BRIEF REPORT

Clusters of Health-Related Social Needs Among Adult Primary Care Patients

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Introduction: **Patients frequently report multiple health-related social needs (HRSNs) at the same time. This study aimed to identify clusters of co-occurring HRSNs in an adult primary care population.**

Methods: **We surveyed 1252 adult (>=18) primary care patients in Indianapolis, IN. Subjects completed surveys in person at 1 of 3 sites operated by 2 different health systems. Data collection was offered in both English and Spanish. Surveys comprised previously published and validated instruments covering housing instability, financial strain, food insecurity, transportation barriers, unemployment, and legal problems.**

Results: **We identified 4 underlying clusters of HRSNs within the patient population using Complete-Linkage Agglomerative Hierarchical Clustering: "low HRSNs" (38.6%), "high HRSNs" (29.6%), "housing dominant" (23.2%), and "food dominant" (8.6%). The high HRSNs cluster had higher average comorbidity scores ($P < .001$), number of inpatient admissions ($P = .004$), number of ED visits ($P < .001$), and number of primary care visits ($P < .001$).**

Discussion: **As health care organizations increasingly focus on HRSNs as an approach to reducing costs and improving health of patients, these findings indicate that organizational strategies and actions should consider the interrelated and co-occurring nature of HRSNs. To support a large number of patients, strategies should support multiple HRSNs. (J Am Board Fam Med 2025;0:000–000.)**

Keywords: **Cluster Analysis, Health Policy, Primary Health Care, Public Health, Screening, Social Care, Social Determinants of Health, Surveys and Questionnaires**

Introduction

Health-related social needs (HRSNs) encompass patients' individual-level nonclinical and contextual factors that drive overall health and wellbeing.[1] HRSN screening is of growing importance to clinical practice. The Centers for Medicare & Medicaid Services recently introduced HRSN screening as a quality reporting metric for the outpatient setting as a Merit-based Incentive Payment System (MIPS) Clinical Quality Measure.[2] In addition, HRSN screening is supported by numerous professional organizations[3] and HRSN screening is also a National Committee on Quality Assurance (NCQA) Health Care Effectiveness Data and Information Set (HEDIS) quality measure.[4]

The purpose of HRSN screening is to identify patients in need of social services, and often, referrals to social service organizations and professionals.[5] However, patients frequently report multiple HRSNs at the same time.[6] This can complicate service delivery: multiple interventions and resources must be marshaled and prioritized[7] and some HRSNs inhibit interventions that address other needs (eg, transportation prevents getting to food banks; incarceration history may affect housing opportunities, etc.).[8,9] Nevertheless, if co-occurring and related HRSNs could be identified, health care clinician and organizations would be better positioned to design and offer comprehensive services to

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patients facing multiple needs. Health care clinician could create personally tailored treatment plans taking multiple HRSNs into consideration simultaneously and streamline referrals to connect patients to meaningful and prioritized resources more efficiently. Further, commonly co-occurring HRSNs could be addressed preventatively, even if not all factors in a cluster are currently endorsed by the patient. Interventions targeting patients with multiple HRSNs may be the most effective and efficient path to overall population health improvement.[8] The objective of this study was to identify clusters of co-occurring HRSNs in an adult primary care population.

Methods

We surveyed 1252 adult (>=18) primary care patients in Indianapolis, IN between January 2022 and June 2023. Subjects completed surveys in person at 1 of 3 sites. Two of the sites were primary care practices operated by a multi-hospital, integrated delivery system. The third site was an FQHC operated by a different health system. All 3 sites were located in downtown, Indianapolis. Data collection was offered in both English and Spanish.

Surveys were comprised of previously published and validated instruments covering housing instability,[10] financial strain (Consumer Financial Protection Bureau's Financial Well-Being Scale),[11] food insecurity (US Department of Agriculture's 6-Item Short Form of the Food Security Survey),[12] transportation barriers,[13] unemployment,[14] and legal problems (2 items related to current situation and seriousness of concerns from the legal section of the Addiction Severity Index).[15] Binary indicators for the presence of each HRSN were calculated following the respective developers' recommendations. As part of the surveys, subjects self-reported race and ethnicity, presence of children in the household, and educational attainment. We linked survey responses via patient identifiers to each health system's respective EHR system. From the EHR sources, we extracted patient gender and counts of health care encounters in the past 12 months and used the data to calculate Elixhauser comorbidity index scores.[16]

We identified underlying clusters of HRSNs using Complete-Linkage Agglomerative Hierarchical Clustering. The method begins by treating each observation as its own cluster and then combines clusters with the smallest maximum distance between observations in the clusters to form larger clusters.[17] The optimal number of clusters was identified using scree plots, average Silhouette width, Dunn Index values, and interpretability and sizes of clusters. All analyses were conducted in R using the "cluster" package.[18] We created labels for each identified cluster based on the distribution of the 6 measured HRSNs within the clusters. We compared demographic and utilization variables across clusters using χ^2 tests for frequencies and one-way ANOVAs for continuous measures. The study was approved by the Indiana University Institutional Review Board, and written informed consent was obtained from all subjects.

Results

HRSNs were common among the sample: 42.6% reported housing instability; 43.1% reported food insecurity; 36.1% reported financial strain; 30.3% reported transportation barriers; and 12.9% reported legal problems. Consistent with an urban, primary care setting, patients were predominantly female, from underrepresented race and ethnicity populations, and averaged 48 years old (Table 1).

We identified 4 clusters within the patient population (Figure 1). The largest cluster (n = 483; 38.6%) was characterized by no, or infrequently, reported HRSNs. We labeled this cluster as "low HRSNs" as all HRSNs were not completely absent, just infrequent. The next largest cluster (n = 370; 29.6%), "high HRSNs," was marked by frequent, and co-occurring, reporting of multiple HRSNs (Table 1). The "high HRSNs" cluster had the highest proportions of transportation barriers (100%), financial strain (57.0%), unemployment (27.8%), and legal problems (20.3%). Food insecurity (74.9%) and housing instability (66.8%) were also reported by the majority of patients in this cluster. The "housing dominant" cluster (n = 291; 23.2%) was identified by nearly all members reporting housing instability (98.3%). Financial strain (47.4%) and food insecurity (53.3%) were also common in this cluster, but other needs were much less common. The last cluster, "food dominant" (n = 108; 8.6%), was marked by all members reporting food insecurity along with a high proportion with financial strain (52.8%). Other needs were less common.

The clusters exhibited some notable variation (Table 1). For example, the average comorbidity index scores ($P < .001$), prior 12-month inpatient admissions ($P = .004$), and prior 12-month count of emergency department visits ($P < .001$) were

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Table 1. Demographics, Utilization, and Health-Related Social Need Presence of Adult Primary Care Patients, Indiana

	Total		Cluster 1 High HRSNs		Cluster 2 Housing dominant		Cluster 3 Food dominant		Cluster 4 Low HRSNs		
	n = 1252		n = 370		n = 291		n = 108		n = 483		
Demographics	n	%	n	%	n	%	n	%	n	%	p
Gender											
Woman	821	65.58	255	68.92	186	63.92	70	64.81	310	64.18	0.452
Race/ethnicity											
Asian	25	2.00	4	1.08	6	2.06	0	0.00	15	3.11	0.002
Black, non-Hispanic	602	48.08	196	52.97	153	52.58	55	50.93	198	40.99	
Hispanic	94	7.51	23	6.22	25	8.59	12	11.11	34	7.04	
White, non-Hispanic	442	35.30	118	31.89	84	28.87	31	28.70	209	43.27	
Multiple	29	2.32	9	2.43	9	3.09	3	2.78	8	1.66	
Other/unknown	60	4.79	20	5.41	14	4.81	7	6.48	19	3.93	
Age (mean, sd)	48.10	16.89	47.80	16.53	45.84	16.00	47.42	14.72	49.83	17.96	0.014
Children (<18) in household	476	38.02	138	37.30	120	41.24	47	43.52	171	35.40	0.246
Preferred language not English	291	23.24	68	18.38	82	28.18	26	24.07	115	23.81	0.029
Education < high school equivalent	124	9.90	60	16.22	27	9.28	15	13.89	22	4.55	<0.001
Utilization[1]											
Inpatient admissions (mean, sd)	0.15	0.68	0.27	1.08	0.10	0.42	0.11	0.39	0.09	0.38	0.004
ED visits (mean, sd)	0.63	1.43	1.09	1.95	0.57	1.28	0.53	0.93	0.33	0.98	<0.001
Primary care visits (mean, sd)	4.98	4.41	5.90	5.16	4.97	4.46	4.93	4.38	4.29	3.56	<0.001
Elixhauser comorbidity index	2.64	2.60	3.36	3.12	2.35	2.32	2.89	2.42	2.22	2.30	<0.001
Health-related social needs[2]											
Housing instability	533	42.57	247	66.76	286	98.28	0	0.00	0	0.00	<0.001
Financial strain	452	36.10	211	57.03	138	47.42	57	52.78	46	9.52	<0.001
Transportation barrier	379	30.27	370	100.00	0	0.00	6	5.56	3	0.62	<0.001
Food insecurity	540	43.13	277	74.86	155	53.26	108	100.00	0	0.00	<0.001
Unemployment	163	13.02	103	27.84	33	11.34	13	12.04	14	2.90	<0.001
Legal problems	161	12.86	75	20.27	41	14.09	19	17.59	26	5.38	<0.001

[1]Prior 12 months.
[2]Per survey response.
Abbreviations: HRSN, Health-Related Social Needs; ED, Emergency department; SD, Social determinants.

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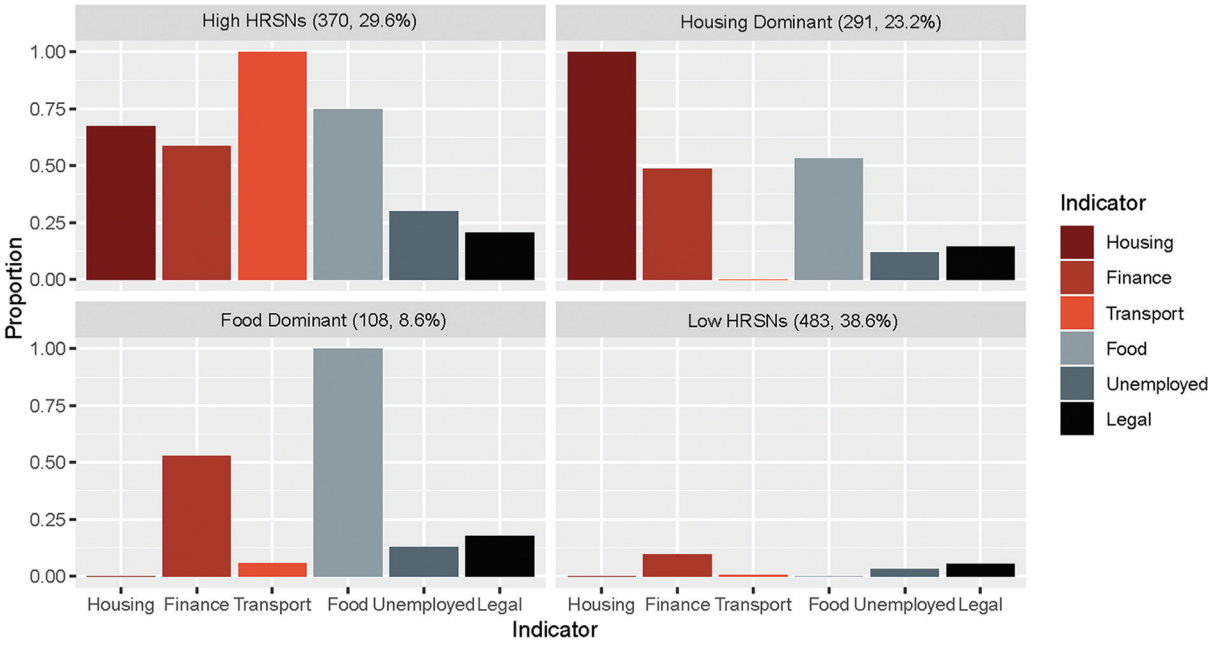
Figure 1. Profiles of 4 health-relates social needs clusters among adult primary care patients.



Notes: HSRNs, Health-Related Social Needs.

highest among the "high HRSNs" cluster. In contrast, these measures were lower among the "low HRSNs" cluster. The "low HRSNs" cluster also had the lowest percentage of individuals with less than a high school education ($P < .001$). In addition, the "low HRSNs" had the lowest proportion of underrepresented minority populations. The proportion of non-White, non-Hispanic subjects were all higher in the "high HRSNs," "housing dominant," and "food dominant" clusters ($P = .002$). While the overall average number of primary care visits in the past 12 months did vary significantly across clusters ($P < .001$), on average patients in all clusters had multiple primary care encounters during the year.

Discussion

Prior research has indicated that HRSNs, like financial strain, housing issues, and food insecurity, often occurred together.[7,19] However, much of the current measurement of HRSNs relies on screening tools with unknown or limited psychometric performance.[20] Our identification of distinct clusters leveraged stronger measures of HRSNs and provided additional insights for health care organizations' social care intervention development and delivery.

For health care organizations, the "high HRSNs" cluster, that is, patients experiencing multiple HRSNs concurrently, may be simultaneously the most important and challenging. In terms of importance, these patients likely have the most to benefit from social care interventions due to the multiplicity of HRSNs. Racial and ethnic minority patients are more likely to be in the high HRSNs cluster, further highlighting the impact of structural racism and oppression on the social determinants of health. In addition given the inequitable distribution of HRSNs by race and ethnicity, addressing this cluster may help organizations' and communities' goals of equitable and fair population health. As such, it is critical that social care interventions designed to address HRSNs are created using a health equity lens to ensure cultural responsiveness (eg, food vouchers for culturally traditional foods etc.).

In addition, from the health care system perspective, these patients are important as this cluster had the highest utilization of costly health care services (ie, emergency department and inpatient admissions) and the highest comorbidities. At the same time, meeting all these needs may require health systems and partners to deploy diverse and longitudinal interventions.[8] The existence of such an underlying high-risk cluster suggests the need for coordinated and multifaceted health care and system-wide public policy interventions.[21]

In addition challenging for health care organizations is the identification of a housing dominant

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cluster. The challenges of housing in the US are longstanding with roots in economic conditions, policies, and structural racism.[22] Of all the identified HRSNs, housing instability may require the most extensive partnering and collaboration outside the health care organization. Housing instability requires organizations with physical space to house individuals temporarily, access to community shelters able to accept individuals, or broader community-based solutions to change housing availability and accessibility.[23] In the near term, housing instability requires health care organizations to connect with community partners with such resources. Longer term solutions require policy-oriented interventions. In contrast, for many health care organizations, addressing food insecurity, even in the short term, may be more readily achievable.[24] Vouchers for local food pantries or hospital cafeterias are resources that both are easy to deliver within clinical settings and would support a large number of patients' primary HRSN or at least one of their HRSNs. These 2 examples illustrate the value of a comprehensive consideration of multiple needs in tailoring potential interventions.

Limitations

These clusters identified in this sample may not be generalizable to other geographic areas due to local socioeconomic conditions or to other settings of care due to differences in patient populations. Likewise, due to differences in survey tool performance,[25] studies using alternative instruments to identify HRSNs may identify different clusters. All survey data were collected by research staff as part of a research study with informed consent. Responses may differ if the same data were collected as part of clinical care delivery.

As health care organizations increasingly focus on HRSNs as an approach to reduce costs and improve health of patients, these findings indicate that organizational strategies and actions should reflect the interrelated and co-occurring nature of HRSNs. To support a large number of patients, strategies should support multiple HRSNs.

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