

Caring for older dependent people in low and middle-income countries: the effect of age on mental health in caregivers

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Research article

Keywords: Ageing, Caregiver, Mental health, Burden, Developing countries

Posted Date: October 27th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-40311/v2>

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Abstract

Background: Older people worldwide are living with chronic health problems, of whom 80% are from low and middle-income countries. Caregiver stress is a complex interplay of health and socio-economic factors with older caregivers; however, the effects of caregiver age upon their mental health have not been well-described. This study aimed to examine whether caregiver age predicts their mental health outcomes in terms of psychological morbidity and care burden in Latin America and China.

Methods: The present study was based on cross-sectional baseline data of seven low and middle-income countries: Cuba, the Dominican Republic, Peru, Venezuela, Mexico, China, and Puerto Rico. Data were collected between February 2003 and June 2009 by the 10/66 Dementia Research Group. Data from 1348 households where the caregiver provided care for one older person in the household were included in the current analysis. Psychological morbidity was assessed through the Self-Reporting Questionnaire. The Zarit Burden Inventory was used to measure the levels of care burden of caregivers. Multivariate logistic regression was used to investigate the effects of caregiver age upon psychological morbidity and care burden. Meta-analysis was performed to obtain a pooled estimate of overall odd ratios and 95% confidence intervals of the analyses from the different countries, using the inverse-variance weighted fixed-effect method.

Results: The prevalence of households with older caregivers is almost at the same level as that of households with younger caregivers in Puerto Rico and China. The models unadjusted and adjusted for all potential covariates (household size, number of household assets, caregiver sex, caregiver marital status, caregiver education, cognitive impairment of older person, functional dependency of older person, behavioural problems of older person, and caregiving hours) showed that there was no statistically significant difference in psychological morbidity and care burden between older caregivers and non-older caregivers across countries. The adjusted pooled estimates, however, indicated lower psychological morbidity among older caregivers (OR = 0.61, 95% CI: 0.41–0.93, $I^2 = 0.0\%$).

Conclusions: Older caregivers are at lower risk of mental health problem than younger caregivers. This information may help to provide a greater understanding for service support, policy makers, and health care providers.

Background

The projected increase in the burden of chronic diseases in low and middle-income countries (LMICs) is largely driven by the underlying determinants of rapid population ageing. It has been estimated that 70 million older people worldwide are living with chronic health problems, of whom 80% were from LMICs [1]. Moreover, the prevalence of chronic disease is rising quickly across LMICs [2].

The proportion of the population aged 65 years or older in LMICs is projected to double between 2019 and 2050 [3]. Along with the ageing population situation, one of the major concerns is that both care receivers and caregivers are growing older [4, 5]. Current demographic trends such as decreases in

household sizes, higher occurrences of divorce, and greater geographic distances between families, have limited the availability of caregivers [6]. As a result, spouses and older adult children of the older people are progressively becoming responsible for caregiving in LMICs [7, 8].

Caregiving stress and burden are inevitable parts of being a caregiver, which adversely affect their physical and mental health and financial stability and cause a social burden [9, 10]. Caregivers' mental health problems have been recognised as a crucial health risk and mortality determinants for both caregivers and care receivers [11]. Caregiver burden is a complex interaction of caregivers' demographic and socio-economic factors and the health conditions of the people being cared for.

Compared with younger caregivers, older caregivers tend to have a *double-burden* due to their age [12, 13], which is related to physical and psychological morbidity and lower employment [14-16]. The older caregivers who are financially supporting other household members, and those with economically inactive or financial strain reported psychological problems [17, 18]. Moreover, it has been reported that the number of hours dedicated to caregiving by older caregivers is almost twice as high as by younger caregivers [19]. However, it was evident that better preparedness (perceived readiness) for the caregiving role interacting with high mutuality (relationship quality) [20], which was normally found in older spouse caregivers, buffer caregivers' psychological distress in response to high caregiver demands [21-23]. Closer relationships provided positive outcomes for the caregivers such as compromise, problem-solving skills, and positive adjustment [24]. In addition, the impact of caregiver age upon caregiver mental burden might be different across cultures, particularly in LMICs societies due to social expectations and long-term care availability [25].

Nevertheless, the middle-aged caregivers (mainly daughters or wives) might experience severe strain because they are embedded with multiple social role demands and responsibilities [26-28]. Previous literature reported that many younger caregivers were faced with mental problems from family and career disruption due to prolonged caregiving [29, 30].

Existing studies from the 10/66 Dementia Research Group (DRG) population-based cohort surveys of dementia and ageing in low and middle-income countries provides evidence to suggest that caring for older dependent people is associated with substantial mental health problems in caregivers [31-33]. To the author's knowledge, the effects of caregiver age upon their mental health have not been well-described. To address this gap in the current literature on caregiving in the context of the 10/66 DRG surveys and our understanding of these challenges, the objective of this study is to examine how caregiver's age group at baseline predicts their mental health in Latin America and China.

As mentioned previously, demographic change has contributed to a decrease in available young caregivers resulting in older caregivers having to serve this function. It presents a double-burden for older caregivers due to their age with related stress and morbidity. This study, therefore, aimed to test two hypotheses; (i) older caregivers experience worse psychological morbidity compared to younger caregivers, and (ii) older caregivers experience a worse care burden compared to younger caregivers.

Methods

Study design, settings, and sample

The 10/66 DRG is a population-based cohort study, which has carried out a series of repeated cross-sectional surveys in Cuba, the Dominican Republic, Peru, Venezuela, Brazil, Mexico, Puerto Rico, China, and India with the aim of understanding the health of older people with dementia in low and middle-income countries. This study was conducted in older residents aged 65 years and over and their caregivers, living in 11 geographically defined urban and rural catchment area sites. Details of the study methodology and protocols for the 10/66 DRG have been described elsewhere [34]. A full assessment was conducted for all eligible older individuals if they, or their kin, agreed to participate in the survey. The assessment covers a background socio-demographic, health and risk factor interview; a structured clinical mental state assessment; and a physical examination.

Data for the present study were drawn from the baseline phase of the 10/66 DRG in catchment area sites in seven low and middle-income countries: Cuba, the Dominican Republic, Peru, Venezuela, Mexico, China, and Puerto Rico. The study was conducted between February 2003 and June 2009 (in 2003–2006 for Cuba; in 2003–2004 for the Dominican Republic; in 2005–2007 for Peru; in 2004–2006 for Venezuela; in 2005–2007 for Mexico; in 2003–2005 for China; and in 2006–2009 for Puerto Rico). The study sites consisted of urban and rural areas. The boundaries of each catchment area were precisely defined, and households were assigned an identification number. Each household was then systematically visited to identify all household members aged 65 years and over who were eligible to participate in the survey. The specific details of the data of each country have been published elsewhere [35]. The total sample of households with older people from the seven countries was 11,717.

Selected households and participants

This study defined a main caregiver as a person who provides the most ‘hands on’ care or the family member who is the main ‘organisational’ caregiver. Data from 1348 households, where the main caregiver provided care for one older person diagnosed with dementia or without dementia in the household, were included in the current analysis. In order to test the research hypotheses, the sample households were classified into two categories: (i) younger caregiver households (where the main caregiver of the household was aged 64 years or younger), and (ii) older caregiver households (where the main caregiver of the household was aged 65 years or over).

Measures of caregiver mental health

Psychological morbidity was assessed through the Self-Reporting Questionnaire (SRQ). The questionnaire has been widely used in different populations. There are 20 items covering symptoms of depression, anxiety, and somatised distress [36]. The SRQ detects the presence of non-psychotic psychological symptoms over the past two weeks. It yields a total score that ranges from 0 to 20. Recommended by the WHO [37], higher scores indicating higher psychological morbidity with a cut-off

score ≥ 8 were identified as psychological morbidity (coded as 1), whereas scores of less than 8 were coded as 0 for non- psychological morbidity.

Care burden was measured using the Zarit Burden Inventory (ZBI) which is widely cited in the caregiver burden literature and has been translated and validated allowing for international comparisons. It was used in the 10/66 pilot studies of the listed countries for this study; strong psychometric properties and cultural relevance were found [31]. The ZBI consists of 22 items including; health, psychological well-being, social life, finances, and the relationship between the caregiver and the older person, with each item being evaluated using a 5-point Likert scale [38]. Scores from 41 to 88 indicate 'a high burden' (coded as 1), and the scores below 41 signify 'a low burden' (coded as 0) [38, 39].

Measures of covariate variables

Guided by the Pearlin Stress Process Model [40] and the Yates Stress Process Model [41], the study sought to control for potential factors including household characteristics, older people's health status, socio-demographic status of the caregivers, and caregiving hours. These were entered into the model analyses as potential confounding factors, since these variables might affect caregivers' psychological distress and care burden.

1. Household characteristics

Household size refers to the number of household members in the older people household. Size of a household is often associated with considerable mental health issues due to long-term care for older people in the household [42].

Number of assets in a household out of a possible total list of seven (television, fridge/freezer, mains water, mains electricity, telephone, plumbed toilet, plumbed bathroom) is a proxy of socioeconomic status of the household since it represents more permanent status than does either income or consumption [43].

2. Older people's health status

Dementia refers to the presence of dementia according to the 10/66 Dementia Diagnostic assessments (the CERAD 10-word list recall task, the Community Screening Instrument for Dementia [CSI-D], and the Geriatric Mental State examination [GMS]) or DSM-IV dementia criteria. Presenting dementia either measured by the three 10/66 assessments or the DSM-IV was coded as 1, and 0 for the non-presence of dementia assessed by both measurements.

Functional dependency is severe difficulty performing basic Activities of Daily Living (ADLs) (eating, dressing, toileting, bathing, and walking) assessed by the WHO-DAS developed by WHO. This measure has shown promise in predicting disability level of older people, which affects care burden [44]. Severe difficulty with three or more basic ADLs was coded as 1, and severe difficulty with less than three ADLs was coded as 0.

Behavioural problems is the severity of 12 behavioural problems including presence of delusions, hallucinations, agitation/aggression, depression, anxiety, irrational euphoria, apathy, disinhibition, irritability, motor disturbance, disruptive nighttime behaviour, and adverse appetite/eating changes. The measurement is based on the Neuropsychiatric Inventory-Questionnaire (12NPI-Q) score, administered to the main caregiver.

3. Socio-demographic characteristics of the caregivers and caregiving hours

Sex refers to sex of the main caregiver. Sex difference is mentioned frequently in the literature, it is related to the kinship role and perception of stress and caregiver burden [45].

Marital status refers to the marital status of the main caregiver at the time of the survey. Theory and empirical findings suggest that there is a relationship between marital status and stress or mental health [46, 47]. It was coded for this analysis as a partnership (currently married or cohabiting) versus non-partnership (single /widowed/divorced/separated).

Education level is the highest level of education completed by the main caregiver. Caregivers with a relatively low education could be assumed to report a higher burden [48]. In this study, education was categorized into primary or lower and higher than primary.

Caregiving hours is the time spent assisting the older person with ADLs (eating, dressing, toileting, bathing, communicating, using transportation, looking after one's appearance, and supervising) by the main caregiver in the last 24 hours. The more confining the caregiver task, the more likely that it will create adverse mental health consequences for the caregiver [49, 50].

Statistical Analyses

Descriptive analysis was employed to describe the sample, to analyse the distribution of the background variables, and to explore the quantitative level of the variables. Tests of significance were performed to examine the association between the household and caregiver background variables, and the health status variables of the older persons with the caregiver age group using chi-square tests or Mann-Whitney U tests.

The main strategy for analysis was to apply multivariate models based on binary logistic regression to investigate the effects of caregiver age upon psychological morbidity and care burden. The first model was an unadjusted model. All covariate variables (household size, number of household assets, caregiver sex, caregiver marital status, caregiver education, cognitive impairment of older person, functional dependency of older person, behavioural problem of older person, caregiving hour) were controlled in the second model. An odd ratio (OR) and 95% confidence interval (CI) were presented to determine whether a caregiver age is a risk factor for psychological morbidity and care burden, and to compare the magnitude of the effect of caregiver age on the psychological morbidity and care burden. Meta-analysis was

performed to obtain pooled estimating one overall OR and 95% CI of the analyses from the different countries, using the inverse-variance weighted (fixed-effect) method. All statistical analyses were performed using STATA/SE 14.0 [51].

Results

Sample characteristics

In total, 1348 older people households were included in the study. The prevalence of older caregiver household where an older person in the household received care from a main older caregiver, was broadly similar across the seven countries (Table 1). The households with older caregivers were less prevalent compared to younger caregiver households. Notably, in China and Puerto Rico, 40.2% and 45.2% respectively, were older caregiver households. The characteristics of the households, background variables for the older people, socio-demographics of caregivers, and caregiving hours between the caregiver age group by country are summarised in Tables 1 and 2.

Table 1 Prevalence of older caregiver households vs. younger caregiver household, and background characteristics of households, health status of the older people between the caregiver age by country (n = 1348 households)

		Prevalence	Household characteristics		Older people's health status				
			size	No. assets	Dementia		Functional dependency		Behavioural problem
					No (%)	Yes (%)	No (%)	Yes (%)	median (p25, p75)
Cuba (n = 222)	Y	66.7	3(2, 5)	6(5, 6)	27.7	72.3	39.2	60.8	5(2, 10)
	O	33.3	3(2, 4)	6(5, 6)	29.7	70.3	39.2	60.8	4(2, 8)
	<i>p</i>		<i>0.12</i>	<i>0.43</i>	<i>0.75</i>		<i>1.00</i>		<i>0.10</i>
Dominican Republic (n = 208)	Y	76.9	4(3, 6)	5(4, 6)	54.4	45.6	60.6	39.4	8(3, 15)
	O	23.1	3(2, 5)	5(4, 6)	52.1	47.9	54.2	45.8	6(3, 10)
	<i>p</i>		<i>0.07</i>	<i>0.75</i>	<i>0.78</i>		<i>0.54</i>		<i>0.36</i>
Peru (n = 137)	Y	75.2	4(3, 6)	6(6, 6)	47.6	52.4	55.3	44.7	5(2, 9)
	O	24.8	5(3, 7)	6(6, 6)	52.9	47.1	41.2	58.8	5(2, 10)
	<i>p</i>		<i>0.57</i>	<i>0.33</i>	<i>0.59</i>		<i>0.15</i>		<i>0.99</i>
Venezuela (n = 181)	Y	87.8	4(3, 6)	6(6, 7)	51.6	48.4	78.6	21.4	4(1, 8)
	O	12.2	4(2, 5)	6(6, 6)	45.5	54.5	72.7	27.3	7(4, 13)
	<i>p</i>		<i>0.33</i>	<i>0.06</i>	<i>0.59</i>		<i>0.53</i>		<i>0.14</i>
Mexico (n = 157)	Y	80.3	3(1, 5)	6(5, 6)	58.7	41.3	71.4	28.6	5(2, 9)
	O	19.7	2(1, 4)	5(4, 6)	71.0	29.0	58.1	41.9	4(1, 6)
	<i>p</i>		<i>0.08</i>	<i>0.37</i>	<i>0.21</i>		<i>0.15</i>		<i>0.07</i>
China (n = 204)	Y	59.8	3(2, 4)	6(5, 7)	55.7	44.3	54.1	45.9	0(0, 2)
	O	40.2	3(2, 5)	5(5, 6)	57.3	42.7	48.8	51.2	0(0, 1)
	<i>p</i>		<i>0.69</i>	<i>0.28</i>	<i>0.82</i>		<i>0.46</i>		<i>0.72</i>
Puerto Rico (n = 239)	Y	54.8	2(2, 3)	7(6, 7)	44.6	55.4	44.3	55.7	3(0, 8)
	O	45.2	2(2, 3)	7(6, 7)	42.1	57.9	47.2	52.8	3(0, 6)

3)

<i>p</i>	0.43	0.46	0.69	0.65	0.23
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Note: Y=younger caregiver; O=older caregiver; *p*=*p*-value; p25=the 25th percentile; p75=the 75th percentile

Table 2 Socio-demographic background of caregivers and caregiving hours between the caregiver age by country (n = 1348 households)

		Caregiver characteristics						Caregiving hours
		Sex		Marital status		Education		median (p25, p75)
		Male (%)	Female (%)	P (%)	NP (%)	P (%)	S (%)	
Cuba (n = 222)	Y	18.9	81.1	62.6	37.4	7.4	92.6	5(2, 7)
	O	23.0	77.0	69.0	31.0	47.3	52.7	5(2, 9)
	<i>p</i>	0.48		0.36		<0.001		0.47
Dominican Republic (n = 208)	Y	18.8	81.2	50.8	49.2	44.0	56.0	4(1, 6)
	O	20.8	79.2	71.1	28.9	87.5	12.5	3(1, 5)
	<i>p</i>	0.75		0.02		<0.001		0.11
Peru (n = 137)	Y	8.7	91.3	42.7	57.3	20.4	79.6	6(2, 7)
	O	28.2	61.8	76.5	23.5	44.1	55.9	6(4, 6)
	<i>p</i>	<0.001		<0.001		0.01		0.87
Venezuela (n = 181)	Y	17.8	82.2	46.8	53.2	27.7	72.3	1(0, 3)
	O	27.3	72.7	50.0	50.0	59.1	40.9	1(0, 3)
	<i>p</i>	0.29		0.08		<0.001		0.67
Mexico (n = 157)	Y	14.3	85.7	68.3	31.8	38.9	61.1	3(1, 5)
	O	41.9	58.1	71.0	29.0	87.1	12.9	3(1, 5)
	<i>p</i>	<0.001		0.77		<0.001		0.80
China (n = 204)	Y	34.4	65.6	91.0	9.0	27.9	72.1	4(1, 8)
	O	42.7	57.3	97.6	2.4	61.0	39.0	5(2, 8)
	<i>p</i>	0.23		0.06		<0.001		0.48
Puerto Rico (n = 239)	Y	16.2	83.2	26.2	73.8	17.6	82.4	3(1, 5)
	O	35.2	64.8	11.8	88.2	39.8	60.2	4(1, 6)
	<i>p</i>	<0.001		0.01		<0.001		0.06

Note: Y=younger caregiver; O=older caregiver; *p*=*p*-value; p25=the 25th percentile; p75=the 75th percentile; Marital status (P=partnership, NP=non-partnership); Education

(P=primary or less, S= higher than primary)

The findings showed neither household characteristics nor health status in older people was significantly different between younger and older caregivers. In addition, there was no significant median difference in caregiving hours between older and younger caregivers. In regards to caregiver characteristics, the majority of the caregivers were female across the different countries. The association of sex and caregiver age was statistically significant in Peru, Mexico, and Puerto Rico. According to marital status, a higher prevalence of partnership caregivers was shown in both younger and older caregiver households, in China in particular. In contrast, the majority of both younger and older caregivers in Puerto Rico were non-partnership. In terms of caregiver's education, the bivariate analysis indicated that there were significant differences between younger and older caregivers across the seven countries, with younger caregivers having a higher education status than older caregivers. In the Dominican Republic, Venezuela, Mexico, and China, there was a higher prevalence of older caregivers being educated at primary school or less, whereas the majority of older caregivers in Cuba, Peru, and Puerto Rico had an educational level higher than primary level.

The effects of caregiver age upon psychological morbidity and care burden

To investigate the effect of caregiver age group (older caregivers vs. non-older caregivers) upon their psychological morbidity and care burden alongside other potential confounders, therefore a multivariate analysis based on binary logistic regression was used as shown in Table 3.

Table 3 Unadjusted and adjusted association between older caregiver and caregiver psychological morbidity and care burden

Country	Psychological morbidity				Care burden			
	n	OR	95% CI		n	OR	95% CI	
			Lower	Upper			Lower	Upper
Model I (unadjusted model)								
Cuba	222	0.60	0.30	1.20	220	1.12	0.57	2.23
Dominican Republic	208	0.85	0.41	1.78	206	0.80	0.28	2.27
Peru	137	0.78	0.36	1.69	137	0.94	0.32	2.78
Venezuela	181	1.50	0.51	4.44	178	1.43	0.44	4.63
Mexico	157	0.52	0.18	1.46	156	0.43	0.05	3.52
China	204	6.21	0.68	56.55	204	0.67	0.27	1.63
Puerto Rico	239	0.65	0.33	1.30	239	0.38	0.12	1.22
<i>Pooled estimate</i>		<i>0.77</i>	<i>0.56</i>	<i>1.06</i>		<i>0.84</i>	<i>0.58</i>	<i>1.24</i>
<i>Heterogeneity I²</i>		<i>3.7%</i>				<i>0.0%</i>		
Model II (adjusted model)								
Cuba	208	0.48	0.20	1.14	206	1.17	0.50	2.76
Dominican Republic	175	0.82	0.33	2.05	173	1.30	0.34	4.91
Peru	134	0.45	0.14	1.41	134	0.23	0.03	1.41
Venezuela	162	1.24	0.29	5.24	159	0.72	0.09	5.49
Mexico	152	0.35	0.09	1.28	122	2.59	0.18	36.95
China	189	5.22	0.51	53.94	202	0.41	0.12	1.34
Puerto Rico	202	0.53	0.22	1.24	202	0.29	0.07	1.18
<i>Pooled estimate</i>		<i>0.61*</i>	<i>0.41</i>	<i>0.93</i>		<i>0.73</i>	<i>0.43</i>	<i>1.21</i>
<i>Heterogeneity I²</i>		<i>0.0%</i>				<i>9.9%</i>		

Note: model II adjusted for sex, marital status, education, cognitive impairment, functional dependency, behavioural problem of older person, time spent helping with ADLs, household size, number of household asset

OR=odd ratio; 95CI = 95% confidence interval

**p-value* < 0.05

In model I, the unadjusted analysis showed no significant differences in caregivers' mental health outcomes in terms of psychological morbidity and care burden between younger and older caregivers across the countries, and the pooled estimates remained unaffected. The adjusted analysis (model II), also showed no statistically significant differences between younger and older caregivers in all countries. However, the pooled estimates showed that psychological morbidity was significantly associated with caregiver age (OR = 0.61, 95% CI 0.41–0.93, $I^2 = 0.0\%$), with older caregivers being at 39% less risk of psychological morbidity than younger caregivers. It is worth noting that the odds ratio of the psychological morbidity in China was larger compared to Latin America, although this was not significant.

Discussion

According to demographic data not only the percentage of older people has been increasing, but also the prevalence of older caregivers, particularly in low and middle-income countries [4]. In this study, overall, the percentage of households with older caregivers (aged 65 years and over) was less prevalent than the percentage of households with younger caregivers across all countries. However, the prevalence of older caregiver households in Puerto Rico and China was almost half (45.2% and 40.2%, respectively) of the total household with older people. When compared with a high-income country such as the United States of America [19], Puerto Rico and China showed a higher prevalence of older caregivers. This might reflect patterns of demographic ageing, with the rate of ageing being faster in Puerto Rico and China than in other low and middle-income countries. At the time of the survey, the median age of the population of these two countries was high [5]. Likewise, increased international migration of younger age household members in these two countries might have contributed to a decrease in available younger caregivers resulting in older caregivers serving in this role.

This study investigated the association of baseline caregiver age and caregiver psychological morbidity and care burden. Overall, the findings of multivariate analysis indicated that being an older caregiver was not associated with higher psychological morbidity and care burden across all countries. However, the pooled estimates of multivariate analysis for all countries of this study revealed that older caregivers were associated with significantly lower risk of psychological morbidity compared with younger caregivers. Thus, the findings did not support our research hypotheses that older caregivers experience worse psychological morbidity and care burden compared to younger caregivers. This is inconsistent with previous studies which indicated that higher levels of burden were associated with increased caregiver age [12, 13]. The possible explanation for this is that caregivers may have different issues depending on their age. The availability and preparedness of older age might be related to more caregiving effectiveness and less caregiving stress and burden [20-22]. The quality of relationship between spouses influences self-esteem and engagement of care [22, 24].

Younger caregivers, as well as dealing with caregiving issues, are also often in the midst of transitions into careers and/or parenthood. Becoming a caregiver can impact a young adult's ability to form intimate relationships, engage in family life, or obtain career goals [26]. Maintaining a career while providing care has been associated with strain [27], and young adult caregivers reported difficulties in managing both responsibilities [25, 26]. Combining looking after young children with caring for dependent older loved ones, sometimes called '*sandwich carer*', are associated with younger populations. The insights of the analysis in this study showed that the younger caregivers had a higher number of children (aged lower than 16 years) in their households than the older caregivers [see Additional file 1; Supplementary Table 1]. Yet it is because of these role demands that many younger caregivers reported significantly more strain and psychological stress from lack of personal resources, such as time and energy, and career disruption [21, 28, 29].

Apart from fewer multiple role demands and less time constraints, older caregivers perceived lower stress and burden than younger caregivers due to more personal satisfaction [21]. The developmental stage of older age usually involves a transition to retirement, and goals of work performance and achievement typically shift to finding goals that give one a sense of inner fulfillment and maintaining valued relationships. Having a closer relationship to the older person as a partnership or providing care to a spouse means a decreased burden [24]. Older caregivers, usually the spouse, compared to younger caregivers, who more often are children, had the ability to see the positive rewards of caring for their beloved older household members [33]. However, psychological morbidity numbers were very low for China [see Additional file 1; Supplementary Table 2]. This undermines the statistical power for estimating with precision, thus leading to an overestimate of the odds ratios and very wide confidence intervals, which may also have affected the care burden data for Mexico [see Additional file 1; Supplementary Table 2]. A large odds ratio with wide confidence intervals usually happens when the prevalence of an event of interest (e.g., psychological morbidity, care burden) is very low in a sample [52].

To the authors' knowledge, this is the first multi-country study on LMICs using standardised questionnaires to investigate the effect of caregiver age on psychological morbidity and care burden across a range of cultures. However, there are limitations; firstly, the data of this study is a cross-sectional design which is unable to predict a true value of the investigated factors. Prior mental health status of the caregivers or how this may change over time is unable to be determined. Secondly, the study is limited to households where a main caregiver provided care for one older person in the household. Thirdly, there were no available data on physical health status and social support of the caregivers, which should be considered as the mediators for adjustment of the care burden. Fourthly, this study is a secondary data analysis based on the population cohort research. We focused on the cohort at a baseline phase, so the data may be out of date. However, this might provide baseline information for further research. Lastly, the study used a quantitative approach to enable comparison of findings across countries. In order to have a more complete analysis, future studies should consider a qualitative approach. In-depth interviews may help to obtain greater details on the quality of the relationships within households and attitudes towards care that might affect caregivers' mental health. Further work is required to explore the psychological morbidity among younger caregivers in providing care to older people and the identification of factors affecting the psychological morbidity in order to obtain suggestions for improving the mental health of caregivers of older people in LMICs.

Conclusion

The distribution of households with older caregivers was inconsistent across the seven LMICs. However, the prevalence of households with older caregivers is almost at the same level as that of the households with younger caregivers in Puerto Rico and China. The unadjusted and adjusted models for all potential covariates showed that there was no statistically significant difference in mental health outcomes in terms of psychological morbidity and care burden between younger and older caregivers across countries. The adjusted pooled estimates, however, indicated lower psychological morbidity among older caregivers. This information may help to provide a greater understanding for service support, policy

makers and health care providers to plan efficient support programmes considering all caregiver age groups.

List Of Abbreviations

LMICs: Low and Middle-Income Countries; DRG: Dementia Research Group; SRQ: Self-Reporting Questionnaire; WHO: World Health Organization; ZBI: Zarit Burden Inventory; CERAD: Consortium to Establish a Registry for Alzheimer's Disease; CSI-D: Community Screening Instrument for Dementia; GMS: Geriatric Mental State examination; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition; ADL: Activities of Daily Living; WHO-DAS: World Health Organization – Disability assessment schedule; NPI-Q: Neuropsychiatric Inventory-Questionnaire; OR: Odd Ratio; CI: Confidence Interval

Declarations

Ethics approval and consent to participate

Ethical approval was provided by King's College London Research Ethics Committee and by local ethical review boards in each country: Finlay Albarrañ Medical Faculty of Havana Medical University Ethical Committee (Cuba); Consejo Nacional de Bioética y Salud (CONABIOS, Dominican Republic); the Memory, Depression Institute and Risk Diseases (IMEDER) Ethics Committee (Peru); Hospital Universitario de Caracas Ethics Committee (Venezuela); Instituto Nacional de Neurología y Neurocirugía Ethics Committee (Mexico); Medical Ethics Committee of Peking University the Sixth Hospital, Institute of Mental Health (China); Oficina para la Protección de Participantes Humanos en Investigación (OPPHI, Puerto Rico). All the participants read and signed the informed consent forms.

Consent for publication

Not applicable.

Availability of data and materials

Please contact the 10/66 Dementia Research Group, King's College London, United Kingdom for data requests.

Competing interests

The authors have declared that no competing interest exist.

Funding

This work was supported by the Thailand Research Fund through the Royal Golden Jubilee Ph.D. Programme [PHD/0167/2557 to RP and PV]; and the Newton Fund Ph.D. Placement for Scholars

Authors' contributions

RP prepared the first draft, investigated, conducted a formal analysis, and was the major contributor in writing the manuscript. RM conceptualized, supervised the analysis and interpretation of results, and reviewed and edited the manuscript. PV and MP conceptualized, reviewed the manuscript, and provided further contributions. KCC supervised the analysis and interpretation of results, and reviewed and edited the manuscript. All authors read and approved the final manuscript.

Acknowledgments

This is a secondary analysis of data collected by the 10/66 Dementia Research Group (www.alz.co.uk/1066/). The 10/66 DRG is led by Martin Prince from the Institute of Psychiatry, Psychology and Neuroscience, King's College London. The other principal investigators, data custodians and those responsible for research governance in each site are Juan Llibre Rodriguez (Cuba), Daisy Acosta (Dominican Republic), Mariella Guerra (Peru), Aquiles Salas (Venezuela), Ana Luisa Sosa (Mexico), Ivonne Jimenez (Puerto Rico) and Yueqin Huang (China). We would like to thank Jim Richards at University Central Lancashire for helpful feedback on a draft manuscript.

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