



# Predictors of female caregivers' burden: An estimated conceptual model in low income settings

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Globally, there has been increasing interest in the study of caregiving. Female caregiver predictors or mediators and a multidimensional female caregiver burden (FCG burden) model that incorporates environmental hygiene factors such as toilet hygiene and kitchen are lacking, particularly in low- and middle-income countries. This study evaluates caregiver burden predictors and provides a multidimensional model of unremunerated care burden for family practice and policy in two different population group communities in Cape Town, South Africa. A systematic random sampling (SRS) procedure was employed, and 100 black or African and 100 mixed race female caregivers in two different cultural communities were selected for a reliable cross-section. A questionnaire was used to solicit caregiver burden information. The average age of the female caregivers was 47.9 years (standard deviation [SD] = 11.7 years). About 49.0% of the selected participants were older than 50 years. There was a significant relationship between environmental health (kitchen hygiene and toilet hygiene). Social grant receipt and physical health status of care recipients were predictors of caregiver burden. The overall model explained the largest variation (43.4%) in caregiver burden. This study recommends an increase in the social grants given to caregivers. National health policies should reflect female caregivers' circumstances.

**Transdisciplinarity Contribution:** This article contributes to the improvement in community health.

**Keywords:** caregiver burden; burden mediators; regression analysis; modelling; government policies.

## Introduction

The ageing of the population is an increasing phenomenon, particularly in the low- and middle-income countries.<sup>1,2</sup> For many of the aged and frail elderly persons and the children, who are dependent on others for their daily activities of living is the only way to live. The provision of care for these care recipients living in the community mostly come with some inherent challenges perceived as negative or a burden on those involved in the care giving.<sup>3,4</sup> The negative effects or burden are multifaceted and mostly influenced by a variety of both caregiver and recipient attributes and available social support.<sup>5,6</sup> As in many African countries, caregiving in South Africa seems to have become more burdensome with the effects of the prevalence of multiple factors, including the effects of diseases such as human immunodeficiency virus (HIV), acquired immunodeficiency syndrome (AIDS) and coronavirus disease 2019 (COVID-19), which still remains a major health challenge.<sup>7,8,9</sup> Other major challenges in the burden experience include the psychological and physical functional status of the recipient, the need for support in instrumental activities of daily need, a lack of financial support and the basic knowledge about prevention of infection of primary caregivers and other family members.<sup>5,10,11</sup>

It is important to comprehend the interaction of the multifaceted domains of influence in the conceptualisation of caregiving in an all-inclusive manner with an in-depth understanding of elements specific to the South African context. The typical South African perspective involves the need for a broader comprehension of the contextual effects of caregiving and how female caregivers may in turn influence their environment. Limited financial and material resources, together with other spheres of the environment, may further compound the female caregiver burden (FCG burden).<sup>12,13,14</sup> About 32% of the South African, in 2021, population live in rural areas,<sup>15</sup> and a large proportion of the rural dwellers are said to be poor.<sup>16</sup> The underlying factors of burden are those related to poverty and powerlessness, and these are particularly endemic among the nonwhite citizens. In the low-income settlements where poverty is widespread, the main

sources of compensation in the form of food and/or transportation costs are significant predictors of participation in palliative care. Therefore, for some the caregiving role manifests as a source of livelihood that cannot be ignored and an important factor in a country that has high rates of insufficiency and dispossession.<sup>17,18,19</sup> Clearly, this phenomenon would have major implications regarding an individual's inspiration to become a caregiver. But in most poor communities, caregiving is not a choice. In such situations, caregivers are at a greater health risk regarding obligation and a sense of distress that is concomitant with their caregiving role.<sup>20</sup> Therefore, circumstantial factors could permeate the emotional impact within the broader caregiving context and knowledge. These factors can have a negative effect on the consideration of the caregiver's involvement and the nature of the caregiving, especially among less affluent families.

In this research, a caregiver (irrespective of age and sex) refers to any person who takes care of a nonbiological child, physically impaired person or a person who needs assistance in activities of daily living. The focus of this research is the informal caregivers, usually women, who play an important role in their dependents' well-being (i.e. care recipients such as children and aged persons) living in the household. Several studies<sup>21,22,23</sup> have reported on an experience of burden in executing this role, with few studies<sup>24</sup> contending that the caregiving role is beneficial. Moreover, a majority of the research on caregiver burden seems to involve meta-analysis of qualitative studies, with little quantitative research. This research will be largely quantitative to identify the predictors of caregiver burden within the study population to aid the statistical modelling in the estimation of a multidimensional model in the selected different cultural low-income settlements in Cape Town. The extant literature focuses only on a subsection of the group of concepts, and the measure of these concepts is limited to a few variables only. This study takes all of these spheres or contexts into account for an in-depth understanding of the burden processes in the study setting. It is against this backdrop that this work takes the Lazarus and Folkman model into account,<sup>25</sup> which is consistent with stress process model<sup>26</sup> that generally provides a basis to explain the processes when a person has to make an effort to cope with a stressful event such as caregiving.

## Research methods and design

From each of the two different cultural settlements (i.e. black or African and mixed race communities), a total of 100 female caregivers were selected through a systematic random sampling (SRS) procedure; thus, there was a total of 200 participants in this study. Data were collected on each construct emanating from the literature. However, two additional constructs of interest were included, namely: (1) environmental factors and (2) some selected health outcomes of care recipients, to allow for a more complete assessment of their effects on caregiver burden. The data were collected

using structured interviews with the primary female caregiver in each household. Two study areas chosen for the study included a predominantly black (New Rest in Gugulethu) and a predominantly mixed race (New Woodlands in Mitchells Plain) settlement that consists of mainly subsidised housing in Cape Town. A pilot survey was used to test the validity and consistency in the questions.

Inclusion criteria were the primary female caregivers who were present during the interview and willing and able to give informed consent. The study defined caregiver as someone having an elderly person and/or a nonbiological child under her care and living in a formal settlement within a defined boundary of the settlement. Further, dwelling units that formed part of the pilot study were not included in the main study.

## Outcome variables and measurement

Consistent with the main effects of social research in caregiver studies, the main interest was related to FCG burden or strain. This effect was measured as either being burdened or feeling no burden, using the applicable inventory variables in the study settings.

## Data analysis

The fully structured instrument assessed the caregiving burden and used both objective and subjective measures.

*Caregiver burden* was measured with the aid of self-report information from the recipients. The study used eight questions in the assessment, including: (1) financial strain, (2) insufficient level of funds, (3) a lack of privacy, (4) physical strain, (5) change in lifestyle, (6) difficulties with social life, (7) sleep disturbance and (8) a lack of control over one's life.

*Function* of the care recipients was examined by using the *activities of daily living* and *instrumental activities of daily living*. The former included difficulties the participants experienced with feeding, cooking, dressing, bathing and washing the clothes of care recipients. The latter included the user needs of care recipients (i.e. wheelchair, spectacles, walking stick and transport).

*Descriptive statistics* were used to depict the sociodemographics of the data and caregiving burden mediators, and the regression method was used to determine predictors of caregiver burden in the study. All statistical analyses were done using Statistical Package for the Social Sciences (SPSS) version 22 (IBM Corporation, Armonk, New York, United States).

## Ethical consideration

The Ethical Committee of the Faculty of Applied Sciences of the Cape Peninsula University of Technology (CPUT) gave the ethical clearance for the study (ref. no. 07/2013), and all participants had to complete a consent form.

## Results

The reliability test was conducted and the results showed that the Cronbach's alpha for items of activities of daily living was 0.909, and that of instrumental activities of daily living was 0.836. The caregiving burden mediators and regression analysis were preceded by a brief description of the sociodemographic attributes or characteristics of the sample and burden evaluation.

### Sociodemographic characteristics of the sample

The sample comprised 50.0% black African and 50.0% mixed race respondents. The mean age of the participants was 47.9 years (standard deviation [SD] = 11.7 years) and about one-third (35.5%) of the caregivers were educated. A total of 61% of the respondents were not in a spousal relationship. Only 2.6% earned R2000.00 or above per month. Almost half (i.e. 49.5%) of the respondents were in the caregiving role, providing care for 30 h or more per week. And only a small percentage (1.6%) indicated using some sort of caregiving burden-alleviating programme associated with the caregiving tasks.

### Female caregiver burden evaluation

From the eight caregiver-strain or burden-inventory questions, FCG burden was computed using a composite score with a mean after a reliability test (Cronbach's alpha = 0.819). The mean FCG burden was 27.04 (SD = 5.46), with minimum and maximum scores of 13 and 40, respectively. The percentage of people below the mean caregiving burden was 45.7%, and the percentage of those above the mean score was 54.3%. Caregivers with a score above the mean were presumed to be burdened. The score indicates that the higher the score, the higher the caregiver burden.

### Female caregiver burden mediators

Table 1 presents the socio-economic characteristics, the caregiving contexts and female caregiving burden mediators. The results show that, the average burden score was 27.04% (SD = 5.46), with minimum and maximum scores of 13.0% and 40.0%, respectively.

In terms of a caregiver approach when something goes wrong with the care recipients, a majority of the caregivers reported a spiritual approach (contacting a pastor, 14.5%, and praying over it, 37.0%). A small proportion (12.5%) made use of other approaches. About 20.0% of the caregivers reported approaching their family and/or neighbours, and 13.5% of caregivers reported contacting the care recipient's parents directly. Only 2.5% reported taking a walk to relax as an approach.

For reliability on family support, 64.0% reported that they can rely on their family for support, whereas 36.0% reported that they cannot rely on their family for the necessary support.

**TABLE 1:** Female caregiving burden mediators (*n* = 200).

Characteristics	Number	Percentage
Minimum score	13	-
Maximum score	40	-
<b>Care approach</b>		
Take a walk	5	3
Contact family	24	12
Contact neighbours	16	8
Contact pastor	29	15
Pray over it	74	37
Contact CRs parent	27	14
Other	25	13
<b>Reliability on family support</b>		
Yes	128	64
No	72	36
<b>Financial reward or pay</b>		
Yes	51	26
No	149	74
<b>Receive social grants (CRs)</b>		
Yes	144	72
No	56	28
<b>Chronic condition</b>		
Yes	67	34
No	133	67
<b>Taking Chronic medication</b>		
Yes	197	98
No	3	2
<b>Road-To-Health card for child</b>		
Yes	193	96
No	7	4
<b>Community support</b>		
Yes	138	69
No	62	31

Note: Mean burden score (SD) = 27.04 (5.46).  
SD, standard deviation; CRs, care recipients.

Regarding receipt of any financial reward or pay for the caregiving task, 26.0% reported *yes* and 74.0% reported *no* to the question.

With respect to receiving social grants for care recipients under their care, a significant proportion of caregivers (72.1%) reported receiving a form of social grant on behalf of the care recipients, while 27.9% reported that they do not receive any form of social grant on behalf of the care recipients. The question was asked because in Cape Town there do exist safety nets such as child support grants.

As informal caregiving takes place in the community, this study explored whether the caregivers could rely on the social networks within their community to give quality care. Interestingly, larger proportions of caregivers (69.0%) reported that they could rely on their settlements for support, whereas 31.0% reported that they could not rely on their settlements for support if and when needed.

For the childcare recipients' health, it is quite striking that as countries seek to achieve full universal coverage of immunisation against childhood diseases in an effort to eradicate both infant mortality and child mortality, some settlements in parts of Africa are sadly reporting low coverage levels. A large proportion of the caregivers (95.9%)

in this study reported that they have a 'Road-to-Health card' for the children under their care. It is to be mentioned that a caregiver (respondent) who responded 'yes' to having a health card for the child was asked by the interviewer to show it before it was noted as such.

In terms of care recipients' health evaluation, chronic condition status was used as the health outcome in this study. The caregiver was probed to learn whether any of the care recipients lived with a chronic condition. About one-third of the respondents (33.5%) mentioned that the care recipient has some or other chronic condition, with the remainder (66.5%) reporting that the care recipient has no chronic condition. For verification, those who responded 'yes' on this question were further probed to learn if the care recipients who live with the chronic condition were taking chronic medication. An overwhelming majority (98.4%) of this group indicated that those living with these conditions were on some type of chronic medication. For further verification for this information, the caregiver was asked to show the container of the chronic medication.

### Regression analysis with caregiving burden as the dependent variable – An estimated model

The results of the individual constructs with the set of predictors in five blocks using FCG burden as the dependent variable are presented in Table 2, and the regression model effect on caregiver burden is given in Table 3.

In Table 2, Model 1, the results showed that 15.8% of the variation in caregiver burden (Adj.  $R^2 = 0.158$ ) was explained by female caregivers' age, population group or race, education, income and marital and employment status. In this model, population group statistically predicts FCG burden ( $\beta = 4.805$ ,  $p < 0.05$ ). Further, in Table 2, about 25.0% of the variation in caregiver burden (Adj.  $R^2 = 0.25$ ) in Model 2 was explained by the background characteristics of respondents and the stressor variables, such as duration in the care role, number of hours care provided, the daily living activities, instrumental activities of daily living, chronic diseases and diarrhoea. In Model 2, the caregiving burden for those who provided care for recipients living with chronic disease was 2.7 points higher than that of those providing care for recipients with no chronic disease ( $\beta = 2.733$ ,  $p < 0.05$ ).

In Table 2, Models 3, 4 and 5, controls for constructs 1 and 2, *stress mediator variables* such as family support, social grants, coping strategies and programme use were introduced. Furthermore, 34.5% of the variation in caregiver burden (Adj.  $R^2 = 0.345$ ) in Model 3 was explained by the three constructs. In this case, receipt of social grants was the only significant predictor of caregiver burden. Specifically, the caregiving burden for those who received social grants was higher than those with no social grants ( $\beta = 4.487$ ,  $p < 0.05$ ). In Model 4, the *environmental factors* such as kitchen hygiene and toilet hygiene were added to Model 3. Also, 35.3% of the variation in caregiver burden (Adj.  $R^2 = 0.353$ ) in Model 4

was explained by the model, and social grants were still the only significant predictor of caregiver burden ( $\beta = 4.355$ ,  $p < 0.001$ ).

The final or overall model (Model 5), adjusting for Models 1–4, is the proposed estimated model (an estimated model of caregiver burden in the study) of FCG burden, with the set of predictors that were statistically significant and jointly explained approximately at 43.4% of the variance in caregiver burden (adj.  $R^2 = 43.4\%$ ,  $p < 0.05$ ). Considering the four estimated models that preceded Model 5, the results showed that in the models, the variation in caregiver burden was explained by significant variables of the constructs. These variations were as follows: 15.8% for Model 1, 25.0% for Model 2, 34.5% for Model 3 and 35.3% for Model 4.

In each of the models, there were additional predictors of FCG burden, with the exception of Model 4, in which the hypothesised construct (environmental health – kitchen hygiene and toilet hygiene) did not show any effect but slightly increased the variation in caregiver burden from 34.5% to 35.3%. The effect of environmental health factors could be nested in key socio-economic factors such as education and income status. Model 1, the population group of caregivers; Model 2, availability of social support in the form of grants; Model 3, chronic disease status of care recipients; and Model 5, social support and physical health or function of care recipients all significantly predict caregiving burden in the study population.

## Discussion

The majority of the researches on caregiver burden involves the meta-analyses of qualitative studies with little quantitative research. This research was largely quantitative and evaluated caregiving burden with prediction possibility constructs. Female caregiver burden was reported among the participants. The study showed a significant statistical relationship between the posited constructs in the study, *environmental health* (kitchen hygiene and toilet hygiene) in the physical home environment and the *care recipients' physical health*. Further, this study aided in providing female caregiving burden predictors and estimated a multidimensional model that showed: (1) *social grant receipt* as a form of safety net and (2) the *physical health status* of the care recipient being key predictors of female caregiver strain (burden) and explained the largest variation (approximately 43.4%) in caregiver strain in the selected different cultural low-income settlements in Cape Town.

This study evaluated caregiving burden with the aid of the Lazarus and Folkman model<sup>25</sup> and stress process models<sup>26</sup> for their wide acceptance in the caregiving burden literatures. Two important constructs – that is, environmental health and care recipients' physical health – were incorporated towards estimation of a multidimensional model of caregiver burden in the two low-income but different cultural settlements in Cape Town.

**TABLE 2:** Results of multiple regression analysis of mediators, environmental and physical health factors (Model 5).

Variable	$R^2$ change	F ratio for $R^2$ change	Model of caregiver burden				
			$\beta$	SE	T	p-value	95% CI
<b>Background and context</b>	0.158	2.716**	-	-	-	-	-
<b>Age</b>							
Less than 30 (RC)	-	-	-	-	-	-	-
30–49	-	-	-0.031	1.525	-0.020	0.984	-3.044, 2.982
50 and above	-	-	-1.565	1.770	-0.884	0.378	-5.063, 1.982
<b>Level of education</b>							
Less than Grade 8 (RC)	-	-	-	-	-	-	-
Grade 8–11	-	-	0.820	1.224	0.670	0.504	-1.599, 3.238
Grade 12 and higher	-	-	1.036	1.317	0.787	0.433	-1.568, 3.639
<b>Income</b>							
R0.00–R500 (RC)	-	-	-	-	-	-	-
R501.00–R1000.00	-	-	-1.402	1.712	-0.819	0.414	-4.785, 1.981
> R1001.00	-	-	-2.661	1.641	-1.622	0.107	-5.903, 0.582
<b>Marital status</b>							
Currently married (RC)	-	-	-	-	-	-	-
Never married	-	-	0.037	1.048	0.035	0.972	-2.034, 2.107
Formerly married	-	-	1.061	0.899	1.180	0.240	-0.715, 2.837
Cohabiting	-	-	-0.310	1.608	-0.193	0.847	-3.487, 2.867
<b>Population group</b>							
Mixed race people (RC)	-	-	-	-	-	-	-
Black people	-	-	-0.370	2.907	-0.127	0.899	-6.116, 5.376
<b>Employment status</b>							
Housewife (RC)	-	-	-	-	-	-	-
Employed	-	-	-0.102	1.416	-0.072	0.943	-2.901, 2.697
Unemployed	-	-	-0.800	1.316	-0.608	0.544	-3.402, 1.801
<b>Stressors</b>	0.25	2.334**	-	-	-	-	-
<b>Duration of care</b>							
< 1 year	-	-	-	-	-	-	-
1–2 years	-	-	-0.116	0.987	-0.811	0.906	-2.067, 1.834
3–5 years	-	-	-0.006	1.382	-0.004	0.997	-2.736, 2.735
6 years and above	-	-	0.427	1.609	0.265	0.791	-2.753, 3.607
<b>Number of hours for care</b>							
< 10 (RC)	-	-	-	-	-	-	-
10–19	-	-	-0.251	1.048	-0.239	0.811	-2.321, 1.819
20–29	-	-	-0.183	1.582	-0.116	0.908	-3.309, 2.943
30–39	-	-	-1.355	2.586	-0.524	0.601	-6.467, 3.757
40+	-	-	-2.750	2.832	-0.971	0.333	-8.347, 2.847
<b>Activities Of daily living (ADLs)</b>			0.259	0.195	1.331	0.185	-0.126, 0.643
<b>IADLs</b>	-	-	-0.045	0.223	-0.204	0.839	-0.486, 0.395
<b>Chronic diseases</b>							
No (RC)	-	-	-	-	-	-	-
Yes	-	-	0.110	0.858	0.128	0.989	-1.586, 1.806
<b>Diarrhoea</b>							
No (RC)	-	-	-	-	-	-	-
Yes	-	-	1.324	0.845	1.567	0.119	-0.346, 2.993
<b>Stress mediators</b>	0.345	2.553***	-	-	-	-	-
<b>Family support</b>							
No (RC)	-	-	-	-	-	-	-
Yes	-	-	-0.258	0.816	-0.316	0.752	-1.871, 1.355
<b>Social grants</b>							
No (RC)	-	-	-	-	-	-	-
Yes	-	-	3.011	1.063	2.834	0.005*	0.911, 5.112
<b>Coping strategies</b>							
Contact family members (RC)	-	-	-	-	-	-	-
Contact neighbours	-	-	-0.621	1.554	-0.399	0.690	-3.693, 2.451
Contact pastor	-	-	-0.133	1.320	-0.101	0.920	-2.741, 2.475
Praying	-	-	-1.442	1.397	-0.56	0.577	-2.868, 1.602

Table 2 Continues on te next page →

**TABLE 2 (Continues...):** Results of multiple regression analysis of mediators, environmental and physical health factors (Model 5).

Variable	$R^2$ change	F ratio for $R^2$ change	Model of caregiver burden				
			$\beta$	SE	T	p-value	95% CI
Contact parents	-	-	-1.442	1.397	-1.033	0.303	-4.203, 1.318
Others	-	-	-0.602	1.351	-0.445	0.657	-3.272, 2.069
<b>Programme use</b>							
No (RC)	-	-	-	-	-	-	-
Yes	-	-	1.784	1.657	1.076	0.284	-1.491, 5.058
<b>Environmental</b>	0.353	2.447***	-	-	-	-	-
<b>Kitchen hygiene</b>							
Good (RC)	-	-	-	-	-	-	-
Bad	-	-	1.800	1.812	0.993	0.322	-1.782, 5.381
<b>Toilet hygiene</b>							
Good (RC)	-	-	-	-	-	-	-
Bad	-	-	-0.854	1.687	-0.506	0.614	-4.188, 2.481
<b>Care recipients' physical health status</b>	0.434	3.198	-	-	-	-	-
<b>Excellent (RC)</b>							
Good	-	-	3.464	1.256	2.758	0.007*	0.982, 5.947
Bad	-	-	6.084	1.333	4.564	0.000*	-3.450, 8.710

$R^2$ , coefficient of determination;  $\beta$ , beta; SE, standard error; IADLS, instrumental activities of daily living; CI, confidence interval; RC, reference category.  
\*,  $p < 0.001$ ; \*\*,  $p < 0.001$ ; \*\*\*,  $p < 0.001$ .

**TABLE 3:** Constructs and regression model effect on caregiver burden.

Construct: Variation	Model 1 – Background and context	Model 2 – Stressors	Model 3 – Stress mediators	Model 4 – Environmental	Model 5 – Care recipients' physical health status
Adjusted $R^2$	15.8%	25%	34.5%	35.3%	43.4%

Note:  $p < 0.05$  – 5% statistical significance level at 95% confidence interval.

The findings of the study indicate that the number of hours of care, daily living activities, instrumental activities of daily living and the chronic disease status of the care recipients were all significantly related to caregiving burden. Thus, female caregivers who spent more hours in care tended to experience less care burden ( $r = -0.248, p < 0.01$ ). This finding concurs with other studies<sup>27,28,29</sup> that suggest that the caregiving role is rewarding rather than being viewed as negative to the mental health of the caregiver. However, care recipient stressors such as duration of care, the daily living instrumental activities and diarrhoea were not significantly related ( $p > 0.05$ ) to caregiving burden. In the case of the care recipient's needs for activities of daily living and instrumental activities of daily living, important care-recipient characteristics were associated with caregiver mental health, such as depression, including problem behaviour and higher dependence in activities of daily living.<sup>30,31,32</sup> When the female caregiver participates in instrumental activities in her effort to give care to the dependent recipient, such activities can obstruct other aspects of her life, such as relationships with other family members and even personal privacy, which could potentially result in stress or burden.<sup>11,18,25,26</sup> Other works posit a positive relationship between time in assisting with activities of daily living and objective burden.<sup>26</sup> This study established that the more impaired a care recipient was in reference to activities of daily living, the greater the burden of the caregiver's experience ( $r = 0.153, p < 0.05$ ). This corroborates the findings that care recipients' dependence for using the toilet is burdensome.<sup>1</sup>

These associations suggest that age, cultural differences, differences in education and income levels are important factors regarding experience of infectious or noninfectious

diarrhoea in care recipients in the caregiving environment. These findings are supported by studies of the experiences of caregiver burden among Asian-American caregivers,<sup>33</sup> as well as research regarding caregiver strain among black and white daughter caregivers<sup>34</sup> and a meta-analysis of ethnic differences in stressors, resources and psychological outcomes of family caregiving.<sup>32</sup> In the selected areas for this study, this was not the case for marital status, probably because marital status determines transmission of infection.

The study showed a statistically significant relationship between environmental health (kitchen hygiene and toilet hygiene) of the home and the physical health of care recipients. It is shown that a majority of the caregivers have a basic education and therefore read and understand basic health information. This means that the caregivers could have access to hygiene-sensitive information. Thus, one would expect that in these homes, if the kitchen were clean, the toilet too would be hygienically clean. However, it is expected that with a bad home hygiene status, especially if the toilet is not kept clean and regularly disinfected, the care recipients would be exposed to bacterial infections. A preliminary analysis using the chi-square test (bivariate analysis) for environmental factors such as kitchen hygiene and toilet hygiene status found a statistically significant relationship between these factors and the physical health of care recipients. This finding suffices for a conclusion that there is an association between environmental health status and the physical health of care recipients. This was supported by the results of the Pearson correlation analysis.<sup>30</sup> Therefore, the possibility of 'formalising' the 'informal caregiving' sector in society, especially in lower socio-economic status communities, could alleviate the

need for caregiving facilities and caregivers by the state, in which case the informal caregiving households could be registered as such, and the households could be subjected to regular health and hygiene inspections by environmental health practitioners.

The estimated model presented by this study, Model 5, showed that only two variables: (1) social grant receipt as a form of safety net and (2) physical health status of care recipient, predicted female caregiver strain (burden) and explained the largest variation (approximately 43.4%) in caregiver strain. The caregiver strain or burden was reported by caregivers who did not receive social grants on behalf of their care recipients. Categorically, only these two predictor variables made a difference in caregiver strain in the study areas in Cape Town. Thus, social grants and care recipients' physical health status are important community policy factors.

## Limitations

A major limitation experienced was that it was not possible to determine the specific or chronic disease for which caregivers were providing care. Soliciting such information would have infringed upon the respondents' privacy, but such data could have helped to determine the effect of each disease on the burden. Because of the complexity of the caregiving situations encountered during the interviews, further probing was not carried out to learn who else was present to provide care in the absence of the main caregiver, nor if there were deterrents such as toilet soap in the house. Information on hygiene practices such as washing hands after toileting were not probed for or directly captured in the questions. Adding this element would have allowed for a better understanding of the difference between knowledge and practice among caregivers in the study settings. Also, with the small number of caregivers in the sample, it was not possible to infer the findings to all caregivers in Cape Town. More low-income settlements should be included in future studies on modelling caregiver burden to aid an estimation of national burden model.

## Conclusion

On the basis of the current work, future research and healthcare policies by government to help ameliorate FCG burden at the household level should consider the estimated model proposed (Model 5) as a benchmark. The key factors of caregiver burden were the number of hours in the care role, daily living activities, instrumental daily living activities and care recipients' chronic disease status. Families are recommended to support caregivers by providing the needed instrumental support and socio-economic support.

The results of the analyses of the relationships between the constructs provided a critical basis for making recommendations for both policy and future research.

The inclusion of the care recipient's physical health status and the environmental health factors such as kitchen and

toilet hygiene statuses in the stress process model<sup>26</sup> could have improved the model. The work of Lazarus and Folkman<sup>25</sup> has given this postulation an impetus by buttressing the importance of caregivers' appraisal of the caregiving environment. It is, in this view, supporting the statistical model presented from this study that the model proposed (Model 5), should suffice for the need for a robust model of caregiving burden in designing healthcare intervention for both caregivers and care recipients in less affluent settlements in the developing world.

Findings from the study shed light on important aspects of informal carers' circumstances, particularly in the low-income settlements in Cape Town. It would make a significant contribution to the realm of public health, specifically on issues of informal caregivers' literature for family practice and policy.

The study recommends government recognition of the increasing importance of care recipients' physical health and thus increase the amount of the social grants given to the caregivers, because it could improve the circumstances of both the caregivers and the care recipients. Also, it could reduce the burden on the government to provide more formal care institutions for care recipients, while it could assist with improving the standard of living of the female caregivers in the population.

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### Competing interest

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

### Authors' contributions

Y.A.Y. is the lead researcher who led the conception and design, collection and analysis of data, interpretation of results and manuscript write-up. D.W.S. substantially contributed to the conception and design of the study and also provided guidance in the manuscript write-up.

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### Data availability

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

### Disclaimer

The views expressed in the article are solely of the authors and not an official position of the affiliated institution or the publisher.

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