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Cognitive, functional and behavioral factors associated with the burden of caring for geriatric patients with cognitive impairment or depression: evidence from a South American sample

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SUMMARY

Objective To examine behavioral, cognitive and functional factors associated with psychosocial burden in caregivers of geriatric patients.

Methods Primary caregivers assessed were included if the geriatric patient cared for had a cognitive impairment or dementia (degenerative, vascular or mixed) (Group 1) or depression and cerebrovascular disease (CVD) (Group 2). Caregivers completed the Zarit questionnaire, the Neuropsychiatric Inventory (NPI) and Instrumental Activities of Daily Living (IADL). Patients were evaluated for dementia severity using the Clinical Dementia Rating (CDR), Mini Mental State Examination (MMSE) and Beck Depression Inventory (BDI). Structural equation modelling (SEM) was used to assess measurement models and the factors associated with burden.

Results Two hundred and fifty-eight caregiver–patient pairs were included. The best model fit was obtained with a model with two constructs: function-cognition (CDR, MMSE, and IADL) and behavior (neuropsychiatric symptoms from the NPI). In Group 1, both function ($B = 0.32$. $T = 2.79$) and behavior ($B = 0.72$, $T = 7.84$) were significantly correlated with caregiver burden, although the strength of association was more than two times higher for behavior. In Group 2, behavior was related to caregiver burden ($B = 0.68$, $T = 6$) but not function-cognition ($B = 0.16$, $T = 1.36$).

Conclusion These findings suggest that behavioral symptoms are an important factor associated with caregiver burden in patients with cognitive impairment, dementia, or depression, while functional and cognitive factors seem to also have an influence in patients with cognitive impairment. Copyright © 2008 John Wiley & Sons, Ltd.

KEY WORDS — caregiven burden; geriatric patient; depression; cognitive impairment

INTRODUCTION

Caregiving of elderly relatives by family members is a recognized feature of several conditions such as dementia (Leinonen *et al*., 2001; Thommessen *et al*., 2002), depression (Leinonen *et al*., 2001), stroke and Parkinson's disease (Thommessen *et al*., 2002). Caregiving is associated with negative impacts in health status, stress levels, finances and psychosocial burden. Subjective burden is another important dimension of caregiving burden, as it relates to negative feelings due to the caregiving process (Donaldson *et al*., 1998). Caregiving is a valuable activity and as such it is important to understand the factors associated with higher or lower levels of burden. Such knowledge may shed light into the prevention, management and alleviation of caregiver burden.

Several demographic, functional, cognitive and behavioral factors had been associated with caregiving

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burden. One important area of research is the comparison of factors that impact caregiving burden in different diseases. Regarding daily function, no relationship between Activities of Daily Living/Instrumental Activities of Daily Living (ADL/IADL) and psychosocial burden was found in mild dementia, stroke and Parkinson's disease (Thommessen *et al*., 2002); while a negative association was documented in depression (Leinonen *et al*., 2001), and a positive one was found in more severe dementia (Nagatomo *et al*., 1999). The Clinical Dementia Rating (CDR) could not be related to caregiver burden in dementia patients (Mangone *et al*., 1993; Allegri *et al*., 2006). The Mini Mental Scale Examination (MMSE) was found to be related to caregiver burden in stroke and Parkinson's disease but that was not the case for mild or severe dementia (Thommessen *et al*., 2002; Allegri *et al*., 2007). However, a different measure of cognitive status (the revised Hasegawa Dementia Rating Scale) was found to be related to caregiver's burden in dementia (Nagatomo *et al*., 1999). Different types of behavioral symptoms were associated with caregiver burden in dementia (Donaldson *et al*., 1998), as well as other types of symptoms such as unusual motor behavior and sleep disturbances (Donaldson *et al*., 1998; Allegri *et al*., 2006). Depressive symptoms had a positive relationship with caregiver burden in Parkinson's disease, while the evidence for dementia is mixed (Donaldson *et al*., 1998; Thommessen *et al*., 2002; Allegri *et al*., 2006). Patient's gender (Nagatomo *et al*., 1999) and caregiver's income (Allegri *et al*., 2006) were found to be associated with caregiver burden in dementia. Caregiver's gender was associated with burden in stroke and Parkinson's disease (Thommessen *et al*., 2002).

Caregiver burden in diseases of the elderly is of particular concern in the developed world due to population ageing. However, it also involves developing countries with regions of ageing demographic structure. It is therefore important to understand how caregiver burden is influenced in specific settings. Relationships found in other settings need to be tested locally because the relative importance or the mix of factors influencing caregiver burden could change.

In a previous report, it was shown that caregiver burden in demented patient was mainly influenced by neuropsychiatric symptoms in Buenos Aires, Argentina (Allegri *et al*., 2007). A summary symptom burden was found to be correlated with caregiving burden. Moreover, bivariate correlations with positive symptoms such as aggression, but not with negative/affective symptoms such as depression were found. Cognitive function and dementia severity were not correlated with caregiver burden, while education level was the only demographic factor associated with caregiver burden.

The objective of this research was to compare the determinants of caregiving burden in geriatric patients with cognitive impairment/dementia or depression/cerebrovascular disease in Buenos Aires. The research previously reported was expanded in two ways. First, the sample size of cognitive impairment/dementia patients was more than doubled. Second, a structural equation model (SEM) approach was used. SEM incorporates measurement error in the estimation process, it adapts to many types of data and violations of the normal classical theory and it allows for models that can include intermediate variables.

METHODS

Patient population

The study population was obtained from the Memory Clinic in Zubizarreta Hospital at Buenos Aires, Argentina, a reference public hospital for patients with cognitive and behavioral problems. Since 2001, the clinic has implemented a clinical database with data collected as part of the routine initial visit of the patient and his/her primary caregiver. The routine clinical protocol records demographic information, clinical variables (functional status, neurological examinations, neuropsychiatry evaluation and neuropsychological assessment) and caregiver burden.

All caregivers assessed since 2001 were included in this study if the geriatric patient cared for had a clinical diagnosis of dementia or cognitive impairment (Alzheimer, vascular and mixed) (Group 1) or geriatric depression (with or without cerebrovascular disease (CVD)) (Group 2). A cross-sectional study design was used. Due to sample size considerations, patients were divided in two groups: cognitive impairment/dementia and CVD/depression. The study received local IRB approval and appropriate informed consent was obtained from the caregivers and the patients.

Caregiver variables

Caregivers' demographic data were assessed by a clinical assistant in the clinic, including age, gender, education level and income. Caregivers completed the Zarit Burden Interview (Zarit and Vandenbos, 1990). It consists of 22 items that are self-administered (score

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ranges from 0–88). Higher score represent higher burden.

Patient variables

Patients were assessed with the Mini-Mental Scale Examination (MMSE) (Folstein *et al*., 1975), the Clinical Dementia Rating (CDR) (Hughes *et al*., 1982) and the neuropsychiatric symptoms assessed with the Neuropsychiatric Inventory (NPI) (Cummings *et al*., 1994).

Depression was assessed with the Beck Depression Inventory (BDI), a 21-item questionnaire with a 0–63 total score. Higher scores indicate more depressive symptoms (PROQOLID, 2007).

Functional assessment was recorded with the Instrumental Activities of Daily Living (IADL). The IADL considers eight activities with a total score with range 0–17. Higher score indicates more functional impairment (Lawton and Brody, 1969).

Measurement constructs

Structural equation modeling postulates that observed variables are approximations to unobserved (but real) constructs. As such observed variables are subject to measurement error and it is better to capture a given characteristic with more than one observed variable. The following latent constructs were hypothesized in the original measurement models:

Cognition/Function: MMSE, CDR, IADL
Positive symptoms: psychotic and frontal symptoms
Depression: affective and negative symptoms in the NPI and BDI
Caregiver burden: Zarit value, assuming a reliability of 0.7 as found in Arai *et al*. (1997).

Statistical analysis

All analyses were performed with SPSS version 13 (SPSS Inc, Chicago, IL, USA) and Lisrel 8.80 (Scientific Software International, Inc, Lincolnwood, IL, USA). Scoring was performed according to each questionnaire's guidelines. Missing values were imputed both for continuous and ordinal variables. Variables were tested for normality. Given the small sample size and the presence of non-normal data, maximum likelihood with an asymptotic covariance weight matrix was used in the measurement and structural model estimations. Ordinal variable recoding was performed to obtain stable asymptotic covariance matrices. Recoded CDR ranged from 0–3 and recoded IADL from 0–3.

Measurement model

The first step when fitting structural models is to postulate a measurement model. Measurement models link observed variables with latent constructs, but do not allow for relationships between independent and dependent latent constructs. When the relationship between measured and latent variables is not established, exploratory measurement models seek to elucidate models with theoretical sense and good statistical fit. An initial measurement model was postulated for each caregiver group using the constructs mentioned in the previous section (except the burden construct that was used as a dependent construct in the structural model). The model was modified in the following cases: (i) poor factor loading (<0.6); (ii) high correlation between latent constructs pointing into the need to unify some of those; and (iii) poor fit. Once an initial model was estimated, it was tested for equality of measurement model invariance across the cognitive impairment/dementia and CVD/depression patients with a Chi-square test. If a single model for the two caregiver groups could not be substantiated, then specific measurement models for each patient group were estimated.

Structural models link independent and dependent latent constructs that are defined by observed variables. Final measurement models were linked to a caregiver burden construct (defined by the Zarit).

Measures of model fit examine if the hypothesized covariance structure of a measurement or structural model can account for the observed covariance in the data. Measurement models and structural model fit were evaluated with the Satorra-Bentler Chi-square statistic, the Root Mean Square Error of Approximation (RMSEA) (≤ 0.05 or with 90% Confidence Interval), Comparative Fit Index (CFI) and Non-Normed Fit Index (NNFI) (both ≥ 0.9 for good fit).

RESULTS

Study sample

Two hundred and sixty-three caregivers–patients pairs were included. After missing data imputation, 258 caregiver–patient pairs could be analyzed (162 in the cognitive impairment/dementia group and 96 in the depression/CVD group).

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Table 1. Caregivers: demographic and caregiving-related variables ($n = 258$)

Variable	Cognitive Impairment/Dementia ($n = 162$)	Depression/CVD ($n = 96$)	*P*-value
Age (years) mean (SD)[a]	56.6 (15.9)	52.6 (16.2)	0.91
Gender, n (%)[a]			
Female	93 (69.4%)	58 (73.4%)	0.64
Education (years) mean(SD)[a]	10.3 (4.5)	10.6 (4.9)	0.26
Relationship to patient, *n* (%)[a]			
Spouse	73 (54.9%)	33 (41.8%)	0.094
Son/Son-in-law	41 (30.8%)	36 (45.6%)	
Brother/Sister	14 (10.5%)	4 (5.1%)	
Other relative	3 (2.3%)	3 (3.8%)	
Other	2 (1.5%)	3 (3.8%)	
Paid caregivers, *n* (%)[a]	15 (12.7%)	6 (9.0%)	0.30
Zarit, mean (SD)	97 (59.9)	25 (26.0)	0.065

[a]Values do not add up to 256 due to missing values.

Table 1 presents caregiver-related variables. Gender, educational level and number of paid caregivers were similar in both groups.

Table 2 shows patients demographic and clinical variables. Cognitive impairment patients were older ($p < 0.05$). Gender and education levels were similar. A higher proportion of patients with Cognitive impairment/Dementia had a CDR of 1 or higher ($p < 0.001$). Mean MMSE and BDI were lower among patients with cognitive impairment/dementia, while mean NPI was higher. An important proportion of patients with cognitive impairment had a IADL score of 4 or higher ($p < 0.001$). There were no statistically significant differences in presence of psychotic, frontal and affective symptoms between groups.

Measurement models

Model 1 in Table 3 shows the results of the initially postulated measurement model for the pooled sample. The fit of the model was inadequate by using the Satorra-Bentler Chi-square statistic but it was adequate using the RMSEA, CFI and NNFI. The factor loading of BDI was low, and the correlation between the constructs depressive symptoms and positive symptoms was high, indicating that these constructs should be combined in one. Based on these considerations a second model was fitted, where the depressive symptoms and positive symptoms constructs were combined into a behavior construct and BDI was eliminated from the construct (Model 2 in Table 3). Factor loadings were good for all the measures except for depression (affective/negative symptoms from the NPI), which had a borderline value. Model fit was not adequate with the Satorra-Bentler Chi-square statistic and the RMSEA but it was adequate with the CFI and NNFI. A Chi-square test for the equality of factor loadings indicated a statistically significant reduction in chi-square when the factor loadings were allowed to vary between the samples (Table 4). Therefore, it was concluded that separate measurement model had to be estimated for each group.

The final measurement models for both groups are shown in Table 5. The factor loadings were adequate for all the variables in both models. Model fit was adequate by three of the four fit indices for Group 1 (RMSEA with a Confidence Interval including 0.05, CFI and NNFI) and for all indices for Group 2. Both models showed increasing behavioral problems with increasing number of depressive/negative, psychotic and frontal symptoms. Also, both models showed that cognition-function deteriorated (higher score means deterioration) if the CDR rating increased and if the MMSE and IADL activities reduced.

Structural models

The structural models are presented in Table 6. The measurement models factor loading in the structural changed slightly in both cases for the behavior construct (compared to the results in Table 5).

The structural model for Group 1 sample had a good statistical fit by all the indices that were considered. The model indicated that both the functional and symptoms constructs were significantly associated to caregiver burden. Structural regression coefficients are interpreted as standardized regression coefficients (range: −1–1). The structural coefficient linking function and burden was 0.32, indicating that lower

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Table 2. Patients: demographic and clinical variables ($n = 258$).

Variable	Cognitive Impairment/Dementia ($n = 162$)	Depression/CVD ($n = 96$)	P-value
Demographic variables			
Age (years) mean (SD)	77.7 (8.5)	68.9 (9.7)	0.01
Gender, n (%)[a]			
Female	98 (60.5%)	58 (60.4%)	0.54
Education (years) mean (SD)	8.5 (3.9)	9.2 (3.9)	0.24
Clinical variables			
Time since diagnosis in months, mean(sd)	complete	complete	
CDR, *n* (%)			
0	0 (0.0%)	1 (1.0%)	<0.001
0.5	51 (31.4%)	69 (71.9%)	
1	47 (29.0%)	20 (20.8%)	
2	33 (20.4%)	2 (2.1%)	
3	31 (19.1%)	4 (4.1%)	
MMSE, mean (SD)	19.5 (8.2)	25.4 (5.6)	<0.001
NPI, mean (SD)	20.8 (23.2)	13.7 (14.2)	0.007
Psychotic symptoms, *n* (%)			
0	47 (29.0%)	37 (35.8%)	0.25
1	43 (26.5%)	26 (27.1%)	
2	37 (22.8%)	22 (22.9%)	
3	22 (13.6%)	6 (6.3%)	
4	13 (8.0%)	5 (5.2%)	
Frontal symptoms, n(%)			0.069
0	110 (67.9%)	59 (61.5%)	
1	40 (24.7%)	21 (21.9%)	
2	12 (7.4%)	16 (16.7%)	
Affective symptoms, *n* (%)			0.31
0	31 (19.1%)	16 (16.7%)	
1	36 (22.2%)	23 (24.0%)	
2	51 (31.5%)	22 (22.9%)	
3	44 (27%)	35 (36.5%)	
BDI, mean (SD)	10.5 (7.3)	15.2 (10.0)	<0.001
IADL, *n* (%)			
0	25 (15.4%)	43 (44.8%)	<0.001
1–3	40 (24.7%)	28 (29.2%)	
3–14	97 (59.9%)	25 (26.0%)	

[a]Values do not add up to 256 due to missing values.

function was associated with higher burden. The structural coefficient was 0.69 for the relationship between symptoms and burden, indicating a stronger relationship between burden and symptoms than between burden and function. Both structural coefficients had a significant T-value. The structural regression model accounted for 71% of the variation in burden.

The structural model for the combined CVD/depression sample also had a good fit by all the fit indices considered. However, the structural regression coefficient for function was not statistically significant. The coefficient for symptoms was similar to the value obtained in the analysis for cognitive impairment/dementia patients, and it was statistically significant. The structural regression accounted for 55% of the variance in the burden construct.

DISCUSSION

Caregiving is an important aspect related to the diseases of the elderly population, and it is important to understand its determinants. To our knowledge, this is the first reported research about caregiving burden using a SEM approach in a South American sample.

This study estimated measurement models and structural models. Although the final measurement models included the same constructs defined by the same measures in each constructs, a test for invariance of factor loadings indicated that each group had to be modeled separately because factor loadings were not comparable between both groups.

In the structural models having IADL as one component of the function construct, both functional status and behavioral symptoms were associated with

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Table 3. Measurement models for pooled sample

Mode 1		Model 2	
Factor/Variable		Factor/Variable	
Affective symptoms		Behavior	
Depressive	0.89	Depressive	0.55
BDI	0.35	Psychotic	0.83
Positive		Frontal	0.77
Psychotic	0.84		
Frontal	0.75		
Cognition – Function		Cognition – Function	
CDR	1	CDR	1
MMSE	−0.86	MMSE	−0.85
IADL	0.84	IADL	0.84
Factor correlations		Factor correlations	
Affective-Positive	0.74	Behavior-Cognition	0.2
Affective-Function	0.05		
Positive-Function	0.23		
Model fit		Model fit	
S-B X^2 statistic	61.8 ($p < 0.001$)	S-B X^2 statistic	44.0 ($p = 0.00$)
RMSEA	0.13 (0.01–0.16)	RMSEA	0.12 (0.09–0.16)
CFI	0.95	CFI	0.96
NNFI	0.91	NNFI	0.93

Table 4. Test of factor loading invariance between the cognitive impairment/dementia and CVD/depression patients (using Model 2, Table 3)

Model	X^2	Df
Unconstrained models	380.99	19
Equality of factor loadings	589.34	24
Test of equality of factor loadings	208.35	5
P-value		<0.00001

caregiver burden in the cognitive impairment/dementia patients. In contrast, only behavioral symptoms were associated with caregiver burden in the CVD/depression sample. Previous literature found some of the factors in the defined construct function not associated with caregiver function in dementia. The construct was nevertheless somewhat heterogeneous and the common traits defined by CDR, MMSE and IADL may be influencing burden. The effect estimate for function-cognition was however less than 50% of the effect estimated for behavior, consistent with previous findings that showed behavior to be more important than function regarding caregiver burden

Table 5. Measurement models: cognitive impairment/dementia and CVD/depression patients

Factor/Variable	Cognitive impairment/Dementia	CVD/Depression
Behavior		
Depression	0.61	0.71
Psychotic	0.85	0.85
Frontal	0.70	0.89
Cognition – Function		
CDR	1	1
MMSE	−0.92	−0.65
IADL	0.84	0.74
Factor correlation		
Behavior-Function	0.19	0.28
Model fit		
S-B X^2, df, *p*-value	17.4, 9 ($p = 0.04$)	8.0, 9 ($p = 0.53$)
RMSEA	0.08 (0.01–0.13)	0.00 (0.00–0.11)
CFI	0.98	1
NNFI	0.97	1.01

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Table 6. Structural equation models with IADL in function construct

Factor/Variable	Cognitive Impairment/Dementia		CVD/Depression	
Regression model	Coef.	*T*-value	Coeff.	*T*-value
Behavior	0.32	2.79	0.68	6.02
Cognition – Function	0.72	7.48	0.16	1.35
Correlations				
Function-Behavior	0.19		0.27	
Function-Burden	0.46		0.35	
Behavior-Burden	0.76		0.73	
R2	0.71		0.55	
Model fit				
S-B X^2, df, *p*-value	20.8 13 ($p = 0.08$)		5.9, 13 ($p = 0.95$)	
RMSEA	0.00 (0.0–0.07)		0.0 (0.0–0.01)	
CFI	0.99		1	
NNFI	0.98		1.03	

(Donaldson *et al*., 1998; Allegri *et al*., 2006). In contrast, in the CVD/depression patients, only function-cognition was significantly associated with caregiver burden.

This study had some limitations. Sample sizes were small, below the recommended minimum of 200 per group. This may have compromised the stability of the estimates. It would have been more informative to analyze the patients with depression with or without CVD separately; however, due to sample size limitations this was not possible. With increased sample sizes, it may become possible to include gender in the model, as each dichotomous variable requires 200 patients per each of the two categories in the dichotomous variable. The variable education was originally included in the models and later excluded due to problems with model fit. Another limitation is that both the burden construct and the ADL construct (when defined) had only one measure. The reliability of the Zarit was assumed from previous literature, while it was assumed that IADL had a reliability of 0.7. Further research should incorporate the NPI burden component as another measure of burden to be combined with the Zarit. It should also be possible to use hours of caregiving as additional estimate of ADL; however, this was not feasible in this research.

In summary, it was shown that dementia severity, cognitive status, IADL and behavioral symptoms are related to caregiver burden in a South American sample of patients with cognitive impairment, dementia, CVD and depression, using a method of estimation that allows for measurement error and flexible model building. Moreover, these factors seem to impact dementia differently than in the CVD/depression, although given the explained limitations this conclusion should be considered with care. Further work should be undertaken in Latin-America to assess the several dimensions of caregiving burden and the relative weight of the determinants of care according to different diseases.

CONFLICT OF INTEREST

None known.

DESCRIPTION OF AUTHORS' ROLES

GM and RFA conceived the project, designed the study, supervised the data collection, statistically analyzed the collected data and wrote the paper. CS and CD were involved in carrying out the study, collected the data and assisted in writing the paper. All authors read and approved the final manuscript.

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