



Aging in Rural Communities

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Abstract

Purpose of Review Population aging is occurring worldwide, particularly in developed countries such as the United States (US). However, in the US, the population is aging more rapidly in rural areas than in urban areas. Healthy aging in rural areas presents unique challenges. Understanding and addressing those challenges is essential to ensure healthy aging and promote health equity across the lifespan and all geographies. This review aims to present findings and evaluate recent literature (2019–2022) on rural aging and highlight future directions and opportunities to improve population health in rural communities.

Recent Findings The review first addresses several methodological considerations in measuring rurality, including the choice of measure used, the composition of each measure, and the limitations and drawbacks of each measure. Next, the review considers important concepts and context when describing what it means to be rural, including social, cultural, economic, and environmental conditions. The review assesses several key epidemiologic studies addressing rural–urban differences in population health among older adults. Health and social services in rural areas are then discussed in the context of healthy aging in rural areas. Racial and ethnic minorities, indigenous peoples, and informal caregivers are considered as special populations in the discussion of rural older adults and healthy aging. Lastly, the review provides evidence to support critical longitudinal, place-based research to promote healthy aging across the rural–urban divide is highlighted.

Summary Policies, programs, and interventions to reduce rural–urban differences in population health and to promote health equity and healthy aging necessitate a context-specific approach. Considering the cultural context and root causes of rural–urban differences in population health and healthy aging is essential to support the real-world effectiveness of such programs, policies, and interventions.

Keywords Rural health · Aging · Epidemiology · Social determinants

Introduction

Rural environments present distinct challenges and opportunities for aging populations [1]. As population aging is occurring worldwide, especially in more developed countries such as the United States (US) and many European and East Asian countries [2], understanding current issues facing rural older adults is increasingly important to promote healthy aging. The number of people in the US aged 65+ increased by 54%, from 35 million or 12.4% of the population in 2000 [3] to 54 million or 16.9% of the population

in 2022 [4]. Furthermore, although only 15% of the US population lives in “rural” areas, a disproportionate share of older Americans (22%) lives in rural areas (Fig. 1). A 2019 US Census Bureau report found that 17.5% of rural populations were aged 65+, compared to 13.8% of urban populations [5]. Although the US population is aging in both rural and urban areas, over time, population aging, defined as the number and percent of the population aged 65+, is occurring more rapidly in rural areas than in urban areas [6].

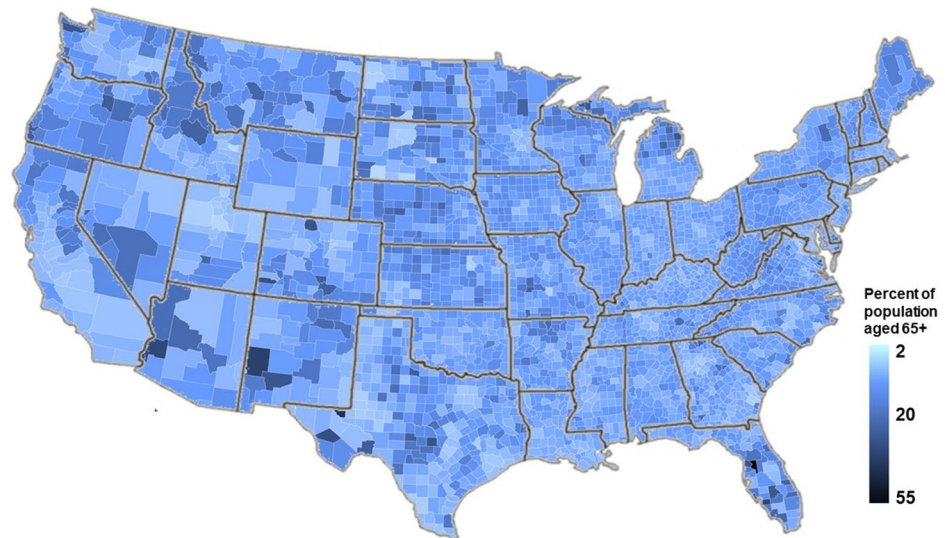
Understanding the unique challenges and dynamics of aging in rural communities is critically important to ensure healthy and successful aging and promote health equity across the rural–urban divide. Increasingly, place-based factors, including rurality, are being recognized as directly contributing to healthy aging and playing a vital role in promoting or precluding health equity. A recent study defined “successful aging” in the context of five domains: productivity and engagement, security, equity, cohesion, and well-being [7].

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Fig. 1 Percent of the population aged 65 + by county (source data: US Census 2020)



Study findings showed notable variability in successful aging across these domains over time and space, with higher levels of successful aging in more developed, urban regions.

There is, therefore, a critical need to identify and consider rural aging populations as a distinct population subgroup due to the unique cultural, socioeconomic, and health-related attributes inherent in these populations. The National Institute of Minority Health and Health Disparities considers rural populations a health disparity group, in part because these populations have higher rates of mental health concerns, chronic diseases, and worse general health outcomes than non-rural populations [8]. As a result, rural populations, particularly older adults, face elevated rates of morbidity, including obesity [9], diabetes [10, 11], coronary heart disease [12], and cancer [13], COVID-19 [14], as well as excess mortality [10, 13, 15]. Therefore, the review aims to present findings and evaluate recent literature, with a primary focus on research published over the past three years, on a breadth of issues related to aging in rural communities and propose potential future directions to improve population health and promote healthy aging in rural communities. This review focuses primarily on aging in rural communities in the US, drawing on relevant recent literature from other countries to compare and contrast evidence, as well as informing research, policy, and programs aimed at older adults in those rural communities in the US.

Defining Rurality: Methodological Considerations

To highlight the challenges and opportunities facing rural older adults, it is important to first define “rurality” in the context of health research. There is no universally accepted standard of what distinguishes “rural” areas from “urban”

areas [16]. For example, the US Census Bureau [17] and the US Health Resources and Services Administration [18] define rural as an area that is not urban. However, most health research considers the concepts of “rural” and “urban” to be complex, multidimensional, and often context-specific [16, 19–22]. The choice of rurality measure influences which areas are classified as most rural or urban [23]. Furthermore, many measures are context-specific for defining “rural” or “urban [2], vary by region [16], and depend primarily on the geographic unit of measurement [24, 25]. In other words, rural communities are not all alike, and existing measures may not fully capture the characteristics that make a place rural. As a result, identified rural–urban associations with population health outcomes vary across region and cultural context [26], and are strongly dependent on the specific measure used [9, 20].

Multiple measures are available to characterize rural–urban status of communities in population health and aging research (Table 1), with the most commonly used measure being population density [27–33]. Often, population density is used as a log-transformed measure or ordinal measure, given the extreme right-skewed nature of the distribution of population density in the US. For example, in 2010, county-level population density ranged from less than 0.1 people per square mile in Yukon-Koyukuk Census Area (county equivalent) to 69,468.4 people per square mile in New York City, with a median county-level population density of just 45.0 people per square mile [4]. The percent of the population considered “urban” is another frequently used measure [34–36]. The US Census Bureau considers “urban” populations to be those located in Census-designated urbanized areas and places of at least 2500 inhabitants outside of urban areas [37]. In addition, distance to the nearest major metropolitan area or city is increasingly used to measure rurality and remoteness in studies of population health,

Table 1 Summary of commonly used measures of rural–urban status in the epidemiologic and broader public health literature available on the county level for all US counties

Measure of rural–urban status	Source	Variable type	Minimum- maximum	General distribution	Definition or description
Population density	Decennial US Census and American Community Survey	Continuous	<0.01–69,468.4 per square mile	Highly right-skewed	County population size divided by county land area
Percent urban population	Decennial US Census and American Community Survey	Continuous	0–100%	Right-skewed	US Census definition of percent of county population considered “urban”
Rural–Urban Continuum Code (RUCC)	United States Department of Agriculture (USDA) latest: 2013	Ordinal	1–12	12 levels with sub-levels	Based on proximity of metropolitan statistical area and population size, designed as a continuum
Urban Influence Code (UCC)	United States Department of Agriculture (USDA) latest: 2013	Ordinal	1–9	9 levels with sub-levels	Based on the overall estimated economic influence of urban areas on counties and population size
Rural–Urban Commuting Area (RUCA)	United States Department of Agriculture (USDA) latest: 2010	Ordinal	1–10	10 levels with sub-levels	Based on a combination of population density, urbanization, and daily commuting time abstracted from the American Community Survey
Index of Relative Rurality	Decennial US Census and American Community Survey (originally developed by researchers at Purdue University)	Continuous	0–1	Nearly symmetric and approximately uniform	Composite scale of several component variables: (1.) population size, population density, percent urban population, and proximity to nearest metropolitan area

aging, and development [38–40]. Other standard measures of rural–urban status used in health and aging research include several variables produced by the US Department of Agriculture, such as the Rural–Urban Continuum Codes (RUCC) [41, 42], Urban Influence Codes (UIC) [43, 44], and Rural–Urban Commuting Areas (RUCA) [23, 45–47]. However, there is substantial heterogeneity across the measures of rural–urban status [48] with respect to what each measure actually assesses and their associations with other population measures.

Consider the percentage of the population age 65 + using county-level data from the 2020 US Decennial Census: although the percentage of the population age 65 + had a significant correlation ($p < 0.001$) with all measures of rural–urban status (population density, distance to nearest metropolitan area, RUCC, UIC, and RUCA), the strength of the Spearman correlation ranged from 0.34 for distance to the nearest metropolitan area to 0.53 for the percentage of the population considered non-urban. Aside from this heterogeneity, an important limitation of these measures is that they focus on only a limited number of characteristics related to rural–urban status (e.g., the influence of urban areas, commuting, etc.).

As a result of the heterogeneity among rural–urban measures used in epidemiologic studies, there is increasing interest in utilizing composite measures of rural–urban status that consider multiple aspects of rural or urban living in health research. One such measure is the Index of Relative Rurality (IRR) [49], which is calculated using population size, population density, distance to nearest metropolitan area, and percent urban population. The IRR has been used in several recent studies on health and aging, including health services utilization [50], geographic inequities in healthcare providers [51], availability of hospice care [52], opioid prescribing patterns [53], obesity [54], and COVID-19-related outcomes [55, 56].

Another consideration when assessing measures of urban–rural status is the geographic level to which rural–urban status is measured and contributes to barriers, challenges, and opportunities in population aging. Several recent studies have used the county as the geographic level on which rural–urban status is ascribed [57–60]. Other studies have examined rural–urban status as a predictor of health and health inequities at a finer geographic level, including zip code [61] and census tract [62]. There is increasing recognition that the influence of rurality on population health and aging is complex and varies based on the geographic unit of observation. Consequently, a recent analysis recommends that, where possible, associations between rural–urban status and health be examined using multilevel models to distinguish these potentially complex pathways [63]. As there is no universally accepted definition of “rural”, in this paper, we will include the results of studies

that use an array of definitions of “rural” used in the public and population health, epidemiological, and gerontological literature, and will identify what levels of geography (e.g., state, county, census tract, etc.) on which these results were obtained.

Defining Rurality: Concepts and Context

As described above, the concept of rurality is complex, context-specific, and challenging to measure. Common questions asked in population health and aging research are what specific attributes make a place rural and how do these attributes contribute to population health and healthy aging across the lifespan? There is extensive historical research on what attributes are considered when classifying a location as “rural” and “urban” in sociology and other social sciences [64–70]. However, disentangling the multifaceted individual attributes of rural or urban places that contribute to health and well-being is difficult; therefore, less is known to address the question of how community attributes impact health and aging.

There are three broad, but interconnected categories of attributes that often describe rural places: cultural, social, and environmental factors. Recent studies emphasize that rural culture plays a significant role in shaping rural landscapes, and vice versa. Consequently, culture can and does shape healthy aging in rural environments. Although it would be misleading to classify or view all rural cultures as being one under the umbrella term of a unified rural culture, it is important to recognize the cultural contributions (e.g., norms, values, traditions, perspectives, etc.) that shape rural cultures. The historical events (e.g., migration patterns, economic opportunities, collective hardships, etc.) help shape the culture of places as the people who live in the areas we understand them. As John Steinbeck wrote in *Of Mice and Men*, “How can we live without our lives? How will we know it’s us without our past?” The history of a place certainly defines the culture there, and can have profound, albeit indirect, influences on population health.

One of the longstanding cultural attributes of rural places within the US is the concept of “rugged individualism,” which values self-reliance over collectivism [71]. One consequence of rugged individualism on healthy aging is the resistance by many living in rural areas to government and communal interventions, which may undermine individual and policy responses to improve health and promote healthy aging at the population level [72, 73]. This was observed during the COVID-19 pandemic in terms of preventive behaviors, vaccinations, and COVID-19 outcomes and could be a contributing factor leading to worse health outcomes for rural populations in the US, particularly among older adults [73, 74]. Other cultural attributes in rural areas that influence

		Overall		Northeast		Midwest		South		West	
		Population Density	RUCA	Population Density	RUCA	Population Density	RUCA	Population Density	RUCA	Population Density	RUCA
Education	≥ High school	-0.099	0.115	-0.421	-0.016	-0.136	0.073	0.134	0.282	-0.272	0.006
	≥ College	0.160	0.307	-0.070	0.207	0.124	0.286	0.283	0.370	-0.003	0.206
	≥ Graduate or professional school	0.120	0.251	-0.111	0.146	0.134	0.276	0.233	0.306	-0.073	0.152
Income	Median household income	0.002	0.204	-0.232	0.152	-0.176	0.084	0.087	0.258	-0.033	0.222
Income inequality	Gini index	0.054	-0.047	0.303	0.096	0.122	0.017	-0.079	-0.163	-0.021	-0.091
Poverty rates	General poverty	0.134	-0.094	0.399	-0.036	0.253	0.006	-0.018	-0.187	0.151	-0.120
	Child poverty	0.068	-0.105	0.291	-0.054	0.188	-0.006	-0.035	-0.169	0.104	-0.110
Insurance	Percent insured	-0.048	0.071	-0.339	0.001	-0.135	0.043	-0.099	0.020	-0.131	0.104

Fig. 2 Heat map of county-level Spearman correlations between two measures of rural–urban status (population density and Rural–Urban Commuting Area [RUCA]) and measures of social determinants, overall and by US Census region. Red and pink boxes indicate positive associations, and blue areas indicate negative associations. Bold-

face indicates statistically significant correlation. RUCAs are available from the US Department of Agriculture and are a composite measure of population density, urbanization, and daily commuting time abstracted from the American Community Survey

healthy aging include an emphasis on kinship relationships and family preservation in the US and internationally [75, 76]. Cultural attributes, such as lower education levels and perceived toughness, are more common in rural areas and can lead to lower health literacy and increased stigma against mental health [77]. Stigma against mental health in rural areas has profound consequences for everyone across the lifespan, including older adults, such as resistance to recognizing essential mental health issues and cognitive decline [78], as well as refusal to access vital services to address these conditions [79, 80].

There is wide heterogeneity across the US and globally with respect to the social determinants of rural areas compared to more urban areas [81]. A correlational analysis of US Census tracts in 2020 using two measures of rural–urban status—population density and RUCA—and multiple measures of socioeconomic status showed a significant, positive correlation between rural–urban status measures and education (Fig. 2). However, the associations become less consistent for other social determinants—namely median household income—which was positively associated with RUCA codes, indicating urban areas were wealthier than rural areas, but not significantly associated with population density. Similar results were observed for poverty rates and percent insured: more rural areas fared better than urban areas when measured by RUCA, while urban areas fared better when using population density. Notably, there was substantial variability in the magnitude and direction of the associations both by the rural–urban status measure used (population density versus RUCA) and by US region.

We can draw three important conclusions from these data. First, “rural” does not necessarily equate to having

lower socioeconomic status. While there are indicators (e.g., education) indicating that rural areas generally have lower socioeconomic status than urban areas, even after accounting for the overall lower cost of living, there are other indicators (e.g., income and poverty) that are not correlated with rural–urban status or that indicate better socioeconomic conditions in rural areas than in urban ones. Second, there is clear geographic variability with respect to these correlations between social determinants and rural–urban status. Therefore, a one-size-fits-all approach or generalizing about all rural communities may limit the effectiveness of policies and programs designed to reduce rural–urban health inequities and promote healthy aging. Third, these findings emphasize the earlier discussion about the variability of the measurements used to assess rural–urban status. The lack of consistency between population density and RUCA in their associations with social determinants underscores the notion that many rural–urban differences in health and other factors depend heavily on the choice of rural–urban measurement.

The third broad category of attributes used to classify “rural” versus “urban” are environmental factors, which fall into two interrelated categories: the physical environment and the built environment. The physical environment consists of both the natural and the altered environment—the chemicals, radiation, and biological products that humans introduce into the environment [82], often through waste management, development, and agriculture. The US Environmental Protection Agency defines the “built environment” as all human-made or modified structures that facilitate everyday living, working, and recreation [83]. This

would include roadways, buildings, sidewalks, infrastructure for water, sewage, and heating, and recreational spaces.

In rural communities, the physical environment is often, but not always, dominated by green space, agriculture, recreation, and natural green space, which has important implications for healthy aging [84]. It is important to emphasize that the relationships between physical environment and health among older adults are not always clear or linear, and at times, contradictory. For example, green space, including recreational spaces and natural features, may promote healthy aging by increasing perceived security and community social cohesion among older adults, which may lower stress and improve overall population health [85]. One study of an urban area determined that associations between self-reported health and green space were strongest when considering green space across a wide area (blocks, neighborhoods, and communities) surrounding one's place of residence [86]. Two recent studies of older adults in China found a strong association between green space and self-reported general health, although the association was stronger in urban than rural areas [87, 88]. Declines in physical and mental health among older adults as a result of the COVID-19 pandemic-related safety measures were attenuated in populations with access to green space [89]. A US study of middle-aged adults found that residential areas with more green space were significantly associated with higher overall cognitive function, including faster thinking and better attention [90]. Despite these recent studies on the association between the natural environment and healthy aging, there is a relative paucity of longitudinal, life-course research examining the associations between green space and healthy aging in rural and urban contexts.

A limited number of studies have examined the altered environment's role in healthy aging in rural communities. Rural communities are more likely to depend upon agriculture to sustain the local economy, which has a significant impact on health and aging. Since 2019, numerous studies examining the impacts of agricultural and industrial waste on human health and aging among rural populations have been published, primarily in settings outside of the US, particularly in China [91–93], South Asia [94–96], and sub-Saharan Africa [97–100]. Agricultural waste, more common in rural than urban areas [101], contains multiple types of pollutants, including antibiotics [91, 93, 102], heavy metals [94, 103], ammonia [104], pesticides [96, 99], and many others. Furthermore, residents exposed to pollutants may not be aware of their risk [105]. Further complicating the health risks for older adults of perhaps unknown pollutants from agricultural waste is the location of landfills and other disposal sites in rural areas. It is increasingly evident that the location of these sources of pollution are likely to be situated in areas of lower socioeconomic status [106], and their locations disproportionately impact population health

for disadvantaged populations [107]. There is comparatively less research on the temporal or longitudinal linkages between those chemical, radiological, and biological pollutants and their impacts on rural health and aging in the US than internationally. Given that in the US have a greater proportion of older adults are in rural areas than urban areas, and the plethora of mechanisms through which dangerous pollutants can impact health and increase the risk of disease, there is a crucial need to encourage research in this area.

As with research into the natural environment, recent research on the built environment and aging in rural areas of the US is sparse compared to international research [88, 108–116] and the built environment in urban areas of the US [117–119]. The degree to which the built environment affords the ability for people to walk and, more generally, move within a community without the use of other transportation methods [120], is an important, composite attribute of the built environment that impacts older adults' ability to live and age successfully in both urban and rural communities [121•]. Recent research indicates that higher levels of walkability are associated with increased physical activity [121•, 122], and also allows for better social support [123–125], and reduced loneliness among older adults [123, 126]. Despite the more natural physical environment, rural areas have significantly lower walkability than urban areas [127•]. Walkability has been shown to be an independent risk factor for obesity and related cardiovascular disease (CVD) [128], which has substantial implications for the health of rural older adults.

Other aspects of the built environment directly or indirectly influence population health and healthy aging, including aging rural infrastructure [129, 130], availability of and access to basic health services [131•] and community supports [132], and perceived safety due to the physical infrastructure and surroundings [133]. Research on the built environment and healthy aging is limited, and is largely focused on urban areas in the US and in developed nations outside the US. That said, the existing research suggests a critical need to modify and improve aspects of the built environment, such as walkability and infrastructure (e.g., accessible sidewalks) to improve the ability of older adults to age successfully in rural areas and reduce rural–urban inequalities in health. Although there are practical and significant challenges with translating and adopting initiatives often developed for urban and suburban areas to those rural and under-resourced communities, doing so can positively impact rural aging to an even greater degree than urban areas [121•]. Future studies should examine multilevel factors—individual, neighborhood, and regional—and assess not only clinical measures of population health, but also sociocultural acceptance of modifications to the built environment by those populations most impacted [121•]. To increase the

Table 2 Summary of key populations addressed and research domains where additional research is needed

Key populations addressed	Domains in which additional research is needed
Racial and ethnic minorities in rural areas (e.g., African Americans, Hispanic/Latino/a/x populations)	Conduct longitudinal, life-course research examining the associations between green space and healthy aging in rural and urban contexts
Informal caregivers to rural older adults	Examine rural informal caregivers to older adults with Alzheimer's disease and other dementias
Indigenous populations from rural regions (e.g., Native Americans, Alaska Natives, Native Hawaiians, First Nations)	Investigate temporal or longitudinal linkages between critical environmental hazards (e.g., chemical, radiological, and biological pollutants) and their impacts on rural health and aging
Institutionalized rural older adults (e.g., those living in nursing homes, assisted living facilities, etc.)	Identify and address systematic rural–urban differences in healthcare quality and access
Rural older adults with mental health issues	Obtain a more complete picture of population health and quality of life in rural areas by including clinical measures of population health and sociocultural acceptance of modifications that are made to the built environment Assess what specific, multi-level (e.g., individual, neighborhood, community, etc.) attributes of rural living contribute to population health and rural–urban health disparities Identify and modify aspects of the built environment such as walkability and infrastructure (e.g., accessible sidewalks) to improve the ability of older adults to promote healthy aging in rural areas and reduce rural–urban health disparities Provide reliable, national or international data to researchers and policymakers on all aspects of health and quality of life in rural and urban areas

internal validity and strength of evidence, future research should use robust, longitudinal study designs and incorporate researchers, policymakers, and design experts [134].

Epidemiology of Aging and Health Conditions in Rural Areas

Diseases and conditions more prevalent in older populations include frailty, cognitive decline, disabilities, mobility, and falls, in addition to other broad categories of diseases, such as cancers, CVD, and some infectious diseases [135]. Alzheimer's disease and related dementias (ADHD) are major areas of focus in the epidemiology of aging. A 2020 study using national data of Medicare beneficiaries found that rural residents with ADHD had significantly lower survival rates and spent significantly more time in nursing homes than urban residents with ADHD [136•]. Furthermore, rural residents were less likely than their urban counterparts to receive neuropsychological testing to detect early-onset ADHD, impacting their ability to seek treatment and care [137]. Recent studies also show that the incidence of falls [138] and mortality from falls [139] among older adults are more common in rural than urban areas. As described above, the built environment has important implications for reducing rural–urban inequalities in mobility among older adults [121•], but comprehensive recent research in this domain is lacking (Table 2).

Recent research indicates that rural areas also experience a higher incidence of cancer [140, 141] and lower survival rates for various types of cancer [142–144], which may be due, in part, to reduced access to preventive and screening services in rural areas [145] and increased distance and travel time to seek cancer treatment [42]. Rural–urban differences in the incidence and associated mortality of several infectious diseases among older adults are well documented in the recent literature, including pneumonia [146] and COVID-19 [147–149]. Differences in the risk of CVD and stroke by rural–urban status are pronounced. A 2022 study of Medicare beneficiaries showed that rural older adults had higher rates of hospitalization and mortality from ischemic stroke, myocardial infarctions, and thrombolysis [150]. These results corroborate findings from other recent studies [58, 151–153]. A 2019 study of CVD in Medicare beneficiaries found that rural older adults were more likely to be hospitalized from CVD with more severe disease than their urban counterparts [154•], which was supported by another study that found higher emergency department visits comparing rural to urban populations [155]. Together, these findings lead to another broad observation about rural–urban differences in health. Reducing these pervasive rural–urban inequalities across multiple diseases and chronic conditions requires addressing the root causes of the inequalities throughout the life course. These include, but are not limited to, addressing underlying socioeconomic determinants and environmental factors, and ensuring access to high-quality

health services that result in better health outcomes on the population level for all rural and underserved populations [154, 156].

Mental health issues, often unrelated to aging itself, pose unique challenges for older adults in rural areas. Suicidality, for example, has been a growing issue for older adults across the country over the past several decades and is more prevalent in rural areas [157]. The COVID-19 pandemic exacerbated rural–urban differences in suicidal ideation and attempts [158], particularly among older adults [159]. Effective and widescale screening for precursors of suicidal ideation and attempts are challenging, particularly in rural and remote areas. However, recent research into simple screening measures that can be implemented in primary care, whether in-person or through telemedicine appointments, such as the Ask Suicide Screening Questions toolkit, is both feasible and effective to use in the primary care setting [160, 161]. A pilot study conducted with rural, Appalachian older adults suggests that universal suicide screening tests would have wide acceptability among these populations and that primary care visits would be an effective setting to implement these programs [162]. Over the past several years, US-based research examining the epidemiology of other mental health conditions, such as depression, anxiety, and schizophrenia, among rural older adults or comparing rural and urban older adults is limited. Given the plethora of related rural–urban differences in other population health metrics and predictors, there is a clear need to encourage more detailed and comprehensive research in this area.

Health and Social Services: Access and Quality

As described earlier, access to high-quality health and healthcare services are key components of healthy aging. Recent studies have identified important structural barriers, such as a shortage of healthcare specialists and primary care providers in rural areas that likely contribute to the rural health disadvantage [163, 164]. An example is the relative lack of availability of cancer screening in rural areas compared to more urban areas [145, 165, 166]. Healthcare facilities in rural areas are more likely to be understaffed than comparable facilities in urban areas [51, 167]. When healthcare access is limited, differences in broadband access compared with urban areas likely contributed to the inability of many rural residents to seek health care when in-person care [168]. These differences were exacerbated during the peaks of the COVID-19 pandemic, particularly among older adults, when in-person healthcare was limited and telehealth appointments were often the only choice [169, 170].

Rural areas also experience reduced quality and availability of home and community-based services,

including health care [171]. This inhibits older adults living with chronic diseases, cognitive decline, and disabilities from seeking needed services [172], and encourages the use of skilled nursing facilities over aging in place [173]. Although healthcare quality is multifaceted and often difficult to measure, several recent studies have identified rural–urban differences in the quality of healthcare services received after accounting for demographic factors and other social determinants [174]. However, the breadth of recent research on rural–urban differences in quality is limited. Systematic research is needed to quantify these differences to inform policies and interventions designed to improve healthcare equity across geographies.

Special Populations in Rural Areas

The rural population is heterogeneous with respect to socioeconomic, demographic, and cultural factors and should not be considered monolithic in research. There are important population subgroups that merit special attention when conducting research and designing evidence-based policies and interventions. Examples include racial and ethnic minorities, Native or Indigenous people, and informal caregivers for older adults. Although rural areas tend to have a greater proportion of White residents than urban areas, racial and ethnic minorities living in rural areas may experience aspects of rural culture differently than White residents. Prior studies have observed a rural race- and ethnicity-specific health “penalty”, where racial or ethnic disparities in health, health care, or healthcare quality are more severe in rural areas compared to urban areas [175, 176]. A recent study observed such a penalty, and found that differences between Hispanic/Latinx and non-Hispanic/Latinx Medicare beneficiaries were more pronounced in rural areas compared to urban areas. The researchers attributed this difference in part to lower cultural competency and poorer provider–patient communication in rural areas [177]. Another example is social isolation. A 2019 study showed that although White rural older adults reported less social isolation than their urban counterparts, the association was reversed among some racial and ethnic minorities, where rural Black older adults experienced significantly greater social isolation than urban Black older adults [178]. Another recent study found that the well-documented Black–White differences in obesity were significantly worse in rural areas compared to urban areas [54].

Indigenous people in rural areas in the US face unique cultural and technical barriers to healthy aging. These include barriers specific to rural America, barriers within the Indian Health Services system itself, and the limitations of services offered, leading to many health disparities for

indigenous populations across the lifespan [179]. Henning-Smith and colleagues found that after adjusting for community-level covariates, the highest rates of premature deaths across the US were in those counties, with a majority of American Indian/Alaska Native residents located in rural areas [180]. Some conditions that created these disparities and barriers to healthy aging could be mitigated to improve health among indigenous populations. These include increasing incentives for indigenous people to enter the healthcare workforce, removing unnecessary barriers to seeking health care, and improving both the quality of and services offered through Indian Health Services, particularly in rural and remote regions and reservations [179, 181].

Informal caregivers—those who provide regular care or assistance to a friend or family member aged 65+ with a chronic health problem, disability, or cognitive decline—are another important population subgroup to consider in the context of aging in rural communities. Over 44 million adults are informal caregivers, representing an essential and often-overlooked component of the broader health care system, allowing older adults to age in place. Informal caregiving is estimated to save the US economy over \$500 billion that would be spent on formal care and/or institutionalization of older adults [182]. Approximately one-quarter of all adults aged 45–64 are informal caregivers to older adults [183]. There is a limited amount of research on rural informal caregivers, however. Informal caregivers in rural areas reported geographic barriers such as transportation to provide care and a lack of social services offering caregiver support [184]. Rural informal caregivers provide higher levels of care than their urban counterparts, which has implications for their health and well-being [185]. Younger people are more likely to migrate from rural to urban areas due to a higher perceived likelihood of finding a skilled job with higher incomes and opportunities for advancement [186], which both increases the percent of the population aged 65+ [5] and decreases the pool of informal family caregivers.

In a 2020 study, Pedersen and colleagues raised important methodological issues when studying rural informal caregiving. These include sample size, data access, and how to accurately estimate rurality, as well as the critical need to study this vulnerable population to protect the health and well-being of rural informal caregivers and strengthen their ability to help older adults age successfully in place [187]. There is a clear tradeoff between using primary or secondary data to understand rural caregiving. While primary data collection can be designed to target and recruit rural caregivers and get detailed information about their experiences, limitations include the breadth of coverage and national representativeness of the sample, as well as sample size. Secondary data has the advantages of both a large sample size and national coverage, but recruitment may

be biased toward those caregivers who provide less care than other caregivers, and are, therefore, more available to be part of a research study. Researchers using secondary data are limited by the variables already asked during the data collection [187] and may not have the validated and precise data needed to fully address critical research questions. Furthermore, although Alzheimer's disease and related dementias disproportionately impact racial and ethnic minority groups, these populations and their caregivers have been historically underrepresented in research [188].

To gain a better understanding of the unique needs of rural caregivers, it is necessary to understand who they are, the unique barriers and challenges they face, how best to provide support for their health and well-being, and how to prepare them and informal caregivers for the continued growing population of older adults needing care, particularly in rural areas [189], as new research on rural informal caregivers is somewhat sparse. An example of ongoing data collection efforts specifically targeting geographic aspects of informal caregiving is the National Study of Caregiving (NSOC). NSOC is a national, longitudinal, multi-wave database that provides over 200 variables on all aspects of caregiving, including caregiver health, caregiver burden, activities related to caregiving, and detailed demographics. It is linked to the National Health and Aging Trends Study (NHATS), collectively providing over 500 variables about the caregiver and care recipient on many aspects of health, well-being, and caregiving [190]. Initiatives such as NHATS/NSOC and other databases such as the Health and Retirement Study offer promise to help address the questions of who rural caregivers are and what their needs are, but are still limited by the issues raised by Pedersen and colleagues [187].

Future Directions

This review highlighted recent research on a breadth of issues related to healthy aging in rural communities, emphasizing several practical and research-related challenges associated with studying these vulnerable populations. This body of research aims to reduce rural–urban disparities in population health and promote health equity across the lifespan, regardless of geographic and demographic characteristics, allowing all residents to age in place successfully. Achieving this goal is challenging for a number of reasons. First, not all rural areas are alike. There is substantial heterogeneity among areas categorized as rural with respect to demographics, culture, and population health [81]. Reducing rural–urban health disparities and promoting health equity and healthy aging requires a nuanced, context-specific approach. Policies, programs, and interventions working in one area may not work in all rural areas. Therefore, moving away from one-size-fits-all programs

and policies may be more effective at improving health and well-being for rural older adults [191]. Second, there are data-related and methodological challenges in rural areas. Research in rural and remote places poses various challenges for recruitment and retention that often result in biased samples [187, 192]. Third, the complex nature of rural environments is challenging. It is difficult to identify and isolate what specific factors—cultural, socioeconomic, environmental, infrastructural, health systems, etc.—actually drive health disparities among older adults.

Critical to the success of these research endeavors is the development and implementation of evidence-based programs for older adults that consider the cultural context in which programs are implemented to create age-friendly communities across all geographies [193]. Evidence-based initiatives can provide needed information for key stakeholders, such as community leaders, policymakers, and funding agencies, to make informed decisions about populations most in need and which populations will benefit most from these initiatives. As discussed earlier, rural areas often have limited healthcare resources compared to urban and suburban areas. Therefore, programs designed to support healthy aging and aging in place in rural areas should complement traditional healthcare services and be readily available in the community [191]. In 2020, the World Health Organization made this a priority by emphasizing its commitment to supporting healthy aging across all communities through supporting age-friendly neighborhoods, increasing collaboration between community stakeholders, government officials, and residents, and making health care, in general, more friendly toward older adults [194]. They also acknowledged that this would require significant shifts in rural culture and a deep monetary commitment to support the implementation of evidence-based initiatives on a mass scale.

There is a clear and urgent need to identify factors contributing to rural–urban and other place-based disparities among older adults. This review provided some recent examples of rural–urban health disparities in mortality, obesity, and other aspects of health. The need to identify, understand, and address rural–urban disparities is particularly urgent because the rural health and mortality penalty has grown steadily and, until the 1970s, has reversed from an urban health and mortality penalty [195]. Pervasive and increasing rural–urban disparities in numerous health outcomes will likely change due to the depopulation and diversification of rural areas [196]. To effect change and promote healthy aging for all, regardless of place, it is crucial to recognize the multidimensional complexity of rural life and develop data, strategies, and initiatives to translate evidence-based research into effective, long-lasting policies.

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