Archives of Gerontology and Geriatrics 81 (2019) 39–47

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

# Patterns of aged care use among older Australian women: A prospective cohort study using linked data

Mijanur Rahman[a,b,c,*], Jimmy T. Efird[a,b], Julie E. Byles[a,b]

[a] Priority Research Centre for Generational Health and Ageing, University of Newcastle, Australia
[b] Centre for Clinical Epidemiology and Biostatistics, University of Newcastle, Australia
[c] Department of Statistics, Comilla University, Bangladesh

ARTICLE INFO

*Keywords:*
Older women
Aged care
Data linkage
Latent patterns
Influencing factors
Australia

ABSTRACT

*Background:* Women live longer than men and have an increased need for long-term care. The objective of this study was to identify patterns of aged care use among older Australian women and to examine how these patterns were associated with their demographic and health-related characteristics.

*Methods:* The sample consisted of 8768 women from the 1921–1926 birth cohort of the Australian Longitudinal Study on Women's Health (ALSWH), who had survived to age 75-80 years. ALSWH survey and linked administrative aged care and death datasets from 2001 to 2011 were utilized. Patterns of aged care use were identified using a repeated measure latent class analysis.

*Results:* We identified four patterns of aged care use over time, differentiated by timing of service onset, types of service use and time of death. Approximately 41% of the sample were non-users or using basic home and community care (HACC), while 24% were at high risk of using moderate to high-level HACC/community aged care package (CACP). Only 11% had a greater risk of using residential aged care (RAC) over time. Being widowed, residing in remote/regional areas, having difficulty in managing income, having a chronic condition, reporting poor/fair self-rated health, and lower SF-36 quality of life scores were associated with an increased odds of being a member of the following classes: 1) moderate to high-level HACC/CACP, 2) increasing RAC, and 3) early mortality, compared with the non-user class.

*Conclusions:* Distinct patterns of aged care use were identified. These results will facilitate future capacity planning for aged care systems in Australia.

## 1. Introduction

The demand for formal long-term care among older people (known as aged care in Australia) has been increasing in recent years. This is attributable to increasing longevity and age-related chronic conditions (Francesca, Ana, Jérôme, & Frits, 2011; WHO, 2015; Wouterse, Huisman, Meijboom, Deeg, & Polder, 2015). While most people in their sixties or seventies continue to live independently, they are likely to become frail and experience multiple morbidities and disabilities in their eighties (Austad, 2009; Stones & Gullifer, 2016). This group is particularly dependent on care in the community/residential setting. However, there is an increasing gap between the number of very old people (aged 85 and over) needing care and the availability of informal caregivers (WHO, 2015).

The proportion of very old people in Australia is ~2% of the population. This number is projected to increase to ~5% by 2050 (Australian Bureau of Statistics, 2016). Aged care use is particularly prevalent in the last few years before death. For example, among those over 65 years of age who died between 2010–2011, approximately 80% had used one or more aged care services within the eight years prior to their death. Over three-quarters entered the aged care system by first using community care services (Joenpera, Van Der Zwan, Karmel, & Cooper-Stanbury, 2016).

Most Australians aspire to stay connected with their families and communities as they grow older. Having autonomy and control over their aged care, and how and where they live remain important for this group (Productivity Commission, 2011). Overall, older Australians are a diverse group in terms of socio-demographic, cultural, and linguistic background. There exists a wide variation in their expectations and preferences of care choices (Hughes, 2011) (Australian Institute of

* Corresponding author at: Priority Research Centre for Generational Health and Ageing, School of Medicine and Public Health, The University of Newcastle, Hunter Medical Research Institute, West Wing, Level 4, Lot 1 Kookaburra Circuit, New Lambton Heights, NSW, 2305, Australia.
*E-mail addresses:* MdMijanur.Rahman@uon.edu.au (M. Rahman), jimmy.efird@newcastle.edu.au (J.T. Efird), julie.byles@newcastle.edu.au (J.E. Byles).

https://doi.org/10.1016/j.archger.2018.11.010
Received 1 June 2018; Received in revised form 16 November 2018; Accepted 17 November 2018
Available online 19 November 2018

Health and Welfare (AIHW) (2012)). Understanding patterns of aged care use across later life and identifying influencing factors associated with different patterns of service use are critical for better planning and delivery of aged care services.

The vulnerability of older people with respect to demographic predisposing and enabling factors (e.g., higher age, being female and widowed, living alone, lower socio-economic status) are associated with an increased odds of using community aged care (Alkema, Reyes, & Wilber, 2006; Jorm, Walter, Lujic, Byles, & Kendig, 2010; Lafortune, Beland, Bergman, & Ankri, 2009). However, higher education has been associated with both increased (Steinbeisser, Grill, Holle, Peters, & Seidl, 2018; Wee et al., 2014) and decreased odds of utilization of long-term aged care (Fu, Guo, Bai, & Chui, 2017; Van der Heyden, Demarest, Tafforeau, & Van Oyen, 2003). Health-related needs including chronic conditions (e.g., cardiovascular diseases, diabetes), physical functioning and activities of daily living are associated with utilization of community-based aged care (Jorm et al., 2010; Rochat et al., 2010). Furthermore, various conditions (e.g., dementia, cerebrovascular disease, cardiovascular disorder, diabetes) have been associated with an increased risk of entering residential aged care (Nihtilä et al., 2008; Rosemary, Diane, Phil, Yvonne, & Stephen, 2012; Runge, Gilham, & Peut, 2009).

The current study implemented the Andersen's Behavioral Model (BM) to identify factors associated with different patterns of aged care use (Andersen & Newman, 1973). This model often has been applied to identify determinants of long-term care use in later life (Chen & Berkowitz, 2012; Slobbe, Wong, Verheij, van Oers, & Polder, 2017; Steinbeisser et al., 2018). The model categorizes the individual/societal characteristics into three groups: predisposing factors (age, widowed, and education), enabling factors (income, living arrangements, and area of residence), and need factors (physical, psychological and functional health status including illness and disability). In several recent studies, most of these factors have been found to be predictors of long-term care use in later life (Fu et al., 2017; Steinbeisser et al., 2018).

Older women are more likely to use aged care as they live longer and have a shorter disability-free life than men (Laditka & Laditka, 2001; Murtaugh, Kemper, & Spillman, 1990). In general, women are more likely to report a greater degree of disability (in particular, difficulties with instrumental activities of daily living) originating from health conditions in later life (Murtagh & Hubert, 2004). Furthermore, older women are more likely than men to live alone and without a spouse, resulting in an increased need for aged care (McCann, Donnelly, & O'Reilly, 2012). Living alone is associated with an increased risk of depending on formal long-term care; this is attributed to a lack of informal care support (Slobbe et al., 2017; Steinbeisser et al., 2018).

More than two-thirds of clients receiving aged care in Australia are women. However, limited evidence exists regarding the characteristics that influence their transition from supportive care in the community to more complex residential aged care over their lifespan. The objective of the current study was to identify patterns of formal aged care use among older women in Australia and to examine how socio-demographic (predisposing and enabling) and health-related need factors were associated with these patterns.

## 2. Methods

### 2.1. Data

Data for this study were from the 1921–1926 birth cohort of the Australian Longitudinal Study of Women's Health (ALSWH) and linked aged care and death data collected from 2001 to 2011. The ALSWH is a national population-based health study, involving almost 57,000 Australian women across four representative cohorts (Dobson et al., 2015; Loxton et al., 2015). In brief, participants were randomly sampled from the Medicare Australia database (the national universal health insurance database) with oversampling of women from remote and rural areas (twice as many compared with those living in urban areas) (Brown et al., 1999). In 1996, 12,432 women born between 1921–1926 (then aged 70–75 years) completed a postal questionnaire. Women were surveyed every three years until 2011, and on a six-monthly rolling basis thereafter. As records of most aged care services (including Home and Community Care (HACC), the largest care type in terms of the number of clients) have been compiled from 2001, the current study included 8768 women. This excluded 847 who died before 2001, 340 who opted out of linkage of their aged care information, and 2477 who had Veterans' Affairs coverage and may have used Veteran's Home Care. The average age of women included in the sample and those excluded was similar (~78). However, compared with those who were excluded, the sample over represented women from inner/outer/remote areas (43% vs. 38%), and those born overseas (26% vs 10%), and underrepresented those who were widowed (43% vs. 63%).

The aged care administrative datasets came from two sources: a) HACC Minimum Data Sets (MDS) (available from 2001), and b) program administrative data for residential aged care (RAC) and community aged care package programs (CACP). The Australian Government maintained this database for the purpose of paying subsidies to service providers of RAC and CACP. Death records were obtained from the Australian National Death Index. The HACC MDS provided information on the quarterly use of HACC (28 available service types) for each client. Survey data for all ALSWH participants were linked with administrative aged care data and death records with approval from the Australian Government Department of Health (DOH). Data linking was performed by the Australian Institute of Health and Welfare (AIHW) using a probabilistic linkage algorithm (Karmel et al., 2010; National Statistical Services, 2017; Zinn & Havlicek, 2014). The resulting dataset consisted of unique anonymous records.

### 2.2. Measures

#### 2.2.1. Age care use

The linked aged care datasets provided detailed information on aged care use including service types, start date, end date, and date of death from 2001 onward (Department of Health & Ageing, 2006). Using this information, our study determined the status of each woman in each year in terms of service use across 11 time points from 2001 to 2011, by five categories: 1) non-user, 2) basic HACC, 3) moderate to high-level HACC/CACP, 4) RAC, and 5) death. In the current study, CACP users were merged together with the Moderate to high-level HACC group. A woman who used multiple services in a year was coded according to the service which she used most frequently. In case of death, the last service category for that year was used, and in subsequent years, she was coded as deceased. The status of women in each year according to their aged care use was the indicator or observed variable in this study.

#### 2.2.2. ALSWH survey items

A range of socio-demographic (predisposing and enabling) and health-related need factors were included in accordance with the Anderson's Behavioral Model for explaining patterns of health service use (Andersen & Newman, 1973). With the exception of the highest educational qualification (measured only in Survey 1 (1996)), variables were measured at Survey 3 (in 2002), which was the nearest ALSWH survey point to the baseline year (2001). Data from adjacent surveys (Survey 2 in 1999 and Survey 4 in 2005) were used to fill-in missing values (< 5%), rather than using model-based imputation techniques. Detailed information about the impact of attrition on the representativeness of the cohort has been published elsewhere (Brilleman, Pachana, & Dobson, 2010).

Area of residence was categorized as 'Major cities' and 'Inner/outer/remote areas' based on the Accessibility/Remoteness Index of Australia Plus. This index measures distance to services, including access to tertiary teaching hospitals (Glover & Tennant, 2003). There were a small

**Table 1**
Distribution of baseline demographic predisposing and enabling factors by latent patterns of aged care service use from 2001 to 2011 (n = 8768).

| Demographic factors (predisposing and enabling) | Mostly non-user (n = 3626) % | Mostly high-level HACC/CACP (n = 2117) % | Increasing RAC (n = 927) % | Early mortality (n = 2098) % | P-value[a] |
|---|---|---|---|---|---|
| **Area of residence** | | | | | |
| Major cities | 48 | 40 | 43 | 41 | < 0.001 |
| Inner/ outer/remote areas | 52 | 60 | 57 | 59 | |
| **Country of birth** Australia | 69 | 68 | 72 | 70 | |
| Other country | 25 | 26 | 21 | 23 | < 0.001 |
| Missing | 5 | 6 | 8 | 8 | |
| **Highest qualification** | | | | | |
| No formal/school certificate | 67 | 67 | 72 | 69 | |
| Higher secondary/University/other[c] | 28 | 28 | 22 | 24 | < 0.001 |
| Missing | 5 | 5 | 5 | 7 | |
| **Widowed** | | | | | |
| No[b] | 62 | 51 | 51 | 56 | < 0.001 |
| Yes | 38 | 49 | 49 | 44 | |
| **Difficulty in managing income** | | | | | |
| Easy /not too bad | 75 | 65 | 67 | 69 | |
| Difficult some / all the time | 24 | 35 | 32 | 29 | < 0.001 |
| Missing | 1 | < 1 | 1 | < 2 | |
| **Living arrangement** | | | | | |
| Live alone | 38 | 52 | 51 | 42 | |
| Live with partner/others | 62 | 47 | 48 | 56 | < 0.001 |
| Missing | 1 | 1 | 1 | 2 | |
| **Supporting sources** | | | | | |
| Do people help you to do odd jobs? | | | | | |
| Yes | 39 | 54 | 49 | 47 | |
| No | 18 | 17 | 13 | 13 | < 0.001 |
| I do not need help | 27 | 15 | 16 | 13 | |
| Do people give you information/advice? | | | | | |
| Yes | 35 | 39 | 41 | 37 | |
| No | 26 | 27 | 20 | 20 | < 0.001 |
| I do not need advice | 25 | 22 | 17 | 15 | |
| Do people help you if you call upon them to do so unexpectedly? Yes | 63 | 69 | 62 | 58 | < 0.001 |
| No | 4 | 5 | 4 | 5 | |
| I do not need help | 17 | 12 | 11 | 10 | < 0.001 |
| Do people help you generally? Yes | 64 | 74 | 68 | 63 | |
| No | 4 | 4 | 2 | 4 | < 0.001 |
| I do not need help | 16 | 10 | 8 | 7 | |
| **Providing care/work for others** | | | | | |
| To grandchildren/other people's children | | | | | |
| Yes (daily/weekly/occasionally) | 37 | 31 | 23 | 22 | < 0.001 |
| No | 48 | 57 | 56 | 51 | |
| To any other person? Yes | 24 | 23 | 17 | 15 | < 0.001 |
| No | 64 | 68 | 67 | 66 | |
| Volunteer work for the community? | | | | | |
| Yes (every day/week/month) | 44 | 44 | 36 | 38 | < 0.001 |
| No | 39 | 41 | 40 | 32 | |

Note 1: Percentage of missing category for the variables under 'Supporting sources' and 'Providing care/work for others' are not mentioned but can be computed by subtracting the column sum of each variable from 100.
[a] Chi-square test (not adjusted for multiplicity).
[b] Included married, de facto, separated, divorced and never married.
[c] Included trade or apprentice, and certificate or diploma.

proportion of women in the outer and remote categories, and so these categories were combined with the inner region category. The categorization of other socio-demographic (predisposing and enabling) factors are shown in Table 1.

Health-related need factors included being diagnosed with physical conditions, falls with injury in the past 12 months, self-rated health, and the physical, social and mental functioning scores of the health-related quality of life profile (Table 2). The scores were determined from the Medical Outcomes Study Questionnaire Short Form-36 (SF-36) and raw scores were linearly transformed to produce subscale scores ranging from 0 to 100 (with higher scores indicating better health).

### 2.3. Statistical analyses

HACC users were categorized into basic HACC and moderate to high-level HACC using a k-median cluster analysis based on the volume and number of services used from 2001 to 2011. Clusters were identified in a two-part process by first minimizing the Euclidian distance within a cluster and then maximizing the differences between clusters. Participants were assigned to mutually exclusive clusters based on their closeness (or similarity) and volume of service use. The Calinski/Harabasz Pseudo F statistic (PFS) value was used to determine the number of clusters (Boone, 2011).

Repeated measure latent class analysis (RMLCA) was conducted to identify latent patterns of aged care use over the study period. RMLCA is a technique for analyzing longitudinal data by means of latent class analysis (LCA) and is useful for identifying time-dependent patterns of different sub-groups/populations, without imposing any restrictions. This approach works best when a small number of indicator variables are measured three or more times (Collins & Lanza, 2010). LCA has been used for a number of time-varying outcomes including health behaviors and care use (Dolja-Gore, Harris, Kendig, & Byles, 2017; S. T. Lanza & Collins, 2006; McCarthy, Ebssa, Witkiewitz, & Shiffman, 2015). As previously indicated, the outcome variable included five mutually

**Table 2**
Distribution of baseline health-related need factors by latent patterns of aged care use from 2001 to 2011 (n = 8768).

| Health-related need factors | Mostly non-user (3626) | Mostly high-level HACC/CACP (2117) | Increasing RAC (927) | Early mortality (2098) | P-value[a] |
|---|---|---|---|---|---|
| **Physical functioning** | 75.0 | 55.0 | 50.0 | 50 | < 0.001 |
| Median score ($1^{st}$ and $3^{rd}$ quartile) | (55.0-87.5) | (35.0-75.0) | (25.0-75.0) | (20.0-75.0) | |
| **Social functioning** | 100 | 87.5 | 75.0 | 75.0 | < 0.001 |
| Median score ($1^{st}$ and $3^{rd}$ quartile) | (75.0-100) | (62.5-100) | (50.0-100) | (50.0-100) | |
| **Mental health index** | | | | | |
| Median score | 84.0 | 80.0 | 80.0 | 80.0 | < 0.001 |
| ($1^{st}$ and $3^{rd}$ quartile) | (72.0-92.0) | (68.0-88.0) | (64.0-88.0) | (65.0-88.0) | |
| **Chronic conditions** (%) | | | | | |
| None | 16.7 | 10.1 | 11.6 | 11.8 | < 0.001 |
| Heart problems | 14.8 | 22.6 | 22.5 | 26.3 | < 0.001 |
| Arthritis | 46.0 | 57.6 | 50.9 | 49.3 | < 0.001 |
| Diabetes | 7.1 | 10.6 | 12.7 | 14.3 | < 0.001 |
| Asthma | 11.0 | 15.5 | 13.0 | 19.0 | < 0.001 |
| **Leaking urine in the last 12 months** (%) | | | | | |
| Sometimes/often | 16.4 | 21.7 | 22.5 | 19.5 | < 0.001 |
| **Had falls that caused injury** (%) | | | | | |
| Yes | 11.4 | 14.9 | 16.1 | 16.3 | < 0.001 |
| **Self-rated health** (%) | | | | | |
| Poor or fair | 17.2 | 30.4 | 38.2 | 45.4 | < 0.001 |
| **Hospitalized in the last 12 months** (%) | | | | | |
| Yes | 23.3 | 29.6 | 34.1 | 39.9 | < 0.001 |
| **Regular help with daily tasks** (%) | | | | | |
| Yes | 4.6 | 13.6 | 23.4 | 28.1 | < 0.001 |
| **Difficulty with vision** (%) | | | | | |
| Yes | 12.9 | 20.2 | 23.9 | 23.7 | < 0.001 |
| **Difficulty with hearing** (%) | | | | | |
| Yes | 11.5 | 14.7 | 15.4 | 13.5 | < 0.001 |
| **Difficulty with bathing / dressing** (%) | | | | | |
| Yes | 5.8 | 13.3 | 19.7 | 23.5 | < 0.001 |

[a] Kruskal-Wallis test for continuous variables and Chi-square test for categorical variables (not adjusted for multiplicity).

exclusive catergories for aged care use.

Parameters were estimated from the models using the maximum likelihood method (Collins & Lanza, 2010). A model with an optimal number of classes (from 2 to 7) was determined by examining various fitting criteria (Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), likelihood-ratio $G^2$ diagnostic, and entropy) (Celeux & Soromenho, 1996; Nylund, Asparouhov, & Muthén, 2007). The conditional probabilities of responding to an item given membership within a latent class were graphically presented for interpretability of each of the resultant latent classes. These latent classes were then used as a response variable for further analyses. Participants were classified into mutually exclusive latent classes based on their maximum posterior probability of belonging to a particular latent class.

The characteristics of women assigned to the different classes were then explored using Chi-square or Kruskal-Wallis procedures to assess their association with latent classes. Multinomial logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CI) for membership of different latent classes, according to their baseline characteristics. Participants who had complete information with regard to covariates were included in the model. Variables (except self-rated health and SF-36 physical, mental and social functioning scores) were simultaneously entered into the model to adjust for the independent effects of demographic (predisposing and enabling) and health-related need factors. Given the known associations with other health indicators, self-rated health, and physical, social and mental functioning scores were entered into separate models, adjusting for demographic variables. Analyses were performed using SAS 9.4 (Cary, N.C.) utilizing the LCA procedure. (S. Lanza, Dziak, Huang, Wagner, & Collins, 2013).

## 3. Results

Six distinct clusters were identified, with more than half of HACC clients belonging to the Basic HACC cluster. These women used a low volume and number of services such as domestic assistance and transportation. The remaining five clusters (Basic domestic, Home meal, Complex domestic, Complex transport, and Complex nursing) were categorized as Moderate to high-level HACC users, considering their volume and complex pattern of service use.

The demand for aged care increased with age, particularly in the last few years before death. Of the 8768 women in 2001 (aged 75–80), 18% used aged care, mostly basic or moderate to high-level HACC/CACP services (5% and 12% respectively) (Fig. 1). In contrast, among women who survived to 2011 (aged 85–90), ~65% used aged care. This included 15% using basic HACC, 29% moderate to high-level HACC/CACP, and 21% RAC. More than one-third of participants died during the study period, of whom 75% used one or more types of aged care, disproportionately near the time of death.

Six models were compared using 2–7 classes. Based on the fit indices and meaningfulness of the classes, a 4-class model was selected and interpreted (Supplementary Table 1). This model represented mutually exclusive patterns (classes), and distinguished women according to their level of aged care use over time. The average posterior probability

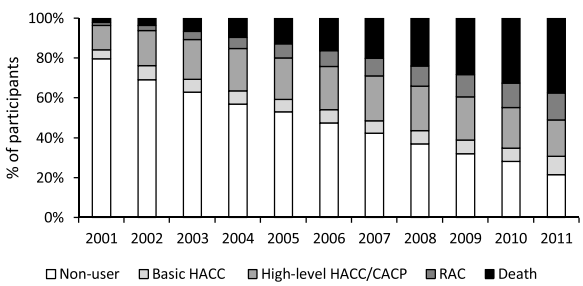


**Fig. 1.** Distribution of the sample by status of aged care use (indicator variable) during 2001–2011 (n = 8768 and death counted as cumulative).

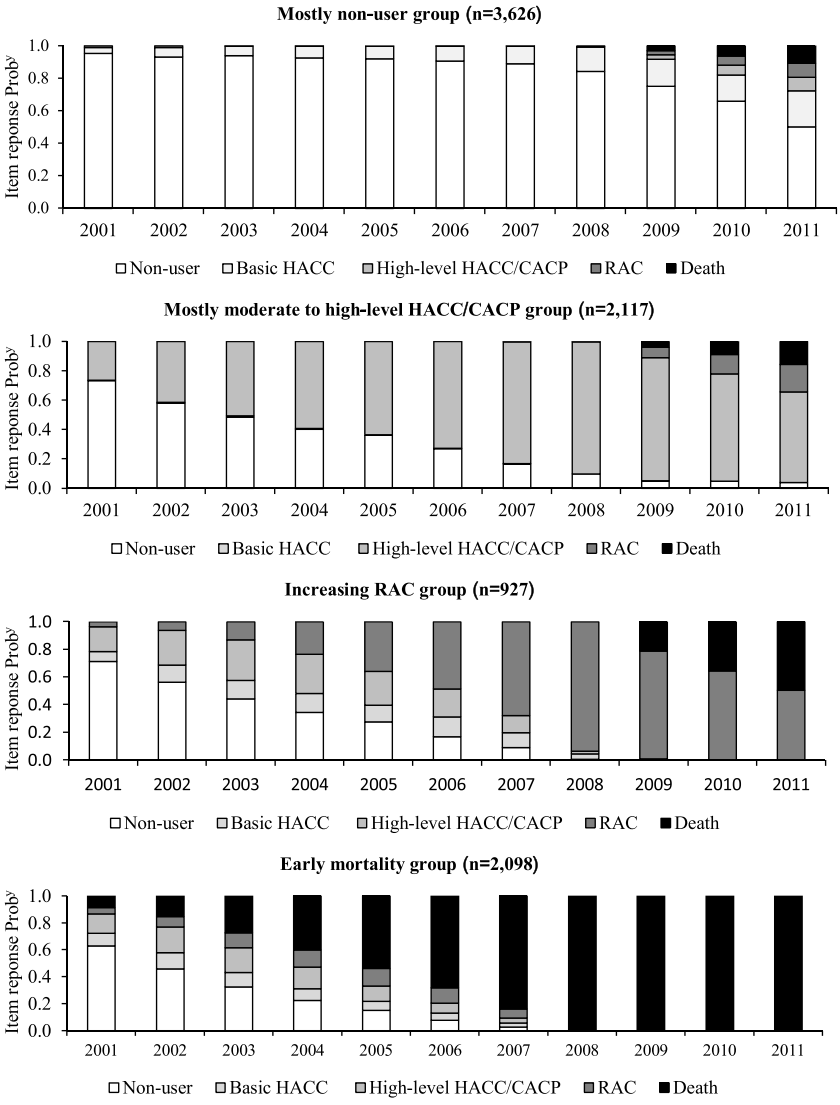


**Fig. 2.** Latent patterns of aged care use from 2001 to 2011 (n = 8768).

for each of the 4 classes was ≥0.9, demonstrating that women were appropriately classified into latent classes (Collins & Lanza, 2010). Pathways were depicted for the latent classes illustrating how women used different types of aged care across later life (Fig. 2).

The first latent class included 41% of the sample who were categorized as 'mostly non-users'. These women had the highest probability of not using any aged care or a limited chance of using only basic HACC throughout the 11-year period. They also had the highest probability of surviving. However, even in this group, the use of aged care and the number of deaths increased over the last few years of the study when the women were aged 85 and over. The second class, constituting 24% of the sample, was classified as 'mostly moderate to high-level HACC/CACP' users. Most of the women in this class used moderate to high-level HACC/CACP. However, the probability of entering RAC increased in the last three years, with a corresponding rise in mortality.

Latent class 3 was the smallest group and included 927 women who were described as 'increasing RAC' users. These women had a greater chance of entering RAC as they aged, and many used basic HACC and moderate to high-level HACC/CACP over the first half of the study. In 2009, when most of the women were in RAC, their chance of dying rapidly increased and nearly half were deceased by the end of the study. The last latent class included 2098 women (24%) who were classified as the 'early mortality' class. These women had the highest probability of dying. Approximately 15% died in the first two years, with a sharp increase in mortality over subsequent years. By 2008, all women in this class were deceased. Many had used different types of aged care before death.

The categories of all socio-demographic factors at baseline differed by latent class (Table 1). For example, a greater percentage of women in the non-user class resided in major cities, had difficulty in managing their income, lived with a partner/other family members, and provided care to grand children/other people's children relative to other classes ($p < 0.001$). Similarly, a higher percentage of women in the mostly moderate to high-level HACC/CACP class lived in inner/outer/remote areas, had difficulty in managing their income, lived alone, and received support services compared with other classes ($p < 0.001$).

All health-related need factors (depicted as quartile levels or descriptive categories) also differed by latent class (Table 2). For example, a greater percentage of women in the early mortality class had heart problems, asthma, and poor/fair self-reported health, while the highest median score for social functioning and mental health index were observed for women belonging to the non-user class.

Effect sizes for belonging to a particular latent class were differentially associated with demographic and health-related factors (Table 3). For example, increased odds of being in the mostly moderate to high-level HACC/CACP class was associated with living in inner/outer/

**Table 3**
Odds ratios (OR) and 95% confidence intervals (CI) for membership of different latent classes on baseline predisposing, enabling and health-related need factors (n = 7617).

| Covariates (reference group) | Mostly non-users OR (Ref.) | Mostly to high-level HACC/CACP users OR (95%CI) | Increasing RAC users OR (95%CI) | Early mortality group OR (95%CI) |
|---|---|---|---|---|
| ***Categorical variables*** | | | | |
| **Area of residence**[†] (Major cities) | | | | |
| Inner/outer/remote areas | 1.0 | 1.3 (1.2-1.5) | 1.2 (1.0-1.4) | 1.3 (1.2-1.5) |
| **Widowed**[†] (No) | | | | |
| Yes | 1.0 | 1.6 (1.4-1.8) | 1.6 (1.4-1.9) | 1.3 (1.1-1.5) |
| **Managing income**[†] (Easy/not too bad) | | | | |
| Difficult some/all of the time | 1.0 | 1.5 (1.3-1.7) | 1.3 (1.1-1.6) | 1.1 (1.0-1.3) |
| **Heart problems**[†] (No) | | | | |
| Yes | 1.0 | 1.5 (1.3-1.8) | 1.5 (1.3-1.9) | 1.9 (1.6-2.2) |
| **Arthritis**[†] (No) | | | | |
| Yes | 1.0 | 1.5 (1.4-1.7) | 1.2 (1.0-1.4) | 1.1 (0.9-1.2) |
| **Diabetes**[†] (No) | | | | |
| Yes | 1.0 | 1.5 (1.2-1.8) | 1.8 (1.4-2.2) | 2.0 (1.7-2.4) |
| **Asthma**[†] (No) | | | | |
| Yes | 1.0 | 1.3 (1.1-1.6) | 1.1 (0.9-1.4) | 1.8 (1.5-2.1) |
| **Had falls with injury**[†] (No) | | | | |
| Yes | 1.0 | 1.3 (1.1-1.5) | 1.4 (1.2-1.8) | 1.4 (1.2-1.7) |
| **Self-rated health**[‡] (Good to excellent) | | | | |
| Poor or fair | 1.0 | 2.0 (1.8-2.3)[†] | 2.9 (2.5-3.5)[†] | 4.0 (3.5-4.6)[†] |
| ***Continuous variables*** | | | | |
| **Physical function score**[‡] | 1.0 | 0.981 (0.979-0.983) | 0.976 (0.973-0.979) | 0.974 (0.972-0.976) |
| **Mental health score**[‡] | 1.0 | 0.986 (0.983-0.990) | 0.974 (0.969-0.978) | 0.979 (0.976-0.983) |
| **Social functioning score**[‡] | 1.0 | 0.985 (0.983-0.988) | 0.980 (0.977-0.983) | 0.979 (0.976-0.981) |

[†] Adjusted for area of residence, widowed, managing income, heart problems, arthritis, diabetes, asthma, and had falls with injury.
[‡]Adjusted for area of residence, widowed, and managing income.
Ref. = Reference class.

remote areas (OR = 1.3, 95%CI = 1.2–1.5), being widowed (OR = 1.6, 95%CI = 1.4–1.9), difficulty in managing income (OR = 1.5, 95%CI = 1.3–1.7), and having chronic conditions such as arthritis (OR = 1.5, 95%CI = 1.4–1.7). A 1-unit increase in SF-36 quality of life score in areas such as physical functioning was significantly associated with a 2% decreased odds (OR = 0.981, 95%CI = 0.979-0.983) of being included in the mostly moderate to high-level HACC/CACP class than the mostly non-user class. Furthermore, women with poor/fair self-rated health (OR = 2.0, 95%CI = 1.8–2.3) were more likely to be included in the mostly moderate to high-level HACC/CACP class than the mostly non-user class.

Women who were widowed (OR = 1.6, 95%CI = 1.4–1.9), had difficulty in managing income (OR = 1.3, 95%CI = 1.1–1.6), diagnosed with a chronic condition such as heart problems (OR = 1.5, 95%CI = 1.3–1.8), arthritis (OR = 1.2, 95%CI = 1.0–1.4), diabetes (OR = 1.8, 95%CI = 1.4–2.2), and had falls with injury (OR = 1.4, 95%CI = 1.2–1.8) were more likely to be a member of the increasing RAC than the mostly non-users class. A 1-unit increase in physical functioning, mental health, and social functioning scores were associated with a decreased odds (OR = 0.976, 95%CI = 0.973-0.979), (OR = 0.974, 95%CI = (0.969-0.978), (OR = 0.980, 95%CI = 0.977-0.981) of being a member of the increasing RAC vs. mostly non-users class.

Furthermore, a 1-unit increase in SF-36 quality of life score was associated with a decreased odds of being in the early mortality vs. the mostly non-user group. In terms of self-rated health, women who reported poor/fair self-rated health had an increased odds of being a member of the mostly moderate to high-level HACC/CACP (OR = 2.0, 95%CI = 1.8–2.3), increasing RAC (OR = 2.9, 95%CI = 2.5–3.5), and early mortality classes (OR = 4.0, 95%CI = 3.5–4.6) than the mostly non-user class.

## 4. Discussion

Our study identified patterns of aged care use among a nationally representative cohort of older Australian women over the period 2001–2011 (when the cohort was aged 75–80 to 85–90 years). One of the key findings is that a large proportion (41%) of the sample were not likely to use any services or used only entry-level (basic HACC) services. Approximately one quarter used moderate to high-level HACC/CACP, and a relatively smaller proportion (11%) used RAC (with many of the latter having previously used HACC/CACP). The estimated probability of using RAC across later life was higher than the cohort prevalence at any given time point. Previous research showed that at age 65, two out of three women need care at some point in their remaining life, mostly consisting of community care services. The majority of women do not enter RAC (Chomik & MacLennan, 2014; Productivity Commission, 2011).

The findings from the RMLCA suggest that there was a large variation among the women in terms of their patterns of service use across later life. Women differed with respect to timing of entry into different services, as well as the type and combination of services used. Their survival patterns also differed. The mostly non-user class accounted for over two-fifths of the sample and were the longest living group. These women were most likely to be non-users across the study period. However, with a rapid increase in both the probability of using services and mortality in the last few years, many women may have entered the aged care system at an older age (85 and over). This is when most people are increasingly dependent on some levels of aged care services (Reeve et al., 2018).

While the moderate to high-level HAC class also included long-living women, they also had the highest probability of consistently using community care services, in particular moderate to high-level HACC/CACP. Their chances of entering RAC increased in the last few years of the study, as they approached end of life. During this period, community care services were no longer able to adequately meet their increasing care needs. This is consistent with other research suggesting that long-term care begins with receiving care in the community followed by a combination of community care and respite RAC, before transitioning permanently to RAC (Australian Institute of Health & Welfare, 2017; Mehdizadeh, 2002). During the first half of the study, women in the increasing RAC class used multiple services. However,

with increasing age they were more likely to exclusively use RAC, in agreement with the literature (Australian Institute of Health & Welfare, 2018b). Women in the early mortality class used different types of services in the last few years of life, but they had the lowest survival probability, with all being deceased by 2008. The nearer people were to death, the more likely they were to use aged care, in accordance with the findings of the AIHW study (Joenpera et al., 2016).

Our study observed that baseline sociodemographic predisposing and enabling factors were associated with membership of different latent patterns. Those who lived in inner/outer/remote areas, were widowed, had difficulty managing income, and lived alone were more likely to be a member either of the moderate to high-level HACC/CACP or increasing RAC or early mortality classes than the mostly non-user class. Researchers in another Australian study (based on the HACC database) demonstrated that the aforementioned characteristics were associated with an increased odds of using HACC services (Jorm et al., 2010). In a related study, having never married, living alone, and being socially vulnerable were associated with an increased risk of entering RAC (Kendig, Browning, Pedlow, Wells, & Thomas, 2010). The increased odds of older women living in inner/outer/remote areas reflect a lack of informal support (both from family members and community) as well as the availability of HACC/CACP services in these areas. Those who were widowed and lived alone were more likely to be frail and less likely to receive informal support, leaving them increasingly dependent on formal aged care services.

In terms of health-related need factors, we found that lower scores on the SF-36 quality of life quesnnaire, diagnosed with chronic conditions, falls with injury in the last 12 months, and reported poor/fair self-rated health were associated with an increased odds of membership in the following classes: early mortality, increasing RAC, and moderate to high-level HACC/CACP, compared with non-users. Individuals with the above mentioned health profile were found to be associated with an increased odds of HACC service use (Jorm et al., 2010). Poor physical functioning is a major driver of need for support with physical care. It also may be associated with comorbid conditions which contribute to poor survival. A lower SF-36 quality of life score (in particular physical functioning) was significantly associated with fear of falls and increased aged care admission (Cumming, Salkeld, Thomas, & Szonyi, 2000). In a US-based study, falls with injury were a significant risk factor of nursing home admission (Tinetti & Williams, 1997). Additionally, self-reported poor health status/disability was a significant predictor of nursing home admission and mortality (Guralnik et al., 1994; Weinberger et al., 1986). As reported in another study, patterns of aged care use varied widely according to different health conditions that affected their care needs (Rosemary et al., 2012). Those with musculoskeletal problems were more likely to use community care services and those with dementia or cerebrovascular disease were more likely to enter RAC. In our study, we found that those with arthritis were associated with having an increased odds of being a member of moderate to high-level HACC/CACP (OR = 1.5, 95%CI: 1.4–1.7) and increasing RAC (OR: 1.2, 95%CI: 1.0–1.4), but were not associated with being in the early mortality class. However, those diagnosed with asthma were observed to have an increased odds of belonging to the mostly moderate to high-level HACC/CACP and early mortality classes, compared with non-users. The latter finding is consistent with another study of this cohort that found women who had asthma had a 17% higher risk of death than those without asthma (Eftekhari, Forder, Majeed, & Byles, 2016).

Our study was strengthened by the use of linked data from a nationally representative sample and administrative aged care datasets. This provided a broad platform to analyze different patterns of aged care use over time. However, a few limitations should be noted. Oversampling from remote/regional areas may have introduced selection bias with respect to the care needs of older women in major cities vs. inner/outer/remote areas. Thus, other more representative samples may yield different results. Among women who used multiple services, their status in a particular year was determined based on the most frequently used service. Services that were used for a fewer number of days (such as respite RAC, or women who were admitted to RAC within a few days before death) may have been missed. Some women were excluded from the multivariable analyses because of missing covariate information, potentially biasing results. In particular, women with missing values had a greater risk of using aged care and subsequent early mortality.

The findings of our study are only representative of women, as men were not included in the ALSWH. Men tend to enter RAC earlier in life than women because the latter generally received support from other formal aged care programs such as HACC (Australian Institute of Health & Welfare, 2014). However, the average length of stay for women in RAC is 1.5 times higher than men, reflecting their longer lifespan (Australian Institute of Health & Welfare, 2018a). The study also did not include information on dementia or cognitive function. Dementia is an important determinant of RAC use, with a corresponding decrease in use of HACC. In a separate analysis, we found that 80% of women with dementia spent time in RAC in the two years prior to death (ALSWH, 2018). Our findings can motivate further study regarding the estimation of transition probabilities from one group to another and to identify influencing factors for each level of transition over time.

## 5. Conclusions

The first wave of baby boomers are now entering old age. Consequently, the number of individuals depending on aged care is projected to double in Australia over the next two decades (Australian Bureau of Statistics, 2016). Currently, there is a paucity of evidence as to how older people utilize different types of services, ranging from supportive care in the community to high-level care in residential settings (Productivity Commission, 2011). This study is a first step in identifying different patterns of aged care use and factors associated with each pattern. Women in the four patterns differed with respect to the timing of their entry into aged care, type and combination of service use, and their survival patterns. A relatively small proportion of women required RAC, following previous HACC/CACP use. By better understanding the differential care needs of older women, our findings will help guide policy-makers in their efforts to improve service delivery and to optimize future capacity planning in the aged care system.

## Financial disclosure

None.

## Conflicts of interest

None.

## Acknowledgments

The Australian Longitudinal Study on Women's Health (ALSWH) is managed jointly by the University of Newcastle and the University of Queensland. We are grateful to the Australian Government Department of Health for funding and to the women who participated in the survey and provided data, and Australian Institute of Health and Welfare (AIHW) as an integrating authority and source of aged care data. We also thank Emily Princeton (Priority Research Centre for Generational Health and Ageing) and Dr. Charulata Jindal (Centre for Clinical Epidemiology and Biostatistics) for their editorial assistance.

## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.archger.2018.11.010.

## References


Alkema, G. E., Reyes, J. Y., & Wilber, K. H. (2006). Characteristics associated with home- and community-based service utilization for Medicare managed care consumers. *Gerontologist, 46*(2), 173–182.

ALSWH (2018). *Health service use at the end of life by older Australian women with chronic conditions.* http://www.alswh.org.au/.

Andersen, R., & Newman, J. F. (1973). Societal and individual determinants of medical care utilization in the United States. The Milbank Memorial Fund Quarterly. *Health and Society,* 95–124.

Austad, S. N. (2009). Comparative biology of aging. *The Journals of Gerontology Series A, Biological Sciences and Medical Sciences, 64*(2), 199–201. https://doi.org/10.1093/gerona/gln060.

Australian Bureau of Statistics (2016). *Australian Demographic Characteristics (3101.0).* Canberra: Australian Bureau of Statistics. (10 January 2017) http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/6DAF7F7C4A59465DCA25808900122564/$File/31010_jun%202016.pdf.

Australian Institute of Health and Welfare (2014). *Patterns in use of aged care 2002–03 to 2010–11.* Canberra: Australian Institute of Health and Welfare. (20 December 2017) https://www.aihw.gov.au/getmedia/267392cc-7fd4-488a-8626-6a84ac2eeaab/16893.pdf.aspx?inline=true.

Australian Institute of Health and Welfare (2017). *Pathways to permanent residential aged care.* Canberra: Australian Institute of Health and Welfare. (20 March 2018) https://www.aihw.gov.au/getmedia/71d37559-36f7-4274-9417-83977cb6e4f6/21233.pdf.aspx?inline=true.

Australian Institute of Health and Welfare (2018a). *GEN fact sheet 2015-16:People leaving aged care.* Canberra: Australian Institute of Health and Welfare. (20 April 2018) https://www.gen-agedcaredata.gov.au/Resources/Factsheets-and-infographics/Exits_factsheet.pdf?ext=.

Australian Institute of Health and Welfare (2018b). *Cause of death patterns and people's use of aged care.* Canberra: Australian Institute of Health and Welfare. (10 April 2018) https://www.aihw.gov.au/getmedia/eb5eeae9-3a5b-46e8-87f8-6cfddda5e7b7/aihw-age-83.pdf.aspx?inline=true.

Australian Institute of Health and Welfare (AIHW) (2012). *Aged care packages in the community 2010-11: A statistical overview.* Canberra: AIHW. (20 March 2018) https://www.aihw.gov.au/getmedia/c684d8f8-d73f-4dcc-905f-a216377dce97/13754.pdf.aspx?inline=true.

Boone, D. S. (2011). Determination of the number of clusters in a data set: A stopping rule× clustering algorithm comparison. *International Journal of Strategic Decision Sciences (IJSDS), 2*(4), 1–13.

Brilleman, S. L., Pachana, N. A., & Dobson, A. J. (2010). The impact of attrition on the representativeness of cohort studies of older people. *BMC Medical Research Methodology, 10*(1), 71.

Brown, W. J., Bryson, L., Byles, J. E., Dobson, A. J., Lee, C., Mishra, G., et al. (1999). Women's Health Australia: Recruitment for a national longitudinal cohort study. *Women & Health, 28*(1), 23–40.

Celeux, G., & Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification, 13*(2), 195–212.

Chen, Y.-M., & Berkowitz, B. (2012). Older adults' home-and community-based care service use and residential transitions: A longitudinal study. *BMC Geriatrics, 12*(1), 44.

Chomik, R., & MacLennan, M. (2014). *Aged care in Australia: Part I-Policy, demand and funding. Sydney.* (Accessed: 5 September, 2018) https://cepar.edu.au/resources-videos/research-briefs/aged-care-australia-part-i-policy-demand-and-funding.

Collins, L. M., & Lanza, S. T. (2010). *Latent class and latent transition analysis with applications in social, behavioral and health sciences.* John Wiley Sons, Inc.

Cumming, R. G., Salkeld, G., Thomas, M., & Szonyi, G. (2000). Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. *The Journals of Gerontology Series A, Biological Sciences and Medical Sciences, 55*(5), M299–305.

Department of Health and Ageing (2006). *Home and community care progrom national minimum dataset user guide version 2.* Canberra: Department of Health and Ageing. (15 June 2018) https://agedcare.health.gov.au/sites/g/files/net1426/f/documents/11_2014/prov_4b1_hacc_mds_user_guide.pdf.

Dobson, A. J., Hockey, R., Brown, W. J., Byles, J. E., Loxton, D. J., McLaughlin, D., et al. (2015). Cohort profile update: Australian longitudinal study on women's health. *International Journal of Epidemiology, 44*(5) 1547-1547f.

Dolja-Gore, X., Harris, M. L., Kendig, H., & Byles, J. E. (2017). Patterns of hospitalization risk for women surviving into very old age: Findings from the australian longitudinal study on women's health. *Medical Care, 55*(4), 352–361.

Eftekhari, P., Forder, P. M., Majeed, T., & Byles, J. E. (2016). Impact of asthma on mortality in older women: An Australian cohort study of 10,413 women. *Respiratory Medicine, 119*, 102–108. https://doi.org/10.1016/j.rmed.2016.08.026.

Francesca, C., Ana, L.-N., Jérôme, M., & Frits, T. (2011). *OECD health policy studies help wanted? Providing and paying for long-term care: Providing and paying for long-term care.* OECD Publishing.

Fu, Y. Y., Guo, Y., Bai, X., & Chui, E. W. T. (2017). Factors associated with older people's long-term care needs: A case study adopting the expanded version of the Anderson Model in China. *BMC Geriatrics, 17*(1), 38. https://doi.org/10.1186/s12877-017-0436-1.

Glover, J. D., & Tennant, S. K. (2003). *Remote areas statistical geography in Australia: Notes on the Accessibility/Remoteness Index for Australia (ARIA+ version): Public Health Information Development Unit.* the University of Adelaide.

Guralnik, J. M., Simonsick, E. M., Ferrucci, L., Glynn, R. J., Berkman, L. F., Blazer, D. G., et al. (1994). A short physical performance battery assessing lower extremity function: Association with self-reported disability and prediction of mortality and nursing home admission. *Journal of Gerontology, 49*(2), M85–94.

Hughes, M. (2011). The productivity commission inquiry into aged care: A critical review. *Australian Social Work, 64*(4), 526–536. https://doi.org/10.1080/0312407x.2011.621084.

Joenpera, J., Van Der Zwan, F., Karmel, R., & Cooper-Stanbury, M. (2016). Long and winding road: Aged care use before death. *Australasian Journal on Ageing, 35*(1), 9–11. https://doi.org/10.1111/ajag.12317.

Jorm, L. R., Walter, S. R., Lujic, S., Byles, J. E., & Kendig, H. L. (2010). Home and community care services: A major opportunity for preventive health care. *BMC Geriatrics, 10*(1), 26. https://doi.org/10.1186/1471-2318-10-26.

Karmel, R., Anderson, P., Gibson, D., Peut, A., Duckett, S., & Wells, Y. (2010). Empirical aspects of record linkage across multiple data sets using statistical linkage keys: The experience of the PIAC cohort study. *BMC Health Services Research, 10*, 41. https://doi.org/10.1186/1472-6963-10-41.

Kendig, H., Browning, C., Pedlow, R., Wells, Y., & Thomas, S. (2010). Health, social and lifestyle factors in entry to residential aged care: An Australian longitudinal analysis. *Age and Ageing, 39*(3), 342–349. https://doi.org/10.1093/ageing/afq016.

Laditka, S. B., & Laditka, J. N. (2001). Effects of improved morbidity rates on active life expectancy and eligibility for long-term care services. *Journal of Applied Gerontology, 20*(1), 39–56.

Lafortune, L., Beland, F., Bergman, H., & Ankri, J. (2009). Health state profiles and service utilization in community-living elderly. *Medical Care, 47*(3), 286–294. https://doi.org/10.1097/MLR.0b013e3181894293.

Lanza, S., Dziak, J., Huang, L., Wagner, A., & Collins, L. (2013). *PROC LCA & PROC LTA users' guide (Version 1.3. 0).* University Park: The Methodology Center, Penn State.

Lanza, S. T., & Collins, L. M. (2006). A mixture model of discontinuous development in heavy drinking from ages 18 to 30: The role of college enrollment. *Journal of Studies on Alcohol, 67*(4), 552–561.

Loxton, D., Powers, J., Anderson, A. E., Townsend, N., Harris, M. L., Tuckerman, R., et al. (2015). Online and offline recruitment of young women for a longitudinal health survey: Findings from the australian longitudinal study on women's health 1989-95 cohort. *Journal of Medical Internet Research, 17*(5).

McCann, M., Donnelly, M., & O'Reilly, D. (2012). Gender differences in care home admission risk: Partner's age explains the higher risk for women. *Age and Ageing, 41*(3), 416–419. https://doi.org/10.1093/ageing/afs022.

McCarthy, D. E., Ebssa, L., Witkiewitz, K., & Shiffman, S. (2015). Paths to tobacco abstinence: A repeated-measures latent class analysis. *Journal of Consulting and Clinical Psychology, 83*(4), 696–708. https://doi.org/10.1037/ccp0000017.

Mehdizadeh, S. A. (2002). Health and long-term care use trajectories of older disabled women. *The Gerontologist, 42*(3), 304–314. https://doi.org/10.1093/geront/42.3.304.

Murtagh, K. N., & Hubert, H. B. (2004). Gender differences in physical disability among an elderly cohort. *American Journal of Public Health, 94*(8), 1406–1411.

Murtaugh, C. M., Kemper, P., & Spillman, B. C. (1990). The risk of nursing home use in later life. *Medical Care,* 952–962.

National Statistical Services (2017). *Statistical data integration invovling commonwealth data.* (Accessed date: 12 November, 2017) http://www.nss.gov.au/nss/home.nsf/pages/Data%20integration%20-%20data%20linking%20information%20sheet%20four.

Nihtilä, E. K., Martikainen, P. T., Koskinen, S. V., Reunanen, A. R., Noro, A. M., & Häkkinen, U. T. (2008). Chronic conditions and the risk of long-term institutionalization among older people. *European Journal of Public Health, 18*(1), 77–84.

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling, 14*(4), 535–569.

Productivity Commission (2011). *Caring for older australians (53).* (10 November 2017) http://www.pc.gov.au/inquiries/completed/aged-care/report/aged-care-overview-booklet.pdf.

Reeve, R., Srasuebkul, P., Langton, J. M., Haas, M., Viney, R., & Pearson, S.-A. (2018). Health care use and costs at the end of life: A comparison of elderly Australian decedents with and without a cancer history. *BMC Palliative Care, 17*(1), 1. https://doi.org/10.1186/s12904-017-0213-0.

Rochat, S., Cumming, R. G., Blyth, F., Creasey, H., Handelsman, D., Le Couteur, D. G., et al. (2010). Frailty and use of health and community services by community-dwelling older men: The concord health and ageing in men project. *Age and Ageing, 39*(2), 228–233.

Rosemary, K., Diane, G., Phil, A., Yvonne, W., & Stephen, D. (2012). Care trajectories through community and residential aged care services: Disease effects. *Ageing and Society, 32*(8), 1428–1445.

Runge, C., Gilham, J., & Peut, A. (2009). *Transitions in care of people with dementia. A systematic review of the literature.* Australian Institue of Health and Welfare Catalogue no: AIHW, 11074.

Slobbe, L. C. J., Wong, A., Verheij, R. A., van Oers, H. A. M., & Polder, J. J. (2017). Determinants of first-time utilization of long-term care services in the Netherlands: An observational record linkage study. *BMC Health Services Research, 17*(1), 626. https://doi.org/10.1186/s12913-017-2570-z.

Steinbeisser, K., Grill, E., Holle, R., Peters, A., & Seidl, H. (2018). Determinants for utilization and transitions of long-term care in adults 65+ in Germany: Results from the longitudinal KORA-Age study. *BMC Geriatrics, 18*(1), 172. https://doi.org/10.1186/s12877-018-0860-x.

Stones, D., & Gullifer, J. (2016). At home it's just so much easier to be yourself': Older adults' perceptions of ageing in place. *Ageing and Society, 36*(03), 449–481. https://doi.org/10.1017/S0144686X14001214.

Tinetti, M. E., & Williams, C. S. (1997). Falls, injuries due to falls, and the risk of

admission to a nursing home. *The New England Journal of Medicine, 337*(18), 1279–1284. https://doi.org/10.1056/NEJM199710303371806.

Van der Heyden, J., Demarest, S., Tafforeau, J., & Van Oyen, H. (2003). Socio-economic differences in the utilisation of health services in Belgium. *Health Policy, 65*(2), 153–165.

Wee, S. L., Liu, C., Goh, S. N., Chong, W. F., Aravindhan, A., & Chan, A. (2014). Determinants of use of community-based long-term care services. *Journal of the American Geriatrics Society, 62*(9), 1801–1803.

Weinberger, M., Darnell, J. C., Tierney, W. M., Martz, B. L., Hiner, S. L., Barker, J., et al. (1986). Self-rated health as a predictor of hospital admission and nursing home placement in elderly public housing tenants. *American Journal of Public Health, 76*(4), 457–459.

WHO (2015). *World report on ageing and health*Geneva: WHO. (20 February 2018) http://apps.who.int/iris/bitstream/handle/10665/186463/9789240694811_eng.pdf;jsessionid=A8EA0B1291BCC423FE618C057247A18A?sequence=1.

Wouterse, B., Huisman, M., Meijboom, B. R., Deeg, D. J., & Polder, J. J. (2015). The effect of trends in health and longevity on health services use by older adults. *BMC Health Services Research, 15*(1), 574. https://doi.org/10.1186/s12913-015-1239-8.

Zinn, A., & Havlicek, J. (2014). Pathways to residential care: Latent class and confirmatory analyses of adolescents' adverse placement event histories. *The Social Service Review, 88*(3), 367–406.