The Synergistic Effects of Social Determinants of Health and Racial-Ethnicity on 30-day Readmission Disparities in an Inpatient Population

Wan-Ting Su, PhD[1], Cara Cannella, MS[1], Albert M. Levin, PhD[1], Jessica Haeusler, MA[2], Indra Adrianto, PhD[1], Ilan Rubinfeld, MD[3]

[1]Department of Public Health Sciences, Henry Ford Health System, Detroit, MI, USA
[2]Clinical and Quality Analytics, Henry Ford Health System, Detroit, MI, USA
[3]Administration, Henry Ford Hospital, Detroit, MI, USA

What might the attendee be able to do after being in your session?

The attendees will learn how the combination of social determinants of health (SDH) and racial-ethnicity impact disparities in 30-day readmission using multiple multivariate analytic methods. Further, they will learn how such a mixed methods approach can reveal different groups of patients (not defined by a single predictor alone) at the highest risk of readmission, towards whom health care organizations can deploy resources to reduce readmissions.

Description of the Problem or Gap

Reduction in hospital readmission rates has been a priority for improvement of healthcare quality and patient outcomes. The informatics community has been hard at work modeling, predicting and optimizing readmission risk analysis. While the focus of this work has tended to be on medical, procedural, operational and demographic factors, there is evidence that both SDH and race-ethnicity influence the likelihood of readmission. Previous studies found that race-ethnicity and SDHs—including the newly developed Area Deprivation Index (ADI)—were associated with readmission. These effects have been explored within the settings of both Medicare and surgical/disease related cohorts[1,2]. However, there is a lack of research studying a) the impact of SDH and race-ethnicity on readmission risk in the broader population setting and b) how the effects of SDH on readmission may depend upon race-ethnicity. To address these knowledge gaps, the aims of this study are to: (1) examine the effects of SDH and race-ethnicity on readmission separately for all inpatient populations across a large health care system; (2) investigate the racial-ethnicity specific effects of SDH on readmission; and (3) identify groups of patients with differing readmission risk based on SDH and race-ethnicity.

Methods

Our study was conducted within the Henry Ford Health System (HFHS), which is an integrated health care system centered in Detroit and covering southeastern Michigan. We conducted a retrospective study on all system inpatients from five HFHS hospitals admitted from November 2015 to December 2018, excluding mortalities during index admission. We obtained patients' demographics, the five available SDH (ADI, drug use, live alone, depression history, dual eligible, and insurance type), Charlson comorbidity index (CCI), and AHRQ ICD-10-CM Diagnosis Code and Clinical Classifications Software Refined (CCSR) Categories for primary diagnosis. ADI at the national percentile ranking level for socioeconomic disadvantage was merged to our dataset using zip-code plus 4 resolution. We also grouped the populations into quartiles of the national ADI to compare the ADI effects. The outcome variable was 30-day all-cause readmission based on the HFHS enterprise data warehouse, with additional updates from the Michigan Health Information Network (MiHIN). To achieve the study aims, we first examined the unadjusted relationships between readmission and both SDH and race-ethnicity using chi-squared and t-tests. We further compared the effects of SDH and race-ethnicity on readmission adjusted for age, gender, CCI, and the CCSR categories using logistic regression, and we tested the synergistic effect of SDH and race-ethnicity by modelling multiplicative interaction terms. Finally, latent class analysis (LCA) was conducted to identify distinct readmission risk subgroups within the population based on SDH, demographics, race-ethnicity, and CCI.

Results

Out of total 256,077 patient encounters, 34,901 were readmitted to HFHS (13.6%). In unadjusted analyses, all five SDH and race-ethnicity were significantly associated with 30-day readmission ($p<0.001$). After performing adjusted multivariate analyses, all SDH remained significant and were independently associated with a higher likelihood of readmission. The largest effects were drug use (odds ratio (OR)=1.24, $p<0.001$), dual eligible coverage (OR=1.22, $P<0.001$), and insurance type (Medicare vs. Commercial) (OR=1.2, $p<0.001$). Furthermore, for each 10 units increase on ADI (i.e., from 10 to 20), the odds of readmission increase by 1.02 ($p<0.001$). Consistently, the odds of readmission for the patients living in areas with high levels of deprivation (ADI > 90) was 1.13 times higher ($p<0.001$) relative to patients from lower deprivation areas (ADI ≤ 45). African American patients were more likely to be readmitted in comparison to Non-Hispanic White patients (OR=1.06, $p<0.001$). Additionally, we found that effect of depression on readmission was dependent upon race-ethnicity (interaction $p<0.001$). Specifically, stratified analyses demonstrated

that the largest effect of depression on readmission was for Hispanic/Latino patients (OR=1.53, p<0.001) compared to both Non-Hispanic White (OR=1.15, p<0.001) and African American (OR=1.20, p<0.001) patients. Finally, based on the adjusted Bayesian Information Criterion, LCA defined three discrete groupings of individuals based on SDH, race/ethnicity, and CCI, that differed based on readmission rate: High Readmission (19.5% readmission; 20% of patients), Medium Readmission (15.7% readmission; 35% of patients), and Low Readmission (9.5% readmission; 45% of patients) (Figure 1). In the High Readmission group, the majority of patients were African American (59%) and had the highest percentages for most SDH, including more patients with Medicare insurance and higher area deprivation (ADI ≥ Q3). In the Medium Readmission group, most patients were non-Hispanic White (89%), with the highest proportions of patients who live alone and in lower ADI areas (ADI ≤ Q2). Lastly, the Low Readmission group had the highest proportions of lower CCI score (83% with CCI < 4). Most patients in this group were most likely to live with another person, were least likely to have a history of depression, and none were covered by dual-eligible insurance.

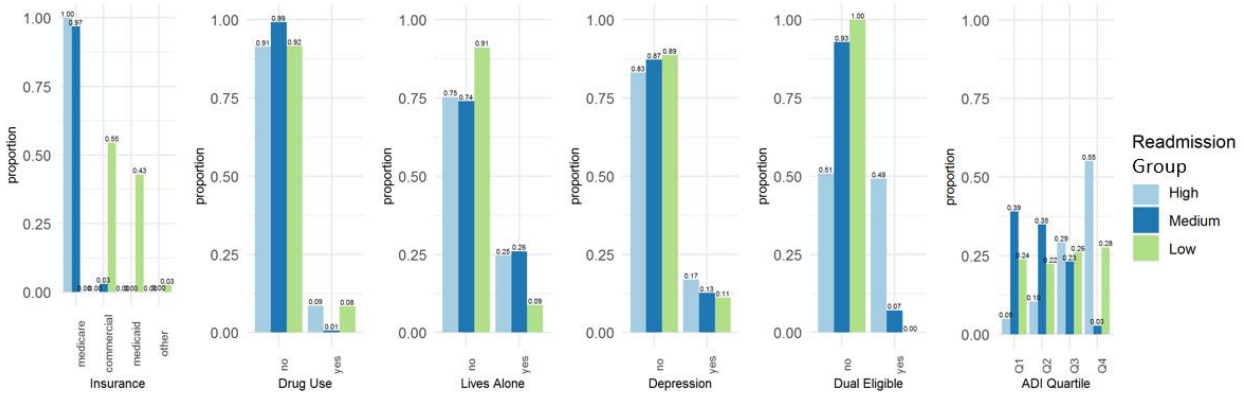

Figure 1. SHD proportions for three readmission groups
Note: ADI quartile groups Q1(ADI: 1-45), Q2 (46-69), Q3 (70-90), and Q4 (91-100).

Discussion

To study the synergistic effects of SDH and race-ethnicity on readmission, we have used multiple analytic methods, which have revealed different groups of individuals at high risk of readmission that were not evident based on single predictors alone. While all SDH were independently, significantly associated with increased risk of readmission, the effect of depression was highest for Hispanic/Latino patients. Further, LCA identified a group of patients with a high risk of readmission SDH profile that were also disproportionately African American. These results underscore the need to account for the context of race-ethnicity when evaluating the impact of SDH on hospital readmissions. Further, multiple modeling approaches are likely to reveal different aspects of these context dependent effects, resulting in a robust approach for the identification of subgroups of patients that would benefit from additional care/support following inpatient stays[1]. Our findings suggest that targeting these high-risk patients and providing care and resources (i.e. education) will be needed for reducing disparities[3].

Conclusion

Findings from this study demonstrate the complex interplay between SDH and race-ethnicity influencing 30-day readmission. Based on the identification of susceptible groups of patients, these results will be used to establish priorities for limited resources to reduce readmission. Future work will leverage insight obtained for this study combined with additional clinical and discharge features to develop comprehensive predictive models for 30-day readmission.

References

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