred from October to December 2011. To protect the confidentiality of hospitals participating in the NHSN, recruitment letters were sent by the CDC and information about the study was posted on the NHSN website. The survey requested that respondents be the director or manager of the hospital's IP&C department. To increase participation rates, respondents were entered into lotteries with $100 incentives.

For those hospitals with NICUs, the survey inquired about NICU-specific policies and practices related to CL insertion and maintenance. Respondents were asked whether the NICU had written policies for checklist use at CL insertion and used the following CL bundle practices (as defined by the study NICU) for insertion: monitoring hand hygiene, use of maximal barrier precautions, and choice of optimal catheter insertion site, and for maintenance: assessment of daily line necessity. The survey also asked about the percent compliance with each practice during the last period monitored; compliance levels were defined using a previous survey[10] as the following: all of the time (95% - 100%), usually (75% - 94%), sometimes (25% - 74%), rarely or never (<25%), don't know, or no monitoring was performed. In addition to CLABSI prevention practices, the survey inquired about the level of each NICU (i.e., neonatal critical care Level II/III or Level III as classified by NHSN). [12]

NICU CLABSI surveillance rates

All hospitals participating in this sub-study reported NICU-specific CLABSI rates to NHSN for all quarters in 2011 and as per NHSN methodology, stratified CLABSI rates by birth weight (BW) groups (≤750, 751-1000, 1001-1500, 1501-2500, and >2500 grams). In addition to hospital-level characteristics such as teaching status and geographic location (i.e., states categorized by census regions), NICU characteristics including the number of beds, and level (i.e., neonatal critical care level II/III or Level III) [12] were also obtained from the NHSN annual survey.

Statistical Analysis

To determine the generalizability of the study sample, the CDC compared the NICU characteristics and CLABSI rates in the last quarter of 2011 of the study sites with the pooled NHSN data for non-participating NICUs (i.e., those that did not respond to the survey and/or did not join the PNICER NHSN Research Group) using chi squared tests and ANOVA. The CDC did not provide the study team direct access to non-participating NHSN data.

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To determine if the presence of a written policy for specific bundle practices, the use of an insertion checklist, and level of compliance with these practices were associated with lower CLABSI rates overall and among the different birth weight groups, bivariate analyses were conducted using Wilcoxon Rank Sum and Kruskal Wallis tests (for non-normally distributed right skewed rate data). Pooled overall mean CLABSI rates per 1000 CL days were calculated for each NICU by dividing the summed number of CLABSI events by the summed number of CL device days, multiplied by 1000. The minimum level of compliance with using a checklist for CL insertion and using specific bundle components that were associated with lower overall CLABSI rates was determined in bivariate analysis. The following levels of implementation and compliance were tested based on previous studies in adult ICUs[11]: presence of a written policy (Yes/No); ≥ 95% compliance vs. all other responses including don't know and no monitoring; and ≥ 95% vs. 75%-94% vs. all other responses. The minimum level of compliance associated with lower CLABSI rates determined using bivariate analysis was then used to conduct multivariable regression analyses. These included a primary model, sensitivity analysis to assess robustness of the primary model, and secondary analysis.

The primary multivariable regression model assessed the association of the level of compliance with each specific preventive practice and overall CLABSI rates. The chi-squared goodness of fit test was used to guide model selection (negative binomial chosen over Poisson). The primary model was thus a negative binomial regression model adjusted for variables significant in bivariate analysis, with overall CLABSI rates as the outcome variable, the level of compliance with each preventive practice as the exposure variable, and device days as the offset variable. Incidence rate ratios (IRRs) were calculated for parameters of interest, and an alpha error of 0.05 was pre-specified as the level for significance.

We followed this with sensitivity analysis to assess robustness of the primary model. To account for possible non-independence of observations among NICUs from the same state, possibly due to factors such as statewide CLABSI reduction collaboratives[13, 14] or state law mandated CLABSI reporting, [15] we accounted for clustering by state, and Huber White robust standard errors were calculated. Possible heterogeneity in duration and BW-specific use of CL's across compliance categories, that could explain any observed association between overall CLABSI rates and the level of compliance in the primary model were also examined. If the rate of compliance was missing in the survey, compliance was assumed to be low and considered “rarely/never” in the primary model. To assess robustness of this assumption analysis was repeated with missing responses reclassified under various levels of compliance (other than rarely/never), as a separate category, or excluded.

In supplementary analysis, we used multivariable negative binomial regression to test the association of overall CLABSI rates, with level of reported compliance with all practices or at least one prevention practice, regardless of the nature of the specific practice. In addition the analysis was repeated specifically for each BW category using BW specific CLABSI events and BW specific CL days for each NICU. All analysis was done using SAS software (version 9.3; SAS Institute, Cary, NC).

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Results

Comparison of Study Sites with NHSN Surveillance Sample

In the PNICER study, 201 hospitals from 41 states with 204 NICUs responded to the survey and agreed to participate in the PNICER NHSN Research Group, thus providing the study team with access to their CLABSI rate data. The 204 study NICUs represented 23.4% (204/870) of NICUs that reported CLABSI data to NHSN in the last quarter of 2011. Of the study NICUs, 104 were level II/III and 100 were level III. Comparison of CLABSI rates and NICU characteristics between the study sites and non-participating sites are shown in Table 1. The pooled mean CLABSI rates in the last quarter of 2011 were significantly higher for level II/III NICUs that did not respond to the survey. Study NICUs were more likely to be located in the Northeastern U.S. and affiliated with a medical school than non-participating sites.

CLABSI Rates in Participating NICU's

Fourteen (6.8%) of the 204 NICUs that submitted surveys and provided CLABSI rate data were excluded from analysis of the association of compliance to prevention practices and CLABSI rates. Reason for exclusion included incomplete survey responses for prevention practices (n=2) and inability to match survey results with NHSN data due to discrepancies in the NICU level (n=12). These excluded NICUs contributed 1037 CL days (0.3%) of the total device days in study NICUs.

Of the 190 NICUs included in this analysis, the overall 2011 annual pooled mean CLABSI rate was 1.6 infections/1000 CL-days; rates by BW groups, ≤750, 751-1000, 1001-1500, 1501-2500, and >2500 grams were 3.5, 2.0, 1.2, 1.0, and 0.9 infections/1000 CL-days, respectively.

Compliance with CLABSI bundles and checklists in study NICU's

The majority of study NICUs (84.2% -93.2%) responded that they had written policies for insertion checklists and CLABSI bundle practices. The proportion that reported monitoring compliance with these practices ranged from 88.1% - 90.8%. Compliance ≥ 95% for a specific practice ranged from 50% of NICUs that assessed daily line necessity to 62.7% for use of maximal barrier precautions as shown in Table 2. Overall, 124 (65.3%) NICUs reported ≥ 95% compliance with at least one practice and 53(27.9%), NICUs reported ≥ 95% compliance to all prevention practices.

Association of NICU Characteristics and Prevention Practices with CLABSI Rates

In bivariate analyses, the number of NICU beds, NICU level, and medical school affiliation status were significantly associated with CLABSI rates as shown in Table 3. Lower rates were seen in level II/III NICUs compared to level III NICUs, NICUs with ≤ 15 beds as compared to larger NICUs, and NICUs unaffiliated with a medical school as compared to those affiliated with a medical school. Having a written policy for any of the surveyed practices was not significantly associated with lower CLABSI rates (Table 3). Reporting ≥ 95% compliance for daily line necessity was significantly associated with lower overall CLABSI rates. NICUs that reported ≥95% compliance to all the preventive practices had

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lower overall CLABSI rates (1.1/1000 CL days) compared to those who did not (1.5/1000 CL days) (p=0.03).

In the multivariable analysis, in the primary regression model, compliance ≥ 95% with use of an insertion checklist and assessment of daily line necessity were significantly associated with lower overall CLABSI rates with IRRs of 0.71 and 0.73 respectively as shown in Table 4. In the primary model, NICU level was the only other significant predictor of CLABSI rates (IRR of 1.39, Parameter estimate= 0.3, SE =0.1, p=0.03) and level III NICUs had higher CLABSI rates.

In sensitivity analysis when adjusted for intra-state clustering, only reporting compliance ≥ 95% for an insertion checklist remained associated with lower CLABSI rates (IRR of 0.69, parameter estimate -0.37, SE 0.19, p=0.05). When BW specific CL utilization across compliance categories was assessed, total CL utilization was similar or higher in NICUs reporting ≥ 95% compliance to most preventive practices, except in those reporting ≥ 95% compliance to the assessment of daily CL necessity. NICUs reporting ≥ 95% compliance used CL lines proportionately more in the smaller BW groups (Table 5). Reclassifying missing responses under other compliance categories, a separate category or excluding them did not alter the findings of the above primary regression analyses above (data not shown).

In secondary analysis, though reporting ≥ 95% compliance with at least one or all preventive practices, regardless of the specific practice, trended towards lower CLABSI rates, this was not significant in the multivariable analysis. When CLABSI rates were analyzed by BW groups in bivariate analysis, ≥ 95% compliance was associated with lower CLABSI rates in certain BW groups as shown in Table 6. However, this did not attain significance in the BW-specific multivariable regression analysis (data not shown).

Discussion

This study is the first, to our knowledge, to examine the practices of implementing and monitoring CLABSI-specific prevention practices and their association with CLABSI rates in NICUs across the U.S. We observed that although the majority of participating NICUs have instituted similar prevention policies for CLABSIs, considerable variability existed in compliance, and overall compliance tended to be less than optimal as only 28% of the study NICUs reported ≥ 95% compliance with all the prevention practices assessed. This finding is important because, in this analysis, instituting a policy, monitoring compliance, and reporting compliance ≥ 95% with specific prevention practices were all required to demonstrate an association with lower CLABSI rates. As our national focus broadens to include other patient safety goals[16] improving and sustaining excellent adherence to proven CLABSI prevention practices remains essential to achieve the target goal of zero CLABSIs.

In this study, use of a checklist at insertion and assessment of daily line necessity were the only practices significantly associated with lower overall CLABSI rates in the primary analysis. After adjusting for state-level clustering, using an insertion checklist was the only practice that remained significantly associated with lower CLABSI rates. As the checklist includes multiple components of an insertion bundle, this finding could suggest that

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additional unmeasured prevention practices may be important including increased institutional investment in IP&C activities generating a favorable climate for CLABSI prevention and increased clinician attention during the insertion procedure resulting in more meticulous technique. The importance of maintenance bundles in reducing CLABSIs in neonates and children has been suggested previously.[17] Ongoing initiatives, such as the Agency for Healthcare Research and Quality led Comprehensive Unit based Safety Program in NICUs[18] also emphasize maintenance practices and our finding of the importance of assessment of daily line necessity further supports this priority. We did not find ≥ 95% compliance with all components to be significantly associated with lower CLABSI rates in multivariable analysis. We speculate this could be partly due to the small percentage of NICUs within our sample that reported excellent compliance with all prevention practices. In BW-specific analysis, a stronger association of ≥ 95% compliance with prevention practices and lower CLABSI rates was observed in the higher BW groups. This could be due to the differing pathophysiology of CLABSIs in extremely low birth weight infants (mucosal or skin barrier injury) compared to that in larger and older infants (contamination with skin flora during CL insertion/maintenance).

There are a number of limitations to this study. Study NICUs constituted only 23% of NICUs contributing to NHSN surveillance. Our sample was not representative of the larger NHSN population, since study NICUs tended to be academically affiliated NICUs and located in the Northeastern U.S. Compliance and rates were both self-reported by the hospitals' IP&C director/manager and varying measurement strategies could have led to biases. Our survey assessed only one possible element of a maintenance bundle. Specific definitions and interpretations of each prevention practice could have varied between NICUs. There could be lack of a temporal correlation between the measured time of self-reported compliance and CLABSI rates. Finally unique patient characteristics (e.g., the percentage of neonates with complex surgical issues, BW-specific case-mix) were not fully captured by the NICU characteristics measured.

In conclusion, in this study of CLABSI prevention practices in NICUs in the U.S., the majority have established policies for CLABSI checklists and bundles of prevention practices and monitor compliance. However, compliance continues to vary widely between NICUs and is often below optimal levels. Reporting ≥ 95% compliance with a checklist for insertion and daily line necessity was significantly associated with lower CLABSI rates. Further efforts should focus on strategies to identify and improve compliance with effective CLABSI prevention practices in neonates.

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Table 1

Comparison of CLABSI rates and Hospital and NICU characteristics between Study Sites vs. Non-Study Sites

Hospital Characteristics	**Study Sites**	**Non-participants in PNICER NHSN Research Group/Survey Respondents**	**Non-participants in PNICER NHSN Research Group/Non-respondents to Survey**
Number of Hospitals	201	84	2398
Medical School Affiliation*	**n (%)**		
Major	75 (37.3)	17 (20.2)	261 (10.9)
Graduate	27 (13.4)	6 (7.1)	202 (8.4)
Limited	26 (12.9)	11 (13.1)	257 (10.7)
Non-teaching	73 (36.3)	50 (59.5)	1,678 (70)
Ownership			
For profit	30 (14.9)	17 (20.2)	497 (20.7)
Not for profit	159 (79.1)	59 (70.2)	1,754 (73.1)
Other	12 (6.0)	8 (9.5)	147 (6.1)
Location*			
Northeast (9 states)	49 (24.4)	9 (10.7)	406 (16.9)
Midwest (12 states)	58 (28.9)	14 (16.7)	515 (21.5)
South (17 states)	53 (26.4)	44 (52.4)	956 (39.9)
West (11 states)	39 (19.4)	17 (20.2)	487 (20.3)
Other (Hawaii, Alaska, Puerto Rico)	2 (1.0)	0	34 (1.4)
NICU Characteristics	**Mean (median) CLABSI Rate Reported to NHSN, Q4 2011 per 1000 CL-days**		
Number of NICUs	204	66	600
*Level II/III NICU***	1.5 (0)	1.4 (0)	1.8 (0)
Level III NICU	1.9 (0.2)	2.5 (1.5)	1.6 (0)

*P< 0.001- Chi squared test

**P<0.01- ANOVA

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Table 2

Compliance with selected CLABSI prevention practices in 190 study NICUs

Presence of Written Policy for Prevention Practices	Response to Extent of Compliance					
N (%)	**All the time (95-100%)**	**Usually (75-94%)**	**Sometimes (25-74%)**	**Missing Responses**	**Don't Know**	**No Monitoring**
Checklist (163, 85.8%)	85 (52.1%)	28 (17.2 %)	4 (2.5%)	10 (6.1%)	21 (12.9%)	15 (9.2%)
Hand Hygiene (176, 92.6%)	110 (62.5%)	20 (11.4%)	2 (1.1%)	8 (4.5%)	19 (10.8%)	17 (9.7%)
Maximal Barrier Precautions (177, 93.2%)	111 (62.7%)	15 (8.5%)	2 (1.1%)	12 (6.8%)*	16 (9.0)%	21 (11.9%)
Optimal catheter site (165, 86.8%)	97 (58.8%)	22 (13.3%)	1 (0.6%)	10 (6.1%)	17 (10.3%)	18 (10.9%)
Daily Necessity (160, 84.2%,)	80 (50.0%)	29 (18.1%)	4 (2.5%)	12 (7.5%)	17 (10.6%)	18 (11.3%)

* One respondent observed compliance rates for maximal barrier precautions to be rarely/ never (< 25%)

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Table 3
Factors associated with mean CLABSI rates in Study NICUs in 2011-bivariate analysis

	CLABSI Rates/1000 CL days	
Hospital / NICU characteristics	**Median**	**P- value** **
Children's hospital (Yes/No)	1.5/0.7	0.06
Geographic location (Northeast/West/Midwest/South)	0.9/0/0.7/1	0.2
Level (II/III/ III)	0.3/1.2	**0.01**
Size (≤15, 16-30, 31-45, >46 beds)	0/0.9/0.9/1.3	**0.0001**
Medical School Affiliation (Yes/No)	1.3/0	**0.001**
Not for Profit Ownership (Yes/No)	0.8/0.7	0.9
CLABSI Prevention Practices		
Use of Checklist		
Presence of written policy (Yes/No)	0.6/0.8	0.8
Compliance ≥ 95% vs. all other responses *	0.7/1.1	0.2
Compliance ≥ 95% vs. 75-94% vs. all other responses	0.7/1.5/0.9	0.3
Hand Hygiene		
Presence of written policy (Yes/No)	0.8/0.8	0.51
Compliance (≥ 95% vs. all other responses)	0.7/1.1	0.62
Compliance ≥ 95% vs. 75-94% vs. all other responses	0.7/0.8/1.1	0.39
Daily Necessity		
Presence of written policy (Yes/No)	0.8/0.9	0.41
Compliance ≥ 95% vs. all other responses	0.4/1.1	**0.03**
Compliance ≥ 95% vs. 75-94% vs. all other responses	0.4/1.1/1.1	0.08
Maximum Barrier Precautions		
Presence of written policy (Yes/No)	0.8/0.8	0.78
Compliance ≥ 95% vs. all other responses	0.7/1.3	0.52
Compliance ≥ 95% vs. 75-94% vs. all other responses	0.7/1.4/1.1	0.82
Optimal Catheter Site		
Presence of written policy (Yes/No)	0.8/0.8	0.82
Compliance ≥ 95% vs. all other responses	0.7/1.1	0.35
Compliance ≥ 95% vs. 75-94% vs. all other responses	0.7/1.8/1.0	0.5

* Other responses includes < 75% compliance, missing responses, ‘don't know’, and ‘no monitoring’

** Using Wilcoxon Rank Sum test and Kruskal Wallis test

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Table 4

Multivariable negative binomial regression model* testing association of compliance ≥ 95 % with prevention practices (independent variable) with CLABSI rates (dependent variable) in 190 study NICUs

CLABSI Prevention Practices ≥ 95% compliance	Parameter	SE	95%CI	P value
Use of checklist at insertion**	-0.37	0.15	(-0.67, -0.07)	**0.01**
Insertion Bundle				
Hand Hygiene	-0.12	0.15	(-0.42, 0.18)	0.42
Use of maximum barrier precautions	-0.13	0.15	(-0.42, 0.17)	0.41
Choice of optimal catheter site	-0.17	0.15	(-0.46, 0.13)	0.27
Maintenance Bundle				
*Assessment of daily necessity****	-0.33	0.16	(-0.64, -0.03)	**0.03**
At least one element	-0.13	0.16	(-0.43, 0.18)	0.42
Compliance with all elements	-0.31	0.17	(-0.65 0.03)	0.07

* All models adjusted for NICU size, NICU level, and hospital teaching status

** P=0.05 after adjusting for state-level clustering

*** P = 0.07 after adjusting for state -level clustering

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Table 5

Distribution of CL days across BW groups in compliance categories

	Birth weight (grams)	≤750	751-1000	1001-1500	1501-2500	>2500	Total Central Line Days
Compliance		Percentage of Line Days					
Use of checklist at insertion							
≥ 95%		21.0	19.7	17.4	17.7	24.2	174869
< 95%		20.2	16.0	21.8	20.2	21.8	181436
Hand hygiene at insertion							
≥ 95%		20.6	17.5	19.1	19.2	23.6	195103
< 95%		20.6	18.2	20.3	18.7	22.1	161112
Use of maximum barrier precautions							
≥ 95%		21.1	17.3	18.5	19.4	23.7	201178
< 95%		20.0	18.4	21.1	18.5	22.1	155127
Choice of optimal catheter site							
≥ 95%		20.9	17.8	18.5	19.1	23.8	182817
< 95%		20.3	17.8	20.9	18.9	22.2	173488
Assessment of daily necessity							
≥ 95%		24.7	18.6	18.7	18.3	19.8	148636
< 95%		16.9	21.0	19.4	18.6	24.1	217580

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Table 6

Association of CLABSI rates and compliance with CLABSI prevention practices among birth weight groups (≥95% vs. < 95%)

Compliance with CLABSI prevention practice	Birth weight Groups (grams)				
	≤750	751-1000	1001-1500	1501- 2500	> 2500
	Mean (Median) CLABSI rates /1000 CL days				
Use of checklist at insertion					
≥ 95%	3.0 (0)	1.6(0)*	0.8(0)	0.8(0)	0.2(0)*
< 95% including all other responses	4.5(0.2)	2.6(0)	1.7(0)	0.9(0)	0.9(0)
Hand hygiene at insertion					
≥ 95%	3.3 (0)	1.7(0)	1.2(0)	0.8(0)	0.3(0)*
< 95% including all other responses	4.5(0.7)	2.7(0.4)	1.2(0)	0.9(0)	1.0(0)
Use of maximum barrier precautions					
≥ 95%	2.8(0)	2.0(0)	1.2(0)	0.8(0)	0.3(0)*
< 95% including all other responses	5.2(0.6)	2.4(0)	1.3(0)	0.9(0)	1.0(0)
Choice of optimal catheter site					
≥ 95%	3.7(0)	2.0 (0)	1.1(0)	0.7(0)	0.1(0)*
< 95% including all other responses	4.0(0)	2.3(0)	1.4(0)	1.0(0)	1.1(0)
Assessment of daily necessity					
≥ 95%	2.9(0)	1.8(0)	0.6(0)*	0.5(0)	0.2(0)*
< 95% including all other responses	4.5(0.7)	2.3(0)	1.8 (0)	1.2(0)	0.9(0)

* P< 0.05 (Wilcoxon Rank Sum Test)