Original Article

# Prevalence and Risk Factors of Caregiver Dependence among Older Adults in a Southeast Asian Population

Louisa Picco, [1]*MPH*, Edimansyah Abdin, [1]*PhD*, Janhavi A Vaingankar, [1]*MSc*, Shirlene Pang, [1]*MSc*, Saleha Shafie, [1]*BSSci*, Rajeswari Sambasivam, [1]*BPsy*, Siow Ann Chong, [1]*MBBs, M.Med, MD*, Mythily Subramaniam, [1]*MBBS, MHSM*

**Abstract**

   **Introduction:** Currently very little is known about the prevalence or magnitude of caregiver dependence in Singapore and thus, there is a need to fill this gap in this multiethnic ageing population. This study aims to determine the prevalence and risk factors of caregiver dependence among older adults in Singapore. **Materials and Methods:** Data were used from the Well-being of the Singapore Elderly (WiSE) study, a nationally representative, cross-sectional survey among Singapore residents aged 60 years and above. Caregiver dependence was ascertained by asking the informant (the person who knows the older person best) a series of open-ended questions about the older person's care needs. **Results:** The older adult sample comprised 57.1% females and the majority were aged 60 to 74 years (74.8%), while 19.5% were 75 to 84 years, and 5.7% were 85 years and above. The prevalence of caregiver dependence was 17.2% among older adults. Significant sociodemographic risk factors of caregiver dependence included older age (75 to 84 years, and 85 years and above, *P* <0.001), Malay and Indian ethnicity (*P* <0.001), those who have never been married (*P* = 0.048) or have no education (*P* = 0.035), as well as being homemakers or retired (*P* <0.001). After adjusting for sociodemographic variables and all health conditions in multiple logistic regression analyses, dementia (*P* <0.001), depression (*P* = 0.011), stroke (*P* = 0.002), eyesight problems (*P* = 0.003), persistent cough (*P* = 0.016), paralysis (*P* <0.001), asthma (*P* = 0.016) and cancer (*P* = 0.026) were significantly associated with caregiver dependence. **Conclusion:** Various sociodemographic and health-related conditions were significantly associated with caregiver dependence. Dependent older adults will put greater demands on health and social services, resulting in greater healthcare expenditures. Hence, effective planning, services and support are crucial to meet the needs of dependent older adults and their caregivers.

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**Key words:** Epidemiology, Multiethnic, Singapore

## Introduction

   Globally, people are living longer and it has been estimated that the number of people aged 60 years and above will more than double, from 841 million people in 2013 to more than 2 billion in 2050.[1] Various chronic non-communicable diseases are associated with ageing including heart disease and cancers, and whilst these can often contribute to mortality, others such as dementia, stroke and various mental disorders can result in years lived with disability and associated burden.[2] For some older adults, these non-communicable diseases do not have a huge impact on their functioning, allowing them to largely remain independent. For others, however, prolonged and more permanent functional limitations result in them becoming dependent on a caregiver.

   Dependence is most commonly defined as the "need for frequent human help or care beyond that habitually required by a healthy adult".[3] Some studies have defined and assessed dependence as a composite measure of functional disability whereby help is needed to perform activities of daily living (ADL).[4,5] Others state that while dependence is strongly linked to disability, whereby disability is often a significant contributing factor to dependence, one can have a disability without being dependent. Currently, there is no

[1]Research Division, Institute of Mental Health, Singapore
Address for Correspondence: Ms Louisa Picco, Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, Singapore 539747.
Email: louisa_picco@imh.com.sg

gold standard, standardised definition or measure to assess dependence, making comparisons across studies difficult.

Research has consistently shown that dependence or functional disability is associated with various sociodemographic correlates including age, gender, education and marital status.[5-7] Being dependent is also associated with various health conditions, with the most significant contributor being dementia.[5-8] Currently, very little is known about the prevalence of caregiver dependence in Singapore and therefore, understanding more about the predictors or determinants of caregiver dependence among older adults is essential to future prevention, long-term care, policy making and planning. Given that caregivers of older adults in Singapore experience significant burden as a result of their caregiving role,[9] efforts to reduce and alleviate this burden, and support caregivers of dependent older adults are needed.

Singapore is a multiethnic, developed country in Southeast Asia. In 2013, the resident population was 3.85 million, consisting predominantly of Chinese (74.2%), Malays (13.3%) and Indians (9.1%), while other ethnic groups constitute approximately 3.3% of the population.[10] In 2014, Singapore residents aged 65 years and above made up 11% of the total resident population, a figure that has nearly doubled since 1990[10] and is expected to continue to increase. An ageing population and a decrease in fertility rates in Singapore will result in more people becoming dependent on caregivers and fewer people being able to take on a caregiving role. It is estimated that the older adult population will triple to 900,000 by 2030, while there will only be 2.1 working-age citizens for each citizen aged 65 years and above.[11] Dependent older adults will put greater demands on health and social services, not to mention caregivers themselves. This will result in several challenges in the future, including greater healthcare expenditures. At the same time, it highlights the critical role caregivers play in elder care.

Data for this study was extracted from the Well-being of the Singapore Elderly (WiSE) study, a population-based, cross-sectional study that established the prevalence of dementia among residents aged 60 years and above in Singapore. The aim of the current study was to determine the prevalence and risk factors of caregiver dependence among older adults in Singapore.

## Materials and Methods

### Study Design and Participants

The WiSE study was a single phase, cross-sectional survey of Singapore residents (citizens and permanent residents) aged 60 years and above that was conducted between August 2012 and December 2013. Ethical approval was obtained from the relevant institutional review boards (National Healthcare Group Domain Specific Review Board and the SingHealth Centralised Institutional Review Board).

Respondents were randomly selected via a national administrative database provided by the Ministry of Health that maintains the names and sociodemographic details such as age, gender, ethnicity and addresses of all residents in Singapore. The sample was inclusive of community-dwelling older adults as well as those residing in nursing homes, daycare centres or hospitals at the time of the survey. Residents aged less than 60 years, those who were living outside of Singapore and were unable to be contacted due to incomplete or incorrect addresses, those who were unable to complete the interview in one of the specified languages or dialects, and all foreigners were excluded from the survey.

A probability sample was randomly selected using a disproportionate stratified sampling design with 12 strata defined according to ethnicity (Chinese [38.5%], Malay [30%], Indian [30%], Others [1.5%]) and age groups (60 to 74, 75 to 84, and 85 years and above). Residents aged 75 years and above, and Malays and Indians were oversampled to ensure that a sufficient sample size would be achieved to improve the reliability of estimates for the subgroup analyses and to account for cultural differences in the 3 main ethnic groups in Singapore. A target sample size of 2500 was estimated to be adequate, based on the previous prevalence rate of dementia in Singapore being 5.2%,[12] as well as for subgroups by age and ethnicity. A total of 2565 respondents completed the study, yielding a response rate of 65.6%. Of these respondents, 2421 had an informant who completed the requisite interview and it was these respondents who were included in the current study.

In addition to each selected respondent, an informant was also chosen to participate in the study. An informant was defined as "the person who knows the older person best" and was someone who could provide the clearest and most detailed account of the older person's circumstances; the priority was a co-resident or family member in close contact with the older person. The actual amount of time spent (i.e. the person who spent the most time) with the older person was used as a criterion to decide on the best informant.

Written informed consent was obtained from all respondents (older person and the informant). For each older person who was not cognitively capable of providing informed consent, written consent was obtained from a legally acceptable representative or next-of-kin. Information pertaining to the WiSE methodology has been described in greater detail in a previous article.[13]

### Measures

The WiSE study adopted the 10/66 Dementia Research

Group protocol,[14] which has previously been validated in China, India and Malaysia. Given that Chinese, Malays and Indians are the 3 main ethnic groups in Singapore, it stood to reason that this instrument would be best suited to our population. Culturally adapted versions of the instruments were used as part of our research and the specific measures administered in the current study are described in more detail below:

i)   Geriatric Mental State (GMS): a semi-structured clinical interview which provides both dementia (as determined by 10/66 criteria and cutoff point) as well as past 1-month depression diagnoses. The diagnostic validity of the 10/66 dementia diagnosis was established by comparing this against a clinical diagnosis (sensitivity = 95.6% and specificity = 81.8%), whilst the positive predictive value was 72.9% in our sample.[13]

ii)  Sociodemographic characteristics: information relating to age, gender, ethnicity, marital status, level of education and employment status was collected.

iii) Health status questionnaires which included self-reported a) global health, b) doctor diagnosis of medical illnesses, and c) current physical impairments. The older person was asked, "Have you ever been told by a doctor that you have: a) high blood pressure, b) heart problems, c) diabetes, d) stroke, or e) sudden weakness of a limb, loss of speech, or partial blindness (transient ischaemic attacks [TIAs])?" Data relating to self-reported 'current' health conditions were also collected for the following: arthritis or rheumatism; eyesight problems; hearing difficulties or deafness; persistent cough; breathlessness, difficulty in breathing or asthma; stomach or intestine problems; fainting or blackouts; paralysis, weakness, or loss of one leg or arm; skin disorders; and cancer. Blood pressure readings were taken as part of a physical and neurological examination and they were used in this analysis instead of self-reported hypertension.

The interviewer administered a series of open-ended questions to the informant in order to ascertain caregiver dependence from his/her perspective. Examples of questions include: "Who shares the home with the respondent?"; "What kind of help does the respondent need inside of the home and outside of the home?"; "Who, in the family, is available to care for the respondent?"; "What help do you provide?"; "Do you help to organise care and support for the respondent?"; "Is there anyone else in the family who is more involved in helping than you?"; and "What about friends and neighbours?"

Based on the responses provided by the informant, the interviewer then coded whether the respondent needed care "much of the time", "occasionally" or "not at all". This coding was based on the interviewer's perception of the need for care, independent of whether this was routinely met. Caregiver dependence was classified as needing care either "occasionally" or "much of the time", while those that indicated that the older respondent did not need care at all were classified as independent.

Both the older person and the informant were administered the respective questionnaires, via a face-to-face interview, which took place at the respondent's residence or another preferred location. Administration of the questionnaires was either in English, Chinese, Malay, Tamil or in one of the following dialects: Cantonese, Hokkien or Teochew. The language used was based on the preference of the person being interviewed and the interview itself took an average of 2 to 3 hours to complete.

*Quality Control*

Trained interviewers conducted the interviews after undergoing an intensive 3-week training. In total, 3 trainings, attended by 47 interviewers, were conducted. The training was then followed by an evaluation to certify that the interviewer was proficient to begin data collection and they were also closely monitored and supervised in the period after passing the evaluation. In addition, throughout the data collection phase, quality assurance processes were also implemented to ensure high quality data whereby a minimum of 20% of each interviewer's cases were subjected to detailed verification in order to determine any falsification of data. Regular monitoring visits were conducted throughout the duration of the study to ensure all study records including consent forms and electronic data were in order and where necessary, errors were amended. Vigorous attempts were also made to contact each respondent; interviewers were required to make up to 10 attempts (at different days and times) to reach the respondent before they could be classified as a non-responder.

*Statistical Analysis*

Statistical analyses were carried out using the SAS System version 9.3. All data analyses were performed using weighted data. A series of multivariate regression models were used to examine sociodemographic correlates of caregiver dependence, associations between caregiver dependence, and other health outcomes with adjustment for sociodemographic variables and other health outcomes. To account for the effects of the complex sample design due to stratification and weighting, standard errors and significance tests were estimated using the Taylor series linearisation method. Multivariate significance was evaluated using the Wald test based on design-corrected coefficient variance-covariance matrices. Statistical significance was set at the conventional level of $P < 0.05$, using two-sided tests.

## Results

The sociodemographic characteristics of the respondents are shown in Table 1. The mean age of respondents was 70 years and the sample comprised 57.1% female and 42.9% male respondents, with the majority of the sample being of Chinese ethnicity (82.6%), currently married (65.4%) and retired (38.5%). The majority of informants were female (59.6%), aged between 45 to 64 years (42.1%), married (71.5%) and were the child of the older respondent (36.9%).

The prevalence of caregiver dependence (needing care occasionally or much of the time) was 17.2% (n = 693). Table 2 shows the prevalence of caregiver dependence by sociodemographic characteristics while Table 3 shows the sociodemographic correlates of caregiver dependence in this sample. Caregiver dependence was most prevalent among those who were 85 years old and above, females, of Malay ethnicity, widowed, had no formal education, or retired (Table 2). After controlling for sociodemographic variables, the odds of being caregiver-dependent were significantly higher among older age groups (75 to 84 years, and 85 years and above) ($P$ <0.001), Malay and Indian ethnicity ($P$ <0.001), those who had never been married ($P$ = 0.048) and those with no education ($P$ = 0.035), as well as homemakers and those who were retired ($P$ <0.001) (Table 3).

Table 4 shows the prevalence rates and odds ratio of health conditions with caregiver dependence. Amongst those with caregiver dependence, the most prevalent physical conditions were hypertension (77.6%), eyesight problems (56.6%) and dementia (50.1%). After adjusting for sociodemographic variables in multiple logistic regression analyses, we found dementia ($P$ <0.001) and depression ($P$ <0.001) diagnoses as well as the following physical conditions: heart problems ($P$ <0.001), stroke ($P$ <0.001), diabetes ($P$ = 0.004), TIAs ($P$ = 0.007), eyesight problems ($P$ <0.001), hearing difficulty ($P$ = 0.04), persistent cough ($P$ = 0.001), stomach or intestine problems ($P$ = 0.001), paralysis ($P$ <0.001), skin disorders ($P$ <0.003) and cancer ($P$ = 0.039) were significantly associated with caregiver dependence. In the final model after adjusting for all health conditions and sociodemographic characteristics, we found that dementia ($P$ <0.001) and depression ($P$ = 0.0113) diagnoses as well as stroke ($P$ = 0.002), eyesight problems ($P$ = 0.0031), persistent cough ($P$ = 0.0158), asthma ($P$ = 0.0161), paralysis ($P$ <0.001), and cancer ($P$ = 0.026) remained significantly associated with caregiver dependence.

## Discussion

This study determined the prevalence and risk factors of caregiver dependence and highlighted that caregiver dependence is not uncommon among older adults in

Table 1. Sociodemographic Characteristics of the Sample (n = 2421)

| Demographic Characteristic | n | Unweighted % | Weighted % |
|---|---|---|---|
| Age group | | | |
| 60 – 74 | 1403 | 58 | 74.8 |
| 75 – 84 | 633 | 26.1 | 19.5 |
| 85+ | 385 | 15.9 | 5.7 |
| Gender | | | |
| Men | 1039 | 42.9 | 43 |
| Women | 1382 | 57.1 | 57 |
| Ethnicity | | | |
| Chinese | 931 | 38.5 | 82.6 |
| Malay | 728 | 30.1 | 9.8 |
| Indian | 728 | 30.1 | 6.1 |
| Others | 34 | 1.4 | 1.5 |
| Marital status | | | |
| Never married | 108 | 4.5 | 6.8 |
| Married/cohabiting | 1419 | 58.7 | 65.4 |
| Widowed | 798 | 33 | 22.8 |
| Divorced/separated | 94 | 3.9 | 5 |
| Education | | | |
| None | 502 | 20.9 | 17.1 |
| Some, but did not complete primary | 579 | 24.1 | 23.8 |
| Completed primary | 597 | 24.8 | 24.1 |
| Completed secondary | 488 | 20.3 | 22.5 |
| Completed tertiary | 241 | 10 | 12.5 |
| Employment | | | |
| Paid work (part-time and full-time) | 632 | 26.4 | 32.9 |
| Unemployed (looking for work) | 30 | 1.3 | 1.4 |
| Homemaker | 782 | 32.7 | 27.2 |
| Retired | 947 | 39.6 | 38.5 |
| Informant's gender | | | |
| Women | 1559 | 64.4 | 59.6 |
| Men | 861 | 35.6 | 40.4 |
| Informant's age group | | | |
| 21 – 44 years | 629 | 26 | 25.7 |
| 45 – 64 years | 1151 | 47.6 | 42.1 |
| ≥65 years | 638 | 26.4 | 32.2 |
| Informant's marital status | | | |
| Never married | 528 | 21.8 | 23.8 |
| Married/cohabiting | 1720 | 71.2 | 71.4 |
| Widowed | 116 | 4.8 | 3.1 |
| Divorced/separated | 53 | 2.2 | 1.7 |
| Informant's relationship to older respondent | | | |
| Spouse | 883 | 36.5 | 44.1 |
| Child | 1082 | 44.7 | 36.9 |
| Son-/daughter-in-law | 147 | 6.1 | 4 |
| Sibling | 97 | 4 | 5.9 |
| Other | 211 | 8.7 | 9.1 |

Table 2. Caregiver Dependence Prevalence by Sociodemographic Characteristics

| Demographic Characteristic | Caregiver Dependence | | | | | |
|---|---|---|---|---|---|---|
| | Yes | | | No | | |
| | n | % | SE | n | % | SE |
| **Age group** | | | | | | |
| 60 – 74 | 169 | 8.8 | 1 | 1234 | 91.2 | 1 |
| 75 – 84 | 251 | 34.9 | 2.6 | 382 | 65.1 | 2.6 |
| 85+ | 273 | 67.8 | 3.2 | 112 | 32.2 | 3.2 |
| **Gender** | | | | | | |
| Men | 212 | 13 | 1.3 | 827 | 87 | 1.3 |
| Women | 481 | 20.4 | 1.3 | 901 | 79.6 | 1.3 |
| **Ethnicity** | | | | | | |
| Chinese | 230 | 16.1 | 1.1 | 701 | 83.9 | 1.1 |
| Malay | 250 | 24.9 | 1.6 | 478 | 75.1 | 1.6 |
| Indian | 208 | 21.5 | 1.4 | 520 | 78.5 | 1.4 |
| Others | 5 | 13.9 | 6 | 29 | 86.1 | 6 |
| **Marital status** | | | | | | |
| Never married | 26 | 15.2 | 4.3 | 82 | 84.8 | 4.3 |
| Married/cohabiting | 242 | 11.7 | 1.1 | 1177 | 88.3 | 1.1 |
| Widowed | 408 | 34.9 | 2.3 | 390 | 65.1 | 2.3 |
| Divorced/separated | 15 | 8.2 | 3.3 | 79 | 91.8 | 3.3 |
| **Education** | | | | | | |
| None | 257 | 35 | 2.9 | 245 | 65 | 2.9 |
| Some, but did not complete primary | 176 | 18.2 | 2 | 403 | 81.8 | 2 |
| Completed primary | 125 | 14 | 1.8 | 472 | 86 | 1.8 |
| Completed secondary | 83 | 9.7 | 1.6 | 405 | 90.3 | 1.6 |
| Completed tertiary | 41 | 10.4 | 2.4 | 200 | 89.6 | 2.4 |
| **Employment** | | | | | | |
| Paid work (part-time and full-time) | 15 | 0.8 | 0.4 | 617 | 99.2 | 0.4 |
| Unemployed (looking for work) | 2 | 1.7 | 1.4 | 28 | 98.3 | 1.4 |
| Homemaker | 306 | 21.4 | 1.8 | 476 | 78.6 | 1.8 |
| Retired | 352 | 27.9 | 1.9 | 595 | 72.1 | 1.9 |

SE: Standard error

Singapore. More specifically, it determined specific sociodemographic correlates associated with caregiver dependence including age, ethnicity, as well as marital, educational and employment status. The study also revealed that dementia, depression, stroke, eyesight problems, persistent cough, asthma, paralysis and cancer were also significantly associated with caregiver dependence.

Findings from the study showed that 17.2% of older adults were dependent on a caregiver. Whilst previous studies have measured dependence, it is difficult to make exact comparisons due to methodological differences including differences in age ranges and population age structures, as well as the way in which dependence is defined and measured. Despite these variances however, dependence is most commonly reported to be between 12% to 20%[6,7,15-18] among older adults.

One in 6 older adults were caregiver-dependent and as the population continues to age, it is expected that dependency will also increase. At the same time, fertility rates have decreased in Singapore from a total fertility rate of 3.07 in 1970, to just 1.19 in 2013.[10] This "demographic transition" or shift from high fertility and high mortality to low fertility and low mortality means that services and infrastructure for health and social care need to be in place to not only support the dependent older adults, but also their caregivers.

In a recent study among the same sample, Vaingankar et al[9] investigated care participation, care needs and care burden among caregivers of older adults. Findings revealed that

Table 3. Sociodemographic Correlates of Caregiver Dependence

| Demographic Characteristic | OR* | 95% CI | | P Value |
| | | Lower Limit | Upper Limit | |
|---|---|---|---|---|
| Age group | | | | |
| 60 – 74 | Ref. | | | |
| 75 – 84 | 3 | 2.1 | 4.4 | <0.001 |
| 85+ | 10 | 6.3 | 15.8 | <0.001 |
| Gender | | | | |
| Men | Ref. | | | |
| Women | 1.3 | 0.8 | 2.1 | 0.328 |
| Ethnicity | | | | |
| Chinese | Ref. | | | |
| Malay | 2.2 | 1.6 | 3.1 | <0.001 |
| Indian | 2.1 | 1.5 | 2.8 | <0.001 |
| Others | 1.1 | 0.3 | 3.6 | 0.891 |
| Marital status | | | | |
| Never married | 2.4 | 1.01 | 5.8 | 0.048 |
| Married/cohabiting | Ref. | | | |
| Widowed | 1.4 | 0.96 | 2.1 | 0.078 |
| Divorced/separated | 1.04 | 0.4 | 3.1 | 0.941 |
| Education | | | | |
| None | 2.2 | 1.1 | 4.5 | 0.035 |
| Some, but did not complete primary | 1.2 | 0.6 | 2.4 | 0.667 |
| Completed primary | 1.1 | 0.5 | 2.2 | 0.876 |
| Completed secondary | 0.9 | 0.4 | 1.9 | 0.808 |
| Completed tertiary | Ref. | | | |
| Employment | | | | |
| Paid work (part-time and full-time) | Ref. | | | |
| Unemployed (looking for work) | 1.6 | 0.2 | 10.9 | 0.645 |
| Homemaker | 14.9 | 5.7 | 38.9 | <0.001 |
| Retired | 27.6 | 10.6 | 72.1 | <0.001 |

CI: Confidence interval; OR: Odds ratio; Ref.: Reference category

*Derived from multiple logistic regression analyses.

care participation was highest in activities of communication (35.1%), feeding (32%), and bathing (21.1%) while care burden was experienced by 24.5% of caregivers and was significantly associated with dependent older adults who needed care "much of the time" (OR: 2.5 vs no care needed). Resources and support services are needed to address potential caregiver challenges, burden and strain that can arise as a result from caring for dependent older adults. Adequate and sustainable long-term care arrangements also need to be considered when planning future healthcare policies for a rapidly ageing population.

Various sociodemographic characteristics were found to be associated with caregiver dependence. Malays and Indians were more likely to be caregiver-dependent compared with Chinese. In an earlier study undertaken in Singapore which examined late-life functional disability among the elderly (aged 60 years and above), Ng and colleagues[5] reported Malays and Indians were significantly associated with disability based on the respondent's level of dependence in performing 10 ADLs. There has been substantial variance between studies investigating the extent to which sociodemographic and health factors explain ethnic differences.[19,20] It is likely that dependence has social, cultural and environmental underpinnings including learned dependency or adaptation, acceptance of the "sick role" and the attitudes toward aged care of family members.[21] Therefore, further research is needed to better understand these ethnic and cultural differences.

Those who were never married were significantly more likely to be dependent on a caregiver. These differences

Table 4. Prevalence Rates and Odds Ratio of Other Health Conditions in Dependence

| Health Conditions | Prevalence Rates | | Caregiver Dependence | | | | Caregiver Dependence | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Yes | | Multiple Logistic Regression Adjusting for Sociodemographic Characteristics | | | | Multiple Logistic Regression Adjusting for Sociodemographic Characteristics and Other Health Conditions | | | |
| | | | | 95% CI | | | | 95% CI | | |
| | n | % | OR* | Lower Limit | Upper Limit | *P* Value | OR† | Lower Limit | Upper Limit | *P* Value |
| 10/66 Dementia | 356 | 50.1 | 27.2 | 15 | 49.4 | <0.001 | 22.8 | 12.5 | 41.5 | <0.0001 |
| GMS-AGECAT depression cases | 85 | 9.6 | 4.2 | 2.1 | 8.4 | <0.001 | 2.7 | 1.3 | 6.0 | 0.0113 |
| Hypertension | 500 | 77.6 | 0.9 | 0.6 | 1.3 | 0.47 | 0.9 | 0.5 | 1.6 | 0.7083 |
| Heart problems | 179 | 22.9 | 2.3 | 1.5 | 3.5 | <0.001 | 1.4 | 0.8 | 2.5 | 0.2568 |
| Stroke | 135 | 27.6 | 11.7 | 6.4 | 21.6 | <0.001 | 3.9 | 1.9 | 7.9 | 0.0002 |
| Diabetes | 272 | 37.2 | 1.7 | 1.2 | 2.4 | 0.004 | 1.4 | 0.9 | 2.2 | 0.1507 |
| TIAs | 39 | 4.5 | 4.5 | 1.5 | 13.5 | 0.007 | 1.1 | 0.2 | 4.9 | 0.9501 |
| Arthritis or rheumatism | 264 | 38.7 | 1.2 | 0.9 | 1.8 | 0.211 | 0.9 | 0.6 | 1.4 | 0.6188 |
| Eyesight problems | 355 | 56.6 | 2 | 1.4 | 2.7 | <0.001 | 2.0 | 1.3 | 3.1 | 0.0031 |
| Hearing difficulty | 243 | 31.7 | 1.5 | 1.02 | 2.2 | 0.04 | 1.05 | 0.6 | 1.8 | 0.8683 |
| Persistent cough | 60 | 8.4 | 2.7 | 1.5 | 5.1 | 0.001 | 3.3 | 1.3 | 8.7 | 0.0158 |
| Asthma | 89 | 10.3 | 0.99 | 0.6 | 1.7 | 0.987 | 0.4 | 0.2 | 0.8 | 0.0161 |
| Stomach or intestine problems | 100 | 17.2 | 2.3 | 1.4 | 3.7 | 0.001 | 1.8 | 0.98 | 3.5 | 0.0583 |
| Faints or blackouts | 53 | 10.3 | 1.7 | 0.9 | 3.1 | 0.112 | 2.1 | 0.9 | 5.0 | 0.0836 |
| Paralysis | 229 | 32.1 | 8.7 | 5 | 14.9 | <0.001 | 6.9 | 3.6 | 13.3 | <0.0001 |
| Skin disorders | 82 | 12.1 | 2.5 | 1.4 | 4.6 | 0.003 | 1.1 | 0.4 | 2.9 | 0.8608 |
| Cancer | 31 | 5.8 | 2.2 | 1.04 | 4.6 | 0.039 | 3.0 | 1.1 | 8.0 | 0.026 |

CI: Confidence interval; GMS-AGECAT: Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy; OR: Odds ratio; TIAs: Transient ischaemic attacks

*OR was derived from multiple logistic regression analyses after adjusting for age, gender, ethnicity, marital, education and employment status.

†OR was derived from multiple logistic regression analyses after adjusting for age, gender, ethnicity, marital, education, employment status and other health conditions.

may be attributed to the marital resource model, which shows that marriage provides social, psychological and economic resources, which in turn promote health and reduce the risk of disability.[22] Having no formal education was also associated with caregiver dependence, a finding that is consistent with previous research.[23,24] Caregiver dependence was more prevalent among homemakers and retirees. Given that these older adults were not working at the time of the survey, it is possible that their age or current health status affected their ability to work and/or caused them to be dependent on a caregiver.

People diagnosed with dementia were nearly 23 times more likely to be caregiver-dependent, where dementia was the highest predictor of caregiver dependence; this finding has similarly been reported in previous research.[3,4,6,7] Given the debilitating nature of dementia and its devastating impact on the capacity for independent living, it is not surprising that caregiver dependence is common among those with this condition. Consequently, these impacts place huge constraints on caregivers themselves as well as on social and health services. A recent meta-analysis which explored the prevalence of mental disorders among caregivers of people with Alzheimer's disease revealed that these caregivers had a higher prevalence of depression and anxiety, as compared with the general population and those caring for patients with other illnesses,[25] which may further compound existing challenges of caregiving. Future health policies need to address the associated issues of an ageing population, taking into account chronic and debilitating non-communicable diseases such as dementia.

A significant psychiatric predictor of caregiver dependence in our study was depression. Depression in the elderly is not uncommon and may be a result of social, psychological or biological influences.[26,27] Alternatively, pre-existing caregiver dependence as a result of poor physical health conditions could be associated with depression. However,

due to the cross-sectional nature of this study, we were unable to establish any temporal relationship between caregiver dependence and associated factors. Given the significant public health implications of depression among older adults, in conjunction with the associated negative consequences that include functional decline, disability, decreased quality of life, comorbid medical conditions[28,29] and an increase in healthcare utilisation associated with increased healthcare costs,[30] it is imperative that routine systems and processes are in place to regularly screen for depression in this vulnerable population.

Stroke is the leading cause of disability in Singapore.[31] However, unlike dementia, the occurrence of stroke is sudden and therefore caregiver dependence is unlikely to be gradual. This will often result in older adults needing assistance with care immediately, whilst at the same time they will be faced with both the complexities and acceptance of dependency.[32] Clinicians should be aware that individuals with recently diagnosed chronic conditions such as stroke may also need guidance or direction in managing newly acquired dependency.[4] Persistent cough was also found to be significantly associated with caregiver dependence, and to our knowledge, we are not aware of any studies that have reported this association nor the nature of the association. Thus, further exploration into this relationship is needed. Whilst little is known about over-the-counter medicine misuse or abuse among community-dwelling older adults in Singapore, studies elsewhere have shown that prescription drug abuse, including cough syrups, is on the rise.[33,34] Therefore, diligent prescription and monitoring of medications by doctors is needed.

Caregiver dependence was significantly associated with cancer. Fatigue is a common side-effect of cancer.[35] It is also one of the greatest threats to functional independence among older adults[36] and is the most frequent chronic symptom of cancer and cancer treatment. Furthermore, it is a major cause of disability for cancer survivors and their caregivers.[35,36] Given that ageing is a major risk factor for cancer, it is important that, whenever possible, independence is maintained among this population. Community-based strategies and interventions are needed to support and assist independent living among cancer survivors, which will also alleviate any unnecessary caregiver burden or stress.

The study findings should be interpreted in light of the following limitations. Firstly, caregiver dependence was ascertained using a semi-structured interview and the rating of caregiver dependence was somewhat subjective. However, as caregiver dependence was determined based on the need for care, according to the informant and not the older person, this more direct approach may have minimised under-reporting due to social desirability or cognitive impairment. There may have also been information bias, given that the interviewers' rated caregiver dependence was based on the informant's account of needs for care, which may have been influenced by knowledge of the older person's health status. Data on the inter-rater reliability of our assessment would have been valuable. Furthermore, as there is no operational definition of caregiver dependence, this lends itself to the need for further research relating to the construct which would also allow for cross-cultural comparisons to be made across studies in the future. In Singapore, 49% of households with an older adult who has some limitations in ADL employ foreign domestic workers.[38] Whilst we did not specifically gather information on whether care was provided by foreign domestic workers, 44.3% of those who were caregiver-dependent indicated that "paid help" was provided during the day and 26.4% said it was provided during the night.[9] "Paid help" refers largely to care and help provided by domestic workers in the Singapore context. Physical conditions were self-reported rather than clinician assessed or verified via medical records and therefore could be affected by various biases. Finally, the cross-sectional design of the study precludes any inferences on the causal relationship between health conditions and caregiver dependence.

The strengths of the study are the large sample size, inclusion of a representative sample of the general population, good response rate, cognitively testing the survey questionnaires prior to the survey launch, the option of completing the survey in 1 of 4 local languages or 1 of 3 dialects, and the superior quality control measures and processes that were implemented throughout the study duration.

### Conclusion

The study has several important implications. We identified specific sociodemographic and health conditions that were significantly associated with caregiver dependence—older age, Malay and Indian ethnicity, being single/unmarried, having no education, being a homemaker or retired as well as dementia, depression, stroke, eyesight problems, persistent cough, asthma, paralysis and cancer. These associations should be considered when planning interventions, services and support to promote independent living among older adults, especially given that healthy ageing may postpone the onset of chronic diseases and disability in the final years of life.[7] Furthermore, given the burden associated with caring for older adults and the declining working age support ratio and fertility rates, the needs of caregivers of older adults also must be considered when planning future interventions and caregiver support programmes so that caregiving experiences may be improved.

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