Supplementary Online Content

Christopher R. Polage MD, MAS, Kathleen A. Quan RN, MSN, Keith Madey, et al.

Evaluation of the NHSN standardized infection ratio (SIR) risk adjustment for healthcare facility-onset *Clostridioides difficile* infection (HO-CDI) in intensive care unit (ICU), oncology, and hematopoietic cell transplant (HCT) patients in general acute care hospitals

eMethods. Sample calculations for adjusted Facility-Wide Inpatient SIRs

This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods. Sample calculations for adjusted Facility-Wide Inpatient SIRs. Note: Quarterly calculations were used to follow quarterly NHSN reporting practice and account for bed changes at participating facilities; quarterly observed and predicted HO-CDI events were summed for annual SIR calculation.

Sample calculation #1: Unmodified Facility-Wide Inpatient SIR for Facility D

SIR = # observed HO-CDI events / # predicted HO-CDI events from NHSN negative binomial regression risk adjustment model

NHSN equation for # predicted HO-CDI cases for comparable facility:
No. of predicted (expected) HO CDI LabID events = EXP[− 8.9463 + 0.7339*(CO CDI prevalence rate) +0.157 (CDI test type = EIA*) + 0.1307 (CDI test type = NAAT*) + 0.7465 (ICU beds ≥43*) + 0.7145 (ICU beds: 20–42*) + 0.6261 (ICU beds: 10–19*) + 0.4349 (ICU beds: 5–9*) + 1.2420 (oncology hospital*) + 0.3740 (general hospital) + 0.0003 (*total facility bed size) + 0.1119 (reporting from ED or 24 h Obs) + 0.0331 (teaching hospital*)] × CDI patient days

2016 data inputs for facility D (unmodified)

	2015Q3	2015Q4	2016Q1	2016Q2
Total # Observed CO-CDI events	24	28	22	24
Total # admissions	5,436	5,241	5,269	4,895
CO prev rate = (events/admissions)*100	0.4415	0.5342	0.4175	0.4903
Test Type (CDI test type=EIA)	0	0	0	0
Test Type (CDI test type=NAAT)	1	1	1	1
ICU beds: >= 43	1	1	1	1
ICU beds: 20-42	0	0	0	0
ICU beds: 10-19	0	0	0	0
ICU beds: 5-9	0	0	0	0
(Fac Type) Oncology Hospital	0	0	0	0
(Fac Type) General Hospital	1	1	1	1
Total Facility bed size	411	411	414	414
Reporting from ED or 24 hr Obs.	1	1	1	1
Teaching Hospital	1	1	1	1
Total CDI patient days	27,368	27,287	27,533	23,185
Observed HO-CDI events	**32**	**47**	**31**	**28**

NHSN risk adjustment model parameter settings and predicted HO-CDI events for facility D (unmodified)

	2015Q3	2015Q4	2016Q1	2016Q2
Intercept	-8.9463	-8.9463	-8.9463	-8.9463
CO prev rate	0.7339* (24/5436)*100 = 0.3240	0.7339* (28/5241)*100 = 0.3921	0.7339* (22/5269)*100 = 0.3064	0.7339* (24/4895)*100 = 0.3598
Test Type (CDI test type=EIA)	0.0000	0.0000	0.0000	0.0000
Test Type (CDI test type=NAAT)	0.1307	0.1307	0.1307	0.1307
ICU beds: >= 43	0.7465	0.7465	0.7465	0.7465
ICU beds: 20-42	0.0000	0.0000	0.0000	0.0000
ICU beds: 10-19	0.0000	0.0000	0.0000	0.0000
ICU beds: 5-9	0.0000	0.0000	0.0000	0.0000
(Fac Type) Oncology Hospital	0.0000	0.0000	0.0000	0.0000
(Fac Type) General Hospital	0.3740	0.3740	0.3740	0.3740
Total facility bed size	0.0003*411	0.0003*411	0.0003*414	0.0003*414
Reporting from ED or 24 hr Obs.	0.1119	0.1119	0.1119	0.1119
Teaching Hospital	0.0331	0.0331	0.0331	0.0331
CDI patient days	27368	27287	27533	23185
NHSN Predicted HO-CDI events	**22.52**	**24.03**	**22.28**	**19.79**

NHSN Facility-wide HO-CDI SIR for facility D (unmodified)

	2015Q3	2015Q4	2016Q1	2016Q2	FY2016
Observed HO-CDI events	32	47	31	28	138
NHSN Predicted HO-CDI events	22.52	24.03	22.28	19.79	88.62
SIR	**1.42**	**1.96**	**1.39**	**1.41**	**1.56**

Sample calculation #2: Facility-wide SIR for facility D with ICU data and ICU bed risk adjustment removed

SIR = # observed HO-CDI events (with ICU observed HO-CDI events *removed*) / # predicted HO-CDI events from NHSN negative binomial regression risk adjustment model (with ICU admissions, ICU patient days, ICU CO-CDI events, ICU bed adjustment *removed*)

NHSN equation for # predicted HO-CDI cases for comparable facility:
No. of predicted (expected) HO CDI LabID events = EXP[− 8.9463 + 0.7339*(CO CDI prevalence rate) +0.157 (CDI test type = EIA*) + 0.1307 (CDI test type = NAAT*) + 0.7465 (ICU beds ≥43*) + 0.7145 (ICU beds: 20–42*) + 0.6261 (ICU beds: 10–19*) + 0.4349 (ICU beds: 5–9*) + 1.2420 (oncology hospital*) + 0.3740 (general hospital) + 0.0003 (*total facility bed size) + 0.1119 (reporting from ED or 24 h Obs) + 0.0331 (teaching hospital*)] × CDI patient days

2016 data inputs for facility D with ICU patient days, beds, admissions, CO-CDI events removed

	2015Q3	**2015Q4**	**2016Q1**	**2016Q2**
Total # Observed CO-CDI events	24	28	15	17
Total # admissions	4,950	4,746	4,788	4,423
CO prev rate = (events/admissions)*100	0.4848	0.5900	0.3133	0.3844
Test Type (CDI test type=EIA)	0	0	0	0
Test Type (CDI test type=NAAT)	1	1	1	1
ICU beds: >= 43	0	0	0	0
ICU beds: 20-42	0	0	0	0
ICU beds: 10-19	0	0	0	0
ICU beds: 5-9	0	0	0	0
(Fac Type) Oncology Hospital	0	0	0	0
(Fac Type) General Hospital	1	1	1	1
Total Facility bed size	298	298	301	301
Reporting from ED or 24 hr Obs.	1	1	1	1
Teaching Hospital	1	1	1	1
Total CDI patient days	22,093	22,004	22,225	17,729
Total # Observed HO-CDI events	**15**	**38**	**20**	**22**

NHSN risk adjustment model parameter settings and predicted HO-CDI events for facility D

with ICU patient days, beds, admissions, CO-CDI events removed

	2015Q3	2015Q4	2016Q1	2016Q2
Intercept	-8.9463	-8.9463	-8.9463	-8.9463
CO prev rate	0.7339*(24/4950)*100 = 0.3558	0.7339*(28/4746)*100 = 0.4330	0.7339*(15/4788)*100 = 0.2299	0.7339*(17/4423)*100 = 0.2821
Test Type (CDI test type=EIA)	0.0000	0.0000	0.0000	0.0000
Test Type (CDI test type=NAAT)	0.1307	0.1307	0.1307	0.1307
ICU beds: >= 43	0.0000	0.0000	0.0000	0.0000
ICU beds: 20-42	0.0000	0.0000	0.0000	0.0000
ICU beds: 10-19	0.0000	0.0000	0.0000	0.0000
ICU beds: 5-9	0.0000	0.0000	0.0000	0.0000
(Fac Type) Oncology Hospital	0.0000	0.0000	0.0000	0.0000
(Fac Type) General Hospital	0.3740	0.3740	0.3740	0.3740
Total facility bed size	0.0003*298	0.0003*298	0.0003*301	0.0003*301
Reporting from ED or 24 hr Obs.	0.1119	0.1119	0.1119	0.1119
Teaching Hospital	0.0331	0.0331	0.0331	0.0331
CDI patient days	22,093	22,004	22,225	17,729
NHSN Predicted HO-CDI events	**8.60**	**9.25**	**7.63**	**6.42**

NHSN Facility-Wide HO-CDI SIR for facility D with ICU data and ICU bed adjustment removed

	2015Q3	2015Q4	2016Q1	2016Q2	FY2016
Observed HO-CDI events	15	38	20	22	95
NHSN Predicted HO-CDI events	8.60	9.25	7.63	6.42	31.90
SIR	**1.74**	**4.11**	**2.62**	**3.43**	**2.98**

Sample calculation #3: Facility-wide SIR for facility D with ONC/HCT data removed

SIR = # observed HO-CDI events (with ONC/HCT observed HO-CDI events *removed*) / # predicted HO-CDI events from NHSN negative binomial regression risk adjustment model (with ONC/HCT admissions, ONC/HCT patient days, ONC/HCT CO-CDI events *removed*)

NHSN equation for # predicted HO-CDI cases for comparable facility:
No. of predicted (expected) HO CDI LabID events = EXP[− 8.9463 + 0.7339*(CO CDI prevalence rate) +0.157 (CDI test type = EIA*) + 0.1307 (CDI test type = NAAT*) + 0.7465 (ICU beds ≥43*) + 0.7145 (ICU beds: 20–42*) + 0.6261 (ICU beds: 10–19*) + 0.4349 (ICU beds: 5–9*) + 1.2420 (oncology hospital*) + 0.3740 (general hospital) + 0.0003 (*total facility bed size) + 0.1119 (reporting from ED or 24 h Obs) + 0.0331 (teaching hospital*)] × CDI patient days

2016 data inputs for facility D with ONC/HCT patient days, beds, admissions, CO-CDI events removed

	2015Q3	2015Q4	2016Q1	2016Q2
Total # Observed CO-CDI events	24	28	19	24
Total # admissions	4,942	4,783	4,784	4,424
CO prev rate = (events/admissions)*100	0.4856	0.5854	0.3972	0.5425
Test Type (CDI test type=EIA)	0	0	0	0
Test Type (CDI test type=NAAT)	1	1	1	1
ICU beds: >= 43	1	1	1	1
ICU beds: 20-42	0	0	0	0
ICU beds: 10-19	0	0	0	0
ICU beds: 5-9	0	0	0	0
(Fac Type) Oncology Hospital	0	0	0	0
(Fac Type) General Hospital	1	1	1	1
Total Facility bed size	381	381	384	384
Reporting from ED or 24 hr Obs.	1	1	1	1
Teaching Hospital	1	1	1	1
Total CDI patient days	27,368	27,287	27,533	23,185
Total # Observed HO-CDI events	**31**	**34**	**25**	**20**

NHSN risk adjustment model parameter settings and predicted HO-CDI events for facility D with ONC/HCT patient days, beds, admissions, CO-CDI events removed

	2015Q3	2015Q4	2016Q1	2016Q2
Intercept	-8.9463	-8.9463	-8.9463	-8.9463
CO prev rate	0.7339*(24/4942)*100 = 0.3564	0.7339*(28/4783)*100 = 0.4296	0.7339*(19/4784)*100 = 0.2215	0.7339*(24/4424)*100 = 0.3981
Test Type (CDI test type=EIA)	0.0000	0.0000	0.0000	0.0000
Test Type (CDI test type=NAAT)	0.1307	0.1307	0.1307	0.1307
ICU beds: >= 43	0.7465	0.7465	0.7465	0.7465
ICU beds: 20-42	0.0000	0.0000	0.0000	0.0000
ICU beds: 10-19	0.0000	0.0000	0.0000	0.0000
ICU beds: 5-9	0.0000	0.0000	0.0000	0.0000
(Fac Type) Oncology Hospital	0.0000	0.0000	0.0000	0.0000
(Fac Type) General Hospital	0.3740	0.3740	0.3740	0.3740
Total facility bed size	0.0003*381	0.0003*381	0.0003*384	0.0003*384
Reporting from ED or 24 hr Obs.	0.1119	0.1119	0.1119	0.1119
Teaching Hospital	0.0331	0.0331	0.0331	0.0331
CDI patient days	25,010	24,899	25,205	20,835
NHSN Predicted HO-CDI events	**21.07**	**22.57**	**19.91**	**18.31**

Facility-wide SIR for facility D with ONC/HCT data removed

	2015Q3	2015Q4	2016Q1	2016Q2	FY2016
Observed HO-CDI events	31	34	25	20	110
NHSN Predicted HO-CDI events	21.07	22.57	19.91	18.31	81.86
SIR	**1.47**	**1.51**	**1.26**	**1.09**	**1.34**