Socioeconomic Disparities in Infection-related Hospitalization among the U.S. Home Health Care Population: Insights from a National Study

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BACKGROUND

- Home health care (HHC) agencies provide skilled nursing care or therapy services to the elderly and acutely ill Medicare beneficiaries within the comfort of their homes.
- About 3.1 million Medicare beneficiaries receive HHC, and infections are a leading cause of hospitalization among HHC patients (based on the Outcome and Assessment Information Set data).
- However, limited evidence has focused on the relationship between the risk of infection and neighborhood socioeconomic status (SES).

- The Area Deprivation Index (ADI) offers a more comprehensive measure of neighborhood SES.
- Includes 17 different metrics (Fig. 1) to assess disadvantages at the neighborhood level based on a 9-digit zip.
- Each neighborhood (at the 9-digit zip code level) is assigned a score, ranked into percentiles (based on national scores) from 1 to 100.

  - 1st percentile ⟶ lowest deprivation
  - 100th percentile ⟶ highest deprivation

Area Deprivation Index (ADI)

Income	Median Family Income
	Income Disparity
	Percent of families below the poverty level
	Percent of population below 150% of the poverty threshold
Education	Percent of population age >= 25 years with < 9 years of education
	Percent of population age >= 25 years with < high school diploma
Employment	Percent of employed persons aged >= 16 years who are employed in white-collar occupations
	Percent of civilian labor force population aged >= 16 who are unemployed
Housing / Household	Percent of single-parent households with children age < 18 years
	Percent of households without a motor vehicle
	Median home value
	Median gross rent
	Median monthly mortgage
	Home ownership rate
	Percent of households without a telephone
	Percent of occupied housing units without complete plumbing
	Percent of households more than one person per room (crowding)

Fig. 1 The Area Deprivation Index (ADI) integrates 17 socioeconomic indicators.

RESEARCH OBJECTIVE

To Analyze the **association between neighborhood deprivation** and **infection-related hospitalization** of HHC patients prior to the pandemic.

STUDY DESIGN

- 2019 Outcome and Assessment Information Set (OASIS).
- 2019 Medicare Provider Analysis and Review file (MedPAR).
- 2019 Master Beneficiary Summary File (MBSF) & 2010 Rural-Urban Commuting Area (RUCA).
- 2019 Area Deprivation Index (ADI) & 2019 Area Health Resources File (AHRF).
- 60-day HHC episodes were defined from the OASIS and linked with hospitalization data (from MedPAR) within 60 days of HHC initiation.
- 3,656,734 Medicare beneficiaries from 8,135 HHC agencies.
- **Outcome** - Hospitalization due to infection was defined using MedPAR ICD-10 principal or admitting diagnosis codes present on admission.
- **Explanatory Variable** - Neighborhood deprivation measured by ADI -categorized into quintiles (Quintile 1= lowest deprived, Quintile 5= highest deprived)
- **Covariates** - Agency and patient level characteristics and county level health resources.

ACKNOWLEDGEMENTS

PRINCIPAL FINDINGS

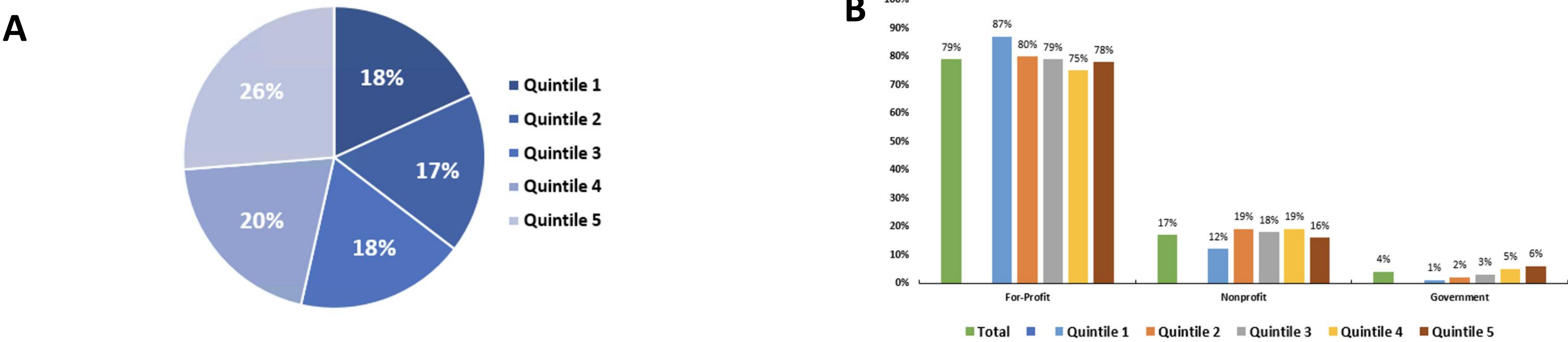### Agency (N = 8,135) Characteristics

Fig.2 Distribution of (A) HHC Agency (B) HHC Agency Ownership by ADI Quintile.

- Compared to patients living in the least deprived neighborhoods (Quintile 1), those living in the most deprived neighborhoods (Quintile 5) were more likely to obtain HHC services from non-profit or government agencies.
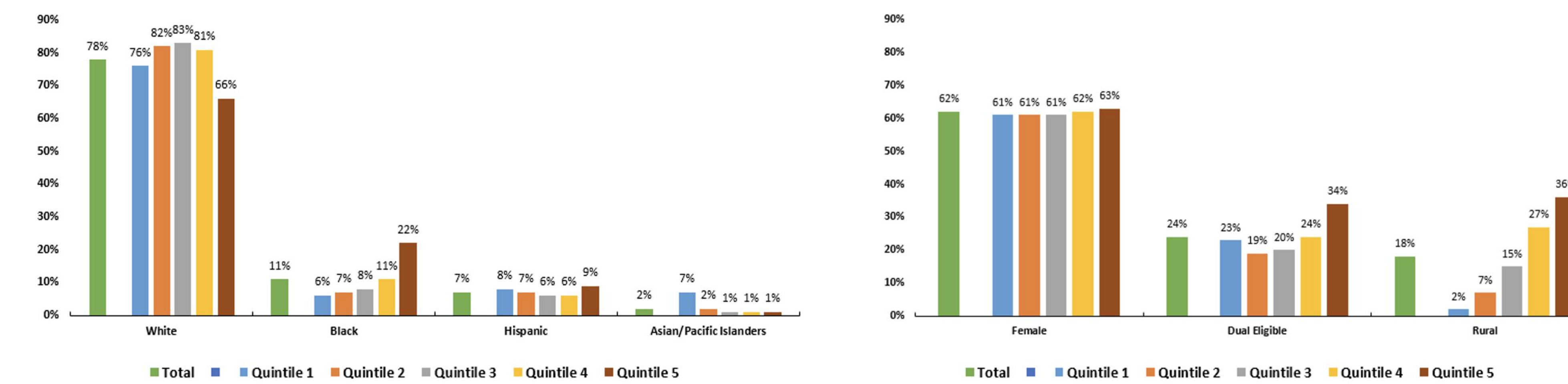
Patient Characteristics

Fig. 3 Patient-level characteristics across the Area Deprivation Index (ADI).

- Overall, most of HHC patients were White (78%) and had an average age of 80. More than half were female (62%), and 18% resided in rural areas. About 24% of patients were eligible for both Medicare and Medicaid.
- Compared to patients living in the least deprived neighborhoods (Quintile 1), those living in the most deprived neighborhoods (Quintile 5) were less likely to be White or Asian and more likely to be Black, have dual eligibility, and live in rural areas.

County-Level Health Resources

	Overall	Area Deprivation Index (ADI) Quintile				
		Quintile 1 (1-21%)	Quintile 2 (22-39%)	Quintile 3 (40-57%)	Quintile 4 (58-77%)	Quintile 5 (78-100%)
No. of Hospital Beds						
Zero	3.72	1.91	1.91	3.33	5.18	7.59
>0-512	32.08	9.80	24.58	35.38	44.54	45.58
513-2,473	31.93	31.08	39.48	35.33	28.54	25.61
>2,473	32.26	58.66	34.04	25.96	21.74	21.22
No. of PCPs (%)						
Zero	0.31	0.02	0.04	0.12	0.41	0.94
>0-123	33.32	5.18	19.91	35.75	49.79	55.07
124-740	33.12	27.01	42.86	39.02	30.72	26.45
>740	33.25	67.79	37.19	25.11	19.08	17.54
No. of HHAs (%)						
Zero	8.74	1.51	4.90	8.74	13.00	15.27
>0 to 4	29.83	14.89	24.90	32.00	38.46	38.54
5 to 23	30.87	34.98	35.96	32.67	26.99	24.06
>23	30.56	48.61	34.24	26.58	21.56	22.12

Table 1 County level characteristics across the Area Deprivation Index (ADI).

- Compared to patients living in the least deprived neighborhoods (Quintile 1), those living in the most deprived neighborhoods (Quintile 5) tended to reside in areas with fewer hospital beds, fewer Primary Care Physicians, and HHC agencies (as highlighted in Table 1).

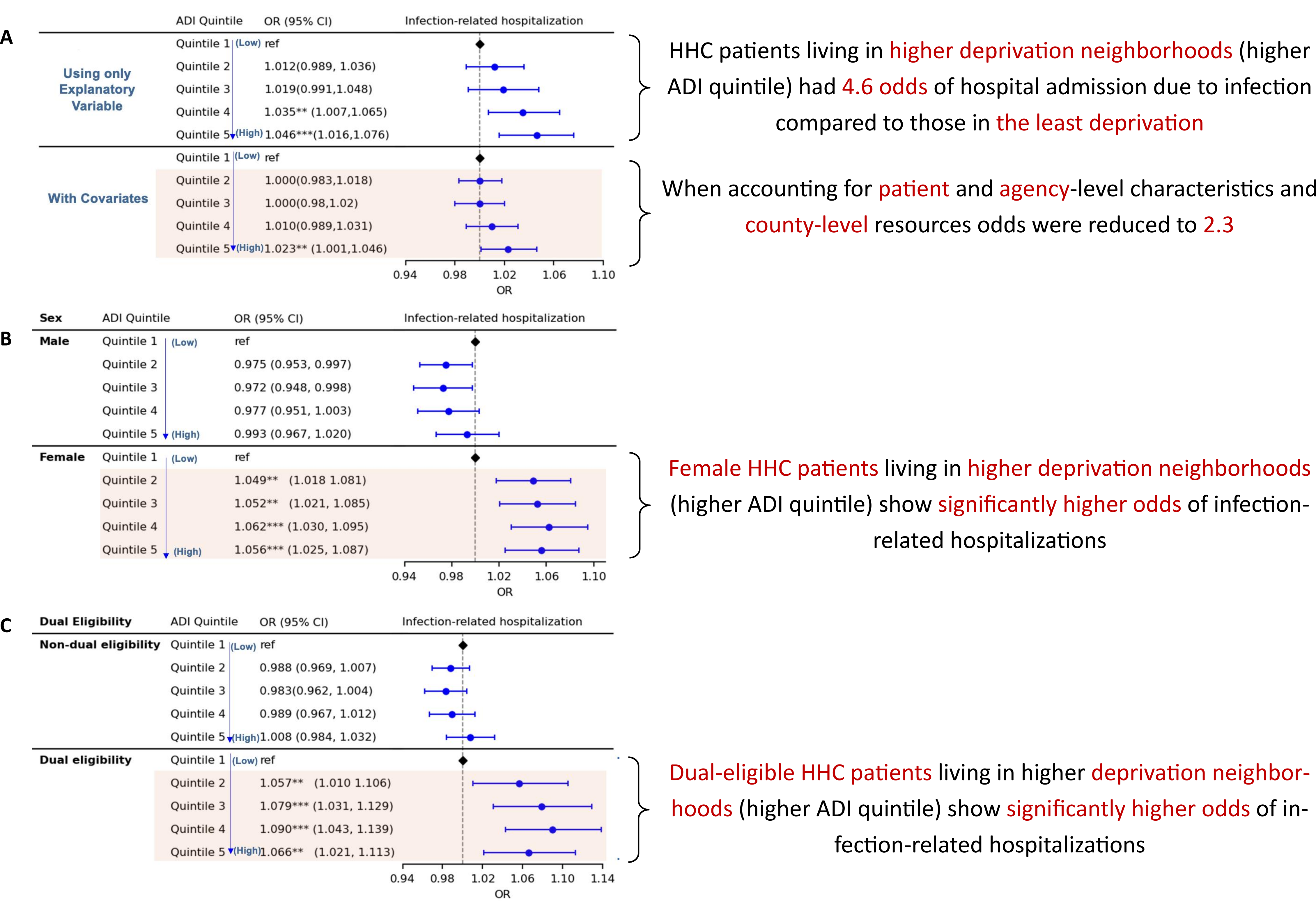### Multivariable Logistic Regression Models

Fig. 4 Odds Ratio (OR) of infection-related hospitalization for quintiles of ADI by (A) Unadjusted and Adjusted, (B) ADI and Sex interaction, (C) ADI and Dual Eligibility interaction. CI: Confidence Interval. Quintile 1 is the least deprived (reference), and Quintile 5 is the most deprived. *** p<0.01,**p<0.05,*p<0.1

- HHC patients living in **higher deprivation neighborhoods** (higher ADI quintile) had **4.6 odds** of hospital admission due to infection compared to those in **the least deprivation**
- When accounting for **patient** and **agency**-level characteristics and **county-level** resources odds were reduced to **2.3**
- **Female HHC patients** living in **higher deprivation neighborhoods** (higher ADI quintile) show **significantly higher odds** of infection-related hospitalizations
- **Dual-eligible HHC patients** living in higher **deprivation neighborhoods** (higher ADI quintile) show **significantly higher odds** of infection-related hospitalizations

CONCLUSIONS

- ♦ **Residing in the most socioeconomically disadvantaged neighborhoods is associated with an increased risk of infection-related hospitalizations.**
- ♦ **Sex and dual eligibility for Medicare and Medicaid interact with neighborhood deprivation, revealing that females and dual-eligible individuals in socioeconomically disadvantaged areas are particularly at risk for infec-**

IMPLICATIONS FOR POLICY AND PRACTICE

Our results emphasize the pressing need to address healthcare disparities within vulnerable populations and provide valuable insights for implementing focused interventions to improve infection prevention and control in HHC.

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