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Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Clinical Case Study

Healthcare-associated infections studies project: An American Journal of Infection Control and National Healthcare Safety Network data quality collaboration



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Key Words:

Pneumonia
 Ventilator-associated events
 Bloodstream infections
 COVID-19

This case study is part of a series centered on the Centers for Disease Control and Prevention/National Healthcare Safety Network (NHSN) healthcare-associated infection (HAI) surveillance definitions. This specific case study focuses on the application of the Pneumonia (PNEU), Ventilator-associated event (VAE), and Bloodstream infections (BSI) surveillance definitions to a patient with COVID-19. The intent of the case study series is to foster standardized application of the NHSN HAI surveillance definitions among Infection Preventionists (IPs) and encourage accurate determination of HAI events.

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This National Healthcare Safety Network (NHSN) surveillance case study is part of a case-study series in the American Journal of Infection Control (AJIC). These cases reflect some of the complex patient scenarios Infection Preventionists (IPs) have encountered in their daily surveillance of healthcare-associated infections (HAI) using NHSN definitions. Objectives have been previously published.¹

For each case, a link to an online survey is provided, where you may answer the questions posed and receive immediate feedback in the form of answers and explanations. All individual participant answers will remain confidential, although it is the authors' intention to share a summary of the findings later. Cases, answers, and explanations have been reviewed and approved by NHSN Protocol and Validation Team.

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Conflicts of interest: Jennifer Watkins has nothing to disclose. Cindy Gross has nothing to disclose. Dominique Godfrey-Johnson has nothing to disclose. Katherine Allen-Bridson has nothing to disclose. Joan N. Hebden has relevant financial activities outside the submitted work; received personal fees from PDI, Inc., Netflix, Cepheid. Marc-Oliver Wright is employed by Professional Disposables International, Inc. A healthcare disinfectant company. Unrelated to this submission.

<https://doi.org/10.1016/j.ajic.2021.02.010>

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We hope that you will take advantage of this offering, and we look forward to your active participation. The online survey may be found at: <https://www.surveymonkey.com/r/NHSNCOVID>.

We strongly recommend participants review or reference the website and *NHSN Patient Safety Component Manual Device-Associated Module* for information that may be needed to answer the case study questions. The website links are https://www.cdc.gov/nhsn/pdfs/pscmanual/2psc_identifyinghais_nhsncurrent.pdf, https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf, <https://www.cdc.gov/nhsn/pdfs/pscmanual/6pscvcapcurrent.pdf>, https://www.cdc.gov/nhsn/pdfs/pscmanual/10-vae_final.pdf.

The findings and conclusions in this case study are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

For each question, please select the **most correct answer**.

Case Study #1 Scenario:

On 5/1/2020, a 54-year-old woman with a history of hypertension and diabetes presents to the ED. She reports feeling lethargic and achy for the past week, and has had a mild fever, headache, intermittent coughing, and occasional shortness of breath. Two days ago, her cough and shortness of breath worsened significantly. When her husband woke her this morning, she was confused, weak, and dizzy.

In the ED, her temperature is 38.3°C and her O₂ saturation is 82% on room air. She is placed on 6L O₂ via a high-flow nasal cannula and her O₂ saturation increases to 92%. Chest imaging findings demonstrate bilateral patchy alveolar opacities. A nasopharyngeal swab of respiratory secretions to test for COVID-19 (SARS-CoV-2) is performed, and she is admitted to the facility's inpatient COVID ward with a diagnosis of suspected COVID pneumonia. On 5/2/2020, her COVID-19 (SARS-CoV-2) test result is reported as positive.

Question 1.

Based on the admitting details, which best describes the infection criterion that is met?

- A. No infection criterion is met - the patient was admitted with pneumonia
- B. PNEU (PNU1)
- C. PNEU (PNU2)
- D. PNEU (PNU3)

On 5/9/2020, the patient's temperature increases to 39.0°C, and her O₂ saturations begin dropping into the 80s while receiving supplemental O₂ via a high-flow nasal cannula. The patient is placed on BiPAP. Around 22:30 she becomes minimally responsive and hypotensive (BP 75/42), and her O₂ saturation drops to 73%. The Rapid Response Team is called, and the patient is intubated. She is transferred to the facility's COVID ICU and placed on a mechanical ventilator, and a right subclavian central line and an indwelling urinary catheter are placed. A postintubation, postline insertion chest radiograph demonstrates worsening bilateral diffuse opacities, consistent with COVID-19 pneumonia.

Urine, blood, and endotracheal aspirate specimens are collected on 5/9 and sent to the microbiology lab for culture. Culture results are as follows:

Urine culture – No growth

Blood cultures x 2 sets – *Staphylococcus aureus*

Endotracheal aspirate culture - scant growth of *Staphylococcus aureus*

Question 2.

Based on the events on 5/9, which best describes the event that is identified?

- A. Secondary BSI to a POA PNEU
- B. Secondary BSI to an HAI PNEU
- C. BSI/LCBI 1
- D. Central Line-Associated BSI (CLABSI)

Case Study #2 Scenario:

On 4/20/2020, a 60-year old male presents to the ED in respiratory distress. His family reports via phone that he tested positive for COVID-19 (SARS-CoV-2) on 4/18/2020. He is intubated in the ED, placed on a mechanical ventilator, and admitted to the facility's COVID ICU. Admitting chest imaging demonstrates multi-lobe pneumonia. Urine culture and blood cultures collected in the ED result with no growth. An indwelling urinary catheter and a left internal jugular triple lumen catheter are placed on admission to the ICU. In-plan VAE surveillance is being performed in this location.

On 4/24 his temperature increases to 39.4°C and his WBC count increases to 14.9 cells/mm³. Arterial blood gas results are consistent with hypoxemia, and PEEP and FiO₂ ventilator settings are increased to compensate. A portable chest radiograph is performed and demonstrates worsening multilobar pneumonia. The hospitalist orders blood, urine, and endotracheal aspirate cultures, and changes the antibiotics to cefepime. On 4/25 the patient is re-tested for COVID-19 (SARS-CoV-2).

Question 3.

Based on the information in the table, which VAE specific event is identified?

- A. Ventilator-Associated Condition (VAC)
- B. Infection-related Ventilator-Associated Complication (IVAC)
- C. Possible Ventilator-Associated Pneumonia (PVAP) Criterion 1
- D. PVAP Criterion 2
- E. PVAP Criterion 3
- F. PVAP Criteria 1 and 3

Question 4.

What is the determination for the 4/27 bloodstream infection (BSI)?

- A. BSI/CLABSI
- B. Secondary BSI to VAE (VAC)
- C. Secondary BSI to VAE (IVAC)
- D. Secondary BSI to VAE (PVAP)
- E. Secondary BSI to PNEU (PNU2)

Case Study #3 Scenario:

A 62-year-old male has been intubated and mechanically ventilated in the facility's COVID ICU since 6/22/2020. In-plan VAE surveillance is being performed in this location. An indwelling urinary catheter was placed on 6/22, and a left upper arm PICC was placed on

| Date | Vent day | Daily minimum PEEP (cmH ₂ O) | Daily minimum FiO ₂ (%) | Temp (°C) | WBC (cells/mm ³) | Antimicrobial agent | Laboratory results |
|------|----------|---|------------------------------------|-----------|------------------------------|---------------------------------------|---|
| 4/20 | 1 | 5 | 100 | 38.2 | 8.3 | Piperacillin/tazobactam Vancomycin | |
| 4/21 | 2 | 8 | 70 | 38.1 | 9.2 | Piperacillin/tazobactam Vancomycin | |
| 4/22 | 3 | 8 | 60 | 38.3 | 10 | Piperacillin/tazobactam Vancomycin | |
| 4/23 | 4 | 8 | 50 | 38.5 | 11.1 | Piperacillin/tazobactam Vancomycin | |
| 4/24 | 5 | 8 | 50 | 39.4 | 14.9 | Cefepime | Urine culture: no growth Blood culture: no growth Endotracheal aspirate culture: 1+ growth of MRSA SARS-CoV-2 PCR: positive |
| 4/25 | 6 | 12 | 70 | 39 | 15.3 | Cefepime | |
| 4/26 | 7 | 12 | 60 | 38.2 | 16.6 | Cefepime Linezolid | |
| 4/27 | 8 | 12 | 50 | 38.5 | 18.2 | Linezolid | Blood culture: MRSA |
| 4/28 | 9 | 12 | 50 | 39 | 19 | Linezolid | |
| 4/29 | 10 | 12 | 50 | 39.3 | 19.6 | Linezolid | |

| Date | Vent day | Daily minimum PEEP (cmH ₂ O) | Daily minimum FiO ₂ (%) | Temp (°C) min/max | WBC (cells/mm ³) | Antimicrobial agent | Laboratory results |
|------|----------|---|------------------------------------|-------------------|------------------------------|---------------------|---|
| 7/12 | 21 | 5 | 40 | 37.1/37.5 | 11.1 | Meropenem | SARS-CoV-2 PCR: positive |
| 7/13 | 22 | 5 | 40 | 37/37.3 | 11.0 | Meropenem | |
| 7/14 | 23 | 5 | 40 | 37.1/37.9 | 11.3 | Meropenem | |
| 7/15 | 24 | 5 | 40 | 37.9/39 | 12.6 | Meropenem | |
| 7/16 | 25 | 5 | 80 | 38.2/38.9 | 14.7 | Meropenem | Urine culture: no growth Blood culture: Vancomycin-resistant <i>Enterococcus</i> (VRE) ET aspirate: Gram stain - 4+ neutrophils, rare epithelial cells; culture - Vancomycin-resistant <i>Enterococcus</i> (VRE) |
| 7/17 | 26 | 10 | 60 | 38.3/39 | 14.0 | Meropenem Linezolid | |
| 7/18 | 27 | 10 | 60 | 38.2/38.7 | 14.6 | Linezolid | |
| 7/19 | 28 | 10 | 50 | 37.8/38 | 13.5 | Linezolid | |
| 7/20 | 29 | 8 | 50 | 37.5/37.8 | 12.3 | Linezolid | |
| 7/21 | 30 | 8 | 40 | 37.2/37.8 | 12.5 | Linezolid | |

7/10. He received a 10-day course of dexamethasone from 7/3 to 7/12. Repeat COVID-19 (SARS-CoV-2) test on 7/12 was positive. The patient was stable on the ventilator until 18:23 on 7/15 (Mechanical Ventilation day 24), when his respiratory rate increased to 30-35 breaths per minute, and his O₂ saturation decreased from 95% to 83%. His FiO₂ setting on the ventilator was increased from 40% to 100%. Blood, urine, and endotracheal aspirate cultures were ordered. A portable chest radiograph demonstrated worsening diffuse pulmonary infiltrates bilaterally.

Question 5.

Based on the information provided in the table, which VAE specific event is identified?

- A. VAC
- B. IVAC
- C. PVAP Criterion 1
- D. PVAP Criterion 2
- E. PVAP Criterion 3
- F. No VAE is identified

Reference

1. Wright MO, Hebden JN, Bridson KA, Morrell GC, Horan T. Healthcare-associated infections studies project: An American Journal of Infection Control and National Healthcare Safety Network Data Quality Collaboration. *Am J Infect Control.* 2010;38:416–418.