



Research Article

Community Participation and Risk for Depressive Symptoms in Rural Areas

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Abstract

Research has shown that social participation has a positive effect on health, particularly mental health. We looked at the possible relationship between community participation/involvement, social networks, and the risk for depressive symptoms. The survey we used consisted of the Lubben Social Network Scale (LSNS-18) and the Patient Health Questionnaire-9 (PHQ-9). It was distributed to patients, aged 18 years and older, in healthcare clinics in rural Illinois. We found that the total score of the PHQ-9 was negatively correlated with the total score of the LSNS-18 and each of the subscales, meaning that participants, who scored high on the LSNS-18 and each subscale, suggesting a viable social network, were less likely to score high on the PHQ-9. This indicates that social connectedness with family, friends, and neighbors can be beneficial in preventing depression. Participants that answered they often participated in community activities were also significantly less likely to score high on the PHQ-9, as were participants who felt they spent enough time participating in and contributing to the community in which they lived. Participants who were married, living with a partner or in a relationship were also significantly less likely to score high on the PHQ-9, as were those with children and those that were employed. These results create possibilities for new treatment options that aim to improve social support and social activities that will positively impact mental health.

Keywords

Social participation, Community participation, Depression, Mental health, Rural health

Background

The World Health Organization (WHO) has ranked depression as the single largest contributor to global disability. Globally, the number of people with depression has been estimated to exceed 300 million in 2015 [1]. The results from the WHO World Health Survey data support this, showing that depression produces the greatest decrement in health compared with other chronic diseases like angina, arthritis, asthma, and diabetes [2]. For women, depression is the leading cause for disease burden in both high-income and low- and middle-income countries [3].

In the United States, major depressive disorder is one of the most common mental health issues. Research has shown that depression is the leading cause for disability in the United States for people ages 15 to 44 years, with the disorder being related to a decrement in health and declines in health-related quality of life [4]. In 2015, data showed that 6.7% of adults aged 18 or older in the United States had had at least one major depressive episode, with women being almost twice as likely as men to have been depressed. In 2016, 4.3% of U.S. adults had at least one major depressive disorder with severe impairment [5], and about 80% of adults with depression reported at least some difficulty with work, home, and social

activities because of their depression [6]. With depressive disorders compromising productivity at home and at work, as well as interfering with fulfillment of social and familial roles, depression can lead to major economic ramifications [4]. Smit, et al. [7] found that costs for treatment are rising, while still only being a fragment of the costs brought on by reduced productivity caused by depression.

Research establishing a relationship between population density and risk for depression has shown varying results. Work conducted in Manitoba, Canada, showed no differences in depressive symptoms when comparing rural and urban areas [8], while one study among community dwelling people

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over 65 years of age in Quebec showed a higher prevalence for depression in rural areas than in metropolitan and urban areas [9]. A study conducted in Sweden showed that living in an urban area was associated with a higher incidence of depression for both men and women [10]. This is supported by results using the General Health Questionnaire in the United Kingdom, which also showed that the participants living in rural areas experienced statistically significant better mental health than the participants living in non-rural areas [11]. One reason offered to explain these results links the tranquility, peace, and beautiful surroundings of rural areas to having a positive effect on the human psyche. Also, lower levels of social support might be more common in urban social environments. Research in rural areas in Texas showed no significant difference in the rates of severe depression between rural and urban areas [12]. However, research analyzing data from the National Health Interview Survey showed that rural residents had higher odds for depression than urban residents [13].

Overall research has shown that rural residents usually lack social, health, and mental services and have an increased risk for mental health problems [14]. Consequently, there are less outpatient visits, resulting in an increased probability of hospitalization. Previous research has also shown the importance of social ties within the community and how much more important community participation is in rural areas, when compared to suburban and urban settings [15,16].

Humans have profound needs to form bonds with other people and to be accepted into social groups [17]. These bonds are formed eagerly, and even under seemingly adverse conditions. Furthermore, humans have a pervasive drive to form and maintain at least a minimum quantity of lasting, positive, and significant interpersonal relationships. Losing attachments and breaking social bonds is resisted, even when maintaining the bond would be difficult. Overmore, humans crave repeated interactions with the same partners over constantly changing partners, and these interactions are most rewarding when they are stable and include affective concern for each other's wellbeing. Forming social attachments usually produces positive emotions, while potential threats to existing social bonds generate unpleasant emotions. People need few close relationships, and forming additional social ties beyond the few close relationships has less and less impact. This is consistent with the satiation hypothesis, showing that humans become less active at seeking additional relationships. Furthermore, this correlates with the knowledge that both psychological and physical health problems are more common among people who lack social ties, as are behavioral pathologies [18].

The interpersonal motive to belong is the cause of a great deal of human behaviors and emotions and a lack of belongingness can lead to severe deprivation. These ties in with the symbolic interactionism theory, which is a theory used to explain the structure on which society is built [19-21]. The theory suggests that people give meaning to objects and actions based on reciprocal values. Objects do not have meaning on their own, therefore the meanings given are subjective, where different people might interpret the same object in dif-

ferent ways. With research having shown that people suffering from depressive symptoms are more likely to frequently report negative social interactions, [18,22-24] this shows that the same social cues can be interpreted in both negative and positive ways. It would make sense that interpreting social cues to have a negative value will lead to further development of more symptoms of depression, which in turn will lead to more negatively interpreted social interactions. This will lead to a downward spiral, which in turn could lead to a depressive episode if not addressed in a timely manner.

Social support has been long known to exert considerable influence on mental health and well-being [25]. Depression has been associated with social impairments, resulting from social emotional dysfunction, making it less likely that someone suffering from depression will recognize cues of acceptance or belonging in social situations [17,26]. Patients with depression also experience increased rejection sensitivity [27]. Furthermore, research has shown that patients suffering from major depressive disorder reported significantly poorer intimate relationships and feeling less satisfied by social interaction than those with no psychiatric disorder [28]. Decreased initiation and responsiveness to social contacts can give their partners an impression of having lack of interest to engage in social interactions. Possibly, patients with depression withdraw from others in order to protect themselves from anticipated disappointment, rejection, scorn, and social exclusion [29]. Impaired emotion recognition and a negative emotional bias contribute to deficits in communication abilities [30-32].

On the other hand, positive, supportive, and intimate relationships with family and friends are known to have a beneficial effect on maintaining psychological health, with high quality relationships being associated with better self-esteem and well-being, while also providing a sense of belonging [33]. Moreover, negative exchanges with family and friends are associated with greater occurrence of depression, [34] and social rejection has been found to be one of the strongest proximal risk factors for depression [35]. Having a low overall quality of social relationships and social isolation has been associated with depression [36,37].

This is supported by research showing that higher levels of loneliness are associated with elevated levels of depressive symptoms [38]. Social engagement, such as volunteering, church attendance, and informal activities are known to have a positive effect on health [39]. Also, religious activities have shown to assist in dealing with stressors, although women seem to be more likely than men to seek and receive social support from faith community involvement [40,41]. Research focusing on social integration showed that rural residents are more involved in their communities [42], Living in the same neighborhood was associated with a greater sense of belonging to the neighborhood [43]. Overall, sense of community seems to be an essential component for elderly participation in local activities, while research has shown that social participation and social networks seem to be key mental health resources, particularly for older people [39,44].

Materials and Methods

Settings and subjects

This study was conducted over a six-week period. Participants were recruited from six different healthcare clinics in rural Illinois, with populations ranging from 2,344 to 15,202. All were considered rural according to the Rural Urban Commuter Access (RUCA) codes. The study was approved by the [institution's] Institutional Review Board.

Patients and their accompanying family members or friends were asked to participate in the research, by the principal investigator, who was available in the clinic's waiting area. Participants were informed the survey was for a community project investigating rural mental health, that participation was voluntary, and that they were allowed to skip questions or stop the survey at any time. Participants had to be at least 18 years of age.

Instruments

Demographics and community participation: Demographic information included age, gender, ethnicity, highest educational degree earned, having children, and years spent within the current community. We also asked participants for their opinion of their social participation in and contribution to their community, including participation in school, church, local government, and other activities in their community. Participants were asked to rate their participation in these four community activities, from always, very often, sometimes, rarely to never.

Depressive symptom: The PHQ-9 was developed as the self-administered version of the PRIME-MD [45]. It consists of nine items correlating with the nine criteria used in the DSM-IV for diagnosis of depressive disorders. An additional question was added, asking participants about functional impairments due to any problems they checked off [46]. The validity of the PHQ-9 has been proved to be reliable when taking a cut-off point of 10 points [47]. For the PHQ-9, the internal consistency has been shown to be excellent [48]. The brevity of the PHQ-9, coupled with its construct and criterion validity results in an excellent instrument for screening, diagnosing and assessing the severity of depressive disorders [46]. The PHQ-9 was chosen as the last part of the survey, to prevent participants from feeling negatively or depressed when filling out the other questions in the survey.

Social networks: The Lubben Social Network Scale (LSNS-R) was developed in 1988 [49], as a 12-item questionnaire including questions about social interactions with family and friends to measure social isolation in older adults. It was revised in 2002, with the addition of an abbreviated version (LSNS-6) and an expanded version (LSNS-18). The expanded version also includes questions about neighbors. For this research the LSNS-18 was used. Previous studies have shown the internal consistency for the LSNS-18 to be high [50], being the highest of all three scales (LSNS-6, LSNS-R, LSNS-18). For the LSNS-18 the internal consistency is highest for the friends subscale and lowest for the neighbor's subscale [51].

Statistical analysis: Data were analyzed using the SPSS package 24.0.0.0. Pearson correlation coefficients were used

to assess the possible relationship between the PHQ-9 total score, the LSNS total score and each subscale, and general demographics. Linear regression analysis was conducted to determine the effect of possible confounding factors, with PHQ-9 total score as the dependent variable.

Study hypotheses: This study had two main hypotheses

1. Rural residents with a small social network will score higher on the PHQ-9.
2. Participants who do not feel that they participate enough in or contributed enough to their community will score lower on the LSNS and higher on the PHQ-9.

Results

A total of 439 participants completed the survey. The overall response rate was 65%.

Descriptive results

Demographics: Demographics for the respondents are presented in Table 1. Mean age was 53.6 years, with 66.4%

Table 1: Demographic characteristics of respondents related to mental health issues in rural areas (n = 439).

1.1	Mean	SD	Range
Age, years	53.6	18.7	18-91
Time in community, years	23.8	20.7	0.8-84
1.2	N*	%	
Gender			
- Male	147	33.60%	
- Female	290	66.40%	
Ethnicity			
- Caucasian	429	98.60%	
- Other ¹	6	1.40%	
Marital Status ²			
- Married/living with a partner	310	70.90%	
- In a relation, but not living with a partner	16	3.70%	
- Single	45	10.30%	
- Divorced/separated	41	9.40%	
- Widowed	24	5.50%	
- Other	1	0.20%	
Children			
- Yes	366	83.80%	
- No	71	16.20%	
Education			
- High school or lower	155	35.40%	
- College	231	52.70%	
- Graduate school	52	11.90%	
Employment			
- Employed, student or retired	338	79.50%	

- Not-employed	87	20.50%
Yearly household income		
- \$0-\$20,000	55	14.10%
- \$20,000-\$60,000	158	40.60%
- \$60,000-\$100,000	109	28.00%
- \$100,000 or more	67	17.20%
*might not add up to 439 due to missing data.		
¹ Includes African American, Hispanic, Asian and Native American.		
² For analysis purposes, marital status was recorded into a binary variable: married/living with a partner and in a relationship but not living with a partner versus divorced/separated, widowed, single and other.		

Table 2: Responses to the Patient Health Questionnaire 9 (PHQ-9).

PHQ-9 (n = 416)*		
- Mean = 4.63		
- SD = 5.10		
- Range = 0-26		
Score	N	Percentage
0	95	22.80%
1-4: Minimal depression	170	40.90%
5-9: Mild depression	90	21.60%
10-14: Moderate depression	32	7.70%
15-19: Moderately severe depression	21	5.10%
20-27: Severe depression	8	1.90%
*Does not add up to 439 due to missing data.		

female respondents. Most respondents were Caucasian (98.6%), employed a student or retired (79.5%), and had finished college or graduate school (64.6%). The majority were married or living with a partner (70.9%) and had children (83.8%). The average time participants had spent living in the same zip code was 23.8 years (SD = 20.7 years).

When asked if they felt that they spent enough time participating in the community, 51.8% agreed, while 23.1% of participants did not agree. 53.3% of participants felt that they contributed enough to the community, while 21.2% felt that they had not.

PHQ-9: Table 2 presents the results for the PHQ-9, which showed that 22.8% of participants did not have any signs of depression. The mean of 4.63 points shows that the average participant scored just above the cut-off point for mild depression. However, almost 15% of respondents suffered from moderate to severe depression.

LSNS-18: Table 3 and Table 4 show the results for the LSNS-18 and the LSNS-subscale, respectively. The LSNS-18 does not have any cut-off point for determining when someone has good or bad social network status. Results show that less than 10% of participants scored 25 points or less. The majority scored between 36 and 60 points, with only 6% of participants scoring more than 66 points. This shows that the

Table 3: Responses to the Lubben Social Network Scale (LSNS-18).

LSNS-18 (n = 420)*		
- Mean = 44.78		
- SD = 13.94		
- Range = 6-81		
Score	N	Percentage
0-5	0	0%
6-10	4	1.00%
11-15	7	1.70%
16-20	10	2.40%
21-25	18	4.30%
26-30	30	7.10%
31-35	40	9.50%
36-40	46	11%
41-45	57	13.60%
46-50	51	12.10%
51-55	61	14.50%
56-60	43	10.20%
61-65	29	6.90%
66-70	12	2.90%
71-75	11	2.60%
76-80	0	0%
81-85	1	0.20%
86-90	0	0%
*Does not add up to 439 due to missing data.		

majority of the respondents seem to have a fairly good social network, with only a small group having an excellent social network. Each of the separate subscales shows that participants scored best on the family subscale; the score on the neighbors subscale was lowest.

Analysis

Pearson Correlation coefficients showed a statistically significant relationship between the total score on the PHQ-9 and the total score on the LSNS-18, showing that a higher LSNS total score correlated with a lower PHQ-9 total score ($p < 0.001$, see Table 5). This indicates that close ties to family, friends, and neighbors may decrease the risk for symptoms of depression.

PHQ-9: The correlation between the PHQ-9 and each subscale of the LSNS-18 showed the same results, with the correlation for each subscale being statistically significant with $p < 0.001$. Interestingly, we found a negative correlation between age and the PHQ-9 total score, meaning that younger participants scored higher on the PHQ-9 ($p < 0.001$). Having no children was associated with a higher PHQ-9 score ($p = 0.025$), as was being single, separated, divorced or widowed compared to being married, living with a partner or being in a relationship ($p < 0.001$). Having finished higher education

Table 4: Responses to each subscale (family, neighbors, and friends) of the Lubben Social Network Scale (LSNS-18).

	LSNS_family (n = 433)*		LSNS_neighbors (n = 429)*		LSNS_friends (n = 433)*	
	- Mean = 19.00		- Mean = 10.33		- Mean = 15.48	
	- SD = 5.64		- SD = 6.38		- SD = 6.34	
	- Range = 0-30		- Range = 0-30		- Range = 0-30	
Score	N	Percentage	N	Percentage	N	Percentage
0-5	16	3.70%	114	26.60%	38	8.80%
6-10	19	4.40%	110	25.60%	50	11.50%
11-15	63	14.50%	104	24.30%	99	22.90%
16-20	139	32.10%	79	18.40%	148	34.20%
21-25	152	35.10%	19	4.40%	84	19.40%
26-30	44	10.20%	3	0.70%	14	3.20%

*Does not add up to 439 due to missing data.

Table 5: Overview of the most important statistically significant findings for the subscales of the LSNS-18.

Age: Older participants had better social contacts with their neighbors, yet less social contact with friends than younger participants
- Positively correlated with neighbors subscale ($p < 0.001$)
- Negatively correlated with friends subscale ($p = 0.003$)
Gender
- Women more likely to score high on family subscale ($p < 0.001$)
- Women more likely to score high on friends subscale ($p = 0.029$)
Having children
- Positively correlated with family subscale ($p < 0.001$)
- Negatively correlated with friends subscale ($p = 0.002$)
Being married, living with a partner or being in a relationship
- Positively correlated to the family subscale ($p < 0.001$)
Having finished higher education
- Correlated with higher score on family subscale ($p = 0.002$)
- Correlated with higher score on neighbors subscale ($p = 0.003$)
- Correlated with higher score on friends subscale ($p = 0.005$)
Having a higher income
- Correlated with higher score on family subscale ($p < 0.001$)
- Correlated with higher score on friends subscale ($p = 0.004$)
Living in the same community for longer
- Correlated with higher score on neighbors subscale ($p = 0.004$)
Participants who felt they spent enough time participating in community activities
- Correlated with higher score on family subscale ($p < 0.001$)
- Correlated with higher score on friends subscale ($p < 0.001$)
- Correlated with higher score on neighbors subscale ($p < 0.001$)
Participants who felt they contributed enough to their community
- Correlated with higher score on family subscale ($p < 0.001$)
- Correlated with higher score on friends subscale ($p < 0.001$)
- Correlated with higher score on neighbors subscale ($p < 0.001$)

and being employed corresponded with lower total scores on the PHQ-9 ($p = 0.001$ for both), as did having a higher income ($p < 0.001$). The longer participants had lived within the

same community, the lower the PHQ-9 score ($p < 0.001$). Participants who answered that they participated in community events, participants who felt that they spent enough time par-

ticipating in community activities, and participants who felt that they contributed enough to their community also had lower PHQ-9 total score ($p < 0.001$ for each variable). Gender and ethnicity were not statistically significant variables.

LSNS-18 and subscales: Correlation coefficients showed that women scored higher on the LSNS-18 ($p = 0.014$). Having finished higher education and having a higher income were associated with a higher score on the LSNS-18 ($p < 0.001$). Being unemployed was associated with a lower score on the LSNS-18 ($p = 0.011$). Participants who answered that they participated in community events, participants who felt that they spent enough time participating in community activities, and participants who felt that they contributed enough to their community scored higher on the LSNS-18 ($p < 0.001$ for each variable). Ethnicity was not a statistically significant variable. Both age and having children did not show a statistically significant correlation with the LSNS-18 total score, but this can easily be explained by the different correlation for each variable on the subscales of the LSNS-18.

Table 5 shows the most important statistically significant correlations for each subscale of the LSNS-18. Table 6 shows the overview for correlations between all variables.

Community activities: When combining the answers of all four participation categories (church activities, school activities, local government, and other activities), we found that older participants ($p < 0.001$), participants with children ($p = 0.002$), participants that had finished higher education ($p < 0.001$), participants with a higher income ($p < 0.001$), and participants that had been living in the community longer ($p < 0.001$) were statistically significantly more likely to participate always or very often in community activities. When looking at the categories individually, older participants were more likely to participate in church activities ($p < 0.001$) and local government activities ($p = 0.001$), while younger participants were more likely to participate in school activities ($p < 0.001$). Gender showed to be statistically significant in the category for other activities, with women being more likely to participate in these activities ($p = 0.049$). Participants that are married, in a relationship or living with a partner were more likely to participate in school activities ($p = 0.004$).

Participants with children were more likely to participate in church activities ($p = 0.002$) and school activities ($p = 0.001$). Participants who had finished higher education were more likely to participate in all activities, as were participants with a higher income. Participants who had lived within their community longer were more likely to participate in church activities and local government activities.

Linear regression

Linear regression analysis was used to test whether the participants' demographics (age, gender, marital status, having children, education level, employment, income, months in community, participation in community activities, and contributing to the community) and the scores of the separate subscales significantly predicted the participants' score on the PHQ-9. Since the Pearson's Correlation coefficients revealed that the subscales of the LSNS-18 have different correlations

with each of the demographics compared to the total LSNS-18 score, and therefore give more information than the LSNS-18 total score, we decided to run each subscale individually for the linear regression. An overview of all results is provided in Table 7.

PHQ-9, demographics and LSNS subscales: Simple linear regression including participants' demographics and the total scores on each of the LSNS subscales showed a significant relationship between the PHQ-9 total score and the participants' demographics and total scores on each of the subscales of the LSNS-18 ($R = 0.590$, $F = 13.16$, $p < 0.001$). The R^2 value of 0.348 showed that 34.8% of the variation in the PHQ-9 can be explained by the model containing the demographics and the total scores for each of the LSNS-18 subscales.

Results showed that age ($\beta = -0.205$, $p < 0.001$), marital status ($\beta = -0.126$, $p = 0.017$), employment ($\beta = 0.106$, $p = 0.025$), income ($\beta = -0.115$, $p = 0.042$) and contributing to the community ($\beta = 0.191$, $p < 0.001$) significantly predicted the PHQ-9 total score, as did the total score for the LSNS friends subscale ($\beta = -0.211$, $p < 0.001$) and LSNS family subscale ($\beta = -0.134$, $p = 0.016$).

Discussion

The results of this research are in line with results found in recent studies [25,52]. The total score of the PHQ-9 is negatively significantly correlated with the total score of the LSNS-18 and each of the subscales, meaning that participants who scored high on the LSNS-18 and each subscales, indicating a good social network, were less likely to score high on the PHQ-9. This point out that social connectedness with family, friends and neighbors is beneficial in preventing depression. Participants that answered, they often or always participated in community activities were also significantly less likely to score high on the PHQ-9, as were participants who felt they spend enough time participating in and contributing to the community in which they lived.

Our results also showed that living within the same community longer was significantly correlated with less symptoms of depression, while it also leads to more participation in the community. With community participation also leading to significantly lower scores on the PHQ-9, this demonstrates that having lived within the same community for many years could be beneficial for mental health in more than one way. We found that lower income levels are associated with symptoms of depression, which is supported by previous research [53]. We also found that younger participants scored higher on the PHQ-9, which is also supported by other research showing depression to be more prevalent among younger adults than older adults [5,54]. Our results did not show women to be more likely to score high on the PHQ-9, while previous research does suggest that women are more likely to be depressed [55]. Participants that were married, in a relationship or living with a partner were significantly less likely to score high on the PHQ-9, as were participants who had children and participants that were employed. Level of education was also significantly correlated with the PHQ-9 total score, with participants that had finished a higher of level of education being

Table 6: Pearson Correlation coefficients and p-values between study variables.

	LSNS total score	LSNS family	LSNS neighbors	LSNS friends	Age	Gender	Marital status*	Children	Education	Employment	Income	Months in community	Participating in community activities	Participating enough in community	Contributing enough to community
PHQ-9 total score	-0.337** (< 0.001)	-0.304** (< 0.001)	-0.203** (< 0.001)	-0.274** (< 0.001)	-0.241** (< 0.001)	-0.021 (0.669)	-0.251** (< 0.001)	0.116* (0.018)	-0.163** (0.001)	0.154** (0.002)	-0.305** (< 0.001)	-0.227** (< 0.001)	0.211** (< 0.001)	0.319** (< 0.001)	0.337** (< 0.001)
Age	-0.016 (0.741)	-0.076 (0.114)	0.177** (< 0.001)	-0.142** (0.003)	-0.131** (0.006)										
Gender	0.120* (0.014)	0.192** (< 0.001)	-0.016 (0.735)	0.105* (0.029)											
Marital status*	0.073 (0.137)	0.206** (< 0.001)	-0.035 (0.470)	0.019 (0.693)	-0.004 (0.940)	-0.046 (0.342)									
Children	0.041 (0.400)	-0.185** (< 0.001)	0.088 (0.070)	0.148** (0.002)	-0.151** (0.002)	-0.127** (0.008)	-0.284** (< 0.001)								
Education	0.192** (< 0.001)	0.147** (0.002)	0.144** (0.003)	0.135** (0.005)	0.020 (0.676)	0.039 (0.411)	0.053 (0.273)	0.054 (0.263)							
Employment	-0.126* (0.011)	-0.108* (0.027)	-0.040 (0.412)	-0.150** (0.002)	0.088 (0.071)	0.060 (0.220)	-0.105 (0.031)	0.048 (0.327)	-0.170** (< 0.001)						
Income	0.199** (< 0.001)	0.219** (< 0.001)	0.083 (0.106)	0.149** (0.004)	0.096 (0.060)	-0.053 (0.299)	0.403** (< 0.001)	-0.095 (0.063)	0.426** (< 0.001)	-0.242** (< 0.001)					
Months in community	0.075 (0.129)	0.043 (0.379)	0.140** (0.004)	0.005 (0.927)	0.470** (< 0.001)	-0.065 (0.183)	0.095 (0.051)	-0.081 (0.097)	-0.126** (0.010)	-0.039 (0.426)	0.086 (0.094)				
Participating in community activities	-0.250** (< 0.001)	-0.230** (< 0.001)	-0.218** (< 0.001)	-0.112* (0.021)	-0.288** (< 0.001)	-0.004 (0.938)	-0.084 (0.082)	0.150** (0.002)	-0.201** (< 0.001)	0.082 (0.094)	-0.196** (< 0.001)	-0.190** (< 0.001)			
Participating enough in community	-0.288** (< 0.001)	-0.216** (< 0.001)	-0.214** (< 0.001)	-0.189** (< 0.001)	-0.160** (0.001)	-0.019 (0.689)	-0.057 (0.241)	0.004 (0.942)	-0.160** (0.001)	0.077 (0.116)	-0.147** (0.004)	-0.105* (0.033)	0.354** (< 0.001)		
Contributing enough to community	-0.317** (< 0.001)	-0.228** (< 0.001)	-0.268** (< 0.001)	-0.206** (< 0.001)	-0.209** (< 0.001)	0.010 (0.840)	-0.081 (0.097)	0.050 (0.308)	-0.143** (0.003)	0.105* (0.034)	-0.161** (0.001)	-0.145** (0.003)	0.281** (< 0.001)	0.808** (< 0.001)	

*Marital status was recorded into a binary variable: married/living with a partner and in a relationship but not living with a partner versus single, divorced/separated, widowed and other.

Table 7: Results of linear regression examining the relationship between demographics, the Lubben Social Network Scale (LSNS-18) subscales and the Patient Health Questionnaire-9 (PHQ-9).

PHQ-9, demographics and LSNS-18 subscales	
Variable	β (p-value)
LSNS-friends	-0.211 (< 0.001)
Age	-0.205 (< 0.001)
Contributing to community	0.191 (< 0.001)
LSNS-family	-0.134 (0.016)
Marital status	-0.126 (0.017)
Employment	0.106 (0.025)
Income	-0.115 (0.042)
Months in community	-0.093 (0.083)
Children	0.063 (0.212)
LSNS-neighbors	0.044 (0.413)
Gender	-0.039 (0.415)
Participating in community activities	0.028 (0.580)
Education	-0.007 (0.891)

less likely to score high on the PHQ-9. Additionally, higher income was significantly associated with lower PHQ-9 scores.

Previous international research regarding the relationship between population density and social participation supports our findings. Research conducted amongst rural and urban residents of South Australia showed that residents in rural areas reported higher levels of network, civic participation and cohesion compared to urban areas, with higher incomes and higher educational achievement leading to higher levels of social capital. Furthermore, higher levels of trust, cohesion, and help were associated with better mental health [56]. Canadian research showed that rural residents are more likely to know all of their neighbors, and they are more likely to trust their neighbors [57]. These differences could not be explained by socio-economic or demographic characteristics, which seem to support the hypothesis that the residents of rural areas are more engaged because of where they are and not because of who they are [58]. Research on the perception of living in a rural village in South East England showed that the residents of the small village experienced their rural living as beneficial, making associations between living in the village and their improved physical and emotional well-being [59]. Recently published results from Wave 2 of the National Social Life, Health and Aging Project (NSHAP) showed that older adults and their spouses/partners in rural areas, compared to their urban peers, have larger and stronger social networks, and were more likely to say that they could rely on those contacts [60].

Prior research has also demonstrated that depressed people may find social interactions, regardless of partner type, to be less enjoyable than non-depressed people [61]. This would make it seem reasonable that depressed people are less likely to engage in social interaction, which raises the question as to which problem occurred first: did someone be-

come depressed, therefore have less social interactions and subsequently a smaller social network, or was a small social network, meaning they have less social support, leading to depression? This makes it important for additional research, since appropriate preventive measures can be taken if a small social network could lead to depression.

Research investigating peer support interventions has shown that these interventions decrease depression symptoms more than usual care alone, suggesting that peer support interventions have the potential to be effective components of depression care [62,63]. Furthermore, there is substantial evidence showing that social interventions for depression are effective and boost long-term resilience [64,65]. Moreover, interventions that include a component that facilitates social interaction in groups appear to be particularly effective, compared to interventions that focus on skills training, psychoeducation, or one-on-one support [66]. Participating in social interventions as part of treatment has also shown to increase social support, coping skills, mental health knowledge, social capital, and social activity [67]. Developing an awareness of one's limitations on balancing domestic life, leisure time, and social interaction turned out to be critical for successful social integration [68]. Additionally, social network size and resourcefulness are correlated with employment, meaning that interventions to help unemployed people find work are also likely to positively impact their social networks [69]. Depression interventions that include social interaction could therefore be a key element in successfully treating depression, as well as aiding in better management of long-term management of symptoms and avoiding relapses. These peer support interventions could also lead to a change in the perceived meaning of social cues, helping people suffering from depression to perceive social cues as more positive rather than negative. Especially in rural areas, treatment programs should seek to capitalize on the potential strengths known to be embedded in rural social ties.

Limitations

The main limitation of this study is that all data collection was conducted within one geographic region, meaning that the results may only apply to the connection between symptoms of depression and social network that we found in this particular region. However, it is likely that rural areas in the United States will have similar demographics. As shown in our demographics overview, the vast majority of study participants were Caucasian. Furthermore, the majority participants were female, married or living with a partner, had children, completed a college degree or graduate school, and were employed. With recent research showing that adults of African American and Hispanic descent are more likely to be at risk for depression than Caucasian people [70], our results might not be most relevant related to more multicultural or urban settings.

Furthermore, participants from this study were recruited from rural clinics, meaning the participants are not part of the general population of rural towns. This could lead to a bias towards the score on the PHQ-9. It could be possible that participants that see their physician regularly might be screened for

symptoms of depression frequently, meaning that treatment can start immediately if screening shows the patient is at risk for depression. Alternatively, since it is well known that physical health can influence mental health [71,72], it could be possible that patients visiting their physician because of physical health related problems are already at risk for depression and therefore score higher on the screening instrument.

Overall, our results are in line with earlier research. Further research should focus on identifying the causal relationship between social participation and depression. Several participants of our study commented that rural towns tend to have a lot of attention for older adults with depression, so it seems younger adults with depressions are left out. Further research appears to be necessary, to identify possible options to create treatment options for younger adults with depression in rural areas. With our results showing that a good social network can be a protective factor for developing symptoms of depression and recent research showing that peer support interventions can improve depression symptoms, interventions aiming to increase the patient's social network need to be developed. Focusing on the individual within the community and reintegrating into the social system surrounding the patient would be a good starting point.

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