This is the accepted version of the article:

Lopez-Martinez C, Orgeta V, Frias-Osuna A, Del-Pino-Casado R. The mediating role of sense of coherence on mental health outcomes in carers of older dependent relatives: A longitudinal study.

Int J Geriatr Psychiatry. 2021. Nov 13; 36(5):722-30.

DOI: https://doi.org/10.1002/gps.5472

Title

The mediating role of sense of coherence on mental health outcomes in carers of older dependent relatives: a longitudinal study.

Running title

The mediating role of sense of coherence in carers of older relatives.

Authors

Catalina López-Martínez[1]

Vasiliki Orgeta[2]

Antonio Frías-Osuna[1]

Rafael del-Pino-Casado[1]

[1] Department of Nursing, Faculty of Health Sciences, University of Jaén, Jaén (Spain).

[2] Division of Psychiatry, University College London, London, UK.

Corresponding author

Rafael del-Pino-Casado, rdelpino@ujaen.es, Campus Las Lagunillas s/n, 23071 Jaén (Spain).

[†]The research was conducted at University of Jaén

Word count

2,933

Acknowledgements

We would like to thank all carers who agreed to take part in the study.

Funding Sources

None.

Conflict of interest statement

No conflict of interest has been declared by the authors.

Abstract

Background: Sense of coherence (SOC) is an important protective factor for carer well-being but research to date remains cross-sectional, focusing primarily on the direct effects of SOC on carers' mental health. The study's aim was to investigate the mediating role of SOC in the longitudinal relationship between caregiver strain and carers' psychological health, and its stability over time.

Methods: Prospective longitudinal study conducted in Jaén (Spain) with a probabilistic sample of 132 carers of older people, with data collected at baseline and at one-year follow-up. We measured SOC, caregiver strain, anxiety and depressive symptoms, and several care recipient characteristics and intensity of care provided. We used multiple linear regression modelling and the Sobel test to analyse mediation effects.

Results: SOC was significantly negatively longitudinally associated with both anxiety (β= -0.38, p= 0.001) and depressive symptoms (β= -0.28, p= 0.023), after controlling for several confounders. SOC mediated both the relationship between caregiver strain and anxiety and caregiver strain and depressive symptoms (Sobel test; p< 0.001 for anxiety and p< 0.001 for depressive symptoms). Differences between baseline and one-year follow-up SOC scores were not statistically significant (p= 0.617).

Conclusions: SOC appears to buffer the impact of caregiver strain on symptoms of depression and anxiety in informal carers of older people. Our data showed that SOC is an important psychological resource for carers that remained relatively stable under non-experimental conditions over a period of one year in this sample. Findings suggest that interventions aimed at strengthening SOC may protect carer psychological well-being.

Keywords: family carers; sense of coherence; mental health; caregiver strain; anxiety; depression; older relatives; mediating role.

Key points:

- Sense of coherence mediates the relationship between psychological distress and caregiver strain in family carers of dependent older people
- Sense of coherence is an important psychological resource for carers that remained relatively stable over a period of one year in this sample
- Findings suggest that sense of coherence appears to buffer the impact of caregiver strain on symptoms of depression and anxiety in informal carers
- This study cannot rule out the possibility of reverse causation in the relationship between SOC and psychological distress

Introduction

Due to population ageing and rising global life expectancy [1], the number of older people who require full-time support and are dependent on family carers is increasing and will continue to do so [2]. Informal carers comprise between 10-20% of people aged over 50 in developed nations, with their social, caring and economic contribution being the main source of care and support provided to dependent older people. Although caregiving can be rewarding, it is generally associated with an increased risk of negative psychological outcomes [3 4]. Caring for dependent older people can lead to high levels of burden of care which can manifest as strain in a number of ways, increasing caregiver stress [5]. Pearling and colleagues' model [6] identifies four main areas that can contribute to caregiver stress: the background context (such as availability of support), primary stressors of the illness (such as level of assistance required), secondary role strains (such as family conflict), and intrapsychic strains such as personality and role captivity.

Caregiver strain is generally considered as capturing the subjective perception of burden experienced by carers, such as the physical and emotional impact of caring, as well as objective dimensions of strain [7,8]. Several studies have shown that caregiver strain appears to be the most potent contributor to symptoms of depression and anxiety in carers [9]. Previous research has identified similarly high levels of anxiety and depressive symptoms across several caregiving groups such as carers of stroke survivors [10], carers of people living with dementia [11] and those caring for people surviving cancer [12]. Knowing which factors may protect carers from high levels of strain and psychological distress is essential for effective strategies of prevention.

The salutogenesis hypothesis proposed by Antonovsky [13] is a highly prominent theory arguing that generalised resistance resources (GRR) facilitate greater adaptation and resilience to stress, protecting individuals' well-being and allowing them to sustain higher levels of psychological health. Amongst these, sense of coherence (SOC), referring to a dispositional orientation of individuals' ability to maintain a positive life orientation, has been widely researched [14]. SOC is conceptualised as comprising three psychological dimensions known as comprehensibility, manageability and

significance [13]. Comprehensibility refers to the extent to which a person perceives stimuli and events as rationally understandable, whereas manageability is the degree to which a person feels that resources at his/her disposal may be enough to satisfy his/her needs. Significance or meaningfulness refers to the extent to which a person feels that life has an emotional meaning and therefore problems to be addressed are worth committing and resolving. Thus, SOC has been theoretically conceptualised as an important mediating factor between stressful events and well-being, acting as a buffer against stress [15], remaining relatively stable across the life span [14,16].

Salutogenesis theory argues for two key mechanisms hypothesised to play an important role in mediating the association between SOC and carer distress [13]. The first mechanism refers to behavioural aspects of SOC whereby carers' actions are directly influenced by their level of SOC, and a second perceptual mechanism whereby stressors perceived as less benign are less stressful, supporting greater understanding of the situation and resources available [17]. In line with this hypothesis, several studies in the caregiving literature have shown that carers with high SOC are more resilient to caregiving stress [18], and are better able to mobilise support and resources available, making them less vulnerable to psychological distress [19].

Despite the increasing research interest in the association between SOC, caregiver strain, and psychological distress [20] most studies to date remain largely cross-sectional. In addition, the majority of studies assess the direct effects of SOC on carers' health cross-sectionally, with no studies examining longitudinally the mediating role of SOC on carer outcomes [21-23]. Data in relation to the stability of SOC over time remain limited, with conflicting reports in the literature, as to whether SOC remains stable [24], or may in fact change over time [18] .

Our main aim in the present study therefore was to examine the longitudinal relationship between SOC, caregiver strain, and carer psychological distress, and specifically assess the hypothesis that SOC will mediate the effects of caregiver strain on both anxiety and depressive symptoms. Caregiver strain was defined in line with the definition provided by Pearling and Schooler [25] whereby both *strain* and *stressor* are perceived as interchangeable concepts, capturing carers' physical and

emotional responses to caregiving challenges. Based on previous research indicating that a range of care recipient characteristics—such as levels of neuropsychiatric symptoms, cognitive and functional impairment,—and intensity of care provided – are important contributors of caregiver strain, [6,12] and empirically related to both anxiety and depression [26], we controlled for these variables in our analyses. Our secondary aim was to examine the stability of SOC over time given conflicting reports in the literature.

Methods

Design, setting and sample

This study used a longitudinal design with a 1-year follow-up comprising two measurement time-points (baseline [T1] and follow-up [T2]). Participant inclusion criteria were: a) being the main caregiver (primary responsibility for the care provided) to a person aged 65 years or over who is dependent in at least one activity of daily living (basic or instrumental), b) aged 18 or over with kinship ties to the care recipient and c) providing daily care. The study population was carers of older relatives living in the Jaén-Nordeste District, comprising of a population of 175,000 inhabitants spread between both rural and urban areas. The final sample included 132 participants, selected by systematic random sampling from the census of family carers of older dependents (4,545 caregivers).

Carers in this population had the characteristics of the Mediterranean model of informal caregiving[27]: a) positive family attitudes towards older dependent relatives' care; b) high female participation in informal caregiving; c) limited participation of female caregivers in the labour market; and d) lower levels of formal support [28,29].

Measurements

SOC was measured by Antonovsky's [13] Orientation to Life Questionnaire-13 validated in Spanish by Virués-Ortega, Martínez-Martín, del Barrio, and Lozano [30]. This questionnaire consists of 13 items answered on a Likert type scale ranging from 1-7 (range: 13 - 91), with higher scores indicating higher levels of SOC. Cronbach's alpha was 0.79. We measured caregiver strain using the Spanish

version of the Caregiver Strain Index [8], validated by López Alonso, and Moral Serrano [31], comprising 13 items (range of scores 0 to 13), with scores directly proportional to level of strain. Cronbach's alpha was 0.78.

Anxiety and depressive symptoms were measured using the validated Spanish version [28] of the Goldberg Scale [32], comprising two separate subscales (9 items each; range: 0 - 9; higher scores indicative of higher levels of symptoms). Cronbach's alpha scores were 0.83 and 0.84 respectively.

As control variables, we included several care recipient characteristics, and intensity of care provided. We measured functional capacity using the Spanish version [33] of the Barthel Index [34] (Cronbach's alpha: 0.89) and presence of cognitive impairment with the validated Spanish version of the Pfeiffer Test [35] [32] (Cronbach's alpha: 0.89). Behavioural symptoms were assessed with the Spanish version of the Neuropsychiatric Inventory [36] validated by Vilalta-Franch, Lozano-Gallego, Hernández-Ferrándiz, Llinás-Reglá, López-Pousa, and López [37] (Cronbach's alpha: 0.82) evaluating frequency and severity of behavioural symptoms. Intensity of care was measured using the DeCuida questionnaire designed and validated by Serrano-Ortega, Frias-Osuna, Recio-Gomez, and del-Pino-Casado [38] (Cronbach's alpha: 0.86). This questionnaire assessed frequency of care provided and level of dependency of the care recipient on each need attended to. Data on care recipient illness were derived from clinical records.

Procedures

The study was approved by the Research Ethics Committee of Jaén and followed the standards of the Declaration of Helsinki[39]. All participants provided informed consent prior to being recruited to the study. We conducted a small pilot study (N = 20) to evaluate data collection procedures and introduce any necessary amendments. Family nurses contacted participants directly and all data were collected by trained nurses interviewing family carers at home (2015-2016). None of the family carers originally contacted refused participation to the study. At 1-year follow-up, 81 participants (61.4 %) completed data collection. Reasons for loss to follow-up were: care recipient death (33),

admission of care recipient to a nursing home (9), no longer being a carer (6), moving out of the area (2); and carer looking after more than one dependent person (1) (total losses: 51; 38.6 %).

Data analysis

For the descriptive analysis, we measured central tendency and dispersion for the quantitative variables, and percentages for the qualitative variables. For the bivariate analyses, we used the Mann-Whitney U test (non-normality data) and Pearson's chi-square tests comparing participants who remained in the study and those lost at T2. We used Student's t-tests to analyse differences between baseline and follow-up SOC scores.

We tested the longitudinal mediation effect of SOC on the relationship of caregiver strain with anxiety and depressive symptoms using a Generalized Estimating Equations (GEE) model[40]. We used Baron and Kenny's criteria [41] to define mediation (Figure 1): (1) variations in levels of the independent variable significantly account for variations in the presumed mediator (path a), (2) variations in the mediator significantly account for variations in the dependent variable (path b), and (3) when the mediator is added to the model (path c'), the effect of a significant relationship between the independent and dependent variable (path c) is reduced (partial mediation) or is no longer significant (complete mediation; no direct effect). To test these conditions, GEE models were executed in each of the paths described above: (1) SOC on caregiver strain (path a), (2) anxiety or depressive symptoms on SOC (path b), (3) previous regressions including caregiver strain as other independent variable (path c') and anxiety or depressive symptoms on caregiver strain (path c). We used the Sobel test [42] with standardized coefficients and standard errors from GEE models to test for the significance of the mediation effect.

This space is for Figure 1

We used multivariate regression analyses to assess the effect of SOC at T1 on anxiety and depressive symptoms at T2. In each model, we used the dependent variable at T1 as a control variable, along with the initially defined control variables (function, cognitive impairment,

neuropsychiatric symptoms of the care recipient and intensity of care). All data analysis were carried out using IBM SPSS Statistics, version 24.0 (IBM Corp, Armonk, NY, USA).

Results

Description of the sample

Carers had a mean age of 56.3 years (SD= 11.8), with women accounting for 86.5% of the sample. Daughters and spouses were the most frequent kinship groups (74.2% and 12.9% respectively) and average time spent caring was 13.4 hours per day. Care recipient average age was 85.2 years (SD=6.2), with the majority being women (75%). Characteristics of the sample are presented in Table 1. Table 2 shows descriptive data of the main and control variables at both T1 and T2. There were no statistically significant differences between participants who remained in the study and those that were lost (see Table 3).

This space is for Tables 1, 2 and 3

Evolution of SOC

SOC scores ranged from 31 to 89 at baseline, with an average score of 63.6 points. Follow-up measurement scores ranged from 27 to 87, with the average being 64.1. T-tests showed that differences between the first and second SOC measurements were not statistically significant (t value: 0.50, degrees of freedom: 80, p= 0.617), suggesting that SOC remained relatively stable in a period of one year.

Mediating effect of SOC

Figures 2 shows the results of our GEE analysis for the mediating effect of SOC in the relationship between caregiver strain with depressive symptoms and anxiety. As can be seen from this Figure the three mediation conditions of Baron and Kenny [41] were supported. Because the effect in path c' is smaller than in path c but still significant, following Baron and Kenny's criteria [41] the mediation is considered as partial for both anxiety and depressive symptoms. The Sobel test confirmed this effect for both anxiety ($z= 5.25$, $p< 0.001$) and depressive symptoms ($z= 6.18$, $p< 0.001$).

This space is for Figure 2

Longitudinal effects of SOC on anxiety and depressive symptoms

We regressed anxiety at T2 on SOC (T1), anxiety at T1 and control variables (function, cognitive impairment, neuropsychiatric symptoms and intensity of care). We eliminated intensity of care from the regression model due to collinearity (tolerance level was 0.14). The final model (Table 4), showed a negative association between SOC at T1 and anxiety at T2 (β = -0.38, p= 0.001), with the model explaining 54.0% of the variance in anxiety (T2).

This space is for Table 4

We regressed depression at T2 on SOC (T1), depression at T1 and control variables (function, cognitive impairment and neuropsychiatric symptoms) by eliminating intensity of care as before due to collinearity (tolerance level was 0.12). The final model (Table 4), showed a negative association between SOC (T1) and depression at T2 (β = -0.28, p= 0.023) with the model explaining 43.0% of the variance in depression at T2.

Discussion

To our knowledge, this is the first longitudinal study reporting on the mediating effect of SOC on the relationship between caregiver strain and psychological distress in carers of older relatives. An important contribution of our study is that we have been able to demonstrate that sense of coherence mediates the effect of caregiver strain on symptoms of anxiety and depression in carers. We employed a longitudinal design whilst controlling for several potential confounders which increases the external validity of our findings, and our use of probabilistic sampling overcomes important methodological limitations of previous research. The sample recruited in our study is generally representative of the population of informal carers in Spain [43] and is broadly similar in respect to levels of SOC with European studies in the literature [44]. Our study is in line with research showing that SOC is an important stress mediator between caregiver strain and negative psychological outcomes in family carers [45].

The mediating effect of SOC and its evolution over time

We found that SOC mediated the relationship between caregiver strain and psychological distress indicating that low levels of caregiver strain are likely to lessen carers' anxiety and depressive symptoms via their levels of SOC. Caregiver strain is comprised of cognitively appraising the caregiving situation as a highly stressful event [46] leading to increased levels of anxiety [9] and depression [4]. Our results suggest that SOC may be an important therapeutic target in carers with high risk of anxiety and depression and high caregiver strain. We additionally explored the evolution of SOC over time. Our finding that SOC remained relatively stable over a period of one year in this sample is in line with prior studies in the literature [24,47,48], and Antonovky's original hypothesis of the stability of the construct over time [13].

Our results provide further support for coping theories positing that carers with high SOC are less likely to experience high levels of anxiety and depressive symptoms over time. According to theoretical models proposed by Lazarus, Folkman [49], stress and its negative consequences occur when an individual assesses potentially stressful situations as a threat to which the person cannot respond to. Our data support previous theory and research on the important role of SOC as a key psychological resource supporting carers' resilience and ability to cope with stressors, which in turn protects their psychological health [50, 51].

Our results have important clinical implications for the provision of interventions supporting carers. Evidence that SOC plays an important role in the adaptation process of becoming a family carer, and acts as a protective factor, suggests that interventions aimed at strengthening SOC such as coping interventions [52], problem solving therapy [53], or lifestyle interventions [54] may protect carers' psychological well-being long-term. Future longitudinal and intervention studies are needed to investigate whether SOC is responsive to change. These studies should include guidance to carers completing SOC questionnaires, in order to make questions relevant to the caregiving population and thus improve face validity [55].

Limitations

Despite several strengths, our study has several important limitations. Although, we found that carers who dropped out of the study were not significantly different from those who completed follow-up measures, it is likely that these participants had worst outcomes at T1. Our study cannot rule out reverse causality, therefore our results remain limited and should be interpreted with caution. Our sample was comprised of a very heterogeneous care recipient population which limits our findings. The use of self-report measures may have led to biased reporting and we only measured SOC after caregiving has commenced. Future studies should investigate the association of SOC and mental health outcomes in separate groups of informal caregivers and the predictive value of SOC in the context of caregiving transitions from early support to increased levels of care. Although the CSI primarily measures stress and strain associated with the caregiving role, it is not a unidimensional scale of subjective burden but additionally captures several objective burden parameters related to caregiving. We were not able to examine the potential effect of financial resources, social support, or general self-efficacy. Further research is warranted on the contribution of unmet needs and access to community resources in predicting carer well-being and how these factors may affect carer resilience.

Conclusions

Our results show that in carers of dependent older relatives SOC mediates the relationship between caregiver strain and psychological distress. SOC is an important psychological resource, which remained relatively stable under non-experimental conditions in this sample within a period of one year. Future longitudinal studies are needed to investigate the relationship between SOC, caregiver strain and psychological distress in informal carers of dependent older people.

References

1. United Nations. Ageing. 2019; https://www.un.org/en/sections/issues-depth/ageing/. Accessed 2/05/2019.

2. United Nations; Department of Economic & Social Affairs. *World Population Ageing 2015.* New York, NY: United Nations; 2015.

3. van der Lee J, Bakker TJ, Duivenvoorden HJ, Droes RM. Multivariate models of subjective caregiver burden in dementia; a systematic review. *Ageing Res Rev.* Mar 24 2014;15:76-93.

4. del-Pino-Casado R, Rodriguez Cardosa M, Lopez-Martinez C, Orgeta V. The association between subjective caregiver burden and depressive symptoms in carers of older relatives: A systematic review and meta-analysis. *PLoS One.* 2019;14(5):e0217648.

5. Bradshaw LE, Goldberg SE, Schneider JM, Harwood RH. Carers for older people with co-morbid cognitive impairment in general hospital: characteristics and psychological well-being. *Int. J. Geriatr. Psychiatry.* Jul 2013;28(7):681-690.

6. Pearlin LI, Mullan JT, Semple SJ, Skaff MM. Caregiving and the stress process: An overview of concepts and their measures. *Gerontologist.* 1990 Oct 1990;30(5):583-594.

7. Cheng ST. Dementia Caregiver Burden: a Research Update and Critical Analysis. *Current psychiatry reports.* Aug 10 2017;19(9):64.

8. Robinson BC. Validation of a Caregiver Strain Index. *J. Gerontol.* May 1983;38(3):344-348.

9. Cooper C, Balamurali TB, Livingston G. A systematic review of the prevalence and covariates of anxiety in caregivers of people with dementia. *Int. Psychogeriatr.* Apr 2007;19(2):175-195.

10. Zhu W, Jiang Y. A Meta-analytic Study of Predictors for Informal Caregiver Burden in Patients With Stroke. *J. Stroke Cerebrovasc. Dis.* Dec 2018;27(12):3636-3646.

11. Sallim AB, Sayampanathan AA, Cuttilan A, Chun-Man Ho R. Prevalence of Mental Health Disorders Among Caregivers of Patients With Alzheimer Disease. *J. Am. Med. Dir. Assoc.* Dec 2015;16(12):1034-1041.

12. Geng HM, Chuang DM, Yang F, et al. Prevalence and determinants of depression in caregivers of cancer patients: A systematic review and meta-analysis. *Medicine (Baltimore).* Sep 2018;97(39):e11863.

13. Antonovsky A. *Unraveling the mystery os health: how pwople manage stress and stay well.* San Francisco: Jossey-Bas; 1987.

14. Eriksson M, Lindström B. Antonovsky's sense of coherence scale and the relation with health: a systematic review. *J. Epidemiol. Community Health.* May 2006;60(5):376-381.

15. Mittelmark MB, Bauer GF. The meanings of salutogenesis. In: Mittelmark MB, Sagy S, Eriksson M, et al., eds. *The handbook of salutogenesis*. Switzerland: Springer; 2017:7-13.

16. Eriksson M, Lindström B. Antonovsky's sense of coherence scale and its relation with quality of life: a systematic review. *J. Epidemiol. Community Health.* Nov 2007;61(11):938-944.

17. Super S, Wagemakers MA, Picavet HS, Verkooijen KT, Koelen MA. Strengthening sense of coherence: opportunities for theory building in health promotion. *Health promotion international.* Dec 2016;31(4):869-878.

18. Välimäki T, Martikainen J, Hongisto K, et al. Decreasing sense of coherence and its determinants in spousal caregivers of persons with mild Alzheimer's disease in three year follow-up: ALSOVA study. *Int. Psychogeriatr.* Jul 2014;26(7):1211-1220.

19. Wilks S, Croom B. Perceived Stress and Resilience in Alzheimer's Disease Caregivers: Testing Moderation and Mediation Models of Social Support. Comparative Study. *Aging Ment Health.* 2008;12(3):357.

20. del-Pino-Casado R, Espinosa-Medina A, López-Martínez C, Orgeta V. Sense of coherence, burden and mental health in caregiving: A systematic review and meta-analysis. *J Affect Disord.* 2019;242:14-21.

21. Jaracz K, Grabowska-Fudala B, Kozubski W. Caregiver burden after stroke: towards a structural model. *Neurol. Neurochir. Pol.* May-Jun 2012;46(3):224-232.

22. Tang ST, Cheng CC, Lee KC, Chen CH, Liu LN. Mediating Effects of Sense of Coherence on Family Caregivers' Depressive Distress While Caring for Terminally Ill Cancer Patients. *Cancer Nurs.* Oct 23 2013;36(6):2013.

23. Trujillo MA, Perrin PB, Panyavin I, et al. Mediation of family dynamics, personal strengths, and mental health in dementia caregivers. *Journal of Latina/o Psychology.* 2016;4:1-17.

24. Wu MH, Lee S, Su HY, Pai HC. The effect of cognitive appraisal in middle-aged women stroke survivors and the psychological health of their caregivers: a follow-up study. *J. Clin. Nurs.* Nov 2015;24(21-22):3155-3164.

25. Pearlin LI, Schooler C. The structure of coping. *J. Health Soc. Behav.* 1978:2-21.

26. Watson B, Tatangelo G, McCabe M. Depression and Anxiety Among Partner and Offspring Carers of People With Dementia: A Systematic Review. *Gerontologist*2018.

27. del-Pino-Casado R, Pastor-Bravo MD, Palomino-Moral PA, Frias-Osuna A. Gender differences in primary home caregivers of older relatives in a Mediterranean environment: A cross-sectional study. *Arch. Gerontol. Geriatr.* Mar - Apr 2017;69:128-133.

28. OECD. *Long-term care for older people.* Paris: OECD; 2005.

29. Kraus M, Riedel M, Mot E, Willemé P, Röhrling G, Czypionka T. A Typology of Long-Term Care Systems in Europe. ENEPRI Research Report No. 91. European Network of Economic Policy Research Institutes; 2010: www.ceps.eu.

30. Virués-Ortega J, Martínez-Martín P, del Barrio JL, Lozano LM. Validación transcultural de la Escala de Sentido de Coherencia de Antonovsky (OLQ-13) en ancianos mayores de 70 años. *Med Clin (Barc).* 2007;128(13):486-492.

31. López Alonso SR, Moral Serrano MS. Validación del Índice de Esfuerzo del Cuidador en la población española. *Enferm Comunitaria (Gran).* 2005;1(1):12-17.

32. Goldberg D, Bridges K, Duncan-Jones P, Grayson D. Detecting anxiety and depression in general medical settings. *Br. Med. J.* Oct 8 1988;297(6653):897-899.

33. Baztán JJ, Pérez J, Alarcón T, San Cristóbal E, Izquierdo G, Manzarbeitia I. Indice de Barthel: Instrumento válido para la valoración funcional de pacientes con enfermedad cerebrovascular. *Rev Esp Geriatr Gerontol.* 1993;28:32-40.

34. Mahoney F, Barthel D. Functional evaluation: The Barthel Index. *Md. State Med. J.* Feb 1965;14:61-65.

35. Pfeiffer E. A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J. Am. Geriatr. Soc.* Oct 1975;23(10):433-441.

36. Cummings JL, Mega M, Gray K, Roenberg-Thompson S, Carusi DA, Gornbein J. The Neuropsychiatric Inventory: Comprehensive assessment of psychopathology in dementia. *Neurology.* 1994;44:2308-2314.

37. Vilalta-Franch J, Lozano-Gallego M, Hernández-Ferrándiz M, Llinás-Reglá J, López-Pousa S, López OL. Neuropsychiatric Inventory. Propiedades psicométricas de su adaptación al español. *Rev. Neurol.* 1999;29(1):15-19.

38. Serrano-Ortega N, Frias-Osuna A, Recio-Gomez JM, del-Pino-Casado R. Diseño y validación de una escala para la medición de la dedicación al cuidado en personas cuidadoras de mayores dependientes (DeCuida) *Aten. Primaria.* Nov 2015;47(9):589-595.

39. World Medical Association (WMA). WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects. 2013; https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/. Accessed 01/03/2020.

40. Schluchter MD. Flexible Approaches to Computing Mediated Effects in Generalized Linear Models: Generalized Estimating Equations and Bootstrapping. *Multivariate behavioral research.* Apr-Jun 2008;43(2):268-288.

41. Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 1986;51(6):1173-1182.

42. Sobel ME. Asymptotic intervals for indirect effects in structural equations models. S. Leinhart. In: Leinhart S, ed. *Sociological methodology*. San Francisco: Jossey-Bass; 1982:290-312.

43. del-Pino-Casado R, Frias-Osuna A, Palomino-Moral PA, Martinez-Riera JR. Gender Differences Regarding Informal Caregivers of Older People. *J. Nurs. Scholarsh.* Dec 2012;44(4):349-357.

44. Marques M, Woods B, Hopper L, et al. Relationship quality and sense of coherence in dementia: Results of a European cohort study. May 2019;34(5):745-755.

45. Janssen EP, de Vugt M, Köhler S, et al. Caregiver profiles in dementia related to quality of life, depression and perseverance time in the European Actifcare study: the importance of social health. *Aging Ment Health.* Jan 2017;21(1):49-57.

46. Rapp SR, Chao D. Appraisals of strain and of gain: Effects on psychological wellbeing of caregivers of dementia patients. *Aging & Mental Health.* 2000;4(2):142-147.

47. Chumbler NR, Rittman MR, Wu SS. Associations in sense of coherence and depression in caregivers of stroke survivors across 2 years. *J. Behav. Health Serv. Res.* Apr 2008;35(2):226-234.

48. Jaracz K, Grabowska-Fudala B, Górna K, Jaracz J, Moczko J, Kozubski W. Burden in caregivers of long-term stroke survivors: Prevalence and determinants at 6 months and 5 years after stroke. *Patient Educ. Couns.* 2015;98(8):1011-1016.

49. Lazarus RS, Folkman S. *Stress, appraisal and coping.* New York, NY: Springer; 1984.

50. O'Rourke N, Kupferschmidt AL, Claxton A, Smith JZ, Chappell N, Beattie BL. Psychological resilience predicts depressive symptoms among spouses of persons with Alzheimer disease over time. *Aging Ment Health.* Nov 2010;14(8):984-993.

51. Lindström B, Eriksson M. Salutogenesis. *J. Epidemiol. Community Health.* 2005 Jun 2005;59(6):440-442.

52. Lim H, Han K. [Effects of the Family Resilience Enhancement Program for families of patients with chronic schizophrenia]. *J. Korean Acad. Nurs.* Feb 2013;43(1):133-142.

53. Odajima Y, Kawaharada M, Wada N. Development and validation of an educational program to enhance sense of coherence in patients with diabetes mellitus type 2. *Nagoya J. Med. Sci.* Aug 2017;79(3):363-374.

54. Forsberg KA, Bjorkman T, Sandman PO, Sandlund M. Influence of a lifestyle intervention among persons with a psychiatric disability: a cluster randomised controlled trail on symptoms, quality of life and sense of coherence. *J. Clin. Nurs.* Jun 2010;19(11-12):1519-1528.

55. Stansfeld J, Orrell M, Vernooij-Dassen M, Wenborn J. Sense of coherence in family caregivers of people living with dementia: a mixed-methods psychometric evaluation. *Health Qual Life Outcomes.* Mar 11 2019;17(1):44.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Figure legends

Figure 1. Paths in mediation relationships

Figure 2. Sobel test reporting on the mediation effects of SOC on the relationship of caregiver strain with depressive and anxiety symptoms

Abbreviations: B: unstandardised regression coefficient, SE: standard error, z: z-scores of Sobel test, p: p-value.

Table 1 Characteristics of the sample (N= 132)

Characteristics	n	%	*M*	*SD*
Caregiver				
Age			56.27	11.75
Gender				
Female	114	86.4		
Male	18	13.6		
Kinship				
Daughter/Son	98	74.2		
Spouse	17	12.9		
Others	17	12.9		
Co-residence				
Yes	92	69.7		
No	40	30.3		
Duration of caregiving (months)			110.2	94.6
Care recipient				
Age			85.2	6.2
Sex				
Female	100	75.8		
Male	32	24.2		
Cause of dependency				
Frail older people	101	76.5		
Cognitive impairment	15	11.4		
Cancer	10	7.6		
Stroke	4	3.0		
Missing data	2	1.5		

Table 2 Descriptive data of study variables at T1 (baseline) and T2 (follow-up)

Variable (range of scores)	**Time**	**M**	**SD**	**95 % IC**
Sense of Coherence (7 – 91)	1	63.59	13.64	59.58 – 67.36
	2	64.09	15.07	60.75 – 67.42
Caregiver strain (0 – 13)	1	5.39	3.16	4.02 – 5.98
	2	6.04	3.53	4.39 – 6.47
Anxiety (1 – 9)	1	4.06	2.93	3.18 – 4.98
	2	3.14	2.78	2.38 – 4.03
Depressive symptoms (1 – 9)	1	2.91	2.74	2.12 – 3.83
	2	2.51	2.82	1.46 – 3.16
Intensity of care (0 – 100)	1	56.33	27.90	41.23 – 55.83
	2	58.51	30.15	41.58 – 56.42
Functional capacity (0 –20)	1	7.39	5.56	6.16 – 8.62
	2	7.30	5.55	6.07 – 8.53
Cognitive impairment (0 – 10)	1	3.94	3.02	2.96 – 4.51
	2	4.21	3.15	2.66 – 4.32
Behavioural problems (0 – 120)	1	12.39	14.50	7.67 – 16.29
	2	12.47	15.62	5.96 – 11.96

Table 3 Differences on main study variables between completers (n = 81) and non-completers (n = 51).

Variables	Remaining (*M* or %)	Dropping out (*M* or %)	P-value
Sense of coherence	64.35	62.39	0.289[a]
Caregiver strain	5.20	5.69	0.386[a]
Anxiety	3.79	4.51	0.163[a]
Depressive symptoms	2.80	3.10	0.383[a]
Intensity of care	55.16	58.18	0.594[a]
Functional capacity	7.52	6.88	0.521[a]
Cognitive impairment	3.93	3.95	0.994[a]
Behavioural problems	12.05	12.93	0.211[a]
Caregiver gender			
Female	84.0%	90.20%	0.309[b]
Male	16.0%	9.80%	
Kinship			
Spouses	11.10%	15.70%	0.445[b]
Rest	88.90%	84.30%	

Notes: [a] Mann-Whitney's U; [b] Pearson's Chi-squared.

Table 4 Multivariate regression analyses for caregiver strain, anxiety and depressive symptoms at one-year follow-up (T2)

Dependent variable	Independent variables	B	SE	ß	p
Caregiver strain	SOC T1	-0.043	0.029	-0.168	0.010
	Caregiver strain T1	0.575	0.131	0.539	0.142
	Functional capacity T1	-0.034	0.067	-0.051	0.000
	Cognitive impairment T1	-0.131	0.123	-0.111	0.616
	Behavioural problems T1	0.005	0.026	0.022	0.292
	r^2= 0.40				
Anxiety	SOC T1	-0.08	0.021	-0.38	0.001
	Anxiety T1	0.36	0.113	0.39	0.002
	Functional capacity T1	0.09	0.045	0.18	0.045
	Cognitive impairment T1	0.14	0.088	0.14	0.128
	Behavioural problems T1	0.02	0.018	0.11	0.288
	r^2= 0.54				
Depressive symptoms	SOC T1	-0.06	0.024	-0.28	0.023
	Depressive symptoms T1	0.46	0.125	0.47	0.001
	Functional capacity T1	-0.02	0.050	-0.05	0.633
	Cognitive impairment T1	0.06	0.090	0.07	0.483
	Behavioural problems T1	0.02	0.020	0.09	0.417
	r^2= 0.43				

Notes: T1: baseline, SOC: sense of coherence, B: unstandardised regression coefficients, SE: standard error, ß: standardised regression coefficients; p: p-value.