BACKGROUND

- The burden of peripheral intravenous (PIV) related bloodstream infections (BSIs) is currently underestimated.
- Identifying PIV-related complications in real world data is challenging due to the broad use, inconsistent coding, and voluntary reporting of these devices.

OBJECTIVE

- To estimate the incidence of PIV-related complications among hospitalized patients.

METHODS

Study Design

- In this retrospective analysis of Premier Perspective Database, a U.S. hospital discharge records database, we studied hospital admissions between 7/1/2013 and 6/30/2015 to estimate PIV-related complications rates.
- The Premier Perspective Database covers 20% of U.S. hospital discharges. It contains de-identified data including clinical coding, hospital cost, and patient billing from more than 600 hospitals (45 million discharges) throughout the U.S.
- Based on clinical expert input, we selected admissions having 1 of the following 7 primary diagnoses that were likely to be at risk for a complication of interest: congestive heart failure (CHF), chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD), diabetes mellitus with complications (DM), myocardial infarction (MI), pneumonia, and major trauma (i.e., hip, spinal, or cranial fracture).
- All admissions were included to provide PIV use.
- We excluded readmissions with the same primary diagnosis and admissions with evidence of potential non-PIV causes of complications (i.e., dialysis, surgery, or central venous catheter use).

Study Measures

- We examined the following measures within each primary diagnosis group and among all groups combined:
  - Baseline measures included patient age, sex, and race; insurance plan type; admission type; hospital geographic region, location, teaching load, and size.
  - Evidence of a PIV-related complication was defined as the presence of an ICD-9-CM code in the admission record for at least one of the following selected complications:
    1. Bloodstream infection, including: sepsisemia, sepsis, severe sepsis, septic shock, septicemic, bacteremia, disseminated fungal infection, disseminated candida infection, disseminated fungal endocarditis.
    2. Upper extremity cellulitis and abscess at the following sites: upper arm and forearm; hand except fingers and thumb; and unspecified sites.
    3. Upper extremity superficial phlebitis and thrombophlebitis at the following sites: upper extremity superficial vein; upper extremity, unspecified; and unspecified site.
    4. Infections, not elsewhere classified (NEC), including: acute infection following transfusion, infusion, or injection of blood or blood products; infection following other infusion, injection, transfusion, or vaccination; and infection and inflammatory reaction due to vascular device, implant, and graft (includes peripheral venous vascular catheter).
    5. Extravasation, including: extravasation (infiltration) of other vesicant chemotherapy or agent.

Statistical Analysis

- Descriptive statistics were generated for all patient demographic, payer, and admitting hospital characteristics and for rates of PIV-related complications of interest during the index hospitalization.
- o Measures and standard deviations (SD) were reported for continuous variables, and percentages for categorical variables.
- All results were reported for each primary diagnosis group and for the overall combined group.

RESULTS

Patient, Payer, and Hospital Characteristics

- We identified 588,375 qualifying admissions (N=15,637–187,004) (Table 1).
- 71.2% white; and the main payer type among admissions was Medicare (66.2%), followed by commercial insurance (14.7%) (Table 2).
- Hospital admissions were mainly non-elective (95.2%) and were distributed across all geographic regions (Table 2).
- Less than half of the admissions occurred in teaching hospitals (39.5%), most were in urban settings (83.5%), and about a quarter of admissions (24.3%) occurred in very large hospitals with more than 500 beds (Table 2).

Selected PIV-Related Complication Rates

- Overall, 1.8% of patients (N=10,354) had a PIV-related complication, and rates varied by primary diagnosis:
  - CHF: 0.98% (95% CI 0.676–0.979, p<0.001)
  - COPD: 0.43% (95% CI 0.328–0.099, p<0.001)
  - Other: 0.49% (95% CI 0.496–0.048, p<0.001)
  - BSII was most common (82.4% of all selected PIV-related complications), overall ranging from 0.67% (CKD) to 2.46% (pneumonia) (Table 3; Figure 1).
  - Rates of cellulitis, phlebitis, infections NEC, and extravasation were lower than BSII and varied by primary diagnosis (Table 3; Figure 1).

LIMITATIONS

- We assumed all patients received a PIV upon admission to a U.S. hospital based on clinical input; however, to the degree this assumption does not hold, our sample may include patients not at risk for PIV-related complications.
- We attempted to exclude admissions with evidence of a major confounding factor that could have independently led to a PIV complication; however, we were unable to remove all potential confounders, due to coding or identification limitations, leading to possible over-reporting of PIV complication rates.

CONCLUSIONS

- A large number of PIV complications were identified with rates consistent with prior research.
- Further study of hospital discharge records may provide insight into the clinical and economic impact of these complications.
- The risks posed by PIVs are currently underestimated and may be significant as many patients have a PIV during their hospital stay. Our study suggests the risk of PIV-related infections should be considered in addition to CVC and proven interventions mobilized to mitigate these risks.

ACKNOWLEDGMENTS

The authors would like to thank Robert Hyde, MBA for his contributions to the project.

REFERENCES


Table 1. Baseline Characteristics

| Characteristic | CHF | CKD | COPD | DM | MI | Pneumonia | Trauma | All
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<tbody>
<tr>
<td>No. of admissions with selected primary diagnosisa during period (7/1/2013–6/30/2015)</td>
<td>207,643</td>
<td>32,733</td>
<td>151,420</td>
<td>148,539</td>
<td>186,115</td>
<td>250,693</td>
<td>115,205</td>
<td>1,553,149</td>
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<td>Admissions without evidence of dialysis among A</td>
<td>95.6%</td>
<td>95.5%</td>
<td>95.5%</td>
<td>95.4%</td>
<td>95.4%</td>
<td>95.4%</td>
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<tr>
<td>Admissions without evidence of surgery among B</td>
<td>70.9%</td>
<td>71.2%</td>
<td>84.6%</td>
<td>56.4%</td>
<td>19.2%</td>
<td>79.5%</td>
<td>74.8%</td>
<td>59.8%</td>
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<tr>
<td>Admissions without evidence of central line among C</td>
<td>70.5%</td>
<td>71.1%</td>
<td>88.4%</td>
<td>56.6%</td>
<td>19.2%</td>
<td>79.5%</td>
<td>73.8%</td>
<td>59.7%</td>
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<tr>
<td>E2 First qualifying admission among D</td>
<td>90.8%</td>
<td>90.8%</td>
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<tr>
<td>E1 First qualifying admission among D</td>
<td>90.8%</td>
<td>90.8%</td>
<td>90.8%</td>
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<tr>
<td>E1 First qualifying admission among D</td>
<td>90.8%</td>
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</tbody>
</table>

Table 2. Selected Complication Rates Related to PIV

| Characteristic | CHF | CKD | COPD | DM | MI | Pneumonia | Trauma | All
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<td>Any selected complication</td>
<td>154,816</td>
<td>110,017</td>
<td>99,212</td>
<td>91,017</td>
<td>81,917</td>
<td>91,017</td>
<td>81,917</td>
<td>1,553,149</td>
</tr>
<tr>
<td>Bloodstream infection</td>
<td>154,816</td>
<td>110,017</td>
<td>99,212</td>
<td>91,017</td>
<td>81,917</td>
<td>91,017</td>
<td>81,917</td>
<td>1,553,149</td>
</tr>
<tr>
<td>Cellulitis and abscess</td>
<td>154,816</td>
<td>110,017</td>
<td>99,212</td>
<td>91,017</td>
<td>81,917</td>
<td>91,017</td>
<td>81,917</td>
<td>1,553,149</td>
</tr>
<tr>
<td>Phlebitis and thrombophlebitis</td>
<td>154,816</td>
<td>110,017</td>
<td>99,212</td>
<td>91,017</td>
<td>81,917</td>
<td>91,017</td>
<td>81,917</td>
<td>1,553,149</td>
</tr>
<tr>
<td>Infections not elsewhere classified</td>
<td>154,816</td>
<td>110,017</td>
<td>99,212</td>
<td>91,017</td>
<td>81,917</td>
<td>91,017</td>
<td>81,917</td>
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Figure 1. Selected Complication Rates Related to PIV