# Supplemental Online Content

Canterberry M, Figueroa JF, Long CL, et al. Association between self-reported health-related social needs and acute care utilization among older adults enrolled in Medicare Advantage. *JAMA Health Forum*. 2022;3(7):e221874. doi:10.1001/jamahealthforum.2022.1874



This supplemental material has been provided by the authors to give readers additional information about their work.

**eMethods.** Supplemental Methods

Health Related Social Needs (HRSN) Screening Instrument

Adapted from the Center for Medicare and Medicaid Services (CMS) Accountable Health Communities (AHC) HRSNs Screening Tool.[6,7] Underlined answers indicate a positive response/need. For Poor Housing Quality, the selection "all of the above" was added to the digital response channels to increase ease of responding and is not part of the standard tool.

| Domain/Question | Responses |
|---|---|
| **Financial Strain** | |
| How hard is it for you to pay for the very basics like food, housing, medical care, and heating? Would you say it is: | Not hard at all |
| | Somewhat hard |
| | Very hard |
| | No response |
| **Food Insecurity** | |
| Some people have made the following statements about their food situation. Please answer whether the statements were OFTEN, SOMETIMES, or NEVER true for you and your household in the last 12 months.<br><br>Within the past 12 months, you worried that your food would run out before you got money to buy more.<br><br>Within the past 12 months, the food you bought just didn't last and you didn't have money to get more. | Never true |
| | Sometimes true (1 of 2 questions) |
| | Sometimes true (both questions) |
| | Sometimes or Often true (both questions) |
| | Often true (both questions) |
| | No response |
| **Loneliness or Social Isolation** | |
| How often do you feel lonely or isolated from those around you? | Never |
| | Rarely |
| | Sometimes |
| | Often |
| | Always |
| | No response |
| **Housing Insecurity** | |
| What is your living situation today? | I have a steady place to live |
| | I have a place to live but I am worried about losing it in the future |

| | |
|---|---|
| | I do not have a steady place to live |
| | No response |
| **Poor Housing Quality** | |
| Think about the place you live. Do you have problems with any of the following? CHOOSE ALL THAT APPLY. | |
| | Pests such as bugs, ants, or mice |
| | Mold |
| | Lead paint or pipes |
| | Lack of heat |
| | Oven or stove not working |
| | Smoke detectors missing or not working |
| | Water leaks |
| | None of the above |
| | All of the above |
| | No response |
| **Utility Insecurity** | |
| In the past 12 months has the electric, gas, oil, or water company threatened to shut off services in your home? | |
| | No |
| | Yes |
| | Already shut-off |
| | No response |
| **Unreliable Transportation** | |
| In the past 12 months, has a lack of reliable transportation kept you from medical appointments, meetings, work or from getting things needed for daily living? | |
| | No |
| | Yes |
| | No response |

## Additional Information on Survey Administration

Adult, non-institutionalized, enrollees in an individual Medicare Advantage plan offered by Humana Inc. on October 1, 2019 were eligible for outreach. Eligible individuals were sampled at the household level. Among households with two or three eligible individuals, only one was randomly selected for participation. Outreach to eligible individuals occurred over a rolling period, with a maximum of eight contact attempts per individual, and was accomplished using interactive voice response (IVR) phone call, text messaging and email, based on the availability of valid contact information within each channel. Survey completion by channel was as follows: IVR (66%), Text (30%), and email (4%). The survey was administered in English and Spanish. Multi-answer questions were converted to distinct questions for better clarity over IVR.

Measures of Avoidable Utilization

Avoidable hospital stays were defined using the Agency for Healthcare Research and Quality (AHRQ) Prevention Quality Indicators (PQI).[19] A hospital stay is considered potentially avoidable based on presence of discharge ICD-10 diagnosis codes and meeting AHRQ criteria for each condition category. Our analysis includes the sum of PQI 90, the overall composite measure. PQI 90 includes chronic and acute causes of hospital stays related to diabetes, chronic obstructive pulmonary disease or asthma, hypertension, congestive heart failure, community acquired pneumonia, and urinary tract infections.

Avoidable ED were defined using the New York University Emergency Department (ED) visit algorithm, and subsequent algorithm "patch," which, using primary diagnosis ICD-10 codes, assigns ED visits a probability (0.0-1.0) of falling into each of the following four categories: 1) non-emergent; 2) emergent and primary care treatable (treatment required within 12 hours but could have been provided in primary care setting); 3) emergent, ED care needed, and avoidable (ED care required but emergent nature of the condition was preventable if timely ambulatory care had been received); and 4) emergent, ED care needed, and unavoidable.[20,21]We considered an ED visit to be avoidable if they fell into categories 1, 2, or 3, and to improve the specificity of classification, required that the summed probabilities across those three categories be 0.75 or greater to be considered avoidable.[22,34]

**eTable 1.** Comparison of Survey Respondents and Non-Respondents, and Survey Completers and Non-Completers

| | Survey Responders | Survey Non-Responders | SMD | Survey Completers | Survey Non-Completers | SMD |
|---|---|---|---|---|---|---|
| **N** | 105,901 | 325,575 | | 79,848 | 26,053 | |
| **Age, mean (SD)[a]** | 71.05 (9.31) | 70.38 (10.54) | .07 | 70.83 (9.18) | 71.74 (9.66) | .10 |
| **Female Sex, n (%)[b]** | 61,011 (58.0%) | 175,640 (55.1%) | .06 | 46,350 (58.4%) | 14,661 (56.9%) | .06 |
| **Race, n (%)** | | | | | | |
| Black | 18,690 (17.6%) | 51,610 (15.9%) | .05 | 13,853 (17.3%) | 4,837 (18.6%) | .03 |
| White | 76,164 (71.9%) | 230,963 (70.9%) | .02 | 57,970 (72.6%) | 18,194 (69.8%) | .06 |
| Other | 4,384 (4.1%) | 20,581 (6.3%) | .10 | 3,017 (3.8%) | 1,367 (5.2%) | .07 |
| Unknown | 6,663 (6.3%) | 22,421 (6.9%) | .02 | 5,008 (6.3%) | 1,655 (6.4%) | .00 |
| **Geographic region, n (%)** | | | | | | |
| Northeast | 3,605 (3.4%) | 11,754 (3.6%) | .01 | 2,675 (3.4%) | 930 (3.6%) | .01 |
| Midwest | 23,064 (21.8%) | 65,906 (20.2%) | .04 | 17,690 (22.2%) | 5,374 (20.6%) | .04 |
| South | 64,786 (61.2%) | 198,774 (61.1%) | .00 | 48,587 (60.8%) | 16,199 (62.2%) | .03 |
| West | 13,355 (12.6%) | 40,690 (12.5%) | .00 | 10,211 (12.8%) | 3,144 (12.1%) | .02 |
| **Population Density, n (%)** | | | | | | |
| Urban | 64,634 (61.0%) | 199,597 (61.3%) | .01 | 48,760 (61.1%) | 15,874 (60.9%) | .00 |
| Suburban | 26,237 (24.8%) | 77,068 (23.7%) | .03 | 19,845 (24.9%) | 6,392 (24.5%) | .01 |
| Rural | 11,752 (11.1%) | 33,745 (10.4%) | .02 | 8,895 (11.1%) | 2,857 (11.0%) | .01 |
| Unknown | 1,194 (1.1%) | 4,633 (1.4%) | .03 | 852 (1.1%) | 342 (1.3%) | .02 |
| **Dual Medicare and Medicaid Eligible, n (%)** | 22,333 (21.1%) | 71,356 (21.9%) | .02 | 16,425 (20.6%) | 5,908 (22.7%) | .05 |
| **Elixhauser Comorbidity Index, mean (SD)** | 2.97 (2.69) | 2.76 (2.78) | .08 | 2.93 (2.65) | 3.09 (2.79) | .06 |

[a]Among the (non)responder groups age was missing for 7,413 individuals, and among the (non)completer groups age was missing for 783 individuals; thus excluded from the mean.

[b]Among the (non)responder groups gender was missing for 7,403 individuals, and among the (non)completer groups age was missing for 782 individuals; thus the percent calculation did not use the total N.

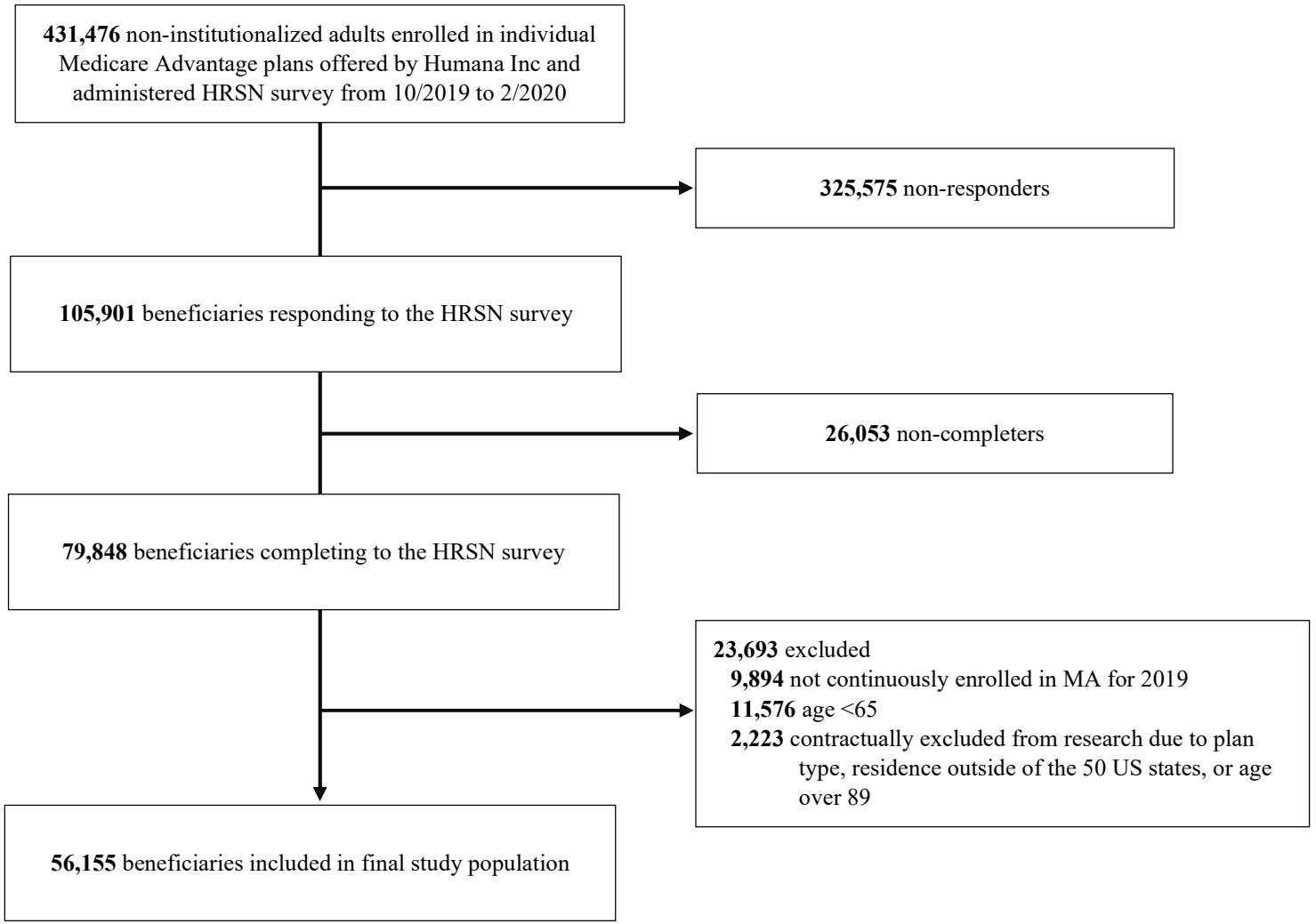
NOTE: Since the intent of these comparisons is to make inferences on the validity, reliability, and generalizability of responses to the survey itself, these data are reflective of the total population surveyed (n=431,476) before the application of research exclusions. As a result, the population of survey completers (n=79,848) is larger than the study population. When research exclusions are applied, the results are similar (SMDs all less than .12).

**eTable 2.** Correlation between Individual Health-Related Social Needs

The table below presents Phi coefficients among individual HRSNs, and for individual HRSNs and dual eligibility, for participants included in the final study population. Correlation coefficients greater than 0.7 were considered to represent strong correlations.

| | Dual Eligibility | Food Insecurity | Financial Strain | Loneliness | Unreliable Transportation | Utility Insecurity | Housing Insecurity | Poor Housing Quality |
|---|---|---|---|---|---|---|---|---|
| Dual Eligibility | -- | | | | | | | |
| Food Insecurity | .26 | -- | | | | | | |
| Financial Strain | .22 | .50 | -- | | | | | |
| Loneliness | .08 | .19 | .17 | -- | | | | |
| Unreliable Transportation | .16 | .27 | .23 | .18 | -- | | | |
| Utility Insecurity | .06 | .14 | .12 | .07 | .11 | -- | | |
| Housing Insecurity | .10 | .20 | .17 | .14 | .15 | .09 | -- | |
| Poor Housing Quality | .14 | .24 | .23 | .14 | .18 | .12 | .13 | -- |

**eFigure.** Participant Flow Through the Study



**eTable 3.** Complete Regression Results*

Any HRSNs and All-Cause Hospital Stays

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .003 | .08 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.046 | .03 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.196 | <.001 |
| Other | -.128 | .04 |
| Unknown | -.008 | .94 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .054 | .05 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .065 | .01 |
| **Elixhauser Comorbidity Index** | .344 | <.001 |
| **Any HRSN** | | |
| No (ref) | -- | |
| Yes | .102 | <.001 |

Any HRSNs and Avoidable Hospital Stays

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .016 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.102 | .08 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.022 | .78 |
| Other | -.183 | .32 |
| Unknown | -.585 | .15 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .394 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .226 | .001 |
| **Elixhauser Comorbidity Index** | .441 | <.001 |
| **Any HRSN** | | |
| No (ref) | -- | |
| Yes | .427 | <.001 |

Any HRSNs and All-Cause ED Visits

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .015 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | .086 | <.001 |
| **Race** | | |
| White (ref) | -- | |
| Black | .081 | .002 |
| Other | -.054 | .30 |
| Unknown | -.079 | .38 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .286 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .310 | <.001 |
| **Elixhauser Comorbidity Index** | .204 | <.001 |
| **Any HRSN** | | |
| No (ref) | -- | |
| Yes | .223 | <.001 |

Any HRSNs and Avoidable ED Visits

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .015 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | .161 | <.001 |
| **Race** | | |
| White (ref) | -- | |
| Black | .228 | <.001 |
| Other | .013 | .86 |
| Unknown | .023 | .86 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .349 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .333 | <.001 |
| **Elixhauser Comorbidity Index** | .201 | <.001 |
| **Any HRSN** | | |
| No (ref) | -- | |
| Yes | .278 | <.001 |

Any HRSNs and Readmissions

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | -.019 | .02 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.234 | .01 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.325 | .01 |
| Other | -.309 | .30 |
| Unknown | -.063 | .90 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .032 | .78 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | -.095 | .39 |
| **Elixhauser Comorbidity Index** | .536 | <.001 |
| **Any HRSN** | | |
| No (ref) | -- | |
| Yes | .184 | .06 |

HRSN Burden and All-Cause Hospital Stays

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .004 | .03 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.050 | .01 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.204 | <.001 |
| Other | -.138 | .02 |
| Unknown | -.007 | .95 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .030 | .27 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .054 | .04 |
| **Elixhauser Comorbidity Index** | .343 | <.001 |
| **HRSN Burden** | | |
| 0 (ref) | -- | |
| 1 | .023 | .37 |
| 2 | .163 | <.001 |
| 3 | .166 | <.001 |
| 4 | .200 | <.001 |
| 5+ | .272 | <.001 |

HRSN Burden and Avoidable Hospital Stays

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .017 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.106 | .07 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.035 | .66 |
| Other | -198 | .29 |
| Unknown | -596 | .14 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .313 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .210 | .003 |
| **Elixhauser Comorbidity Index** | .439 | <.001 |
| **HRSN Burden** | | |
| 0 (ref) | -- | |
| 1 | .303 | <.001 |
| 2 | .519 | <.001 |
| 3 | .451 | <.001 |
| 4 | .599 | <.001 |
| 5+ | .749 | <.001 |

HRSN Burden and All-Cause ED Visits

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .016 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | .081 | <.001 |
| **Race** | | |
| White (ref) | -- | |
| Black | .069 | .007 |
| Other | -.064 | .22 |
| Unknown | -.073 | .42 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .244 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .290 | <.001 |
| **Elixhauser Comorbidity Index** | .202 | <.001 |
| **HRSN Burden** | | |
| 0 (ref) | -- | |
| 1 | .122 | <.001 |
| 2 | .246 | <.001 |
| 3 | .332 | <.001 |
| 4 | .443 | <.001 |
| 5+ | .582 | <.001 |

HRSN Burden and Avoidable ED Visits

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .017 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | .155 | <.001 |
| **Race** | | |
| White (ref) | -- | |
| Black | .215 | <.001 |
| Other | .005 | .94 |
| Unknown | .026 | .84 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .307 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .312 | <.001 |
| **Elixhauser Comorbidity Index** | .199 | <.001 |
| **HRSN Burden** | | |
| 0 (ref) | -- | |
| 1 | .160 | <.001 |
| 2 | .322 | <.001 |
| 3 | .398 | <.001 |
| 4 | .503 | <.001 |
| 5+ | .575 | <.001 |

HRSN Burden and Readmissions

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | -.019 | .03 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.237 | .01 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.337 | .01 |
| Other | -.331 | .27 |
| Unknown | -.064 | .89 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .012 | .92 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | -.106 | .34 |
| **Elixhauser Comorbidity Index** | .535 | <.001 |
| **HRSN Burden** | | |
| 0 (ref) | -- | |
| 1 | .067 | .58 |
| 2 | .339 | .01 |
| 3 | .209 | .19 |
| 4 | .194 | .36 |
| 5+ | .288 | .23 |

Individual HRSNs and All-Cause Hospital Stays

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .004 | .01 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.053 | .01 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.197 | <.001 |
| Other | -.136 | .03 |
| Unknown | -.002 | .98 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .025 | .37 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .051 | .05 |
| **Elixhauser Comorbidity Index** | .342 | <.001 |
| **Food Insecurity** | | |
| No (ref) | -- | |
| Yes | .046 | .11 |
| **Financial Strain** | | |
| No (ref) | -- | |
| Yes | .102 | <.001 |
| **Loneliness** | | |
| No (ref) | -- | |
| Yes | .027 | .50 |
| **Unreliable Transportation** | | |
| No (ref) | -- | |
| Yes | .185 | <.001 |
| **Utility Insecurity** | | |
| No (ref) | -- | |
| Yes | -.025 | .45 |
| **Housing Insecurity** | | |
| No (ref) | -- | |
| Yes | .065 | .11 |
| **Poor Housing Quality** | | |
| No (ref) | -- | |
| Yes | -.028 | .28 |

Individual HRSNs and Avoidable Hospital Stays

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .019 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.107 | .07 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.021 | .79 |
| Other | -.183 | .32 |
| Unknown | -.551 | .17 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .313 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .219 | .002 |
| **Elixhauser Comorbidity Index** | .439 | <.001 |
| **Food Insecurity** | | |
| No (ref) | -- | |
| Yes | .050 | .51 |
| **Financial Strain** | | |
| No (ref) | -- | |
| Yes | .368 | <.001 |
| **Loneliness** | | |
| No (ref) | -- | |
| Yes | .045 | .68 |
| **Unreliable Transportation** | | |
| No (ref) | -- | |
| Yes | .248 | .01 |
| **Utility Insecurity** | | |
| No (ref) | -- | |
| Yes | -.009 | .92 |
| **Housing Insecurity** | | |
| No (ref) | -- | |
| Yes | .090 | .40 |
| **Poor Housing Quality** | | |
| No (ref) | -- | |
| Yes | .039 | .59 |

Individual HRSNs and All-Cause ED Visits

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .017 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | .081 | <.001 |
| **Race** | | |
| White (ref) | -- | |
| Black | .080 | .002 |
| Other | -.064 | .22 |
| Unknown | -.070 | .44 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .238 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .288 | <.001 |
| **Elixhauser Comorbidity Index** | .202 | <.001 |
| **Food Insecurity** | | |
| No (ref) | -- | |
| Yes | .125 | <.001 |
| **Financial Strain** | | |
| No (ref) | -- | |
| Yes | .095 | <.001 |
| **Loneliness** | | |
| No (ref) | -- | |
| Yes | .189 | <.001 |
| **Unreliable Transportation** | | |
| No (ref) | -- | |
| Yes | .222 | <.001 |
| **Utility Insecurity** | | |
| No (ref) | -- | |
| Yes | .029 | .33 |
| **Housing Insecurity** | | |
| No (ref) | -- | |
| Yes | .108 | .003 |
| **Poor Housing Quality** | | |
| No (ref) | -- | |
| Yes | .051 | .03 |

Individual HRSNs and Avoidable ED Visits

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | .017 | <.001 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | .155 | <.001 |
| **Race** | | |
| White (ref) | -- | |
| Black | .229 | <.001 |
| Other | .010 | .90 |
| Unknown | .031 | .81 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | .308 | <.001 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | .310 | <.001 |
| **Elixhauser Comorbidity Index** | .199 | <.001 |
| **Food Insecurity** | | |
| No (ref) | -- | |
| Yes | .131 | <.001 |
| **Financial Strain** | | |
| No (ref) | -- | |
| Yes | .119 | <.001 |
| **Loneliness** | | |
| No (ref) | -- | |
| Yes | .257 | <.001 |
| **Unreliable Transportation** | | |
| No (ref) | -- | |
| Yes | .162 | <.001 |
| **Utility Insecurity** | | |
| No (ref) | -- | |
| Yes | .038 | .37 |
| **Housing Insecurity** | | |
| No (ref) | -- | |
| Yes | .045 | .39 |
| **Poor Housing Quality** | | |
| No (ref) | -- | |
| Yes | .108 | .001 |

Individual HRSNs and Readmissions

| Dependent Variable | Coefficient | P-value |
|---|---|---|
| **Age** | -.015 | .08 |
| **Sex** | | |
| Male (ref) | -- | |
| Female | -.252 | .007 |
| **Race** | | |
| White (ref) | -- | |
| Black | -.318 | .02 |
| Other | -.336 | .26 |
| Unknown | -.005 | .99 |
| **Dual Medicare and Medicaid Eligible** | | |
| No (ref) | -- | |
| Yes | -.008 | .94 |
| **Social Security Disability Eligible** | | |
| No (ref) | -- | |
| Yes | -.112 | .31 |
| **Elixhauser Comorbidity Index** | .535 | <.001 |
| **Food Insecurity** | | |
| No (ref) | -- | |
| Yes | .006 | .96 |
| **Financial Strain** | | |
| No (ref) | -- | |
| Yes | .367 | <.001 |
| **Loneliness** | | |
| No (ref) | -- | |
| Yes | -.163 | .35 |
| **Unreliable Transportation** | | |
| No (ref) | -- | |
| Yes | .434 | .002 |
| **Utility Insecurity** | | |
| No (ref) | -- | |
| Yes | -.320 | .04 |
| **Housing Insecurity** | | |
| No (ref) | -- | |
| Yes | .034 | .85 |
| **Poor Housing Quality** | | |
| No (ref) | -- | |
| Yes | -.225 | .06 |

*All regression also included hospital referral region (HRR) fixed effects. The coefficients for each HRR are not shown.

**eTable 4.** Association between Individual Health-Related Social Needs and Rates of Hospital Stays and ED Visits, with Each HRSN Modeled Independently

| | **Marginal Effect[a] of HRSN on Rates of Utilization** per 1,000 Beneficiaries (95% CI) | | | |
|---|---|---|---|---|
| | **All-Cause Hospital Stays[a]** | **Avoidable[b] Hospital Stays** | **All-Cause ED Visits** | **Avoidable[c] ED Visits** |
| **Food Insecurity** | 35.3* (21.9-48.7) | 12.9* (6.8-18.9) | 107.4* (87.5-127.4) | 45.5* (34.4-56.6) |
| **Financial Strain** | 37.1* (26.1-48.1) | 17.4* (12.5-22.2) | 80.5* (64.9-96.0) | 36.3* (27.5-45.1) |
| **Loneliness** | 27.8* (6.3-49.2) | 9.6 (-0.0-19.2) | 144.6* (108.1-181.2) | 70.3* (49.4-91.3) |
| **Unreliable Transportation** | 66.6* (46.2-86.9) | 18.5* (9.3-27.7) | 158.4* (126.3-190.4) | 54.7* (37.6-71.7) |
| **Utility Insecurity** | 4.3 (-12.5-21.1) | 3.7 (-3.7-11.1) | 46.0* (21.1-70.8) | 21.0* (6.9-35.0) |
| **Housing Insecurity** | 35.0* (12.9-57.0) | 10.7* (0.8-20.7) | 106.5* (72.7-140.2) | 33.2* (15.1-51.4) |
| **Poor Housing Quality** | 7.3 (-5.6-20.2) | 6.8* (1.0-12.6) | 60.3* (41.3-79.3) | 33.5* (22.7-44.3) |

[a]Calculated from negative binomial regression model estimating the association between individual HRSNs and utilization measures. Models adjust for age, sex, race, disability, dual-eligibility, and Elixhauser comorbidity index, with HRR fixed effects. The reference group for all marginal effects is beneficiaries not reporting that specific HRSN.
[b]Hospital stays are an aggregate of inpatient admissions and observation stays.
[c]Avoidable hospital stays were defined using the Agency of Healthcare Research and Quality (AHRQ) Prevention Quality Indicators (PQI) definition.[19]
[d]Avoidable ED were defined using the New York University Emergency Department (ED) visit algorithm, and subsequent algorithm "patch."[20,21]
*Indicates statistical significance at the $P<.05$ level