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Hospital-Acquired Complications: A Comparison of Surveillance and Coding Data

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theAlfred

All contributors declare no conflict of interest

Part of AlfredHealth

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14 state-wide health services including:

- Major trauma
- Complex adult burns
- Heart/lung transplant
- Extracorporeal membrane oxygenation (ECMO) support for profound heart/lung failure

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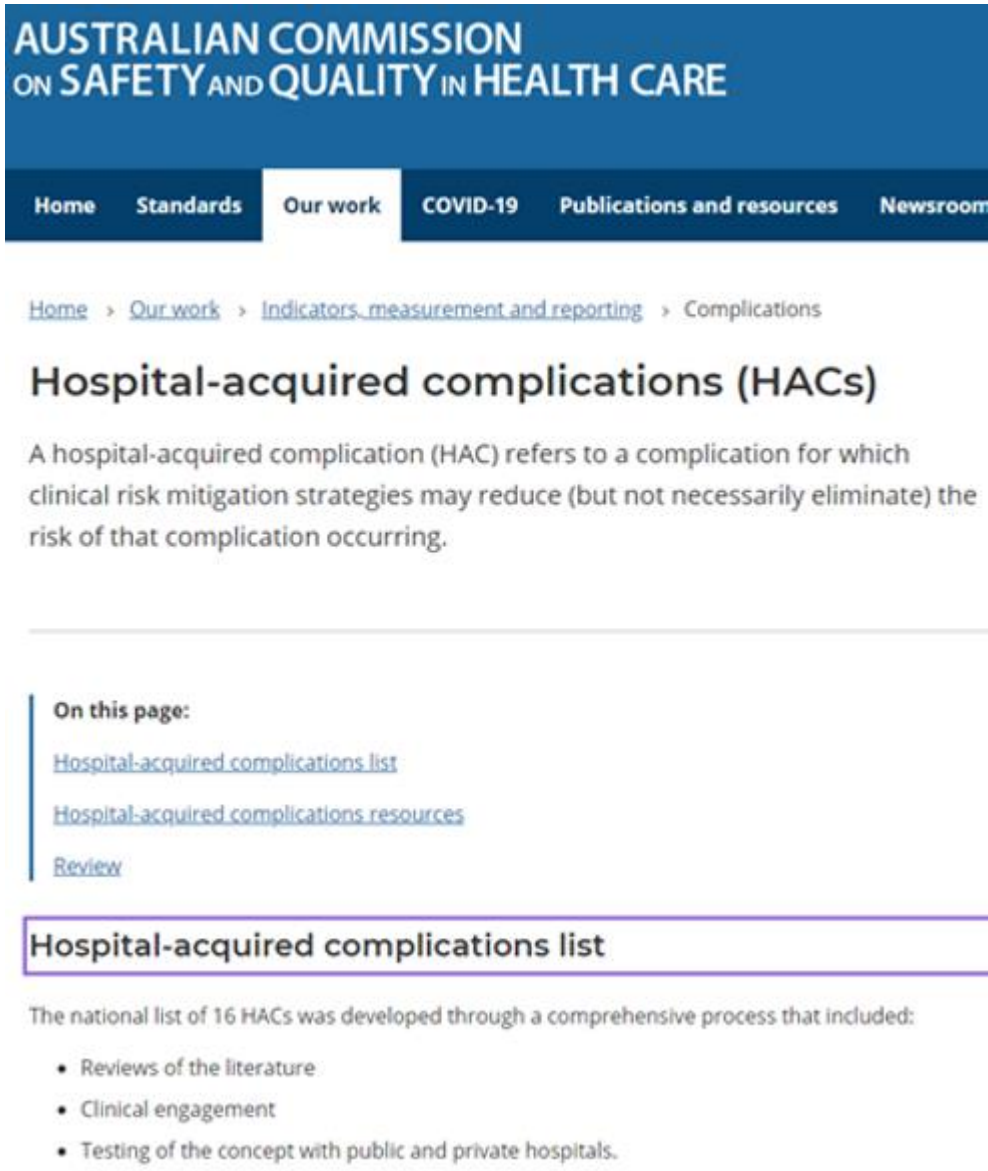
Background

Hospital-acquired complications (HACs) are identified by coding data

HAC detection through coding data is known to have a low positive predictive value (PPV)



PPV = % of patients with a positive test who actually have the disease

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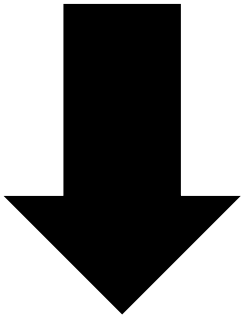
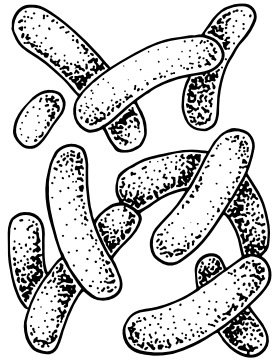
Why this is important

Hospital funding



Known low PPV

Increasing use of coding data



High rates of infection

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Aim

- Evaluate the PPV of HAC detection
- International Classification of Diseases (ICD) coding data versus traditional surveillance data
- Focus on hospital-acquired pneumonia (HAP) and healthcare-associated urinary tract infections (HA-UTIs)

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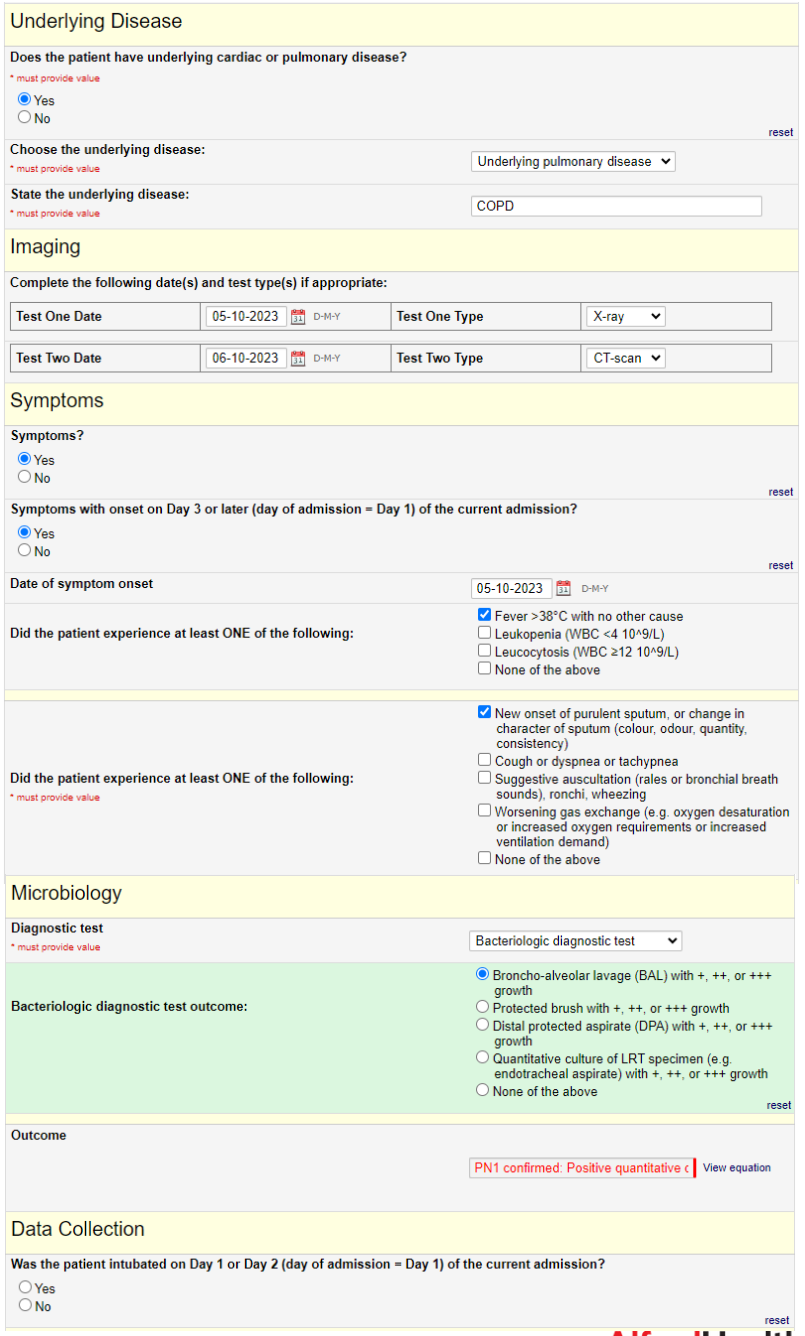
METHOD

Retrospective analysis at Alfred Health: 50 HAP and 50 HA-UTI coded patients

Timeline

- Review/adapt definitions
- Develop electronic surveillance tool
- 100 patient reviews
- Review findings



Underlying Disease

Does the patient have underlying cardiac or pulmonary disease?
* must provide value
(•) Yes
( ) No
reset

Choose the underlying disease:
* must provide value
Underlying pulmonary disease

State the underlying disease:
* must provide value
COPD

Imaging

Complete the following date(s) and test type(s) if appropriate:

Test One Date	05-10-2023 D-M-Y	Test One Type	X-ray
Test Two Date	06-10-2023 D-M-Y	Test Two Type	CT-scan

Symptoms

Symptoms?
(•) Yes
( ) No
reset

Symptoms with onset on Day 3 or later (day of admission = Day 1) of the current admission?
(•) Yes
( ) No
reset

Date of symptom onset
05-10-2023 D-M-Y

Did the patient experience at least ONE of the following:
[x] Fever >38°C with no other cause
[ ] Leukopenia (WBC <4 10^9/L)
[ ] Leucocytosis (WBC ≥12 10^9/L)
[ ] None of the above

Did the patient experience at least ONE of the following:
* must provide value
[x] New onset of purulent sputum, or change in character of sputum (colour, odour, quantity, consistency)
[ ] Cough or dyspnea or tachypnea
[ ] Suggestive auscultation (rales or bronchial breath sounds), ronchi, wheezing
[ ] Worsening gas exchange (e.g. oxygen desaturation or increased oxygen requirements or increased ventilation demand)
[ ] None of the above

Microbiology

Diagnostic test
* must provide value
Bacteriologic diagnostic test

Bacteriologic diagnostic test outcome:
(•) Broncho-alveolar lavage (BAL) with +, ++, or +++ growth
( ) Protected brush with +, ++, or +++ growth
( ) Distal protected aspirate (DPA) with +, ++, or +++ growth
( ) Quantitative culture of LRT specimen (e.g. endotracheal aspirate) with +, ++, or +++ growth
( ) None of the above
reset

Outcome
PN1 confirmed: Positive quantitative c View equation

Data Collection

Was the patient intubated on Day 1 or Day 2 (day of admission = Day 1) of the current admission?
( ) Yes
( ) No
reset

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Surveillance definitions

European Centre for Disease Prevention and Control (ECDC)

PN: PNEUMONIA

Rx

Two or more serial chest X-rays or CT-scans with a suggestive image of pneumonia for patients with underlying cardiac or pulmonary disease, and at least one of the following (in patients without underlying cardiac or pulmonary disease one definitive chest X-ray or CT-scan is sufficient):

Symptoms

- fever >38°C with no other cause;
- leukopenia (<4000 WBC/mm^3) or leucocytosis (≥12 000 WBC/mm^3);

and at least one of the following
(or at least two if clinical pneumonia only = PN 4 and PN 5):

- new onset of purulent sputum, or change in character of sputum (colour, odour, quantity, consistency);
- cough or dyspnea or tachypnea;
- suggestive auscultation (rales or bronchial breath sounds), ronchi, wheezing;
- worsening gas exchange (e.g. oxygen desaturation or increased oxygen requirements or increased ventilation demand);

and
according to the used diagnostic method:

Microbiology

a) Bacteriologic diagnostic test performed by:

- Positive quantitative culture from minimally contaminated LRT (lower respiratory tract) specimen **(PN 1)**:
  - broncho-alveolar lavage (BAL) with a threshold of >10^4 CFU2/ml or ≥5 % of BAL obtained cells contain intracellular bacteria on direct microscopic exam (classified on the diagnostic category BAL);
  - protected brush (PB Wimberley) with a threshold of >10^3 CFU/ml;
  - distal protected aspirate (DPA) with a threshold of >10^3 CFU/ml.
- Positive quantitative culture from possibly contaminated LRT specimen (PN 2):
  - Quantitative culture of LRT specimen (e.g. endotracheal aspirate) with a threshold of 10^6 CFU/ml

b) Alternative microbiology methods **(PN 3)**:

- positive blood culture not related to another source of infection;
- Positive growth in culture of pleural fluid;
- pleural or pulmonary abscess with positive needle aspiration;
- histologic pulmonary exam shows evidence of pneumonia;
- positive exams for pneumonia with virus or particular germs (*Legionella, Aspergillus,* mycobacteria, mycoplasma, *Pneumocystis carinii*):
  - positive detection of viral antigen or antibody from respiratory secretions (e.g. EIA, FAMA, shell vial assay, PCR);
  - positive direct exam or positive culture from bronchial secretions or tissue;
  - seroconversion (e.g. influenza viruses, Legionella, Chlamydia);
  - detection of antigens in urine (Legionella).

c) Others:

- positive sputum culture or non-quantitative LRT specimen culture **(PN 4)**;
- no positive microbiology **(PN 5)**.

Notes:
One definitive chest X-ray or CT-scan for the current pneumonia episode may be sufficient in patients with underlying cardiac or pulmonary disease if comparison with previous X-rays is possible.
PN 1 and PN 2 criteria were validated without previous antimicrobial therapy. However, this does not exclude the diagnosis of PN 1 or PN 2 in the case of previous antimicrobial use.

Comment: The subdivision of the pneumonia definition in five categories allows for the comparison of similar entities of pneumonia within and between countries. It is essential that all hospitals report PN4 and PN5 (clinical pneumonia without microbiological evidence) if appropriate in order to achieve overall comparability, even if a microbiological exam was performed and yielded negative results. It is also advised, both for clinical and surveillance purposes, that networks promote as microbiological confirmation (PN1–3) as a routine practice, at least in the ICU.

Intubation-associated pneumonia (IAP): a pneumonia is defined as intubation-associated (IAP) if an invasive respiratory device was present (even intermittently) in the 48 hours preceding the onset of infection.

UTI: URINARY TRACT INFECTION

UTI-A: microbiologically confirmed symptomatic UTI

- Patient has at least one of the following signs of symptoms with no other recognised cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness

and

- patient has a positive urine culture, that is, ≥ 10^5 microorganisms per ml of urine with no more than two species of microorganisms.

UTI-B: not microbiologically confirmed symptomatic UTI

- Patient has at least two of the following with no other recognised cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness,

and

- at least one of the following:
  - positive dipstick for leukocyte esterase and/or nitrate;
  - pyuria urine specimen with ≥10 WBC/ml or ≥ 3 WBC/high-power field of unspun urine;
  - organisms seen on Gram stain of unspun urine;
  - at least two urine cultures with repeated isolation of the same uropathogen (Gram-negative bacteria or *S. saprophyticus*) with ≥10^2 colonies/ml urine in nonvoided specimens;
  - ≤10^5 colonies/ml of a single uropathogen (Gram-negative bacteria or *S. saprophyticus*) in a patient being treated with effective antimicrobial agent for a urinary infection;
  - physician diagnosis of a urinary tract infection;
  - physician institutes appropriate therapy for a urinary infection.

UTI-C: asymptomatic bacteriuria: EXCLUDED FOR PPS, not to be reported*

- Patient has no fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness

and
either of the following criteria:

- Patient has had an indwelling urinary catheter within seven days before urine is cultured,

and

- patient has a urine culture, that is, ≥10^5 microorganisms per ml of urine with no more than two species of microorganisms;
- patient has not had an indwelling urinary catheter within seven days before the first positive culture;

and

- patient has had at least two positive urine cultures ≥ 10^5 microorganisms per mm^3 of urine with repeated isolation of the same microorganism and no more than two species of microorganisms.

** Note: Bloodstream infections secondary to asymptomatic bacteriuria are reported as BSI with source (origin) S-UTI*

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Pneumonia: Key Findings

6 patients met HAP surveillance criteria (green)

- PN1 = 1 patient
- PN2 = 3 patients
- PN3 = 2 patients

44 patients did not meet HAP surveillance criteria (red)

- PN4 = 4 patients
- No criteria met = 40 patients

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UTI: Key Findings

29 patients met HA-UTI criteria (green)

- UTI-A = 29 patients

21 patients did not meet HA-UTI criteria (red)

- UTI-C (asymptomatic bacteriuria) = 15 patients
- No criteria met = 6 patients

Results

88%

HAP coded patients did not meet surveillance criteria

(PPV = 12%)

42%

HA-UTI coded patients did not meet surveillance criteria

(PPV = 58%)

PPV = % of patients with a positive test who actually have the disease

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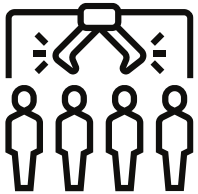
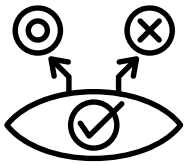
Limitations

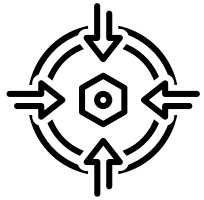


Small sample size

Strict surveillance definitions



Subjective clinical interpretations



Unable to determine sensitivity, specificity or negative predictive value

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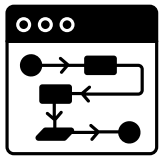
Future possibilities



Further validation and improvement of current algorithms.

Electronic Medical Record template to prompt physicians with HAP and HA-UTI diagnostic criteria.

Infection Prevention surveillance to assist Clinical Coding team.

Align coding and surveillance definitions.

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