Promoting Health Equity Among Patients with Limited English Proficiency

by

Gabriela Dziewulski

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This thesis was presented

by

Gabriela Dziewulski

It was defended on

April 13, 2023

and approved by

Tina Batra Hershey, JD, MPH, Associate Professor,
Health Policy and Management, School of Public Health at the University of Pittsburgh

Maichou Lor, PhD, RN, Assistant Professor,
School of Nursing at the University of Wisconsin-Madison

Grant Martsolf, PhD, MPH, RN, FAAN, Professor
Acute and Tertiary Care, School of Nursing at the University of Pittsburgh

Thesis Advisor/Dissertation Director: Theresa A. Koleck, PhD, RN, Assistant Professor,
Health Promotion and Development, School of Nursing at the University of Pittsburgh

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Background: Research on social determinants of health and patient reported outcomes in adults with limited English proficiency (LEP) is very limited but suggests that patients with LEP have more social needs compared to English proficient patients. The purpose of this project is to examine if social determinants of health influence patient reported outcomes, specifically self-reported physical and mental health, in adults with LEP.

Methods: We used the *All of Us* Research Program, a National Institutes of Health biomedical database, to conduct a retrospective, cross-sectional analysis using data from adults with LEP, operationalized as adults (≥18 years of age) who report speaking English "not well" or "not at all." We evaluated 13 determinants, including neighborhood cohesion, neighborhood disorder, neighborhood environment, social support, loneliness, everyday discrimination, discrimination in health care, food security, housing insecurity, housing instability, perceived stress, religiousness/spirituality, and religious attendance. We calculated physical and mental health t-scores using participant responses from the PROMIS Global Health short form survey v1.2. We conducted univariate linear regression and forward selection, adjusted for age and sex at birth, within the secure Researcher Workbench platform, to investigate relationships between determinants and physical and mental health.

Results: Participants (N=528) had a mean age of 55.28 years and were primarily female (75.57%) and Hispanic or Latino (87.69%). Overall physical health for the cohort was fair to good (mean=44.10; standard deviation [SD]=8.73) and mental health was good to very good

(mean=48.05; SD=8.30). Perceived stress (b=-0.371, p<0.001) and neighborhood disorder (b=-0.225, p=0.021) were identified as the most important determinants for physical health (model R^2=0.1671); higher levels were associated with poorer physical health. Similarly, perceived stress (b=-0.308, p=0.049), loneliness (b=-0.424, p<0.001), and neighborhood disorder (b=-0.213, p=0.007) were identified as the most important determinants for mental health (model R^2=0.2754); higher levels were associated with poorer mental health.

Conclusions: Our study identified targets of nursing interventions for improving self-reported physical and mental health in patients with LEP. Special considerations, such as use of medical interpreters and instruments in a patient's primary language, should be considered. Improving patient reported outcomes in patients with LEP is critical to promoting health equity for LEP populations.

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Preface

I would like to thank everyone who was involved in this process for allowing me to try to do something new. I would like to thank my thesis mentor Dr. Theresa Koleck for making this whole process possible through her expertise and continuous support. I am grateful for Alex Conway who helped me figure out how to analyze all the data gathered. I am thankful for the commitment of my committee Esq. Tina Batra Hershey, Dr. Maichou Lor, and Dr. Grant Martsolf. I would also like to thank my mom, dad, and sister for always listening to me explain this research paper, even when I was translating everything from English to Polish.

We would like to acknowledge the *All of Us* Research Program. The *All of Us* Research Program is supported by the National Institutes of Health, Office of the Director: Regional Medical Centers: 1 OT2 OD026549; 1 OT2 OD026554; 1 OT2 OD026557; 1OT2 OD026556; 1 OT2 OD026550; 1 OT2 OD 026552; 1 OT2 OD026553; 1 OT2 OD026548; 1 OT2 OD026551; 1 OT2 OD026555; IAA #: AOD 16037; Federally Qualified Health Centers: HHSN 263201600085U; Data and Research Center: 5 U2C OD023196; Biobank: 1 U24 OD023121; The Participant Center: U24 OD023176; Participant Technology Systems Center: 1 U24 OD023163; Communications and Engagement: 3 OT2 OD023205; 3 OT2 OD023206; and Community Partners: 1 OT2 OD025277; 3 OT2 OD025315; 1 OT2 OD025337; 1 OT2 OD025276. In addition, the *All of Us* Research Program would not be possible without the partnership of its participants.

1.0 Introduction

Approximately 25 million individuals with limited English proficiency (LEP) live in the United States (Yang et al., 2023). LEP is defined as speaking English less than "well." LEP populations experience significant disparities in health outcomes and access to care due to language barriers, cultural and linguistic differences, and lower levels of health literacy (Wynia & Osborn, 2010). Studies have found that LEP populations have poor relationships with their healthcare providers (Hsueh et al., 2019), high readmission rates (Ju et al., 2017), and unplanned emergency department visits (Ngai et al., 2016). They also have higher rates of chronic diseases (Garcia et al., 2017; Nguyen et al., 2021), poorer health status (Jacobs et al., 2019; Kim et al., 2017; Lommel & Chen, 2015), and more delayed care compared to English-speaking patients (Ramirez et al., 2022). Despite these findings, limited studies have focused on patient reported outcomes to assess self-reported physical and mental health among LEP populations.

Patient reported outcomes are self-reported from patients about their own perceived health, quality of life, or functional status associated with their health care (Weldring & Smith, 2013). Studies have found that incorporating the use of the patient reported outcome measures, such as those available through the Patient-Reported Outcomes Measurement Information System (PROMIS), on a regular basis can empower patients to actively participate in their health care, facilitate early detection and monitoring of patient symptoms, and enables healthcare providers to better understand patients' needs and take appropriate action (Basch et al., 2015; Chen et al., 2013; Kotronoulas et al., 2014).

Social determinants of health are defined as "the conditions in the environment where people are born, learn, work, play, worship, and age that affect a wide range of health, functioning,

and quality of life outcomes and risks" (U.S. Department of Health and Human Services, n.d.). These social, physical environment, and economic factors can influence the health outcomes of an individual and encompass five domains, i.e., education access and quality, neighborhood and built environment, economic stability, healthcare access and quality, and social and community context (U.S. Department of Health and Human Services, n.d.). Patients with LEP often have social determinants that place them at high risk for experiencing poor patient reported outcomes. For example, Fischer and colleagues found that patients with LEP had more social needs compared to English proficient patients (Fischer et al., 2021). Likewise, Benda and colleagues reported that language barriers can contribute to patient safety events for LEP patients (Benda et al., 2022).

A research gap exists in understanding how social determinants of health influence LEP patients' self-reported patient reported outcomes, particularly for physical and mental health. Identification of social determinant of health factors that are potential targets of intervention and/or social support strategies for improving the LEP patient populations' patient reported health outcomes is critical to promoting health equity for LEP patient populations. This study addresses the research gap by analyzing data from the National Institutes of Health *All of Us* Research Program, a large biomedical database of diverse individuals living in the United States.

1.1 Purpose

The purpose of this project is to examine if social determinants of health influence patient reported outcomes, specifically self-reported physical and mental health, in individuals with LEP.

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2.0 Methods

2.1 Design

We conducted a retrospective, cross-sectional analysis using the National Institutes of Health *All of Us* Research Program (allofus.nih.gov) survey data to examine if social determinants of health influence self-reported physical and mental health in individuals with LEP. The *All of Us* Research Program is a large biomedical database that stores health data from a diverse group of participants living in the United States. The goal of the *All of Us* Research Program is to "speed up health research discoveries, enabling new kinds of individualized health care" (NIH, 2021). Over 616,000 individuals have consented to join the *All of Us* Research Program and completed the initial steps of program enrollment.

First, I completed all necessary steps to become a registered *All of Us* researcher, including training on conducting responsible and ethical research with data from *All of Us* Research Program participants. Researcher approval is required to access the Registered and Controlled Tiers of curated, individual level participant data (researchallofus.org). Then, our team created a workspace in the *All of Us* Researcher Workbench for this project. The publicly available description of this project can be found here: https://www.researchallofus.org/research-projects-directory/?searchBy=workspaceNameLike&directorySearch=Promoting+Health+Equity+Among+Patients+with+Limited+English+Proficiency. We used the Controlled Tier *All of Us* Research Program data release version 6 for this study. This study was exempt from human subjects' approval as only deidentified data were analyzed.

2.2 Cohort Identification

We used the Cohort Builder within the *All of Us* Researcher Workbench to identify a cohort of adults (≥18 years of age) with LEP (N=528). We defined a participant as having LEP if they responded (1) "yes" to the question "Do you speak a language other than English at home?" and (2) "not well" or "not at all" to the branching logic question, "Since you speak a language other than English at home, we are interested in your own thoughts about how well you think you speak English. Would you say you speak English… 'very well', 'well', 'not well', 'not at all', 'don't know', or 'prefer not to answer'" on the *All of Us* Research Program Social Determinants of Health Survey (All of Us Research Hub, n.d.). This question was originally included in the California Health Interview Survey (UCLA Center for Health Policy Research, n.d.).

2.3 Building the Dataset

We used the Dataset Builder within the *All of Us* Researcher Workbench to create a dataset containing (1) demographic, (2) physical and mental health, and (3) social determinant of health information for participants with LEP.

2.3.1 Demographic Characteristics

We obtained participant demographic characteristics, including age, gender identity, sex at birth, race, and ethnicity, from the *All of Us* Research Program The Basics Survey (All of Us Research Hub, n.d.). We report ethnicity alone rather than race and ethnicity due to the high

percentage of participants who reported their ethnicity as “Hispanic or Latino” but did not self-select a racial categorization.

2.3.2 Physical and Mental Health

Scores for self-reported physical and mental health were calculated using responses to items on the *All of Us* Research Program Overall Health Survey (All of Us Research Hub, n.d.). Items are originally from the PROMIS Global Health Scale v1.2 (HealthMeasures, 2023). Participants completed the Overall Health Survey between 2017 and 2021.

Specially, four questions were used to assess global physical health: (1) “In the past 7 days, how would you rate your pain on average?” *Response – numeric scale, 0 (no pain) to 10 (worst imaginable pain)*; (2) “In the past 7 days, how would you rate your fatigue?” *Response – 5-point Likert scale (none, mild, moderate, severe, very severe)*; (3) “In general, how would you rate your physical health?” *Response – 5-point Likert scale (excellent, very good, good, fair, poor)*; and (4) “To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair?” *Response – 5-point Likert scale (completely, mostly, moderately, a little, not at all).*

Likewise, four questions were used to assess global mental health: (1) “In general, would you say your quality of life is:” *Response – 5-point Likert scale (excellent, very good, good, fair, poor)*; (2) “In general, how would you rate your mental health, including your mood and your ability to think?” *Response – 5-point Likert scale (excellent, very good, good, fair, poor)*; (3) “In general, how would you rate your satisfaction with your social activities and relationships?” *Response – 5-point Likert scale (excellent, very good, good, fair, poor);* and (4) “In the past 7 days,

how often have you been bothered by emotional problems such as feeling anxious, depressed, or irritable?" *Response – 5-point Likert scale (never, rarely, sometimes, often, always).*

Total raw scores for physical and mental health were converted to t-scores using PROMIS t-score conversion tables (Hays et al., 2009). T-score distributions are standardized with a mean score of 50 and a standard deviation of 10. A higher t-score represents a higher level of the concept being measured (i.e., higher scores indicate better health).

2.3.3 Social Determinants of Health

We evaluated 13 self-reported social determinants of health, including neighborhood cohesion, neighborhood disorder, neighborhood environment, social support, loneliness, everyday discrimination, discrimination in health care, food security, housing insecurity, housing instability, perceived stress, religiousness/spirituality, and religious attendance, using information collected as part of the *All of Us* Research Program Social Determinants of Health Survey. See Table 1 for a description of the determinant, survey items, and source material. Social Determinants of Health Survey responses were collected during 2021.

Further, we evaluated the relationship between deprivation index and physical and mental health. The deprivation index is an evaluation of an area's socioeconomic conditions that have been linked to health outcomes (Maroko et al., 2016). In the *All of Us* dataset, the deprivation index corresponds to the population-weighted average of the index for the United States census tracts covered by the 3-digit Zip Code Tabulation Area code and is a composite of measures related to public assistance income or food stamps/SNAP, educational attainment, household income, health insurance coverage, poverty status, and occupancy status (Yang et al., 2023). Deprivation

index ranges from 0-1, with a higher index indicating higher levels of deprivation (Brokamp et al., 2018; Yang et al., 2023).

Table 1. Social Determinants of Health Survey Information in *All of Us* Research Program

Determinant	*All of Us* Social Determinants of Health Survey Items	Source Survey
Neighborhood Cohesion	1. People around here are willing to help their neighbors 2. People in my neighborhood generally get along with each other 3. People in my neighborhood can be trusted 4. People in my neighborhood share the same values	Social Cohesion Neighborhood Scale
Neighborhood Disorder	5. There is a lot of graffiti in my neighborhood 6. My neighborhood is noisy 7. Vandalism is common in my neighborhood 8. There are a lot of abandoned buildings in my neighborhood 9. My neighborhood is clean 10. People in my neighborhood take good care of their houses and apartments 11. There are too many people hanging around on the streets near my home 12. There is a lot of crime in my neighborhood 13. There is too much drug use in my neighborhood 14. There is too much alcohol use in my neighborhood 15. I'm always having trouble with my neighbors 16. In my neighborhood, people watch out for each other 17. My neighborhood is safe	Ross-Mirowsky Neighborhood Disorder Scale
Neighborhood Environment	18. What is the main type of housing in your neighborhood? 19. Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home 20. It is within a 10-15 minute walk to a transit stop (such as bus, train, trolley, or tram) from my home 21. There are sidewalks on most of the streets in my neighborhood 22. There are facilities to bicycle in or near my neighborhood, such as special lanes, separate paths or trails, shared use paths for cycles and pedestrians 23. My neighborhood has several free or low-cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc. 24. The crime rate in my neighborhood makes it unsafe to go on walks at night 25. The crime rate in my neighborhood makes it unsafe to go on walks during the day	Physical Activity Neighborhood Environment Scale (PANES) - Environmental Module
Social Support	26. Someone to help you if you were confined to bed 27. Someone to take you to the doctor if you need it 28. Someone to prepare your meals if you were unable to do it yourself 29. Someone to help with daily chores if you were sick 30. Someone to have a good time with 31. Someone to turn to for suggestions about how to deal with a personal problem 32. Someone who understands your problems 33. Someone to love and make you feel wanted	Modified Medical Outcomes Study Social Support Survey

Loneliness	34. I lack companionship 35. There is no one I can turn to 36. I am an outgoing person 37. I feel left out 38. I feel isolated from others 39. I can find companionship when I want it 40. I am unhappy being so withdrawn 41. People are around me but not with me	Short Form UCLA Loneliness Scale
Everyday Discrimination	42. You are treated with less courtesy than other people are. 43. You are treated with less respect than other people are. 44. You receive poorer service than other people at restaurants or stores. 45. People act as if they think you are not smart. 46. People act as if they are afraid of you. 47. People act as if they think you are dishonest. 48. People act as if they're better than you are. 49. You are called names or insulted. 50. You are threatened or harassed. 51. What do you think is the main reason for these experiences?	Everyday Discrimination Scale
Discrimination in Health Care	52. You are treated with less courtesy than other people 53. You are treated with less respect than other people 54. You receive poorer service than others 55. A doctor or nurse acts if he or she thinks you are not smart 56. A doctor or nurse acts as if he or she is afraid of you 57. A doctor or nurse acts as if he or she is better than you 58. You feel like a doctor or nurse is not listening to what you were saying	Discrimination in Medical Settings Scale
Food Security	59. Within the past 12 months, we worried whether our food would run out before we got money to buy more 60. Within the past 12 months, the food we bought just didn't last and we didn't have money to get more	The Hunger Vital Sign
Housing Insecurity	61. In the last 12 months, how many times have you or your family moved from one home to another? Number of moves in past 12 months.	Upstream Risk Screening Tool: Housing Insecurity
Housing Instability	62.Think about the place you live. Do you have problems with any of the following (check all that apply)?	Accountable Health Communities Health-Related Social Needs
Perceived Stress	63. In the last month, how often have you been upset because of something that happened unexpectedly? 64. In the last month, how often have you felt that you were unable to control the important things in your life? 65. In the last month, how often have you felt nervous and stressed? 66. In the last month, how often have you felt confident about your ability to handle your personal problems? 67. In the last month, how often have you felt that things were going your way? 68. In the last month, how often have you found that you could not cope with all the things that you had to do?	Perceived Stress Scale

	69. In the last month, how often have you been able to control irritations in your life? 70. In the last month, how often have you felt that you were on top of things? 71. In the last month, how often have you been angered because of things that happened that were outside of your control? 72. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	
Religiousness / Spirituality	73. I feel God's (or a higher power's) presence 74. I find strength and comfort in my religion 75. I feel deep inner peace or harmony 76. I desire to be closer to or in union with God (or a higher power) 77. I feel God's (or a higher power's) love for me, directly or through others 78. I am spiritually touched by the beauty of creation	The Brief Multidimensional Measure of Religiousness/Spirituality – Daily Spiritual Experiences Scale Short Form
Religious Services	79. How often do you go to religious meetings or services?	Nurse Health Study - 2016 Long Version

2.4 Data Analysis

We performed all data analysis within the secure Researcher Workbench platform using R and the Jupyter Notebook environment. First, we calculated descriptive statistics for participant demographics, social determinants of health, and physical and mental health. We excluded individuals who skipped or preferred not to answer these survey questions in the analysis.

We used linear regression models to investigate relationships between each individual social determinant of health and participant reported physical and mental health. Then, we used forward selection, a stepwise selection method, to build linear regression models that include all the social determinant of health variables that are statistically significantly related to (1) physical health and (2) mental health. A stepwise selection method allowed us to determine the "most important" social determinants of health for physical and mental health in adults with LEP. We

chose to use a forward selection method, in particular, due to the large number of candidate variables and the possibility of multiple variables being mediators (i.e., a variable that explains the process through which two variables are related). Determinants meeting a significance level of 0.05 in the univariate models were included as candidates in the forward selection models. Furthermore, we adjusted models for participant age and sex at birth. Sex at birth and gender identity had over a 97% agreement; therefore, we adjusted for only one of these variables. We compared models based on the proportion of variance explained (i.e., R^2). We added candidate predictor variables one-by-one in a stepwise fashion by choosing the model with the highest R^2, provided the variable being added had a p-value below 0.05. This overall approach allowed us to retain the largest sample size possible, while ensuring that every model used in the selection process had the same sample to compare R^2.

For physical health, neighborhood cohesion, neighborhood disorder, loneliness, perceived stress, food security, housing instability, everyday discrimination, and discrimination in health care all had p-values below 0.05 in the univariate models. Therefore, only participants (n=187) who had data for these variables, as well as physical health, were included in the forward selection modeling. For mental health, neighborhood cohesion, neighborhood disorder, loneliness, social support, perceived stress, food security, housing instability, everyday discrimination, and discrimination in health care were significant predictors in the univariate model and, thus, included as candidate variables in the forward selection models (n=206).

3.0 Results

As shown in Table 2, participants had a mean age of 55.28 years and were primarily female (75.57%) and Hispanic or Latino (87.69%). The mean t-score for global physical health for this sample was 44.10 (standard deviation [SD]=8.73), indicating fair to good physical health. The mean t-score for global mental health was 48.05 (SD=8.30), indicating good to very good mental health.

Table 2. Demographics and Health-related Variables (N=528)

	Mean (SD) or n (%)
Age (years)	55.28 (12.74)
Sex at birth	
Female	399 (75.57)
Male	107 (20.27)
Skipped	22 (4.17)
Gender identity	
Woman	401 (75.95)
Man	105 (19.89)
Other, prefer not to answer, or skipped	22 (4.17)
Ethnicity	
Hispanic or Latino	463 (87.69)
Not Hispanic or Latino	39 (7.39)
Other, prefer not to answer, or skipped	26 (4.92)
Physical health	44.10 (8.73)
Mental health	48.05 (8.30)

Table 3 summarizes the social determinants of health for the sample. Overall, participants endorsed high neighborhood cohesion ($\bar{x}$=3.37; SD=0.77), low neighborhood disorder ($\bar{x}$=25.71; SD=6.61), and environmental support for physical activity ($\bar{x}$=4.31; SD=1.61). Participants reported moderate levels of social support ($\bar{x}$=3.33; SD=1.14), loneliness ($\bar{x}$=15.34, SD=5.10), and perceived stress ($\bar{x}$=14.86; SD=7.79) and low levels of everyday discrimination ($\bar{x}$=1.71, SD=0.86) and discrimination in health care ($\bar{x}$=1.47, SD=0.65). The majority of participants reported food security (59.65%), housing security (with 95.85% moving less than two times in the past 12

months), and housing stability (with 61.69% reporting no problems with the place they live). While participants endorsed religiousness/spirituality ($\bar{x}$=4.29; SD=1.20), many infrequently attended religious services with approximately 45% of participants reporting that they are not religious or never or almost never attend religious services. In addition, the mean deprivation index was 0.36 (SD=0.06).

Table 3. Descriptive Statistics for Social Determinants of Health

		Interpretation	
	Mean (SD), Median (IQR) or n (%)	Possible range of values	Meaning
Neighborhood Cohesion	3.37 (0.77), 3.5 (3.0 - 4.0)	1 – 5	Higher = better cohesion
Neighborhood Disorder	25.71 (6.61), 26.0 (21.0 - 30.0)	13 - 52	Higher = more disorder
Neighborhood Environment	4.31 (1.61), 5.0 (3.0 - 6.0)	0 - 6	Higher = more infrastructure for physical activity
Social Support	3.33 (1.14), 3.38 (2.44 - 4.25)	1 - 5	Higher = better social support
Loneliness	15.34 (5.10), 14.0 (11.0 - 19.0)	8 - 32	Higher = more lonely
Everyday Discrimination	1.71 (0.86), 1.44 (1.0 - 2.11)	1 - 6	Higher = more discrimination
Discrimination in Health Care	1.47 (0.65), 1.14 (1.0 - 1.71)	1 - 5	Higher = more discrimination
Food Security		Multiple choice	As is
Secure	303 (59.65)		
Insecure	205 (40.35)		
Housing Insecurity		Multiple choice	As is
Moved >1 time	< 20		
Moved 0-1 times in the past 12 months	460 (95.83)		
Housing Instability		Multiple choice	As is
Instability	195 (38.31)		
Stability	314 (61.69)		

Perceived Stress	14.86 (7.79), 15.0 (9.0 - 20.0)	0 – 40	<14 – low 14-26 – moderate >26 – high
Religiousness/Spirituality	4.29 (1.20), 4.67 (3.67 - 5.0)	1 - 6	Higher = more spiritual
Religious Services		Multiple choice	As is
More than once a week	50 (11.68)		
Once a week	76 (17.76)		
1 to 3 times per month	41 (9.58)		
Less than once per month	41 (9.58)		
Some days/once in a while	26 (6.07)		
Never or almost never	150 (35.05)		
Not religious	44 (10.28)		

From the univariate models, we found that as neighborhood social cohesion increased, physical (b=1.578, p=0.007) and mental (b=1.679, p=0.001) health improved. Likewise, as neighborhood disorder increased, physical (b=-0.319, p=0.001) and mental (b=-0.236, p=0.001) health declined. Food insecurity and housing instability were associated with decreased physical (b=-2.924, p=0.001; b=-2.861, p=0.001) and mental (b=-1.97, p=0.011; b=-2.046, p=0.008) health. In terms of discrimination, greater exposure to everyday discrimination and discrimination in health care decreased physical (b=-1.698, p=0.001; b=-1.908, p=0.005) and mental (b=-3.135, p<0.001; b=-2.559 p<0.005) health. Higher levels of perceived stress and loneliness were also associated with poorer physical (b=-0.35, p<0.001; b=-0.387, p<0.001) and mental (b=-0.419, p<0.001; b=-0.633, p<0.001) health. In addition, as perceived social support increased, mental health improved (b=1.028, p=0.003). While perceived social support was not statistically significantly associated with physical health, the relationship trended in the same direction

(b=0.761, p=0.051) as it did for mental health. Neighborhood environment, housing insecurity, religiousness/spirituality, religious attendance, and deprivation index were not associated with physical or mental health.

The final forward selection model for physical health (R^2=0.1671; Table 4), adjusted for age and sex at birth, included perceived stress (b=-0.371, p<0.001) and neighborhood disorder (b=-0.225, p=0.021). Similarly, the final forward selection model for mental health (R^2=0.2754; Table 5), adjusted for age and sex at birth, included perceived stress (b=-0.308, p=0.049), loneliness (b=-0.424, p<0.001), and neighborhood disorder (b=-0.213, p=0.007).

Table 4. Forward Selection for Physical Health Adjusted for Age and Sex with Candidate Social Determinants of Health Meeting a p<0.05 Threshold in the Univariate Models

Step 1	Step 2	Step 3	Step 4
Neighborhood cohesion	0.066	NS	--
Neighborhood disorder	0.071	0.167*	In model
Food insecurity	0.066	NS	--
Housing instability	0.070	0.161	NS
Loneliness	0.120	0.160	NS
Everyday discrimination	0.071	NS	--
Discrimination in healthcare	NS	--	--
Perceived stress	0.142*	In model	In model

Note. Cells report the model R^2 with the variable added for variables meeting a p<0.05 threshold.

*=variable added to the selection model; NS=not significant.

Table 5. Forward Selection for Mental Health Adjusted for Age and Sex with Candidate Social Determinants of Health Meeting a p<0.05 Threshold in the Univariate Models

Step 1	Step 2	Step 3	Step 4
Neighborhood cohesion	0.062	NS	--
Neighborhood disorder	0.064	0.231	0.275*
Food insecurity	0.041	NS	--
Housing instability	0.050	NS	--
Social support	0.080	NS	--
Loneliness	0.194	0.248*	In model
Everyday discrimination	0.130	0.230	NS
Discrimination in healthcare	0.049	NS	--
Perceived stress	0.196*	In model	In model

Note. Cells report the model R^2 with the variable added for variables meeting a p<0.05 threshold. *=variable added to the selection model; NS=not significant.

4.0 Discussion

To our knowledge, this is the first study investigating the relationship between social determinants of health and self-reported physical and mental health among individuals with LEP. Use of the *All of Us* Research Program participant data facilitated our characterization of social determinants of health and patient reported outcomes, namely self-reported physical and mental health, in adults with LEP. We found that greater neighborhood social cohesion was associated with better physical and mental health and that greater neighborhood disorder, exposure to everyday discrimination, exposure to discrimination in health care, perceived stress, and loneliness as well as food insecurity and housing instability, were associated with poorer physical and mental health. Additionally, as perceived social support increased, mental health improved. Neighborhood environment, housing insecurity, religiousness/spirituality, religious attendance, and deprivation index did not impact physical or mental health. The forward selection model for physical health, adjusted for age and sex at birth, indicated that most influential social determinant of health predictors are stress and neighborhood disorder. Similarly, the forward selection model for mental health, adjusted for age and sex at birth, highlighted the most influential predictors are perceived stress, loneliness, and neighborhood disorder.

Perceived stress and neighborhood disorder were identified as very important social determinant of health factors for both self-reported physical and mental health in adults with LEP. Perceived stress refers to an individual's thoughts or feelings about how much general stress they are under at a point in time and their ability to cope with stress (Phillips, 2013). We found a statistically significant association between higher levels of perceived stress and poorer physical and mental health. Our findings are consistent with the existing literature on LEP populations;

that is, people from racial or ethnic minority backgrounds who have LEP are more prone to experience higher levels of perceived stress than the general population. These increased stress levels are due to the additional burdens of poverty, racial or cultural conflicts, communication difficulties, financial hardships, and racial discrimination that they often face (Kim & Kim, 2013). As a result, LEP populations are more likely to experience higher levels of perceived stress and a greater risk of physical and mental health problems (Kim & Kim, 2013). These findings are consistent with the existing literature on this topic.

Neighborhood disorder is defined as "the presence of features such as trash, vacant buildings, and crime" (Robinette et al., 2018). We found that there was a statistically significant association between neighborhood disorder and physical and mental health; as neighborhood disorder increased, physical and mental health declined. Correspondingly, the univariate models found that as neighborhood social cohesion increased, physical and mental health improved. Neighborhood cohesion describes the residents' sense of community among the inhabitants of a neighborhood, including trust, shared values, and norms (Damurski, 2021). These findings are not surprising and are consistent with the existing literature on immigrant populations. For example, a study of Chinese older adults living in the greater Chicago, Illinois area found that lower levels of neighborhood disorder and higher levels of neighborhood social cohesion are associated with higher overall health status and quality of life (Dong & Bergren, 2017). Likewise, a study of Latino adults living in San Diego, California found that lower levels of neighborhood social cohesion were associated with depressive symptoms; they further found that active use of parks or recreational facilities may protect against depressive symptoms (Perez et al., 2015). These findings suggest that neighborhood order and social cohesion could be a potential source of resilience or a protective factor that contributes to positive health outcomes.

In addition to perceived stress and neighborhood disorder, loneliness was identified as an important factor for self-reported mental health. Loneliness is defined as "the unpleasant experience that occurs when a person's network of social relations is deficient in some important way" (Duck et al., 1981). Research suggests that language proficiency may play a role in the social integration of older immigrants (Diwan, 2008). This finding might explain our results considering that our sample has LEP. Low proficiency in the host language could limit opportunities to interact with other members of society and take part in activities that are more mainstream. Loneliness is also impacted by individual resources, social situation, and the social environment of the surrounding society. Since immigration or migration can lead to social isolation and disconnection from communities, family, and friends, it can have a serious impact on an individual's mental health, resulting in feelings of loneliness and depression (Pan et al., 2023). Social environment, such as social capital and discrimination, and social situation, such as marital status, improve mental health by decreasing levels of loneliness in migrant populations (Pan et al., 2023), which can be seen in our findings as well.

It is interesting to note that we did not find a relationship between deprivation index and self-reported physical or mental health. In contrast to the *All of Us* Research Program Social Determinants of Health Survey items, which represent self-reported perceptions of an individual's social and physical environment, deprivation index is a structural social determinant of health calculated based on public assistance income or food stamps/SNAP, educational attainment, household income, health insurance coverage, poverty status, and occupancy status (Yang et al., 2023). The impact of subjective, self-reported versus objective, structural social determinants of health on patient reported outcomes is an important area for further investigation.

Our study has some limitations which should be considered. Our sample is primarily Hispanic females/individuals who identify as women; therefore, our findings may not be applicable to non-Hispanic individuals or males/individuals who identify as men. We did not have access to language information for our study. Based on the high percentage of participants reporting Hispanic or Latino ethnicity, however, we are assuming that the primary language spoken in our sample to be Spanish. Our findings may not be applicable to individuals with LEP of other languages and/or cultures. Likewise, the *All of Us* Research Program data does not include information on length of residence in the United States, age of entry into the United States, country of origin, or acculturation. Fast social links may lead to closed groups where migrants and natives may not form many connections outside of this initial group (Chuang et al., 2019). In addition, while the full spectrum of self-reported physical and mental health scores were represented, our study cohort endorsed fair to good physical health and good to very good mental health overall. Thus, our results may not be applicable to all individuals with LEP.

This study has implications for nursing practice. These findings are important to nursing practice since social determinants may greatly affect the physical and mental health of future LEP patients. To provide culturally congruent and equity care to LEP patients, it is essential to consider patients holistically. Our findings suggest that special attention should be given to assessment, treatment, and mitigation of perceived stress and loneliness during clinical encounters. Special considerations for patients with LEP, such as use of skilled medical interpreters and availability of assessment instruments translated and validated in a patient's primary language, should be considered. Neighborhood disorder, however, is an "upstream" social determinant, that may need to be addressed at a community level. Nurses could consider community-level interventions, such

as recommending patients to support groups/social groups, walking groups, and exercise buddy systems to promote better physical and mental health outcomes.

Our findings also have implications for health equity. When LEP patients feel lonely and experience high level of stress, it can lead to increased disparities in health outcomes. These outcomes could be due to the fact that isolated and stressed patients may be less likely to seek out and adhere to treatments. Improving health equity for LEP patients requires a holistic approach that addresses their social, economic, and health-related needs. This includes increasing access to culturally appropriate health care services, providing patient education and resources in multiple languages, and building strong connections between patients and health care providers.

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