

A predictive model of carer resilience in dementia family caregiving: A structural equation modelling approach

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Abstract

Objectives: This study aimed to investigate the mediating effects of quality of the caregiving relationship and other carer and person with dementia variables in predicting carer resilience over time.

Method: Carers of people with mild and moderate dementia in community settings completed baseline ($n = 176$ dyads) and six-month follow-up assessments ($n = 139$ dyads). Causal mediation analysis was conducted using Pearson Correlation and Structural Equation Modelling (SEM) to examine longitudinal predictors of carer resilience, and the effect of several mediating person with dementia, and carer factors on carer resilience over time.

Results: At 6-month follow-up, higher levels of carer resilience were longitudinally correlated with higher ratings of perceived relationship quality by people with dementia ($r = 0.53$, $p \leq 0.01$), and lower levels of emotional distress symptoms by carer's ($r = -0.59$, $p \leq 0.01$). Mediation analyses showed that people with dementia perspectives of the quality of the caregiving relationship mediated the relationship between carer distress specific to neuropsychiatric symptoms ($\beta = -0.32$, $p \leq 0.001$) and carer resilience ($\beta = 0.53$, $p \leq 0.001$) over time. The final SEM provided a good fit for the data ($X^2 = 0.12$, $p = 0.72$, CFI = 1.00, NFI = 0.99, and Root Mean Square Error of Approximation = 0.001).

Conclusion: Higher ratings of perceived relationship quality by people with dementia, and lower levels of carer emotional distress predicted higher carer resilience at follow-up. People with dementia perspectives of the quality of the caregiving relationship mediated the relationship between carer distress specific to neuropsychiatric symptoms and carer resilience over time. Our findings indicate that interventions aimed at strengthening the caregiving relationship might have a protective long-term effect for carer resilience in dementia caregiving.

KEYWORDS

carer distress specific to neuropsychiatric symptoms, carer resilience, dementia caregiving, people with dementia, quality of the caregiving relationship

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Key points

- Better relationship quality as perceived by people with dementia predicted higher carer resilience over time.
- Higher levels of neuropsychiatric symptoms experienced by people with dementia predicted lower levels of carer resilience over time.
- Carer's who experienced higher emotional distress and distress specific to neuropsychiatric symptoms reported lower levels of resilience over time.
- People with dementia perspectives of the quality of the caregiving relationship mediated the longitudinal relationship between carer distress specific to neuropsychiatric symptoms and carer resilience.

1 | INTRODUCTION

Most people with dementia live in the community supported by family members, who provide many hours of informal care.¹ Given limited societal resources worldwide the amount of formal care is unlikely to increase, therefore the care provided by families will remain the most important source of care for people with dementia.¹ As the condition progresses, people with dementia become more dependent on their carers, which increases levels of carer burden and can negatively influence the caregiving relationship.² Influential theoretical models of dementia caregiving such as the stress process model proposed by Pearlin and colleagues³ posit that a wide range of stressors influence carer outcomes. Primary stressors such as levels of cognitive impairment, functional dependency, and neuropsychiatric symptoms experienced by people with dementia are strong predictors of carer burden over time.⁴ On the other hand, secondary stressors such as role strains are more likely to influence interpersonal factors such as the quality of the caregiving relationship.^{2,5}

1.1 | Carer resilience

In recent years there has been a shift in caregiving research towards exploring protective factors of carers' mental health, such as the use of positive psychological resources.⁶ Growing evidence suggests that positive adaptations assist carers to thrive despite the challenges of providing care.⁷ For example, carers often develop specific coping strategies that enhance their resilience and psychological adjustment to the caregiving role,⁸ indicating that positive adaptations are key in understanding caregiving experiences.⁹ A recent systematic review examining the key factors influencing resilience in dementia caregiving showed that carer resilience is best defined as a dynamic process that allows carers to make positive adaptations and adjustments, thereby reducing the negative effects of adverse situations.¹⁰

Despite however considerable empirical work in the area^{11,12} definitions of resilience can vary widely depending on the different disciplinary perspectives adopted.¹³ Research in the 1980s for example, conceptualised resilience as a relatively stable personality trait ('trait resilience') assessed by self-report questionnaires (e.g.,

RS-25¹⁴) with more recent conceptualisations viewing resilience as an outcome and a process, whereby resilience is best understood as a multi-faceted construct incorporating both psychosocial and physiological responses.^{10,15,16}

Carer resilience therefore often involves the dynamic interaction of multiple protective and risk factors that change over time.¹⁷ Protective factors that may maintain carer resilience include good physical health and access to social support,¹⁰ which may in turn reduce the effect of risk factors such as the presence of cognitive decline, or neuropsychiatric symptoms.^{18,19} Other protective factors include positive interpersonal interactions and mutual understanding in the caregiving relationship which can reduce role strain.²⁰ Understanding therefore which interpersonal factors influence carer resilience over time is key in understanding caregiving experiences and informing the development of future interventions.

The quality of the caregiving relationship is an important interpersonal variable that can affect carer outcomes, by influencing communication and reciprocity in every-day interactions.² The binding ties theory posits that the quality of the caregiving relationship can act as a mediator between cognitive and psychosocial outcomes and carer well-being.²¹ In line with this theory, studies have shown that relationship closeness accounts for most of the variance in the relationship between caregiver burden and carer resilience.^{10,21,22} However, most of the research conducted to date examining the effect of relationship closeness on carer outcomes remains cross-sectional, with currently no studies examining how the caregiving relationship may influence carer resilience over time.^{9,11}

The primary aim of this study therefore was to employ a longitudinal design in order to identify which person with dementia (presence of neuropsychiatric symptoms, and cognitive decline) or carer (emotional distress, physical health) factors predict carer resilience. Our secondary aim was to investigate the effects of the quality of caregiving relationship between person with dementia and carer variables and carer resilience over time. Based on previous research and theory, we hypothesised that both people with dementia and carer factors will be significant predictors of carer resilience over time and that higher perceived relationship quality will be longitudinally correlated with higher levels of carer resilience.

2 | METHOD

2.1 | Study design

The individual Cognitive Stimulation Therapy (iCST) multi-centre trial recruited a total of 360 dyads of people with dementia and their carers via community mental health teams and memory clinics in England and Wales. All care recipients had a diagnosis of mild or moderate dementia with Mini Mental State Examination (MMSE)²³ scores ≥ 10 , based on Diagnostic and Statistical Manual of Mental Health Disorder criteria,²⁴ and lived in their own home.²⁵ A longitudinal causal mediation analysis was conducted using Pearson Correlation at two-time points; baseline and 6-month follow up. We used structural equation modelling (SEM) to examine predictors of carer resilience and the effect of several mediating person with dementia and carer factors on carer resilience over time (6-month follow up). In this longitudinal investigation we only included data of people with dementia and carer's randomised in the treatment as usual (TAU) group to ensure any effects observed were not related to the intervention.

2.2 | Assessment measures

Assessments were conducted at baseline and 6 months.

Outcome measures for people with dementia:

- 1) Cognition measured by the Alzheimer's Disease Assessment Scale – Cognitive Subscale (ADAS-Cog): consisting of 11 tasks assessing memory, language, praxis, attention, and other cognitive abilities. Higher scores indicate greater severity of cognitive function.²⁶ The ADAS-Cog scale showed excellent internal consistency (Cronbach's $\alpha \geq 0.95$).
- 2) Depressive symptoms measured via self-report by the 15-item Geriatric Depression Scale (GDS-15), with higher scores indicating greater severity of depressive symptoms.²⁷ The GDS-15 scale had good internal consistency ($\alpha \geq 0.81$).
- 3) Quality of Life (QoL) measured via self-report by the QoL Alzheimer Disease Scale (QoL-AD): rating a variety of life domains, including the patient's physical health, mood, relationships, activities, and ability to complete tasks.²⁸ The QoL-AD scale had good internal consistency ($\alpha \geq 0.81$).
- 4) Neuropsychiatric symptoms assessed with the Neuropsychiatric Inventory (NPI) measuring 12 behavioural domains, with higher scores indicating greater severity of behavioural symptoms.²⁹ This proxy measure of ratings of NPI demonstrated good internal consistency ($\alpha \geq 0.77$).
- 5) Quality of the caregiving relationship measured via self-report by the Quality of Caregiver–Patient Relationship (QCPR), comprising of two separate sub-scales: warmth and absence of conflict and criticism. Higher scores reflect better quality of the caregiving relationship.³⁰ The QCPR scale showed excellent internal consistency ($\alpha \geq 0.88$).

Outcome measures for carers:

- 1) Emotional distress assessed by the Hospital Anxiety and Depression Scale (HADS) with higher scores indicating greater severity of depression and anxiety symptoms.³¹ The HADS scale showed very strong internal consistency ($\alpha \geq 0.88$).
- 2) Carer distress specific to neuropsychiatric symptoms assessed by the NPI caregiver distress subscale. Higher scores indicate greater levels of distress.²⁹ The carer NPI distress scale had good internal consistency ($\alpha \geq 0.74$).
- 3) Health-related Quality of life and health status measured using the three-level response version of the European Quality of Life-5 Dimensions (EQ-5D) and health status EQ5D Visual analogue Scale (VAS) with higher values indicating better quality of life and health status.³² The EQ-5D scales had good internal consistency ($\alpha \geq 0.72$).
- 4) Resilience assessed by the Resilience Scale-14 (RS-14) with higher scores reflecting higher levels of resilience.³³ The resilience scale showed excellent internal consistency ($\alpha \geq 0.92$).
- 5) Quality of the caregiving relationship measured by the QCPR.³⁰ The QCPR scale showed very strong internal consistency ($\alpha \geq 0.89$).

2.3 | Statistical analysis

Descriptive statistics for person with dementia and carer factors were computed using SPSS v27, and Pearson correlation matrices were used to measure the association between study variables. Person with dementia specific independent variables included cognition (ADAS-Cog), depressive symptoms (GDS-15), neuropsychiatric symptoms (NPI), quality of life (QoL-AD), and ratings of the caregiving relationship quality (QCPR). Carer specific independent variables were emotional distress (HADS), carer distress specific to neuropsychiatric symptoms (NPI), health-related quality of life (EQ-5D), health status (EQ5D-VAS), and ratings of the caregiving relationship (QCPR).

We used structural equation modelling (SEM)³⁴ to test several hypotheses on the factors increasing or decreasing carer resilience over time,^{3,26} and the Analysis of a Moment Structures (AMOS) statistical programme version 22.00 to test for mediation effects between the different study variables and carer resilience. In SEM, hypothesised models are evaluated for goodness of fit, whereby a good model presents with a nonsignificant chi-square. In order to assess the goodness of fit of our models we used the root means square error (RMSEA),^{35,36} with RMSEA ≤ 0.05 referring to a good fit to the model; normal fit index (NFI) ≥ 0.90 and comparative fit index (CFI) ≥ 0.90 .³⁶ We employed comparisons of nested models to achieve a good-fitting model.³⁷ Missing data were imputed only once given the small number of missing values in the baseline dataset. For the 6-month follow up scores, repeated multiple imputations were performed, and results were pooled for each outcome.³⁸

3 | RESULTS

A total of 356 caregiving dyads were recruited and 273 completed the trial at 6-month follow up. A total of 176 people with dementia and their carer's in the TAU group participated in this study at baseline, with 139 dyads completing the 6-month follow up. Mean age for care recipients was 78.02 (SD = 7.70), of which 82/176 (46%) were female. Mean age of carer's was 65.52 (SD = 13.18), with the majority being female (126/176; 72%). People with dementia had a mean MMSE score of 21.33 (SD = 4.12) at baseline, with the most common diagnosis being that of Alzheimer's Disease (AD) (64%), followed by vascular dementia (11%). Descriptive statistics of the sample are presented in Table 1.

3.1 | Correlations between carer resilience, person with dementia and carer variables

3.1.1 | Baseline

At baseline, there were no significant correlations between carer resilience and either care recipient age ($t = 1.15, p \leq 0.25$), carer age ($t = 0.46, p \leq 0.65$), person with dementia gender or carer gender ($t = 0.32, p \leq 0.75$; $t = -0.26, p = \leq 0.78$). A statistically significant positive correlations were found between carer resilience and the quality of the caregiving relationship from people with dementia perspectives (QCPR, $r = 0.41, p \leq 0.01$) and people with dementia QoL (QoL-AD $r = 0.15, p \leq 0.05$). Higher levels of depressive symptoms in people with dementia were correlated with lower carer resilience (GDS $r = -0.17, p \leq 0.05$). We found no significant correlations between carer resilience and people

with dementia cognition levels and neuropsychiatric symptoms (Table 2).

Higher levels of carer resilience however were correlated with lower carer emotional distress (HADS; $r = -0.46, p \leq 0.01$), and higher ratings of carer health-related QoL and overall health status (EQ5D; $r = 0.23, p \leq 0.01$ and EQ5D VAS $r = 0.25, p \leq 0.01$). There were no correlations between carer resilience and carer distress specific to neuropsychiatric symptoms and the quality of the caregiving relationship from carers perspectives (Table 3).

3.1.2 | 6-month follow-up

At 6-month follow-up higher levels of carer resilience were longitudinally correlated with higher ratings of perceived relationship quality by people with dementia (QCPR; $r = 0.53, p \leq 0.01$). Higher levels of neuropsychiatric symptoms (NPI symptoms $r = -0.20, p \leq 0.05$) and depressive symptoms (GDS15 $r = -0.20, p \leq 0.05$) experienced by people with dementia were correlated with lower levels of carer resilience. Higher ratings of QoL were correlated with higher carer resilience (QoL-AD $r = 0.14, p = \leq 0.05$). No significant correlation was found between carer resilience and people with dementia cognition (Table 2).

Carer perspectives of better relationship quality predicted higher carer resilience over time (QCPR $r = 0.20, p = \leq 0.01$). Similarly to baseline data higher carer resilience was significantly correlated with better health-related quality of life and overall health status in carers (EQ5D $r = 0.21, p \leq 0.01$ and EQ5D VAS $r = 0.20, p \leq 0.01$). Lower levels of carer resilience were correlated with higher emotional distress (HADS total, $r = -0.59, p \leq 0.01$), and higher carer distress specific to neuropsychiatric symptoms (NPI-distress, $r = -0.20, p = 0.01$) (Table 3).

Characteristic	People with dementia Mean [SD] Total n/N (%)	Carers Mean [SD] Total n/N (%)
Age	78.02 [7.70]	65.52 [13.18]
Gender		
Female	82/176 (46)	126/176 (72)
Male	94/176 (54)	50/176 (28)
Ethnicity		
White	167/176 (95)	165/176 (94)
Marital status		
Married/cohabiting/civil partnership	127/176 (72)	148/176 (84)
Living situation		
Living with spouse/partner and other family/other	127/176 (72)	143/176 (81)
Highest level of education		
School leaver (14-18 years of age)	110/176 (62.5)	103/176 (59)
Mini Mental State Examination	21.33 [4.12]	

TABLE 1 Baseline characteristics of people with dementia and their carers.

Abbreviations: (%), percentage; .n/N, numbers/Number; SD, standard deviation.

TABLE 2 Correlations of carer resilience and people with dementia cognitive and psychosocial variables at baseline and 6-month follow up.

People with dementia measures	Baseline		6-month follow up	
	<i>r</i>	Mean (SD)	<i>r</i>	Mean (SD)
RS-14	1.00	83.63 (10.4)	1.00	81.83 (12.90)
QoL-AD	0.15*	37.96 (6.04)	0.14*	37.71 (5.91)
ADAS-Cog	-0.08	19.79 (8.03)	-0.02	20.39 (9.91)
NPI symptoms	-0.09	10.99 (11.98)	-0.20**	11.59 (12.80)
GDS-15	-0.17*	3.16 (3.15)	-0.20**	2.85 (2.67)
QCPR	0.41**	56.72 (8.73)	0.53**	55.55 (10.25)

Abbreviations: ADAS-Cog, Alzheimer's Disease Assessment Scale - Cognitive Subscale; GDS-15, Geriatric Depression Scale-15; NPI, Neuropsychiatric Inventory symptoms; QCPR, Quality of Caregiver-Patient Relationship; QoL-AD, Quality of Life in Alzheimer's Disease Scale; *r*, correlation; RS-14, Resilience Scale-14; SD, standard deviation.

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

TABLE 3 Correlations of carer resilience and carer psychosocial variables at baseline and 6-month follow up.

Carer measures	Baseline		6-month follow up	
	<i>r</i>	Mean (SD)	<i>r</i>	Mean (SD)
RS-14	1.00	83.63 (10.40)	1.00	81.83 (12.90)
EQ5D	0.23**	0.81 (0.21)	0.21**	0.75 (0.25)
Health Status EQ5D VAS	0.25**	76.24 (19.28)	0.20**	76.58 (16.40)
HADS emotional distress	-0.46**	10.02 (6.67)	-0.59**	11.16 (7.59)
NPI carer distress	-0.04	3.23 (2.59)	-0.20**	3.25 (2.41)
QCPR	0.11	58.21 (6.63)	0.20**	57.76 (6.77)

Abbreviations: EQ-5D, European Quality of Life 5 Dimensions; Health Status EQ5D VAS, EQ5D Visual analogue Scale; HADS, Hospital Anxiety and Depression Scale Emotional distress; NPI, Neuropsychiatric Inventory carer distress; QCPR, Quality of Caregiver-Patient Relationship; RS-14, Resilience Scale-14; *r*, correlation; SD, standard deviation.

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

3.2 | Structural equation modelling

SEM was conducted using the 6-month follow-up data which included a pathway of Model A comprising behaviour neuropsychiatric symptoms (NPI) experienced by people with dementia and their depressive symptoms (GDS-15) as the independent variable. Person with dementia and carer perspectives of the quality of caregiving relationship as mediators, and carer resilience as the dependent variable. Ratings of cognition (ADAS-cog) for people with dementia and QoL-AD were excluded from this model, as these variables were not significantly correlated with carer resilience or $r \leq \pm 0.20$. Analyses showed that Model A demonstrated a poor fit for the data with $X^2 = 15.22$, degrees of freedom (DoF) = 3 $p = 0.002$, NFI = 0.87, CFI = 0.88 and RMSEA = 0.17 (Figure 1).

Model B included carer health-related quality of life (EQ5D), carer health status (EQ-5D-VAS), carer emotional distress (HADS), and carer distress specific to neuropsychiatric symptoms (NPI) as independent variables, person with dementia and carer perspectives

of the quality of the caregiving relationship as mediators, and carer resilience as the dependent variable. Similarly, to Model A, Model B also showed a poor fit for the data with $X^2 = 40.01$, DoF = 5 $p = 0.001$, CFI = 0.87 and NFI = 0.87, and RMSEA = 0.23 (Figure 2).

Therefore, model C was developed by using a comparison of nested models by removing non-significant variables after model A was nested with model B to achieve a good fit for the final model. The 'reduced model' C showed that ratings of perceived relationship quality by the person with dementia mediated the relationship between carer distress specific to neuropsychiatric symptoms (NPI) and carer resilience, resulting in a good fit for the data with $X^2 = 0.13$, DoF = 1, $p = 0.72$, CFI = 0.99 NFI = 1.00, and RMSEA = 0.001. At 6-month follow up, person with dementia perspectives of the quality of the caregiving relationship had a direct effect on carer resilience ($\beta = 0.53$, $p \leq 0.001$) and appeared to mediate the effect of carer distress specific to neuropsychiatric symptoms on carer resilience ($\beta = -0.32$, $p \leq 0.001$). (Figure 3).

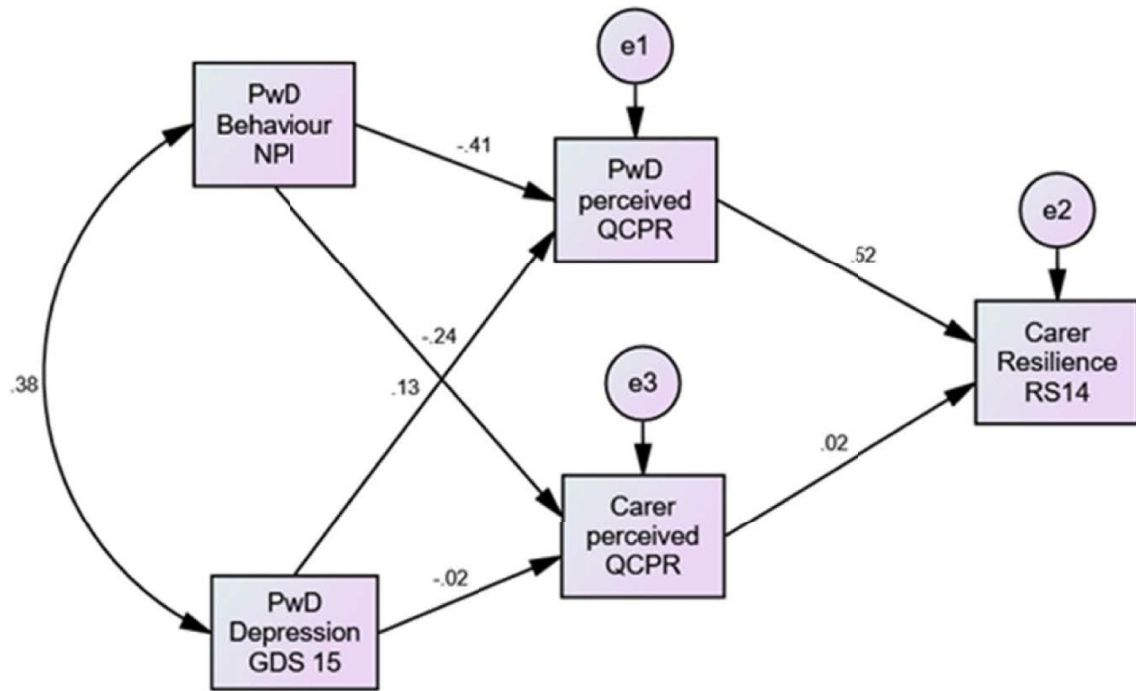


FIGURE 1 Carer resilience and people with dementia variables at 6-month follow up (Model A). Chi-square $\chi^2=15.22$, DoF=3, $p=0.002$. NFI=0.87, CFI=0.88, RMSEA=0.17.

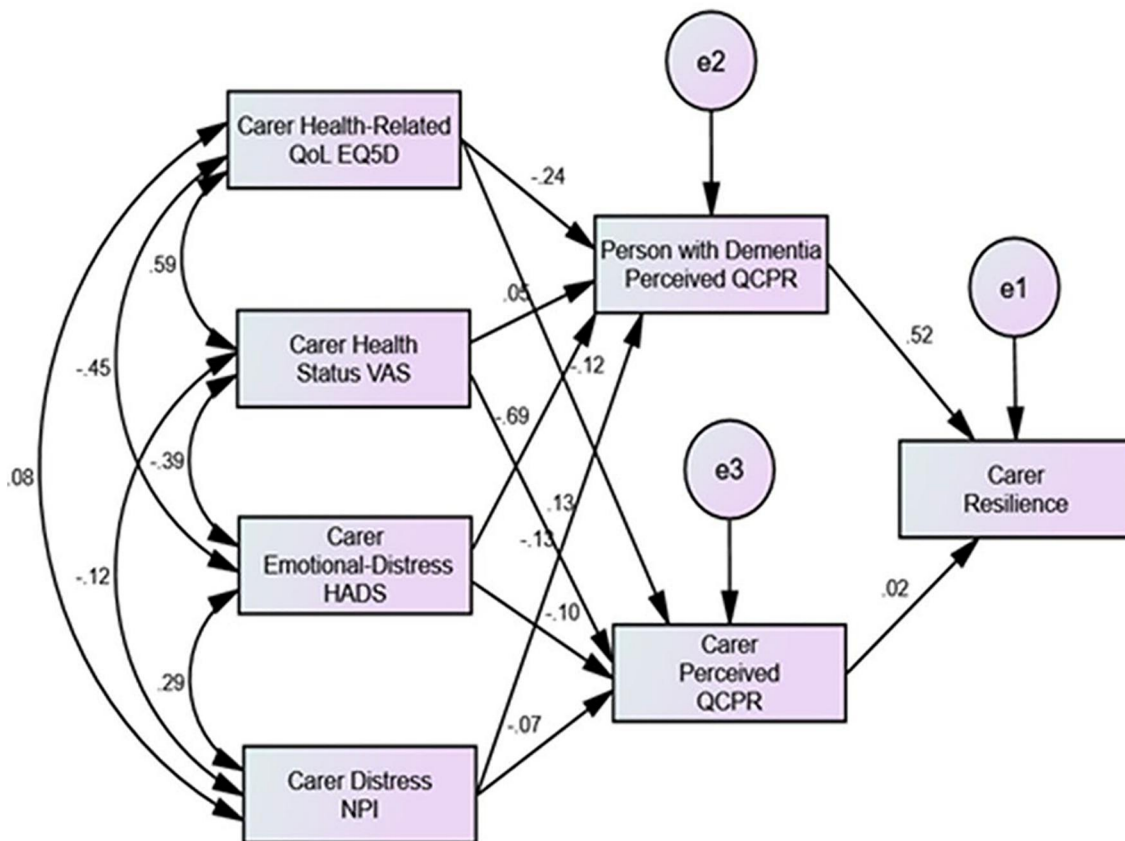


FIGURE 2 Carer resilience and carer variables at 6-month follow up (Model B). $\chi^2 = 40.01$, DoF = 5, $p = 0.001$. NFI = 0.87, CFI = 0.87, RMSEA = 0.23.

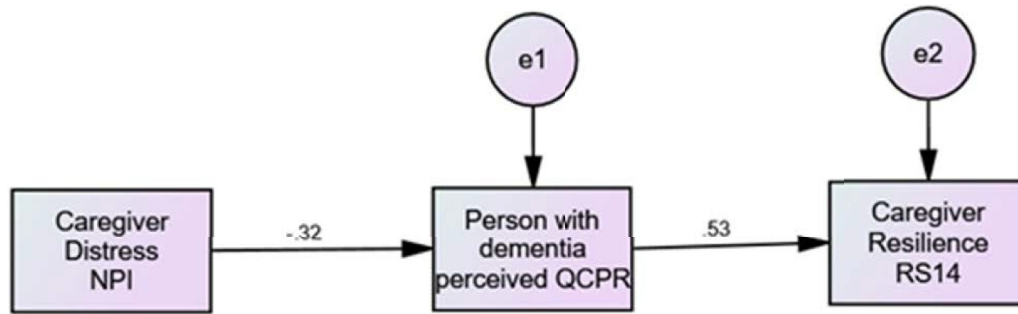


FIGURE 3 Carer resilience and people with dementia and carer variables at 6-month follow up (Model C). $X^2 = 0.13$, DoF = 1, $p = 0.72$. CFI = 1.00, NFI = 0.99, RMSEA = 0.001.

4 | DISCUSSION

The current study is one of the few longitudinal studies investigating the relationship between carer resilience and the influence of specific person with dementia and carer factors over time. Our results showed that carer resilience is longitudinally correlated with better person with dementia and carer outcomes, building further on its positive role in the context of dementia caregiving.³ Higher levels of carer resilience were longitudinally correlated with lower levels of neuropsychiatric symptoms experienced by people with dementia and higher ratings of their perspectives of the quality of the caregiving relationship. These findings indicate that carer resilience was influenced by people with dementia psychosocial variables.¹⁹ A similar pattern of results was also observed for carer outcomes whereby higher resilience reported by carers was predictive of better health overall, and lower levels of emotional distress. These findings therefore collectively highlight the important protective role of carer resilience for both person with dementia and carer outcomes. Results have also contributed towards our understanding of the effects of specific person with dementia and carer factors on carer resilience over time.

An original finding of our study was that ratings of perceived quality of the caregiving relationship by people with dementia had a direct longitudinal effect on carer resilience. Our results therefore suggest that the development of carer resilience interventions may play an important role in strengthening the caregiving relationship by fostering for example, supportive relationships.¹⁹ Understanding further how people with dementia perspectives of relationship quality influences carer resilience would help facilitate the development of more targeted interventions. A further important contribution of our study is the finding that as dementia progressed over 6 months, the correlations between person with dementia and carer perspectives of the quality of the caregiving relationship and carer resilience were strengthened, demonstrating that study design influences the relationship between carer resilience and person with dementia and carer outcomes.

Consistent with existing theories of dementia caregiving, neuropsychiatric symptoms, and carer distress specific to these symptoms lowered carer resilience over time. These findings are consistent with previous studies showing that carers who generally

experience higher emotional distress associated with caregiving report lower levels of resilience.¹⁹ An important implication of our findings is that supporting carers to manage these stressful symptoms, is likely to assist them with developing more resilient coping skills which may decrease or prevent adverse outcomes long-term.

Age, gender, and cognition were not longitudinally correlated with carer resilience and, contrary to our hypothesis, carer perspectives of the caregiving relationship did not influence carer resilience over time in our final model. This may be partly explained by an already strained caregiving relationship as the condition progresses which may directly impact on relationship closeness and relationship reciprocity for carers. For example, in the context of lack of reciprocity, carers often seek support and closeness from other sources, such as family members, friends, and their wider social support network.^{39,40}

Our final full mediation model demonstrated a one direction path whereby carer distress specific to neuropsychiatric symptoms indirectly influenced carer resilience through ratings of relationship quality by the person with dementia. This finding has important clinical implications as it suggests that direct support with dealing with distressing neuropsychiatric symptoms and supporting carers and people with dementia to maintain a caring and positive relationship in the context of distressing situations can maintain carer resilience over time.

Our observed interdependencies between carer distress specific to neuropsychiatric symptoms and person with dementia ratings of perceived relationship quality suggest that carer's reporting high levels of distress specific to neuropsychiatric symptoms in the context of low levels of relationship closeness may benefit from interventions strengthening interpersonal skills and reducing behavioural and psychological symptoms.⁴⁰ Our results, therefore, can inform the development of future interventions aimed at enhancing interpersonal variables such as communication and reciprocity within the context of the caregiving relationship.

5 | STRENGTHS AND LIMITATIONS

To the best of our knowledge, this study is the first longitudinal study to investigate direct and indirect effects of several person with dementia and carer factors including relationship closeness on carer

resilience over time. Our study is novel in highlighting the important role of the perspectives of people with dementia on relationship quality. Investing in interventions that maximise and strengthen the caregiving relationship may protect carers' psychological health long-term.²¹ Using a longitudinal design enabled us to measure changes in both person with dementia and carer variables over time. Similarly, the use of SEM allowed us to test for several hypotheses and relationships amongst several variables simultaneously.

Despite these significant strengths however, our study has several limitations. Although our sample is broadly representative of people living with mild and moderate dementia in community settings, it was relatively small, and our findings may not apply to people with advanced dementia and those living in long-term care. Ethnicity and culture can have a great impact on carers' strain and resilience¹⁰; this means that our study is limited in terms of generalising results across all cultures and ethnicities, as 95% of our sample was white. The 6-month follow up of our study may not have been long enough to detect significant changes of progression of dementia over time which may have influenced both person with dementia and carer variables. Future large scale prospective studies on carer resilience are therefore needed with larger samples that would allow further testing of our results. Resilience is a dynamic process which fluctuates as people respond and adapt to a variety of adverse events overtime. This means that the scale used in our study may have not captured the considerable physical, psychological, and wider social changes which are likely to influence carer resilience over time.¹⁰ Future research should examine the effects of social support, coping, and mastery and how these may influence ratings of carer resilience over time.

6 | CLINICAL IMPLICATIONS AND FUTURE RESEARCH

From a clinical perspective, our study shows that interventions that foster positive perspectives of the quality of the caregiving relationship are likely to protect carer resilience long-term. Therefore, interventions specifically designed to enhance the quality of the caregiving relationship from the perspectives of people with dementia may be key in reducing carer distress and improving carer resilience. Theoretically, our results show that carer resilience is a highly complex construct with several different factors influencing levels of resilience over time. Future research should aim towards understanding which aspects of the caregiving relationship are contributing most in terms of influencing changes on carer resilience.

7 | CONCLUSION

Our study indicates that carer resilience is directly influenced by ratings of relationship quality by people with dementia highlighting the important role of interpersonal factors in predicting carer outcomes. Our findings contribute to current theories highlighting the effects of interpersonal factors on predicting carer mental health and

our understanding of caregiving as an interpersonal stress process. Tailoring future interventions to support carer resilience by specifically strengthening the caregiving relationship may help protect family carers and people with dementia from adverse outcomes.

AUTHOR CONTRIBUTIONS

Phuong Leung and Vasiliki Orgeta prepared the manuscript. Phuong Leung, Martin Orrell, Lauren Yates and Vasiliki Orgeta were involved in the design, development and methodology of the study. Phuong Leung, Lauren Yates and Vasiliki Orgeta recruited participants. Phuong Leung and Lauren Yates collected the data. Phuong Leung conducted the data analysis. All the authors reviewed and commented on drafts of the manuscript; read and approved the final manuscript for publication.

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CONFLICT OF INTEREST STATEMENT

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in University College London at <https://discovery.ucl.ac.uk/id/eprint/1537584/>.

ETHICS STATEMENT

Ethical approval was obtained through the East London 3 Research Ethics Committee (ref no. 10/H0701/71). The study was registered as a clinical trial (ISRCTN 65945963).

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REFERENCES

1. Rippon I, Quinn C, Martyr A, et al. The impact of relationship quality on life satisfaction and well-being in dementia caregiving dyads: findings from the IDEAL study. *Aging Ment Health*. 2020;10(9):1411-1420. <https://doi.org/10.1080/13607863.2019.1617238>
2. Quinn C, Clare L, Woods B. The impact of the quality of relationship on the experiences and wellbeing of caregivers of people with

- dementia: a systematic review. *Aging Ment Health*. 2009;13(2):143-154. <https://doi.org/10.1080/13607860802459799>
3. Pearlin LI, Mullan JT, Semple SJ, Skaff MM. Caregiving and the stress process: an overview of concepts and their measures. *Gerontol*. 1990;30(5):583-594. <https://doi.org/10.1093/geront/30.5.583>
 4. Ornstein K, Gaugler JE. The problem with "problem behaviors": a systematic review of the association between individual patient behavioral and psychological symptoms and caregiver depression and burden within the dementia patient-caregiver dyad. *Int Psychogeriatr*. 2012;24(10):1536-1552. <https://doi.org/10.1017/s1041610212000737>
 5. Vaingankar JA, Chong SA, Abidin E, et al. Care participation and burden among informal caregivers of older adults with care needs and associations with dementia. *Int Psychogeriatr*. 2016;28(2):221-231. <https://doi.org/10.1017/s104161021500160x>
 6. Quinn C, Toms G. Influence of positive aspects of dementia caregiving on caregivers' well-being: a systematic review. *Gerontol*. 2019;59(5):E584-E596. <https://doi.org/10.1093/geront/gny168>
 7. Andren S, Elmstahl S. Family caregivers' subjective experiences of satisfaction in dementia care: aspects of burden, subjective health and sense of coherence. *Scand J Caring Sci*. 2005;19(2):157-168. <https://doi.org/10.1111/j.1471-6712.2005.00328.x>
 8. Yu DSF, Cheng ST, Wang JF. Unravelling positive aspects of caregiving in dementia: an integrative review of research literature. *Int J Nurs Stud*. 2018;79:1-26. <https://doi.org/10.1016/j.ijnurstu.2017.10.008>
 9. Teahan A, Lafferty A, McAuliffe E, et al. Resilience in family caregiving for people with dementia: a systematic review. *Int J Geriatr Psychiatry*. 2018;33(12):1582-1595. <https://doi.org/10.1002/gps.4972>
 10. Dias R, Santos RL, Sousa MFBd, et al. Resilience of caregivers of people with dementia: a systematic review of biological and psychosocial determinants. *Trends Psychiatry Psychother*. 2015;37(1):12-19. <https://doi.org/10.1590/2237-6089-2014-0032>
 11. Ryff CD, Friedman EM, Morozink JA, Tsenkova V. Psychological resilience in adulthood and later life: implications for health. In: Hayslip B, Smith GC, eds. *Annual Review of Gerontology and Geriatrics, Vol 32: Emerging Perspectives on Resilience in Adulthood and Later Life*. Vol 32. Springer Publishing Co; 2012:73-92.
 12. Southwick SM, Bonanno GA, Masten AS, Panter-Brick C, Yehuda R. Resilience definitions, theory, and challenges: interdisciplinary perspectives. *Eur J Psychotraumatol*. 2014;5(1):14. <https://doi.org/10.3402/ejpt.v5.25338>
 13. Windle G. What is resilience? A review and concept analysis. *Rev Clin Gerontol*. 2011;21(2):152-169. <https://doi.org/10.1017/S0959259810000420>
 14. Wagnild, Young. Development and psychometric evaluation of the resilience scale. *J Nurs Meas*. 1990;1(2):1993.
 15. Bonanno GA, Romero SA, Klein SI. The temporal elements of psychological resilience: an integrative framework for the study of individuals, families, and communities. *Psychol Inq*. 2015;26(2):139-169. <https://doi.org/10.1080/1047840x.2015.992677>
 16. Rakesh G, Morey RA, Zannas AS, et al. Resilience as a translational endpoint in the treatment of PTSD. *Mol Psychiatry*. 2019;24(9):1268-1283. <https://doi.org/10.1038/s41380-019-0383-7>
 17. Bekhet AK, Avery JS. Resilience from the perspectives of caregivers of persons with dementia. *Arch Psychiatr Nurs*. 2018;32(1):19-23. <https://doi.org/10.1016/j.apnu.2017.09.008>
 18. Cherry MG, Salmon P, Dickson JM, Powell D, Sikdar S, Ablett J. Factors influencing the resilience of carers of individuals with dementia. *Clin Gerontol*. 2013;23(4):251-266. <https://doi.org/10.1017/S0959259813000130>
 19. Deist M, Greeff AP. Resilience in families caring for a family member diagnosed with dementia. *Educ Gerontol*. 2015;41(2):93-105. <https://doi.org/10.1080/03601277.2014.942146>
 20. Yang CT, Liu HY, Shyu YIL. Dyadic relational resources and role strain in family caregivers of persons living with dementia at home: a cross-sectional survey. *Int J Nurs Stud*. 2014;51(4):593-602. <https://doi.org/10.1016/j.ijnurstu.2013.09.001>
 21. Townsend AL, Franks MM. Binding ties: closeness and conflict in adult children's caregiving relationships. *Psychol Aging*. 1995;10(3):343-351. <https://doi.org/10.1037/0882-7974.10.3.343>
 22. Ortega V, Leung P. Personality and dementia caring: a review and commentary. *Curr Opin Psychiatr*. 2015;28(1):57-65. <https://doi.org/10.1097/ycp.0000000000000116>
 23. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189-198. [https://doi.org/10.1016/0022-3956\(75\)90026-6](https://doi.org/10.1016/0022-3956(75)90026-6)
 24. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed.; 2000.
 25. Orrell M, Yates L, Leung P, et al. The impact of individual Cognitive Stimulation Therapy (iCST) on cognition, quality of life, caregiver health, and family relationships in dementia: a randomised controlled trial. *Plos Med*. 2017;14(3):22. <https://doi.org/10.1371/journal.pmed.1002269>
 26. Rosen WG, Mohs RC, Davis KL. A new rating scale for Alzheimer's disease. *Am J psychiatry*. 1984;141:1356-1364. <https://doi.org/10.1176/ajp.141.11.1356>. PMID: 6496779
 27. Sheikh JI, Yesavage JA. Clinical gerontology: geriatric depression scale (GDS) recent evidence and development of a shorter version. In: Brink TL, ed. *A guide to assessment and intervention*. Haworth Press; 1986.
 28. Logsdon RG, Gibbons LE, McCurry SM. Quality of life in Alzheimer's disease: patient and caregiver reports. *J Ment Health Aging*. 1999;5:21-32.
 29. Cummings JL, Mega M, Gray K, Rosenberg-Thompson S, Carusi DA, Gornbein J. The Neuropsychiatric Inventory comprehensive assessment of psychopathology in dementia. *Neurology*. 1994;44(12):2308. <https://doi.org/10.1212/wnl.44.12.2308>
 30. Spruytte N, Van Audenhove C, Lammertyn F, Storms G. The quality of the caregiving relationship in informal care for older adults with dementia and chronic psychiatric patients. *Psychol Psychother Theor Res Pract*. 2002;75(3):295-311. <https://doi.org/10.1348/147608302320365208>
 31. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361-370. <https://doi.org/10.1111/j.1600-0447.1983.tb09716.x>
 32. Group Euro Qol. EuroQol: a new facility for the measurement of health related quality of life. *Health Pol*. 1990;16:199-208. PMID: 10109801.
 33. Wagnild G. A review of the resilience scale. *J Nurs Meas*. 2009;17(2):105-113. <https://doi.org/10.1891/1061-3749.17.2.105>
 34. Arbuckle JL, Wothke W. *Amos 6.0. User's Guide*. SPSS Small Waters Corporation; 2005.
 35. Steiger JH, Lind JC. Statistically based tests for the number of common factors. In: *Paper presented at the annual Spring Meeting of the Psychometric Society*; 1980.
 36. Kelley K, Lai KK. Accuracy in parameter estimation for the root mean square error of approximation: sample size planning for narrow confidence intervals. *Multivariate Behav Res*. 2011;46(1):1-32. <https://doi.org/10.1080/00273171.2011.543027>
 37. MacCallum RC, Browne MW, Sugawara HM. Power analysis and determination of sample size for covariance structure modeling. *Psychol Methods*. 1996;1(2):130-149. <https://doi.org/10.1037/1082-989x.1.2.130>
 38. Jackson DL, Gillaspay JA, Purc-Stephenson R. Reporting practices in confirmatory factor analysis: an overview and some recommendations. *Psychol Methods*. 2009;14(1):6-23. <https://doi.org/10.1037/a0014694>

39. Schoenmakers B, Buntinx F, Delepeleire J. Factors determining the impact of care-giving on caregivers of elderly patients with dementia. A systematic literature review. *Maturitas*. 2010;66(2):191-200. <https://doi.org/10.1016/j.maturitas.2010.02.009>
40. Wilks SE, Croom B. Perceived stress and resilience in Alzheimer's disease caregivers: testing moderation and mediation models of social support. *Aging Ment Health*. 2008;12(3):357-365. <https://doi.org/10.1080/13607860801933323>

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