Care Needs Profiles and Their Association with Caregiver Strain among Community-Dwelling Older Adults with Cognitive Impairment

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Abstract

Introduction: This study examined distinct profiles of met and unmet care needs among community-dwelling older adults with cognitive impairment and their association with caregiver strain. Methods: Latent class analysis and multivariable regression were applied to data from 266 caregivers of older Singaporeans, aged 60 years and above, with cognitive impairment. Care needs were evaluated by caregivers using the Camberwell Assessment of Need for the Elderly. Caregiver strain was measured by the Zarit Burden Interview. Results: Four need profiles were identified: (1) no need (38% of caregivers), (2) met social and memory needs (29%), (3) no social and met memory needs (17%), and (4) unmet social and memory needs (16%). The unmet social and memory needs profile was associated with a higher level of caregiver strain, compared to the no need profile. Discussion: A person-centered approach captured heterogeneity in the care needs of community-dwelling older adults with cognitive impairment. Policymakers should develop tailored interventions based on need profiles that may help reduce caregiver strain. © 2022 The Author(s).

Introduction

A majority of persons with cognitive impairment (PCI) live in the community with different types of met and unmet care needs [1–3]. Identifying the care needs of community-dwelling PCI is important not only for the health and well-being of PCI and their caregivers, but also for the effective allocation of healthcare resources and the tailored delivery of social services [4, 5]. To evaluate the care needs of PCI in the community, researchers have paid attention to the Camberwell Assessment of Need for the Elderly (CANE) [6, 7]. The CANE has been known to comprehensively assess met and unmet care needs in the domains of daily activities, physical and psychological health, social relationships, and financial situations [3, 6].

Previous studies using the CANE have often constructed aggregated scores of met and unmet needs to examine care needs and their correlates [8, 9]. However, this approach gives equal weight to different domains of need, making it difficult to identify specific domains that warrant policy intervention. A recent study focused on unmet needs in specific CANE domains, such as daytime activities and company [10]. However, this may not capture the overlapping and interactive aspects of various care needs.

A person-centered approach (clustering) may help fill these gaps by identifying prevalent profiles, each of which...
possesses a certain combination of met and unmet needs [11]. One recent study used this approach to identify four heterogeneous profiles of care needs – no need, met psychological needs, met social needs, and unmet social needs – among community-dwelling older adults with dementia in Europe [11]. While informative, more studies are needed to examine the need profiles in different sociocultural contexts. Therefore, this study investigates need profiles in Singapore, a rapidly aging Asian country where family caregivers play a crucial role in caregiving due to increasing longevity, low fertility rates, and the cultural legacy of familism and filial piety [12].

Moreover, it is unclear whether need profiles are associated with caregiver strain, defined as the perceived adversity and disruption on the emotional and physical health, social life, and financial status of caregivers arising from caregiving [13, 14]. As caregiving strain requires targeted assessment and intervention [15], it is important to investigate whether there are substantial differences, to the extent to which caregivers perceive strain, by care need profiles. Therefore, using the CANE, this study examines (1) distinct profiles of care needs of community-dwelling PCI in Singapore and (2) the association of need profiles with caregiver strain.

Materials and Methods

Data and Analysis Samples

We used data on 266 PCI and caregivers, living in a Whampoa community in Singapore, who participated in the “Caring for Persons with Dementia and their Caregivers in the Community: Toward a Sustainable Community-Based Dementia Care System (COGNITION)” study. Whampoa community, a geographically defined region with a total population of 41,000, has garnered policy and research attention on successful aging initiatives, due to a higher proportion of older adults with a relatively low socioeconomic status [16, 17]. In 2018, the study team visited 9,828 households in Whampoa and administered a 10-item screener for the assessment of cognitive impairment [18] to 3,589 older adults aged 60 years and above. Of those, 323 older adults who scored lower than 8 on the screener and their caregivers were asked to participate in the survey [18]. An eligible caregiver must be a family member or friend who was most involved in caregiving or ensuring the provision of care to PCI. Foreign domestic workers (FDW) [19] were excluded as caregivers because the study focused on informal, unpaid family caregivers. The final respondents were 266 community-dwelling dyads of PCI and their caregivers, who provided written informed consent for study participation.

Measures

Met and Unmet Needs

The CANE, answered by caregivers, measured the met and unmet care needs of PCI [6]. The CANE consists of 26 items with three response categories: no need, met need, and unmet need. Following Janssen et al. [11], we considered four CANE domains – daytime activities, company, memory, and eyesight/hearing/communication – in which more than 10% of caregivers reported unmet needs (online suppl. Fig. 1; for all online suppl. material, see www.karger.com/doi/10.1159/000525999). We then constructed 12 dichotomized variables from the CANE: no needs (1 = no need; 0 = met/unmet needs), met needs (1 = met need; 0 = no/unmet needs), and unmet needs (1 = unmet need; 0 = no/met needs) in each of the abovementioned four domains.

Caregiver Strain

The 22-item Zarit Burden Interview (ZBI) measured caregiver strain [13]. There were five response categories: “never,” “rarely,” “sometimes,” “quite frequently,” and “nearly always.” We used the summed variable (Cronbach’s α = 0.96), ranging from 0 to 86.

Other Covariates

We considered caregiver and PCI characteristics, and caregiving contexts, known to be associated with caregiver strain [15]. Caregiver characteristics included age (range: 23–93 years), female (1 = female; 0 = male), minority ethnicity (1 = Malay, Indian, and other nationalities; 0 = Chinese), married (1 = married; 0 = non-married), highest completed education (1 = no formal education; 2 = primary school; 3 = secondary; 4 = postsecondary and tertiary), working status (1 = working full-time or part-time; 0 = not working and never worked), and financial adequacy (1 = usually inadequate; 2 = occasionally adequate; 3 = adequate; 4 = more than adequate). PCI characteristics comprised cognitive function (measured by mini-mental state examination [MMSE] ranging from 0 to 30), functional difficulties (measured by instrumental activities of daily living [IADL], ranging from 0 to 7) [20], age (range: 61–103 years), and gender (1 = male; 0 = female). Caregiving contexts included spouse caregiver (1 = caregiver was a spouse of PCI; 0 = the rest), long-term caregiver (1 = caregivers provided care to PCI for 5 years or longer; 0 = less than 5 years of caregiving), and foreign domestic worker (1 = hiring foreign domestic worker for caregiving [19]; 0 = the rest).

Analytic Strategy

We used latent class analysis (LCA) to identify care-need profiles. LCA unveils unobserved classes (care profiles in this study) within a population, based on individuals’ responses to a set of observed indicators (12 variables from four CANE domains in this study) [21]. To identify an optimal model, we fitted multiple LCA models with different numbers of classes and compared the fit indices [22]. The model with the lowest information criteria (IC) values was considered to fit the data better than the others. Two likelihood tests – the bootstrapped likelihood ratio test (BLRT) and the Vuong-Lo-Mendell-Rubin (VLMR) adjusted likelihood ratio test – compared the neighboring models; the model with k-class outperformed the model with k-1 class if the test is statistically significant (p < 0.05) [23]. The precision and reliability of the class distinction were further checked using the entropy index and the proportion of the smallest class. The entropy value greater than 0.80 shows a good class distinction. The smallest class should be at least 5–8% of the sample for classification reliability and replicability [22].

Once class distinction was completed, each participant was assigned to a specific class (profile) based on the highest posterior probability. Using this information, multivariable regression estimated the association of care need profiles with caregiver strain.
There were eight missing values: two in the CANE variables and six in the covariates (MMSE and financial adequacy). Assuming the missing values can be inferred by observed sample characteristics under missing at random assumption [24], we handled missing values using the robust maximum likelihood estimator in LCA models and multiple imputations in the regression model. In particular, predictive mean matching, which imputes missing values using information from the complete cases, generated ten imputed data sets for multivariable regression [25].

Results

Sample Characteristics

Table 1 reports sample characteristics. The average caregiver reported mild caregiver strain with a mean value of 23.9 [26]. The average age of caregivers was 63 years old. About 60% of caregivers were female, 10% were ethnic minorities, 65% were married, and 44% were working. The average caregiver completed secondary school and considered their financial resources occasionally adequate. The mean PCI MMSE score was 15.34. On average, PCI had four IADL difficulties. The average age of PCI was 81 years, 57% of them were female and 47% were married. About 34% of the caregivers were the spouses of their PCI; 16.5% provided care to their PCI for more than 5 years, and 37% received help from FDW. The sample characteristics were largely similar to the recent caregiving study conducted in Singapore in 2019–2020 [27], although more caregivers in this study were male and an ethnic majority (Chinese).

Model Selection

According to the model fit indices (online suppl. Table 1), the IC did not converge to a single solution. The BLRT and VLMR tests did not differentiate the models as well. Across models, the class distinction was clear (entropy above 0.99), and the proportion of the smallest class was sufficiently large (greater than 10%). However, the reduction in Bayesian Information Criterion (BIC), Sample size adjusted BIC (aBIC), Consistent Akaike Information Criterion (CAIC) flattened, and Approximate Weight of Evidence Criterion (AWE) increased after the four-class model [22] (shown in Fig. 1). Therefore, a four-class model was selected.

Four Profiles of Care Needs

Figure 2 shows how the four classes were distinguished. The x-axis indicates the probability of reporting no/met/unmet needs. Numerical details are shown in online supplementary Table 2.

| Variable | Mean (SD)/% | Range |
|----------|-------------|-------|
| Caregiver strain | 23.90 (13.58) | 0–86 |
| Caregiver characteristics | | |
| Age | 62.85 (13.79) | 23–93 |
| Female | 59.4 | |
| Ethnic minority | 9.8 | |
| Married | 64.7 | |
| Education | 2.73 (0.99) | 1–4 |
| Working | 44.4 | |
| Financial adequacy | 2.37 (0.84) | 1–4 |
| PCI characteristics | | |
| Cognitive function (MMSE) | 15.34 (8.18) | 0–30 |
| Functional difficulties (IADL) | 4.17 (2.77) | 0–7 |
| Age | 81.39 (8.60) | 61–103 |
| Female | 57.1 | |
| Caregiving contexts | | |
| Spouse caregiver | 33.8 | |
| Long term caregiver | 16.5 | |
| Foreign domestic worker | 36.5 | |

Listwise deletion applied (n = 263 for financial adequacy and cognitive function). PCI, persons with cognitive impairment; MMSE, mini-mental state examination; IADL, instrumental activities of daily living.

The first profile comprised 38% of caregivers who were less likely to report any needs across the four domains. We labeled this group a “no need” profile. The second profile classified 28.5% of caregivers who mainly reported met needs in daytime activities, company, and memory. We labeled this group a “met social and memory needs” profile. The third type represented 17.4% of caregivers who were less likely to report needs in two social domains but more likely to report met memory needs. This group was labeled a “no social and met memory needs” profile. The last profile, labeled an “unmet social and memory needs” profile, consisted of caregivers who were more likely to report unmet needs in the social and memory domains, compared to the rest.

Table 2 provides the distribution of caregiver strain, caregiver and PCI characteristics, and caregiving contexts by care need profiles. Caregivers in the no need profile reported significantly lower caregiver strain than caregivers in the unmet social and memory needs profile. While need profiles were undifferentiated by caregiver sociodemographic characteristics, the no need profile had caregivers whose PCI reported better cognitive function and a fewer number of IADL difficulties than the rest. Furthermore, caregivers in the no need profile were more likely to be spouses of their PCI and less likely to hire FDW and provide long-term caregiving.
Fig. 1. IC for latent class models. Note. \(N=266\); BIC, Bayesian Information Criterion; aBIC, Sample size adjusted BIC; CAIC, Consistent Akaike Information Criterion; AWE, Approximate Weight of Evidence Criterion.

Fig. 2. Item response probability of four need profiles (\(N=266\)).
Care Needs Types and Caregiver Strain

Table 3 presents the results of the stepwise linear regression for the association of care need profiles with caregiver strain. Model 1 shows that compared to the no need profile, the three need profiles were positively associated with caregiver strain. However, when caregiver characteristics and PCI characteristics were considered in Models 2 and 3, respectively, no social and met memory needs and met social and memory needs became insignificant in their association with caregiver strain. The final model, Model 4, confirmed the positive association between the unmet social and memory need profile and caregiver strain, taking other covariates, including caregiving context variables, into account.

Among the controls, financial adequacy and PCI cognitive function were negatively associated with caregiver strain, whereas caregiver education and spousal caregiver were positively associated with caregiver strain. Hiring FDWs was unrelated to caregiver strain, as the recent study reported [28].

Discussion/Conclusion

Using four domains of the CANE, this study provided the first systematic investigation of distinct care needs profiles among community-dwelling older adults and their association with caregiver strain in Singapore. First, we identified four care need profiles: no need (38.0%), met social and memory needs (28.5%), no social and met memory needs (17.4%), and unmet social and memory needs (16.2%). These four profiles confirm the importance of social and memory needs among community-dwelling PCI [4, 8, 29]. For instance, top three unmet needs Dutch caregivers reported were memory (32.5%), daytime activities (16%), and company (13.1%) [30]. Likewise, Chilean caregivers reported unmet needs the most in domains of daytime activities (39.2%), company (36.1%), and memory (34.9%) [8]. At the same time, the profiles reaffirm the necessity of considering met and unmet needs in different CANE domains concurrently [11]. For instance, we could not distinguish no need and no social and met memory need profiles unless both social and memory needs were explored. Overall, the findings...
highlight that in Singapore, met and unmet needs in the social and memory domains were intertwined in shaping the need profiles.

Analyzing data on 447 community-dwelling people with dementia from eight European countries, Janssen et al. [11] reported four need profiles: no need (41%), met psychological needs (25%), met social needs (19%), and unmet social needs (15%). In addition to contextual differences, it is less plausible to make a direct comparison between our study and the previous study for two reasons. First, our study sample included older adults with mild cognitive impairment who had not been formally diagnosed with dementia. Second, the domains of the CANE used to derive profiles were different: two items measuring caregiver needs – caregiver psychological distress and information – were used in the previous study, whereas the memory domain was not. Nevertheless, both studies reported a similar proportion of caregivers in the no need profile (around 40%) and caregivers with unmet social needs (around 15%). Considering that caregivers reported unmet needs in social and memory domains in Chile [8], in the Netherlands [30], and in Ireland [31], a similar pattern of need profiles, a combination of met and unmet social and memory needs, may emerge in these countries. In contrast, the need profile may vary to a greater extent in China, where caregivers reported unmet needs in the domains of caring for someone (65.1%), looking after the home (63.5%), and self-care (58.7%) [9]. More studies are needed to investigate need profiles in other parts of the world.

Next, we delineated the need profiles. We observed that caregivers whose PCI had poorer cognitive function and a greater number of functional difficulties, caregivers who provided more than 5 years of caregiving, and hired FDWs were more likely to be classified into the met social and memory needs profile and the unmet social and memory needs profile. Online supplementary Table 3 further shows that it was mainly the poor health of PCI that differentiated care need profiles.

Lastly, we found that caregivers in the unmet social and memory needs profile were more likely to report higher levels of caregiver strain, compared to those in the

| Table 3. The association of care needs profiles with caregiver strain |
|---------------------------------------------------------------|
| Profiles of care needs                                      | Model 1       | Model 2       | Model 3       | Model 4       |
| No need                                                      | Reference     | Reference     | Reference     | Reference     |
| Met social & memory needs                                   | 4.48*         | 4.78*         | 2.03          | 2.78          |
| No social & met memory need                                 | 3.89*         | 3.74          | 2.52          | 2.62          |
| Unmet social and memory needs                               | 9.47****      | 9.10****      | 6.88**        | 7.49**        |
| Caregiver characteristics                                   |               |               |               |               |
| Age                                                         | 0.04          | 0.01          | −0.09         |               |
| Female                                                      | 1.03          | 0.90          | 1.07          |               |
| Ethnic minority                                             | −3.32         | −3.90         | −4.22         |               |
| Married                                                     | −1.13         | −0.32         | −2.13         |               |
| Education                                                   | 1.81          | 1.75          | 2.34*         |               |
| Working                                                     | −1.86         | −1.54         | −0.39         |               |
| Financial adequacy                                          | −4.44****     | −4.39****     | −4.35****     |               |
| PCI characteristics                                          |               |               |               |               |
| Cognitive function (MMSE)                                   | −0.19         | −0.26*        |               |               |
| Functional difficulties (IADL)                              | 0.39          | 0.50          |               |               |
| Age                                                         | 0.04          | 0.16          |               |               |
| Female                                                      | −0.32         | 1.38          |               |               |
| Caregiving contexts                                         |               |               |               |               |
| Spouse caregiver                                            | 7.21**        |               |               |               |
| Long term caregiver                                         | −2.64         |               |               |               |
| Foreign domestic worker                                     | −2.56         |               |               |               |
| Constant                                                    | 20.42****     | 24.58****     | 25.36**       | 18.97*        |
| Observations, n                                             | 266           |               |               |               |

Results based on 10 imputed data sets. PCI, persons with cognitive impairment; MMSE, mini-mental state examination; IADL, instrumental activities of daily living. * p < 0.05, ** p < 0.01, *** p < 0.001.
no need profile in Singapore. The results confirmed a link between unmet care needs and caregiver strain frequently reported in the literature [8]. At the same time, no significant differences in caregiver strain were observed between the no need profile and the two profiles with met needs (the met social and memory needs and the no social and met memory needs profiles). This implies that caregivers may not perceive strain as much when the social or memory needs of their PCI have been properly managed. Future studies may revisit if and how different types and degrees of met and unmet needs lead to caregiver strain in other sociocultural contexts.

This study has some limitations. First, we relied on CANE evaluated by caregivers. Previous studies recommended comparing needs assessed by PCI with those assessed by their caregivers [30, 32]. However, we were unable to fully exploit information from PCI because approximately 50% of PCI could not respond to CANE, mostly due to health reasons. Second, this study used cross-sectional data. Thus, the causal direction in the association between care need profiles and caregiver strain could not be determined. Third, although we accounted for a wide array of covariates, unmeasured confounders may have biased our results. For instance, caregiver personality traits could influence both care needs and caregiver strain, leading to a spurious relationship between them [33].

Despite these limitations, this study identified prevalent profiles of met and unmet care needs of community-dwelling PCI and their associations with caregiver strain in Singapore. This study thus helps policymakers and practitioners design more targeted services to address unmet social and memory needs of PCI in the community, which may reduce caregiver strain.

**Statement of Ethics**

The Caring for Persons with Dementia and their Caregivers in the Community: Toward a Sustainable Community-Based Dementia Care System (COGNITION) study received approval from the Institutional Review Board at the National University of Singapore (approval number H-17-013). Written informed consent was obtained from participants in the COGNITION study prior to survey administration.

**Conflict of Interest Statement**

The authors have no conflicts of interest to declare.

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**Author Contributions**

Pildoo Sung designed the study, conducted data analysis, and wrote the manuscript. Angelique Wei-Ming Chan, the principal investigator of the COGNITION study, managed the project and critically reviewed the manuscript.

**Data Availability Statement**

The complete COGNITION study dataset is not publicly available. The data used in this study are available upon reasonable request. Further inquiries can be directed to the corresponding author.

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