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Psychiatric morbidity and its correlates among informal caregivers of older adults

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Abstract

Objective: This present study estimated the psychiatric morbidity among informal caregivers of older adults and investigated its association with their socio-demographic factors and older adult's health status, including dementia, depression and physical health conditions.

Methods: Data from a national cross-sectional survey were used. For each participating older adult, an informal caregiver who 'knew the older adult best' and was aware of their health condition, was also interviewed to collect information on the older adults' care needs, and behavioral and psychological symptoms of dementia (BPSD). Data from 693 pairs was used. Informal caregivers were administered the Self Reporting Questionnaire (SRQ)-20 and psychiatric morbidity was defined as those with a total SRQ score of ≥ 8. Measures included informal caregivers' socio-demographic characteristics, assessment of dementia and depression in the older adults and self-report on their lifetime and current physical conditions. The association of socio-demographic characteristics, health conditions, care assistance and BPSD was investigated using backward stepwise logistic regression analysis where psychiatric morbidity (total SRQ score < or ≥ 8) was used as a dependent variable and all other variables served as independent covariates.

Results: Among informal caregivers, 8.8% exhibited psychiatric morbidity. Higher proportions of spousal caregivers and caregivers of older adults having more care needs and BPSD exhibited psychiatric morbidity. After adjusting for all covariates, caregivers' marital status, and the presence of BPSD and dementia in the older adults were identified as the strongest correlates of caregivers' psychiatric morbidity. The prevalence of psychiatric morbidity was 10%, 13.9% and 12.7% respectively in these groups. Married caregivers had higher odds of psychiatric morbidity (OR 2.50, 95% CI: 1.13–5.52). In addition, caregivers of older adults' with any BPSD (OR 5.87, 95% CI: 2.60–13.24) and dementia (OR 2.28, 95% CI: 1.23–4.20) were also associated with higher odds of psychiatric morbidity.

Conclusion: Informal caregivers' marital status and presence of any BPSD and dementia in the older adults in their care were identified as the strongest correlates of caregivers' psychiatric morbidity. Clinicians should be cognizant of the risk in this group of caregivers and assess and intervene to alleviate caregivers' psychological problems.

1. Introduction

Health problems associated with aging account for a major share of the global burden of disease [1,2]. While chronic conditions mainly contribute to mortality in this population, much of the burden of years lived with disability arise from dementia and related behavioral problems. Among informal caregivers (ICs) of older adults with health problems such as dementia, the adverse consequences of the constant care demands are numerous [3]. Such caregiver experiences are in turn more likely to be associated with the emotional and physical health of the older adults in their care and are important predictors of their institutionalization and higher service utilization [4,5].

Singapore is a developed economy of 3.8 million residents in South-East Asia, comprising a multi-racial population of 74.2% Chinese, 13.2% Malays, 9.2% Indians and 3.3% other races [6]. It is one of the fastest aging nations

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with an unprecedented age shift towards the higher end. There are an estimated 600,000 older adults currently residing in Singapore and this number is expected to triple by the year 2050. This population aging has numerous implications on various facets of the economy, healthcare and society as a whole. In view of these imminent challenges, a slew of population-wide measures and policies have been implemented that aim to address the needs of the aging population and their ICs. These include measures such as coverage for seniors' healthcare expenditure, designing a fiscally sustainable healthcare financing system for the older adults and having 24-hour helpline, elder-sit, respite care and home intervention programs that support caregivers in managing older adults in the community. The importance of caregivers' health is further underscored by the enhanced caregiver support and counseling services offered by various governmental and non-governmental organizations.

Despite these efforts, the strain of caregiving is often unavoidable and this has been associated with higher burden [7], which in turn is associated with problems such as physical complaints of pain and headaches or psychiatric morbidity (PM) such as depression, anxiety and/or insomnia [8]. An estimated 25–70% of caregivers have depression while about one third report having anxiety [9,10].

Numerous observational studies have shown higher prevalence of PM in co-residents and ICs of older adults with dementia, particularly those exhibiting severe behavioral problems which were found to be twice as high compared to other older adults [11]. Factors that moderate and increase the presence of PM in ICs include being female or a spousal caregiver, additional stressful events in caregivers' life, their own physical health, quality of relationship between caregiver and care recipient, and high neuroticism, multiple chronic conditions, dementia and behavioral and psychological symptoms of dementia (BPSD) among older adults [11–14]. On the contrary, caregiver preparedness, increased social support and social networks, assistance in care, positive appraisal and coping, and satisfaction with healthcare services are associated with reduced depression and stress in ICs [15–17]. Evidence of these effects is important to plan caregiver interventions to mediate their psychological outcomes.

Studies conducted previously among caregivers of older adults in Singapore have yielded information on the associations of older adults' health status, particularly dementia, dependency and caregiver's attitudes and characteristics to caregivers' mental health [18]. Higher distress and anxiety were reported among female caregivers of older adults [18,19] while higher depression was noted among Chinese caregivers of people with dementia and community dwelling caregivers of older adults [16,20]. However these studies were largely conducted in small samples – studies by Mehta et al. [18] and Tan et al. [19] included 61 and 85 caregivers, respectively. Others were conducted in select cohorts based on geographic location, age, ethnicity or among help-seeking populations – the study by Malhotra et al. [16] included only caregivers of 'older olds' aged above 75 years while the Singapore Longitudinal Aging Study included only informal caregivers of Chinese older adults aged 55 years and above. Moreover the chronic conditions and variables included in the analysis varied widely, which make comparisons across the studies challenging. Therefore the findings on the risk of PM among ICs are still inconclusive and identification of the important and strongest correlates of PM from a comprehensive and relevant pool of variables is necessary.

In the present study, we estimated PM among ICs of older adults in Singapore using data from the Well-being of the Singapore Elderly (WiSE) study and investigated the factors associated with ICs' PM. The independent associations of caregivers' PM with older adults' BPSD, activity limitation, dementia, depression and physical conditions were also examined after adjusting for covariates.

2. Material and methods

2.1. Study design

A cross-sectional single-phase study, the WiSE survey, was conducted among population-based older adults and their informants in Singapore in the year 2013. Older adults aged 60 years and above were randomly selected for the survey from a sampling frame of all residents in Singapore. Older adults belonging to the three major ethnic groups – Chinese (38.5%), Malays (30%) and Indians (30%) were selected using disproportionate sampling with oversampling of Malays and Indians and those aged 75 years and above. A small proportion (1.5%) belonged to 'Other' ethnic groups.

2.2. Study process

The study methodology is described in detail in a preceding article [21]. Briefly, the study was initiated following approval from the relevant ethics committees (National Healthcare Group's Domian Specific Review Board and SingHealth Centralised Institutional Review Board). Participants were approached at their households or nursing homes for the study. Informed consent was obtained from participants themselves or from their legally acceptable representatives (for those participants who were mentally or physically incapable to consent themselves). For each participant, an informant was chosen and both were invited to participate in the survey. A total of 2565 older adults and 2421 informants were interviewed between August 2012 and November 2013 giving a response rate of 66%. In the current study, data from 693 older adults with care needs and their caregivers were analyzed.

2.3. Study sample

Informants who were Singapore residents (Singapore Citizens or Permanent Residents), aged 21 years and above and were able to provide adequate and accurate information on the older person's health condition and service use were

eligible for the study. Informants were excluded if a) interviewers were unable to contact them after ten contact attempts, b) they were foreigners or non-residents of Singapore, residing outside Singapore at the time of the survey, c) they were unwilling or unable to complete the interview in English, Chinese (either Mandarin or one of three dialects – Hokkien, Teochew or Cantonese), Malay or Tamil, or d) they were paid caregivers. An informant was defined as 'a person who knew the older person best'. While some informants were caregivers (i.e. actively involved in care provision of the older person), others were co-residents or other close contacts with no caregiving role. In this paper 'informants', who were also the ICs of older adults with care needs, are henceforth referred to as 'ICs'.

2.4. Measurements

2.4.1. Measures of demographic and risk factor questionnaire

The interview covered the older adult and ICs' demographic information (age, gender, ethnicity, marital status, education, employment, relationship with the older adult, etc). The interview also contained questions on care needs of the older adult where ICs were asked to report if the older adult 'required extra help, support or supervision because of a health condition or disability' and what was the 'longest period of time (a few hours/whole day/two to three days/longer than that) they could manage by themselves, without help from others, supposing they were living on their own'. ICs were then asked whether the older adult needed care 'much of the time, some of the time or did not need care (i.e. they were able to do everything for themselves)' and whether they received any care assistance defined as help received in care from other family members or friends or paid helpers. ICs also reported on their participation in eight activities of daily living (ADLs) – communicating with the older adult, supervising the person, and helping them with using transport, dressing, eating, grooming (looking after their appearance), toileting and bathing. The older adult or their IC, in instances where the older adult was unable to provide reliable information due to physical or mental disability, self-reported older adult's life-time and current health conditions. These included ever being diagnosed with depression, cardiac problems, diabetes, hypertension, stroke or transient ischemic attacks (TIAs) in their life-time or currently having arthritis/rheumatism, eyesight problems, hearing difficulty, persistent cough, asthma, stomach/intestine problems, faints/blackouts, paralysis, skin disorders or cancer.

2.4.2. Measures of dementia and behavioral and psychological symptoms of dementia (BPSD) in older adults

The questionnaire comprised the Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy (GMS/AGECAT) which was administered to the older adults to obtain a 10/66 dementia diagnosis [21,22]. GMS/AGECAT was administered along with other measures such as the Community Screening Interview for Dementia (CSI-D), Consortium to Establish a Registry for Alzheimer's Disease (CERAD) test battery and History and Aetiology Schedule – Dementia Diagnosis and Subtype (HAS-DDS). BPSD in older adults were measured using the Neuropsychiatric Inventory Questionnaire (NPI-Q) which was administered to ICs. It provided information on 12 types of BPSD: delusions, hallucinations, anxiety, depression/dysphoria, agitation/aggression, elation/euphoria, disinhibition, irritability/lability, apathy/indifference, motor disturbance, nighttime waking or sleep problem, and problems with appetite/eating [23].

2.4.3. Assessment of PM in informal caregivers

PM was assessed using the 20-item Self-Reporting Questionnaire (SRQ-20), which detects presence of non-psychotic psychological symptoms over past 2 weeks. The questionnaire has been widely used in different populations including South-East Asian samples to assess PM [24,25]. Its correlation with depression has also been well-established [26–28]. The SRQ-20 yields a total score that ranges from 0 to 20, with higher scores indicating higher PM. In our sample, high internal consistency was observed for the scale with a Cronbach's alpha of 0.84. A cut-off based on ≥ 8 score as recommended by the WHO [29] was used to identify those with PM. To the best of our knowledge, this is the first study in Singapore to use this cut-off for the assessment of PM. However, it has shown high sensitivity, specificity and positive predictive value when validated against gold standards such as DSM-IV diagnosis and clinician assessments in other populations [30–32].

2.5. Statistical analysis

All statistical analyses were performed using SPSS version 18.0 and statistical significance was set at p value <0.05. Chi squared tests were conducted to compare differences in the proportions of socio-demographic variables between the groups of ICs with and without PM. Multiple logistic regression analyses were conducted to investigate associations between older adults health conditions, including presence of BPSD, medical conditions and any ADL limitation, with caregivers' PM after adjusting for older adults' and ICs' age and gender. Backward stepwise multivariate logistic regression analysis was undertaken to identify the strongest correlates of PM among ICs of older adults. All variables – caregivers' and older adults' socio-demographic characteristics and older adults' health conditions, care needs and ADL limitation, were included in the initial regression model, and only those with significant associations were retained for the subsequent runs until a model with only significant associations was obtained.

3. Results

The socio-demographic characteristics of ICs and older adults in their care are reported in Table 1. Mean age of the

Table 1
Socio-demographic characteristics of informal caregivers, older adults in their care and differences by presence of psychiatric morbidity (N = 693).

		Overall		Without psychiatric morbidity		With psychiatric morbidity		p-value
		n	%	n	%	n	%	
Characteristics of informal caregivers								
Age group (years)	21–34	46	6.7	42	6.7	4	6.6	0.805
	35–49	185	26.8	170	27.0	15	24.6	
	50–64	312	45.2	286	45.5	26	42.6	
	65+	147	21.3	131	20.8	16	26.2	
Gender	Women	455	65.9	409	65.0	46	75.4	0.065
	Men	235	34.1	220	35.0	15	24.6	
Ethnicity	Chinese	230	33.3	212	33.7	18	29.5	0.060
	Malay	250	36.2	234	37.2	16	26.2	
	Indian	205	29.7	178	28.3	27	44.3	
	Others	5	0.7	5	0.8	0	0.0	
Marital status	Never married	179	26.0	170	27.1	9	14.8	0.177
	Married/cohabiting	452	65.6	407	64.8	45	73.8	
	Separated/divorced/widowed	58	8.4	51	8.1	7	11.2	
Education level	None	18	2.6	14	2.2	4	6.6	0.082
	Minimal/less than primary	51	7.4	45	7.2	6	9.8	
	Completed primary	137	19.9	123	19.6	14	23.0	
	Completed secondary	289	41.9	262	41.7	27	44.3	
	Completed tertiary	195	28.3	185	29.4	10	16.4	
Employment	Paid full time	324	47.2	303	48.3	21		0.424
	Paid part time	74	10.8	65	10.4	9		
	Unemployed	35	5.1	32	5.1	3		
	Student	4	0.6	4	0.6	0	0.0	
	Housewife/husband	149	21.7	132	21.1	17	28.8	
	Retired	100	14.6	91	14.5	9	15.3	
Relationship with the older resident	Spouse	131	19.0	113	18.0	18	29.5	**0.018**
	Son/Daughter	428	62.0	390	62.0	38	62.3	
	Other relative/friend	131	19.0	126	20.0	5	8.2	
Characteristics of older adults								
Age	60–74	169	24.5	154	24.5	15	24.6	1.000
	75–84	250	36.2	228	36.2	22	36.1	
	85+	271	39.3	247	39.3	24	39.3	
Gender	Women	481	69.7	444	70.6	37	60.7	0.107
	Men	209	30.3	185	29.4	24	39.3	
Care need	Some	362	52.5	340	54.1	22	36.1	**0.005**
	Much	328	47.5	289	45.9	39	63.9	

ICs was 54.5 (SD 12.9) years, ranging from 21 to 88 years. Majority of the caregivers were aged between 50 and 64 years (45.2%), women (65.6%), married/cohabiting (65.6%), with secondary education (41.9%), and employed full time (47.2%). Older adults in their care were largely aged over 85 years (39.3%) and were women (69.7%). Of these older adults, 47.5% needed care much of the time (Table 1).

The total SRQ scores ranged from 0 to 20 in the overall sample of ICs with a mean (SD) of 2.1(3.2). PM was observed in 61 (8.8%) ICs who met the SRQ cut-off criterion. Among this group the total SRQ mean (SD) score was 10.7(2.6), median: 10, range: 8–20. The socio-demographic background of ICs with and without PM was largely similar with the exception of their relationship with the older adult; higher proportion of ICs with PM were spousal caregivers (29.5%) as compared to ICs without PM (18%) (Table 1). As compared to ICs without PM, significantly higher proportion of ICs with PM had an older relative who needed care much of the time.

Psychiatric morbidity in ICs was significantly associated with older adults' medical conditions (Table 2). After adjusting for caregivers' and older adults' age and gender, ICs' PM showed significant association with almost all BPSD except for anxiety, 10/66 dementia, depression, current arthritis/rheumatism and ADL limitation.

Concurrent adjustment of all covariates in the backward stepwise regression analysis identified ICs' marital status and presence of any BPSD and dementia among older adults as its strongest correlates (Table 3). Married caregivers had higher odds of PM (OR 2.50, 95% CI: 1.13–5.52). In addition, ICs had higher odds of PM when the older adults'

Table 2
Association of informal caregivers' psychiatric morbidity with older adults' health conditions (n = 693).

	Logistic regression*			
	OR	95% C.I		p-value
Presence of BPSD				
Delusions	3.207	1.293	7.956	**0.012**
Hallucinations	3.124	1.729	5.643	**<0.001**
Agitation/aggression	4.254	2.288	7.909	**<0.001**
Depression/dysphoria	3.04	1.616	5.721	**0.001**
Anxiety	3.962	0.992	15.82	0.051
Elation/euphoria	3.98	2.137	7.415	**<0.001**
Apathy/indifference	2.56	1.155	5.675	**0.021**
Disinhibition	3.212	1.807	5.71	**<0.001**
Irritability/lability	2.429	1.123	5.254	**0.024**
Motor disturbance	2.712	1.481	4.966	**0.001**
Nighttime waking/sleep problems	2.084	1.186	3.662	**0.011**
Appetite/eating problems	3.207	1.293	7.956	**0.012**
Life-time health conditions				
10/66 Dementia	4.172	2.134	8.156	**<0.001**
Depression	2.791	1.489	5.229	**0.001**
Cardiac problems	0.733	0.387	1.385	0.338
Diabetes	0.796	0.45	1.409	0.434
Hypertension	0.789	0.407	1.527	0.481
Stroke	1.294	0.684	2.447	0.428
TIAs	1.847	0.714	4.779	0.206
Current health conditions				
Arthritis or rheumatism	1.794	1.029	3.128	**0.039**
Eyesight problems	1.374	0.792	2.385	0.259
Hearing difficulty	0.588	0.317	1.088	0.091
Persistent cough	0.654	0.225	1.899	0.435
Asthma	1.219	0.584	2.542	0.598
Stomach/intestinal problems	1.631	0.829	3.209	0.156
Faints/blackouts	0.774	0.264	2.272	0.641
Paralysis	1.119	0.633	1.977	0.700
Skin disorders	1.735	0.852	3.53	0.129
Cancer	1.317	0.379	4.58	0.665
ADL limitation	1.839	1.089	3.413	**0.044**

BPSD= behavioral and psychological symptoms of dementia; TIAs= transient ischemic attacks;ADL= activities of daily living: caregiver involvement in any of 8 ADLs – communicating with the person, supervising the person, and helping them with using transport, dressing, eating, grooming (looking after their appearance), toileting and bathing.

* Independent logistic regression analyses, adjusted for caregivers' and older adults' age and gender.

had any BPSD (OR 5.87, 95% CI: 2.60–13.24) or dementia (OR 2.28, 95% CI: 1.23–4.20).

4. Discussion

The study showed that 8.8% of the ICs of older adults in the population met criteria of SRQ-20 score of ≥ 8 for PM. This is within the 8–18% range reported in studies among caregivers from other countries [33,34]. The study also established independent associations between ICs' PM and older adults' BPSD, ADL limitation and chronic conditions – dementia, depression and arthritis/rheumatism (Table 2). Well-documented evidence suggests that presence of BPSD directly influences the mental health status of caregivers of older adults. Consecutively, PM in caregivers may also negatively affect the manifestation of BPSD in older adults [35]. Our findings with respect to behavioral disturbances are consistent with prior cross-sectional studies. It is posited that severity of BPSD and not the type of BPSD determines PM among caregivers [36], however, the presence of almost all BPSD showed a significant association with caregivers' PM in this study, signifying the impact of BPSD on ICs' mental health. Although the effect of BPSD has been studied in the literature, most studies have not identified a relationship between older adults' ADL function and caregivers' PM as seen in this study. Since ADL function is strongly correlated with other predictors of caregivers' PM such as care need, time spent caring and behavioral disturbances, these results have important implications for screening of morbidity in ICs' and designing interventions. Surprisingly, older adults' care needs and ADL limitation did not remain significant after the multivariate analysis. A meta-analysis conducted by Pinquart and Sörensen found that care recipients' behavioral problems were more consistently related to poorer caregiver outcomes than their impairment and intensity of caregiving [37]. It is also his suggested caregiver stress results from their exposure to 'primary and secondary stressors' and while primary stressors are hardships and problems directly encountered in caregiving, secondary stressors relate to role strains and activities outside of caregiving [38]. ADL limitation and care needs are considered primary stressors and it is possible that in our sample primary stressors did not have a strong relationship with PM among caregivers. Further research focusing on the role strain and other demands on the caregivers is necessary and could add to this area of research.

Dementia caregiving literature is replete with studies on caregivers' PM and excluding a couple of studies conducted in India and Dominican Republic [33,34], virtually all have reported heightened PM or depressive symptomatology in ICs [39]. Our study contributes to this literature, further establishing the association in a developed economy with a multi-ethnic population and after adjusting for multiple covariates (Table 2). As opposed to the multitude of studies in dementia caregiving, very few studies have reported the association of older adults' depression with ICs' PM. Among all the chronic physical conditions investigated in this study, arthritis/rheumatism in older adults was the only condition related to ICs' PM after adjusting for caregivers and older adults' age and gender. Activity and mobility limitations imposed by physical restrictions in people with arthritis and rheumatism have been previously linked to increased physical strain, care burden and PM in caregivers [40–42]. This relationship, however, did not remain significant after adjusting for all other covariates.

Table 3
Significant correlates of psychiatric morbidity in informal caregivers.

	Bivariate association			Multivariate association*			
	Psychological morbidity		*p*-value[#]	OR	95% CI		*p*-value
	No	Yes					
	n (%)	*n* (%)					
Caregivers' marital status							
Never married	170 (95.0)	9 (5.0)	0.097	**Ref**			
Married/cohabiting	405 (90.0)	45 (10.0)		2.50	1.14	5.52	**0.023**
Separated/divorced/widowed	51 (87.9)	7 (12.9)		3.11	0.92	10.47	0.067
Older adult has BPSD							
None	300 (97.7)	7 (2.3)	<**0.001**	**Ref**			
At least one	327 (18.1)	53 (13.9)		5.87	2.640	13.24	<**0.001**
Older adult has dementia							
No	320 (95.2)	16 (4.8)	<**0.001**	**Ref**			
Yes	309 (87.3)	45 (12.7)		2.27	1.23	4.20	**0.008**

BPSD: behavioral and psychological symptoms of dementia.
[#]Chi-square tests.
*independent backward stepwise regression analyses with adjustment for multiple comparisons.
Controlled for: caregivers' age, gender, ethnicity, marital status, education, employment, socioeconomic status, relationship with older adult, and older adults' age, gender, care needs, dementia, depression, cardiac problems, hypertension, stroke, transient ischemic attacks, diabetes mellitus, arthritis, visual problems, persistent cough, respiratory problems, stomach or intestinal problems, faints or blackouts, paralysis, cancer, ear/hearing problems, skin problems, care assistance, BPSD and ADL limitation.

Apart from BPSD and dementia which were also found to have significant independent associations with PM in the ICs of older adults, a surprising finding was the identification of marital status as an important correlate whereby married caregivers had 2.5 times higher odds of PM when compared to those who were single (Table 3). While a bivariate association was observed for ICs' relationship with the older adults (Table 1), this did not remain significant in the backward stepwise regression analysis. Previous research has shown higher PM among spousal caregivers and this has been linked to higher care role, time and type of care activities they engaged in as compared to other relatives, activity restriction and lack of personal mastery in spousal caregivers [43]. Our results suggest that ICs' marital status was more strongly associated with PM than ICs' relationship with the older adult. Owing to the lack of studies that have investigated the concurrent associations of both these parameters, we are unable to fully explain the findings. However, some considerations could shed light on the likely stronger relationship of marital status with caregivers' PM. Our sample comprised more women (65.5%) then men, and this proportion was even higher (75.4%) among those with PM. Research has consistently shown higher psychological morbidity and depression among married women than men [44] and these have been associated with higher social role and perceived strain and difference in coping strategies [45], which are in-turn associated with poorer outcomes in women caregivers [46]. Although gender was controlled in the regression analysis, other parameters such as time spent caring and perceived burden were not included in the analysis and these could have influenced some of the findings. Future studies are therefore needed to understand the association of marital status with PM across different gender groups and to assess the role of marital status versus spousal relationship in ICs' PM.

Our study has several limitations. Firstly, this is a cross-sectional study therefore a causal relationship cannot be established between the factors found to be associated with caregivers' PM. Secondly, comprehensive psychiatric assessments were not performed for exploring other underlying medical causes for psychiatric symptoms among the ICs and the assessment of PM was based on self-report using the SRQ-20 and a cut-off score of ≥ 8. Validation studies conducted in various countries have yielded differing SRQ-20 cut-offs. However, the cut-off employed in this study has been most widely used in the literature and found to be correlated with DSM-IV conditions [31]. Thirdly, the presence of physical conditions was measured through self-report on diagnosed conditions through information gathered from older adults or ICs; thus, there is a possibility of under-reporting of some conditions that could have led to non-significant findings. Lastly, although the sample was obtained from a nationally representative survey of older adults in Singapore, parameters to calculate appropriate weights for the caregivers, such as total number of caregivers in the household, selection probability and population estimates were not available, to allow for weight adjustment and oversampling of the Malay and Indian caregivers, however, caregivers' ethnicity was used a covariate in the regression analyses to adjust for its effect. These limitations notwithstanding, this study provides an estimate and evidence of the PM among a national population-based sample of ICs of older adults and provides information on its strongest correlates after

examining a comprehensive set of risk factors in the local population.

Findings of this study have direct implications for current public health screening programs and practice. At present, the main health burdens for older people worldwide are from non-communicable diseases, an estimated 47.5 million have dementia, and one-third have long-term care needs and have lost the ability to look after themselves [47]. Therefore, ICs will increasingly play a critical role in the health and well-being of older adults. Consequently, a higher number of ICs will be at risk of having PM and will need public health initiatives for downsizing the impact of their caregiving role on their mental health. Results of this study emphasize the mental healthcare needs of ICs of older adults. The study found that PM in caregivers usually has multiple correlates and these can change depending on the socio-demographic and clinical characteristics of older adults. Independent associations showed that older adult-caregiver relationship and older adults' care needs, BPSD and dementia were associated with PM in caregivers (Tables 1 and 3). This study also identified chronic conditions in the older adults – arthritis/rheumatism, depression and dementia, to be associated with increased odds of caregivers' PM after adjusting for caregivers and older adults' age and gender (Table 2). Caregivers of older adults with these characteristics deserve attention of care providers, and may be candidates for more active clinical and social interventions to alleviate their PM. These would also likely be the most beneficial at an individual level for the caregivers. On the other hand, caregivers who were married and caring for an older adult with behavioral problems and/or dementia were almost twice as likely to have PM after considering the effect of all other factors. Population level awareness and screening for these caregivers would be more effective in alleviating the risk of PM among informal caregivers. In addition, disease-specific studies that closely examine PM within caregiver groups might help to explain their basic relationship. Furthermore, interventions to prevent, delay, or alleviate BPSD or dementia in older adults may also have a beneficial impact on the psychological health of caregivers. According to the WHO Global Forum Report (2013) [48], 'innovations are needed to better care for the global ageing population, and that co-creation (with older adults) is needed for effective solutions'. Hence, in addition to the inputs from the older adults, their informal caregivers are also important co-creators for the innovations of the future. Incorporating such interventions might optimize the chance for reducing the adverse impact of PM on caregivers and the older adults in their care.

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