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Associations between occupational balance and health- related quality of life in informal caregivers of persons after stroke: a cross-sectional study

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Abstract

Background

Informal caregivers are essential in post-stroke care but often face challenges affecting health-related quality of life (HRQoL). Occupational balance - the satisfaction with the amount and variety of daily activities - has been linked to health and well-being. This study examined associations between restricted occupational balance and HRQoL in informal caregivers of persons after stroke and explored moderation by positive caregiving experience.

Methods

A cross-sectional online survey among informal caregivers of persons after stroke in Austria (August 2023–April 2025; *N* = 138) assessed health-related quality of life (HRQoL) using the 12-Item Short Form Health Survey (SF-12; Physical and Mental Component Summary scores, PCS/MCS) and occupational balance with the Occupational Balance in Informal Caregivers (OBI-Care; Occupational Areas [OA], Occupational Characteristics [OC], Occupational Resilience [OR]; higher scores indicate lower balance). Hierarchical ordinary least squares regressions examined associations with PCS/MCS, adjusting for caregiver age, care recipient age and gender, cohabitation, additional caregiving responsibilities, and caregiver burden. Moderation by positive caregiving experience was tested using PROCESS Model 1.

Results

Greater occupational imbalance was associated with poorer HRQoL. For PCS, lower balance in OA (β = −0.258, p = .014) and OC (β = −0.299, p = .002) was linked to poorer physical health after adjustment; OR was not significant. For MCS, all subscales were associated with poorer mental health, strongest for OA (β = −0.571, p < .001), followed by OC (β = −0.376, p < .001) and OR (β = −0.218, p = .009). Moderation analyses showed domain-specific effects for OC: positive caregiving experience strengthened the negative OC–PCS association (b = − 0.64, p = .013) but weakened the OC–MCS association (b = 0.57, p = .025), which became non-significant at higher levels. No moderation was found for OA; OR showed a non-significant trend for MCS (p = .083).

Conclusions

Restricted occupational balance is strongly associated with HRQoL in informal caregivers after stroke, particularly for mental health when participation across life domains is limited. Task-related characteristics relate to both physical and mental HRQoL, with effects varying by positive caregiving appraisal. Although causality cannot be inferred, the findings underscore the value of subscale-specific

assessment and support targeted, occupation-based interventions addressing participation (OA), task demands (OC), and adaptive strategies (OR).

Introduction

Stroke is one of the leading causes of long-term disability worldwide (1), and the number of people living with its consequences is expected to rise steadily until at least 2046 (2). As a result, many persons after stroke depend heavily on informal caregivers - family members or close friends who provide essential support without financial compensation (3). These caregivers often assume a complex mix of responsibilities, ranging from physical assistance and mobility support to managing household tasks, coordinating medical appointments, organizing professional services, and providing ongoing emotional support (4). Informal care represents a fundamental pillar of long-term care provision, mitigating strain on formal health and social care infrastructures. Demographic ageing and rising care demands indicate that the reliance on informal caregivers will not only persist but is likely to expand markedly in the future (5, 6).

Against this backdrop of growing dependence on informal care, it is important to recognize that a stroke often results in profound changes not only for the persons after stroke but also for the individuals who care for them (7). These changes can have both positive and negative consequences, although negative impacts tend to predominate. Some caregivers report strengthened relationships, increased appreciation, and supportive interpersonal environments (8, 9). At the same time, caregiving may contribute to socioeconomic disadvantages, including poverty, social exclusion, and unemployment (10). Beyond these social impacts, a substantial body of research has demonstrated adverse effects on caregivers' health and well-being, with evidence of poorer physical and psychological health (11), elevated symptoms of depression (12) and anxiety (13), increased mortality (14) and lower life satisfaction (11).

One mechanism contributing to these adverse outcomes is the disruption of caregivers' daily routines and occupations. Informal caregivers frequently struggle to maintain a balanced engagement in meaningful, restorative, and necessary activities while meeting the demands of caregiving (5). This challenge highlights the relevance of *occupational balance*, a central concept in occupational therapy and occupational science. Occupational balance refers to the perceived satisfaction with the amount and variety of everyday occupations - activities people want, need, or are expected to perform (15, 16). Since it captures how individuals organize, diversify, and derive meaning from their daily activities, occupational balance provides an important lens for understanding caregiver wellbeing. Within caregiving research, restricted balance of everyday occupations is typically grouped under the concept of *caregiver burden*, which reflects physical, emotional, social, and financial strain (17). However, caregiver burden primarily addresses the consequences of caregiving demands, whereas occupational balance helps explain how caregiving reshapes daily life and the degree to which informal caregivers experience satisfaction or conflict among their various occupations connected to their different roles.

Consistent with this theoretical distinction, evidence shows that disproportionate or restricted engagement in daily occupations is associated with reduced satisfaction and diminished wellbeing (18). In stroke caregiving - where care-related tasks frequently restructure and displace meaningful activities - occupational balance may therefore be especially critical for understanding informal caregivers' physical and mental health. Moreover, occupational balance has been shown to be associated with multiple indicators of health and wellbeing across general and caregiving populations, underlining its relevance as a factor that warrants systematic exploration in the context of informal stroke care.

The association between occupational balance and health and wellbeing

Evidence from multiple populations - including adults with chronic conditions, parents, students, and women - indicates that lower occupational balance is associated with stress, depressive symptoms, lower health-related quality of life (HRQoL), poorer sleep quality, and reduced life satisfaction (19–25). Importantly, studies focusing specifically on informal caregivers show a similar pattern. Röschel et al. (26) reported significant associations between occupational balance and subjective health, wellbeing, anxiety, depression, social support, and caregiver burden in caregivers of older adults. In parents of very low birthweight infants, occupational balance was positively associated with parental subjective health and also related to infant clinical outcomes, underscoring its relevance in intensive caregiving contexts (19). Studies with mothers of children with cerebral palsy and parents of children with autism further demonstrated that lower occupational balance is associated with poorer quality of life, greater emotional strain, and reduced life satisfaction (27, 28).

Beyond these cross-sectional associations, early causal modelling work indicates that occupational balance may function as a determinant of health. Structural equation modelling in community-dwelling older adults showed that occupational balance predicts subjective health, HRQoL, and other health-related variables (25). Similarly, occupational balance and meaning were found to mediate mental health outcomes in students exposed to extreme stress (29), pointing to a directional mechanism whereby disruptions in daily occupations influence psychological wellbeing.

Occupational balance and its potential to buffer negative health outcomes

While occupational balance is closely associated with health and wellbeing, informal caregivers' subjective appraisals of their caregiving role may influence how strongly restrictions in occupational balance affect their physical and psychological health. The concept of *positive caregiving experience* (30) - encompassing perceived meaning, emotional closeness, fulfillment, and personal growth - has been widely described in caregiving research as a protective psychological resource (31). Stress-appraisal frameworks such as Pearlin's Stress Process Model (32), and resilience-based approaches (33), propose

that positive appraisals can buffer the negative effects of caregiving demands by enhancing coping, fostering perceived control, and reinforcing a sense of purpose.

Empirical evidence supports this buffering potential. Earlier work by Cohen et al. (34) showed that informal caregivers who reported more positive feelings showed fewer depressive symptoms, reduced burden, and better self-rated health. Systematic reviews similarly indicate that positive aspects of caregiving - such as feelings of meaning, personal growth, strengthened relationships, and a sense of usefulness - are associated with improved mental health, life satisfaction, and self-efficacy (33, 35), and may act as moderators that soften the impact of caregiver burden on depression, anxiety, and psychological distress (36, 37).

Despite this growing evidence, research integrating *positive caregiving experience* into models of occupational balance are lacking. Existing studies on occupational balance and caregiving primarily focus on cross-sectional associations between occupational balance and health outcomes (e.g., 19, 26, 27, 28), or identify predictors of occupational balance such as burden, stress, and social support (38). To our knowledge, no study has tested whether positive caregiving experience moderates the relationship between occupational balance and informal caregiver subjective HRQoL - a gap that is particularly relevant in stroke caregiving, where daily routines are profoundly disrupted.

Aim of the Study

Although occupational balance has been linked to health in various populations, caregiver studies remain heterogeneous and use broad measures that overlook the distinct occupational challenges of stroke caregiving. No work has yet isolated the unique effect of occupational balance using hierarchical modelling. The present study hence aimed to explore the associations between occupational balance and HRQoL in informal caregivers of persons after stroke. Using the OBI-Care questionnaire, we examined whether more restricted occupational balance is associated with poorer physical and mental health outcomes, accounting for relevant demographic and caregiving-context variables (caregiver age, care recipient gender, care recipient age, cohabitation, and additional caregiving responsibilities).

A second aim was to examine whether the association between occupational balance and HRQoL is modified by subjective caregiving appraisals, specifically positive caregiving experiences, while accounting for caregiver burden as a confounding variable due to its established influence on both occupational balance and HRQoL.

By focusing on the unique context of stroke caregiving, applying a validated, population-specific measure, and incorporating contextual and confounding variables, this study aims to extend current understanding of how occupational balance contributes to the physical and mental health of informal caregivers in the context of stroke. Findings may provide a foundation for developing targeted, occupation-based interventions that support informal caregivers' well-being and sustainable participation in care.

Method

Study Design, Recruitment, and Data Collection

This study employed a cross-sectional design using an online survey to collect data from informal caregivers of persons after stroke residing in Austria (39). Eligibility was determined through screening questions at the beginning of the survey. Inclusion criteria required participants to: (a) provide unpaid care to a family member, relative, or friend following a stroke; (b) have been engaged in caregiving for at least three months; (c) reside in Austria; and (d) be aged 18 years or older. Individuals who did not meet these criteria were excluded prior to completing the questionnaire.

Data collection took place between August 2023 and April 2025. Recruitment strategies were designed to ensure broad reach and diversity among participants. Invitations were disseminated through multiple channels, including healthcare providers (e.g., rehabilitation centers, allied health professions, general practitioners, neurologists), community-based organizations (such as *Caritas* and *Hilfswerk*), and local caregiver support groups (*IG Pflege*). Digital recruitment complemented these efforts through social media campaigns and press releases targeting caregiver networks and relevant online communities.

The survey was administered via the EFS Survey platform (Tivian XI GmbH, Cologne, Germany) hosted on UNIPARK. Participants accessed the questionnaire through a secure link and were informed about the study purpose, confidentiality, and voluntary nature of participation before proceeding. Broad consent was obtained electronically by clicking a confirmation button prior to survey initiation. The questionnaire was designed to take approximately 15–20 minutes to complete, and no financial incentives were offered. To maintain data integrity, the platform implemented measures to prevent duplicate submissions and monitored completion times to identify implausible entries. All responses were collected anonymously and stored on secure servers in compliance with the General Data Protection Regulation (GDPR).

The dataset was also utilized for a complementary psychometric investigation of the German version of the OBI-Care questionnaire, applying Rasch measurement principles to evaluate item functioning, construct validity, and internal consistency within the same population of informal caregivers of persons after stroke (39). Using the same dataset for this secondary analysis was methodologically justified, as both studies addressed distinct research questions while relying on identical inclusion criteria and measurement instruments, thereby avoiding additional participant strain.

Sample size planning considered two aspects: For the cross-sectional component, an a priori power analysis indicated that approximately 109 participants would be required to detect a moderate correlation ($\rho \approx 0.30$) with 80% power at a two-tailed significance level of $\alpha = 0.05$ (40, 41). In addition, Rasch analysis guidelines to achieve stable item calibrations and robust measurement precision were considered (42).

Study Variables and Measurement Instruments

HRQoL was the primary outcome, assessed with the German 12-Item Short Form Health Survey (SF-12). Physical and Mental Component Summary Scores (PCS; MCS) were computed using norm-based scoring algorithm and weights (Hogrefe Verlag GmbH & Co. KG, 2011), yielding scores with mean = 50 and SD = 10 in the reference population (higher scores indicate better health). When a single SF-12 item was missing, we imputed the value following the manual's regression-weight procedure; cases with more than one missing SF-12 item were excluded listwise from SF-12 scoring.

The primary independent variable was *occupational balance*, measured with the Occupational Balance in Informal Caregivers questionnaire (OBI-Care) (43). This tool conceptualizes occupational balance as satisfaction with the diversity, characteristics, and adaptability of daily occupations. It comprises three subscales: OBI-Care OA (Occupational Areas): satisfaction with occupations across different life domains (range: 5–45); OBI-Care OC (Occupational Characteristics): satisfaction with the qualities and perceived effects of occupations (range: 5–35); OBI-Care OR (Occupational Resilience): satisfaction with the adaptability of occupations (range: 5–30). Items are rated on a five-point scale, and subscale scores are summed. Importantly, higher scores indicate lower occupational balance, reflecting dissatisfaction with occupational balance.

Several additional variables were included to account for potential confounding and moderating effects. Caregiver burden was assessed using a Numeric Rating Scale (NRS) ranging from 0 to 10, where 0 indicated no caregiver burden and 10 indicated highest level of caregiver burden. Similarly, positive caregiving experience was measured on an NRS from 0 (no positive perceptions regarding caregiving) to 10 (highest positive caregiving experience). A single-item NRS for positive caregiving experience was used for parsimony and to minimize respondent burden in a multi-instrument online survey. Anchors reflected core facets of the positive caregiving experience construct (e.g., meaning, fulfillment) as summarized by Lee and Li (31) noting that brief single-item formats are used pragmatically when brevity is essential. Caregiver burden was treated as a confounder, given its established influence on both occupational balance (e.g., 26, 44) and HRQoL (e.g., 45, 46, 47).

In contrast, positive caregiving experience was conceptualized as a moderator, based on evidence that informal caregiving can also have beneficial effects on health and well-being for some individuals. Research has shown that informal caregiving may foster resilience, enhance a sense of purpose, and strengthen social relationships, which can contribute to improved psychological outcomes and even reduced mortality risk (48–50). These findings suggest that positive appraisals of informal caregiving could buffer the negative impact of restricted occupational balance, thereby mitigating their effect on HRQoL. Demographic and caregiving-context covariates included caregiver age, care recipient gender (0 = male, 1 = female), care recipient age in years, cohabitation with the care recipient (yes/no), and additional caregiving responsibilities for others (yes/no). These variables were included to account for individual and contextual differences identified a priori.

Statistical Analysis

All analyses were conducted using IBM SPSS Statistics (version 26 or later). Participants were included if complete OBI-Care and SF-12 data were available, allowing for single-item imputation of SF-12 responses in accordance with the scoring manual. Remaining missing data were handled via listwise deletion.

Descriptive statistics were computed for all variables: means, standard deviations (SD), minima and maxima for continuous variables, and counts and percentages for categorical variables. Pearson correlations quantified bivariate associations among HRQoL (PCS, MCS), OBI-Care subscales, positive caregiving experience, caregiver burden, and demographic/caregiving-context variables. Distributional assumptions were screened visually using histograms and Q–Q plots.

Main effects of restricted occupational balance on HRQoL were estimated using hierarchical OLS regressions separately for each OBI-Care subscale (OA, OC, OR; independent variables) and each outcome (PCS, MCS; dependent variables). For each model: Model 1 included the OBI subscale; Model 2 added informal caregiver age and care recipient gender (0 = male, 1 = female); Model 3 added cohabitation (0 = no, 1 = yes), positive caregiving experience (0–10), caring for more than one person (0 = no, 1 = yes), caregiver burden (0–10), and care recipient age. For these regressions, all predictors were z-standardized; results are reported as standardized coefficients (β) with p-values, R^2, and ΔR^2.

Because the three OBI-Care subscales are conceptually related, multicollinearity was examined with variance inflation factors (VIF) and tolerance values. To avoid inflation of standard errors due to shared variance, primary analyses estimated separate hierarchical models for each OBI-Care subscale (OA, OC, OR). A sensitivity model including all subscales jointly is reported in the supplement.

Moderation by positive caregiving experience (PosCareExp) was tested using the PROCESS macro for SPSS (version 5.0; Model 1), a regression-based tool for estimating moderation and interaction effects. Analyses were conducted for each combination of HRQoL outcome (PCS, MCS) and OBI-Care subscale (OA, OC, OR), adjusting for the same covariates as the hierarchical models (caregiver age, care recipient gender, cohabitation, additional caregiving responsibilities, caregiver burden, care recipient age). Positive caregiving experience served as the moderator (included as main effect and in the interaction term).Continuous predictors (independent variable *X* and moderator *W*) were grand-mean centered prior to constructing interaction terms; we report unstandardized coefficients (b), standard errors (SE), p-values, 95% CIs, model R^2, $\Delta \mathrm{R}^2$ for the interaction, simple slopes at the moderator's mean and $\pm 1\backslash\mathrm{hspace}\{0.17\mathrm{em}\}\mathrm{SD}$, and Johnson–Neyman intervals.

Residual linearity, normality, and homoscedasticity were assessed using residual-versus-fitted plots, normal probability (Q–Q) plots, and scale–location plots. Potentially influential observations were screened using Cook's distance (D > 4/n), but no exclusions were required. When heteroscedasticity was observed, models were re-estimated using HC3 heteroscedasticity-consistent standard errors, which did

not change substantive conclusions. Acceptable multicollinearity levels were confirmed (VIF < 5, tolerance > 0.20).

Because higher OBI-Care scores indicate greater restrictions in occupational balance, negative regression coefficients (β or b) reflect poorer HRQoL with lower occupational balance. In moderated models, lower-order coefficients represent effects at the mean of the moderator, and simple slopes indicate the OBI-Care–HRQoL association at low (− 1 SD), mean, and high (+ 1 SD) levels of positive caregiving experience.

Ethical Considerations

The study received approval from the Ethics Committee of Lower Austria (reference: GS1-EK-4/852–2023). Participation was entirely voluntary, and respondents were informed that they could discontinue at any point without consequences. Consent was considered given upon active indication, as participants were required to click a consent-confirmation box at the beginning of the questionnaire before proceeding. No monetary or material incentives were offered to participants or individuals involved in recruitment. Data collection was anonymous, and all procedures adhered to the principles of the GDPR. The dataset was used exclusively for the purposes outlined in the research protocol. A parallel study was conducted in Sweden under comparable ethical guidelines.

Results

Participant Flow and Final Analytical Sample

A total of 424 individuals accessed the survey link, of whom 365 started the questionnaire. Before completing the German version of the OBI-Care, 151 respondents exited the survey due to not meeting inclusion criteria, leaving 214 eligible participants. Of these, 156 completed the OBI-Care section (dropout rate: 27.1%). After applying listwise deletion based on SF-12 requirements, the final analytical sample comprised 143 participants for descriptive and correlational analyses. For hierarchical regression analyses, complete data for covariates were available for 138 informal caregivers.

Sample Characteristics

Descriptive characteristics of the 143 informal caregivers are presented in Table 1. Informal caregivers were predominantly female (85.3%) with a mean age of 56.98 years (SD = 13.33). Most were retired (40.6%) or employed full-time (27%). Caregiving demands were substantial, with caregivers performing an average of 7.72 tasks (SD = 2.11), most commonly household activities (84.6%), daily organization (83.2%), and health-promoting activities (83.2%). Nearly half had provided care for more than four years (49.7%), and 76.2% delivered care five to seven days per week. Additional caregiving responsibilities were frequent, with 44.1% caring for more than one person. Care recipients had a mean age of 70.82 years (SD = 13.75), and 72.7% had additional diagnoses.

Table 1. Sample characteristics	
Informal Caregivers (N = 143)	
Gender (female) *n* (%)	122 (85.3)
Age in years M (± SD)	56.98 (± 13.327)
Employment status (N = 138)	
Employed full-time (> 50%) *n* (%) (N = 138)	39 (27)
Employed part-time (< 50%) *n* (%)	20 (14)
Self-employed *n* (%)	9 (6.3)
Currently not working (e.g, sick leave, unemployed) *n* (%)	11 (7.97)
Retired or not specified *n* (%)	58 (40.6)
Not specified *n* (%)	7
Performed caregiving tasks (N = 138)	
Personal hygiene *n* (%)	94 (65.7)
Preparation of meals *n* (%)	114 (79.7)
Feeding activities *n* (%)	48 (33.6)
Household activities *n* (%)	121 (84.6)
Preserving and promoting health *n* (%)	119 (83.2)
Maintenance activities *n* (%)	105 (73.4)
Daily organization *n* (%)	119 (83.2)
Accompaniment and social participation *n* (%)	112 (78.3)
Hobbies and leisure activities or other *n* (%)	96 (69.56)
Length of time providing care (N = 138)	
3 months − 2 years	45 (31.5)
2 years − 4 years	22 (15.4)
Over 4 years	71 (49.7)

Notes: Percentages may not total 100% due to rounding and missing data; Higher values in “high caregiver burden” and “high positive caregiving experience” indicate scores above the scale midpoint (Numeric Rating Scale 0–10); Decimal points standardized to international scientific reporting format. Caregiver age and gender are reported for 143 participants, as these variables were collected at the beginning of the survey. Subsequent measures (including SF-12, and other characteristics) were completed by 138 participants due to attrition after the OBI-Care section.

Table 1. Sample characteristics	
Not specified	5 (3.5)
Number of care days per week (N = 138)	
Less than one per week or not specified n (%)	8 (5.79)
1–2 days per week *n* (%)	10 (7.0)
3–4 days per week *n* (%)	16 (11.2)
5–7 days per week *n* (%)	109 76.2)
Additional caregiving responsibilities (N = 138)	
Caring for > 1 person (yes) *n* (%)	63 (44.1)
Caregiving experience (N = 138)	
High caregiver burden *n* (%)	87 (60.8)
High positive caregiving experience *n* (%)	58 (40.6)
Relationship to the care recipient (N = 138)	
Partner /spouse *n* (%)	76 (53.1)
Mother/father *n* (%)	41 (28.7)
Other person or not specified *n* (%)	21 (15.2)
Living arrangement (N = 138)	
Living in same household as care recipient (yes) *n (%)*	104 (72.7)
Care recipients (N = 138)	
Gender (female) *n* (%)	51 (35.7)
Age in years M (± SD)	70,82 (± 13.752)
Additional known diagnose (yes) *n* (%)	104 (72.7)

Notes: Percentages may not total 100% due to rounding and missing data; Higher values in “high caregiver burden” and “high positive caregiving experience” indicate scores above the scale midpoint (Numeric Rating Scale 0–10); Decimal points standardized to international scientific reporting format. Caregiver age and gender are reported for 143 participants, as these variables were collected at the beginning of the survey. Subsequent measures (including SF-12, and other characteristics) were completed by 138 participants due to attrition after the OBI-Care section.

Descriptive Statistics and Correlations

Table 2 presents the means, standard deviations, and bivariate correlations among the main study variables. The three OBI-Care subscales showed strong positive intercorrelations (r = .576–.800, all p < .001), indicating substantial conceptual overlap across dimensions of occupational balance.

Consistent with expectations, lower occupational balance was associated with poorer mental health. All three OBI-Care subscales demonstrated significant negative correlations with the SF-12 Mental Component Summary (MCS), with the strongest association observed for OA (r = –.613, p < .001), followed by OC (r = –.515, p < .001) and OR(r = –.390, p < .001). Associations with physical health (PCS) were weaker in magnitude. Both OA (r = –.264, p = .001) and OC (r = –.303, p < .001) showed small to moderate negative correlations with PCS, whereas OR was not significantly related to physical health (r = –.161, p = .054).

As expected in the general SF-12 structure, the physical and mental health summary scores were not correlated with one another (r = .007, p = .938), indicating relative independence of these two components in this sample.

Residual diagnostics further confirmed the appropriateness of correlations and subsequent regression analyses. No major deviations from linearity or normality were detected, no case exceeded the Cook's D threshold of 4/n, and all inferences remained unchanged when models were re-estimated using HC3 robust standard errors.

Table 2
Means, standard deviations and correlation coefficients (N = 143)

Variable	M (SD)	(1)	(2)	(3)	(4)	(5)
(1) OBI-Care OA	27.08 (± 6.922)	-				
(2) OBI-Care OC	20.54 (± 5.190)	.800**	-			
(3) OBI-Care OR	18.25 (± 5.053)	.576**	.675**	-		
(4) PCS	45.057 (± 9.783)	− .264**	− .303**	− .161	-	
(5) MCS	38.679 (± 11.152)	− .613**	− .515**	− .390**	.007	-

Notes. OBI-Care = Occupational Balance in Informal Caregivers questionnaire (Dür et al, 2021), with higher scores indicating lower occupational balance; OA = Occupational Areas; OC = Occupational Characteristics; OR = Occupational Resilience. PCS = Physical Component Summary and MCS = Mental Component Summary of the 12-Item Short Form Health Survey (SF-12), with higher scores indicating better health. Values are Pearson correlation coefficients. ** p < .01 (two-tailed). Decimal points follow international scientific reporting conventions.

Associations Between Occupational Balance and Physical Health (SF-12 PCS)

To examine whether different dimensions of occupational balance were associated with physical health, three separate hierarchical linear regression models were conducted - one for each OBI-Care subscale

(Table 3). All predictors were standardized (z-scores), and higher OBI-Care scores indicate lower occupational balance.

In Model 1, higher OA scores significantly predicted poorer physical health (β = − 0.278, p < .001), explaining 7.7% of the variance (R^2 = .077). In Model 2, caregiver age and care recipient gender were added, resulting in a significant improvement in model fit (ΔR^2 = .048, p = .027; R^2 = .126). OA remained a robust predictor (β = − 0.312, p < .001), and older caregiver age was also associated with lower PCS (β = − 0.182, p = .028). In Model 3, contextual caregiving factors (cohabitation, positive caregiving experience, multiple caregiving roles, caregiver burden, and care-recipient age) did not contribute additional explanatory power (ΔR^2 = .020, p = .689). OA remained a significant predictor (β = − 0.258, p = .014).

In Model 1, OC significantly predicted poorer physical health (β = − 0.321, p < .001; R^2 = .103). In Model 2, the addition of caregiver age and care recipient gender improved the model modestly (ΔR^2 = .041, p = .045; R^2 = .143), while OC remained strongly associated with PCS (β = − 0.335, p < .001). In Model 3, contextual factors again did not significantly enhance model fit (ΔR^2 = .027, p = .521; R^2 = .171). OC remained a significant predictor (β = − 0.299, p = .002).

In Model 1, OR was a weaker but significant predictor of poorer PCS (β = − 0.172, p = .043; R^2 = .030). In Model 2, the addition of control variables did not significantly improve the model (ΔR^2 = .036, p = .077), although OR remained significant (β = − 0.186, p = .028). In Model 3, contextual factors increased R^2 to .119, but this change was not statistically significant (ΔR^2 = .053, p = .181). OR became non-significant (β = − 0.132, p = .152), whereas caregiver burden emerged as a significant predictor of lower PCS (β = − 0.192, p = .033).

Across all models, *lower occupational balance* consistently predicted *poorer physical health*, particularly for OA and OC. The predictive value of OR diminished after adjusting for broader caregiving context. Full results are shown in Table 3, and model-fit comparisons in Table 5.

Associations Between Occupational Balance and Mental Health (MCS)

Three parallel hierarchical models were conducted to assess the association between occupational balance and mental health (Table 4). Effect sizes were consistently larger than for PCS.

In Model 1, OA showed a strong negative association with mental health (β = − 0.626, p < .001), explaining 39.1% of the variance (R^2 = .391). In Model 2, adding caregiver age and care-recipient gender improved model fit (ΔR^2 = .030, p = .035; R^2 = .421). OA remained a strong predictor (β = − 0.623, p < .001), and caring for a female recipient was associated with better mental health (β = 0.172, p = .010). In Model 3, contextual factors increased the total explained variance to 45.0% (ΔR^2 = .029, p = .240). OA remained the dominant predictor (β = − 0.571, p < .001), and higher care-recipient age was associated with lower caregiver mental health-related quality of life (MCS) (β = − 0.161, p = .038).

In Model 1, OC predicted poorer mental health (β = − 0.508, p < .001; R^2 = .258). In Model 2, OC remained significant (β = − 0.495, p < .001) and the model approached significance (ΔR^2 = .031, p = .056), with care-recipient female gender again predicting higher MCS (β = 0.146, p = .048). In Model 3, contextual factors significantly improved the model (ΔR^2 = .063, p = .034; R^2 = .352). OC remained significant (β = − 0.376, p < .001). Additional predictors included caregiver age (β = 0.186, p = .024), care-recipient gender (β = 0.183, p = .019), and caregiver burden (β = − 0.211, p = .010). Cohabitation showed a trend toward significance (β = 0.163, p = .054).

In Model 1, OR was significantly associated with poorer MCS (β = − 0.366, p < .001; R^2 = .134). In Model 2, the model approached significance (ΔR^2 = .035, p = .065); OR remained significant (β = − 0.352, p < .001). In Model 3, contextual factors substantially improved model fit (ΔR^2 = .117, p = .001; R^2 = .286). OR remained significant (β = − 0.218, p = .009). Positive predictors included caregiver age (β = 0.199, p = .021), care-recipient gender (β = 0.206, p = .011), and cohabitation (β = 0.189, p = .033). Caregiver burden was again associated with poorer MCS (β = − 0.308, p < .001).

Across all models, OA showed the strongest and most stable association with mental health (Model 3 R^2 = .450). OC and OR also remained significant predictors after full adjustment. Caring for a female recipient and living with the care recipient were associated with better mental health, whereas greater caregiver burden and older care-recipient age were consistently linked to poorer MCS. All findings are detailed in Table 4, with model-fit indices shown in Table 5.

Model Diagnostics and Fit

Model fit indices are summarized in Table 5. For physical health (PCS), the proportion of variance explained (R^2) increased across models, reaching approximately .15–.17 for OA and OC, and .12 for OR in the fully adjusted models. For mental health (MCS), explained variance was higher overall, increasing to .45 (OA), .35 (OC), and .29 (OR). The three OBI-Care subscales were moderately to strongly intercorrelated (r = .576–.800). However, when entered separately, all regression models showed low multicollinearity (variance inflation factors [VIFs] ≈ 1.0–1.6). An exploratory model including all three subscales simultaneously resulted in higher collinearity (VIFs up to 3.44), supporting the decision to analyze subscales in separate models. Visual inspection of residual plots indicated no major violations of regression assumptions (linearity, normality, homoscedasticity). A small number of cases in the MCS models showed moderately elevated standardized residuals (slightly exceeding ± 3), but influence diagnostics (Cook's distance ≤ .13; leverage < .24) suggested these observations did not unduly affect the results. Excluding these cases did not change the overall findings.

Table 3
Hierarchical regressions predicting SF-12 Physical Health (PCS) from OBI-Care subscales, controls and caregiving context (N = 138)

Predictor	Model 1 β	Model 1 p	Model 2 β	Model 2 p	Model 3 β	Model 3 p
OBI-Care OA	−.278***	< .001	−.312***	< .001	−.258*	.014
OBI-Care OC	−.321***	< .001	−.335***	< .001	−.299**	.002
OBI-Care OR	−.172*	.043	−.186*	.028	−.132	.152
Care recipient gender			−.118	.147	−.097	.269
Age of caregiver			−.182*	.028	−.199*	.039
Cohabitation (same household)					.030	.754
Positive Caregiving Experience					−.073	.390
Caring for multiple persons					−.005	.955
Caregiver Burden					−.100	.311
Care recipient age					.093	.332

Notes: PCS = Physical Component Summary of the 12-Item Short Form Health Survey (SF-12), with higher scores indicating better physical health. OBI-Care = Occupational Balance in Informal Caregivers questionnaire (Dür, et al, 2021), assessing perceived restrictions in occupational balance across Occupational Areas (OA), Occupational Characteristics (OC), and Occupational Resilience (OR), with higher scores indicating lower occupational balance. β = standardized coefficient. Each OBI-Care subscale (OA, OC, OR) was analyzed in a separate hierarchical regression model; reported covariate effects correspond to the model including the respective subscale. Negative β values for OBI-Care indicate poorer physical health (lower PCS). *** p < .001; ** p < .01; * p < .05.

Table 4
Hierarchical regressions predicting SF-12 Mental Health (MCS) from OBI-Care subscales, controls and caregiving context (N = 138)

Predictor	Model 1 β	Model 1 p	Model 2 β	Model 2 p	Model 3 β	Model 3 p
OBI-Care OA	−0.626***	< .001	−0.623***	< .001	−0.571***	< .001
OBI-Care OC	−0.508***	< .001	−0.495***	< .001	−0.376***	< .001
OBI-Care OR	−0.366***	< .001	−0.352***	< .001	−0.218**	.009
Care recipient gender			0.172**	.010	0.178*	.013
Age of caregiver			0.007	.916	0.101	.191
Cohabitation (same household)					0.108	.166
Positive Caregiving Experience					−0.040	.562
Caring for multiple persons					−0.033	.634
Caregiver Burden					−0.082	.305
Care recipient age					−0.161*	.038

Notes: MCS = Mental Component Summary of the 12-Item Short Form Health Survey (SF-12), with higher scores indicating better mental health. OBI-Care = Occupational Balance in Informal Caregivers questionnaire (Dür et al., 2021), assessing perceived restrictions in occupational balance across Occupational Areas (OA), Occupational Characteristics (OC), and Occupational Resilience (OR), with higher scores indicating lower occupational balance. β = standardized coefficient. Each OBI-Care subscale (OA, OC, OR) was analyzed in a separate hierarchical regression model; reported covariate effects correspond to the model including the respective subscale. Negative β values for OBI-Care indicate poorer mental health (lower MCS). Positive β values for care recipient gender indicate higher MCS when the care recipient is female (coding: 1 = female). *** p < .001; ** p < .01; * p < .05.

Table 5
Model-fit summary (R^2 and R^2) for hierarchical regressions

Δ				
Outcome	**Subscale**	**Model 1 R^2**	**Model 2 R^2 (ΔR^2)**	**Model 3 R^2 (ΔR^2)**
PCS	OA	.077	.126 (.048)	.146 (.020)
PCS	OC	.103	.143 (.041)	.171 (.027)
PCS	OR	.030	.066 (.036)	.119 (.053)
MCS	OA	.391	.421 (.030)	.450 (.029)
MCS	OC	.258	.289 (.031)	.352 (.063)
MCS	OR	.134	.169 (.035)	.286 (.117)

Notes: PCS = Physical Component Summary and MCS = Mental Component Summary of the 12-Item Short Form Health Survey (SF-12), with higher scores indicating better health. OBI-Care = Occupational Balance in Informal Caregivers questionnaire (Dür, et al, 2021), assessing perceived restrictions in occupational balance across Occupational Areas (OA), Occupational Characteristics (OC), and Occupational Resilience (OR), with higher scores indicating lower occupational balance. Each subscale was analyzed in a separate hierarchical regression model. Model 1 = OBI-Care subscale; Model 2 = + caregiver age and care recipient gender; Model 3 = + cohabitation, multiple caregiving, caregiver burden, positive caregiving experience, and care recipient age. ΔR^2 reflects the additional variance explained by each successive block.

Moderation Analyses Predicting Health-Related Quality of Life

Conditional main effects from the PROCESS models (evaluated at the mean of the moderator) mirrored the hierarchical OLS results in direction and significance; differences in coefficients reflect unstandardized scaling, centering, and inclusion of the interaction (see Table 6).

To examine whether positive caregiving experience moderated the association between occupational balance and HRQoL, six moderation models (PROCESS Model 1) were estimated. Each OBI-Care subscale (OA, OC, OR) was tested as a predictor of physical health (PCS) and mental health (MCS), with positive caregiving experience (PosCareExp) included as the moderator. All continuous variables were mean-centered, all analyses included the prespecified covariates, and listwise deletion yielded a final sample of N = 138.

As for physical health, a significant OC × PosCareExp interaction (b = − 0.64, p = .013) indicated an exacerbation effect. At higher levels of positive caregiving experience, the negative association between lower occupational balance (OC) and physical health became stronger. Johnson–Neyman output showed that the effect of OC on PCS became statistically significant once centered PosCareExp ≥ − 1.83, corresponding to raw PosCareExp ≥ ~ 3.12. No evidence of moderation emerged for OA (p = .107) or OR (p = .265), indicating that their associations with PCS did not vary across levels of positive caregiving experience.

As for mental health, a significant OC × PosCareExp interaction also emerged (b = + 0.57, p = .025), but in the opposite direction, indicating a buffering effect. Here, the negative association between lower occupational balance (OC) and mental health weakened as positive caregiving experience increased and became non-significant at very high levels of PosCareExp. Johnson–Neyman analysis confirmed that OC significantly predicted MCS only when centered PosCareExp ≤ 2.83 (raw ≤ ~ 7.78). For OR, a similar positive moderation trend was observed (b = + 0.49, p = .083), but this interaction did not reach statistical significance. OA again showed no moderation (b = − 0.07, p = .763). These results suggest that positive caregiving experience may act as a supportive resource for mental well-being, while paradoxically amplifying vulnerability in the physical health domain when occupational imbalance in task characteristics is high. Model R^2 and ΔR^2 for the moderation models are reported in Table 6

Table 6
Moderation of the Association Between Occupational Balance and HRQoL by Positive Caregiving Experience (N = 138)

HRQoL Outcome	OBI-Care Sub-scale (X)	R^2	Main Effect of X (b, SE, p)	X × W Interaction (b, SE, p)	Simple Slope at Low W (− 1 SD)	Simple Slope at Mean W	Simple Slope at High W (+ 1 SD)	Johnson–Neyman Region (Centered W)
PCS	OA	.163	−2.73 (1.01), .008	−0.43 (0.26), .107	—	—	—	n/a (no interaction)
	OC	.210	−3.10 (0.90), .001	−0.64 (0.25), .013	−1.20 (.286)	−3.10 (.001)	−5.00 (< .001)	Significant for W ≥ − 1.83
	OR	.127	−1.24 (0.91), .176	−0.31 (0.28), .265	—	—	—	n/a (no interaction)
MCS	OA	.451	−6.27 (0.92), < .001	−0.07 (0.24), .763	−6.27 (< .001)	−6.27 (< .001)	−6.27 (< .001)	n/a (no interaction)
	OC	.377	−3.97 (0.89), < .001	+ 0.57 (0.25), .025	−5.66 (< .001)	−3.97 (< .001)	−2.27 (.064)	Significant for W ≤ 2.83
	OR	.303	−2.55 (0.92), .006	+ 0.49 (0.28), .083	−3.99 (.002)	−2.55 (.006)	−1.11 (.353)	Significant for W ≤ 1.32

Notes: PCS = Physical Component Summary and MCS = Mental Component Summary of the 12-Item Short Form Health Survey (SF-12), with higher scores indicating better health. OBI-Care = Occupational Balance in Informal Caregivers questionnaire (Dür, et al, 2021), assessing perceived restrictions in occupational balance across Occupational Areas (OA), Occupational Characteristics (OC), and Occupational Resilience (OR), with higher scores indicating lower occupational balance. Coefficients are unstandardized (b) from PROCESS Model 1 (OLS). X = OBI-Care subscale; W = positive caregiving experience (PosCareExp). Continuous predictors were mean-centered prior to forming interaction terms. R^2 values refer to the full model including covariates (caregiver age, care recipient gender, care recipient age, cohabitation, multiple caregiving, and caregiver burden). Negative b values for OBI-Care indicate poorer HRQoL (lower PCS or MCS). Simple slopes represent the effect of X on the outcome at W = − 1 SD (low), W = mean, and W = + 1 SD (high). For non-significant interactions, simple slopes are shown for completeness but should be interpreted as consistent with the main effect. Johnson–Neyman (J–N) regions are reported in centered W units; to obtain raw values, add the sample mean of positive caregiving experience (4.96).

Discussion

This study provides novel evidence on the role of occupational balance in shaping health-related quality of life (HRQoL) among informal caregivers of people after stroke, using the caregiver-specific OBI-Care questionnaire. To our knowledge, this is among the first studies to examine domain-specific associations of occupational balance with both physical and mental health while simultaneously

accounting for caregiving context and positive caregiving experiences. Using hierarchical regression analyses, we demonstrate that lower occupational balance is consistently associated with poorer HRQoL beyond demographic and caregiving-related factors. In addition, the findings highlight a nuanced, domain-specific moderating role of positive caregiving experience, revealing its dual function as both a protective and, in certain contexts, amplifying factor for caregiver health.

Greater restrictions in occupational balance were robustly associated with poorer HRQoL, with the strongest and most consistent effects observed for mental health. Reduced breadth and diversity of life domains, captured by the Occupational Areas (OA) subscale, emerged as the dominant predictor of the SF-12 Mental Component Summary (MCS) across all models. Occupational Characteristics (OC) and Occupational Resilience (OR) were also independently associated with mental health, albeit with smaller effect sizes.

For physical health, OA and OC retained significant associations with the Physical Component Summary (PCS) in fully adjusted models, whereas OR did not. These findings underscore a differential pattern: constraints in life domains and adverse task characteristics relate to both physical and mental health, while resilience-related adaptability appears primarily relevant for psychological outcomes.

A further novel contribution concerns moderation by positive caregiving experience. Positive experience moderated only OC, and effects were domain-specific. Higher positive caregiving experience buffered the negative association between OC imbalance and mental health, rendering this association non-significant at high levels of positive appraisal. Conversely, the same positive experience exacerbated the negative association between OC imbalance and physical health. No moderation effects emerged for OA, and only a positive trend was observed for OR in relation to MCS.

Interpretation in the current body of knowledge

These findings extend a growing body of evidence linking occupational balance to health and well-being across populations, including working adults, older people, and clinical samples (e.g., 19–21, 25, 51). Consistent with this literature, lower levels of occupational balance were associated with poorer HRQoL, particularly in the mental health domain. Our results add nuance by demonstrating that, within stroke caregiving, lower occupational balance in the breadth and mix of occupational domains (OA) shows the strongest and most stable relationship with psychological well-being.

Within caregiving research specifically, constrained social participation, reduced leisure engagement, and disrupted self-care have repeatedly been identified as central contributors to informal caregiver distress and diminished quality of life (26, 52, 53). The present findings extend this work by showing that these associations persist even when caregiver burden and caregiving context are statistically controlled, underscoring restricted occupational balance as a distinct correlate of mental health rather than merely a proxy for burden.

The weaker and context-sensitive role of Occupational Resilience (OR) for physical health, contrasted with its persistence for mental health, mirrors mixed evidence regarding the health effects of adaptability and flexibility in informal caregiving. Previous studies consistently suggest that adaptive capacity is particularly relevant for psychological coping, stress regulation, and meaning-making (50, 54, 55). In contrast, associations with physical health outcomes appear less consistent and more context-dependent. While some reviews report beneficial effects of resilience on physical health and even survival (e.g., 56), these findings often draw on heterogeneous caregiving populations and broad or composite health outcomes and do not specifically isolate the cumulative physical demands of daily caregiving tasks. Other caregiving-focused reviews suggest that adaptive coping is more reliably linked to psychological adjustment than to physical health, which may be driven by long-term physiological load, sustained effort, and limited recovery opportunities (57). Accordingly, flexible routines and problem-solving may help informal caregivers manage emotional demands but are unlikely to fully counteract the cumulative physiological effects of sustained physical effort, time pressure, and reduced recovery.

A key contribution of this study is the identification of domain-specific moderation by positive caregiving experience. Prior research has linked positive aspects of caregiving to better mental health, greater self-efficacy, and higher life satisfaction (31, 35, 58). Our findings refine this literature by showing that positive appraisals primarily modify the impact of the qualitative characteristics of occupations (OC) and that these effects diverge for mental versus physical health. To our knowledge, this asymmetric pattern has rarely been demonstrated empirically in caregiver research.

Potential Mechanisms

Several mechanisms may help explain these findings in the specific context of informal caregiving after stroke. First, the strong association between the restricted occupational with regard to OA and mental health likely reflects a progressive narrowing of meaningful roles, sources of reward, and social connection following stroke onset. As caregiving demands increase, informal caregivers of persons after stroke often reduce or abandon leisure, social participation, and self-care to accommodate ongoing care needs (e.g., 59). This reduced participation across life domains limits opportunities for emotional recovery, identity affirmation, and social support, while increasing feelings of role captivity (60) - mechanisms that are central to stress-process models of caregiving (32) and to occupation-based frameworks emphasizing the role of occupational participation and role balance in psychological well-being (61).

Second, reduced balance in OC plausibly affects both physical and mental health because the qualitative demands of post-stroke caregiving tasks - such as assisting with mobility and transfers, managing personal care, coordinating appointments, and responding to fluctuating impairments - are often physically effortful, time-pressured, unpredictable, and associated with low perceived control. These adverse task qualities simultaneously tax physiological systems (e.g., fatigue, musculoskeletal strain, sleep disruption) and cognitive–emotional systems (e.g., perceived loss of control, sustained stress), resulting in a dual health burden. This pattern is consistent with occupational health and caregiving

research linking demanding care tasks to both somatic complaints and psychological distress (45, 48, 53).

Third, the divergent moderation effects of positive caregiving experience on OC outcomes suggest a trade-off mechanism that is particularly salient in post-stroke caregiving. High levels of meaning, closeness, or fulfillment may support cognitive reappraisal, emotional regulation, and sustained engagement in informal caregiving, thereby buffering the mental health impact of demanding task characteristics. At the same time, in the context of physically intensive stroke care, strong positive appraisals may be accompanied by overcommitment, reduced boundary setting, and “willing overexertion”, whereby informal caregivers persist with physically demanding tasks despite fatigue or pain. This pattern may increase physical strain and limit opportunities for recovery. Such dynamics are consistent with the effort–recovery model, which posits that sustained demands without adequate recovery lead to cumulative physiological strain (Meijman & Mulder, 1998), and with overcommitment frameworks in occupational health describing how excessive personal engagement in demanding roles can exacerbate health risks despite perceived meaning or reward (62, 63). From an occupational science perspective, similar relations are described in models of occupational balance and occupational identity, which emphasize that highly meaningful but dominant occupations - such as intensive caregiving after stroke - may undermine health when demands systematically outweigh opportunities for rest and restoration (64).

Alternative explanations should nevertheless be considered. The observed asymmetry may partially reflect residual confounding by caregivers’ pre-existing physical comorbidities or functional limitations, (unmeasured) caregiving intensity (e.g., hours of hands-on care or transfer load), or differential reporting tendencies, such as social desirability inflating positive appraisals while physical symptoms are underreported (65, 66). Domain-specific sensitivity of the SF-12, nonlinear or threshold effects at higher levels of positive experience, and selection processes related to online recruitment of help-seeking caregivers may also have contributed. Reverse causation cannot be ruled out, whereby better mental health fosters more positive caregiving appraisals, while poorer physical health coincides with greater task imbalance. Future longitudinal research using cross-lagged or within-person designs, incorporating objective workload indicators and physical health measures, testing nonlinear moderation, and triangulating self-report with ecological or wearable-based data, will be important to confirm the robustness and directionality of these associations.

Finally, the absence of moderation effects for OA and OR suggests that these dimensions primarily reflect structural and contextual features of post-stroke caregiving - such as time scarcity, cohabitation with the stroke survivor, limited availability of respite services, and the need for continuous supervision - that are not readily altered through positive appraisal alone (e.g., 32, 60). While finding meaning in caregiving may attenuate emotional distress, it is unlikely to compensate for insufficient time, limited recovery opportunities, or restricted access to diverse and restorative occupations. Consequently, OA and OR appear to capture constraints that are more closely tied to caregiving context and service availability than to subjective caregiving appraisals (67, 68).

Clinical and Rehabilitation Implications

These findings have several implications for clinical practice and rehabilitation. Subscale-sensitive screening of occupational balance should be incorporated into caregiver assessments. Lower occupational balance in OA may serve as a practical marker for elevated mental health risk, whereas lower occupational balance in OC may help identify informal caregivers at risk for both psychological and physical health declines. Assessing positive caregiving experience alongside occupational balance may further help differentiate psychological resilience from potential risk for physical overexertion.

Interventions should be tailored to specific dimensions of occupational balance. Building on existing occupational balance interventions (69–71), OA-focused strategies may include facilitating re-engagement in valued leisure, social, and self-care occupations, protecting time for non-care roles, and supporting graded reintroduction of activities. OC-focused interventions should prioritize optimization of task demands through environmental adaptations, assistive devices, skills training, pacing, and micro-recovery strategies. OR-focused approaches may target problem-solving, contingency planning, and flexible routine design.

Importantly, positive caregiving experiences should be leveraged strategically. Enhancing meaning, mastery, and self-efficacy can support mental health, but should be paired with explicit safeguards for physical health, including planned rest, ergonomic optimization, and access to respite services. At a systems level, integrating informal caregiver occupational balance goals into stroke care pathways, expanding access to respite and day services, and strengthening occupational- and physiotherapy-led caregiver training may mitigate both psychological and physical risks.

Methodological Contributions

Methodologically, this study demonstrates the value of subscale-specific modeling of occupational balance. Distinct associations with PCS and MCS support the use of a caregiver-specific instrument and justify examining Occupational Areas, Occupational Characteristics, and Occupational Resilience separately. The hierarchical modeling approach isolated the contribution of occupational imbalance beyond demographic factors, caregiving context, and perceived burden, while moderation analyses clarified when and for whom occupational imbalance is most detrimental.

Strengths and Limitations

Strengths comprise the use of a population-specific occupational balance measure, prespecified covariate adjustment, and moderation analyses revealing construct- and domain-specific effects. Limitations include the cross-sectional design, which precludes causal inference, and reliance on self-report measures, which may introduce common method bias. The use of single-item ratings for burden and positive caregiving experience may limit construct breadth. The Austrian sample, which was recruited via an online survey, may have systematically excluded less digitally savvy individuals, and together with its predominantly female and cohabiting composition may restrict generalizability. Listwise

deletion reduced the analytic sample and may have introduced selection bias, and multiple comparisons increase Type I error risk, although effect patterns were coherent and mental health effects were moderate to large. Further, we did not collect detailed care recipient clinical data (e.g., stroke severity, functional disability, cognitive status, or comorbidity burden beyond a binary 'additional diagnoses' indicator), which limits clinical characterization and may introduce residual confounding in the observed associations; future studies should include standardized indices (e.g., NIHSS, mRS, Barthel Index, Charlson Comorbidity Index) to better account for care recipient clinical complexity.

Future Research

Future research should employ longitudinal and dyadic designs to examine temporal ordering and reciprocal influences among occupational balance, caregiver burden, positive caregiving experience, and HRQoL. Mechanistic studies should test mediators such as recovery opportunities, sleep quality, social support, and perceived control, and examine moderators including gender, cohabitation, caregiving intensity, and time since stroke. Randomized and hybrid effectiveness–implementation trials are needed to evaluate occupation-based interventions targeting OA and OC, with components that cultivate positive appraisals while explicitly safeguarding against physical overcommitment. Incorporating objective and ecological measures, such as time-use diaries or wearable-based activity and sleep assessments, would further strengthen inference.

Conclusions

Restricted occupational balance is a salient correlate of HRQoL among informal caregivers of people after stroke, with the strongest and most consistent associations observed for mental health, particularly through constraints across life domains. Task-related occupational characteristics are relevant for both physical and mental health, and their impact is conditioned by caregivers' positive appraisals. Positive caregiving experience confers psychological protection but may heighten physical vulnerability when task demands are high. These findings highlight the importance of subscale-sensitive assessment and targeted, occupation-based interventions that expand meaningful participation, optimize task demands, and leverage positive meaning in ways that protect both the mental and physical health of informal

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Committee of Lower Austria (GS1-EK-4/852-2023) on 28 June 2023. All participants received detailed information about the study and the processing of their data prior to accessing the questionnaire. Informed consent was obtained electronically, with participants indicating their agreement by actively commencing the survey. Only anonymised data were collected. All procedures complied with the General Data Protection Regulation (GDPR).

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors’ contributions

HK conceived the study and led the project administration. HK, MD, MS, CL, LB, SL, EH, MF and SG contributed to conceptualization. HK, MF and MD developed the methodology. HK, EH and SL prepared the ethics application. Data collection was carried out by CL, MD, MS, LB, HK, SL and EH. MS curated the data. HK conducted the formal statistical analysis. MS, CL, MD, HK, LB, SL and EH contributed to the investigation. HK drafted the manuscript. All authors (MS, CL, MD, HK, LB, SL, EH, MF and SG) contributed to reviewing and editing the manuscript. MD supervised the study. HK, MD, MF and SG acquired funding.

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