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ORIGINAL RESEARCH

Associations between dyadic spirituality, caregiver burden, disability, and health-related quality of life in stroke survivor–caregiver dyads: a dyadic structural equation modelling study

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Aims

This study examined the associations between spirituality, caregiver burden, disability, and health-related quality of life (HRQoL) within stroke survivor–caregiver dyads using a dyadic structural equation modelling (SEM) approach. The aim was to explore spirituality as a shared dyadic resource in post-stroke adaptation.

Methods and results

A cross-sectional analysis was conducted with 217 stroke survivor–caregiver dyads recruited at discharge from rehabilitation hospitals. Spirituality, caregiver burden, disability, and HRQoL were assessed using validated instruments. Dyadic SEM estimated within-person and cross-dyadic associations. Missing data were minimal and not systematic. Survivors' spirituality showed significant within-person associations with better physical ($\beta = 0.304$, $P < 0.001$), cognitive ($\beta = 0.449$, $P < 0.001$), emotional ($\beta = 0.455$, $P < 0.001$), and social HRQoL ($\beta = 0.343$, $P < 0.001$). Cross-dyadic associations were observed: higher survivor spirituality was associated with lower caregiver time-dependent ($\beta = -0.275$, $P < 0.001$), developmental ($\beta = -0.208$, $P < 0.001$), and physical burden ($\beta = -0.183$, $P = 0.030$). Caregivers' spirituality showed a non-significant trend towards lower survivor cognitive disability ($\beta = -0.117$, $P = 0.052$). After adjustment for caregiver gender and survivors' activities of daily living, caregiver spirituality was associated with lower developmental burden ($\beta = -0.227$, $P = 0.023$).

Conclusion

Spirituality was associated with multiple dimensions of post-stroke adaptation through distinct within- and cross-dyadic pathways. These findings support the relevance of dyadic SEM in stroke rehabilitation and highlight spirituality as a relational psychosocial resource within survivor–caregiver dyads.

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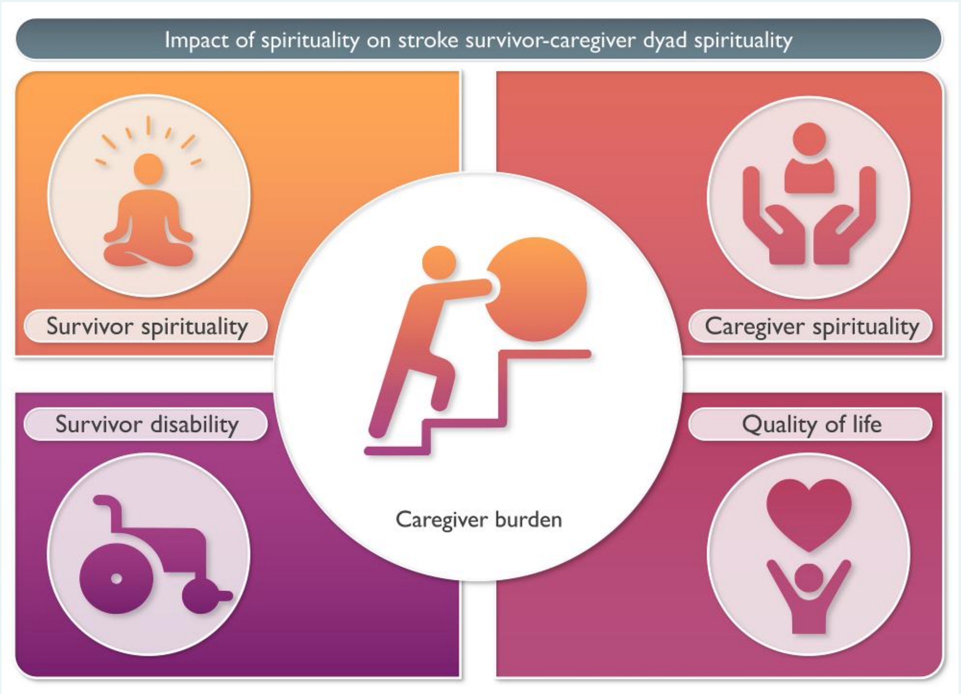
Graphical Abstract



Keywords Caregiver burden • Disability • Health-Related Quality of Life • Spirituality • Stroke

Novelty

- This study is among the first to quantitatively examine the associations of spirituality within stroke survivor–caregiver dyads using a dyadic analytic approach based on structural equation modelling, providing novel insights into within-person and cross-dyadic patterns related to caregiver burden, disability, and health-related quality of life (HRQoL).
- By applying a dyadic approach with structural equation modelling, this research captures interdependent associations—beyond traditional individual-level analyses—thereby advancing current evidence on relational mechanisms relevant to post-stroke adaptation.
- The findings underscore spirituality as a meaningful psychosocial dimension within dyads, revealing its complex and multidimensional associations with survivors' perceived functioning and HRQoL, as well as with caregivers' burden, thereby contributing to a more holistic understanding of post-stroke care.

Introduction

Stroke remains the leading cause of disability worldwide, representing a critical challenge for public health systems globally.[1] Recent trends indicate alarming increases in both incidence and mortality, particularly in the USA, where the age-adjusted stroke mortality rate increased by 8.4% between 2011 and 2021. The rise in life expectancy has further contributed to an increase in the number of people affected by stroke and, consequently, those living with post-stroke disabilities.[2]

Stroke survivors often experience significant functional impairments, including motor difficulties, hemiplegia, central facial paralysis, and speech disorders.[3] Beyond physical disability, many stroke survivors face psychosocial challenges such as anxiety, depression,[4,5] and progressive social isolation.[6] More than a third of stroke survivors reports related to post-stroke anxiety and emotional distress.[5,7] The complexity of post-stroke conditions and long-term prognosis significantly impact the physical, psychological, and social well-being of stroke survivors, negatively affecting their quality of life[8] and self-esteem, often leading to apathy,[9] thus compromising long-term health outcomes.[10]

Furthermore, stroke survivors, due to their residual functional disabilities, often require ongoing support for daily activities.

Caregivers, typically family members, experience a significant caregiving burden that, while potentially strengthening family bonds, also poses risks to their physical and mental health.[11] Proper caregiver preparation is essential to address these challenges, improve physical and emotional difficulties management, reduce the risk of caregiver burnout, and promote more effective caregiving.[12] In the absence of adequate preparation, caregivers can experience stress, fatigue, and challenges in managing daily life.[12,13]

Despite these functional, emotional, and relational challenges, theoretical connections among post-stroke disability, caregiving burden, and the coping strategies used by dyads are not always explicitly articulated in the literature. Coping processes play a central role in shaping psychological adjustment in both survivors and caregivers and spirituality has increasingly been recognized as a meaning-making mechanism that may help individuals reinterpret stressful events and navigate uncertainty.[14,15] In stroke rehabilitation, spirituality may operate as a resource that supports adaptive coping by providing purpose, coherence, and emotional regulation for both members of the dyad.[16,17] Integrating spirituality within the broader framework of coping responses therefore provides a conceptual rationale for examining its associations with both survivor- and caregiver-related outcomes.

In this context, stroke survivors often express an urgent need to find meaning, purpose, and hope for the future.[18] Spiritual needs, defined as the pursuit of meaning, purpose, and values, emerge as critical components of overall well-being and holistic care.[19] As described by the World Health Organization (WHO), spirituality is not synonymous with religiosity but is defined as a dimension unrelated to physical senses or external actions. Instead, it pertains to higher mental faculties and elevated moral qualities, characterized by a refined level of thought and feeling.[20] Meeting these needs has been associated with better healing processes, better mental and physical health, and improved self-management.[21] Within the framework of holistic care,[22] spiritual needs intersect with other factors such as social support, physical and mental health, and psychological well-being. Previous studies highlighted that greater spirituality is associated with better health outcomes among post-stroke survivors, including lower depressive symptoms and engagement in healthy behaviours.[23,24] Spirituality, understood as the search for deeper meaning and connection with a higher force, represents a potential resource for coping with stress and fostering psychological resilience.[16] A strong sense of spiritual well-being has been associated with caregivers' ability to manage difficulties, supporting emotional balance and caregiving capacity.[25]

As described by a recent systematic review, several studies have explored spirituality in the context of stroke,[23] primarily focusing on experiential aspects such as personal narratives and subjective meanings.[26,27] These studies have mostly adopted a qualitative approach, highlighting the role of spirituality in shaping the lived experience of stroke survivors and their caregivers. Many studies have analysed spirituality and its associations with survivors' outcomes[28,29] or on caregivers,[30,31] while only a few have examined its impact within the stroke survivor-caregiver dyad.[24,32] However, existing evidence presents important limitations: most studies rely on small samples, cross-sectional designs, and individual-level analyses that do not account for dyadic interdependence. Moreover, cultural influences on spirituality—particularly within Southern European or Mediterranean contexts—remain largely unexplored in stroke research, despite the fact that countries such as Italy are characterized by familistic long-term care regimes and strong intergenerational caregiving obligations[33–36] and spirituality and religiousness are known to be shaped by sociocultural contexts.[35,37] Given these limitations, it is hypothesized that spirituality may (i) shape the interpretation of stressful events,[15] (ii) mitigate the negative psychological impact of illness-related challenges,[14] and (iii) serve as a resource for emotional regulation in both stroke survivors and their caregivers.[17] Despite the growing recognition of the interaction between spirituality and health outcomes, there is still a lack of robust quantitative studies examining its specific role in post-stroke rehabilitation. In particular, little is known about how spirituality is associated with caregiver burden or with the functional and psychosocial recovery of stroke survivors. Taking into consideration the interdependence between members of the dyad, a dyadic analytic approach based on structural equation modelling (SEM) was adopted. This approach allows for the examination of within-person and cross-dyadic associations between spirituality, caregiver burden, disability, and HRQoL in stroke survivor–caregiver dyads.

Understanding these dyadic relationships is essential to identify dyads at higher risk of poor outcomes and to develop evidence-based interventions that are culturally sensitive and responsive to the global needs of both members of the dyad. By adopting a dyadic perspective, this study provides new quantitative evidence addressing gaps in the conceptualization and measurement of spirituality in post-stroke rehabilitation, with implications for holistic, culturally responsive care. This study aimed to examine the associations between spirituality, caregiver burden, disability, and HRQoL within survivor–caregiver dyads using a dyadic SEM approach.

The aims of this study were to (i) measure the spirituality, caregiver burden, and stroke survivors' disability and health-related quality of life (HRQoL); (ii) identify the within-person associations between spirituality and caregiver burden as well as functional and psychosocial recovery of stroke survivors; (iii) identify the cross-dyadic associations between the spirituality of one member of the dyad and the outcomes (caregiver burden, disability, and HRQoL) of the other member; and (iv) determine the interdependence between spirituality and outcomes within stroke survivor–caregiver dyads.

Methods

Design

This study used a descriptive cross-sectional design to investigate the associations between spirituality, caregiver burden, disability, and HRQoL in stroke survivor–caregiver dyads. Data were drawn from a larger longitudinal research project, the protocol of which has been detailed in previous publications.[38] This longitudinal project included assessments at discharge and at 3, 6, 9, and 12 months post-discharge. However, the present study used only the baseline data collected at discharge, as this time point captures the initial transition from hospital to home, when survivors and caregivers experience significant emotional and practical adjustment demands. All variables in this analysis were collected at a single time point; therefore, findings represent cross-sectional associations, and no causal inferences can be made.

Sample

Participants in the study, consisting of stroke survivors and their caregivers, were recruited consecutively at discharge from rehabilitation hospitals located in central and southern Italy between January 2021 and January 2022. Participants were enrolled as stroke survivor–caregiver dyads, and recruitment occurred at the dyadic level. Stroke survivors were eligible for inclusion if they met the following criteria: (i) a stroke diagnosis confirmed by computed tomography (CT) or magnetic resonance imaging (MRI); (ii) voluntary participation in the study, evidenced by signing an informed consent form after receiving comprehensive details about the research protocol; and (iii) recent discharge from a rehabilitation facility. Exclusion criteria included (i) pre-existing physical or psychiatric conditions (e.g. dementia, multiple sclerosis, Parkinson's disease, psychotic disorders); (ii) a history of previous strokes; (iii) conditions such as aphasia or reduced levels of consciousness; (iv) pre-existing brain injuries, including traumatic brain injuries, concussions, or post-traumatic stress disorder; and (v) significant experiences of psychological trauma. Caregivers were eligible if identified by the stroke survivor as the primary provider of informal care. A convenience, consecutive sampling approach was used. The sample size was determined by the number of eligible dyads discharged during the study period; therefore, no *a priori* power calculation was performed for this cross-sectional secondary analysis. No minimum disability threshold was applied as an inclusion criterion, as the objective was to capture the full range of post-stroke functional conditions.

Data collection

Stroke survivors were recruited upon discharge from rehabilitation hospitals. Research assistants, all trained nurses familiar with the study protocol, identified potential participants (stroke survivors and caregivers) according to the established inclusion and exclusion criteria. Prior to inclusion, participants were fully informed about the study's purpose, scope, and potential implications. Only those meeting the inclusion criteria provided written informed consent to participate in the study. Following consent, data collection commenced. Within the larger research project, a total of 414 stroke survivors were enrolled; however, only 244 stroke survivor–caregiver dyads had a caregiver who was willing and/or available to participate. Reasons for caregiver non-participation included unavailability, refusal, and logistical constraints. Of these, 27 dyads were excluded due to incomplete baseline questionnaires, resulting in a final sample of 217 complete dyads at the time of data collection. All questionnaires were administered in paper format during face-to-face sessions at discharge. Completion required approximately 20–30 min. Research nurses provided clarification for unclear items when needed, without influencing participants' responses. Caregivers completed their questionnaires independently during the same session. Data were collected concurrently from both members of the dyad, ensuring temporal alignment of measures.

Data collection tools

Data on the socio-demographic characteristics of stroke survivors and their caregivers were collected, including age, gender, education level, as well as information regarding the relationship between the stroke survivor and caregiver, stroke type and location, and the presence of comorbidities in stroke survivors. A battery of standardized psychometric instruments, validated for this specific population, was employed for data collection. All measures were administered at the individual level to both members of the dyad, allowing the examination of within-person and cross-dyadic associations. To ensure comparability between the groups, the following instruments were administered to both stroke survivors and their caregivers, enabling the collection of data on various psychological, social, and clinical aspects. All instruments were administered in their validated Italian versions. The WHOQOL-SRPB was used with authorization from the WHOQOL Group. The Stroke Impact Scale (SIS) and Caregiver Burden Inventory (CBI) are available in validated Italian versions and do not require additional permissions.

Measures

For stroke survivors' and caregivers' data collection, a battery of validated instruments was utilized.

Spirituality was measured using the WHOQOL-SRPB (*World Health Organization Quality of Life—Spiritual, Religious, and Personal Beliefs*),[39] a 32-item tool exploring eight dimensions: spiritual connection, meaning in life, sense of awe, wholeness and integration, spiritual strength, inner peace, hope and optimism, and faith. Each dimension and total score are rated 0–100, with higher scores indicating greater spirituality. The WHOQOL-SRPB has demonstrated robust validity and reliability across settings.[32]

Stroke survivors' disability and HRQoL were assessed using the SIS 3.0, a 59-item instrument measuring post-stroke impairment across eight domains: muscular strength (4 items); upper limb functionality (5); autonomy in daily and instrumental activities (10); mobility (9); communication (7); emotional wellbeing (9); cognitive functions (7); and social participation (8). An additional item asks participants to rate their perceived recovery from 0 to 100. Items use a 5-point Likert scale, from 1 (unable) to 5 (no difficulty). Domain scores are calculated, with higher values indicating lower disability and better HRQoL.[40] The SIS was chosen instead of the Stroke-Specific Quality of Life Scale (SS-QOL) because it provides a broader multidimensional profile of post-stroke functioning and is widely validated in Italian rehabilitation settings, with strong sensitivity to functional differences at discharge.

The CBI[41] was used to assess caregiver burden across five dimensions: objective, psychological, physical, social, and emotional. It provides a multidimensional evaluation of caregiver stress. Baseline data included socio-demographic info on stroke survivors and caregivers (age, gender, education, relationship) and clinical data such as stroke site/type and comorbidities.

Data analysis

Little's test[42] verified whether data were missing completely at random (MCAR). Preliminary analysis identified potential outlier dyads using Z-scores and Mahalanobis distance.[43]

Descriptive statistics (means, standard deviations, frequencies, percentages) characterized the demographic and clinical variables. Pearson's correlation coefficients assessed non-independence of variables. According to Kenny and Ledermann,[44] correlations of 0.10–0.29 were weak, 0.30–0.49 moderate, and 0.50–1.00 strong. Dyadic analysis was conducted using SEM,[45] to determine within-person (intra-dyadic) and cross-dyadic associations. Structural equation modelling accounts for the non-independence of dyad members by modelling their data simultaneously, enabling investigation of self- and other-directed effects.[45] *Figure 1* shows the tested model. Structural equation modelling incorporates multiple dependent variables, correlates errors, and allows parameter restrictions, making it ideal for complex dyadic relationships.[46] The model assessed the associations between both members' spirituality, caregiver burden, stroke survivors' disability, and HRQoL.

As variables were not standardized, unstandardized coefficients were reported, consistently with Kenny and colleagues' (2006) advice. Structural equation modelling was estimated using maximum likelihood robust (ML-r) estimation,[45] a statistical estimation method that applies robust corrections to standard errors and test statistics, with Full Information Maximum Likelihood (FIML) in Mplus to handle missing data.[47] Goodness-of-fit indices (e.g. CFI, RMSEA) were not used, as SEM often yields poor fit indices in models with moderate effect sizes (http://davidakenny.net/kkc/c7/c7.htm).

Unstandardized (b) and standardized (β) coefficients, with standard errors and confidence intervals, were used to describe models. A further SEM tested the influence of two covariates—survivor ADL and gender—on disability, HRQoL, and caregiver burden, based on literature.[48,49]

To assess whether within-person and cross-dyadic associations differed between stroke survivors and caregivers, we compared χ^2 values of models with constrained vs. unconstrained effects.[50] A non-significant $\Delta\chi^2$ using the ML-robust estimator indicated constraints did not worsen model fit, supporting use of the constrained model.[45]

The significance level was set at 0.05. IBM SPSS version 27.0 was used for descriptive analyses, and SEM was performed using Mplus 8.2 (Muthén & Muthén, Los Angeles, CA, USA).

Ethical approval

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and received approval from

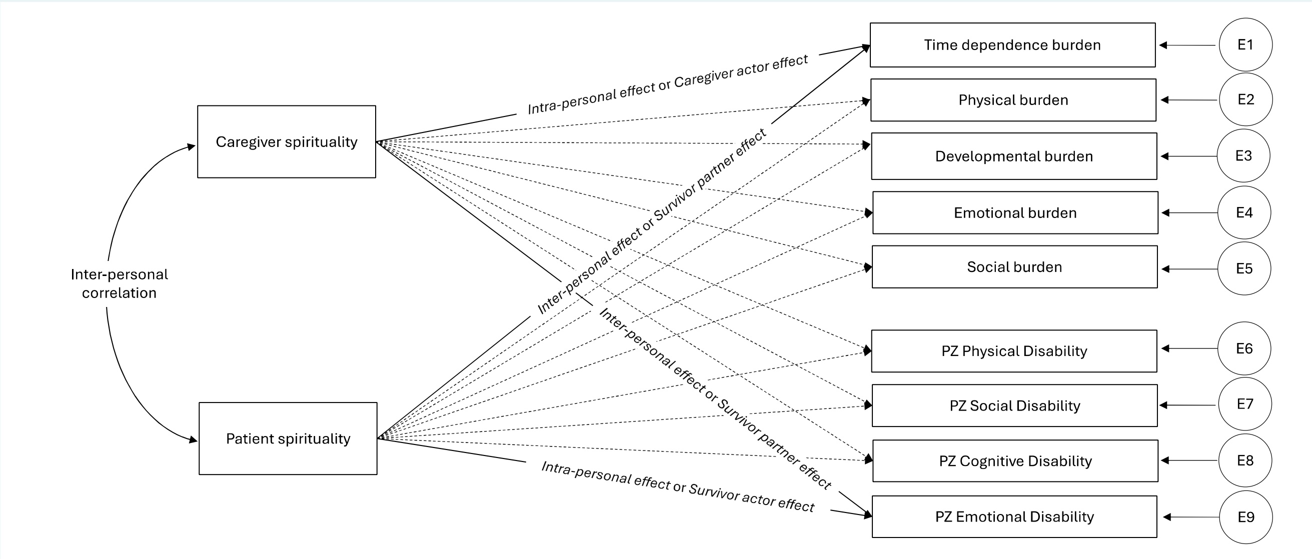


Figure 1 Graphical representation of the model tested. The structural equation modelling is represented graphically by placing the independent variable on the left (in our study the spirituality) and the dependent variable on the right of the figure (for caregiver: time dependence, physical, developmental, emotional, and social burden; for stroke survivor: physical, social, cognitive, and emotional disability). The intra-personal or actor effects are represented by horizontal arrows (i.e. the influence of each dyad member's spirituality on their dependent variable) and the inter-personal or partner effects by diagonal arrows (i.e. the influence of a dyad member's spirituality on the dependent variable of the other member of the dyad). The significant effects are represented by the continuous line while non-significant effects by the dashed line. On the left, a curved double-headed arrow describes the correlation between the independent variables (spirituality) of dyad members and on the right the circles describe the error terms (E1–E9) of dependent variables. The interdependence between the members of a dyad is indicated through the partner effects, the correlation between the independent variables, and the correlation among the error terms of the dependent variable of the two members of the dyad. PZ, patient.

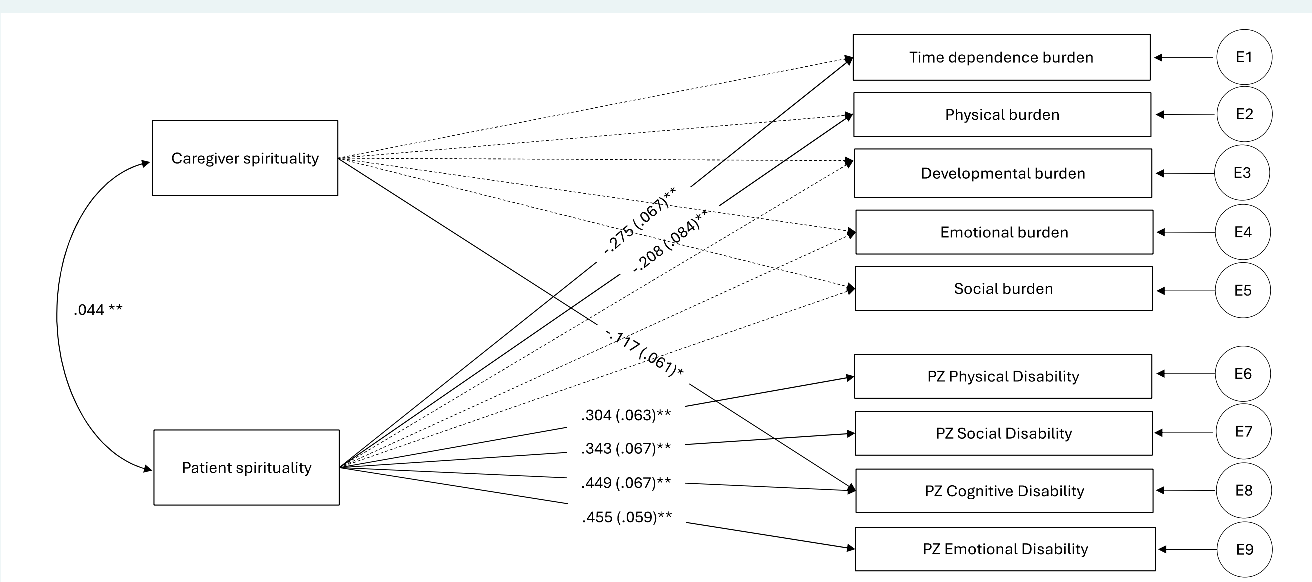


Figure 2 Dyadic impact of spirituality on caregiver burden and stroke survivors' disability and health-related quality of life. E1–E9 represent the error terms of corresponding dependent variables. $*P < 0.05$; $**P < 0.001$; standardized coefficients (β) are reported with standard error in parentheses.

Table 1 Demographic and clinical characteristics of stroke survivor and their caregiver ($n = 217$ dyads)

Characteristic	SS	CG
Age, mean (SD), y	71.2 (11.8)	52.7 (13.1)
Female, *n* (%)	108 (49.8)	141 (65)
Marital status (married), *n* (%)	126 (58.1)	161 (74.2)
Employed, *n* (%)	62 (29.4)	172 (79.6)
More than middle school, *n* (%)	50 (23)	92 (42.4)
Stroke type (ischaemic), *n* (%)	169 (78.6)	–
Stroke site (right hemisphere), *n* (%)	107 (49.8)	–
Adult child caregiver, *n* (%)		109 (50.2)
Other relative caregiver, *n* (%)		34 (15)
Time since stroke (range, 0–146), d	17.4 (21.4)	–

SS, stroke survivors; CG, caregiver.

Table 2 Stroke survivors and caregiver spirituality, caregiver burden, and stroke survivors disability and health-related quality of life ($n = 217$)

	M ± SD	Paired *t*-test (*P*-value)
Stroke survivors spirituality	44.59 ± 16.03	1.338
Caregiver spirituality	45.67 ± 13.30	(0.182)
Time dependence burden	10.17 ± 5.71	
Physical burden	4.52 ± 4.06	
Developmental burden	4.89 ± 5.04	
Social burden	3.03 ± 4.23	
Emotional burden	1.82 ± 3.59	
Physical disability	42.99 ± 26.99	
Social disability	74.07 ± 25.28	
Cognition disability	57.96 ± 20.96	
Emotional disability	42.33 ± 17.56	

SD, standard deviation.

the Ethics Committee of the Lazio Region 2, Rome (protocol no. 26.15). Prior to participation, stroke survivors and caregivers were fully informed about the study's objectives, procedures, and potential implications, as well as the measures in place to protect personal data. They were assured that all collected information would be treated with strict confidentiality. Written and verbally informed consent was obtained from all participants. Furthermore, participants were informed of their right to withdraw from the study at any time, without the need to provide any justification.

Results

No missing data were identified for the CBI and SIS scores. However, spirituality scores were missing for 3.7% of stroke survivors and 0.5% of caregivers. Little's test was non-significant, suggesting no evidence of systematic missingness in the data [$\chi^2(33) = 44.7$; $P = 0.084$]. Not all variables were normally distributed, as indicated by skewness and kurtosis indices greater than |1|.

Characteristics of stroke survivors and their caregivers

The socio-demographic and clinical characteristics of stroke survivors and their caregivers are summarized in *Table 1*. A baseline comparison between the final sample of this study and a larger cohort of stroke survivors without caregivers revealed no significant differences in socio-demographic variables (e.g. age), clinical characteristics (e.g. stroke type), depression levels, or quality of life scores (all comparisons: $P > 0.05$). At baseline, the mean age of stroke survivors was 71.2 years (SD ± 11.8), while that of caregivers was 52.7 years (SD ± 13.1). Among stroke survivors, males accounted for a slightly higher proportion (50.2%), whereas the majority of caregivers were female (65%). Most participants in both groups were married, with 58.1% of stroke survivors and 74.2% of caregivers reporting being in a marital relationship. Ischaemic stroke was the most common type of cerebrovascular event (78.6%), with an even distribution between the right and left hemispheres. Non-ischaemic strokes in the sample consisted primarily of haemorrhagic events (intracerebral or subarachnoid), grouped together due to small cell counts. Educational level was dichotomized ('middle school or less' vs. 'more than middle school') to ensure sufficient subgroup size and facilitate model stability.

Stroke survivors and caregiver spirituality, caregiver burden, and stroke survivors' disability and health-related quality of life

Comparable levels of spirituality were found between stroke survivors and caregivers (*Table 2*). Caregivers reported higher burden levels in the time dependence and developmental burden factors, while experiencing lower burden levels in the emotional domain. Stroke survivors reported higher levels of disability in the social and cognitive domains, while experiencing lower levels of disability in the emotional domain.

The spirituality of stroke survivors and caregivers were significantly correlated with cross-dyadic outcomes. Specifically, stroke survivors' spirituality was correlated with time dependence, developmental, and physical burden whereas caregivers' spirituality was correlated with stroke survivors' physical, emotional, and social disability. Additionally, a significant correlation was found between stroke survivors' and caregivers' spirituality (*Table 3*).

Dyadic impact of spirituality on caregiver burden and stroke survivors' disability and health-related quality of life

The SEM examining the impact of spirituality on caregiver burden and stroke survivors' disability and HRQoL is presented in *Table 4*. Four statistically significant within-person associations were observed: stroke survivors' spirituality positively influenced their physical ($\beta = 0.304$, $P < 0.001$), cognitive ($\beta = 0.449$, $P < 0.001$), emotional ($\beta = 0.455$, $P < 0.001$), and social ($\beta = 0.343$, $P < 0.001$) disability and HRQoL.

Three statistically significant cross-dyadic associations were also found: one on caregivers' spirituality and three on stroke survivors' spirituality. Specifically, stroke survivors' spirituality negatively affected time dependency ($\beta = -0.275$, $P < 0.001$), developmental ($\beta = -0.208$, $P < 0.001$), and physical ($\beta = -0.183$, $P = 0.030$) burden. Additionally, while caregivers'

Table 3 Correlations of spirituality, caregiver burden, and stroke survivors disability and health-related quality of life (n = 217)

	1	2	3	4	5	6	7	8	9	10	11
1. Stroke survivors spirituality	–	**0.43**[a]	**−0.32**[a]	**−0.26**[a]	**−0.23**[a]	−0.11	−0.11	**0.29**[a]	**0.39**[a]	**0.44**[a]	**0.37**[a]
2. Caregiver Spirituality		–	**−0.22**[a]	**−0.21**[a]	−0.17	−0.01	−0.06	**0.18**[a]	0.11	**0.25**[a]	**0.25**[a]
3. Time dependence burden			–	**0.55**[a]	**0.54**[a]	**0.32**[a]	**0.32**[a]	**−0.64**[a]	**−0.40**[a]	**−0.39**[a]	**−0.55**[a]
4. Developmental burden				–	**0.76**[a]	**0.63**[a]	**0.58**[a]	**−0.39**[a]	**−0.29**[a]	**−0.32**[a]	**−0.43**[a]
5. Physical burden					–	**0.62**[a]	**0.60**[a]	**−0.38**[a]	**−0.30**[a]	**−0.32**[a]	**−0.40**
6. Social burden						–	**0.77**[a]	**−0.29**[a]	**−0.25**[a]	**−0.27**[a]	**−0.32**[a]
7. Emotional burden							–	**−0.26**[a]	−0.13	**−0.26**[a]	**−0.28**[a]
8. Physical disability								–	**0.56**[a]	**0.48**[a]	**0.75**[a]
9. Cognitive disability									–	**0.49**[a]	**0.53**[a]
10. Emotional disability										–	**0.52**[a]
11. Social disability											–

Values in bold indicate significant correlation at $P \leq 0.050$.
[a]Significant correlation at $P \leq 0.010$.

spirituality was negatively associated with stroke survivors' cognitive disability ($\beta = -0.117$, $P = 0.052$), this effect was not statistically significant, suggesting a potential influence that warrants further investigation. The model demonstrated excellent fit: χ^2 (2, $n = 217$) = 0.789 ($P = 0.6739$); RMSEA = 0.000 [90% CI = (0.000 0.012); P (RMSEA < 0.05) = 0.791]; CFI = 1.000; TLI = 1.000; and SRMR = 0.0109. We conducted comparisons between the χ^2 values of models in which actor and partner effects of spirituality on stroke survivors' cognitive disability and HRQoL were constrained to be equal in both members of the dyads.[50] The $\Delta\chi^2$ test between these two models was statistically significant ($\Delta\chi^2_{(\Delta df = 1)} = 15.68$, $P = 0.0001$), indicating that the effects of spirituality on stroke survivors' cognitive disability and HRQoL differed between the members of the dyads. As a result, we interpreted the SEM in which the actor and partner effects were not constrained to be equal. For clarity, *Figure 1* illustrates within-person and cross-dyadic associations between spirituality and outcomes within the dyad *Figure 2*.

When we controlled for covariates (caregiver's gender and stroke survivors' ADL), some differences emerged compared with the SEM without covariates. In particular, no significant effects of the stroke survivors' spirituality on development and physical burden were found. Moreover, a significant within-person association emerged for caregivers: caregiver spirituality was negatively associated with development burden ($\beta = -0.227$, $P = 0.023$) when controlling for caregiver gender and stroke survivors' ADL.

Discussion

This study examined the associations between spirituality, disability, caregiver burden, and HRQoL within stroke survivor–caregiver dyads using a dyadic analytic framework based on SEM. Consistent with the study aim, the findings revealed multidimensional and interdependent associations, suggesting that spirituality is meaningfully linked to both personal and relational aspects of post-stroke adaptation. In line with previous dyadic research,[24,51] higher levels of spirituality in survivors were associated with more favourable perceptions of HRQoL and with lower caregiver burden. These associations are coherent with theoretical perspectives that describe spirituality as a meaning-making and emotion-regulating resource that may support individuals in navigating stressors related to illness.[52,53] An important finding concerns the associations between survivor spirituality and multiple dimensions of caregiver burden: higher survivor spirituality was associated with lower time dependence, developmental, and physical burden in caregivers. Within a dyadic perspective, these associations are compatible with the idea that survivors' spiritual meaning-making may be linked to better emotional adjustment and more collaborative illness management, which in turn may reduce caregivers' perception of daily care demands. Similar dynamics have been described in dyadic coping research, particularly in the Systemic Transactional Model, which posits that one partner's stress and coping responses are closely tied to the other partner's experience of strain.[54] Although causality cannot be established here, our results are coherent with recent quantitative evidence indicating that dyadic processes of coping and mutual support are systematically associated with couple-level outcomes in chronic illness.[55]

Stroke survivors' spirituality was also significantly associated with reduced caregiver burden when examined dimensionally, particularly for time dependence, developmental strain, and physical burden. This pattern is in line with studies suggesting that spiritually inclined individuals may exhibit greater acceptance, autonomy, and psychological resilience, which may indirectly ease caregiving demands.[53,56,57] At the same time, caregivers' spirituality showed an inverse association with survivors' perceived disability. Although some cross-dyadic associations did not reach statistical significance, the overall trend suggests that caregivers' spiritual resources may be linked with better support quality and survivor adaptation, consistent with evidence that spirituality can enhance caregivers' meaning, resilience, and caregiving engagement.[52] The association between caregivers' spirituality and survivors' disability is also coherent with work showing that perceived disability is strongly shaped by family support and relational climate.[21] Recent longitudinal dyadic research on young and middle-aged stroke couples further indicates that disability, depression, and social support are dynamically interrelated for both partners and influence physical and mental health trajectories over time.[58] Taken together, these findings point to the importance of considering spirituality as one component within a broader network of psychological and social resources that operate at the dyadic level.

Table 4 **Structural equation model parameter estimates for dyadic impact of spirituality on caregivers' burden and stroke survivors' disability and health-related quality of life (*n* = 217 stroke survivor-caregiver dyads)**

Predictors	*b*	*β*	SE	*P*-value
SS_SPIR on PHY_SIS (A)	**0.509**	**0.304**	0.063	**<0.001**
CG_SPIR on PHY_SIS (P)	0.000	0.000	0.000	999.000
SS_SPIR on COGN_SIS (A)	**0.584**	**0.449**	0.067	**<0.001**
CG_SPIR on COGN_SIS (P)	**−0.185**	**−0.117**	0.061	**0.052**
SS_SPIR on EMO_SIS (A)	**0.494**	**0.455**	0.059	**<0.001**
CG_SPIR on EMO_SIS (P)	0.000	0.000	0.000	999.000
SS_SPIR on SOC_SIS (A)	**0.535**	**0.343**	0.067	**<0.001**
CG_SPIR on SOC_SIS (P)	0.130	0.069	0.055	0.212
CG_SPIR on Time_CBI (A)	−0.027	−0.064	0.062	0.306
SS_SPIR on Time_CBI (P)	**−0.097**	**−0.275**	0.067	**<0.001**
CG_SPIR on DEV_CBI (A)	−0.038	−0.101	0.064	0.112
SS_SPIR on DEV_CBI (P)	**−0.065**	**−0.208**	0.084	**<0.001**
CG_SPIR on PHY_CBI (A)	−0.021	−0.068	0.067	0.308
SS_SPIR on PHY_CBI (P)	**−0.046**	**−0.183**	0.084	**0.030**
CG_SPIR on SOC_CBI (A)	0.021	0.066	0.066	0.314
SS_SPIR on SOC_CBI (P)	−0.037	−0.140	0.091	0.123
CG_SPIR on EMO_CBI (A)	0.002	0.006	0.061	0.922
SS_SPIR on EMO_CBI (P)	−0.022	−0.101	0.101	0.315

The statistically significant effects are indicated in bold. Only unstandardized coefficients are interpreted.
SS, stroke survivors spirituality; CG, caregiver Spirituality; PHY_SIS, physical disability; COGN_SIS, cognitive disability; EMO_SIS, emotional disability; SOC_SIS, social disability; Time_CBI, time dependence burden, DEV_CBI, developmental burden; PHY_CBI, physical burden; SOC_CBI, social burden; EMO_CBI, emotional burden; A, intra-personal effect or actor effect; P, inter-personal effect or partner effect; *b*, unstandardized coefficients; *β*, standardized coefficients within roles; SE, standard error.

Spirituality in stroke survivors was positively associated with HRQoL across physical, psychological, social, and environmental domains, supporting its role as an integrative resource associated with better well-being. At the same time, prior research has underlined that spiritual reflection may also intensify distress when existential beliefs conflict with illness-related losses or when identity is profoundly disrupted after stroke.[59–61] This duality—spirituality as a potential coping resource and as a possible amplifier of suffering—warrants clinical attention and cautions against uniform or idealized interpretations of spirituality. The present dyadic SEM results suggest that spirituality is not uniformly beneficial across all outcomes and pathways; instead, its role appears nuanced and likely mediated or moderated by personal, relational, and contextual factors, especially when identity disruptions arise post-stroke. From a theoretical standpoint, the use of a dyadic SEM approach represents a strength and an innovative quantitative contribution to the literature on spirituality in stroke. Dyadic models allow simultaneous examination of within-person and cross-dyadic associations, capturing interdependence rather than assuming independence of survivors and caregivers. Our findings extend existing dyadic evidence in stroke and other chronic conditions[32,58] by focusing specifically on spirituality and by documenting significant within-person associations and selected cross-dyadic trends within survivor–caregiver dyads. They also resonate with broader meta-analytic evidence showing that dyadic coping in chronic illness consistently exhibits both actor and partner effects on relationship satisfaction in couples coping with chronic disease.[55] In this perspective, survivor and caregiver spirituality can be conceptualized as part of a wider dyadic coping and meaning-making system, in which shared appraisals, mutual support, and communal efforts contribute to adaptation at the couple level. The cultural and religious context in which this study was conducted is also relevant for interpreting the findings. Italy is characterized by strong family caregiving norms and a predominantly Catholic cultural background, where spiritual and religious beliefs often influence how individuals interpret illness and caregiving roles. Such a context may shape both the expression of spirituality and the ways in which spiritual resources are activated within survivor–caregiver dyads. These cultural specificities may partly contribute to the associations observed in this study and should be considered when evaluating the generalizability of the findings to populations with different sociocultural or religious profiles. Future research should compare dyadic associations between spirituality, disability, burden, and HRQoL across diverse cultural settings to clarify how cultural values and practices may moderate these relationships. The broader dyadic literature on coping suggests that interventions which enhance collaborative coping, mutual support, and shared appraisals can improve relational and psychological outcomes in couples facing chronic illness.[54,55] Stroke-specific interventions might therefore consider incorporating modules on spiritual and existential resources for both survivors and caregivers, while maintaining sensitivity to individual preferences and beliefs.

Several strengths and limitations should be considered. Strengths include the dyadic design, the use of dyadic SEM to estimate within-person and cross-dyadic associations, and the use of validated measures for spirituality, disability, caregiver burden, and HRQoL. Including both survivors and caregivers responds to calls for more relational perspectives on post-stroke adaptation and allows a more comprehensive understanding of how spirituality is associated with outcomes at the dyad level. However, the cross-sectional nature of the study represents an important limitation. Because all variables were assessed at a single time point, the observed associations cannot be interpreted as directional or causal, and no temporal inferences can be drawn regarding the relationships between spirituality, disability, caregiver burden, and HRQoL. The use of convenience sampling may limit representativeness, as dyads who agreed to participate may differ systematically from those who declined (for example in terms of burden, religiosity, or relationship quality). All measures were self-reported, which increases the risk of social desirability bias, particularly for spirituality-related items. Although the HRQoL measure (SIS) captures aspects related to functional status, disability may still act as a confounding variable in the associations between spirituality and HRQoL, and it was not fully controlled for in all models. This consideration is consistent with recent evidence showing that spiritual and psychosocial outcomes in stroke survivors are closely intertwined with functional status.[62,63] Finally, this study did not include explicit measures of cultural, religious, or social determinants of spirituality, nor of dyadic processes such as shared meaning-making, dyadic communication, or relational resilience, which could help explain the observed patterns. Future research should build on these findings by adopting longitudinal and intervention designs to clarify temporal pathways and potential mechanisms linking spirituality, disability, caregiver burden, and HRQoL in stroke dyads. Longitudinal dyadic SEM approaches[58] could be used to model change over time and reciprocal influences between dyad members. Incorporating culturally informed variables and explicit measures of dyadic coping and communication would also help situate spirituality within broader relational and sociocultural frameworks. Finally, controlled intervention studies are needed to examine whether spirituality-informed or spiritually sensitive dyadic interventions can effectively improve psychological and functional outcomes for both stroke survivors and their caregivers, while avoiding overstatement of causal claims.

Conclusion

This study examined the associations between spirituality, disability, caregiver burden, and HRQoL within stroke survivor–caregiver dyads using a dyadic analytic approach. The findings indicate that spirituality is linked with multidimensional aspects of post-stroke adaptation through distinct within-person and cross-dyadic associations, reinforcing the relevance of considering dyadic interdependence when addressing the needs of both survivors and caregivers. These results suggest that spirituality may function as one of several relational and psychosocial resources that accompany post-stroke adjustment, although the cross-sectional nature of the data precludes any inference about temporal or causal pathways. Our findings underscore the importance of integrating spiritual, emotional, relational, and physical dimensions within holistic rehabilitation frameworks. Approaches that support meaning-making, spiritual coping, and open dyadic communication may represent promising avenues for enhancing well-being in both members of the dyad; however, their effectiveness requires empirical evaluation in controlled and longitudinal studies. Moreover, the cultural context in which this study was conducted—characterized by strong family caregiving norms and a predominantly Catholic environment—may shape the expression and relevance of spirituality and thus may influence the generalizability of these associations to other sociocultural settings.

Future research should employ longitudinal, mechanistic, and cross-cultural designs to clarify how spiritual resources develop over time, how they interact with disability and burden within dyads, and how cultural values and relational processes modulate their role in post-stroke adaptation. Incorporating spiritual and relational dimensions into post-stroke care may contribute to more comprehensive and person-centred rehabilitation strategies, while acknowledging that spirituality represents one element within a broader constellation of factors shaping dyadic well-being.

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Data availability

The data are not publicly available due to ethical restrictions and sensitive personal data but are available upon reasonable request.

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