Central Line Associate Blood Stream Infections
Mary-Louise McLaws, University of New South Wales
A Webber Training Teleclass

Central Line Associated Bloodstream Infections
Prevention relies on analysis, what happens when analysis is flawed?

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Hosted by Jane Barnett
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www.webbertraining.com April 18, 2012

1. Why is there a call for Zero-tolerance for CLABSI? *How large is the problem, how serious is the problem?*
2. How does the current method of analysis hide the actual successes and failures of CLABSI prevention?
3. Is there an alternative method of analysis that would provide accurate and rapid feedback?
4. What are the current infection control and prevention guidelines – how could these now be tailored for the actual success and failure?

CDC DEFINITION

Central line:

intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring

Great vessels:

Aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common femoral veins [& in neonates: the umbilical artery/vein]

Insertion site and the device type ARE NOT used to determine line as central line

CVL MUST terminate in a great vessels or in/near the heart

CLABSI rates/1000 line-days

Australia (32 NSW + 13 VIC adult ICUs)

3.7 (95%CI 2.5-5.3)
McLaws ML, Taylor P *J Hosp Infect* **2003**; 53 (4): 260-268.

2.3 (95%CI 1.5-3.3)
Russo PL, Bull A, Bennett N, et al.. *Am J Infect Control* **2006**;34: 430-6.

USA 5266 adult

2.0

1.0 to 5.6 Range across 10 units
Edwards JR, Peterson KD, Andrus M et al. *Am J Infect Control* **2008**; 36:609-26.

Germany 248 adult

2.0 (95%CI 1.8-2.1)
Gastermeier P et al. JHI **2006**; 64:16-22.

What does this mean in terms of infected patients per year?

Australia ≈ 195 - 266

calculations:
•NSW ≈ (80/36351)

• VIC (26/11536), QLD, SA, WA, NT, TAS
≈58% of admissions
line-days ≈ 50200/86550
CLABSI ≈ 2.3 - 3.7/1000 ≈ 115 - 186

What does this mean in terms of infected patients per year?

Germany
921 from 248 ICU (≈ 4 each / yr)

USA
5266 from 1045 ICU (≈ 5 each / yr)

Aust (NSW + VIC)
106 (80+26) from 45 (32+13) ICUs (≈ 2 each / yr)

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What does this mean in terms of death per year

attributable mortality 12% -25%

CDC. Vital Signs: Central line - associated blood stream infections - United States, 2001, 2008, and 2009. MMWR 2011; 60(8): 243-8.

≈1 death each unit / year

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15 years of Evidence

CLABSI is preventable

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Early highlights

- **Prevention of central venous catheter-related infections by using maximal sterile barrier precautions during insertion.** Raad II et al. *Infect Control Hosp Epidemiol* 1994; 15:231-8.
- **Eliminating catheter-related bloodstream infections in the intensive care unit.** Berenholtz et al. *Crit Care Med* 2004; 32 (10): 2014-2020.
- **Prevention of intravascular catheter infection.** Eggimann P. *Curr Opin Infect Dis* 2007; 20:360-369

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National Healthcare Safety Network 2006/2010

Number patients with ≥1 central lines in situ = ∑ central-line days

Lab Dx
Criterion 1. *recognised pathogen from ≥ B/C*
And
organism cultured from B/C is not related to infection at other site

Criterion 2. *patient has at least 1: fever (>38˚C) or chills or hypotension*
And
Common skin contaminants (Corynebacterium spp, Bacillus spp, Proprionibacterium spp, coag neg staph, strep viridians, Aerococcus spp, Micrococcus spp) is cultured from ≥2 B/C drawn on separate occasions.

Rate = ***Lab diagnosis CVL related BSI***
number of patients with ≥1 central lines

Major collaborative studies

- **CLABSI rate ↓ by 68% to 1.36/1000 line days** over a 4 year period 69 ICUs in South Western Pennsylvania *MMWR. 2005;54:*1013-1016. *& JAM*A 2006; 269-270.
- **Comparable results were obtained in 46 ICUs in New York State & a group of Veterans Affairs hospitals**.
  Koll BS et al. *Jt Comm J Qual Patient Saf* 2008;34:713-723.
  Bonello RS et al. *Jt Comm J Qual Patient Saf* 2008;34:639-645.
- **A regional collaborative study 44 ICUs underway in Tuscany.**
  Rodell S et al.*Qual Saf Health Care* 2008;17:20-21.
- **Low resourced setting**.
  Marra AR, Cal RG, Durao MS et al. *Am J Infect Control* 2010;38:434-439.

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Pronovost et al ***NEJM* 2006**;355(26): 2725-32.

Pronovost et al ***BMJ* 2010**;340:c309

55 then 108 ICU Michigan

0 months	**median 2.7 (IQR 0.6 - 4.8) /1000 line-days**
3 months	**median 0.0 (IQR 0.0 - 2.4) /1000 line-days**
16-18 months	**median 0.0 (IQR 0.0 - 3.0) /1000 line-days**
34-36 months	**median 0.0 (IQR 0.0 - 1.2) /1000 line-days**

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All Hospital Quality Report
Measured:

- **Frequency of missed *Pronovost* items**
- **preparation**
- **operational**
- **immediate management**

***Pronovost et al NEJM* 2006**

Pre intervention	**1**
3/12	**IRR = 0.62 (0.47-0.81)**
16-18/12	**IRR = 0.34 (0.23-0.50) (p<0.002)**

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Clinical Excellence Commission

Intensive Care Centre Monitoring Unit

NSW Ministry of Health

2007-2008

Aseptic insertion all 37 public ICUs

Burrell A, McLaws ML, Herkes R, Mungo M, Pantle A. Aseptic insertion of central lines reduces bacteraemia: The NSW Central Line Associated Bacteraemia Collaborative (CLAB-ICU). *Med J Aust* 2011; 194: 583-587.

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Patient Bundle: **aseptic insertion of central line**
patient fully draped & skin prep

Clinician Bundle: **hat, mask, hand hygiene, glove, gowns**
check inserted properly - transducer/x-ray

Potential confounder: **type of central line, insertion site, coating**
level of ICU
compliance with bundles
ALOS
accreditation for insertion

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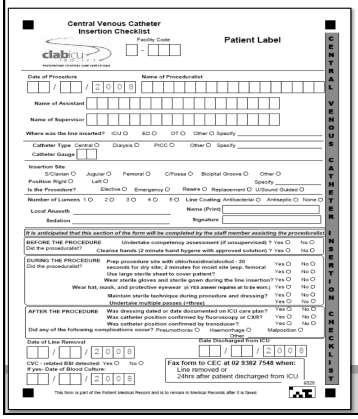
Checklist produced


Central Venous Catheter Insertion Checklist

Patient Label

CENTRAL VENOUS CATHETER INSERTION CHECKLIST

Clinician bundle
- Undertake competency assessment
- Clean hands
- Sterile gloves/gown
- Hat mask protective eyewear

Patient bundle
- Prep with 2% chlorhexidine & dry 2 mins
- Large sterile drape
- Maintain sterile technique
- No multiple passes
- Confirm catheter position

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Implementation issues

☹ Initial clinician resistance
'We don't have CLABSIs'
'I don't believe the evidence'
4 ICUs would not wear hats
'Where's the money?' (Data collection/reporting)
Apathy

☺ With increased senior intensivist involvement ⇨ greater scrutiny of data submitted by ICU due to feedback reports from us to participating ICUs/ great co-operation

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After Safe Insertion
Checklist Compliance - all participating ICUs

Competency assessed	48.3% (22.9% No; 28.8% missing)
Hat, mask, eyewear	79.9%
Hands washed 2 mins	91.6%
Sterile gown/gloves	95.9%
Alcoholic chlorhexidine prep allowed to dry	95.8%
Entire patient draped	93.4%
Sterile technique maintained	95.6%
No multiple passes	80.9%
Confirm position radiologically	74.3%
Other method to confirm placement	43.6% (44.7% No; 11.7% missing)

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☹ Non compliers with clinician bundle (***no hats***)
CLABSI rate significantly higher than hat wearers
Aggregated RR CLABSI 1.6 (CI_{95} 1.1-2.4, p=0.0178)
- Central lines RR 2.0 (CI_{95} 1.2-3.2, p=0.0037)
- PICC RR 5.1 (CI_{95} 1.03-25.0, p=0.059)
- Dialysis catheters – not significant

Conclusion: Proxy for other poor IC related behaviours

☺ Compliers with both clinician bundle & patient bundle
RR CLAB 0.6 (CI_{95} 0.4-0.9, p=0.0103)

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Aggregated 10,575 centrally inserted lines
No confounding dwell time or catheter utilization

1-12 months 3.7 (95%CI 2.4-4.6)/1000 line-days **[37/10974]**

13-18 months 1.5 (95%CI 1.1-2.0)/1000 line-days **[40/26668]**

RR 0.44 (95%CI 0.28- 0.70) *p*=0.0003

McLaws ML, Burrell A. Zero risk for central line-associated bloodstream infection: Are we there yet? Critical Care Medicine 2012 Feb;40(2):388-93

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Pronovost et al ***NEJM* 2006**;355(26): 2725-32. **& *BMJ* 2010**;340:c309

0 months	**median 2.7 (IQR 0.6 - 4.8) /1000 line-days**
3 months	**median 0.0 (IQR 0.0 - 2.4) /1000 line-days**
16-18 months	**median 0.0 (IQR 0.0 - 3.0) /1000 line-days**
34-36 months	**median 0.0 (IQR 0.0 - 1.2) /1000 line-days**

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Why Not Zero?

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2. How does the current method of analysis hide the actual successes and failures of CLABSI prevention?

&

What makes the current calculation flawed ?

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CDC/NHSN: CLABSIs/Line-days in ICU /Other location

Surveillance - in any inpatient location where denominator data can be collected...may include critical/intensive care units (ICU), specialty care areas (SCA), neonatal units, stepdown units, wards, & long term care units. Surveillance ...in at least one inpatient location in the healthcare institution for at least one calendar month

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NNIS in 2005 became *National Healthcare Safety Network*

Central line-associated BSI rate per 1,000 central line-days

$$= \frac{\text{Number of central line-associated BSI}}{\text{Number of central line-days}} \times 1{,}000$$

Represents days of exposure to at least 1 device (not total devices)

"For device-associated HAI incidence density rates[9]: record daily the total number of patients and ***total number of ….central line-days****….in the patient care area(s) under surveillance; sum these daily counts at the end of the surveillance period for use as denominators" (CDC* ***April 2006)***

"..the number of ***patients with one or more central lines*** *of any type is collected daily, at the same time each day, during the month and recorded on the Denominators for Intensive Care Unit (ICU)/Other Locations" (CDC* ***May 2010****)*

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Incidence Density

Total number of occupational injuries
∑ **Person years** at-risk of occupational injury

Allows persons at-risk to contribute their own sum of duration of risk

Total number of CLABSI
∑ central **line-days** (for every line in situ is counted)

or

Total number of CLABSI
∑ central line-days (exposure to at least 1 line at time of observation)

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History **sophistication of disease frequency and distribution**

1620-74 John Graunt - Quantified disease patterns in *The Nature of Political Observations Made Upon the Bills of Mortality (1664)*

1807- 83 William Farr - Vital statistics system (1837) for *surveillance* person-time

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Fixed and *Dynamic* populations

Fixed

Mt (or Mb) in a fixed population is evaluated within successive 'same time' intervals so that time dependence of Mt can be elucidated.

Life table

Dynamic

Persons enter (born, migrate, aging into a stratum) as observation time proceeds. Some exit (emigrate, die, become diseased for only incidence, age out of a stratum) but population is in a steady state

number entering must = number leaving the population to be in a *'steady state'*

Person-time

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Table 1. Graunt's Life Table (fixed populations)

Age Interval	Proportion of Deaths in Interval	Proportion of Surviving 'til start of Interval
0-6	0.36	1.00
7-16	0.24	0.64
17-26	0.15	0.40
27-36	0.09	0.25
37-46	0.06	0.16
47-56	0.04	0.10
57-66	0.03	0.06
67-76	0.02	0.03
77-86	0.01	0.01

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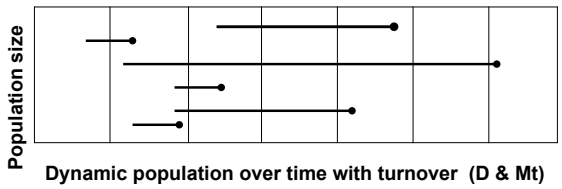
Incidence density (dynamic populations)
In theory incidence rates to provide good estimates of *disease incidence* requires:
- constant *person-time* over time
- taking any portion of the population-time experienced by
- dynamic populations will be in a *steady state*



Dynamic population over time with turnover (D & Mt)

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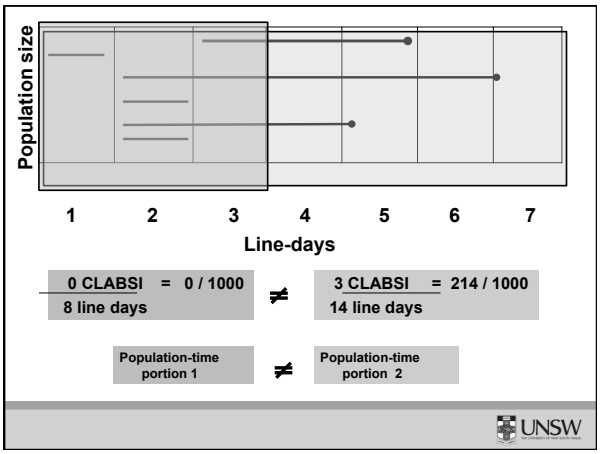
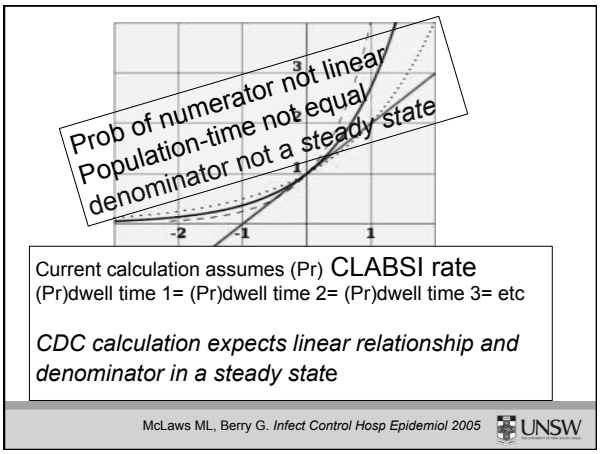


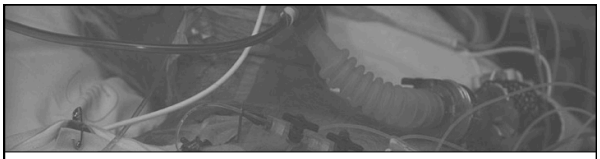


Healthcare Infection Standardised Surveillance (HISS) surveillance data 1998-2001

Catheter dwell time (days) strata	Adjusted CLABSI/1000 line-days (95%CI)	Survival Analysis	
		Cumulative survival proportion at end of *dwell time* period	Failure rate by the end of each *dwell time* period / 1000 line-days
1-5	2.1 (0.8 – 4.3)	**0.99**	**2.5**
6-15	4.5 (1.9 – 8.9)	**0.94**	**4.8**
16-30	10.2 (4.9 – 18.7)	**0.79**	**10.5**
31-320	2.1 (0.4 – 6.2)	**0.47**	**2.2**
Total	3.7 (2.5-5.3)	Pr not linear	

Dwell time not steady state after ~ day 7 (75% of patients discharge by day 7)

Mc Laws ML, Berry G. Non uniform risk for bloodstream infection with increasing central venous catheter-days. *Infect Control Hosp Epidemiol* 2005; 26:715-719. UNSW



With safe insertion

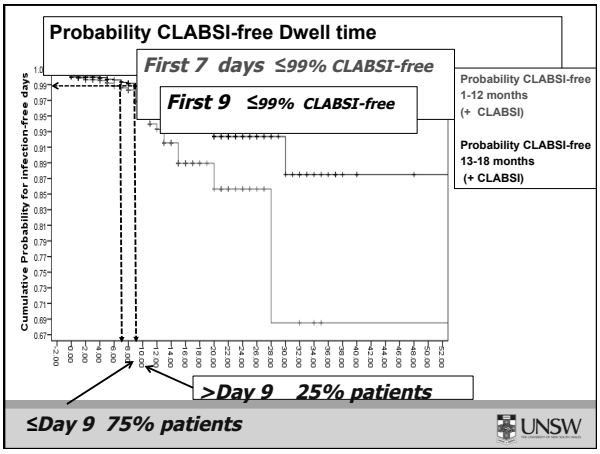
CLABSI 3.7/1000 ⇨ 1.5/1000 ***crude aggregated rate***

What dwell time gives lowest **(Pr) CLABSI ≤*1 in 100 chance?***

Pre: End Day 7 1.8/1000 line-days adjusted rate

Post: End Day 9 0.9/1000 line-days adjusted rate

McLaws & Burrell Crit Care Med 2012



Teaching ICU (level 6) Dwell time	Adjusted CLABSI/1000 line-days (CI_{95})	Probability *CLABSI-free* for dwell time
1-12 months		
1-7	1.8 (0.9-3.3)	0.99
8	2.8 (0.0-15.7)	0.98
9	15.1 (4.1-38.3)	0.97
10	5.1 (0.0-27.5)	0.96
11	24.5 (6.7-61.6)	0.94
12	7.5 (0.2-41.2)	0.93
13	18.3 (2.2-64.7)	0.92
14-15	9.1 (1.1-32.4)	0.89
16-20	3.0 (0.0-16.5)	0.86
>20	2.7 (0.0-15.2)	0.68
Total crude rate (CI_{95})	3.8 (2.5-5.5)	
13- 18 months		
1-9	0.9 (0.5-1.5)	0.99
Total crude rate (CI_{95})	1.6 (1.0-2.4)	

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Level 6 ICU Dwell time	Adjusted CLABSI /1000 line-days (CI_{95})	Probability CLABSI-*free* for dwell time
1-12 months		
1-7	**1.8 (0.9-3.3)**	0.99
13- 18 months		
1-9	**0.9 (0.5-1.5)**	0.99
10-11	5.9 (1.9-13.7)	0.98
12-13	4.1 (0.5-14.6)	0.97
14	22.3 (6.1-56.2)	0.95
15-16	3.9 (0.0-21.5)	0.94
17-20	3.3 (0.0-18.2)	0.92
>20	3.2 (0.0-17.7)	0.87

Level 6 ICU Dwell time	Adjusted CLABSI /1000 line-days (CI_{95})	Probability CLABSI-*free* for dwell time
13- 18 months		
10-11	5.9 (1.9-13.7)	0.98
12-13	4.1 (0.5-14.6)	0.97
14	22.3 (6.1-56.2)	0.95
15-16	3.9 (0.0-21.5)	0.94
17-20	3.3 (0.0-18.2)	0.92
>20	3.2 (0.0-17.7)	0.87

CLABSI average rate for dwell time >9 days 5.5/1000 line-days

Level 6 ICU Other centrally inserted lines

Probability CLABSI-free	1-12-months Dwell time	1-12-months Adjusted Rate CLABSI/ 1000 line-days (95%CI)	Last 6-months Dwell time	Last 6-months Adjusted Rate CLABSI/ 1000 line-days (95%CI)
0.998	1-2	4.3 (0.9-12.5)	1-7	0.6 (0.0-2.4)
0.98	3-8	3.7 (0.8-10.8)	8-10	2.8 (0.0-15.6)
0.94	>8	17.2 (0.4-92.4)	11-18	3.0 (0.0-16.6)
0.47			>18	5.9 (0.0-32.5)
Total Unadjusted CLAB rate (95%CI)		3.9 (1.6-8.0) [7/1805]	-	1.2 (0.4-2.8) [5/4126]

McLaws ML, Burrell A. Zero risk for central line-associated bloodstream infection: Are we there yet? Critical Care Medicine 2012 Feb;40 (2):388-93

1. There are 2 distinct ICU patient groups:
   *75% Short (*closer to *steady state)*
   25% long dwell time
2. CLABSIs are not equally distributed over each line-day of exposure

Therefore

1. Aggregated CLABSI rate is ***not informative***

2. Zero-risk for CLABSI

3. ***Two rates & two thresholds*** **for two at-risk patient groups**

Mc Laws ML, Burrell A. **Zero risk for central line-associated bloodstream infection: Are we there yet?** *Critical Care Medicine* 2012:40(2):388-93

Where is the wisdom we have lost in knowledge?

Where is the knowledge we have lost in information?

TS Eliot

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What if Hospital X attempts to reduce CLAB through safe insertion?

Line-days	CVC-BSI (%) [% exposed to line-days]	Chance of Failure Adjusted CLAB/1000 line-days, (95%CI)
1-8	10 (52.6) [73.9]	3 in 100 0.5 (0.7-2.8)
9-12	4 (21.0) [17.4]	5 in 100 0.8 (0.2-2.0)
13-16	4 (21.0) [6.8]	11 in 100 2.0 (0.5-5.1))
17-24	1 (5.3) [2.4]	21 in 100 1.4 (0.0-7.8)
Total	19 (100.0)	2.0 (1.2-3.3)

Looking like a waste of time??

McLaws et al CLAB project unpublished

Before Safe Insertion in Hospital X

Line-days	CLABSI (%) [% exposed to line-days]	Chance of Failure Adjusted CLAB /1000 line-days (95%CI)
1-8	10 (52.6) [73.9% day1-8 only; but *100%* patient suffered this risk of CLAB in first 8 days]	3 in 100 0.5 (0.7-2.8)
9-12	4 (21.0) [17.4]	5 in 100 0.8 (0.2-2.0)
13-16	4 (21.0) [6.8]	11 in 100 2.0 (0.5-5.1))
17-24	1 (5.3) [2.4]	21 in 100 1.4 (0.0-7.8)
Total	19 (100.0)	2.0 (1.2-3.3)

McLawset al unpublished

Hospital G

Total 1842 line-days range ≤24 hours-96 days
25th Day 6; 50th Day 11; 75th Day 19

Central 1591

Line-days ranged ≤24 hours – 96 days
25th Day 7; 50th Day 11; 75th Day 17

Days 1-7 old rate=1.8 (0.9-3.3)

new CLAB rate= 0.9 (0.5-1.5) !!!

Hospital G

23.0% Competency training (70.4% no; 6.6% missing)

99.6% Prep procedure site
96.1% Sterile sheet
99.6% Clean Hands
99.6% Sterile gloves
84.0% Hat
99.6% Sterile technique maintained
86.8% No multiple passes
65.4% Position of line confirmed
58.8% Used Transducer (39.7% no; 1.6% missing)

Hospital G

	% [lines inserted]
Central	72.8 [3389]
PICC	15.0 [700]
Dialysis	11.5 [533]
Other & not specified	0.7 [33]
TOTAL lines inserted	100 [4655]
lines	
Singular	74.3%
Concurrent	20.6%
Sequential	5.1%

Hospital G *Process Surveillance* for Anatomical insertion sites

Line type	% [lines]
Central:	
Subclavian	36.2% [80]
Jugular	35.3% [78]
Femoral	28.5% [63]
Not specified	-
	100 [257]
Dialysis:	
Femoral	81.5% [22]
Jugular	11.1% [3]
Subclavian	7.4% [2]
Not specified	-
	100 [27]

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Why setting targets using the current calculation is flawed

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Hypothetical improvement **10%** Hospital X over 3 years

Central line Dwell time	Time 0 CLABSI/line-days CLABSI/1000 line-Days (95%CI)	Time 3 years CLABSI/line-days CLABSI/1000 line-Days (95%CI) Relative Risk (95%CI)
1-8	10/21354 0.5 (0.2-0.9)	8/21354 0.4 (0.2-0.7) RR=0.8 (95%CI 0.3-2.0) (p=0.65)
1-24	19/29141 0.6 (0.4-1.0)	17/29141 0.6 (0.3-0.9) RR=0.9 (95%CI 0.5-1.7) (p=0.743)

Hypothetical **23%** improvement Hospital X 6 months

Central Line dwell time	Time 0 CLABSI/Line-days CLABSI/1000 CL-days (95%CI)	Time 6/12 CLABSI/Line-days CLABSI/1000 CL-days (95%CI) Relative Risk (95%CI)
1-8	6/3559 1.7 (0.6-3.7)	5/3559 1.4 (0.5-3.3) IRR=0.8 (0.2-2.7) (p=0.77)
1-24	13/4857 2.7 (1.4-4.6)	10/4857 2.1 (1.0-3.8) IRR=0.8 (0.3-1.7) (p=0.54)

Hypothetical **20%** improvement Hospital 1 and 2 6/12

	Time 0 CLABSI/line days (days 1-8 only) CLABSI rate	Time 6/12 CLABSI/ line days (days 1-8 only) CLABSI rate
Hospital 1	10/4000 2.5 (1.2-4.6)	8/4000 2.0 (0.9-3.9) IRR= 0.8 (95%CI 0.3-2.0) (p=0.6)
Hospital 2	30/4000 7.5 (5.1-10.7)	24/4000 6.0 (3.8-8.9) IRR= 0.8 (95%CI 0.5-1.4) (p=0.42)

11 hospitals aggregated – over 6/12

Can we prove we reached our 20%↓ goal?	Time 0 CLABSI/line-days CLABSI rate	Time 6/12 Theoretical 20% ↓ CLABSI/line days CLABSI rate
Lower rate ☒	110/44000 2.5 (2.1-3.0)	88/44000 2.0 (1.6-2.5) IRR=0.8 (95%CI 0.6-1.1) (p=0.12)
Higher rate ☑	330/44000 7.5 (6.7-8.3)	264/44000 6.0 (5.3-6.8) IRR=0.8 (95%CI 0.7-0.9) (p<0.007)

Process surveillance report

- Distribution of CL duration (range, median, 75th)
- Line utilisation: type of line & ratio per patient
- Frequency of *recommended insertion site*
- CLABSI rates: CLABSI in 75% patients (e.g. 1-8 line-day)
  1000 patient-days [95%CI]
  100 patients [95%CI]
- Counts of prevention & % of all CLABs by operator
- Aggregated CLABSI: survival analysis
  insertion site
  elective/emergency
  lumen number
  (line coating)

Conventional aggregated CLAB rate

- biased by 25% patients with prolonged CVL
- biased by statistically rare nature of CLABSI
- will not described 75% ICU patient

UNSW

4. Is there an alternative method of analysis that would provide accurate and rapid feedback?

UNSW

CDC/NHSN

Surveillance ...in at least one inpatient location in the healthcare institution for at least one calendar month

Past larger numbers simple analysis

CLABSI ≈10 per year Statistically rare

*Distribution **not normal***

*Line-days are not in a **steady state***

UNSW

Processes

monitoring of CVL insertion placement practices:

hand hygiene
barrier precaution
skin preparation

UNSW

Hospital G non compliance

improvements pre- and post

83.3% Clinician Bundle **p=0.0003**

92.6% Patient Bundle **p=0.049**

Hospital G by length of participation	Counts of non compliance with Clinician Bundle [Patient Bundle]
1st 6 months	15 [7]
2nd	5 [5]
3rd	8 [0]
4th	9 [4]
5th	4 [3]
6th	2 [0]

CVC inserted in ICU only

Hospital G by length of participation	Counts of CLABSI [Malposition + haem]
1st 6 months	8 [4]
2nd	1 [4]
3rd	2 [1]
4th	0 [3]
5th	2 [0]
6th	1 [1]

Malposition+/-Haemorrhage *reduction* 7.8% to 4.6% to 1.5%

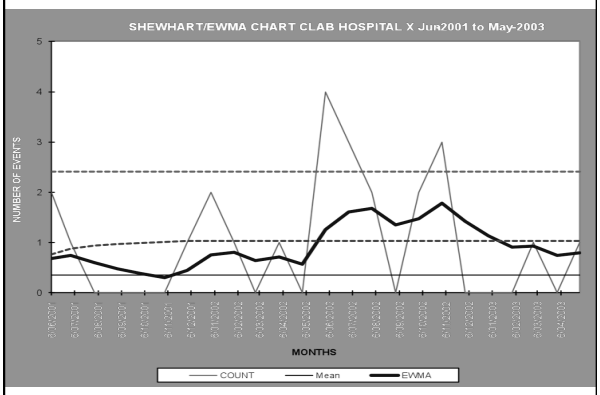
Pneumothorax for 3 years *0.4%* [1 count]

CVC inserted in ICU only

Length of participation	Hospital G CLABSI /100 insertions *p=0.037*	All level 6 (teaching) ICUs CLABSI/ 100 insertions *p=0.0019*
1st 6 months	**13.8%** (95%CI 6.1-25.4)	2.4% (95%CI 1.5-3.6)
2nd	**2.3%** (95%CI 0.06-12.0)	1.4% (95%CI 0.7-2.4)
3rd	**5.3%** (95%CI 0.6-17.7)	0.9%(95%CI 0.4-1.6)
4th	**0.0%** (95%CI 0.0-7.2)	1.0% (95%CI 0.5-1.8)
5th	**5.4%** (95%CI 0.7-18.2)	0.7%(95%CI 0.2-1.5)
6th	**3.2%** (95%CI 0.08-16.7)	0.5%(95%CI 0.2-1.2)

All ICUs (district-teaching) by length of participation	CLABSI/ 100 insertions	Total line days
1st 6 months	3.2% (2.1-4.9)	23/7070
2nd	2.7% (1.6-4.4)	16/5837
3rd	2.0% (1.1-3.4)	14/6989
4th	1.9% (1.2-3.0)	19/9819

CVC inserted in ICU only



Morton, Whitby, McLaws et al *J Qual Clin Practice* 2001

4. What are the current infection control and prevention guidelines – how could these now be tailored for the actual success and failure?

- **first 9 days 0.9/1000 line-days**
- **>9 days** average rate **5.5/1000 line-days**

Technologies for expected prolonged dwell time

- antiseptic/antibiotic impregnated lines & locks

Maki DG, et al. A novel antimicrobial and antithrombotic lock solution for hemodialysis catheters: A multi-center, controlled, randomized trial. *Crit Care Med* 2011; 39 (4): 613-620.

Hockenbull JC, et al. The clinical effectiveness of central venous catheters treated with antiinfective agents in preventing catheter-related bloodstream infections: a systematic review. Crit Care Med 2009; 37: 702-712.

Inexpensive intervention for all dwell time

- Pronovost bundle (clinician & patient)
  Pronovost et al *N Eng J Med* 2006 & *BMJ* 2010 ;340:c309
- early removal of catheters Mermel LA, et al. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 Update by the Infectious Diseases Society of America. Clin Infect Dis 2009; 49: 1-45.
- where possible removal of CVL on discharge from ICU

Post insertion care

- **Hand hygiene**

Marschall J, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. Infect Control Hosp Epidemiol 2008;29:S22-30.

Rosenthal VD, et al. Reduction in nosocomial infection with improved hand hygiene in intensive care units of a tertiary care hospital in Argentina. Am J Infect Control 2005;33:392-7.

- **chlorhexidine for site cleansing**

Maki DG, et al. Prospective randomised trial of povidone-iodine, alcohol, and chlorhexidine for prevention of infection associated with central venous and arterial catheters. Lancet 1991;338: 339-43.

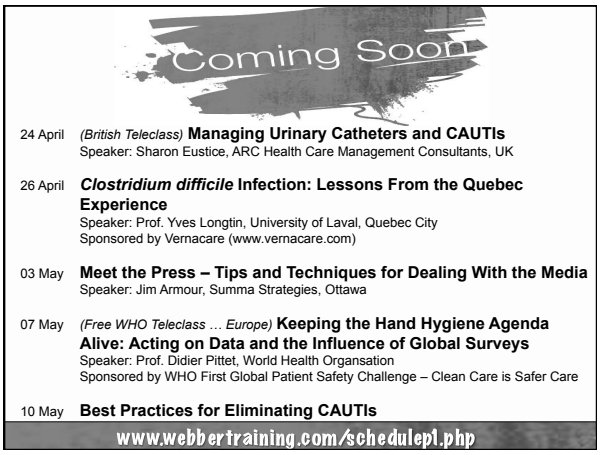
- **CHG-impregnated sponges**

Timsit JF et al. Chlorhexidine-impregnated sponges and less frequent dressing changes for prevention of catheter-related infections in critically ill adults: a randomized controlled trial. JAMA 2009;301:1231-41.

- **attention to decontamination of access ports**

Luebke MA et al. Comparison of the microbial barrier properties of a needleless and a conventional needle-based intravenous access system. Am J Infect Control 1998;26:437-41.

Central Line Associate Blood Stream Infections
Mary-Louise McLaws, University of New South Wales
A Webber Training Teleclass



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