Published in final edited form as:

Disabil Health J. 2020 January ; 13(1): 100829. doi:10.1016/j.dhjo.2019.100829.

Differences in social connectedness and perceived isolation among rural and urban adults with disabilities

Meredith A. Repke^{*}, Catherine Ipsen

University of Montana Rural Institute, USA

Abstract

Background: Social isolation has been compared to smoking in terms of risk to public health. Some groups are at particularly high risk for these feelings, including people with disabilities and rural residents. Few studies have considered the potentially compounding effects of disability status and rural residency.

Objective: To evaluate how reported satisfaction with social participation and perceived isolation relate to the health of rural and urban people with disabilities, and to consider whether number of disabilities, living arrangement, and employment status were associated with differences in reported satisfaction with social participation and perceived isolation.

Methods: This observational, cross-sectional analysis utilized data from working-age adults with disabilities ($n = 1246$) collected by the Collaborative on Health Reform and Independent Living (CHRIL).

Results: There were significant associations between reported health and measures of satisfaction with social participation and perceived isolation (all $ps < .001$). Increased number of disability issues, not being employed, and living with at least one other person were associated with reduced satisfaction with social participation ($ps < .01$), and number of disability issues and not being employed were associated with increased perceived isolation ($ps < .01$). Urban residents reported feeling more isolated ($ps < .05$) and there were multiple predictor $\times$ geographic residency (rural versus urban) interactions.

Conclusion: These results underscore the importance of considering geography as a factor in understanding satisfaction with social participation and perceived isolation and how these factors relate to health in people with disabilities.

Keywords

Rural; Social connection; Disability; Health

1. Introduction

A substantial body of evidence links factors such as social participation and social isolation to health and wellbeing outcomes. For example, social participation (as indicated by group membership and involvement) has been linked to improved psychological health¹ while

^{*}Corresponding author. 242 Corbin Hall, Missoula, MT, 59812, USA. Meredith.repke@mso.umt.edu (M.A. Repke).

social isolation has been associated with increased risk of death^{2,3} and poor physical^{4–6} and mental health.^{7–9} The evidence for these linkages is so robust that social isolation has been compared to smoking in terms of risk to public health.^{2,10}

Much of the research on social factors and health has focused on older adults. Older adults are more likely than others to report being socially isolated and lonely^{11–13} and have more health issues than the general population. Another group that shares these qualities, but has received less attention from researchers, are people with disabilities. People with disabilities face various challenges in daily life that could affect their opportunities for social participation (e.g., transportation issues,^{14,15} mobility challenges,¹⁶ and discrimination¹⁷). Further, people with disabilities report being in worse health than people without disabilities.¹⁸ For these reasons, it is unsurprising that disability has been associated with lower levels of social interaction (measured as in-person contact with non-household members).¹⁹

People with disabilities are also less likely to be employed²⁰ and more likely to live in rural areas.²¹ Further, these factors may be compounded because rural residents are less likely to be employed and have less access to transportation than urban residents.²² Therefore, rural people with disabilities may be at particularly high risk for experiencing decreased social participation and increased isolation due to these types of factors.

Prior research assessing social factors variables across geography is inconsistent. For example, one study found rural residency to be associated with reduced belonging support (perceived availability of people with whom one can do things) and tangible support (perceived availability of material aid).²³ In contrast, another study found that rural older adults were more likely to say they could rely on family and friends, and tended to report having more close friends and relatives than urban older adults.²⁴ In an effort to better understand social isolation and loneliness differences for very old rural and urban adults, researchers conducted an analysis of factors predicting each of these outcomes for rural and urban residents.²⁵ Most predictors were not shared between groups. Only living alone was found to predict social isolation for each geographic group, and the only shared predictor of loneliness for each group was having four or more chronic illnesses. In sum, geography is a meaningful factor in understanding social isolation and loneliness. While few studies have considered rural and urban differences in social factors, fewer still have done so focusing exclusively on people with disabilities.

Given the strong associations between health and social factors, it is important to understand this phenomenon from a public health standpoint. Improved knowledge of how these factors affect health and how such effects differ across geography may provide meaningful insight for intervention development that improves the health and wellbeing of people with disabilities. This paper contributes to this effort by utilizing data from the Collaborative on Health Reform and Independent Living (CHRIL) 2018 National Survey on Health Reform and Disability (NSHRD) to evaluate the association between reported health, satisfaction with social participation (defined as satisfaction with performing one's social roles and activities²⁶), and perceived isolation (defined as a perceived lack of social support⁶) among people living in rural versus urban places. We analyze how factors identified in prior research (living alone, number of chronic health or disability issues, and employment status)

are associated with satisfaction with social participation and perceived isolation for people with disabilities in rural versus urban places.

2. Methods

2.1. Recruitment and data collection

CHRIL researchers initiated the first phase of recruitment at the 2017 National Council on Independent Living conference where the survey was announced and informational flyers were distributed in print, electronic, large print, and Braille formats. These flyers were also distributed at four additional organizations' national conferences (Associations of Programs for Rural Independent Living, Amputee Coalition, AcademyHealth, and American Public Health Association) in 2017. The flyers included a link to a one-page recruitment form individuals could use to indicate their interest in participating by providing their email address. The online form also provided further information about the survey and timeline.

The second phase of recruitment began in January 2018 with distribution of a University of Kansas (KU) IRB-approved survey recruitment write-up that included the survey link, a brief explanation of the survey's purpose, target audience and toll-free telephone number and email address to reach KU CHRIL staff. KU staff contacted 49 national disability organizations and agencies to illicit their assistance recruiting survey participants. The organizations used the write-up provided by KU to recruit participants using various distribution methods of their choosing. Nearly all of the organizations distributed the survey recruitment information to their constituents/members/consumers multiple times during January through May of 2018. Methods of distributing the information varied across sites depending upon how much time they had to contribute to survey recruitment and their established ways of dissemination and communication, such as newsletters, social media accounts, organization websites and others. CHRIL researchers also partnered with the Research and Training Center on Disability in Rural Communities (RTC:Rural) at the University of Montana to perform targeted recruitment through local Center for Independent Living (CIL) offices to address gaps in rural representation. Most participants completed the 2018 NSHRD via the internet. Six participants completed the survey over the phone with a member of the research team.

2.2. Health status

Health status was measured using two variables. For the first variable, which we call *general health*, participants responded to an item assessing overall health: "in general, would you say your health is ..." (1 = poor; 5 = excellent). For the second variable, which we call *unhealthy days*, two questions were taken from the BRFSS Health-Related Quality of Life Module (HRQoL-14; "Healthy Days") to measure prevalence (in days per month) of health issues. Participants estimated how many days in the past 30 days (1) their physical health was not good and (2) their mental health was not good. These items were summed into a single item (with a range of 0–60 days) representing number of unhealthy days per month.²⁷

2.3. Satisfaction with social participation

Satisfaction with social participation was measured using a composite variable calculated from four items ($\alpha = .92$) taken from the Patient-Reported Outcomes Measurement Information System (PROMIS) Satisfaction with Participation in Discretionary Social Activities survey.²⁸ The items were as follows (1 = not at all; 5 = very much):

1. I am satisfied with the amount of time I spend doing leisure activities.
2. I am satisfied with my ability to do all of the leisure activities that are really important to me.
3. I am satisfied with my current level of social activity.
4. I am satisfied with my ability to do activities in community that are really important to me.

2.4. Perceived isolation

To measure *perceived isolation*, a single item from the PROMIS Relationships/Social Support survey²⁸ was used: “I feel that I am isolated from other people and my community” (1 = not at all; 5 = very much).

2.5. Geography

Respondents provided county and zip code information. We matched counties to Federal Informational Processing Standards codes and classified counties using the Office of Management and Budget’s (OMB) rural-urban classification scheme. OMB classifies counties as metropolitan, micropolitan, or neither based on proximity to an urban core. Counties are classified metropolitan (urban) if they are located within an urban core of 50,000 or more people, or are an outlying county with close economic ties to an urban core. Counties are classified micropolitan if they are located within an urban core of at least 10,000 but less than 50,000. Remaining counties fall outside an urban core and are considered non-core. Both micropolitan and non-core counties are considered rural. We chose the OMB rural-urban classification scheme to identify rural individuals, whose county did not include any large urban hub and were at a distance from urban resources.

2.6. Number of disability issues

Consistent with the measurement of disability in the Health Reform Monitoring Survey (HRMS), participants indicated whether they had any of the following disability types (participants could select multiple disability types): mental illness/psychiatric, physical, chronic illness, intellectual and developmental disability and/or Autism Spectrum Disorder, sensory, or neurological. The number of disabilities indicated was then summed to create a variable representing the total number of disability issues. Descriptive statistics for health, satisfaction with social participation, perceived isolation, and number of disability variables is available in Table 1.

2.7. Living arrangement

Participants responded to a single item asking who lives with them in their home. Responses were coded into a dichotomous variable delineating participants who lived alone versus those who did not live alone. Frequency data is presented in Table 2.

2.8. Employment

Participants responded to a single item, “Are you currently working for pay or self-employed?” Response options included: not working, working for pay, and self-employed. “Working for pay” and “self-employed” responses were combined to create a dichotomous employment variable (employed or not employed). Frequency data is presented in Table 2.

2.9. Data weighting

Given the under-representation of certain groups in this sample, the 2018 NSHRD was weighted to be representative of adults aged 18 to 62 with one or more disabilities using the 2016 American Community Survey (ACS). We compared unweighted tabulations of sociodemographic characteristics from the sample of 1246 respondents in the NSHRD to weighted estimates from the 138,227 adults ages 18 to 62 with at least one disability and internet access at home in the 2016 ACS. The ipf weight program in STATA (v14) was used to perform iterative proportional fitting, creating survey weights based on estimated population margins for gender, race/ethnicity, region, and educational attainment from the 2016 ACS.

2.10. Sample

The 2018 NSHRD data was collected between February and June 2018 ($n = 1246$; 69% female). The average age of respondents was 44.06 years, with a range of 18–62 years. Most respondents were white (75.1%) or multi-racial/ethnic (7.9%), with some African American (5.1%), Hispanic (3.2%), Asian (1.6%), American Indian (1.2%), and Native Hawaiian or Pacific Islander (0.2%) representation. The most prevalent primary disability/health issue reported was neurological impairments (27.4%), followed by physical disabilities (22.6%), chronic illnesses/diseases (20.1%), mental illnesses/psychiatric disabilities (16.3%), intellectual and developmental disabilities (7.3%), and sensory impairments (6.3%). In this sample, 12.4% of respondents had a high school degree or diploma, 20.2% had some college, 11.9% had a 2-year college degree or technical school certificate, 28.2% had a 4-year college degree, and 23.7% had a graduate or doctoral degree. The majority of the sample resided in urban locations (85.3%).

2.11. Data analysis

We used SPSS V. 25 to run statistical analyses. We tested for correlations between satisfaction with social participation and health, as well as perceived isolation and health, using Pearson's r . We analyzed the overall sample, and rural and urban samples, separately. Multiple regression was used to evaluate whether number of disability issues, geography, and their interaction predicted satisfaction with social participation or perceived isolation, while controlling for age. We used Analyses of Variance (ANOVAs) to test for main effects of living arrangement and employment status (separately), geography, and the interaction of

these variables on satisfaction with social participation and perceived isolation, and conducted these analyses with number of disability issues and age as covariates. We employed pairwise deletion of missing data.

3. Results

3.1. Satisfaction with social participation, perceived isolation, and health

For the overall sample, we found a significant association between general health and satisfaction with social participation ($r[1241] = 0.39, p < .001$), general health and perceived isolation ($r[1192] = -0.26, p < .001$), unhealthy days and satisfaction with social participation ($r[1236] = -0.44, p < .001$), and unhealthy days and perceived isolation ($r[1189] = 0.35, p < .001$). Each of these correlations was significant for people living in urban places. All correlations were also significant for people in rural places with the exception of general health and perceived isolation. See Table 3 for urban and rural correlation results. Using Fisher's r -to- z transformation, we compared the rural and urban correlations to look for potential differences between these correlation coefficients. The only correlation that differed significantly was between general health and perceived isolation, $z = -2.91, p < .01$.

3.2. Number of disability issues

Table 4 reports two findings from two regression analyses; one for satisfaction with social participation and one for perceived isolation. Each regression included number of disability issues, geography, and their interaction as independent variables. Number of disability issues was a significant predictor of satisfaction with social participation, such that those reporting fewer disability issues reported increased satisfaction with social participation. There were no differences between rural and urban residents. There was a significant interaction between number of disability symptoms and geography on satisfaction with social participation such that rural and urban people reported similar levels of satisfaction with social participation when few disability issues were reported, but as the number of disability issues increased, satisfaction with social participation deteriorated more steeply for rural people than urban people. Related to perceived isolation, we found that having more disability issues was associated with increased perceived isolation and that urban residency was associated with an increased perception of isolation. We did not find an interaction.

3.3. Living arrangement

Table 5 provides ANOVA summary statistics for two 2 (living arrangement: lives alone vs. does not live alone) x 2 (geography: rural vs. urban) ANOVAs (note that living arrangement is coded as lives alone = 0, does not live alone = 1; geography is coded as urban = 0, rural = 1). Each ANOVA assessed the effects of living arrangement, geography, and their interaction on satisfaction with social participation and perceived isolation, separately. From these analyses, we found that people living alone reported more satisfaction with social participation ($M = 2.80$) than those not living alone ($M = 2.57$). There were no differences between rural and urban residents in satisfaction with social participation. The interaction of living arrangement and geography on satisfaction with social participation fell short of statistical significance but may indicate a trend for future exploration (urban live alone $M =$

2.75; urban does not live alone $M = 2.60$; rural live alone $M = 3.01$, rural does not live alone $M = 2.47$).

We found that those living in rural places tended to report less perceived isolation ($M = 2.58$) than those living in urban places ($M = 2.87$). No difference was found in perceived isolation between those living alone and those not living alone. The interaction of living arrangement and geography on perceived isolation was significant. Living arrangement had a greater effect on perceived isolation for those living in rural relative to urban places (urban lives alone $M = 2.99$; urban does not live alone $M = 2.85$; rural lives alone $M = 2.14$; rural does not live alone $M = 2.68$).

3.4. Employment

Table 6 provides summary statistics for two 2 (employment status: employed vs. not employed) $\times$ 2 (geography: rural vs. urban) ANOVAs. These analyses evaluated the effects of employment status, geography, and the interaction of these variables on satisfaction with social participation and perceived isolation, separately. Results revealed that those not employed reported significantly less satisfaction with social participation ($M = 2.36$) compared to those employed ($M = 3.02$). No difference between rural and urban residents was found. A significant interaction effect revealed that the effect of employment was stronger for rural people (rural not employed $M = 2.19$; rural employed $M = 3.25$) compared to urban people (urban not employed $M = 2.40$; urban employed $M = 2.97$).

Related to perceived isolation, we found that people living in rural places reported lower levels of perceived isolation ($M = 2.59$) than people living in urban places ($M = 2.89$). We also found that employed people reported less perceived isolation ($M = 2.53$) than people not working ($M = 3.03$). There was not a significant interaction between employment and geography.

4. Discussion

Several notable outcomes emerged from the present analysis. First, consistent with prior research, we found strong linkages between our measures of health and both satisfaction with social participation and perceived isolation. While most of these associations were found for both rural and urban residents, the correlation between reported general health and perceived isolation was only observed for urban people with disabilities. It is beyond the scope of the current data to draw firm conclusions about the underlying reason(s) for this difference, however we speculate it may relate to differences in perceptions of isolation between rural and urban residents. Consistent with the statement by De Jong Gierveld and Havens²⁹ that “the intensity of loneliness ... is largely dependent on the prevailing (social) standards as to what constitutes an optimal network of relationships” (p. 110), it may be that rural and urban residents have different expectations of the experience of isolation. Differing expectations may lead to increased resilience to isolation for rural residents. Compared to urban residents who may feel singularly isolated when experiencing isolation in a densely populated area due to the expectation that bustling urban life should preclude loneliness, rural residents may expect that some degree of isolation is a normal part of rural life and

therefore be less likely to report feeling isolated and also less likely to report an associated change in health. Future research should explore this possibility.

Also consistent with prior research, increased number of disability issues was associated with reduced satisfaction with social participation and increased perceived isolation. The finding that the effect on satisfaction with social participation was stronger for people living in rural places is a unique contribution of this investigation. While we are unable to draw a definitive conclusion to explain the interaction of geography and number of disability issues on satisfaction with social participation with the present data, we posit that the difference may be related to differences between rural and urban baseline levels of obstacles to community participation. As rural residents are more likely to face transportation and mobility-related obstacles due to infrastructure that is often less adequate and accessible than in urban places, it may be that increased disability issues result in a unique accumulation of obstacles for rural people relative to urban people.

Employment status was also associated with satisfaction with social participation and perceived isolation. While prior research has connected employment to increased social interaction, our analysis adds to the existing literature by including comparisons between rural and urban residents. For satisfaction with social participation, we found an interesting interaction between employment status and geography, suggesting that while employment could have social participation benefits for both rural and urban residents, it may be especially beneficial for rural residents. We speculate that as rural residents have potentially fewer opportunities for social participation, employment may be a uniquely important opportunity for social participation, thereby having a greater impact on rural residents' perception of participation relative to their urban peers.

Related to living arrangement, we found that living alone was not associated with perceived isolation, but was associated with decreased satisfaction with social participation. This was in contrast to some prior research on geography, social isolation, and loneliness.²⁹ However, others have suggested that living alone is often incorrectly conflated with loneliness and that some data suggest that people who live alone are actually more active in their communities.³⁰ While more research is needed to understand the association between living arrangement and social wellbeing factors in general, there are likely additional complexities associated with understanding the effects for people with disabilities. For example, living alone may encourage autonomy among people with disabilities, which could lead to a person being more likely to participate in their communities relative to others who live with another person.

Taken together, these data suggest rural people with disabilities may be at increased risk for low levels of satisfaction with social participation (as evidenced by interaction effects suggesting satisfaction with social participation may deteriorate more quickly for rural relative to urban residents under certain conditions) and urban people with disabilities may be at increased risk for feeling isolated (as evidenced by increased perceived isolation among urban residents). While additional research is needed to better understand the experience of disability in rural and urban places including predictors of satisfaction with social participation and perceived isolation, these findings, along with other recent research,

³¹ offers evidence that rural life may have social benefits contrary to the conventional wisdom that rural life is synonymous with social deprivation.

4.1. Future directions

These findings suggest more research on the predictors of satisfaction with social participation and perceived isolation for people with disabilities living in rural versus urban places is needed, particularly related to the aforementioned issues. In addition to further research, these findings also have policy and practice implications. For instance, the results of this investigation suggest community health programs targeted at people with disabilities may be more effective if designed with rurality in mind. Programs for urban residents may be most effective when focusing on reducing feelings of loneliness while programs for rural residents may be more valuable when focused on removing obstacles that impede social participation. Further, these findings support the ongoing need for public health services targeting social participation and isolation for both rural and urban residents with disabilities. With research supporting the potential efficacy of interventions targeting social isolation³² and our increasing understanding of the significant effects of social factors like isolation on health and wellbeing, designing policy that supports interventions designed to increase social participation and reduce isolation among people with disabilities should be a primary concern of disability advocates.

4.2. Limitations

As with all studies, these findings must be considered in the context of their limitations. Relevant to the rural and urban comparisons presented here, we are unable to quantify the survey completion rate for participants recruited via national networks compared to those recruited from rural CIL offices. Because the survey was anonymous, we do not know how these different recruitment strategies may have resulted in meaningful differences between rural and urban samples. Without knowing the impact of these different recruitment strategies, we acknowledge the possibility that rural and urban participants may differ beyond the geographical location of their home. That said, we do not have reason to think such potential differences meaningfully impact our findings. Utilizing the rural CIL network is a strategic way to reach people with disabilities living in rural places.

Additionally, the CHRIL survey did not include measures of satisfaction with social participation or perceived isolation most typically cited in the literature. The PROMIS Satisfaction with Participation in Discretionary Social Activities survey is described as a measure of contentment with leisure interests and relationships with friends and includes 12 items. The CHRIL utilized just five of these items. We felt the selected items were consistent with conceptualizations of satisfaction with social participation and perceived isolation as described in prior research,⁶ however this difference in measurement of satisfaction with social participation and perceived isolation presents a significant limitation in terms of comparing the present findings to prior research. Nevertheless, as the significance of social connectedness and perceived isolation for health and wellbeing becomes increasingly clear, we felt these findings were relevant to expanding our understanding of the relationship between satisfaction with social participation, perceived isolation, health, and geography.

Further, as the PROMIS measures are used more broadly, we expect there will be more varied opportunities for comparison in the future.

5. Conclusion

Overall, we found associations between satisfaction with social participation, perceived isolation, and reported health for people with disabilities akin to prior research on people without disabilities. The present results, however, underscore the importance of considering people with disabilities as a unique population in their experience of satisfaction with social participation and perceived isolation, as well as the importance of geographical context. More research is needed on rural and urban residents with disabilities in order to better understand drivers of satisfaction with social participation and perceived isolation. Ultimately these findings can inform policies and interventions aimed at reducing the risk of negative outcomes known to be associated with low levels of social participation and increased isolation.

Acknowledgements

The authors would like to thank Adele Shartzter, Urban Institute for conducting and describing the data weighting for the NSHRD.

Disclosures

This work was supported by The National Survey on Health Reform and Disability (NSHRD) as part of The Collaborative on Health Reform and Independent Living (CHRIL). CHRIL is funded by a 5-year Disability and Rehabilitation Research Program (DRRP) from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR, grant number 90DP0075-01-00). In addition, research for this manuscript was supported by the Research and Training Center on Disability in Rural Communities (RTC:Rural) under another NIDILRR grant (grant number 90RTCP0002-01-00). NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS). The research does not necessarily represent the policy of NIDILRR, ACL, or HHS and one should not assume endorsement by the federal government.

References

1. Fiorillo D, Lavadera GL, Nappo N. Social participation and self-rated psychological health: a longitudinal study on BHPS. *SSM Popul Health*. 2017;3: 266–274. 10.1016/j.ssmph.2017.02.003. [PubMed: 29349223]
2. Holt-Lundstad J, Smith TB, Baker M, Harris T, Stephenson D. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspect Psychol Sci*. 2015;10(2):227–237. 10.1177/1745691614568352. [PubMed: 25910392]
3. Elovainio M, Hakulinen C, Pulkki-Raback L, et al. Contribution of risk factors to excess mortality in isolated and lonely individuals: an analysis of data from the UK Biobank cohort study. *Lancet Public Health*. 2017;2(6):e260–e266. 10.1016/S2468-2667(17)30075-0. [PubMed: 28626828]
4. Holt-Lundstad J, Smith TB. Loneliness and social isolation as risk factors for CVD: implications for evidence-based patient care and scientific inquiry. *Heart*. 2016;102(13):987–989. [PubMed: 27091845]
5. Valtorta NK, Kanaan M, Gilbody S, Ronzi S, Hanratty B. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. *Heart*. 2016;102(13):1009–1016. [PubMed: 27091846]
6. Cornwell EY, Waite LJ. Social disconnectedness, perceived isolation, and health among older adults. *J Health Soc Behav*. 2009;50:31–48. [PubMed: 19413133]

7. Cruwys T, Dingle GA, Haslam C, Haslam SA, Jetten J, Morton TA. Social group memberships protect against future depression, alleviate depression symptoms and prevent depression relapse. *Soc Sci Med*. 2013;98:179–186. [PubMed: 24331897]
8. Cacioppo JT, Hughes ME, Waite LJ, Hawkley LC, Thisted RA. Loneliness as a specific risk factor for depressive symptoms: cross-sectional and longitudinal analyses. *Psychol Aging*. 2006;21:140–151. [PubMed: 16594799]
9. Hawkley LC, Cacioppo JT. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. *Ann Behav Med*. 2010;40(2). doi:10.1007/s12160-010-9210-8.
10. Pantell M, Rehkopf D, Jutte D, Syme SL, Balmes J, Adler N. Social isolation: a predictor of mortality comparable to traditional clinical risk factors. *Am. J. Public Health*. 2013;103(11):2056–2062. [PubMed: 24028260]
11. Cacioppo JT, Hawkley LC, Norman GJ, Berntson GG. Social isolation. *Ann N Y Acad Sci*. 2011;1231:17–22. [PubMed: 21651565]
12. Hawkley LC, Cacioppo JT. Aging and loneliness: downhill quickly? *Curr Dir Psychol Sci*. 2007;16(4):187–191.
13. McPherson M, Smith-Lovin L, Brashears ME. Social isolation in America: changes in core discussion networks over two decades. *Am Sociol Rev*. 2006;73(3):353–375.
14. Institute of Medicine (US) Committee on Disability in America. G, transportation patterns and problems of people with disabilities In: Field MJ, Jette AM, eds. *The Future of Disability in America*. Washington DC: National Academies Press (US); 2007 Available from: <https://www.ncbi.nlm.nih.gov/books/NBK11420/>.
15. Bezyak JL, Sabella SA, Gattis RH. Public transportation: an investigation of barriers for people with disabilities. *J Disabil Policy Stud*. 2017;28:52–60.
16. Kenyon S, Lyons G, Rafferty J. Transport and social exclusion: investigating the possibility of promoting inclusion through virtual mobility. *J Transp Geogr*. 2002;10(3):207–219.
17. Hall E The entangled geographies of social exclusion/inclusion for people with learning disabilities. *Health Place*. 2005;11(2):107–115. [PubMed: 15629678]
18. Institute on Development and Disability, Oregon Health & Science University, Nosek MA Gender differences in self-reported health. Available from: <https://www.ohsu.edu/xd/research/centers-institutes/institute-on-development-and-disability/public-health-programs/rtrc/sos2008/gender-differences-nosek.cfm>.
19. Simonsick EM, Kasper JD, Phillips CL. Physical disability and social interaction: factors associated with low social contact and home confinement in disabled older women (the Women's Health and Aging Study). *J Gerontol: Ser Bibliogr*. 1998;53B(4):S209–S217. 10.1093/geronb/53B.4.S209.
20. United States Department of Labor, Bureau of Labor Statistics. Persons with a disability: labor force characteristics – 2017. Available from: <https://www.bls.gov/news.release/pdf/disabl.pdf>; 2018.
21. von Reichert C, Greiman L, Myers A. Rural Institute, University of Montana, “The Geography of Disability in America: On Rural-Urban Differences in Impairment Rates” (2014). Independent Living and Community Participation. 7. 2014.
22. United States Department of Agriculture, Economic Research Service. Rural employment and unemployment. Available from: <https://www.ers.usda.gov/topics/rural-economy-population/employment-education/rural-employment-and-unemployment/>; 2017.
23. Tittman SM, Harteau C, Beyer KMM. The effects of geographic isolation and social support on the health of Wisconsin women. *Wis Med J*. 2016;115(2): 65–69.
24. Henning-Smith C, Echlund A, Kozhimannil K. Rural-urban differences in social isolation and its relationship to health. *Innov Aging*. 2018;2(S1):770 10.1093/geroni/igy023.2851.
25. Havens B, Hall M, Sylvestre G, Jivan T. Social isolation and loneliness: difference between older rural and urban Manitobans. *Can J Aging*. 2004;23(2):129–140. [PubMed: 15334813]
26. Terwee CB, Crins MHP, Boers M, de Vet HCW, Roorda LD. Validation of two PROMIS item banks for measuring social participation in the Dutch general population. *Qual Life Res*. 2019;28(1):211–220. 10.1007/s11136-018-1995-0. [PubMed: 30203302]

27. Centers for Disease Control, Prevention. Measuring Healthy Days. Atlanta, Georgia: CDC; 2000
Available from: <https://www.cdc.gov/hrqol/pdfs/mhd.pdf>.
28. Hahn EA, DeVellis RF, Bode RK, et al. Measuring social health in the patient-reported outcomes measurement information System (PROMIS): item bank development and testing. *Qual Life Res.* 2010;19:1035–1044. [PubMed: 20419503]
29. De Jong Gierveld J, Havens B. Cross-national comparisons of social isolation and loneliness: introduction and overview. *Can J Aging.* 2004;23(2):109–113. [PubMed: 15334811]
30. Klinenberg E Social isolation, loneliness, and living alone: identifying the risks for public health. *Am. J. Public Health.* 2016;106(5):786–787. [PubMed: 27049414]
31. Henning-Smith C, Moscovice I, Kozhimannil K. Differences in social isolation and its relationship to health by rurality. *The Journal of Rural Health*; 2019 online advanced issue 10.1111/jrh.12344.
32. Dickens AP, Richards SH, Greaves CJ, Campbell JL. Interventions targeting social isolation in older people: a systematic review. *BMC Public Health.* 2011;11 10.1186/1471-2458-11-647. Article 647. [PubMed: 21208451]

Table 1

Descriptive statistics for health, satisfaction with social participation, perceived isolation, and number of disabilities variables by geography.

Variable (Range)	Statistic	Rural	Urban	Total (missing)
General Health (1–5)	n	212	1026	1246 (0)
	M	2.56	2.77	2.73
	SD	0.84	0.95	0.94
Unhealthy Days (0–60)	n	212	1021	1241 (5)
	M	22.42	19.21	19.80
	SD	18.40	17.07	17.31
Satisfaction with Social Participation (1–5)	n	212	1021	1241 (5)
	M	2.62	2.64	2.63
	SD	1.18	1.29	1.27
Perceived Isolation (1–5)	n	191	933	1192 (29)
	M	2.50	2.86	2.81
	SD	1.36	1.49	1.47
Number of Disabilities (1–6)	n	201	964	1172 (74)
	M	1.54	1.60	1.59
	SD	0.69	0.75	0.74

Table 2

Living arrangement and employment status frequencies by geography.

	Rural	Urban	Total (missing)
Lives alone	43 (20.6%)	215 (21.2%)	258
Does not live alone	167 (79.4%)	799 (78.8%)	966
Total	210 (100%)	1014 (100%)	1224 (13)
Not employed	129 (60.8%)	585 (57.1%)	714
Employed	83 (39.2%)	440 (42.9%)	523
Total	212 (100%)	1025 (100%)	1237 (1)

Table 3
Health, Satisfaction with Social Participation, and Perceived Isolation Correlations by Rurality.

Urban				
Variables	1	2	3	4
1. General Health	–			
2. Unhealthy Days	–.61 [*]	–		
3. Satisfaction with Social Participation	.38 [*]	–.43 [*]	–	
4. Perceived Isolation	–.29 [*]	.38 [*]	–.48 [*]	–
Rural				
Variables	1	2	3	4
1. General Health	–			
2. Unhealthy Days	–.56 [*]	–		
3. Satisfaction with Social Participation	.44 [*]	–.45 [*]	–	
4. Perceived Isolation	–.07	.27 [*]	–.41 [*]	–

Notes.

^{*} $p < .001$.

Table 4

Regression analysis summary for satisfaction with social participation and perceived isolation by number of disability issues, rurality, and their interaction.

Satisfaction with Social Participation					
Variable	B	SE B	β	t	p
Number of Disability Issues	-.18	.05	-.11	-3.69	<.001
Rurality	-.04	.10	-.01	-0.39	.69
Interaction	-.08	.04	-.06	-1.99	<.05
Perceived Isolation					
Variable	B	SE B	β	t	p
Number of Disability Issues	.30	.06	.15	5.10	<.001
Rurality	-.40	.12	-.10	-3.41	.001
Interaction	-.02	.05	-.01	-0.42	.67

Notes. Rurality was coded such that 0 = urban, 1 = rural. Satisfaction with Social Participation $R^2 = 0.01$. Perceived Isolation $R^2 = 0.03$.

Table 5

ANOVA summary for satisfaction with social participation and perceived isolation by living arrangement, rurality, and their interaction.

Satisfaction with Social Participation					
Variable	Sum of Squares	df	Mean Squares	F	p
Living Arrangement	13.31	1	13.31	8.29	<.01
Rurality	0.57	1	0.57	0.35	.55
Interaction	4.31	1	4.31	2.68	.10
Perceived Isolation					
Variable	Sum of Squares	df	Mean Squares	F	p
Living Arrangement	3.84	1	3.84	1.78	.18
Rurality	25.09	1	25.09	11.60	.001
Interaction	11.36	1	11.36	5.25	.02

Notes. Living Arrangement variable was coded such that 0 = live alone, 1 = does not live alone. Rurality variable was coded such that 0 = urban, 1 = rural. Satisfaction with Social Participation $R^2 = 0.03$. Perceived Isolation $R^2 = 0.05$.

Table 6

ANOVA summary for satisfaction with social participation and perceived isolation by employment status, rurality, and their interaction.

Satisfaction with Social Participation					
Variable	Sum of Squares	df	Mean Squares	F	p
Employment Status	110.07	1	110.07	72.88	<.001
Rurality	0.20	1	0.20	0.13	.72
Interaction	9.65	1	9.65	6.39	.01
Perceived Isolation					
Variable	Sum of Squares	df	Mean Squares	F	p
Employment Status	29.47	1	29.47	13.93	<.001
Rurality	11.76	1	11.76	5.56	.02
Interaction	1.62	1	1.62	0.77	.38

Notes. Employment Status was coded such that 0 = not employed, 1 = employed. Rurality variable was coded such that 0 = urban, 1 = rural. Satisfaction with Social Participation R2 = 0.07, Perceived Isolation R2 = 0.04.