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ORIGINAL ARTICLE

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We are all in this together: Rurality, Social cohesion, and COVID-19 prevention behaviors

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Abstract

Background: Social cohesion refers to an individual's sense of belonging to their community and correlates with health outcomes. Rural communities tend to have higher social cohesion than urban communities. Social cohesion is relatively understudied as a factor impacting COVID-19 prevention behaviors. This study explores the associations between social cohesion, rurality, and COVID-19 prevention behaviors.

Methods: Participants completed a questionnaire assessing rurality; social cohesion (subscales of (1) attraction to neighborhood, (2) acts of neighboring, and (3) sense of community); COVID-19 behaviors; and demographics. Chi-square tests were used to characterize participant demographics and COVID-19 behaviors. Bivariate and multivariable logistic regression models were used to analyze the relationship between COVID-19 outcomes and rurality, social cohesion, and demographics.

Results: Most participants (n = 2,926) were non-Hispanic White (78.2%) and married (60.4%); 36.9% were rural. Rural participants were less likely than urban participants to practice social distancing (78.7% vs 90.6%, $P<.001$) or stay home when sick (87.7% vs 93.5%, $P<.001$). Social distancing was more common among participants with higher "attraction to neighborhood" scores (adjusted odds ratio [aOR] = 2.09; 95% confidence interval [CI] = 1.26-3.47) but was less common among participants with higher "acts of neighboring" scores (aOR = 0.59; 95% CI = 0.40-0.88). Staying home when sick was also more common among participants with higher scores on "attraction to neighborhood" (aOR = 2.12; 95% CI = 1.15-3.91), and less common among participants with higher scores on "acts of neighboring" (aOR = 0.53; 95% CI = 0.33-0.86).

Conclusions: Efforts to maximize COVID-19 behavioral prevention, particularly among rural communities, should emphasize the importance of protecting the health of one's neighbors and how to support one's neighbors without face-to-face interactions.

KEYWORDS
COVID-19, health behavior, rural health, social cohesion

INTRODUCTION

Since the first cases of a "pneumonia of unknown etiology" were reported in Wuhan, China, in December 2019, daily life around the world has drastically changed.[1] Later classified as the SARS-CoV-2 virus, or COVID-19, this pandemic has changed how individuals, communities, and nations interact with each other. The U.S. Centers for Disease Control and Prevention (CDC) has been a vital player in organizing the American response to the virus. In addition to increasing awareness and launching research initiatives, the CDC has provided behavioral guidelines for COVID-19 safety and prevention. These guidelines include information on social distancing, personal protective equipment, proper sanitation, testing, and vaccination practices.[2]

COVID-19 cases and deaths were initially higher in densely populated urban areas; however, beginning in May 2020, this trend began to reverse, and recent data demonstrated that COVID-19 death rates were almost twice as high in rural counties compared to urban counties.[3,4] Previous studies have indicated that factors such as population density, career choices, politics, demographic spread, and levels of educational attainment may influence these numbers.[4,5] However, few studies have investigated the impact of social cohesion on COVID-19 prevention and burden.

Social cohesion is an individual's sense of belonging to their community.[6] People living in communities with higher social cohesion tend to have better health outcomes, including lower mortality after a cancer diagnosis, better mental health, and a greater quality of life in older adults.[7–9] Research also suggests higher social cohesion in rural compared to urban communities.[10] Since social cohesion promotes health-positive behaviors and is higher in rural communities, we sought to explore these associations in the context of COVID-19 prevention behaviors.

This study examined social cohesion and adherence to CDC COVID-19 prevention behaviors in a sample of rural and urban older adults from the mid-Atlantic United States. Given the variety in the current literature about the impact of social cohesion on COVID-19 prevention behaviors, we considered 2 competing hypotheses: (1) higher social cohesion could encourage prevention behaviors out of concern for the health of one's neighbors, or (2) higher social cohesion could discourage behaviors that decrease interpersonal interaction. Conceptually, rural communities will have higher social cohesion than urban communities, but the relationship between social cohesion and COVID-19 prevention is unclear. Understanding these pathways can point to different interventions for COVID-19 prevention in rural communities, which now have a higher COVID-19 burden than urban communities.

METHODS

Data source

Participants were recruited from a pre-established national panel maintained by Qualtrics, a survey research company. Inclusion criteria were: ages 50+, fluent in written English, and living in Delaware, Maryland, Ohio, Pennsylvania, New Jersey, New York, or West Virginia. We attempted to oversample participants who were (1) racial/ethnic minorities or (2) living in rural counties. All participants provided informed consent prior to completing the 30-minute online survey. From February to August 2021, 2,966 eligible responses were collected. Of these, 2,926 (98.7%) were successfully classified as either rural or urban (see ***Rurality***, below).

Measures

Participants answered questions assessing rurality; social cohesion; COVID-19 experiences, attitudes, and behaviors; and demographics.

Rurality was defined via the US Department of Agriculture Rural-Urban Continuum Code (RUCC), a highly regarded convention used in many similar studies.[11] Participants' county of residence was classified as urban/metropolitan if it had a RUCC of 1-3 or rural/nonmetropolitan if it had a RUCC of 4-9.[12]

Social cohesion was assessed with Buckner's 18-item neighborhood cohesion instrument.[13] This instrument assesses social cohesion with 3 subscales: attraction to neighborhood (a person's desire to be a part of their neighborhood), acts of neighboring (the tendency to interact with other residents in the neighborhood), and psychological sense of community (the feeling of belonging to the neighborhood).[13] Response options consisted of a 5-point Likert scale from strongly agree (1) to strongly disagree (5). We followed standard procedures to create subscale scores such that higher scores indicated higher social cohesion. Scores ranged from 3 to 15 on the attraction to neighborhood scale (3 of the 18 items), 6-30 on the acts of neighboring scale (6 of the 18 items), and 9-45 on the psychological sense of community scale (9 of the 18 items).[13]

COVID-19 experiences, attitudes, and behaviors were self-reported using adapted items from WHO and CDC.[14,15] For COVID-19 experiences, we assessed whether the participant had been tested for COVID-19, had tested positive for COVID-19, and had been hospitalized for COVID-19, as well as whether a close contact had died from COVID-19.

For attitudes, we assessed changes in perceived isolation/loneliness due to COVID-19 prevention, perceived likelihood of being diagnosed with COVID-19, and perceived harm of being diagnosed with COVID-19.[14,15] The latter 2 items excluded participants who reported previously testing positive for COVID-19. These were evaluated on a 5-point Likert scale from very low (1) to very high (5).

For behaviors, we focused on the CDC-recommended COVID-19 prevention behaviors of (1) social distancing and (2) staying home when sick (notably, we did not limit this outcome to only when the participant had COVID-19).[14,15] We dichotomized responses for adherence to prevention behaviors as *yes* (almost always or often) versus *no* (sometimes, rarely, or almost never). These 2 variables were the focal outcomes of our study.

Demographic information included age group, sex, race/ethnicity, education level, annual household income, and marital status. These variables were selected to be included in the models because of their previous relationships with social cohesion.[7–10]

TABLE 1 Demographic characteristics of analytic sample (n = 2,926).

	Overall		Rural		Urban		
	n	%	n	%	n	%	*P*
Age group							<.01
<65 years	1,212	41.6	479	44.7	733	39.8	
65+ years	1,704	58.4	593	55.3	1,111	60.3	
Sex							<.05
Male	1,239	42.4	428	39.7	811	44.0	
Female	1,682	57.6	649	60.3	1,033	56.0	
Race/ethnicity							<.001
Non-Hispanic White	2,287	78.2	956	88.5	1,331	72.1	
Other	638	21.8	124	11.5	514	27.9	
Education level							<.001
Less than a college degree	1,710	58.6	779	72.3	931	50.5	
College degree or higher	1,210	41.4	299	27.7	911	49.5	
Annual household income							<.001
<$50,000	1,282	44.0	584	54.2	698	37.9	
$50,000+	1,635	56.0	493	45.8	1,142	62.1	
Marital status							<.01
Married/living as married	1,766	60.4	689	63.9	1,077	58.3	
Other	1,158	39.6	389	36.1	769	41.7	

Statistical analysis

First, we characterized differences in participant demographics and COVID-19 experiences, attitudes, and behaviors by rurality using chi-square tests.

Next, we created bivariate and multivariable logistic regression models to analyze the relationships between rurality, social cohesion, and demographic factors (age group, sex, race/ethnicity, education level, annual household income, and marital status), and COVID-19 prevention behaviors.

Statistical analyses used a 2-sided *P*-value of .05. Analyses were conducted using SAS version 9.4 (Cary, NC). The Penn State College of Medicine Institutional Review Board/Human Subjects Protection Office approved data collection and analysis for this project.

RESULTS

Descriptive statistics

Table 1 characterizes the sample demographics overall (n = 2,926) and by rurality (rural n = 1,080, urban n = 1,846). Overall, most participants were non-Hispanic White (78.2%) and married/living as married (60.4%). Compared to urban participants, rural participants were more likely to be in the younger age group, female, non-Hispanic White, have less than a college degree, have an annual household income of less than $50,000, and be married (all *P*<.05).

In general, social cohesion scores were similar or slightly higher for rural participants compared to their urban counterparts. For the attraction to neighborhood subscale (range: 3-15), the average score was 11.4 (standard error [*SE*] = 0.09) for rural and 11.1 (*SE* = 0.07) for urban participants (*P* = .01). For the acts of neighboring subscale (range: 6-30), the average score was 18.8 (*SE* = 0.15) for rural and 18.5 (*SE* = 0.12) for urban participants (*P* = .16). For the psychological sense of community subscale (range: 9-45), the average score was 31.5 (*SE* = 0.21) for rural and 31.1 (*SE* = 0.17) for urban participants (*P* = .06).

COVID-19 experiences, attitudes, and behaviors by rurality

Although almost half of the participants had been tested for COVID-19 (44.9%), few had tested positive (3.8%), been hospitalized (0.5%), or had a close contact die from COVID-19 (1.5%) (Table 2). Urban participants were more likely than rural participants to have tested for COVID-19 (*P*<.001), but there was no difference in the other COVID-19 experiences by rurality.

Many participants experienced more isolation/loneliness due to COVID-19 prevention (46.4%), and most perceived low likelihood (94.3%) and low harm (68.0%) from COVID-19 (Table 2). Urban participants were more likely to have experienced increased loneliness (*P*<.001) and to have high perceived harm of COVID-19 (*P*<.01) (Table 2).

TABLE 2 COVID-19 experiences and attitudes by rurality.

	Overall		Rural		Urban		
	n	%	n	%	n	%	*P*
Tested for COVID-19							<.001
No	1,608	55.1	650	60.4	958	52.0	
Yes	1,312	44.9	427	39.7	885	48.0	
Tested positive for COVID-19							.92
No	2,795	96.2	1,030	96.3	1,765	96.2	
Yes	110	3.8	40	3.7	70	3.8	
Hospitalized for COVID-19							.64
No	2,887	99.5	1,065	99.5	1,822	99.4	
Yes	16	0.5	5	0.5	11	0.6	
Close contact has died from COVID-19							.77
No	2,723	98.5	1,008	98.5	1,715	98.4	
Yes	43	1.5	15	1.5	28	1.6	
Perceived change in isolation/loneliness due to COVID-19 prevention							<.001
Much less/less/no change	1,566	53.6	622	57.7	944	51.2	
More/much more	1,355	46.4	457	42.3	898	48.8	
Perceived likelihood of being diagnosed with COVID-19							.19
Very low/low/neither high nor low	2,648	94.3	987	95.1	1,661	93.9	
High/very high	159	5.7	51	4.9	108	6.1	
Perceived harm of being diagnosed with COVID-19							<.01
Very low/low/neither high nor low	1,907	68.0	737	71.3	1,170	66.1	
High/very high	896	32.0	297	28.7	599	33.9	

Most participants reported practicing social distancing (86.0%) and staying home when sick (91.2%). However, these behaviors were less common among rural than urban participants (social distancing: rural = 78.7%, urban = 90.6%, *P*<.001; staying home when sick: rural = 87.7%, urban = 93.5%, *P*<.001) (Figure 1 A,B).

Correlates of social distancing

In bivariate analysis, social distancing was associated with rurality and with the attraction to neighborhood subscale; this behavior was also associated with perceived change in isolation, age group, sex, education, and income (Table 3).

The multivariable analysis demonstrated that social distancing was more common among participants from urban compared to rural counties (adjusted odds ratio [aOR] = 2.48, 95% confidence interval [CI] = 1.96-3.15) (Table 3). In addition, social distancing was more common among participants with higher scores on the attraction to neighborhood subscale (aOR = 2.09 for each 10-point change in social cohesion score; 95% CI = 1.26-3.47), but was less common among participants with higher scores on the acts of neighboring subscale (aOR = 0.59; 95% CI = 0.40-0.88); no association was observed for the sense of community subscale. Participants who reported experiencing more isolation, and were older than 65 years of age, female, and higher income, were more likely to engage in social distancing.

Correlates of staying home when sick

In bivariate analysis, staying home when sick was associated with rurality and with the attraction to neighborhood subscale; this behavior was also associated with perceived change in isolation, age group, race/ethnicity, education, and income (Table 4).

In multivariable analysis, staying home when sick was more common among participants from urban compared to rural counties (aOR = 2.07, 95% CI = 1.55-2.77). Moreover, staying home when sick was more common among participants with higher scores on the attraction to neighborhood subscale (aOR = 2.12; 95% CI = 1.15-3.91), but was less common among participants with higher scores on the acts of neighboring subscale (aOR = 0.53; 95% CI = 0.33-0.86); no association was observed for the sense of community subscale. Participants who reported experiencing more isolation, and were older than 65 years of

TABLE 3 Correlates of social distancing.

	Bivariate		Multivariable	
	OR	95% CI	aOR	95% CI
Rurality				
Rural		(ref)		(ref)
Urban	2.60	(2.10-3.22)	2.48	(1.96-3.15)
Social cohesion subscale score (by 10)				
Attraction to neighborhood	1.86	(1.30-2.65)	2.09	(1.26-3.47)
Acts of neighboring	0.89	(0.73-1.09)	0.59	(0.40-0.88)
Sense of community	1.05	(0.91-1.22)	1.19	(0.86-1.64)
Change in isolation/loneliness due to COVID-19 prevention since the pandemic				
Much less/less/no change		(ref)		(ref)
More/much more	2.04	(1.64-2.55)	1.98	(1.56-2.51)
Age group				
<65 years		(ref)		(ref)
65+ years	2.00	(1.62-2.47)	1.89	(1.50-2.39)
Sex				
Male		(ref)		(ref)
Female	1.36	(1.10-1.67)	1.60	(1.27-2.01)
Race/ethnicity				
Non-Hispanic White		(ref)		(ref)
Other	0.94	(0.74-1.21)	0.96	(0.72-1.28)
Education level				
Less than a college degree		(ref)		(ref)
College degree or higher	1.74	(1.39-2.17)	1.25	(0.97-1.62)
Annual household income				
<$50,000		(ref)		(ref)
$50,000+	1.53	(1.24-1.89)	1.31	(1.01-1.69)
Marital status				
Married/living as married		(ref)		(ref)
Other	1.17	(0.94-1.44)	1.22	(0.95-1.57)

Note: Multivariable models controlled for age group, sex, race/ethnicity, education level, annual household income, and marital status.

age, female, and non-Hispanic White were more likely to report staying home when sick.

DISCUSSION

In this study, we assessed the relationship between COVID-19 prevention behaviors and social cohesion among rural and urban adults in the mid-Atlantic United States. Given the disproportionate effects of COVID-19 in rural communities,[3,4] we sought to identify possible targets for future interventions to decrease the burden of COVID-19 in rural communities. Our analysis revealed partial support for each of our competing hypotheses. Social cohesion measured with the "attraction to neighborhood" subscale was positively associated with COVID-19 prevention behaviors, supporting our first hypothesis. However, social cohesion measured with the "acts of neighboring" subscale was negatively associated with prevention behaviors, supporting our second hypothesis. These findings suggest that social cohesion is a complicated construct that can affect communities in various ways depending on the component of social cohesion being studied. However, even after controlling for social cohesion, adherence to these behaviors was still lower in rural compared to urban communities, indicating that these relationships did not completely explain the rural/urban differences in COVID-19 prevention.

Participants in rural counties were just as likely as those in urban setting to test positive for COVID-19, be hospitalized for COVID-19, and have a close contact die from COVID-19. Despite these similarities, rural populations had a lower perception of likelihood and harm from a diagnosis of COVID-19, which could have contributed to their lower likelihood of being tested for COVID-19, of staying home when sick, and of not consistently practicing social distancing. These findings

TABLE 4 Correlates of staying home when sick.

	Bivariate		Multivariable	
	OR	95% CI	aOR	95% CI
Rurality				
Rural		(ref)		(ref)
Urban	2.01	(1.55-2.60)	2.07	(1.55-2.77)
Social cohesion subscale score (by 10)				
Attraction to neighborhood	2.16	(1.40-3.31)	2.12	(1.15-3.91)
Acts of neighboring	0.95	(0.74-1.22)	0.53	(0.33-0.86)
Sense of community	1.15	(0.96-1.38)	1.31	(0.89-1.93)
Change in isolation/loneliness due to COVID-19 prevention since the pandemic				
Much less/less/no change		(ref)		(ref)
More/much more	2.03	(1.54-2.67)	1.99	(1.49-2.65)
Age group				
<65 years		(ref)		(ref)
65+ years	2.22	(1.72-2.88)	2.01	(1.52-2.67)
Sex				
Male		(ref)		(ref)
Female	1.26	(0.98-1.63)	1.52	(1.15-2.01)
Race/ethnicity				
Non-Hispanic White		(ref)		(ref)
Other	0.64	(0.49-0.85)	0.72	(0.52-0.99)
Education level				
Less than a college degree		(ref)		(ref)
College degree or higher	1.46	(1.11-1.90)	1.14	(0.83-1.55)
Annual household income				
<$50,000		(ref)		(ref)
$50,000+	1.46	(1.13-1.88)	1.12	(0.82-1.53)
Marital status				
Married/living as married		(ref)		(ref)
Other	0.87	(0.67-1.12)	0.89	(0.66-1.20)

Note: Multivariable models controlled for age group, sex, race/ethnicity, education level, annual household income, and marital status.

are consistent with other research studies that report rural/urban differences in COVID-19 prevention.[16]

Although social cohesion was associated with COVID-19 prevention behaviors, this construct did not completely explain why rural populations were less likely to engage in social distancing or stay home when sick. There are 2 other possible explanations demonstrated in the literature. First, rural residents may have experienced a heavy political influence regarding COVID-19 prevention guidelines.[17] Rural counties tend to lean more Republican in politics. The Republican president at the beginning of the pandemic left public health orders to individual states, which could have signaled to rural, Republican constituents that the President did not believe the pandemic to be serious and that behavioral prevention was unnecessary. This message was propagated by some biased news stations that are popular in rural communities that repeatedly questioned the reliability of health experts' recommendations and the efficacy of preventive behaviors.[17] Second, rural communities have higher poverty and a higher share of essential blue-collar workers, who may have been limited in their ability to social distance and stay home when sick due to financial insecurity.[18] However, there are limited data on social distancing among rural US populations, and the majority of it focuses on politics and work.[19] More research needs to examine attitudes and beliefs that could potentially be targeted in future pandemics to protect residents of rural communities.

Our findings demonstrated complex relationships between social cohesion and engaging in COVID-19 prevention behaviors among older adults. The "attraction to neighborhood" construct was positively associated with social distancing and staying home when sick. This relationship provides support for our first hypothesis, that is, social cohesion would support prevention behaviors, perhaps due to concern for one's neighbors. Indeed, other studies have demonstrated that moral, altruistic concern for other people motivated COVID-19

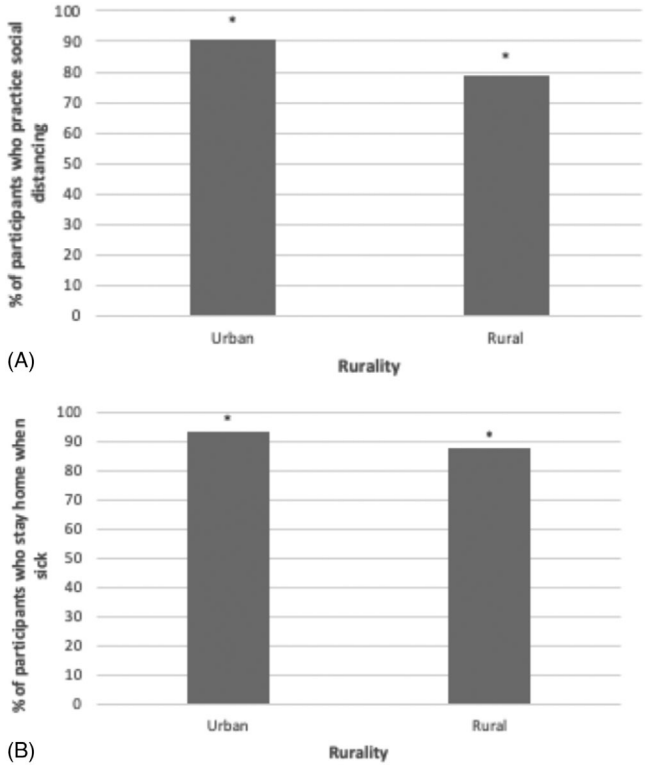

FIGURE 1 COVID-19 behaviors among older adults by rurality (n=2,926). (A) Percent of participants reporting often/almost always practicing social distancing by rurality. (B) Percent of participants reporting often/almost always staying home when sick by rurality. *$P<.001$.

prevention.[21–23] In contrast, the "acts of neighboring" construct was negatively associated with COVID-19 prevention behaviors. This relationship provides support for our second, competing hypothesis, that is, social cohesion would undermine prevention behaviors because they may decrease interpersonal interaction. Conducting acts of neighboring may involve providing instrumental social support[24] via face-to-face interaction (ie, failure to maintain social distancing), such as bringing hand sanitizer, face masks, or groceries to a neighbor. For many people, social support from friends and neighbors increased during the COVID-19 pandemic[25–27]; although this support may have undermined prevention behaviors, it likely accrued benefits to mental health, particularly among socially isolated individuals.[25,28,29] The third social cohesion construct, "sense of community" was not associated with COVID-19 prevention behaviors in this study. Rural participants had slightly higher scores than urban participants on the attraction to neighborhood subscale, but did not differ on the other subscales. In addition, urban participants were more likely to engage in COVID-19 prevention, even after controlling for social cohesion. Thus, although social cohesion was an important, independent correlate of engaging in COVID-19 prevention, it did not explain the rural/urban differences in these behaviors. One possible explanation is that social cohesion is a multifactorial construct, and the component constructs have independent associations with behavioral outcomes. Our competing hypotheses were both partially supported due to different aspects of social cohesion influencing prevention behavior.

Given that we were exploring the implications of social cohesion, we chose to observe COVID-19 prevention behaviors that were more social in nature, such as social distancing and staying home when sick. Additional research could be conducted to explore the impact of social cohesion on more "nonsocial" prevention behaviors, such as vaccination, hand washing, and mask-wearing. Future research should explore the role of acts of neighboring in patterning COVID-19 prevention behaviors, particularly in rural communities. This relationship resonates with other literature demonstrating the influence of social cohesion on health-related behaviors, and how this relationship is especially prominent in rural communities.[10] Future interventions should leverage the influence of interpersonal relationships on COVID-19 prevention behaviors in rural and urban communities. Additional research should evaluate other influences that could impact the relationship between social cohesion and the likelihood of practicing COVID-19 prevention behaviors, for example, if this relationship is especially strong among certain demographic subgroups. Working to facilitate COVID-19 prevention behavior change can play a significant role in the reduction of incidence and mortality from this disease, especially in rural communities, which have a higher disease burden than do urban communities.

In terms of strengths, this study used high-quality survey measures to assess social cohesion and adherence to COVID-19 prevention behaviors. We focused on older adults living in 7 mid-Atlantic states with a large representation of rural communities. In terms of limitations, the survey measures were self-reported and, therefore, subjective. However, when collecting data about individuals' perceptions, this is a valid approach. Our results focused on social cohesion and COVID-19 prevention behaviors may have been impacted by the pandemic itself, given that prolonged physical and social isolation likely reduced social cohesion. Findings may not be generalizable to other populations as the sample was limited to participants who could access the survey through Qualtrics and were 50 years or older. Further, our study sample did not achieve adequate racial/ethnic diversity; across the included states, about 61% of the population is non-Hispanic White compared to the 78% in this sample. Future studies should examine these relationships among different populations.

In conclusion, we evaluated the relationship between social cohesion and COVID-19 prevention behaviors among older adults in the mid-Atlantic region of the United States, with a particular focus on rural/urban differences in these variables. We found partial support for both of our hypotheses: (1) Greater attraction to neighborhood was associated with greater adherence to prevention behaviors, perhaps because participants wanted to protect the health of their neighbors, and (2) Greater acts of neighboring were associated with lower adherence to prevention behaviors, perhaps because participants engaged in face-to-face provision of instrumental social support. These relationships did not completely explain rural/urban differences in engaging in COVID-19 prevention behaviors. Our findings suggest that efforts to maximize COVID-19 behavioral prevention should emphasize the importance of protecting the health of one's

neighbors and how to support one's neighbors without face-to-face interactions.

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CONFLICT OF INTEREST STATEMENT

The authors have no real or perceived conflict of interest to report.

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