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ORIGINAL RESEARCH

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Impact of social determinants of health on access to rhinology care and patient outcomes: A pilot study

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Abstract

Objective: This novel pilot study constructs a social deprivation index (SDI) and utilizes an area deprivation index (ADI) to evaluate the link between social determinants of health and rhinology patient experiences.

Methods: Adult patients undergoing outpatient care of chronic rhinitis and chronic rhinosinusitis at a tertiary academic medical center were recruited to participate in a telephone survey assessing symptoms, social/emotional consequences of disease, and barriers to care on a 5-point Likert scale. Sociodemographic characteristics were utilized to rate SDI on an 8-point scale. ADI was obtained by area code of residence. Ordered logistic regression was used to examine associations between the SDI/ADI and perceptions of rhinology care.

Results: Fifty patients were included. Individuals with higher SDI scores (i.e., more socially deprived) experienced more severe nasal congestion ($p = .007$). Furthermore, higher national ADI correlated with increased severity of smell changes ($p = .050$) and facial pressure ($p = .067$). No association was seen between either deprivation index and global/psychiatric symptoms. While no correlations were found between higher SDI and difficulties with the costs of prescriptions, rhinologist's visits, or saline, higher SDI was correlated with decreased difficulty with surgery costs ($p = .029$), and individuals with higher national ADI percentile had increased difficulties obtaining nasal saline ($p = .029$).

Conclusion: Worse social deprivation is associated with difficulties obtaining saline rinses and increased severity of nasal/sinus symptoms in an urban, underserved, majority-Black population. These findings suggest social factors affect access to and quality of rhinology care in a complex and nuanced way and highlight the need for a specific SDI to further study social determinants of health in rhinology.

Level of Evidence: 2c.

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KEYWORDS
barriers to health care, cost, emotional consequences, otolaryngology, outcomes, rhinology, saline rinses, social deprivation, socioeconomic determinants, symptoms, transportation

1 | INTRODUCTION

Sinonasal diseases are both burdensome to society and detrimental to quality of life. These conditions result in physical symptoms such as nasal congestion and fatigue,[1,2] and emotional consequences such as social isolation, anhedonia, and depression.[3–5] These symptoms have been hypothesized to contribute to impaired sleep quality,[6,7] decreased driving ability,[8] and loss of productivity at work and school.[9,10] The loss of productivity per employee caused by allergic rhinitis is more than that of diabetes, asthma, and coronary artery disease combined.[10,11]

There is unexplained variation in the burden of rhinologic disease on an individual level.[12] Clinically, providers have observed that patient responses to medical and surgical treatment fall along a spectrum; some individuals experience relief with minimal medical intervention, while others are refractory to medical therapies and surgery. Few predictors explaining clinical response to treatment have been found. Researchers have traditionally focused on pathophysiologic explanations for this variance.[13–15] However, recent studies in other health care specialties have shown social determinants of health to be quantifiably strong contributors to the variance of symptomatology and outcomes, with vulnerable populations bearing greater burden.[16,17] Social determinants of health include the patient's upbringing, socioeconomic status (SES), education, and neighborhood of residence.[18(p. 101)] Despite growing literature assessing social determinants of health in the general population, little is known about the impact of social determinants of health on rhinologic disease burden and the availability of rhinology care.

In this analysis, we sought to assess the link between social deprivation and rhinologic disease symptomatology and access to/perceptions of care at a tertiary academic medical center situated in an underserved, majority-Black neighborhood.

2 | METHODS

2.1 | Patient population and study design

The University of Chicago Institutional Review Board approved this study, and written consent was obtained from all survey respondents. Adult patients (≥18 years) were identified and recruited while undergoing standard care for chronic rhinitis or chronic rhinosinusitis at the University of Chicago from November 2021 through July 2022. Data from patient visits, including outpatient, inpatient, and surgical treatment were collected from patient charts prospectively. Patients identified for inclusion in this study were contacted by telephone and invited to participate in a brief telephone questionnaire. Data were securely handled and anonymized to protect patient confidentiality.

Inclusion criteria: this study included adult patients who underwent either surgical or medical therapy, or both, for rhinologic disease beginning in November 2021. Patients were consented verbally via telephone if they wished to participate in this study, and therefore all adult (over the age of 18 years old) patients who were able and willing to give verbal consent for the survey were included.

Exclusion criteria: patients who did not wish to participate in the telephone survey were excluded from the survey portion of the study.

Study data were collected and managed using REDCap electronic data capture tools hosted at the University of Chicago.[19,20] REDCap is a secure, web-based platform that supports data capture for research.

2.2 | Survey design

The 8-minute survey was separated into four areas of interest: social determinants, symptoms, social and emotional consequences of disease, and barriers to accessing care. Symptoms and social and emotional consequences of disease were measured on a 5-point Likert scale (the most common form of administering survey response categories), with 1 as "not at all bothersome" and 5 as "intolerably bothersome." Choosing an odd number of response categories gave participants a midpoint to choose between the two.[21] Barriers to accessing care were measured on a 4-point scale, with 1 as "no problem" and 4 as "severe problem," and an added option of "not applicable."

Questions assessing social determinants were derived from a social needs screening tool released by previous studies on socioeconomic determinants of rhinology care and studies that created social deprivation indices.[22–25] Measures of symptoms and social/emotional consequences of rhinologic disease were derived from the Nasal Obstruction and Septoplasty Effectiveness Scale (NOSE) and the Sino-Nasal Outcome Test (SNOT-22).[1,2(pp. 22)],[26–28] Questions assessing barriers to rhinologic care were derived from surveys and provider concerns noted in other health care specialties.[29,30]

2.3 | Social determinants and social deprivation index

Social determinants measured included demographic data and proxy measures for social deprivation: employment, income, single parenthood, car/home ownership, the ratio of people to rooms in the home, education, and not having a primary care physician (PCP). Income was coded into three categories: $0–$25,000; $25,001–$100,000; and $100,001+. Employment status was coded into six categories: employed, retired, disabled, student, unemployed (actively seeking work), and nonemployed (not seeking work). Single parenthood, car ownership, home ownership, and having a PCP were coded as "yes" or "no." The number of rooms and people living in the home were coded as numbers up to 5 or 5+. Education was coded into six

categories: less than a high school diploma, high school or equivalent, some college, associate's degree, bachelor's degree, and graduate degree.

We created a social deprivation index (SDI) to evaluate individual deprivation based on many categories that reflect the nuances of social deprivation and vulnerability. The SDI is a composite score that quantifies socioeconomic disadvantage, with higher scores indicating increased social deprivation. One point each was assigned to: family income of $0–$25,000; single parenthood; unemployment or disabled; no car ownership; no home ownership; more people than rooms in the home; no PCP; less than high school diploma education. These points were summed to create a SDI (0–8), which was constructed from survey measures following previously published studies on rhinologic, obstetric, and primary care. These previous studies validated and established social deprivation indices and found them to be significantly correlated with other indicators of deprivation, such as unemployment insurance and financial barriers to health care; we examined these papers and chose specific validated variables for our SDI from these studies.[22–24]

Additionally, two area deprivation index (ADI) scores, based on each subject's home address, were measured to quantify each subject's deprivation in relation to the state and the entire United States. Higher state deciles and higher national percentiles both indicate neighborhoods with more socioeconomic disadvantage. The ADI is a freely available index created and updated by the Census Block Group to rank the socioeconomic disadvantage of neighborhoods. The index comprises income, education, housing quality, and employment measures and has been validated for various health outcomes.[31,32]

2.4 | Outcome variables

Outcome measures were divided into three sections: symptoms, social and emotional consequences of disease, and barriers to accessing rhinology care. Symptoms included nasal congestion, nasal drainage, facial pressure, loss of smell, and sleep trouble. Social and emotional consequences included difficulty concentrating, fatigue, sadness, and embarrassment. Barriers to care included transportation, time from beginning of symptoms to seeing a rhinologist, distance traveled to see a rhinologist, time until getting an appointment with a rhinologist, being able to see a rhinologist for follow-up appointments, understanding of disease, filling/obtaining prescriptions, staying on prescriptions long-term, costs of prescriptions, side effects of prescriptions, understanding insurance coverage, obtaining saline rinse equipment, using saline rinses properly, using saline rinses as often as directed, staying on saline rinses long-term, cost of saline rinses, daily time commitment to treatment, cost of rhinologist visits, and cost of surgical treatment.

2.5 | Statistical analysis

Associations between the SDI and outcome variables, as well as between ADI scores and outcome variables, were analyzed using ordered logistic regression. Statistical analyses were conducted with Stata 16 (StataCorp LP, College Station, TX, USA). Statistical significance was set at a p-value less than .05, with trends reported for associations with p-values between .05 and .10.

3 | RESULTS

Fifty patients meeting inclusion criteria completed the survey (response rate: 54.9%). Of these individuals, 27 had chronic rhinosinusitis, 3 had chronic rhinitis, and 20 had both. Respondents were majority female (59.2%, $n = 29$) and Black (58.0%, $n = 29$) (Table 1). Patients ranged in age from 21 to 76. Nine patients (18.0%) were unemployed or disabled. Most had family income levels in the lowest tertile of $0–$25,999 (40.0%, $n = 20$). There were significant numbers of single parents (28.0%, $n = 14$), and car and home ownership were reported by 33 (66.0%) and 21 (42.0%) participants, respectively.

Table 2 details participants' socioeconomic characteristics, stratified by SDI. We stratified our total sample of patients into those with higher and lower SDI by assigning approximately 50% to each group

TABLE 1 Overall socioeconomic characteristics of participants.

Characteristic		n	%
Sex	Female	29	59.2
	Male	20	40.8
Race/ethnic group	White	11	22.0
	Black	29	58.0
	Hispanic, non-black	4	8.0
	Asian	2	4.0
	Other	4	8.0
Education	<HS	3	6.0
	HS/equivalent	11	22.0
	Some college	11	22.0
	Associate degree	6	12.0
	Bachelor's degree	11	22.0
	Graduate degree	8	16.0
Employment	Unemployed	1	2.0
	Nonemployed	3	6.0
	Student	1	2.0
	Disabled	8	16.0
	Employed	28	56.0
	Retired	9	18.0
Family income	$0–25,000	20	40.0
	$25,001–100,000	18	36.0
	$100,000+	12	24.0
Single parent, yes		14	28.0
Own car, yes		33	66.0
Own home, yes		21	42.0
People/rooms >1, yes		9	18.0

TABLE 2 Socioeconomic characteristics of participants by social deprivation index.

Characteristic		Social deprivation index		p-value
		0 or 1 ($n = 24$)	2+ ($n = 26$)	
Sex	Female	12 (50.0)	17 (68.0)	.137
	Male	12 (50.0)	8 (32.0)	
Race/ethnic group	White	7 (29.2)	4 (15.4)	.025[a]
	Black	10 (41.7)	19 (73.1)	
	Hispanic, non-black	2 (8.3)	2 (7.1)	
	Asian	2 (8.3)	0 (0.0)	
	Other	3 (12.5)	1 (3.6)	
Education	<HS	1 (4.2)	2 (7.7)	.019[b]
	HS/equivalent	2 (8.3)	9 (34.6)	
	Some college	2 (8.3)	9 (34.6)	
	Associate degree	5 (20.8)	1 (3.9)	
	Bachelor's degree	8 (33.3)	3 (11.5)	
	Graduate degree	6 (25.0)	2 (7.7)	
Employment	Unemployed	0 (0.0)	1 (3.9)	.045[c]
	Nonemployed	0 (0.0)	3 (11.5)	
	Student	1 (4.2)	0 (0.0)	
	Disabled	0 (0.0)	8 (30.8)	
	Employed	17 (70.8)	11 (42.3)	
	Retired	6 (25.0)	3 (11.5)	
Family income	$0–25,000	2 (8.3)	18 (69.2)	<.001
	$25,001–100,000	14 (58.3)	4 (15.4)	
	$100,000+	8 (33.3)	4 (15.4)	
Single parent	Yes	2 (8.3)	12 (46.2)	.003
	No	22 (91.7)	14 (53.9)	
Own car	Yes	24 (100.0)	9 (34.6)	<.001
	No	0 (0.0)	17 (65.4)	
Own home	Yes	17 (70.8)	4 (15.4)	<.001
	No	7 (29.2)	22 (84.6)	
People/rooms >1	Yes	3 (12.5)	6 (23.1)	.330
	No	21 (87.5)	20 (76.9)	

Note: Values are number (%).
[a]Black patients versus any other race.
[b]High school education or less versus higher education.
[c]Unemployed or disabled versus any other employment status.

based on SDI score. The SDI value was 0 or 1 for 48.0% of the sample and 2+ for 52.0% of the sample. Compared to individuals with a score of 0 or 1, individuals with an SDI score of 2+ were more often Black (73.1% vs. 41.7%; $p = .025$), unemployed/disabled (15.4% vs. 0.0%; $p = .045$), in the lowest tertile of income (69.2% vs. 8.3%; $p < 0.001$), and single parents (46.2% vs. 8.3%; $p = .003$). They were also less likely to own a car (0.0% vs. 65.4%; $p < 0.001$), and less likely to own a home (15.4% vs. 70.8%; $p < 0.001$). The ratio of people to rooms was not significantly different (23.1% vs. 12.5%; $p = .33$).

Having no PCP correlated significantly with higher adjusted SDI (OR = 2.42, 95% CI [1.19, 4.95], $p = .015$) but not with either ADI measure (national: OR = 1.00, 95% CI [0.97, 1.04], $p = .655$; state: OR = 1.11, 95% CI [0.83, 1.49], $p = .482$) (Table 3).

Overall, social deprivation was associated with higher severity of nasal congestion, facial pressure, and smell changes. Having a higher SDI (i.e., greater social deprivation) was significantly associated with increased difficulties with nasal congestion (β-coeff = .43, 95% CI [0.12, 0.74], $p = .007$) (Table 3). Individuals with higher national ADI tended to report higher severity of facial pressure and changes in sense of smell (β-coeff = .02, 95% CI [0.00, 0.04], $p = .067$; β-coeff = .02, 95% CI [0.00, 0.04], $p = .055$). Patients with increased state ADI tended to report increased severity in smell changes (β-coeff = .18, 95% CI [0.00, 0.36], $p = .052$) and in nasal congestion (β-coeff = .16, 95% CI [−0.01, 0.34], $p = .070$). However, no associations were found between SDI/ADI and nasal drainage, sleep trouble, difficulty concentrating, fatigue, sadness, and embarrassment (Table S1).

TABLE 3 Social deprivation index, area deprivation indices, and associated symptoms and barriers to access of rhinologic care.

	Social deprivation index		
Characteristic	**SDI**	**National ADI**	**State ADI**
Obtain saline			
β-coeff	.11	.03	.16
95% CI	−0.20 to 0.43	0.00 to 0.05	−0.03 to 0.36
p-value	.483	.029	.095
Surgery cost			
β-coeff	−.48	.00	−.09
95% CI	= −0.91 to −0.05	−0.03 to 0.02	−0.29 to 0.11
p-value	.029	.680	.939
Nasal congestion			
β-coeff	.43	.02	.16
95% CI	0.12 to 0.74	0.00 to 0.04	−0.01 to 0.34
p-value	.007	.095	.070
Distance to doctor			
β-coeff	−.30	−.01	−.17
95% CI	−0.66 to 0.06	−0.03 to 0.01	−0.38 to 0.03
p-value	.099	.35	.098
Sense of smell			
β-coeff	.09	.02	.18
95% CI	−0.20 to 0.39	0.0 to 0.04	0.00 to 0.36
p-value	.534	.055	.052
Facial pressure			
β-coeff	.22	.02	.15
95% CI	−0.10 to 0.54	0.0 to 0.04	0.03 to 0.32
p-value	.173	.067	.103
No PCP	SDI (w/o PCP measure)		
OR	2.42	1.00	1.11
95% CI	1.19 to 4.95	0.97 to 1.04	0.83 to 1.49
p-value	.015	.655	.482

Individuals with higher national ADI experienced significantly greater difficulty obtaining saline (β-coeff = .03, 95% CI [0.00, 0.05], $p = .029$). Increased state ADI also trended towards an association with increased difficulties with obtaining saline (β-coeff = .16, 95% CI [−0.03, 0.36], $p = .095$). Individuals with higher SDI, national ADI, and state ADI were not more likely to experience difficulty with overall treatment times, nor with using saline rinses properly, as long as directed, or long-term (Table S1).

Having a higher SDI was associated with less difficulties with costs pertaining to surgery (β-coeff = −.48, 95% CI [−0.91, −0.05], $p = .029$). Despite this, more socially deprived individuals, as indicated by either ADI measures or SDI, did not have increased difficulty with prescriptions (cost, filling, long-term use), understanding insurance, cost of saline rinses, nor cost of rhinologist's visits (Table S2). Further stratification of subjects by insurance type (private vs. Medicaid/Medicare) revealed that individuals with private insurance were significantly more likely to report increased difficulty with surgery costs (β-coeff = 1.66, 95% CI [0.29, 3.04], $p = .018$; Table 4).

TABLE 4 Surgery cost and insurance type.

Characteristic	**Insurance type**[a]
Surgery cost	
β-coeff	1.66
95% CI	0.29–3.04
p-value	0.018

[a]Medicaid/medicare versus private.

Increased SDI also trended towards an association with less difficulties with distance to one's rhinologist (β-coeff = −.30, 95% CI [−0.66, 0.06], $p = .099$). This result aligns with a similar association observed between increased state ADI and less difficulties with distance to one's rhinologist (β-coeff = −.17, 95% CI [−0.38, 0.03], $p = .098$). Interestingly, however, SDI, national ADI, and state ADI were not correlated with reported issues with transportation, the timing from the start of symptoms to seeing a rhinologist, and following up with their rhinologist.

4 | DISCUSSION

This study is the first to explore the impact of social deprivation on physical symptoms, emotional consequences, and barriers to accessing rhinology care at a tertiary academic medical center. Our results indicate that worse social deprivation is associated with increased smell change, facial pressure, and nasal congestion severity and difficulties obtaining saline in an urban, underserved, majority-Black population. Interestingly, individuals who were more deprived also had less difficulty with surgery costs and the distance to their rhinologists.

An important variable in our SDI was having no PCP. Within the American health care system, PCPs are generally relied upon to refer patients to specialists per their symptoms. The vast majority of the general public does not know what otolaryngologists do, much less the subspecialty of rhinology. Consequently, not having a PCP negatively impacts access to health care. This variable correlated with our overall SDI (adjusted to subtract "no PCP") but not the ADIs, indicating that this variable measured a type of social deprivation not related to economic deprivation.

While individuals with higher social deprivation reported significantly higher difficulty with sinonasal symptoms (nasal congestion, smell changes, and facial pressure), they did not report more difficulty with more global and psychiatric symptoms such as sleep trouble, difficulty concentrating, fatigue, sadness, and embarrassment. This is supported by our finding that more socially deprived patients experienced increased difficulty obtaining the most basic rhinologic treatment, saline rinses. Saline rinses are a mainstay of medical management of sinonasal diseases and of postoperative maintenance therapy in chronic rhinosinusitis, and have been shown to improve quality of life and humidify atrophic, dry mucosa.[33–35] Thus, more socially deprived individuals may simply have poorer sinonasal symptom control due to worse treatment access. Given that this association is seen with ADI, a deprivation score based on zip code, this may indicate that underprivileged neighborhoods have fewer pharmacies from which individuals can obtain these rinses. Indeed, studies show that in Chicago, "pharmacy deserts," communities whose residents must travel farther to the nearest pharmacy, were more likely to be in low-income neighborhoods.[36]

Individuals who were more socially deprived also reported less difficulty with the distance to a rhinologist than did less socially deprived individuals. This finding may be explained by University of Chicago Medicine's proximity to multiple neighborhoods with higher state and national ADI scores, suggesting that many socially deprived individuals live near the medical center. Given this geographic context, it is important to recognize that the experiences of socially deprived patients in this study may not be representative of experiences held by socially deprived individuals that live in rural areas or in areas far from their place of treatment. As participants with higher SDI were less likely to own a car, we also hypothesize that these individuals prioritized transportation ease when choosing a physician. Individuals without cars often must find other reliable methods of transportation to an appointment, such as public transit, and may prefer providers nearby to allow for a less complicated trip (e.g., a trip with minimal bus transfers). Conversely, individuals with lower SDI scores were more likely to own a car. Patients with vehicles may be more likely to pick a rhinologist based on factors other than proximity.

Surprisingly, individuals who were more socially deprived had less difficulty with the cost of surgery. Upon closer scrutiny, we found that individuals with private insurance reported more difficulties paying for surgeries than individuals with Medicaid/Medicare. We hypothesize that this could be due to coverage differences between private and public health insurance. Due to the eligibility criteria, patients with Medicaid/Medicare are generally more socially deprived.[37,38] Under Medicaid specifically, all medically necessary procedures are covered with no copays or deductibles,[39] whereas patients insured by Blue-Cross BlueShield of Illinois, for example, have a $275 copayment.[40] As such, individuals in this cohort who were less socially deprived by the survey standard may have had more difficulties with the copayments for surgery due to private insurance policies. However, despite experiencing lesser barriers to surgical care, the most socially deprived patients may have difficulty with adhering to routine postoperative care such as intranasal corticosteroid rinses due to their reduced access to saline. Further studies are needed to more thoroughly analyze the relationship between lack of access to saline rinses and postoperative outcomes in larger cohorts of socially deprived individuals.

Of note, differences exist between the state ADI and national ADI in our regression models. Though no studies have been done explaining the differences between the two, we hypothesize these differences can be explained by their capability to capture different aspects of social deprivation. States like New York, Massachusetts, and California are overall more affluent. Thus, although regions might nationally be ranked as having lower area deprivation, this does not account for the higher living costs and differences in transportation (more individuals own cars in more affluent areas). As such, state ADI, which adjusts for these differences, may be more sensitive for deprived areas.

There are several limitations to this study. First, there has been no validation of SDI in previous rhinology studies. Because our SDI is unweighted and thus considers all variables to be equal contributors to social deprivation, our results may be skewed. Given the small sample size, our study was also underpowered to detect other possible barriers to care in those with higher SDI. Another limitation is that our survey provided an option for non-Black Hispanics but did not allow for individuals to select both Black and Hispanic together if they felt that they belonged to both groups. In the next iteration of the survey, we hope to allow for more clarity in ethnicity. Finally, this study was cross-sectional, preventing us from determining causal pathways. We intend to further study our constructed SDI and the ADI in a larger population in future work.

5 | CONCLUSIONS

Socially deprived patients may lack access to the most basic rhinologic treatment: nasal saline irrigations. Paradoxically, socially deprived patients may have less difficulties with one of the most expensive aspects of rhinologic treatment: surgery. Taken together, these results indicate that, although more socially deprived patients are able to

have surgery, they may have more difficulty with postoperative maintenance treatment. Further studies examining the relationship between pharmacy deserts and ADI, as well as between insurance status and variations in medical and surgical treatment should be pursued to better understand barriers faced by underserved populations experiencing sinonasal disease.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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