Author's response to reviews

Title: Risk of death or hospital admission among community-dwelling older adults living with dementia in Australia

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Author's response to reviews: see over
Dear Editor,

Please see below our responses to the two reviewers’ comments. Thanks.

Sincerely,

Emily (Chuanmei) You

Reponses to the first reviewer’s comments

Major Compulsory Revisions

1. Authors mentioned "It is important to examine the impact of risk factors on hospital admissions and death at different times since service arrangements may change due to the change of frail older people’s functioning and health conditions over time.’ in the Introduction. Therefore, to determine the changes of risk factor and their risk ratio over time should be an essential issue of this study. However, authors stated "Given the lack of theoretical and empirical studies exploring the optimum study period for examining risk factors, we were unable to explain why different variables did not emerge or emerged as significant risk factors at different times.” Authors should try to interpret why the risk changed over time.

We have revised some paragraphs in the section “Significant risk factors for time to death or hospital admission over short- and long-term study periods” as follows:

Based on the literature cited above and our findings, it is not surprising that the risk values of previously worse cognitive status and previous hospital admissions do not change over time. Regarding why no previous use of community care services appearing as a short-term (6-month) risk factor, our interpretations included:

First, the use of community care alone may not achieve long-term protective effect for older people living with dementia. This is because the illness of older people living with dementia progresses fast; therefore they need evolving and even special care services that take into account of the change of their physical and cognitive functioning, behaviour, emotion, and dementia related illness [38].

Second, the amount, frequency and time of the use (rather than use or not) of community care services may have more impact on the duration of the protective effect. However, this study could not test this assumption as the original project had not collected information on clients’ use of care services in such detail. Future research is needed to clarify this issue.

2. Authors combined death and hospital admission as one endpoint in the analysis. Although authors discussed this limitation in the Discussion, the background meaning
for hospital admission and death should be different. Especially authors intended to investigate the risk factors for hospital admission and mortality over time, there would be great differences between short-term and long-term risk for death. Hospital admission could be a risk factor for death. When analysing the risk for death, hospital admission becomes a confounding factor for other risk factors.

To address this comment, we have conducted similar univariate and multivariate regression analyses to examine risk factors for time to death. Correspondingly, some paragraphs have been added to the manuscript:

**Background**: As the literature has explored risk factors of mortality, we examined risk factors for time to death as a secondary purpose of this study.

**Methods (outcome variables)**: We also examined risk factors for time to death as among those clients experiencing death or hospital admission most were death cases. As described in the Background, we treated this as a secondary study purpose because there has been similar research on this topic. In addition, we were aware that the findings might be limited by inadequate sample size (See Sample size section below).

**Methods (sample size)**: Using the same method in sample size calculation but based on 10% death, 70%/30% relative size of subgroups and 10% difference, the total sample size of 433 (larger than the sample size of this study—284) was necessary to examine risk factors for time to death. This further supports why we needed to combine death and hospital admission and primarily examined risk factors for time to death or hospital admission.

**Results (Potential and significant risk factors for time to death within different study periods)**:

- **During six-month study period**, potential significant factors included previous GDS score (p=0.011; HR=0.6), ADL score (p=0.001; HR=0.98), hospital admissions (p=0.012; HR=2.67), and community care use (p=0.05; HR=0.45). Main results of the multivariate analysis included: previous hospital admissions (Wald=4.32; HR=2.29; 95% CI of HR: 1.05-4.98; p=0.038) and ADL score (Wald=9.00; HR=0.98; 95% CI of HR: 0.96-0.99; p=0.003).

- **During 9-month study period**, potential significant factors included previous GDS score (p=0.007; HR=0.61), ADL score (p=0.000; HR=0.98), IADL score (p=0.041; HR=0.83), hospital admissions (p=0.026; HR=2.26), carer stress score (p=0.038; HR=1.03), and carer relationships (p=0.042; HR=1.77). Main results of the multivariate analysis included: previous hospital admissions (Wald=3.36; HR=1.99; 95% CI of HR: 0.95-4.13; p=0.067) and previous ADL score (Wald=12.04; HR=0.98; 95% CI of HR: 0.96-0.99; P=0.001).

- **During 16-month study period**, potential significant factors included previous GDS score (p=0.003; HR=0.58), ADL score (p=0.000; HR=0.98), IADL score (p=0.038; HR=0.83), hospital admissions (p=0.014; HR=2.43), carer stress score (p=0.039; HR=1.03), and carer relationships (p=0.026; HR=1.86). Main results of the multivariate analysis included: previous hospital admissions (Wald=4.14; HR=2.12;
95% CI of HR: 1.03-4.36; p=0.042) and ADL score (Wald=12.31; HR=0.98; 95% CI of HR: 0.96-0.99; p=0.000).

To sum up, the multivariate analyses indicated that having previous hospital admissions increased the likelihood of clients’ early death during the six and 16 months’ study periods. Previously worse physical functioning (lower ADL score) was not a significant risk factor as its hazard ratio during each study period was very close to 1:00.

**Discussion:**

Our findings regarding having previous hospital admissions as a strong risk factor for time to death during six-month (HR=2.29) and 16-month study periods (HR=2.12) further confirm the importance of focusing on this risk factor in the management of frail older people living with dementia.

Previously worse cognitive functioning (lower GDS score) and worse physical functioning (lower ADL score) were not identified as risk factors for time to death across the three study periods. The literature has not reached agreement on whether functioning impairment, in particular ADL, is a risk factor for client mortality depending on what measurement tools are used [19]. Our interpretation was that the impact of previous functioning impairment (functioning factors) on a medical event (death) might be trivial compared with previous hospital admissions (a medical factor). As described above, since the sample size is not adequate enough to examine risk factors for time to death, we felt unable to make further comments.

**Minor Essential Revisions**

1. The intensity of use of care service should affect the outcome of care. How long and how frequent the care service were used should be included in the analysis.

As we have responded to the first comment under the Major Compulsory Revisions, the original research project did not collect the intensity and frequency of clients’ use of any care services examined. We therefore proposed that future research is needed to clarify this issue.

2. Authors only demonstrated the Kaplan-Meier survival curve of previous admission to death or hospital admission, please show the survival curve for other risk factors or the mean and median survival time of all risk factors.

We have added two Kaplan-Meier survival curves for GDS score and previous use of community care services for 16-month study period respectively. Correspondingly, the paragraph under the Kaplan-Meier analysis section has been revised:

Figure 1, 2 and 3 show the patterns of the whole study sample and sub-samples presenting death or hospital admission during the 16-month study period. Figure 1 and 2 support the results described above that previous (three months prior to using EACHD program services) hospital admissions and previously worse cognitive status increased the likelihood of earlier death or hospital admission. Figure 3 supports that
previous use of community care did not reduce the likelihood of early death or hospital admission during the nine- and 16-month study periods.

3. Most parts of discussion just repeated the findings in the Results, but did not well interpret and discuss the comparisons of the results in this study and other studies.

We have made significant changes in the Discussion section. Main points include:

- Simplify some paragraphs
- Delete three paragraphs, including: “Previously worse cognitive status and previous inpatient hospital admissions were significant risk factors......”, “Our study provided further evidence......”, and “However, we only found that previous use of community care was......”
- Correct one point: worse cognitive status was a moderately strong risk factor (not very weak risk factor as described in the previous manuscript)......
- Other changes (please see above the responses to the comments under the Major Compulsory Revisions)
Responses to the second reviewer’s comments

Major compulsory revisions

1. According to the result shown in the top paragraph of page 10, 25 people out of 30 death occurred in the first 6 months and it seems that 8 out of 9 hospitalizations occurred in the first 6 months. Without any explanation, it is difficult to understand why most of the events occurred in the first 6 months from a clinical perspective. This observation would have considerable impact on the present analysis.

To address this comment, we have added one paragraph in the Discussion section (Significant risk factors for time to death or hospital admission over short- and long-term study periods):

It should be noted that in our study most events occurred during six months. The literature has reported that EACHD clients typically use the EACHD program services for six months or even a shorter time as their health condition deteriorates fast; therefore they access other care services (e.g. moving to nursing homes) that can better meet their increased care needs [26].

2. The number of incidence of death and hospitalization shown in the top paragraph of page 10 should be included in “Results”, not in “Methods”.

We have moved this information to the Results (Numbers of clients died or were admitted to hospital during different study periods):

Through our analysis, of the 284 EACHD clients, during six months, 25 died, eight moved to hospital, and one moved to nursing home and died; during nine months, 29 died, nine moved to hospital, and one moved to nursing home and died; and during 16 months, 30 died, nine moved to hospital, one moved to nursing home and died, and one moved to hospital and died.

3. The results of univariate Cox regression analysis are insufficient. The authors described only p-values for merely 4 factors, but HR should be described, and for important variables even though they are not statistically significant.

We now include HRs for each potential significant factor in the manuscript (please see details in the manuscript).

Minor essential revisions

1. Why are non-elderly indigenous people included in this study?

This study did not involve indigenous people. We have added several paragraphs in different sections to explain this:
**Methods** (Population of the original project and data collection):

In addition, no indigenous people were enrolled even though they were included in the target population of the EACHD program.

**Results**: Table 1 presents that all 284 clients included in this study were non-indigenous people.

We have also added one paragraph in the Discussion section to emphasize the importance of conducting research targeting indigenous people:

**Discussion (limitations)**: It is noteworthy that the original research project did not involve indigenous people. Research targeting this population is needed because there is a higher prevalence of dementia among indigenous Australians [42], current policies emphasize providing more aged care places for indigenous Australians [43], and indigenous people living with dementia have different health conditions and care needs, and face different risk factors [44, 45].

2. In table 1, “0-64” (age) should be “50-64”.

The first age group was 58-64. As described in the Methods section:

However, it should be noted that at the initial stage of the EACHD program, not all 354 individuals enrolled by the original research project were 70 years old or over. Specifically, 27 clients were aged between 58 and 69, and 19 clients were aged between 58 and 64 (strictly speaking not “older people”).

A legend has been added to Table 1: The 284 clients were aged between 58 and 100, with 19 clients aged between 58 and 64 (strictly speaking not “older people”) (Please note, this information of the 284 clients included in this study is the same as that of the 354 clients recruited by the original research project).

**Discretionary revisions**

1. The treatment status should have had influence on the participants’ death or hospitalization but is not assessed in the present study.

We have already studied the effects of hospital admission and use of community services. We now add previous use of outpatient visits and GP visits (not demonstrated before) as independent variables. Neither was identified as a potential risk factor through univariate regression analyses. So we did not include them in multivariate regression analyses. Correspondingly, some changes have been made in Table 2 and the Results section (Service use and medical conditions):

Changes to Table 2 are that about 65% of the 284 clients had had GP visits, 2.1% had had ED visits, about 30% had used specialist dementia care and inpatient hospital care respectively, over 10% had used outpatient services and home nursing care respectively, and approximately 80% had used some types of community care, such
as personal care, domestic care, and allied health services three months prior to the baseline survey.

**Others changes in the manuscript**

Please note that we also made some changes in the Abstract and Conclusions, as well as added eight references due to expanding the Discussion section (please see details in the manuscript).