

Influence of Food Security and Social Support on Quality of Life Among Rural and Urban Iowans With Multiple Sclerosis: A Mixed-Methods Pilot Study

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ABSTRACT

BACKGROUND: Multiple sclerosis (MS) can influence food security status and social support, affecting an individual's quality of life (QOL). Thus, this pilot study aimed to understand the relationship between food security, social support, and QOL for individuals with MS in rural counties compared with urban counties in Iowa.

METHODS: Using a mixed-methods design, validated self-reported questionnaires were provided: Multiple Sclerosis Quality of Life-54, Social Support and Eating Habits Survey, Social Support and Exercise Survey (SSES), and the United States Department of Agriculture's Household Food Security Survey Module. Semistructured interviews further explored participants' perceptions of QOL, with a focus on food security, social support, and QOL. Thematic analysis was applied to qualitative interviews.

RESULTS: Thirty-four Iowa residents with MS participated (11 rural; 23 urban). Although the impact of food security on QOL did not differ between rural and urban participants, food security was inversely associated with lower mental QOL ($r = -0.63$; $P < .001$). Greater social support from family (SSES family participation; $r = 0.43$; $P = .02$) and friends (SSES friend participation; $r = 0.39$; $P = .04$) was linked to improved mental QOL. Qualitative findings supported these results and highlighted contextual differences in social support and food access between rural and urban residents.

CONCLUSIONS: In individuals with MS, food insecurity is associated with decreased mental QOL scores, regardless of geographic location. Strengthening family- and friend-based social support may be an effective strategy to enhance mental QOL. Further research is warranted with a larger sample size to explore the influence of food security and social support on improving mental QOL.

Int J MS Care. 2026;28(2):65-74. doi:10.7224/1537-2073.2024-068

Multiple sclerosis (MS) is a chronic immune-mediated neuroinflammatory condition that is increasing in prevalence in the United States.¹ Although symptoms of MS vary depending on the individual, it can greatly affect a person's quality of life (QOL), which is the feeling of overall life satisfaction as determined by the individual whose life is being evaluated.² People with MS report lower health-related QOL than the general public and other chronic disease populations.³ Although subjective, the perception of QOL is influenced by social determinants of health (SDOH), which are nonmedical factors that impact health outcomes.⁴ Access to food, which can be evaluated through food security status,^{5,6} is a crucial factor in determining the overall well-being and SDOH of individuals with MS.⁷ Limited access to sufficient nutrients or safe foods can cause food insecurity,⁸ which can lead to malnutrition,⁷ exacerbated MS-related symptoms,⁸ and decreased QOL.^{7,9}

Similarly, social support is a broad term that often refers to the various structural or functional measures individuals use to gain assistance within a social environment.¹⁰ Findings from studies have revealed that greater social support, such as from friends and family, positively influences QOL,¹¹ especially among people with MS.^{12,13} To help address knowledge gaps and enhance resources and services for people with MS, the MS International Federation developed the *Atlas of MS* in 2008, with subsequent editions in 2013 and 2020. The *Atlas of MS* recommends more research to understand factors, including dietary and social influences, that impact the QOL in people with MS on a regional, national, and global scale.¹⁴ Similarly, the US Department of Health and Human Services' Healthy People 2030 identifies access to foods that support healthy dietary patterns as an important example of SDOH.^{4,8} Assessing and addressing SDOH, particularly in terms of food access and social support, has the potential to improve health for people with MS⁷; however, there is a lack of understanding of the relationship between food access and QOL for people with MS in rural areas.

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Within the US, the Midwest has the second-highest prevalence of MS, with approximately 353 cases per 100,000 people.¹⁵ In addition, 2020 US Census data show that 36.8% of Iowa's population resides in rural areas.¹⁶ Thus, residents of rural areas in Iowa with MS may encounter additional barriers that can exacerbate the development and progression of MS compared with their urban counterparts, though the understanding of this relationship is limited. Therefore, the aim of this study is to assess the impact of food security and social support on QOL for Iowa residents living with MS in rural areas compared with their urban counterparts.

METHODS

Study Design

This is a cross-sectional, convergent-parallel, mixed-methods study utilizing concurrent triangulation from both qualitative and quantitative approaches, structured according to the Mixed Methods Appraisal Tool protocol version 2018 (FIGURE S1; all supplemental material is available in a PDF at the end of the online article).¹⁷ Given the limited evidence of perceptions of food access and QOL of individuals with MS living in rural areas, a mixed-methods approach was utilized, as it can provide a holistic view by providing opportunities for participants to have a strong voice and share their experiences, which, in general, are too complex to be approached unidirectionally with quantitative methods.¹⁸

Side-by-side comparison of merged and analyzed quantitative and qualitative data was performed, with interpretations presented in the discussion.¹⁹ Quantitative results were compared with qualitative results to interpret the convergence or divergence of the data to assess food access, food insecurity status, community infrastructures, and social support impact on QOL in individuals with MS living in rural areas compared with urban areas in Iowa. The study protocol for the present study, entitled Food Accessibility in Relation to Quality of Life for Rural versus Urban Iowans with Multiple Sclerosis (FARMS), was approved by the University of Iowa Institutional Review Board (IRB-01# 202306310).

Participants

From August 2023 to October 2023, participants were recruited through an email of the study poster and an online survey link from an internal MS-specific research registry (FIGURE S2) of individuals with MS who had given consent to be contacted for potential participation in future research studies. Using a targeted sampling approach, participants in the research registry were sorted to identify individuals who self-reported living in the state of Iowa (N = 346). A targeted sampling approach was used because of the ability to quickly and strategically recruit hard-to-reach groups—in this case, rural Iowans with MS.²⁰ Participants were eligible for enrollment in the study if they completed the screening survey that included the following study inclusion criteria: (1) self-reported an MS diagnosis, (2) were over the age of 18 years, and (3) resided in Iowa.

The study survey and questionnaire were disseminated using Research Electronic Data Capture (REDCap),²¹ a secure, web-based

software platform designed to support data capture for research studies. Upon completion of the screening survey, electronic informed consent was obtained from all participants deemed eligible for the study.

Consent

The survey included a cover letter that extended an invitation to participate in the research, presented an overview and description of the study, outlined the risks and benefits for participants, and emphasized the study's voluntary nature. Interested individuals completed screening questions for eligibility. Eligible participants proceeded to the quantitative survey, indicating consent with completion.

Quantitative

Demographic data were collected from 34 participants, including age, zip code, sex, MS diagnosis type, body mass index, highest education completed, ethnicity, household income, employment status, household size, and the number of dependents.

The quantitative portion of the study utilized validated questionnaires. QOL was assessed by the Multiple Sclerosis Quality of Life-54 (MSQOL-54)²²; food security status was assessed by the US Department of Agriculture's Household Food Security Survey Module (HFSSM)²³; social support was assessed by the Social Support and Eating Habits Survey (SSEH) and the Social Support and Exercise Survey (SSES).²⁴ The MSQOL-54 is an MS-specific, 54-item health-related questionnaire measuring multidimensional health-related QOL.²² Mental and physical composite scores were calculated using standard scoring procedures, with higher scores indicating greater perceived mental and physical QOL.²² The HFSSM assesses food security status, with scores of 3 or more indicating food insecurity.²³ The SSEH and SSES assess social support in the form of encouragement and discouragement from family and friends about eating and exercise habits as well as food purchasing and meal preparation habits,²⁴ with higher scores indicating greater impact of the respective domain.

Quantitative data were analyzed using SAS 9.4 software (SAS Institute). At enrollment, descriptive statistics for each variable were calculated by group, using frequencies and percentages or means and SDs. Demographic characteristics of rural and urban groups were compared using Fisher exact tests for categorical variables and 2-sample t tests for continuous variables. Missing observations were omitted from comparisons. Pearson correlations were used to determine the main correlates of the mental and physical QOL scores in relation to food security and social support. *P* values less than .05 were considered statistically significant.

Qualitative

Those who completed the quantitative questionnaires could indicate interest in a subsequent qualitative interview. A research team member (A.M.K.) contacted participants to arrange a qualitative interview 2 to 3 weeks after the questionnaire had been completed. Participants were purposely sampled to obtain an equal number of interviews from rural and urban Iowans as well as a good spread of various regions throughout the state of Iowa (FIGURE S3).

With participants' consent to record the session, all interviews were conducted via Zoom, a secure, password-protected platform. Eight one-on-one semistructured interviews were held: 4 with participants from rural areas and 4 with participants from urban areas. The interviews utilized semistructured open-ended questions based on previous qualitative studies²⁵ and were modified to elicit experiences regarding the impact of geographical location on food accessibility and QOL (see **TABLE S1** for the interview guide). Interviewees were further requested to elaborate on details when appropriate. Interviews lasted 15 to 40 minutes. Interviews were transcribed verbatim. Qualitative interview data were analyzed inductively using MAXQDA software (version MAXQDA 2022) by 3 research team members (A.M.K., F.S., and E.T.M.) for common themes based on the method by Braun and Clarke.²⁶

RESULTS

Demographics

A total of 83 individuals were interested in participating in the study; however, 49 individuals did not meet eligibility requirements due to incomplete surveys, duplicates, not residing in Iowa, not having an MS diagnosis, not being fluent in written and spoken English, or an unwillingness to complete the study questionnaires (**FIGURE S4**). A final sample of 34 participants completed and returned a questionnaire. Thirty-two percent ($n=11$) of the sample resided in rural areas and 68% ($n=23$) in urban areas of Iowa. Demographics did not differ between urban and rural participants (**TABLE 1**).

From this pool of 34 participants, 8 interviewees who expressed interest in one-on-one interviews were selected and interviewed, with 4 residing in rural cities and 4 residing in urban cities. Overall, none of the demographics differed between the urban and rural interviewees (Table 1).

Quantitative Data Results

Mental and physical QOL, as well as HFSSM, scores did not differ between rural and urban residents. Overall, 82.6% of participants were food secure, with urban residents having a somewhat lower rate of food security (74.0%) compared with rural residents (100%; $P=.15$; Table 1). SSEH subscores did not differ between rural and urban residents, except for the SSEH friend discouragement measure, which exhibited a statistically significant ($P=.04$) higher mean subscore for rural residents (11.7 ± 7.10) than for urban residents (7.05 ± 3.31 ; **TABLE 2**). Mental QOL scores were inversely correlated with HFSSM scores ($r=-0.63$; $P<.001$) and positively correlated with SSES family participation ($r=0.43$; $P=.02$) and SSES friend participation ($r=0.39$; $P=.04$; **TABLE 3**). Physical QOL was not correlated with food security or social support scores. Participants with food insecurity had significantly lower mental QOL compared with participants with food security ($P=.05$), but physical QOL did not differ (**FIGURE S5**).

Qualitative Data Results

Social Support From Family and Friends

Qualitative findings from both rural and urban interviewees corroborated quantitative results showing that higher mental QOL

PRACTICE POINTS



Food insecurity status is strongly linked to lower mental quality of life in individuals with multiple sclerosis (MS), regardless of rural or urban residence.

Greater social support from family and friends is associated with improved mental quality of life in people with MS.

Interventions aiming to enhance family- and friend-based social support and food insecurity may improve the mental quality of life of people with MS, regardless of rural or urban residence. ■

was associated with support from family and friends, primarily functional and socioemotional forms of help, as reflected in the SSES family and SSES friend participation scores. One slight distinction is that the interviewees reported family members assisting with some physical activity tasks that required navigating long distances for essential needs; this was not specifically captured in the physical activity quantitative results. FARMS1, a rural mother, described how her daughter helps by going to the grocery store, which is located 15 miles away from their home, stating, "...my daughter is really good about going to the grocery store if we need something." Similarly, FARMS19, an urban mother, explained that her husband takes care of the grocery shopping, stating, "My husband does pretty much all the shopping, and he really shops the deals." The qualitative accounts revealed no meaningful differences in the types of support reported by rural and urban participants, reinforcing the finding that both groups primarily relied on day-to-day instrumental support from loved ones.

Other forms of social support were familial support, relationships with others managing an autoimmune condition, having an online community, and receiving support surrounding their chosen diet. FARMS19 described the support she receives from family in accommodating her dietary needs, stating, "I would say my husband is pretty supportive. Now he doesn't follow the same diet, like my husband and kids don't follow it. But he's supportive of me doing it. And I would say my family is pretty great in that, like, when we have family gatherings...there's usually food involved and they're really great about bringing things that I can eat." Another form of social support was interacting with others who manage a similar condition. FARMS9, an urban participant, expressed her excitement in finding a friend with shared dietary

TABLE 1. Characteristics of Rural and Urban Participants and Interviewees

	Quantitative			Qualitative		
	Rural ^a	Urban ^a	P value ^b	Rural ^a	Urban ^a	P value ^b
n	11	23		4	4	
Age , years (mean)	55.9 (9.67)	50.9 (11.2)	.23	45.7 (5.17)	56.6 (5.31)	.19
Sex (%)			.15			> .99
Male	9.09	0.00		25.0	0.00	
Female	90.9	100		75.0	100	
MS type (%)			.51			> .99
Relapsing-remitting	70.0	87.0		100	75.0	
Primary progressive	20.0	8.70		0.00	25.0	
Secondary progressive	10.0	4.35		0.00	0.00	
MS disease duration , years (mean)	17.6 (8.61)	13.7 (9.06)	.28	16.7 (6.55)	17.0 (4.94)	.97
BMI (mean)	27.3 (3.20)	29.6 (7.77)	.36	28.3 (3.50)	27.5 (2.44)	.86
Highest education completed (%)			.80			.34
High school or less	27.3	27.3		25.0	25.0	
Some college	27.3	13.6		0.0	25.0	
4-year degree	18.2	22.7		50.0	0.00	
Advanced degree	27.3	36.4		25.0	50.0	
Race/ethnicity (%)			.42			> .99
American Indian or Alaska Native	0.00	4.35		0.00	25.0	
Asian	0.00	0.00		0.00	0.00	
Black or African American	0.00	0.00		0.00	0.00	
Hispanic or Latino	10.0	4.35		0.00	0.00	
Middle Eastern or North African	0.00	0.00		0.00	0.00	
Native Hawaiian or other Pacific Islander	0.00	0.00		0.00	0.00	
White	90.0	91.3		100	75.0	
Household income (%)			.25			.72
Less than \$40,000	44.4	31.8		25.0	25.0	
\$40,000 to less than \$80,000	0.00	27.3		0.00	25.0	
\$80,000 to less than \$120,000	33.3	13.6		50.0	25.0	
\$120,000 or more	22.2	27.3		25.0	25.0	
Employment (%)			.13			.41
Employed	45.5	69.6		100	50.0	
Out of work/not working	0.0	8.70		0.00	0.00	
Homemaker	0.0	4.35		0.00	0.00	
Retired	9.09	8.70		0.00	50.0	
Unable to work	45.5	8.70		0.00	0.00	
Household size (%)			.42			.51
1 person	20.0	17.4		0.00	25.0	
2 people	60.0	39.1		50.0	50.0	
3 to 5 people	20.0	43.5		50.0	25.0	
6 or more people	0.00	0.00		0.00	0.00	

(continued)

TABLE 1. (continued) Characteristics of Rural and Urban Interviewees

	Quantitative			Qualitative		
	Rural ^a	Urban ^a	P value ^b	Rural ^a	Urban ^a	P value ^b
Dependents (%)			.59			.26
0	72.7	50.0		50.0	50.0	
1	9.09	13.64		25.0	0.00	
2	9.09	27.3		0.00	50.0	
3 or more	9.09	9.09		25.0	0.00	
USDA HFSSM			.32			> .99
High food security	100	69.6		100	100	
Marginal food security	0.00	4.35		0.00	0.00	
Low food security	0.00	13.0		0.00	0.00	
Very low food security	0.00	13.0		0.00	0.00	

BMI, body mass index; MS, multiple sclerosis; USDA HFSSM, United States Department of Agriculture Household Food Security Survey Module.

^aData are shown as either mean (\pm standard error of the mean) or n %.

^bSignificance determined using Pearson χ^2 test for categorical variables or 2-sample *t* test for continuous variables.

restrictions, stating, “I didn’t realize how much it bothered me until...one other friend who came and visited, and he had autoimmune issues, and so he was limiting what he was eating as well, and I...didn’t realize how much that my diet had excluded me from other things, just because it was so mind-blowing to me that somebody else needed to eat what I ate. Like, ‘There’s somebody else out there!’” Similarly, an urban participant, FARMS33, had talked with others who had MS about ways they manage the disease, noting that she has obtained resources she uses this way. She stated, “Once you have something like this, then...you meet all kinds of people who also have this, and then you talk about, like, how they’re managing it and things like that.”

In contrast to positive social support, a lack of knowledge and understanding surrounding MS was identified as a barrier to social support. A rural participant explained her frustration with members of the community who are not sensitive to her condition. She described instances where she was compared with others with MS who have different symptoms and was asked why she could not assist with physical activities at a local gardening club. She stated, “I just don’t think people understand that MS is a condition that affects everyone differently.” The lack of social support had an impact on her mental QOL.

Compared with our quantitative analysis, our qualitative findings provide a more nuanced view of the mental and physical QOL, as well as food security, of people with MS from rural and urban areas. The following subsections examine these subtleties.

Mental and Physical QOL: Contexts of Care, Environment, and Labor on QOL

Where participants lived noticeably impacted their mental and physical QOL in relation to access to therapeutic resources and symptom management. Urban interviewees described the increased availability of numerous medical, homeopathic, and diet-related education options. FARMS33, an urban Iowan, listed a multitude of nearby resources that she utilized, including

massage therapists, personal trainers, chiropractors, a light sauna, an aerobic exercise gym, and a personal home pool. She remarked, “I use a lot of nontraditional things to kind of be more in charge of my health.”

This was in stark contrast to the resources mentioned by a rural interviewee. FARMS68 noted the use of and access to therapeutic resources such as physical and occupational therapy: “That’s about it, besides taking my medications.” Later in the interview, she noted the combined impact of the geographic distance and her MS symptoms in getting to health care appointments: “As far as, like, health appointments and that, I’ve had to cancel a lot because I just haven’t been able to...feel well enough to go...to them.” Similarly, FARMS77, another rural participant, mentioned distance from health care resources in her interview, stating, “Health care is half a, you know, half hour [away], and then my neurologist is 40 minutes.” Qualitative data highlight that as routine health care access is limited geographically for rural participants, access to nontraditional or alternative therapies is also limited.

Due to their location, rural individuals may be more likely to engage in outdoor physical activities as a way to manage MS, as it provides them with a sense of calm that can alleviate stress. Multiple rural participants described the tranquility of rural life. FARMS8, for example, described what he likes about living in a rural area, stating, “I’m rural. Nobody bothers me. I don’t have a lot of people buzzing around, knocking on the door and stuff. So, sometimes it’s nice and quiet and peaceful.” Similarly, FARMS77 explained her preference for rural living: “We have peace and quiet, yet Interstate 80 is a mile down the road. We, you know, don’t have pollution.... It’s ideal, I guess, for us, because we love it.” Thus, despite rurality limiting access to certain resources, it also provides a sense of calm and tranquility that may be beneficial for the QOL of people with MS.

Also impacting interviewees’ mental and physical QOL was their treatment in the workplace. Although data are limited, there was a difference between the workplace accommodations

TABLE 2. Scores From Quantitative Self-Reported Questionnaires

	Rural ^a	Urban ^a	P value ^b
Quality of life			
MSQOL-54 mental	71.2 ± 12.0	79.9 ± 11.7	.10
MSQOL-54 physical	54.7 ± 3.71	53.1 ± 4.27	.32
Social support and eating habits			
SSEH family encouragement	6.50 ± 3.06	7.43 ± 2.82	.41
SSEH family discouragement	10.0 ± 5.08	9.38 ± 4.33	.72
SSEH friend encouragement	6.80 ± 2.35	7.62 ± 4.03	.56
SSEH friend discouragement	11.7 ± 7.10	7.05 ± 3.31	.04
Social support and exercise			
SSES family participation	14.9 ± 5.84	18.3 ± 10.7	.35
SSES family punishment	3.00 ± 0.00	3.28 ± 0.64	.17
SSES friend participation	13.5 ± 5.25	15.9 ± 8.06	.41
Household Food Security Survey Module			
Overall	1.90 ± 5.34	1.52 ± 3.19	.81

MSQOL-54, Multiple Sclerosis Quality of Life-54; SSEH, Social Support and Eating Habits Survey; SSES, Social Support and Exercise Survey.

^aData are shown as mean ± SD.

^bSignificance determined using 2-sample *t* test.

afforded to urban interviewees vs rural ones, as well as the resulting impacts on their professional accomplishments. FARMS19, an urban Iowan, noted generous workplace accommodations for her disability, leading to a sense of “appreciation” and increased mental QOL. She explained, “Now that, like, physically I can’t do a lot anymore, I actually really appreciate my job more.... I mean, working for a university, they tend to be pretty accommodating to disabilities and such.... I basically work from home all the time.... I’ve gotten an accommodation to get a voice-to-text program for my computer because...one of my hands doesn’t work super well. I can still type. I still type a lot, but mostly one-handed.” This quote indicates an increased amount of social support for those facing illness and disability in urban areas.

A rural participant, FARMS68, had a vastly different professional experience. She experienced dramatic professional setbacks due to MS, which negatively overwhelmed her personal life and notion of self. She said, “I lost my career. I lost my income, lost my sense of self. And as far as home life, the most difficult challenge was raising 4 kids and dealing with the MS and the symptoms and everything that goes along with that, all at the same time.” The challenges of balancing illness with career are further shown by FARMS8, another rural participant, who described how he went on disability leave due to how MS impacted his energy: “I went on disability in 2010, because I just, I physically couldn’t stay awake throughout an entire day.” Workplaces that provided accommodations for urban participants were not available for rural residents, forcing them out of the workforce.

Food Security and Economic Access

There was a noticeable difference between the urban and rural interviewees’ perceptions of food security and economic access. Despite there being no explicit reports of food insecurity in the

interviews, a common theme that emerged was the cost of food. A need to budget and restrict personal food expenses was mentioned by 3 of 4 rural respondents. Rural interviewee FARMS68, when asked about what factors impact food accessibility, said, “Income, yeah, I have a budget. Sometimes it’s not always the highest,” later noting a need to “keep track of what’s in my [grocery] cart...so I don’t go over [my budget].” Similarly, FARMS1, another rural participant, remarked that she found she was “spending way too much money [on food].” Although FARMS9, an urban participant, mentioned the cost of food, other urban Iowans described not having financial worries about food access.

Food insecurity loomed larger in the community context for rural Iowans. The presence of community food pantries and breadlines for those in need was mentioned by 3 of 4 rural respondents, but no urban interviewees mentioned these resources, indicating a rural-urban divide in knowledge of food security resources.

Despite this, all participants understood the connection between a healthy diet and better-managed MS. Thus, a common theme among rural and urban participants was the benefits of having access to farm-fresh foods. Notably different, however, was how interviewees accessed these healthy foods: Urban interviewees were more likely to discuss traveling to local farmers markets, enrolling in community-supported agriculture box programs and cooperatives, and buying directly from farms and ranches—they were more likely to *purchase* healthy foods. FARMS19 said, “I would say, for me, like, food accessibility is pretty good, but I also am aware that a lot of that has to do with the fact that we can afford food and we have a lot of connections with local farmers.”

Conversely, rural interviewees, who geographically may have less access to these markets, *raised* their own home gardens and had hobby farms to obtain alternative or supplementary sources of healthy foodstuffs. This was exemplified by rural interviewee

TABLE 3. Pearson Correlation Between Mental and Physical Quality of Life and Food Security, Income, and Social Support

	Mental QOL	Physical QOL	HFSSM	SSEH FE	SSEH FD	SSES FP	SSES FPun	SSEH FrE	SSEH FrD	SSES FrP
Mental QOL	1.00	0.20 (.29)	-0.63 (κ .001)	-0.01 (.97)	-0.12 (.52)	0.43 (.02)	0.25 (.18)	0.30 (.11)	-0.25 (.17)	0.39 (.04)
Physical QOL		1.00	-0.19 (.32)	-0.06 (.74)	0.09 (.65)	-0.08 (.66)	0.06 (.74)	0.08 (.68)	0.13 (.48)	-0.04 (.84)
HFSSM			1.00	0.34 (.07)	0.20 (.29)	-0.22 (.23)	-0.09 (.63)	-0.11 (.56)	0.23 (.22)	-0.21 (.26)
SSEH FE				1.00	0.50 (.005)	0.20 (.30)	0.24 (.20)	0.48 (.007)	0.28 (.14)	-0.04 (.83)
SSEH FD					1.00	-0.04 (.84)	-0.03 (.86)	0.05 (.80)	0.58 (κ .001)	-0.13 (.48)
SSES FP						1.00	0.62 (κ .001)	0.32 (.09)	-0.20 (.29)	0.62 (κ .001)
SSES FPun							1.00	0.52 (.003)	-0.24 (.21)	0.55 (.002)
SSEH FrE								1.00	0.14 (.47)	0.37 (.04)
SSEH FrD									1.00	-0.13 (.50)
SSES FrP										1.00

FD, family discouragement; FE, family encouragement; FP, family participation; FPun, family punishment; FrD, friend discouragement; FrE, friend encouragement; FrP, friend participation; HFSSM, Household Food Security Survey Module; SSEH, Social Support and Eating Habits Survey; SSES, Social Support and Exercise Survey; QOL, quality of life.

Note: Data shown as *r* (*P* value). Bold indicates statistical significance.

FARMS77, who commented, “Being on the farm is a huge blessing because, basically—other than hard cheeses and alcohol—we really don’t buy much at the grocery store because we have all our meat. We have beef; we have chicken. You know, and then I garden a lot. And so, all our produce is from the farm.” Rural interviewees had a positive outlook on how much gardens can provide for individuals and their communities, with FARMS8 noting that he was able to feed “3 other families out of [my] garden this year.” This reinforces the finding that urban Iowans have more economic capital to buy healthy foods, whereas rural Iowans turn to alternatives such as gardening and farming.

Distance to grocery stores also impacted how participants accessed healthy foods: whether they purchased or grew them. Participant FARMS68 explained, “I am farther out from, say, the bigger town. So again, if I am not feeling the greatest that day or whatever, I just don’t go.” Another rural Iowan, FARMS8, noted that the closest grocery store was 35 minutes away, creating a direct barrier to his ability to access food.

Grocery delivery and pickup services helped stem some access issues and were identified as facilitators by individuals with MS in both urban and rural locations. Urban participant FARMS12 explained, “Mostly, I go [to the grocery store] once a week, and a lot of it’s done through pickup just to save on time.” Rural Iowan FARMS8 remarked, “I do a lot of online ordering, so it’s...that’s probably the bulk of it.... I’ll have it shipped here because I can order from Sam’s Club and pay the same price sitting here at my computer as I can going to the store.” Although not all rural individuals had access to grocery delivery, most interviewees viewed these services as increasing their access to food.

DISCUSSION

In this cross-sectional mixed-methods pilot study, mental and physical QOL, as well as food security, did not drastically differ between rural and urban Iowan residents with MS but did show some geographic nuance. Convergence was observed between the quantitative survey results and semistructured interviews when

the cost of food emerged as a common theme rather than food security. However, mental QOL was correlated with food security status, as assessed by the HFSSM, and, for both rural and urban interviewees, with support from family and friends and participation in physical activity, as assessed by 2 SSES subscales. Thus, the interplay between food security and social support with mental QOL should be further assessed when considering the creation of an intervention for individuals with MS.

Among rural and urban Iowans in the present study, food security status did not differ significantly, although 26.0% of urban residents experienced some degree of food insecurity. This converged with the participants’ interviews, which revealed that although food security was not a primary concern, the cost of food significantly impacted participants. Several individuals living in rural areas reported the need to budget and expressed concerns about rising food costs. These results are comparable to those of the 2021 Iowa Women, Infants, and Children food insecurity assessment, which found that respondents living in metropolitan (urban) areas were 1.2 times more likely to experience food insecurity than those in rural areas.²⁷ The lack of significance observed in the present study findings may be due to our small sample size. Although the present study findings also did not demonstrate a pronounced rural-urban divide in terms of food security, the influence of other SDOH, particularly health care access and the geographic environment, should also be considered when assessing differences between rural and urban populations, and it is especially important to consider for individuals with chronic illness, such as MS.

A strong inverse correlation was observed between mental QOL and food insecurity status among participants, with statistically significantly higher mental QOL scores for participants noted as food secure compared with those who were food insecure. The association between mental QOL and food security has been consistently shown in prior research.²⁸ Results from a recent study found that increasing levels of food insecurity were associated with worsening physical and mental QOL scores in a dose-response relationship.²⁹

Similarly, the association between food insecurity and QOL was also present in results from a study among rural and urban women, which found that health-related QOL dimensions, including general health, physical health, and mental distress, were associated with household food insecurity and that household food insecurity was associated with fair to poor general health among rural women but not urban women.³⁰ Given the relationship between food security and mental QOL, it is important to address food security status in people with MS, whose QOL scores are already lower than those of healthy and other chronic disease populations.^{3,31,32}

Strong associations have been found between healthy dietary habits and mental QOL as well as disability status in people with MS³³; thus, food access should be considered in the clinical management of MS. In addition, a cross-sectional analysis of adults with chronic disease revealed that adults who reported food insecurity were significantly more likely to report cost-related medication underuse.³⁴ Given the physical and economic burden of MS, efforts to reduce food insecurity should be considered to improve not only QOL but also health-related outcomes.

Social support was positively associated with mental QOL among participants and converged with themes from the qualitative semistructured interviews, where various forms of social support were meaningful. This aligns with findings from other studies that have observed that social support is associated with mental QOL for people with MS.^{11,12,35,36} Support from family and friends can have a positive influence on eating and physical activity of individuals with chronic illnesses, including MS.³⁷ Another form of social support is having the opportunity to connect with others who are managing similar conditions. Results from a qualitative study exploring facilitators of QOL in patients with MS found social support and social organizations to be among the most important facilitators of QOL.³⁸ Similarly, results from a qualitative pilot study investigating the impact of support group participation on perceptions of patients newly diagnosed with MS found that support groups may increase knowledge about MS and available resources as well as offer the perspectives of others living with MS.³⁹ More generally, for individuals living with a chronic illness, the perceptions of social support can increase not only QOL but also life expectancy.⁴⁰ Social support has also been shown to improve adherence to medical treatments,⁴¹ health outcomes,⁴² and self-efficacy.⁴³ Thus, fostering social support networks is essential to improve the QOL of individuals with MS and other chronic illnesses and should be strongly considered for inclusion in future interventions.

The strengths of this study include its convergent-parallel, mixed-methods design, which incorporates both quantitative data from study questionnaires and qualitative data from one-on-one interviews. This approach allowed the results to converge to explain the influence of food access on QOL for people with MS in Iowa. Additional strengths include validated questionnaires aimed at assessing food security, social support for eating, and QOL. Limitations to this study are its small sample size and its low power, so these results cannot be generalized to the whole state of Iowa or the rest of the US. In addition, participants were recruited with a targeted approach from an MS research registry,

which may have limited the recruitment to certain demographic groups; future efforts should promote the study through larger organizations to potentially influence the demographics of the recruited sample. Further, participants were not compensated for their involvement, a factor that could have introduced volunteer bias, favoring individuals who were more inclined to invest time and energy in research participation. This may be reflected in the limited number of participants who indicated interest in being interviewed. Although a pilot study was necessary to assess recruitment potential and refine or modify the research methodology, including the study questionnaires as well as the interview questions,⁴⁴ a larger study is necessary to further understand the impact of food accessibility and security, as well as social support, on QOL among individuals with MS.

CONCLUSIONS

The findings of our study demonstrate the association between food security status and social support with mental QOL for people with MS. Food security assessments did not find a difference between rural and urban residents of Iowa, but interviews revealed nuanced distinctions. Social support from family and friends also emerged as an important factor for improving mental QOL. Future studies should include more participants, perhaps from additional counties across Iowa and/or other US states, to further assess the relationships among food security status, social support, and mental QOL for individuals with MS. ■

Acknowledgments: The authors would like to acknowledge the following for their contributions to the study: the Iowa Social Science Research Center (ISRC), especially Dawn R. Bower, for facilitating qualitative interview transcription services; the University of Iowa students who were employed and trained through the ISRC to provide transcription services, ensuring all files remained internal; the Public Policy Center, especially Mark T. Berg, for support during the Summer Fellowship for Qualitative Research; Ethan M. Rogers for the constant positive feedback and engaging conversations and the rest of the Public Policy Center staff for their support of the study; and all the study participants, who volunteered their time.

Conflicts of Interest: Terry Wahls, MD, personally follows and promotes the Wahls diet. She has equity interest in Terry Wahls LLC; TZ Press LLC; The Wahls Institute, PLC; FBB Biomed Inc; Levels Health Inc; Foogal Inc; WellTheory Technologies Inc; and the website <http://www.terrywahls.com>. She owns the copyright to the books *Minding My Mitochondria*, *The Wahls Protocol*, and *The Wahls Protocol Cooking for Life* and trademarks on The Wahls Protocol, the Wahls diet, the Wahls Paleo diet, the Wahls Paleo Plus diet, and Wahls Behavior Change. She has completed grant funding from the National Multiple Sclerosis Society for the Dietary Approaches to Treating Multiple Sclerosis-Related Fatigue Study. She has financial relationships with MasterHealth Technologies Inc, WellTheory Technologies Inc, and the Institute for Functional Medicine Inc. She receives royalty payments from Penguin Random House. She has a conflict-of-interest management plan in place with the University of Iowa and the Iowa City Veterans Affairs Medical Center.

All other authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Funding: Support for this project was provided by the University of Iowa Public Policy Center through the Summer Fellowship for Qualitative Research. Solange M. Saxby, PhD, RDN, is a research trainee of the Dartmouth Health Primary Care Research Fellowship, supported by the Health Resources and Services Administration (HRSA) of the US Department of Health and Human Services (HHS; T32HP32520), and receives research support from the Burroughs Wellcome Fund (BWF) Postdoctoral Diversity Enrichment Program (PDEP). Tyler J. Titcomb, PhD, RDN, was supported by a career transition award from the National MS Society (NMSS; TA-2205-39486). Saxby, Titcomb, and Farnoosh Shemirani, PhD, were supported by the Carter Chapman Shreve Family Foundation and the Carter Chapman Shreve Fellowship Fund for diet and lifestyle research conducted by the Wahls Research Team at the University of Iowa. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement by, HRSA, HHS, BWF PDEP, NMSS, or the US government.

Prior Presentation: These data were previously presented at the Consortium of Multiple Sclerosis Centers annual conference from May 29 to June 1, 2024, in Nashville, Tennessee; the Annual Americas Committee for Treatment and Research in Multiple Sclerosis Forum from February 29 to March 2, 2024, in West Palm Beach, Florida; and the American Society of Nutrition Annual Conference from May 31 to June 3, in Orlando, Florida.

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