Public Health England

NHS Improvement

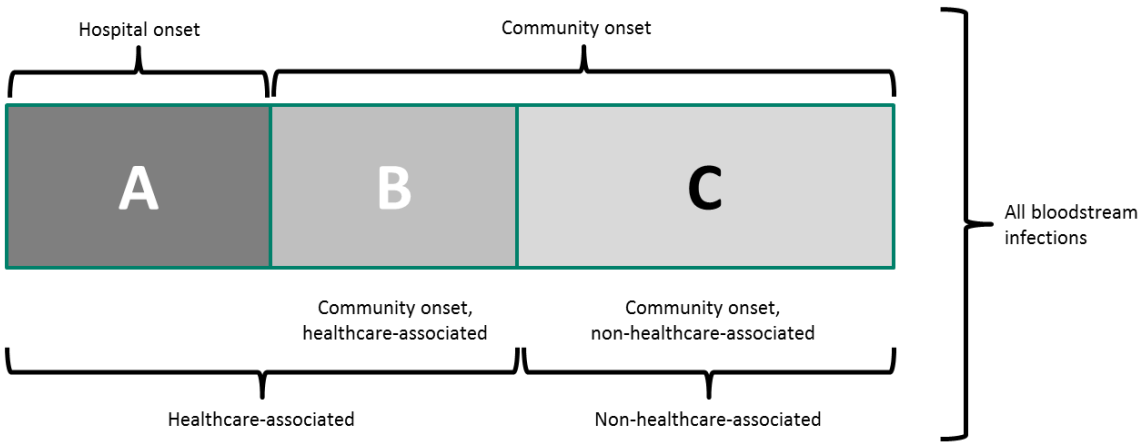
Guidance on the definition of healthcare associated Gram-negative bloodstream infections

July 2017

Gram-negative bloodstream infections (BSIs) are a healthcare safety issue. From April 2017, there is an NHS ambition to halve the numbers of healthcare associated Gram-negative BSIs by 2021.

Figure 1 shows the terminology the NHS will use to categorise healthcare associated Gram-negative BSIs according to where they are detected (community or hospital), and their relationship to healthcare (healthcare vs non-healthcare associated). The relative proportions of Gram-negative BSIs in each category are also shown for the top three Gram-negative BSI causative organisms, *Escherichia coli (E. coli)*, *Pseudomonas aeruginosa (P. aeruginosa)* and *Klebsiella* species (*Klebsiella* spp.) for 2016/17.

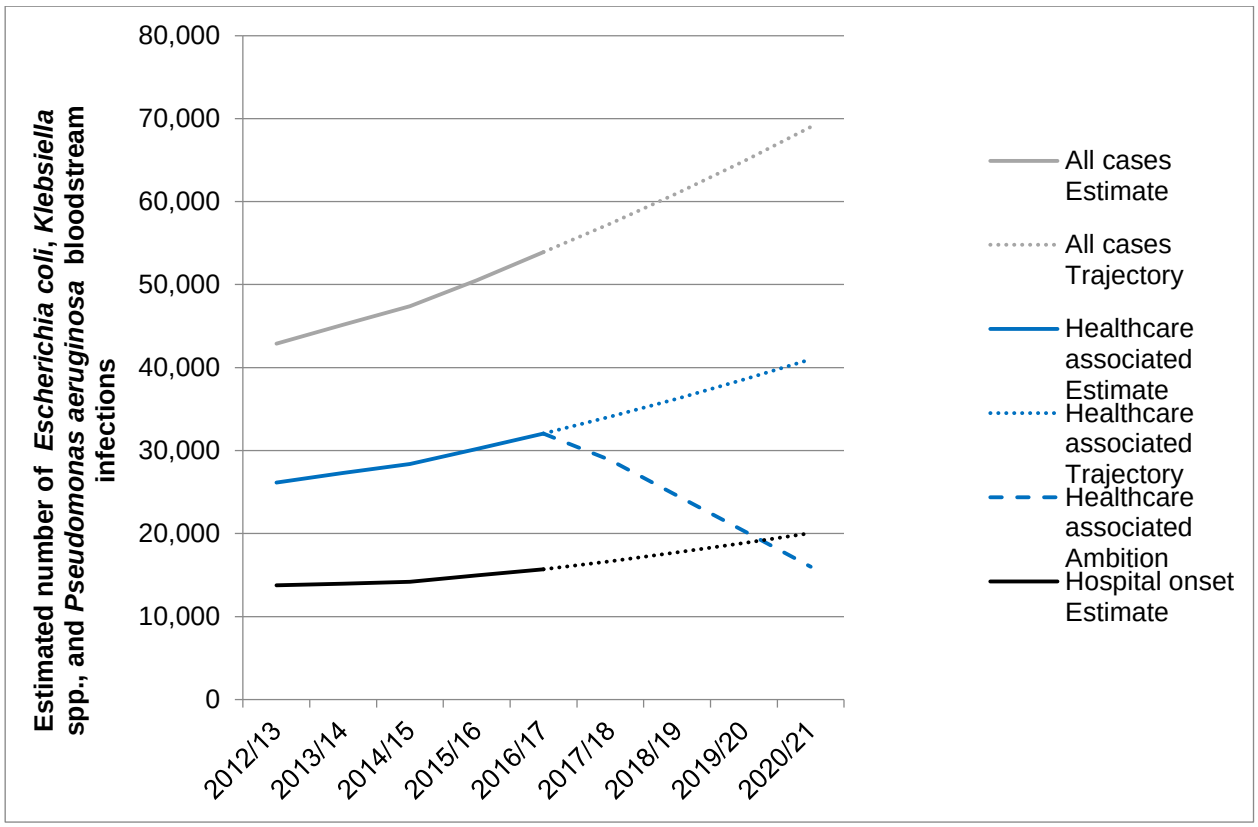
Figure 1. Definitions of different categories of bloodstream infections



Area	Name	Estimated number of *E. coli*, *P. aeruginosa* and *Klebsiella* spp. BSIs (2016/17)	% of total
A+B+C	All infections	53,920	100%
A	Hospital onset	15,687	29%
B+C	Community onset	38,233	71%
B	Community onset, healthcare-associated*	16,351	30%
C	Community onset, non-healthcare-associated*	21,882	41%
A+B	Healthcare-associated	32,038	59%

*Community onset, healthcare associated cases only include *E. coli* as we do not have the data for *Klebsiella* spp. or *P. aeruginosa* to calculate the community onset proportion (which is likely to be healthcare associated at this time).

Figure 2. The size of the reduction in BSIs required to meet the challenge of the NHS ambition



Definition of a bloodstream infection

A laboratory-confirmed BSI is defined as one or more positive blood cultures for a (in this case) Gram-negative pathogen.

Defining healthcare associated Gram-negative BSIs

A healthcare associated Gram-negative BSI will be a laboratory-confirmed positive blood culture for a Gram-negative pathogen in patients who had received healthcare in either the community or hospital in the previous 28 days.

Using a 28 day threshold, half the patients in a pilot *E. coli* enhanced surveillance scheme had previous healthcare exposure before the BSI, with antimicrobial therapy and urinary catheterisation reported in one-third and one-fifth, respectively.[1] Previous healthcare exposure was also associated with a higher proportion of antibiotic non-susceptibility in the blood culture isolates.[1]

Using this 28-day period is also consistent with the newer NHS definition of healthcare associated *Clostridium difficile* infections (CDIs), which it is proposed to phase into the mandatory data during 2017 and is widely accepted in Europe and the US.[2,3] The old 'trust apportioned' definition, meaning CDIs that occur in hospital after the first three days of admission, underestimated the number of healthcare associated cases. Similarly, 30 days is used as the cut-off for (healthcare-associated) surgical site infections (SSIs).[4,5]

It is possible that healthcare interventions (see **below**) occurring before the 28 days could be relevant when determining the risk of an infection and whether it could have been prevented. Notably, healthcare interventions that occurred more than four weeks before a BSI, but remained operational during some or all of the four-week pre-BSI period (such as a urinary catheter placement), could reasonably be assumed to have continued to place an individual at increased risk of infection. Such continuing/operational interventions should be taken into account when assessing if a BSI is healthcare associated. In this context, the 30-day threshold used to define surgical site infections is extended to one year if an implant is in place and the infection appears to be related to the operative procedure.

Key healthcare-associated risk factors

This is **not** an exhaustive list but should be used as a basis to classify Gram-negative BSIs as healthcare associated:

- indwelling vascular access devices (insertion, in situ, or removal)
- urinary catheterisation (insertion, in situ with or without manipulation, or removal)
- other devices (insertion, in situ with or without manipulation, or removal)
- invasive procedures (eg endoscopic retrograde cholangio-pancreatography, prostate biopsy, surgery including, but not restricted to, gastrointestinal tract surgery)
- neutropenia (<500/μL at time of bacteraemia)

- antimicrobial therapy within the previous 28 days
- hospital admission within the previous 28 days.

Frequency and time of healthcare exposure

According to a pilot *E. coli* BSI surveillance scheme,[1] approximately half the patients had a healthcare exposure in the four weeks before the bacteraemia, and one-third had a healthcare exposure in the week before the bacteraemia.

Relation to onset after hospital admission

As expected in the pilot *E. coli* BSI surveillance scheme,[1] the proportion of patients with previous healthcare exposure increased as the time of bacteraemia onset after hospital admission increased; so for BSIs occurring after individuals had been in hospital for seven days, 85% of patients were recorded as having had a healthcare-associated risk factor for bacteraemia.

However, it is not unreasonable, especially from a patient safety perspective (particularly the potential to intervene), to assume that Gram-negative BSIs occurring following hospitalisation (at least 48 hours after admission) are healthcare associated. Thus, Public Health England's data capture system is configured to automatically classify Gram-negative BSIs occurring at least 48 hours after admission to a healthcare institution as healthcare associated.

Relation to onset after discharge

Gram-negative BSIs occurring after discharge from a healthcare institution should be categorised according to the admission period. If a patient develops a Gram-negative BSI after hospital discharge in the previous 28 days, regardless of whether a specific healthcare-associated risk factor for Gram-negative BSI can be identified, this episode should be assumed to be healthcare associated.

Relation to place at time of BSI

In addition to the above considerations, the following will be used to determine if a BSI occurring in an individual in a nursing/care/residential home' is healthcare associated. The Data Capture System (DCS) form asks if the patient was in a 'Nursing/Residential home' at the time of the BSI. If additional information is supplied via the DCS that suggests the BSI is related to a healthcare-associated risk factor (see above), the BSI will be assumed to be healthcare associated. The BSI will also be assumed to be healthcare associated if the individual has been receiving nursing (as opposed to residential) care within the past 28 days.

Why do we focus on only three Gram-negative organisms?

E. coli, Pseudomonas aeruginosa and Klebsiella spp. account for 72% of all Gram-negative BSIs. If we extended the programme to look at the other Gram-negatives it would involve tracking species that cause relatively few BSIs. We believe it is likely that interventions that are effective at reducing BSIs due to the above three bacteria will be similarly effective at decreasing risks associated with other Gram-negative bacilli.

Please note:

1. **Categorisation of a BSI as healthcare-associated should not be avoided because there is no proof of the source/cause:** Often a clinical decision will need to be made about likely source attribution and/or whether there was a healthcare associated risk factor. The ambition to reduce (healthcare associated) Gram-negative BSIs is a patient safety issue, and so opportunities to intervene should not be lost. The presence of a healthcare associated risk factor is enough to assume that the Gram-negative BSI is healthcare associated.

2. **Gram-negative BSI data:** Public Health England will monitor the rate of unknown answers across trusts and CCGs, for example on the source of BSI. As expertise in entering the data on the PHE data capture system increases, the rate of unknown answers is likely to decrease.

3. **Gram-negative BSIs with a urinary source:** A Gram-negative urinary tract infection or catheter associated urinary tract infection temporarily associated with a Gram-negative BSI will often be the presumed source of the bacteraemia, but it could also arise through manipulation of the urinary tract without an overt urinary tract infection **(see the risk factors above).**

References

1. Abernethy J, Guy R, Sheridan EA, Hopkins S, Kiernan M, Wilcox MH, Johnson AP, Hope R (2017) *E. coli* bacteraemia sentinel surveillance group. Epidemiology of Escherichia coli bacteraemia in England: results of an enhanced sentinel surveillance programme. *Journal of hospital infection* 2017; 95:365-375.
2. McDonald LC, Coignard B, Dubberke E, Song X, Horan T, Kutty PK (2007) Ad Hoc Clostridium difficile Surveillance Working Group. Recommendations for surveillance of Clostridium difficile-associated disease. *Infection Control and Hospital Epidemiology* 2007;28:140-5.
3. Kuijper EJ, Coignard B, Tull P (2006) ESCMID Study Group for Clostridium difficile, EU Member States, European Centre for Disease Prevention and Control. Emergence of Clostridium difficile-associated disease in North America and Europe. *Clinical Microbiology and Infection* 2006;12(Suppl 6):2-18.
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5. Centers for Disease Control and Prevention CDC/NHSN (2013) Surveillance definition of healthcare-associated infection and criteria for specific types of infection in the acute care setting. 2013: www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf

0300 123 2257 **enquiries@improvement.nhs.uk** **improvement.nhs.uk**