



Reproducibility of three mortality review measures to assess the contribution of healthcare-associated infections to mortality

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Methods

The review team, consisting of two physicians, the on-site investigator (OSI) and the clinician in charge (TP), independently reviewed the records of deceased patients with healthcare-associated bloodstream infection (BSI), pneumonia, *Clostridium difficile* infection (CDI) or surgical site infection (SSI), and assessed the contribution of these infections to death using three outcomes (Table 1). Interrater reliability was assessed with (weighted) kappa, percent agreement, and/or intra-cluster correlation coefficient (ICC). Reviewers also indicated how the measures fitted each case: Does not fit / fits poorly / reasonably / well.

Table 1: The three mortality review measures used and the percentage of deceased patients in each category, according to the treating physician and the on-site investigator.

3CAT (currently in use in HAI-Net surveillance):	TP % of deceased	OSI % of deceased
- HAI did not contribute to the death of the patient	18	13
- HAI possibly contributed to the death of the patient	38	48
- HAI definitely contributed to the death of the patient	44	39
Combined with 3CAT reviewers could indicate whether the HAI was a major or minor cause.		
WHOCAT (based on World Health Organization medical certification of the cause of death):		
- HAI did not contribute to the death or the contribution was redundant, i.e. the patient would have died anyway	19	16
- HAI was a contributory cause but not related to the disease or condition causing the death	15	19
- HAI was part of the causal sequence of events that led to death but not sufficient on its own	56	55
- HAI was the sole cause of death – no other disease or condition causing the death was present (sufficient condition)	9	7
QUANT:		
Likert scale from 0 (No contribution) to 10 (Definitely cause of death)		
Contribution of HAI to death of the patient could also be unknown or not verified		

Background

The contribution of healthcare-associated infections (HAIs) to mortality can be estimated using statistical methods, but mortality review (MR) is more suited for routine use in clinical settings. The European Centre for Disease Prevention and Control (ECDC) recently introduced MR in the HAI-Net protocols for the surveillance of healthcare-associated *Clostridium difficile* and Intensive Care-associated infections. This study evaluated the reproducibility of three measures for MR of patients with HAI.

Results

Twenty-four hospitals, mostly tertiary care centres (74%), from 11 countries, participated (1–70 cases/centre). In total, 291 cases were reviewed: 29.9% BSI, 38.8% pneumonia, 24.4% CDI and 6.9% SSI. Cases were mostly recorded in ICU only (19 hospitals). Most CDI cases originated from three hospitals (in/outside ICU). Table 1 lists the number of patients per category. The correlations between the three measures are demonstrated in Figures 1–3.

Weighted kappa, that takes into account the order in the measure categories, was 0.68 (95% CI 0.61–0.75) for 3CAT, and slightly less when adjusting for hospitals (Table 2). Reproducibility was best for pneumonia and SSI. Agreement was particularly low in one of the three hospitals reporting most CDI. All three measures fitted 'reasonably' or 'well' in >88% of the cases.

Table 2: Interrater reliability measured with (adjusted) weighted kappa, percentage agreement or the intraclass correlation coefficient (ICC). Excluded when a rating was missing or 'Unknown'.

3CAT	n	Weighted kappa	Weighted kappa, adj. for hospital [§]	Perc. agreement overall
Overall	291	0.68 (0.61 – 0.75)	0.63 (0.55 – 0.71)	76.3
BSI	87	0.60 (0.46 – 0.76)	0.38 (0.20 – 0.56)	75.9
Pneumonia	113	0.72 (0.62 – 0.82)	0.82 (0.74 – 0.90)	77.9
CDI	71	0.57 (0.41 – 0.73)	0.55 (0.40 – 0.70)	69.0
SSI	20	0.88 (0.70 – 1.00)	Not calc.	95.0
WHOCAT	n	Weighted kappa	Weighted kappa, adj. for hospital [§]	Perc. agreement overall
Overall	288	0.65 (0.58 – 0.73)	0.75 (0.71 – 0.80)	73.6
BSI	86	0.60 (0.43 – 0.77)	0.63 (0.55 – 0.71)	74.7
Pneumonia	110	0.72 (0.60 – 0.83)	0.89 (0.83 – 0.96)	80.0
CDI	68	0.52 (0.34 – 0.70)	0.56 (0.46 – 0.66)	64.8
SSI	17	0.63 (0.29 – 0.97)	Not calc.	72.2
QUANT	n	ICC (95% CI for Absolute agreement)		
Overall	289	0.76 (0.71 – 0.81)		
BSI	87	0.75 (0.62 – 0.83)		
Pneumonia	111	0.85 (0.79 – 0.90)		
CDI	71	0.54 (0.35 – 0.69)		
SSI	20	0.71 (0.41 – 0.87)		

[§] excluding hospitals with less than six cases

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Conclusion(s):

Reproducibility of the three MR measures was comparable and acceptable for use in HAI surveillance, but depended on the type of infection. All three measures were perceived as fitting reasonably to well for most cases.

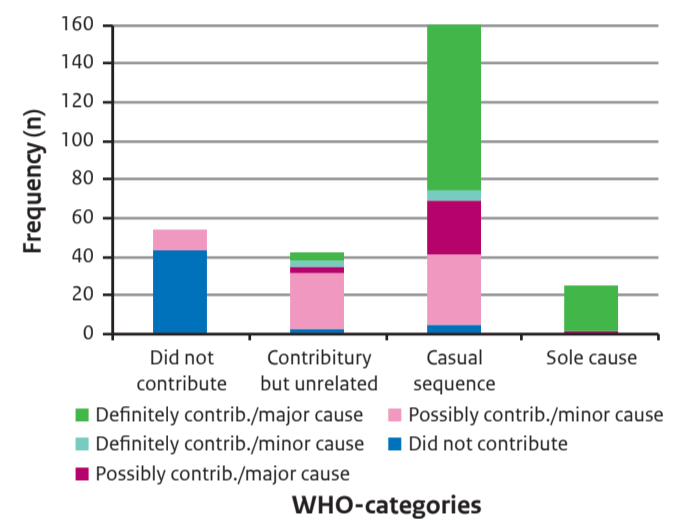


Figure 1: The relationship between 3CAT and WHOCAT (for treating physician).

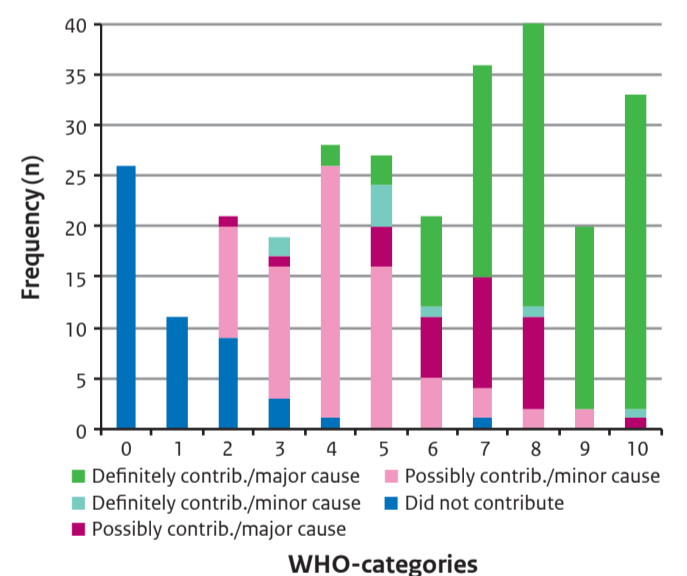


Figure 2: The relationship between 3CAT and QUANT (for treating physician).

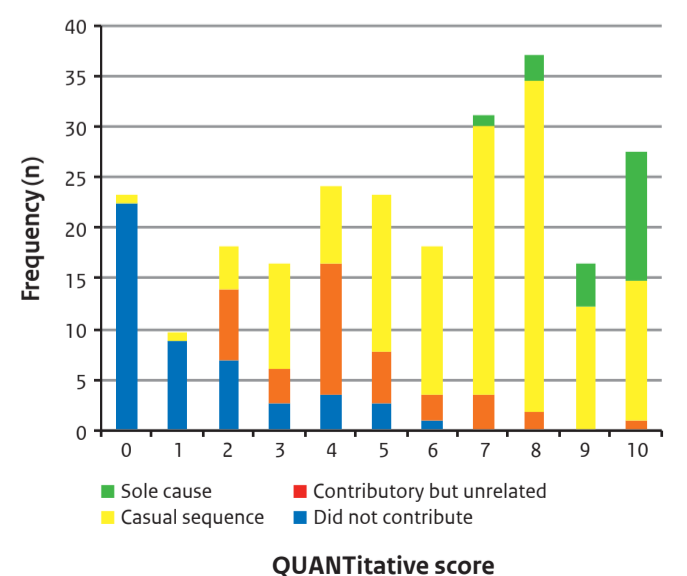


Figure 3: The relationship for WHO-CAT and QUANT (for treating physician).