



# The Utility of the Brokamp Area Deprivation Index as a Prescreen for Social Risk in Primary Care

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**Objectives** To assess the relationship between an Area Deprivation Index (ADI) and a Social Determinant of Health (SDoH) measure within a diverse sample. A prescreening tool based on routinely collected information could reduce clinical burden by identifying patients impacted by SDoH for comprehensive assessment.

**Study design** In total, 499 consented pediatric patient-families who spoke English, Spanish, or Arabic and had a child  $\leq 12$  years receiving primary care at a large academic institution were enrolled. Participants completed the Health Leads Social Needs (HLSN) survey. Residential address was extracted from the electronic health record to calculate Brokamp ADI at the census-tract level. The main outcome was the correlations between the total HLSN score and Brokamp ADI, overall and in each language subgroup. ADI distributions were also compared between participants with/without need for each of the 8 HLSN survey SDoH domains, using 2-sample *t*-tests and Pearson  $\chi^2$  tests.

**Results** In total, 54.9% of participants were English-speaking, 30.9% were Spanish-speaking, and 14.2% were Arabic-speaking. Spearman correlations between Brokamp ADI and total HLSN score were overall ( $r_s = 0.15$ ;  $P = .001$ ), English ( $r_s = 0.12$ ;  $P = .04$ ), Spanish ( $r_s = 0.03$ ;  $P = .7$ ), and Arabic ( $r_s = 0.24$ ;  $P = .04$ ). SDoH domain analyses found significant ADI differences between those with/without need in housing instability, childcare, transportation, and health literacy.

**Conclusions** There were small but statistically significant associations between the Brokamp ADI and total HLSN score and SDoH domains of housing instability, childcare, transportation, and health literacy. These findings support testing the Brokamp ADI as a prescreening tool to help identify patients with social needs in an outpatient clinical setting. (*J Pediatr* 2022;249:43-9).

Clinicians generally agree on the importance of social determinants of health (SDoH) and social needs assessments during clinical encounters but report lack of time and resources as major barriers.<sup>1,2</sup> Gold et al reported that a routine SDoH assessment tool overwhelmed the ability of the health care system to respond due to a high positive screening rate.<sup>3,4</sup> Therefore, a prescreening process that leverages information in the electronic health record (EHR) may offer a complementary approach for identifying patient subpopulations with greater social risk.

The Brokamp Area Deprivation Index (ADI) is a measure of environmental deprivation derived from 6 census tract-level variables.<sup>5</sup> Kostelanetz et al described associations between 4 Brokamp ADI components and the corresponding patient-reported measures of these components.<sup>6</sup> However, the study did not explore the relationship of the Brokamp ADI to those SDoH that may exert an effect on health outcomes independent of socioeconomic status and that health care systems may be able to address.<sup>7,8</sup>

One widely identified pitfall of using community-level data to contextualize individual social need is ecological fallacy, or the misrepresentation of an individual profile based on group characteristics.<sup>9</sup> Cottrell et al and Baldwin et al both demonstrated the underestimation of social need in using community-level data as an aggregate for individual-level risk.<sup>10,11</sup> Recognizing this limitation, a 2-tiered approach, using a community-level measure embedded in the EHR followed by comprehensive individualized assessment, could be a balanced way to address SDoH. This may be particularly useful for those health care systems that cannot immediately amplify screening and referral systems due to lack of clinical resources or infrastructure.

To assess the association between the Brokamp ADI and a prospectively collected individual-level measure of SDoH in a diverse sample both overall and in separate language subgroups. It was hypothesized that there would be a positive correlation between Brokamp ADI and SDoH.

ADI	Area Deprivation Index
EHR	Electronic health record
HLSN	Health Leads Social Needs
SDoH	Social Determinants of Health
SNAP	Supplemental Nutrition Assistance Program

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## Methods

Survey data came from a research project primarily studying telehealth equity in a sample of 499 consented pediatric patient-families who received care at a single large academic institution between December 2020 and May 2021 (grant number: 5P30DK092986-11). Patient address was extracted from the EHR and used to calculate Brokamp ADI at the census-tract level. Because the data came from a project powered for different primary aims (assessing contributors to telehealth equity), no a priori power analyses were conducted to justify the sample size for the results of the specific secondary analyses presented here. Any statistically significant results were obtained despite this. The institutional review board at Vanderbilt University approved all the study procedures (institutional review board number: 201990).

### Recruitment

Patient-families for the original study were prescreened using information in the EHR. Inclusion criteria included having a parent age  $\geq 18$  years old; having a child  $\leq 12$  years old; having a child who received primary care (via an in-person visit, telehealth visit, or both) at the Vanderbilt Pediatric Primary Care Clinic between March 1 and September 30, 2020; having a preferred language of English, Spanish, or Arabic; and having phone access or email access to receive calls or study information electronically. Eligible patient-families were contacted by trained key study personnel through email, text, or phone calls to invite them to participate in the study using a standard script translated into 1 of the 3 required languages. Interested participants provided informed consent verbally via phone call or electronically. Study data were collected and managed using REDCap electronic data tools hosted at Vanderbilt University Medical Center.<sup>12</sup>

### Social Determinants of Health

Key study bilingual personnel administered telephone surveys, including the Health Leads Social Needs (HLSN) survey, to eligible, consented participants in the language of their choice.<sup>13</sup> Alternatively, participants who requested a personal survey link could manually enter survey responses into the REDCap database. The HLSN survey is a widely used, freely available, 10-question instrument designed to capture a broad range of SDoH domains. The first 8 questions ask whether participants had a need (yes–no) in any of the following 8 domains: food insecurity, utility needs, housing instability, childcare, financial resource strain, transportation challenges, health literacy, and social isolation.<sup>13</sup> Each “yes” response to the 8 items provided 1 point, and a summed total HLSN score was calculated, ranging from 0 to 8. Full data were required for a score to be calculated. Positive responses to the last 2 questions “Are any of your needs urgent?” and “Would you like to receive assistance with any of those needs?” were noted by key study personnel, and pamphlets containing information on local community resources were subsequently mailed to these

patient-families. Positive responses to these last two questions did not contribute to the total HLSN score. Participants received a \$15 gift card for their participation.

### Brokamp ADI

There are several composite indices that examine community-level data.<sup>5,14</sup> The Brokamp ADI was selected for evaluation as a prescreening tool for several reasons. It is calculated from only 6 variables, simplifying the design of a calculation tool to embed in the EHR; it can predict population and individual level health outcomes in pediatric populations,<sup>5,15–18</sup> and it is associated with individual level, patient-reported measures of SDoH, although more study is needed with respect to domains that may be addressable by health care systems.<sup>6–8</sup> Furthermore, the Brokamp ADI is not highly dependent on a patient’s ability to speak English, an important consideration when working with limited English proficiency populations who may derive the greatest benefit from SDoH assessment and referral.<sup>19,20</sup>

The Brokamp ADI for all patient-families was derived using principal component analysis of 6 census-tract level variables: (1) fraction of population with income in the past 12 months below poverty level; (2) median household income in the past 12 months in 2015, inflation-adjusted dollars; (3) fraction of population aged  $\geq 25$  years with at least high school graduation; (4) fraction of population with no health insurance coverage; (5) fraction of population receiving public assistance income, food stamps, or Supplemental Nutrition Assistance Program (SNAP) in the last 12 months; and (6) fraction of houses that are vacant.<sup>5</sup> These data were obtained from the 2018 American Community Survey Five-Year Estimates using patients’ residential address extracted from the EHR. ADI ranges from 0 to 1, with greater scores reflecting higher deprivation.

### Statistical Analyses

Participant characteristics, including race/ethnicity, insurance status, number of children, Brokamp ADI and its 6 components, and total HLSN score and its 8 SDoH domain items were summarized in total and by primary language spoken using univariate descriptive statistics (means and SDs for continuous items or frequencies and percentages for categorical items).

A nonparametric Spearman correlation was used to determine whether there was a statistically significant relationship between Brokamp ADI and total HLSN score in the full sample. This was also done within each language subgroup (English, Spanish, and Arabic) to determine whether there was a relationship in each language.

Two-sample *t*-tests were used to compare mean Brokamp ADI between participants who were or were not experiencing need in each of the 8 SDoH domains that constituted the HLSN survey. Need was indicated by a “yes” response to the domain item. Because there was some evidence for non-normality of the Brokamp ADI distribution, nonparametric Wilcoxon rank-sum tests (also referred to as Mann–Whitney

*U* tests) also were conducted, and the significance patterns were identical. These distributional results were not reported in favor of the more interpretable mean comparison results.

To convey the magnitude of the above relationships more fully, participants who lived in census tracts within the lowest and highest quartiles of Brokamp ADI were compared in 2 exploratory analyses. First, a 2-sample *t*-test was used to compare mean total HLSN score between the first and fourth ADI quartiles, and second, Pearson  $\chi^2$  tests were used to determine whether the proportion of participants with need on each of the 8 SDoH domains was different between the first and fourth ADI quartiles. All analyses were conducted in Stata 17.0 (Stata-Corp), and significance was defined by a 2-sided test with  $P < .05$ .

## Results

Of 995 patients who expressed interest in participating, 544 consented. Of those who consented, 501 completed the survey, and 2 of these were ineligible for analysis (one due to age, and one due to incomplete HLSN). Residential address from the EHR was successfully geocoded for all pediatric patient-families eligible for analysis. Of the 499 patient-families analyzed, 274 (54.9%) were English-speaking, 154 (30.9%) were Spanish-speaking, and 71 (14.2%) were Arabic-speaking (Table I). With respect to race/ethnicity, 171 (34.3%) identified as Hispanic; 126 (25.3%) identified Black; and 91 (18.2%) identified as White (Table I).

Mean (SD) Brokamp ADI was 0.397 (0.128), demonstrating variability within the full sample (Table II). Among the census tracts where patient-families lived, the mean (SD) percent of the population receiving assisted income was 15.4% (11.0), percent finished high school was 85.6% (7.9), percent lacking health insurance was 14.4% (8.1), percent living below the poverty line was 17.6% (11.9), and the mean (SD) of the median income was \$54 961 (\$21 923). On the HLSN survey, 65.3% of participants indicated having need in 1 or more SDoH domains (Table II). The Figure illustrates the geographic distribution of ADI values by census tract in Davidson County, Tennessee. Table III shows that the most frequently identified social needs were childcare (39.1%), utility needs (28.7%), food insecurity (25.1%), and financial resource strain (17.4%).

The correlation between Brokamp ADI and total HLSN score was statistically significant and positive ( $r_s = 0.15$ ,  $P = .001$ ). The correlations for each language subgroup were: English ( $r_s = 0.12$ ;  $P = .04$ ;  $n = 274$ ), Spanish ( $r_s = 0.03$ ;  $P = .7$ ;  $n = 154$ ), and Arabic ( $r_s = 0.24$ ;  $P = .04$ ,  $n = 71$ ). The mean ADI scores were significantly greater (greater area deprivation) for participants who indicated need compared with those without need on the HLSN domains of housing instability (0.42 vs 0.39;  $P = .04$ ), childcare (0.42 vs 0.38;  $P = .001$ ), transportation (0.43 vs 0.39;  $P = .02$ ), and health literacy (0.45 vs 0.39;  $P < .001$ ). All other domains were not significant.

Table I. Participant demographics

Demographics	English N = 274	Spanish N = 154	Arabic N = 71	Total N = 499
Race or ethnicity				
Asian	13 (4.7%)	0 (0.0%)	0 (0.0%)	13 (2.6%)
Black	123 (44.9%)	1 (0.6%)	2 (2.8%)	126 (25.3%)
Hispanic	24 (8.8%)	147 (95.5%)	0 (0.0%)	171 (34.3%)
Middle Eastern	8 (2.9%)	0 (0.0%)	11 (15.5%)	19 (3.8%)
Native American	1 (0.4%)	0 (0.0%)	0 (0.0%)	1 (0.2%)
White	85 (31.0%)	6 (3.9%)	0 (0.0%)	91 (18.2%)
Other	1 (0.4%)	0 (0.0%)	0 (0.0%)	1 (0.2%)
Prefer not to answer	5 (1.8%)	0 (0.0%)	0 (0.0%)	5 (1.0%)
Multiple races or ethnicities	14 (5.1%)	0 (0.0%)	58 (81.7%)	72 (14.4%)
Type of insurance for child				
None	2 (0.7%)	5 (3.2%)	0 (0.0%)	7 (1.4%)
Medicaid (such as TennCare, etc)	193 (70.4%)	136 (88.3%)	70 (98.6%)	399 (80.0%)
Private insurance (including through your employer)	75 (27.4%)	3 (1.9%)	1 (1.4%)	79 (15.8%)
Other type of insurance	3 (1.1%)	5 (3.2%)	0 (0.0%)	8 (1.6%)
Don't know or missing	1 (0.4%)	5 (3.2%)	0 (0.0%)	6 (1.2%)
Marital status				
Married	127 (46.4%)	64 (41.8%)	70 (98.6%)	261 (52.4%)
Member of unmarried couple living together	13 (4.7%)	55 (35.9%)	0 (0.0%)	68 (13.7%)
Divorced, separated, or widowed	31 (11.3%)	5 (3.3%)	1 (1.4%)	37 (7.4%)
Single, never married	103 (37.6%)	29 (19.0%)	0 (0.0%)	132 (26.5%)
Missing	0	1	0	1
Parent's number of children				
1	69 (25.2%)	25 (16.2%)	5 (7.0%)	99 (19.8%)
2	97 (35.4%)	47 (30.5%)	15 (21.1%)	159 (31.9%)
3	46 (16.8%)	40 (26.0%)	29 (40.8%)	115 (23.0%)
4	35 (12.8%)	25 (16.2%)	18 (25.4%)	78 (15.6%)
5	16 (5.8%)	11 (7.1%)	3 (4.2%)	30 (6.0%)
6	4 (1.5%)	4 (2.6%)	1 (1.4%)	9 (1.8%)
7	3 (1.1%)	2 (1.3%)	0 (0.0%)	5 (1.0%)
8	2 (0.7%)	0 (0.0%)	0 (0.0%)	2 (0.4%)
9	1 (0.4%)	0 (0.0%)	0 (0.0%)	1 (0.2%)
15	1 (0.4%)	0 (0.0%)	0 (0.0%)	1 (0.2%)

**Table II. Summary of Brokamp ADI and HLSN Scores**

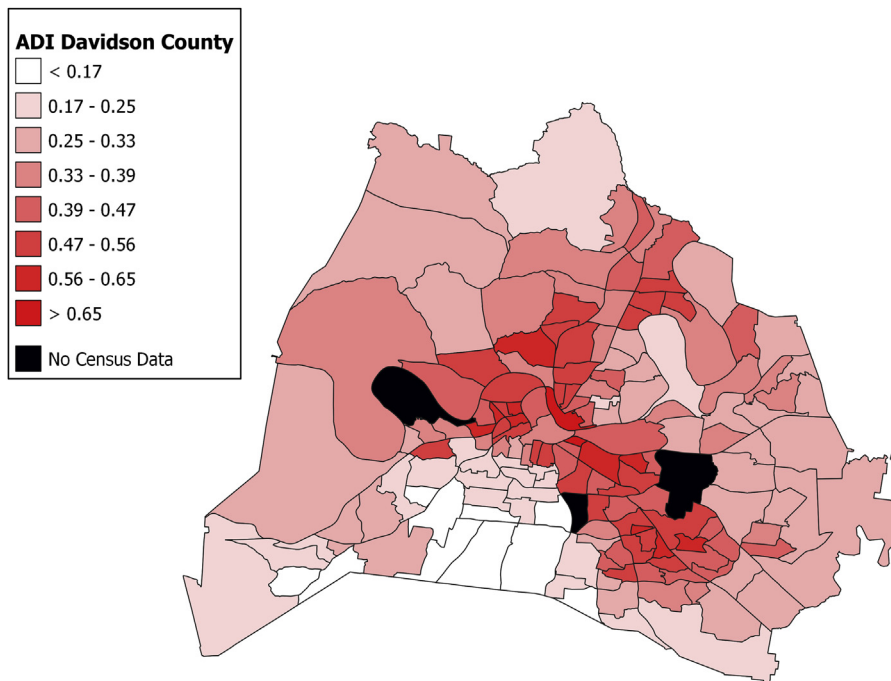
	<b>English</b>	<b>Spanish</b>	<b>Arabic</b>	<b>Total</b>
	<b>N = 274</b>	<b>N = 154</b>	<b>N = 71</b>	<b>N = 499</b>
<b>ADI</b>				
ADI total score (range 0-1)	0.397 (0.128)	0.428 (0.101)	0.333 (0.103)	0.397 (0.120)
Assisted income, No. (%)	16.5 (13.0)	15.6 (7.8)	10.9 (6.8)	15.4 (11.0)
Finished high school, No. (%)	86.3 (7.8)	82.6 (7.7)	89.4 (6.2)	85.6 (7.9)
No health insurance, No. (%)	12.6 (7.1)	18.6 (8.8)	12.3 (7.2)	14.4 (8.1)
Poverty, No. (%)	19.0 (13.8)	17.6 (8.5)	12.3 (8.2)	17.6 (11.9)
Vacant housing, No. (%)	8.8 (6.4)	7.6 (4.0)	5.1 (4.0)	7.9 (5.6)
Median income (US dollars)	54 709 (23 666)	49 954 (14 300)	66 790 (24 300)	54 961 (21 923)
<b>HLSN survey</b>				
HLSN continuous total score (range 0-8)	1.6 (1.8)	2.1 (2.1)	0.9 (1.0)	1.7 (1.8)
<b>HLSN discrete total score (range 0-8)</b>				
0	108 (39.4%)	41 (26.6%)	24 (33.8%)	173 (34.7%)
1	52 (19.0%)	32 (20.8%)	37 (52.1%)	121 (24.2%)
2	40 (14.6%)	30 (19.5%)	3 (4.2%)	73 (14.6%)
3	30 (10.9%)	17 (11.0%)	4 (5.6%)	51 (10.2%)
4	22 (8.0%)	12 (7.8%)	3 (4.2%)	37 (7.4%)
5	11 (4.0%)	10 (6.5%)	0 (0.0%)	21 (4.2%)
6	7 (2.6%)	5 (3.2%)	0 (0.0%)	12 (2.4%)
7	4 (1.5%)	3 (1.9%)	0 (0.0%)	7 (1.4%)
8	0 (0.0%)	4 (2.6%)	0 (0.0%)	4 (0.8%)

In quartile analyses, ADI Q1 (n = 128) contained values equal to 0.302 and lower, and ADI Q4 (n = 114) contained values greater than 0.487. Two-sample *t*-tests indicated that the mean HLSN score was significantly greater for participants in ADI Q4 than for those in ADI Q1 (2.0 vs 1.3, respectively; *P* = .003; n = 242). In addition, Pearson  $\chi^2$  tests for each HLSN domain demonstrated significantly greater rates of having a need for participants in Q4 than those in Q1 for the domains of housing instability

(20.2% vs 9.4%; *P* = .02), childcare (44.7% vs 29.7%; *P* = .02), transportation (18.4% vs 8.6%; *P* = .02), and health literacy (17.5% vs 3.9%; *P* = .001). All other domains were not significant.

## Discussion

The results demonstrated a small, but statistically significant, positive correlation between Brokamp ADI and total HLSN



**Figure.** Illustrated is the geographic distribution of Brokamp ADI by census tract in Davidson County. Those counties with *darker shades of red* indicate greater ADI levels or environmental disadvantage. The figure demonstrates adequate variability in ADI across the patient population.

**Table III. Sample responses by each HLSN subitem**

HLSN survey responses	English N = 274	Spanish N = 154	Arabic N = 71	Total N = 499
Since March 2020, did you ever eat less than you felt you should because there wasn't enough money for food?				
No	212 (77.4%)	97 (63.0%)	65 (91.5%)	374 (74.9%)
Yes	62 (22.6%)	57 (37.0%)	6 (8.5%)	125 (25.1%)
Since March 2020, has the electric, gas, oil, or water company threatened to shut off your services in your home?				
No	209 (76.3%)	119 (77.3%)	28 (39.4%)	356 (71.3%)
Yes	65 (23.7%)	35 (22.7%)	43 (60.6%)	143 (28.7%)
Are you worried that in the next 2 months, you may not have stable housing?				
No	233 (85.0%)	124 (80.5%)	69 (97.2%)	426 (85.4%)
Yes	41 (15.0%)	30 (19.5%)	2 (2.8%)	73 (14.6%)
Do problems getting childcare make it difficult for you to work or study?				
No	157 (57.3%)	86 (55.8%)	61 (85.9%)	304 (60.9%)
Yes	117 (42.7%)	68 (44.2%)	10 (14.1%)	195 (39.1%)
Since March 2020, have you needed to see a doctor, but could not because of cost?				
No	227 (82.8%)	116 (75.3%)	69 (97.2%)	412 (82.6%)
Yes	47 (17.2%)	38 (24.7%)	2 (2.8%)	87 (17.4%)
Since March 2020, have you ever had to go without health care because you didn't have a way to get there?				
No	238 (86.9%)	125 (81.2%)	70 (98.6%)	433 (86.8%)
Yes	36 (13.1%)	29 (18.8%)	1 (1.4%)	66 (13.2%)
Do you ever need help reading hospital materials?				
No	263 (96.0%)	109 (70.8%)	70 (98.6%)	442 (88.6%)
Yes	11 (4.0%)	45 (29.2%)	1 (1.4%)	57 (11.4%)
Do you often feel that you lack companionship?				
No	218 (79.6%)	132 (85.7%)	69 (97.2%)	419 (84.0%)
Yes	56 (20.4%)	22 (14.3%)	2 (2.8%)	80 (16.0%)

score ( $r_s = 0.15$ ,  $P = .001$ ) in the full sample, and significant relationships were also detected for the English- and Arabic-speaking language groups. These findings support the further testing of the Brokamp ADI as a prescreen for social needs in diverse outpatient settings. Singh's original ADI was created for the purposes of examining mortality gradients based on population-level social, behavioral, and medical care factors.<sup>21</sup> The Brokamp ADI, which uses fewer and more granular census-tract level variables, has demonstrated predictive utility in health outcomes at both individual and population levels in pediatric populations.<sup>5,15-18</sup> This study demonstrates an association between Brokamp ADI and prospectively collected individual-level SDoH in a pediatric outpatient setting.

Although the utility of Brokamp ADI as a prescreen for social needs seems promising, the failure to detect a significant correlation with SDoH among Spanish-speaking participants, suggests it might be less useful in some populations. Increased socially desirable reporting in Spanish-speaking populations offers one possible explanation.<sup>22</sup> This finding is notable, given that limited English proficiency is associated with an increased prevalence of social needs, based on the results of a SDoH screening program conducted at 11 acute-care hospitals.<sup>23</sup> The descriptively different ADI-SDoH correlations in Spanish and Arabic speakers also highlight the importance of distinguishing non-English-language subgroups when using tools like the Brokamp ADI. This finding is corroborated by Fischer et al, who demonstrated significant differences in the prevalence of reported SDoH domains between Spanish speakers and other limited English proficiency speakers.<sup>23</sup>

The consistent results of both the mean and quartile analyses demonstrated significant differences in ADI values for participants who indicated need vs those who did not in the SDoH domains of housing instability, childcare, transportation, and health literacy. However, no significant ADI differences were detected in other domains such as food security. This could be due to how the Brokamp ADI captures these domains. For example, although the Brokamp ADI incorporates the fraction of households receiving public assistance enrollment—specifically the SNAP and the Special SNAP for Women, Infants, and Children—into its calculation, this is an indirect measure of food insecurity and may partly explain the lack of association found between the 2 variables. The high prevalence of food insecurity in our sample (25.1%) speaks to the importance of accurately assessing for this domain, regardless of the lack of association. This points to potentially using the ADI as a first point of assessment, followed by a more detailed screen if warranted.

Before determining SDoH screening approaches, ADI or otherwise, the ability of the health care system to respond to identified needs must be clear. Some health care organizations have demonstrated effective approaches addressing specific SDoH domains.<sup>24-26</sup> Polk et al described referral patterns to emergency shelters and housing assistance programs when housing insecurity was identified.<sup>7</sup> Chhabra et al demonstrated another approach in which physicians alerted to this patient context simplified medication regimens, scheduled more frequent follow-up, and ordered additional tests for HIV and tuberculosis.<sup>27</sup> The transportation SDoH domain has been

effectively addressed in a variety of ways. At an individual level, public transport assistance has been provided to those patients with an identified need.<sup>7</sup> On a health care system-level, the American Health Association describes partnerships with transportation services and advocacy for improved travel infrastructure in the local community.<sup>28</sup> The actionability of identified SDoH needs will vary widely and be dependent on health care system and community resources.

Although the HLSN survey incorporates questions from validated screeners, this study used a total HLSN score calculated by summing the “yes” responses, a process that has not yet been validated.<sup>13</sup> The yes/no response structure may lead to a misestimation of social risk.

Social desirability bias also may have impacted participant responses to the questions on the HLSN survey, many of which were of a sensitive nature. Culture, language, and trust in one’s health care system among other factors, can affect a participant’s responses by skewing them towards zero, which, in this case, could potentially lead to underestimating the level of social need.

It was also not possible to account for the impact of residential mobility on variable exposure to areas of environmental deprivation. However, several statistically significant relationships were detected, despite these temporal and potential spatial gaps.

Indices like the Brokamp ADI are composite measures often at a census tract or ZIP code level, meaning they are representations of a larger region rather than specifications of an individual. This ecological fallacy can lead to misestimation of individual social need and reduce the efficiency of resource allocation. This and the small, but statistically significant correlations in only some domains are why relying on ADI alone to screen for social risk is not recommended.

Lastly, the Brokamp ADI was calculated using the 2018 American Community Survey Five-Year Estimates, and, although the use of multiyear estimates increases the statistical reliability, this dataset did not provide information from the year in which the study was conducted. Composite indices such as this will always be based on past data, which can potentially be out of date.

There were small but statistically significant associations between the Brokamp ADI and total HLSN score and SDoH domains of housing instability, childcare, transportation, and health literacy. These findings support testing the Brokamp ADI as a prescreening tool to help identify patients with greater levels of social need in an outpatient clinical setting. Importantly, the Brokamp ADI should not be used as a stand-alone assessment, given the risk of ecological fallacy. Rather, its use as a simple initial screen followed by a personalized individual approach could help streamline busy clinical workflows, target specific SDoH domains, and increase consistency in identifying SDoH needs in ambulatory clinical settings. In short, a 2-tiered approach may be an alternative solution for those health care systems that cannot, due to feasibility or lack of infrastructure, individually screen all patients. Addressing SDoH is critical to address health disparities, a gap worsened by the coronavirus disease 2019 pandemic. As the Centers for Medicare and Medicaid Services’ Promoting Interoperability Programs

(previously known as the Meaningful Use Programs) search for novel ways to use EHRs to achieve health equity, the Brokamp ADI and similar indices may offer one solution by informing the allocation of resources. However, optimizing their use for this purpose will require further investigation. ■

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## 50 Years Ago in *THE JOURNAL OF PEDIATRICS*

### Isolated Rheumatoid-Like Nodules with Positive Rheumatoid Factor in Childhood Is Not a Harbinger for Juvenile Idiopathic Arthritis

Berardinelli JL, Hyman CJ, Campbell EE, Fireman P. Presence of rheumatoid factor in ten children with isolated rheumatoid-like nodules. *J Pediatr* 1972;81:751-7.

The authors described 10 children with rheumatoid-like nodules (also called pseudorheumatoid). As in rheumatoid nodules, pathology findings included a zone of central necrosis surrounded by palisading connective tissue (eg, fibroblast) cells with giant cells, enveloped by a layer of granulation tissue. Nine of the children developed rheumatoid factors (RF) within 2-16 years in at least 1 of the following techniques: sheep red cell agglutination, latex fixation, euglobulin extraction, or euglobulin inhibition of high-titer rheumatoid sera. The authors concluded that isolated rheumatoid-like nodules in children should be considered as part of the spectrum of juvenile idiopathic (rheumatoid) arthritis (JIA). However, none of the children in this series developed arthritis. Furthermore, these findings are opposed to other studies quoted by the authors before the current study and to many studies since, in which the finding of isolated rheumatoid-like nodules is not associated with the development of arthritis.

One of the explanations is that methods used to measure IgM RF have changed since 1972. From the use of agglutination of sheep red blood cells with serum from patients (Rose-Waller test) and the latex particles, as used in this study, modern-day measurements use the more-reliable enzyme-linked immunosorbent assay or laser nephelometry/turbidimetry techniques. The latter measures the effect of particles on light intensity or light scattering.

In general, rheumatoid nodules can be found in children with the RF-positive subclass of JIA, who comprise about 5%-10% of children with JIA. The nodules appear often in patients with severe disease and can be exacerbated by treatment with methotrexate and leflunomide. However, only a minority of children with positive RF have JIA. RF is found more commonly in infections or other chronic inflammatory diseases and even among healthy individuals.

In many children, these nodules represent deep granuloma annulare. Pathology can often distinguish granuloma annulare from rheumatoid nodules by the finding of mucin deposits in the former.

Therefore, we believe there is no need to measure RF in children with isolated rheumatoid-like nodules and no signs of arthritis. Unlike the suggestions of these authors, finding a RF does not predict the development of JIA.

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