

ORIGINAL PAPER

Spiritual/religious coping and cognitive function of urban-rural Brazilian community-dwelling older adults

Coping espiritual/religioso e função cognitiva de pessoas idosas de comunidades urbano-rurais brasileiras

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Abstract

Background and Aim: We compared cognitive function among Brazilian older adults residing in rural versus urban settings and examined whether positive and negative spiritual/religious coping (SRC) were associated with cognitive outcomes. **Method:** We conducted a comparative cross-sectional analysis of two independent samples: older adults residing in rural areas of two small towns in Minas Gerais ($N = 326$), and older adults from the city of São Paulo ($N = 400$). Measures included the Mini-Mental State Examination (MMSE), the Brief Spiritual/Religious Coping Scale, and a sociodemographic/health questionnaire. **Results:** After controlling for sociodemographic and health covariates, rural residents had significantly higher MMSE scores than urban residents (mean difference = 7.43, $p < .001$). Among rural participants, higher positive SRC was associated with better cognitive function ($\beta = 1.6$; $p < .001$). Among urban participants, higher negative SRC was associated with worse cognitive outcomes ($\beta = -0.39$; $p = .021$). **Conclusions:** In Brazil, rural residence may be associated with better late-life cognitive function. Positive SRC may relate to cognitive benefits, whereas negative SRC may be linked to poorer cognition—particularly in urban contexts. Findings may guide health professionals in addressing SRC with older adults, especially in large urban centers.

Keywords: Cognitive Function; Cognitive Impairment; Spirituality; Religiosity; Aging; Older adults; Rural–urban differences; Brazil.

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Resumo

Contexto e Objetivo: Comparamos a função cognitiva de pessoas idosas brasileiras residentes em áreas rurais *versus* urbanas e examinamos se o *coping* espiritual/religioso (CER), positivo e negativo, se associava a desfechos cognitivos. **Métodos:** Realizamos um estudo transversal comparativo com duas amostras independentes: pessoas idosas residentes em áreas rurais de dois municípios de pequena dimensão em Minas Gerais, Brasil ($N = 326$) e pessoas idosas da cidade de São Paulo ($N = 400$). As medidas incluíram o Mini-Exame do Estado Mental (MEEM), a Escala Breve de *Coping* Espiritual/Religioso e um questionário sociodemográfico e de saúde. **Resultados:** Após ajustamento por covariáveis sociodemográficas e de saúde, os residentes rurais apresentaram pontuações significativamente mais altas no MEEM, significativamente superiores às dos residentes urbanos (diferença média = 7,43, $p < 0,001$). Entre participantes rurais, maior CER positivo associou-se a melhor função cognitiva ($\beta = 1,6$; $p < 0,001$). Entre participantes urbanos, maior CER negativo associou-se a piores desfechos cognitivos ($\beta = -0,39$; $p < 0,05$). **Conclusões:** No Brasil, residir em meio rural pode associar-se a melhor função cognitiva na idade avançada. O CER positivo pode conferir benefícios cognitivos, ao passo que o CER negativo pode relacionar-se a pior cognição—particularmente em contextos urbanos. Esses resultados podem orientar a atuação de profissionais de saúde na abordagem do CER entre pessoas idosas, sobretudo em grandes centros urbanos.

Palavras-Chave: Função Cognitiva; Déficit Cognitivo; Espiritualidade; Religiosidade; Envelhecimento; Pessoas idosas; Diferenças rural-urbano; Brasil.

Introduction

The Brazilian population is aging (Chang et al., 2019). By 2030, approximately 13.5% of Brazilians will be older adults. Accordingly, there is a need to identify factors that promote quality of life and autonomy in later life (Chang et al., 2019; Campos et al., 2020). Cognitive impairment is a prevalent determinant of adverse outcomes in older age (Campos et al., 2020). It is associated with higher mortality, increased risk of falls and hospitalizations, and limitations in basic and instrumental activities of daily living, all of which heighten the need for long-term care (Campos et al., 2020; Hosseini et al., 2017).

Dementia is a leading cause of disability in older age, and its incidence and prevalence are strongly linked to age, unhealthy lifestyle behaviors, and lower educational attainment—markers of reduced cognitive reserve (Hyun et al., 2022). Conversely, participation in leisure activities and greater social engagement are associated with slower cognitive decline. Consistent with biopsychosocial–spiritual models informed by the International Classification of Functioning, Disability and Health, environmental and personal factors shape functioning and should be considered in studies of late-life cognition (Paanalahti et al., 2022).

Research indicates that protective correlates of cognitive impairment and dementia in later life include communities with greater social engagement, access to leisure and cultural activities, and community amenities—particularly green spaces that foster connection and belonging.

Therefore, older adults who live in socioeconomically privileged areas with access to physical resources, such as recreation centers and parks, and/or institutional resources, such as community centers, are less likely to experience significant cognitive decline (Besser et al., 2017; Cassarino & Setti, 2015).

Urban and rural environments shape vulnerability to cognitive impairment and dementia in different ways. In urban areas, chronic exposure to air pollution, stress from a fast-paced, sometimes violent milieu, and a more sedentary lifestyle may increase the risk of cognitive decline. Conversely, urban environments offer advantages—greater access to specialized health services, opportunities for early diagnosis, and richer cognitive and social stimulation—that may be protective. Rural environments often entail more physical

activity, lower pollution, and greater contact with nature, which can benefit mental and cognitive health; however, limited healthcare access, lower educational attainment, social isolation among older adults, and fewer intellectually stimulating activities may increase risk over time. Both contexts comprise heterogeneous constellations of risks and resources that vary substantially across regions and sociodemographic profiles in Brazil.

A systematic review with meta-analysis of comparative cross-sectional studies on the prevalence of cognitive impairment by rural–urban residence found that rural living was associated with a higher risk of Alzheimer's disease (Russ et al., 2012). In particular, early-life rural living was linked to increased odds of cognitive decline (OR = 1.64, 90% CI [1.08, 2.50]). Similarly, a Portuguese study using the Mini-Mental State Examination (MMSE) found a higher prevalence of cognitive impairment in rural than urban populations, with a rural/urban prevalence ratio of 2.16 (95% CI [1.04, 4.50]) among the oldest age group (Nunes et al., 2010). However, most evidence derived from high-income countries (e.g., the United States, England, Portugal, other EU countries) with fewer structural challenges, lower violence, more green areas, and stronger healthcare systems—conditions that may not characterize many Brazilian cities, particularly vast metropolitan areas.

Religiosity and spirituality also appear to protect against late-life cognitive impairment (Vitorino et al., 2022; Jung et al., 2019). Religiosity refers to beliefs, practices, values, and rituals within institutional religious traditions, expressed through behavioral (e.g., service attendance, prayer), cognitive (e.g., doctrinal beliefs), affective (e.g., faith experiences), and social (e.g., group belonging) dimensions (Pargament, 1997; Koenig et al., 2012). It may be intrinsic (internally motivated) or extrinsic (motivated by rewards such as status or belonging) (Pargament, 1997).

Spirituality denotes a person's search for meaning, purpose, and transcendence, and a sense of connectedness—to self, others, nature, and the sacred—whether or not tied to formal religion (Puchalski et al., 2009). It may be religious or nonreligious, but typically involves a transcendent frame of reference (Hill et al., 2000). Consistently, spirituality has been described as the pursuit of meaning in relation to the sacred or transcendent, and as a connection with a higher power (Koenig et al., 2012).

Spiritual/religious coping (SRC) denotes how individuals use spiritual or religious beliefs, practices, and communities to appraise and manage major life stressors (Pargament, 1997; Pargament et al., 2011). Positive SRC (PSRC) reflects constructive engagement with the sacred—seeking spiritual support, benevolent religious reappraisal, collaborative coping with God, and support from religious communities—and is typically associated with resilience, meaning-making, and psychosocial well-being (Pargament, 1997; Pargament et al., 2011). Negative SRC (NSRC) reflects spiritual struggle—perceiving God as punitive or abandoning, religious discontent, demonic reappraisal, and interpersonal religious conflict—and is linked to distress, guilt, hopelessness, and social alienation (Pargament, 1997; Pargament et al., 2011).

Greater participation in religious activities has been associated with better cognitive performance over time (Nelson et al., 2022). Positive links between organizational religiosity and memory, language, and visuoconstruction have also been reported (Jung et al., 2019). Interest in religiosity, spirituality, and health is expanding; however, there remains no consensus on precise definitions, particularly for spirituality (Vitorino et al., 2018).

Considering the clinical and social implications of late-life cognitive impairment and the lifelong salience of spirituality and religious practice in Brazilian society, linkages between them warrant empirical attention. To our knowledge, evidence from Brazil and other Latin American countries examining whether PSRC or NSRC are associated with late-life cognitive function is scarce. Accordingly, we compared cognitive function among older Brazilians residing in rural versus urban areas and examined associations between PSRC and NSRC and cognition. We hypothesized, based on prior literature, that older adults living in rural areas would have a higher prevalence of cognitive impairment than their urban counterparts, and that PSRC would be associated with better cognitive function irrespective of residence; analyses of NSRC were exploratory.

Method

Study Design

This research employed a comparative cross-sectional design using data from two samples. For the urban sample, only baseline (cross-sectional) data were extracted from a 12-month longitudinal study conducted in São Paulo (Rivoli et al., 2025). The rural sample comprised community-dwelling older adults from a cross-sectional study in southern Minas Gerais; the home-nursing arm was excluded from the present analyses. Consequently, all analyses in the present work were cross-sectional and focused on comparing cognitive function and its associations with PSRC and NSRC across residence settings.

Participants

The analytic sample comprised 726 older adults (M age = 71.63 years, SD = 8.15), grouped by residence: urban São Paulo (n = 400) and rural southern Minas Gerais—Santa Rita do Sapucaí and Pouso Alegre—(n = 326). Data were obtained in participants' homes (rural) and at a Basic Health Unit (urban).

Inclusion criteria were: age $\geq$ 60 years; absence of clinically significant neurological or psychiatric conditions at data collection; residence in the selected census tracts of Santa Rita do Sapucaí or Pouso Alegre (rural sample) or registration at a Basic Health Unit in São Paulo (urban sample); and MMSE scores at or above education-adjusted cutoffs (Brucki et al., 2003). In Brazil, urban–rural status is defined by the Brazilian Institute of Geography and Statistics (IBGE), which combines the municipal urban-perimeter law with typologies based on population density, settlement size, and proximity to urban centers. Urban tracts lie within the municipal legal urban perimeter—typically with higher density, larger settlements, and stronger connectivity—whereas rural tracts lie outside, with lower density and greater remoteness (IBGE, 2017, 2020).

Data Analysis

Group differences in sociodemographic/health characteristics were examined using independent-samples t tests and Chi-square tests. A univariate general linear model (GLM) estimated MMSE scores with residence (rural = 0, urban = 1) as a fixed factor and biological sex, age, education, marital status, living alone, daily medication use, and self-rated health as covariates. Adjusted (marginal) means for MMSE were

derived by residence. Between-group magnitudes were summarized with Cohen's d for continuous outcomes (small $\approx .20$, medium $\approx .50$, large $\geq .80$) and Cramér's V for categorical outcomes (small $\approx .10$, medium $\approx .30$, large $\geq .50$), following [Cohen \(1988\)](#).

Using G*Power 3.1.9.7 (total $N = 726$), a post hoc GLM calculation with one dependent variable, seven covariates, and $\alpha = .05$ indicated power $> .99$ to detect $f^2 = .10$.

Procedures

Data collection in Santa Rita do Sapucaí and Pouso Alegre (southern Minas Gerais) was conducted from September 2013 to March 2014 by a research assistant and the principal investigator. Interviews were administered in participants' homes. A two-stage probability sampling design was used: (1) census tracts were randomly selected; (2) within selected tracts, households were visited to identify and invite eligible older adults who provided informed consent.

In São Paulo city, data were collected at a Basic Health Unit between January and August 2018. From all attendees aged ≥ 60 years ($N = 5,000$), medical record numbers formed the sampling frame; 400 potential participants were randomly selected and subsequently recruited.

Measures

Sociodemographic and Health Questionnaire (SHQ)

SHQ assessed sex (male/female), age (60–69, 70–79, ≥ 80), education (any formal schooling vs. none), marital status (living with a partner vs. not), living alone (yes/no), daily medication use (yes/no), chronic disease (yes/no), and self-rated health (poor/regular vs. very good).

Mini-Mental State Exam (MMSE)

Cognitive function was assessed with the Brazilian MMSE ([Bertolucci et al., 1994](#); [Brucki et al., 2003](#)). The MMSE comprises items spanning orientation (time/place), immediate registration, attention/calculation, recall, language, and visuoconstruction; total scores range from 0 to 30, with higher scores indicating better cognition. Education-adjusted cutoffs ([Brucki et al., 2003](#)) were applied for eligibility (< 13 no formal education; < 18 1–8 years; $< 26 \geq 9$ years).

Brief-Spiritual/Religious Coping Scale (Brief-SRC)

The Brief-SRC scale ([Pargament et al., 2011](#)), validated for Brazil ([Esperandio et al., 2018](#)), assesses positive SRC (Items 1–7) and negative SRC (Items 8–14). Positive SRC reflects using religion/spirituality as a source of love, care, strength, and help—e.g., seeking spiritual support, benevolent religious reappraisal of stressors, feeling cared for by God/the sacred, and drawing on community support. Negative SRC reflects spiritual struggle—e.g., punitive or abandoning God reappraisals, religious discontent, distressing doubts, and interpersonal conflict in religious settings. Items are rated from 1 (*never*) to 5 (*very much*); subscale scores range from 7 to 35, with higher scores indicating greater use of the respective coping style. In the present samples, internal consistency was acceptable to excellent: PSRC Cronbach's $\alpha = .75$ (rural) and $.88$ (urban); NSRC $\alpha = .69$ (rural) and $.85$ (urban).

Ethical Considerations

The study complied with national regulations and the Declaration of Helsinki. Protocols were approved by Brazil's National Health Council/Ministry of Health for Minas Gerais (#304,745) and São Paulo (#2,468,315). All participants received study information and provided informed consent prior to data collection; confidentiality was safeguarded through deidentification and secure data handling.

Results

The total sample of 726 older adults had a mean age of 71.63 years ($SD = 8.15$ years). Participants from São Paulo were significantly older than those from Minas Gerais, $t_{(724)} = 15.09$, $p < .001$, $d = 1.13$ (Table 1). Older adults from Minas Gerais had higher formal schooling than those from São Paulo, $\chi^2_{(1, N = 726)} = 19.04$, $p < .001$, $V = .16$. The prevalence of daily medication use was higher among participants from São Paulo than among those from Minas Gerais, $\chi^2_{(1, N = 726)} = 48.98$, $p < .001$, $V = .26$. São Paulo participants more frequently reported having a chronic disease, $\chi^2_{(1, N = 726)} = 95.09$, $p < .001$, $V = .36$, whereas self-rated health did not differ significantly between groups, $\chi^2_{(1, N = 726)} = 1.95$, $p = .162$, $V = .05$.

Table 1

Characteristics of Older People in Minas Gerais and São Paulo

Variables	Total (n = 726)	MG (n = 326)	SP (n = 400)	p
	M (SD)	M (SD)	M (SD)	
Age	71.63 (8.15)	67.22 (4.84)	75.23 (8.53)	< .001
	n (%)	n (%)	n (%)	
Sex				.183
Male	251 (34.60)	104 (31.90)	147 (36.80)	
Female	475 (65.40)	222 (68.10)	253 (63.20)	
Educational Level				< .001
Attended School	489 (32.60)	247 (75.80)	242 (60.50)	
Did Not Attend School	237 (67.40)	79 (24.20)	158 (39.50)	
Civil Status				< .001
Living with Partner	300 (41.30)	168 (51.50)	132 (33.00)	
Living without Partner	426 (58.70)	158 (48.50)	268 (77.00)	
Lives Alone				< .874
Yes	377 (51.90)	103 (31.60)	126 (31.50)	
No	349 (48.10)	223 (68.40)	274 (68.50)	
Daily Medication				< .001
Yes	53 (87.70)	230 (70.60)	363 (90.80)	
No	133 (18.30)	96 (29.40)	37 (9.20)	
Chronic Disease				< .001
Yes	573 (78.90)	204 (62.60)	369 (92.20)	
No	153 (21.10)	122 (37.40)	31 (7.80)	
State of Health				< .162
Poor/Regular	4652 (88.80)	252 (77.30)	326 (91.10)	
Very Good	74 (10.20)	74 (22.70)	74 (8.90)	

Note. MG = Minas Gerais; SP = São Paulo.

Adjusted (marginal) means from the GLM (Table 2) indicated that rural participants exhibited markedly better cognitive function than urban participants (large effect). Positive SRC did not differ meaningfully by residence (trivial–small effect), whereas negative SRC was higher in the rural group (medium effect).

Table 2

Comparison of SRC and MMSE of Participants

State	<i>M</i> ^a	<i>SD</i>	CI 95%	<i>DM</i>	<i>p</i>	<i>d</i>
MMSE				7.43	<.001	2.89
Minas Gerais	27.35	2.30	[27.05, 27.65]			
São Paulo	19.88	2.83	[19.62, 20.14]			
PSRC				0.32	.657	0.19
Minas Gerais	3.53	0.49	[3.44, 3.63]			
São Paulo	3.57	0.43	[3.48, 3.65]			
NSRC				0.26	<.001	0.64
Minas Gerais	2.72	0.43	[2.63, 2.81]			
São Paulo	2.46	0.38	[2.38, 2.53]			

Note. Minas Gerais: *N* = 326 and São Paulo: *N* = 400. SRC = Spiritual/religious coping; PSRC = Positive SRC; NSRC = Negative SRC; MMSE = Mini-Mental State Exam; *DM* = difference between means.

^a Adjusted (marginal) means are from a univariate GLM controlling for age, education, marital status, living alone, daily medication use, chronic disease, and self-rated health.

GLM models (Table 3) indicated that positive SRC was associated with better cognitive function in the rural sample ($F = 5.12, p = .001$), but not in the urban sample, whereas negative SRC was associated with poorer cognitive function in the urban sample ($F = 3.98, p < .01$) but not in the rural sample. Residence retained a large independent association with MMSE ($F = 802.69, p < .001$). Among covariates, age ($F = 2.418, p < .001$; inverse in urban), education ($F = 110.92, p < .001$; positive in both), and self-rated health ($F = 736.68, p < .001$; positive in both) were significant; other covariates were not consistently related.

Table 3

Effect of Spiritual/Religious Coping and Covariates on Cognitive Function (MMSE) in Stratified Univariate GLMs by Residence

Predictor	<i>B</i>	SE	<i>p</i>	η^2
PSRC				
Minas Gerais	1.60	0.23	<.001	0.09
São Paulo	0.07	0.13	.638	0.001
NSRC				
Minas Gerais	-0.28	0.26	.141	0.003
São Paulo	-0.39	0.17	.021	0.09
Age				
Minas Gerais	0.00	0.02	.834	0.001
São Paulo	-0.08	0.01	< .001	0.05
Educational Level				
Minas Gerais	2.10	0.31	< .001	0.10
São Paulo	2.03	0.26	< .001	0.12
Civil Status				
Minas Gerais	-0.16	0.26	.557	0.001
São Paulo	0.17	0.28	.550	0.003
Daily Medication				
Minas Gerais	-0.44	0.284	.125	0.003
São Paulo	0.62	0.747	.408	0.001
Chronic Disease				
Minas Gerais	-0.29	0.280	.296	0.002
São Paulo	-0.69	0.815	.397	0.001
Self-Rated Health				
Minas Gerais	2.02	0.20	.001	0.08
São Paulo	-4.74	0.29	.001	0.20

Note. Dependent variable: MMSE. Coding (0/1) unless noted: education (0 = no formal schooling, 1 = any schooling); marital status (0 = without partner, 1 = with partner); living alone (0 = no, 1 = yes); daily medication (0 = no, 1 = yes); chronic disease (0 = no, 1 = yes); self-rated health (0 = poor/regular, 1 = very good). PSRC/NSRC range 7–35; higher scores indicate greater use. Effect sizes are partial eta squared (η^2), computed from Type III sums of squares.

Discussion

Our findings indicate that older Brazilians living in rural Minas Gerais presented better cognitive function than their urban-dwelling counterparts in São Paulo. Positive SRC was associated with better cognitive function among rural, but not urban, older adults. The between-group difference was large; a ~7-point MMSE gap is potentially clinically meaningful in aging populations, as it may reflect differences in cognitive reserve and functional capacity with implications for autonomy, institutionalization risk, and care planning.

Evidence suggests that religiosity and positive SRC are associated with better cognitive outcomes and quality of life in later life (Dominguez et al., 2024; Hosseini et al., 2017; Li et al., 2016; Rosmarin et al., 2020; Vitorino et al., 2018). Our finding that positive SRC related to better cognitive function in rural older people is consistent with previous reports and may reflect multilevel pathways—physiological (e.g., lower allostatic load and HPA-axis activation), psychological (e.g., meaning, purpose, and reduced anxiety), and social (e.g., support and engagement)—that are frequently posited in this literature (Haney & Lane, 2024; Salardini et al., 2025).

Practices commonly reported among individuals with higher positive SRC—meditation, prayer, and contemplative exercises—have been associated with greater prefrontal engagement (e.g., dorsolateral prefrontal cortex) supporting self-regulation, attention, introspection, and inhibitory control; reduced anxiety and worry; and lower stress biomarkers—changes plausibly supportive of late-life cognition (Haney & Lane, 2024; Koenig, 2022; Lucchetti et al., 2011). Positive SRC may also cultivate calm, compassion, and gratitude, processes linked to vagal activation/parasympathetic tone, lower systemic inflammation and blood pressure, and improved autonomic balance, with potential benefits for brain health (Haney & Lane, 2024; Koenig, 2022; Krause, 2006). Psychosocially, positive SRC can provide meaning and purpose, motivate cognitively enriching activities, and strengthen belonging and social support, while promoting healthier lifestyles and mitigating loneliness and common mental-health symptoms—factors associated with better cognition in later life (Dominguez et al., 2024; Haney & Lane, 2024; Pargament et al., 2001).

In this study, lower cognitive performance among urban-dwelling older adults was independently associated with greater use of negative SRC, after adjustment for age and other covariates. This accords with prior research linking spiritual struggle to poorer cognitive and mental-health correlates (Haney & Lane, 2024; Koenig, 2022; Lucchetti et al., 2011). Negative SRC encompasses religious conflict and spiritual discontent (Dominguez et al., 2024; Pargament et al., 2001) and is accompanied by guilt, hypervigilance, fear, and anger—states associated with higher neuroticism, depressive and anxiety symptoms, HPA-axis activation, and elevated cortisol, plausibly undermining cognition (Rhee et al., 2024). The moderate association observed in the urban group underscores clinical relevance. Addressing negative SRC patterns may be a useful component of multidisciplinary geriatric care, particularly for socially vulnerable urban older adults. Environmental stressors common in large cities—auditory/visual overload and air pollution—may compound risk for late-life cognitive decline (Cassarino & Setti, 2015; Wilker et al., 2023). Consistent with this, urban participants in our sample more frequently rated their health as fair/poor.

Rural municipalities often have a lower cost of living and closer proximity to social and emotional support—family, community, and local institutions—factors associated with maintaining cognitive reserve in later life (Li et al., 2022; Jang et al., 2024). Conversely, the urban-dwelling older adults in our sample may have experienced weaker social cohesion. More cohesive neighborhoods have been linked to slower cognitive decline via opportunities for socially and cognitively stimulating activities (Casemiro & Ferreira, 2020). São Paulo—the nation's largest, densely populated metropolis—is characterized by

elevated air and noise pollution, heavy traffic, violence, social inequality/insecurity, and markers of social disconnection (Passarelli-Araujo, 2025; Saldiva, 2018). Furthermore, busier and more individualistic lifestyles, transportation barriers, and limited access to green/leisure spaces may weaken social connectivity and belonging and heighten negative affect, which could relate to poorer cognitive function in later life.

Access to transportation and essential information appears to support positive SRC among community-dwelling older Brazilians (Vitorino et al., 2019). Future work should compare perceived availability across rural versus urban settings and test whether transportation/information moderate SRC–cognition associations (e.g., via GLM interaction terms). Instruments such as the WHOQOL-BREF include items on transport and information relevant to daily life and could operationalize these exposures.

Our finding that positive SRC was associated with better cognitive function—particularly among rural older adults—suggests SRC-informed approaches may help mitigate functional difficulties linked to cognitive aging. Cognitive decline increases limitations in activities of daily living (Jung et al., 2019; Koenig et al., 2012). Even when clinicians do not share patients’ beliefs, adherence tends to improve when belief systems are acknowledged and respected (Quinn & Connolly, 2023). Training should include taking concise spiritual histories and identifying negative SRC during routine encounters (Silva & Vitorino, 2020).

Limitations and Future Directions

This comparative cross-sectional design precludes causal inference among religiosity, SRC, and cognitive function; prospective longitudinal studies are needed to establish temporal ordering and mechanisms. The rural and urban groups differed on key sociodemographic and health characteristics (e.g., age, schooling, daily medication, chronic disease, self-rated health), which may have introduced confounding despite statistical adjustment. Future research should balance these factors at design (e.g., stratification/matching) or analysis (e.g., propensity score methods, weighting).

Residual confounding by unmeasured variables cannot be excluded—physical activity, diet, alcohol and tobacco use, depressive symptoms, perceived social support, and structural/contextual features (air/noise pollution, access to healthcare, violence, social insecurity). These should be measured prospectively to strengthen inference.

Duration of residence (life-course exposure to rural vs. urban contexts) was not assessed and may modify SRC–cognition associations; future studies should collect and model residential histories.

Generalizability of the “urban” findings is limited by the São Paulo–based sample; comparisons with small- and medium-sized Brazilian cities are warranted to assess context specificity.

Conclusion

Older Brazilians residing in rural settings demonstrated better cognitive function than their urban counterparts. Positive SRC was associated with better cognition in the rural sample, whereas negative SRC was associated with poorer cognition in the urban sample. These cross-sectional associations

underscore the need to examine environmental features (e.g., pollution, social support, transportation) alongside SRC, including their potential joint effects on cognitive function in later life.

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