RESEARCH BRIEF

Thirty-Day Readmissions After Hospitalization for *Clostridium difficile* Enteritis Measures and Predictors: A Nationwide Analysis

Clostridium difficile infection (CDI) is the most common cause of healthcare-associated diarrhea and an emerging cause of enteritis in individuals even without significant risk factors or healthcare exposure.[1] CDI frequently requires hospitalizations including 30-day readmissions, contributing to significant healthcare utilization and cost. Limited data are available on demographic characteristics and predictors of readmissions after an index hospitalization for CDI. We determined the national level 30-day readmission measures and predictors after hospitalization for CDI.

METHODS

For our analyses, we utilized the Nationwide Readmission Database (NRD) 2013, an all-payer database that includes 14 million discharges from 21 states representing 49.1% of all US hospitalizations.[2] We identified our index admissions as patients with principal diagnosis of CDI enteritis using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) code 008.45, which has been shown to have good accuracy.[3] The criteria used to identify index admissions and 30-day readmissions were adopted from the definition by Centers for Medicare and Medicaid Services (CMS).[4] Thus, any admission within 30 days of an index admission was considered a readmission, and any admission for CDI beyond 30 days of index admission was a separate index admission. We excluded (1) patients who died during the index admission because they were not at risk of readmission, (2) patients with index discharges in December due to lack of sufficient time to capture their 30-day readmissions, (3) patients with missing information on age or gender, and (4) patients who were not residents of the state of index hospitalization because readmissions cannot be tracked across state boundaries in the NRD.[5] Manufacturer-provided sampling weights were used to produce national-level estimates. Cox proportional hazards regression was used to identify predictors for any-cause 30-day readmission while adjusting for patient demographics, insurance, Elixhauser comorbidities, and hospital characteristics.

RESULTS

In this study, we included 89,174 index hospitalizations due to CDI enteritis between January and November 2013. Among them, 21,289 (23.9%) had at least 1 readmission within 30 days of index discharge. The total number of 30-day readmissions was 24,420 (27 readmissions per 100 index admissions). Compared to patients without 30-day readmissions, those with at least 1 readmission had higher prevalence of comorbidities and had a longer length of stay (LOS) during index admission (Supplemental Table 1). Independent predictors for any-cause 30-day readmissions were younger age (≤40 years, hazard ratio[HR], 1.45; $P < .001$), male sex (HR, 1.09; $P = .001$), index LOS >7 days (75th percentile of LOS; HR, 1.22; $P < .001$), nonroutine home discharge (HR, 1.20; $P < .001$), and Medicare (HR, 1.38; $P < .001$) or Medicaid (HR, 1.50; $P < .001$) as primary insurance (compared to private insurance) (Figure 1A).

The most common reasons for readmission were CDI (26.2%), septicemia (8.3%), and acute kidney injury (2.3%) (data not shown). The median time to readmission was 15 days, and proportion of readmissions showed a slow downward trend with time from index discharge (Figure 1B). The mean costs of an index hospitalization and a readmission were $9,843 and $13,241, respectively.

DISCUSSION

Our data indicate that almost one-fourth of patients hospitalized for CDI are readmitted within 30 days. This readmission rate is as high as that for congestive heart failure and even higher than those for pneumonia and myocardial infarction.[6] Younger males with CDI with a length of hospital stay >1 week are more likely to be readmitted. The finding that younger age was associated with higher readmissions is interesting. Similar results have been shown in previous studies among patients with heart failure, where higher age was associated with lower risk of readmission.[7] A systematic review by Jin et al[8] demonstrated higher medication compliance in the elderly compared to younger patients. The lower risk of readmission among the elderly could be partly explained by this difference in medication compliance. Strategies directed toward improving appropriate use of correct antibiotics should be implemented to improve quality of care.[9] Arranging early follow-up after discharge among susceptible population may also reduce CDI readmissions due to recurrence/nonresolution.

ACKNOWLEDGMENTS

Financial support: No financial support was provided relevant to this article.

Potential conflicts of interest: All authors report no conflicts of interest relevant to this article.

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https://doi.org/10.1017/ice.2017.97 Published online by Cambridge University Press

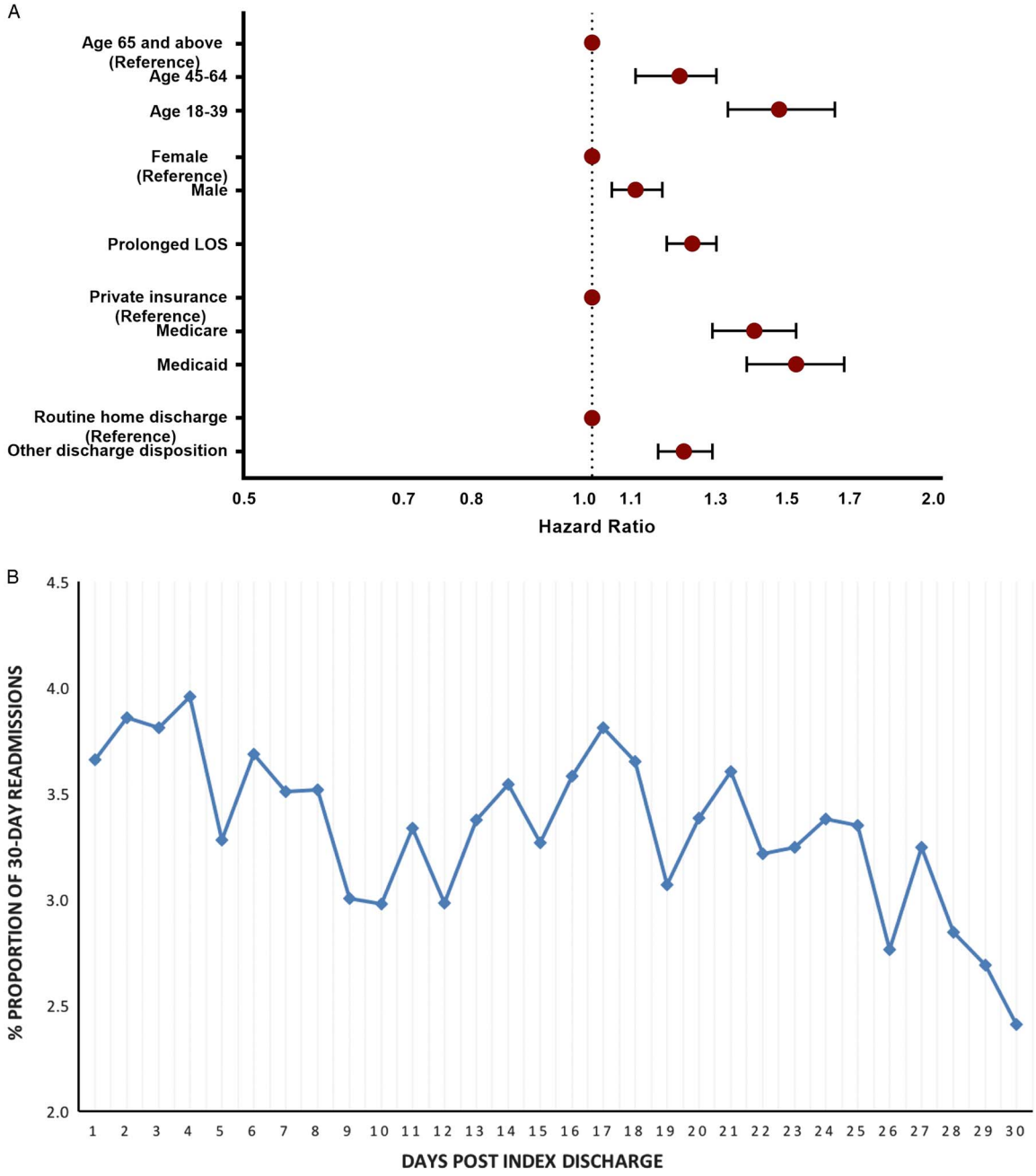

FIGURE 1. (A) Forest plot demonstrating hazard ratio of readmission for key characteristics. The multivariate Cox proportional hazards model was used for these analyses. Covariates included age categories (as above), gender, Elixhauser comorbidities, hospital characteristics, prolonged length of stay for index admission (defined as >75th percentile of LOS or 7 days, disposition (routine home discharge vs others), median household income quartile, and primary insurance. (B) Percentage of readmissions (any cause) against number of days post discharge from index hospitalization.

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Received February 21, 2017; accepted April 15, 2017; electronically published May 10, 2017
Infect Control Hosp Epidemiol 2017;38(7):876–878
 0899-823X/2017/3807-0019. DOI: 10.1017/ice.2017.97

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2017.97

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https://doi.org/10.1017/ice.2017.97 Published online by Cambridge University Press