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ARTICLE

Australian retirement village residents: wellbeing profiles and factors associated with low wellbeing

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Abstract

The characteristics of Australian retirement village residents, an under-researched population, are not well understood. Knowledge of their wellbeing and modifiable factors associated with low wellbeing would aid in the introduction of health promotion measures and supports to facilitate healthy ageing-in-place. A novel approach utilising latent class analysis (LCA), a statistical method not previously employed to study this population, was undertaken to analyse cross-sectional survey data from 871 participants aged ≥65 years from retirement villages in Queensland, Australia. LCA identified latent, *i.e.* unobserved, underlying and often difficult to measure, groups within this population based on the responses of individuals to multiple observed variables. Survey participants were divided into groups, each with a distinct profile associated with a wellbeing state, as determined by responses to questions about physical health, unplanned hospitalisations, cognitive health and social connectedness. Multinomial logistic regression explored the relationship between modifiable health and lifestyle characteristics and membership of a particular wellbeing group. The median age of participants was 82 years (interquartile range = 76–88). While 69.0 per cent reported good to excellent health, polypharmacy was evident with 45.6 per cent of participants taking five or more prescription medications. In the previous 12 months, 33.3 per cent had experienced one or more falls and 30.6 per cent an unplanned hospitalisation. Distinct profiles were identified for three wellbeing groups: high (57.7% of participants), moderate (20.6%) and low wellbeing (21.7%). Injurious falls, limited ability to prepare meals and debilitating pain were associated with the moderate and low wellbeing groups. Physical activity significantly lowered the probability of a retirement village resident being in the low wellbeing group. Our findings

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highlight falls prevention, maintaining adequate nutrition, pain management and regular physical activity as actions that may optimise wellbeing, mitigate functional decline and support the independence of retirement village residents into later years of life.

Keywords: retirement village; retirement community; independent living; positive ageing; wellbeing; latent class analysis

Introduction

Housing options for older adults in English-speaking developed countries have changed dramatically over the years, with an increasing number of older people choosing to live independently within a community of their peers. In 2014, an estimated 184,000 Australians lived in retirement villages, representing 5.7 per cent of the population aged ≥65 years. By 2025, this proportion is predicted to increase to 7.5 per cent of older Australians (Grant Thornton, 2014). The emergence of age-specific retirement communities is a phenomenon also occurring in the United States of America (Campbell, 2016), United Kingdom (Beach, 2015) and Canada (Employment and Social Development Canada, 2019). Typically, an Australian retirement village is an estate comprised of a number of individual villas set in landscaped grounds where residents live independently in their own dwelling. Many of these purpose-built environments include communal facilities such as a community hall or bowling green, and offer organised recreational activities and support services (Grant Thornton, 2014).

In Australia (Australian Institute of Health and Welfare, 2013), as in many countries (Keenan, 2010; Canadian Institute for Health Information, 2011; World Health Organization, nd), the majority of older adults wish to live independently in their own home for as long as possible. However, ageing is associated with physiological (Musi and Hornsby, 2021) and psychosocial change (Ferraro and Carr, 2021; Schaie and Willis, 2021), and is often accompanied by the need for assistance with activities such as house cleaning or cooking. A benefit of residing in a retirement village is that living in your own home preserves independence, however, appropriate supports are in close proximity and can be accessed if needed (Grant Thornton, 2014; Beach, 2015).

A recent study found that for most individuals, joining these communities was a proactive move, made before care needs arise, when relatively good health enables independence (Graham *et al.*, 2018). It is during this time of favourable wellbeing that a crucial opportunity exists to introduce measures to prevent decline and the development of a highly vulnerable state such as frailty (Marcucci *et al.*, 2019). Such measures would optimise the wellbeing of older people, prolong their independence and may counteract the need for future relocation to a nursing home for high-level care.

Retirement is a life-changing event, and for some individuals having the time available to exercise, engage more fully with family and friends, and to establish new social connections may bring about positive health changes (van den Bogaard *et al.*, 2014; Ding *et al.*, 2016; Zhu, 2016; Smeaton *et al.*, 2017). Healthy habits and lifestyle choices adopted by retirees encourage successful 'ageing in place'. A

retirement village setting provides a unique opportunity in which to introduce favourable health-related behaviours (Holt *et al.*, 2016; Graham *et al.*, 2018). In addition, these communities have the potential to support the needs of older adults by offering cost-effective and convenient services as may be required in later years of life (McCullagh, 2014; Productivity Commission, 2015; Xia *et al.*, 2015).

To promote and support positive ageing for residents of retirement villages effectively, the characteristics and needs of this cohort must be understood. We hypothesised that residents are at different levels of wellbeing, ranging from those without significant disease and disability to those who may be experiencing social isolation and/or major health issues. The literature on wellbeing in this cohort has largely reported on a single measure such as physical ability (Li *et al.*, 2018), cognitive functioning (Holland *et al.*, 2017) or loneliness (Crisp *et al.*, 2015). Wellbeing, however, is a multi-dimensional construct encompassing physical, cognitive and social health (Centers for Disease Control and Prevention, nd). Few studies of retirement villages in Australia have combined all these facets of health to explore the overall wellbeing of the residents in these communities.

Latent class analysis (LCA) is an analytic approach used to examine how individuals in different groups in a population are systematically diverse by characterising each group using a pattern or profile that is not usually observable (Collins and Lanza, 2010). As a subset of generalised structural equation modelling, latent class modelling is usually utilised as an exploratory technique to identify heterogeneity in a complex and dynamic phenomenon, such as wellbeing. In a latent class model, individuals are classified into mutually exclusive latent (unobserved) groups, based on their pattern of answers on a set of measured (observed) indicator variables. As categories of a latent variable, these latent groups cannot be directly measured other than through the patterns of responses on the indicator variables. LCA has been employed in several disciplines, including education (Whitelock-Wainwright *et al.*, 2021), economics (Brzezińska, 2016), agriculture (Dakpo *et al.*, 2021), urban planning (Paleti *et al.*, 2021) and to study the effects of socio-economic position (Fairley *et al.*, 2014; Lowthian *et al.*, 2021). Gerontological research has utilised latent class modelling to investigate successful ageing by older women (Byles *et al.*, 2019), work and volunteering during the transition to retirement (Carr *et al.*, 2023) and the impact of retirement on alcohol consumption (Halonen *et al.*, 2017). We believe that LCA would enable overall wellbeing, a latent variable, to be examined by profiling the measured multiple indicators, such as physical, cognitive and social health, that contribute to this phenomenon.

This study aims to examine the complex interplay between the different aspects of health which contribute to overall wellbeing and distinguish heterogeneity between retirement village residents using a LCA approach. Furthermore, we investigate modifiable factors associated with low wellbeing in residents as a first step in considering appropriate activities and support which may serve to halt deterioration or improve residents' health outcomes and enjoyment of later life.

Methods

This study is reported in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) Statement for cross-sectional

studies (Equator Network, 2021). The Bolton Clarke Human Research Ethics Committee granted this study an exemption from research ethics review.

Setting and population

A cross-sectional survey was conducted in 14 retirement villages in Queensland, Australia, operated by a large not-for-profit aged care provider, in 2018. Retirement village residents lived independently in individual villas located within the village grounds. At the time of the survey, 1,506 people lived in these villages; the number of residents per village ranged from 29 to 223.

All villages had a residents' committee, with members organising occasional social events in the village community hall. The type of social event and frequency with which these occurred was dependent on the residents in the village. Some villages may have had a proactive residents' committee with high levels of engagement, others may depend on a dedicated few to organise activities, and others may offer very little with residents seeking engagement in the community outside the village. At the time of this study, none of the participating villages offered home-made meals, wellbeing programmes or gym facilities.

Design of the survey

The 'Be Your Best: Health and Wellbeing Survey 2018' (*see* Appendix S1 in the online supplementary material) was developed to collect information on health, mobility, management of basic needs, social engagement, lifestyle activities, and use of health and support services.

Data collection and sample selection

Village managers distributed a cover letter, a paper copy of the survey and a Participant Information Sheet to all residents in August 2018. Residents were informed that anonymised survey information would be used for research. Completion of the survey was voluntary, and return of a completed survey would be understood by the researchers as consent to utilise their de-identified information for this purpose. Completed surveys were collected in sealed envelopes one month later. Data from individuals aged <65 years were excluded from the analysis.

Variables

Variables for statistical analysis were generated from the survey questions and resident responses. Health and mobility information included self-reported health, number of prescription medications taken, self-reported memory capability, falls and unplanned hospitalisations in the last 12 months, and use of a mobility aid. A gauge of social connectedness was the days per week that individuals spent with someone with whom they did not live. Other variables of interest included physical activity frequency and the ability to manage activities such as personal hygiene and preparation of meals. The four variables selected as indicators of wellbeing had missing values of 6 per cent or less.

Statistical analyses

Descriptive statistics were used to generate frequencies and proportions to characterise respondents. Latent class analysis (LCA) (Collins and Lanza, 2010) was employed to explore different levels of wellbeing, the latent variable. LCA enables study of a complex construct such as wellbeing by analysing, as a collective, multiple components that contribute to overall wellbeing. The four variables selected as indicators of wellbeing were: self-reported health (physical health), unplanned hospitalisations in the last 12 months (physical health), self-reported memory capability (cognitive health) and time spent with someone they did not live with (social health). Survey respondents were clustered across 14 retirement villages thereby introducing the unmeasured effect of specific village environments. A two-level nested latent class model was generated to account for survey respondents at the first level nested within retirement villages at the second level. Dichotomous responses to the indicator variables, and a retirement village variable to control for clustering (*see* Appendix S2 in the online supplementary material), were used in LCA to identify patterns that represented discrete wellbeing groups. Item-response probabilities were used to interpret and label the groups (Collins and Lanza, 2010). Selection of the latent class model with the optimal number of groups was based on (a) low goodness-of-fit measures (Akaike and Bayesian information criteria, chi-square-distributed likelihood ratio statistic (G^2)); (b) the most parsimonious model; and (c) distinct patterns with clinically relevant interpretation. Survey respondents were assigned membership into a wellbeing group based on their maximum posterior classification probability; a categorical variable 'wellbeing group membership' was created. Differences between wellbeing groups were tested by chi-square for categorical variables and one-way analysis of variance (ANOVA) for normally distributed continuous variables.

Multinomial logistic regression was utilised to examine factors associated with different wellbeing levels. The dependent variable 'wellbeing group membership', with the most common membership group as the reference group, was regressed on independent variables postulated as having a relationship with wellbeing. Univariate multinomial regression determined the association between each independent covariate and the dependent variable. Collinearity, defined as a correlation coefficient greater than 0.3, between all independent variables was tested before multivariable regression analysis. If any two variables correlated, only one was retained for further analysis. To inform development of targeted interventions, we retained variables which represented modifiable risk factors. The first multivariable multinomial model included all eligible independent variables. For binary variables, the p-value for a regression coefficient was obtained directly from the regression analysis. For categorical variables with more than two levels, a likelihood ratio test (LRT) was performed following regression modelling to calculate an overall LRT p-value. A value of $p \leq 0.05$ was applied for retaining variables in the multivariable model; the exception was age, which was included in all models as a confounder. Regression findings are presented as relative risk ratios (RRR) with a 95% confidence interval (CI).

Missing data were dealt with in two ways. First, for the descriptive statistical analyses, and the multinomial logistic regression that examined the factors associated

with being in one of the wellbeing groups, respondents with missing values were excluded using listwise deletion. Second, missing data in the four indicator variables for LCA were handled directly within the latent class model. The expectation-maximisation (EM) algorithm was used for obtaining maximum likelihood estimates of the parameters of the latent class model. EM is a stable iterative method that enables maximum likelihood estimation when some of the data are missing. Respondents with missing data were thus included in the analysis and analysed with respondents who had complete data. Respondents with missing values contributed less information to the latent class model parameter estimates than respondents with complete data (Collins and Lanza, 2010; Nylund-Gibson and Choi, 2018).

Statistical analyses were conducted using Stata version 15.0 (StataCorp, College Station, TX).

Results

Of 1,506 village residents, 883 completed the survey (58.6% response rate). After excluding responses from 12 individuals aged <65 years, information from 871 residents was analysed.

Respondent characteristics are summarised in Table 1. The median age was 82 years (interquartile range (IQR) = 76–88) with 130 individuals (14.9%) aged ≥90 years. Two-thirds (69.0%) reported good to excellent health; a slightly higher proportion (78.0%) rated their memory as good to excellent. In the previous 12 months, 33.3 per cent had experienced one or more falls and 30.6 per cent reported an unplanned hospitalisation.

The optimal latent class model had three distinct wellbeing groups, labelled as high wellbeing (Group 1: 57.7% (N = 503) of respondents), moderate wellbeing (Group 2: 20.6% (N = 179) of respondents) and low wellbeing (Group 3: 21.7% (N = 189) of respondents). The item-response probabilities from the latent class model (Figure 1) show the high group characterised by high probabilities (0.75 or greater) of reporting satisfactory health, no unplanned hospitalisations, satisfactory memory and a medium probability (0.51) of frequent social engagement. Members of the moderate wellbeing group exhibited similar characteristics except they were more likely to have unplanned hospitalisations (0.43 probability of no unplanned hospitalisations). The low wellbeing group had lower probabilities (less than 0.50) of satisfactory health, satisfactory memory and frequent socialisation, and were more likely to have unplanned hospitalisations (0.50 probability of no unplanned hospitalisations) compared to high wellbeing individuals. Cross-tabulations did not reveal an association between wellbeing group membership and age at entry into the retirement community (entry age was grouped into 10-year categories) ($\chi^2(8, N = 769) = 12.05$, $p = 0.15$) or the length of residence (number of years was grouped into five categories) ($\chi^2(8, N = 824) = 5.58$, $p = 0.69$). However, a comparison of the average age of participants in each wellbeing group by one-way ANOVA ($F(2,777) = 8.85$, $p = 0.0002$) and a Tukey *post hoc* test showed that members of the moderate and low wellbeing groups were marginally older (mean = 83.5, standard deviation (SD) = 6.8 and 82.6, SD = 7.4 years, respectively) than high wellbeing individuals (mean = 80.9, SD = 7.5 years). The difference

Table 1. Characteristics of 871 retirement village residents who completed the 'Be Your Best: Health and Wellbeing Survey 2018'

Characteristic	N (%)[1]
Age (years) (N = 780):[2]	
Range	65–99
Mean (SD)	81.8 (7.2)
Median (IQR)	82 (76–88)
Age at entry into retirement village (years) (N = 769):[2]	
Range	54–97
Mean (SD)	75.7 (7.4)
Median (IQR)	76 (71–81)
Length of residence in retirement village (years, unless noted otherwise) (N = 824):[2]	
Range	14 days to 27.1 years
Mean (SD)	6.2 (5.4)
Median (IQR)	4.8 (1.7–9.3)
Self-rated health:	
Excellent/very good	205 (24.4)
Good	375 (44.6)
Fair/poor	261 (31.0)
Self-rated memory:	
Excellent/very good	298 (35.1)
Good	364 (42.9)
Fair/poor	187 (22.0)
Time spent with someone who does not live with you (days per week):	
3–7	421 (49.9)
1–2	334 (39.6)
Rarely/never	89 (10.5)
Carer responsibilities (N = 847):[2]	
Yes	114 (13.5)
Prescription medications, number taken	
Range	0–16
Median (IQR)	4 (2–6)
0	35 (4.3)
1–4	410 (50.1)
≥5	374 (45.6)
Unplanned hospitalisations, in past 12 months:	
None	568 (69.4)

(*Continued*)

Table 1. (*Continued.*)

Characteristic	N (%)[1]
1	145 (17.7)
≥2	106 (12.9)
Pain:	
Never interferes with usual activities	188 (22.1)
Sometimes interferes with usual activities	540 (63.5)
Interferes with usual activities all the time	122 (14.4)
Sleep difficulties:	
Never	189 (22.2)
Sometimes	557 (65.4)
All the time	105 (12.3)
Physical activity, 30 minutes of moderately intense activity (days per week):	
5–7	154 (18.6)
3–4	192 (23.2)
1–2	224 (27.0)
Rarely/never	259 (31.2)
Unsteadiness, while walking or turning:	
None	346 (41.2)
Some	423 (50.4)
Moderate to severe	71 (8.4)
Falls, in last 12 months:	
None	568 (66.7)
≥1, no medical treatment required	191 (22.4)
≥1, requiring medical treatment	93 (10.9)
Mobility aid use (N = 849):[2]	
Yes	359 (42.3)
Mobility aid type (N = 359):[3]	
Walking stick	211 (58.8)[3]
Frame	212 (59.0)[3]
Motorised scooter	58 (16.1)[3]
Wheelchair	38 (10.6)[3]
Personal care (showering, bathing, dressing):	
By myself	733 (85.8)
By myself with some difficulty	73 (8.6)
Require some/a lot of help	48 (5.6)

(*Continued*)

Table 1. (*Continued.*)

Characteristic	N (%)[1]
Meal preparation:	
All meals by myself	585 (69.6)
All meals by myself with some difficulty	73 (8.7)
Prepare only some/no meals by myself	182 (21.7)

Notes: 1. Unless stated otherwise. 2. Number of observations in the analysis with missing values excluded. 3. Number of respondents reporting use of a mobility aid was the denominator in this analysis. Percentages indicate the proportion of mobility aid users and will not sum to 100 per cent as some respondents used more than one type of mobility aid. SD: standard deviation. IQR: interquartile range.

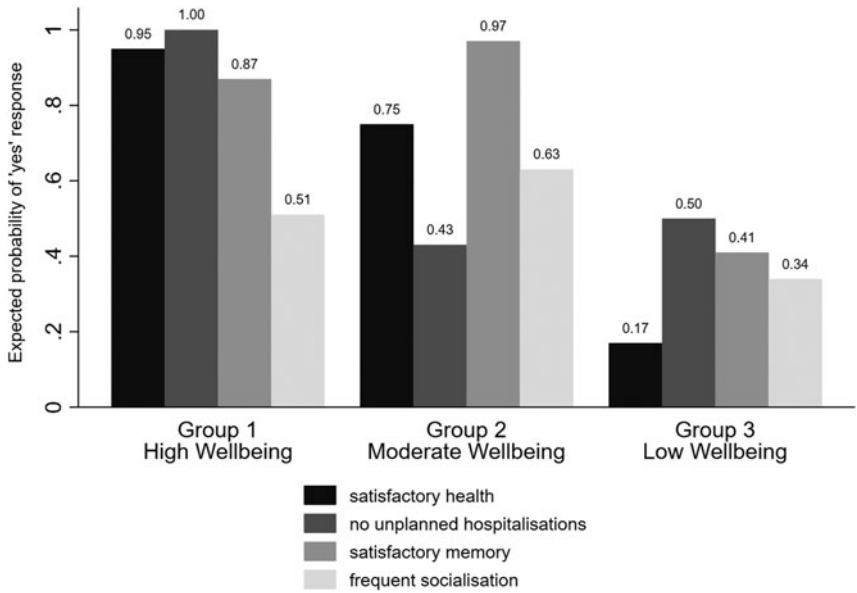

Figure 1. Item-response probabilities for a latent class model with three wellbeing groups for retirement village residents.
Notes: Group 1: high wellbeing (N = 503, 57.7% of respondents). Group 2: moderate wellbeing (N = 179, 20.6% of respondents). Group 3: low wellbeing (N = 189, 21.7% of respondents).

between the average age of participants in the moderate and low wellbeing groups was not statistically significant at the 0.05 level.

Multivariable multinomial regression demonstrated that several factors increased the risk of belonging to the moderate or low group compared to the high wellbeing group (Figure 2; Appendix S3 in the online supplementary material). Increasing age increased the probability of belonging to the moderate rather than high wellbeing group. The relative risk of moderate wellbeing doubled when age increased from 65–74 to ≥75 years (relative risk ratio (RRR) = 2.00, 95% confidence interval (CI) = 1.07–3.75, $p = 0.03$). Other factors which increased the risk of being in the

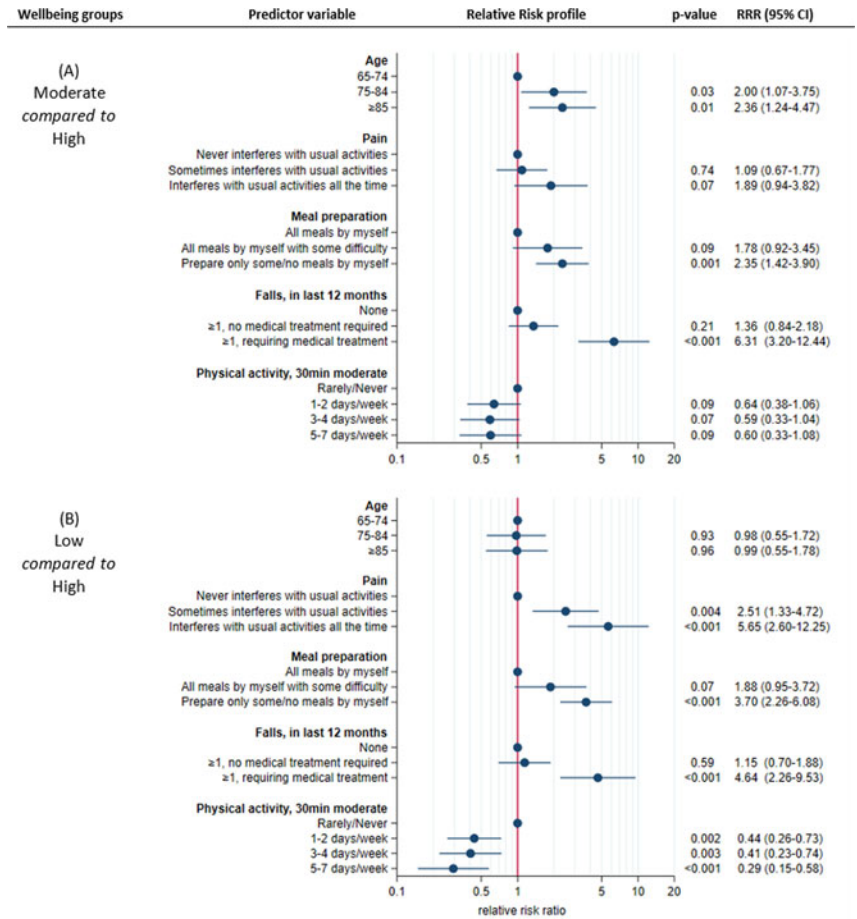

Figure 2. Factors associated with wellbeing status, as identified by multivariable multinomial logistic regression of wellbeing group membership regressed on resident characteristics. (A) The risk profile for the moderate compared to the high wellbeing group; (B) the risk profile for the low compared to the high wellbeing group.
Notes: RRR: relative risk ratio. CI: confidence interval. min: minutes.

moderate rather than high wellbeing group were requiring assistance to prepare meals (RRR = 2.35, 95% CI = 1.42–3.90, $p = 0.001$) and having injurious falls (RRR = 6.31, 95% CI = 3.48–12.47, $p < 0.001$). In contrast to the association between increasing age and the likelihood of moderate wellbeing, older age did not increase the probability of low wellbeing. This regression finding was supported by examining the distribution of participant age by wellbeing group. Respondents in the low wellbeing group were aged between 66 and 99 years (mean = 82.6, SD = 7.4; median = 83, IQR = 77–88) and rather than a negatively skewed age distribution indicating a higher proportion of older people, age in the low wellbeing group approximated a normal distribution as determined graphically and by values of

skewness and kurtosis (excess) which were between −1 and +1 (Mishra *et al.*, 2019). Factors associated with increased risk of belonging to the low rather than the high wellbeing group were debilitating pain (RRR = 5.64, 95% CI = 2.60–12.25, $p < 0.001$), limited ability to prepare meals (RRR = 3.70, 95% CI = 2.26–6.08, $p < 0.001$) and injurious falls (RRR = 4.64, 95% CI = 2.26–9.53, $p < 0.001$).

Conversely, physical activity was a protective factor. Engagement in physical activity relative to rarely or never being physically active, decreased the relative risk of being in the moderate rather than in the high wellbeing group by around 40 per cent (physical activity 1–2 days per week, RRR = 0.64, 95% CI = 0.38–1.06, $p = 0.09$; 3–4 days per week, RRR = 0.59, 95% CI = 0.33–1.04, $p = 0.07$; 5–7 days per week, RRR = 0.60, 95% CI = 0.33–1.08, $p = 0.09$). A comparison of the low to high wellbeing groups showed similar findings. Physical activity for 1–2 days per week relative to no activity showed a likely reduction of 56 per cent (RRR = 0.44, 95% CI = 0.26–0.73, $p = 0.002$) in the relative risk for low rather than high wellbeing; 5–7 days per week of engagement in physical activity indicated a probable decrease in risk of 71 per cent (RRR = 0.29, 95% CI = 0.15–0.58, $p < 0.001$).

Discussion

Older individuals generally join a retirement community with the intention of 'ageing in place' in their own dwelling (Graham *et al.*, 2018). Deteriorating health can undermine this plan and diminish quality of life. Multiple factors contribute to the overall health and wellbeing of an older person. In addition to physical health, other components of personal wellbeing are cognitive health and social connectedness (Centers for Disease Control and Prevention, nd); all these factors are integral to enjoying and living life to the best of one's ability. To measure wellbeing as a multifaceted phenomenon we applied latent class analysis (LCA). This is an unique statistical technique, widely used in the social sciences, to identify heterogeneous patterns within a conceptually complex state of being (Collins and Lanza, 2010). To our knowledge, our novel approach utilising LCA to investigate residents of Australian retirement communities is the first study where a holistic view has been undertaken to examine the wellbeing of older people in this setting. LCA with four indicators of wellbeing revealed three distinct patterns representing high, moderate and low wellbeing in our respondents. By identifying modifiable factors associated with belonging to the low wellbeing group, namely pain, injurious falls, limited ability to prepare meals and physical inactivity, our study points to potential areas for further investigation to mitigate decline in this older population.

LCA showed heterogeneity in the characteristics distinguishing the wellbeing of retirement village residents. Categorised into high, moderate and low wellbeing groups, 22 per cent of our respondents were experiencing low wellbeing. A similar finding was noted by Bloomfield *et al.* (2021), where frailty was assessed in a comparably aged cohort of retirement village residents. Three categories of residents were defined: fit, mildly frail and moderate to severely frail, whereby 19 per cent of residents were in the latter category. Additionally, these researchers reported that, compared to fit people, mildly frail individuals had high odds of acute hospitalisation, with even higher odds of hospitalisation for moderate to severely frail people. In line with the findings of Bloomfield *et al.* (2021), we found that increased

probability of unplanned hospitalisations was the most notable difference between high and moderate wellbeing. The likelihood of unplanned hospitalisations was also a defining characteristic of our low wellbeing group. A conventional method to assess frailty was not used in our study, however, the concordance of our findings with the frailty results of Bloomfield *et al.* (2021) suggests that our three wellbeing groups align with the robust, pre-frail and frail categories observed in the ageing literature.

Multinomial regression showed that advancing age was associated with the moderate wellbeing group; this may reflect unavoidable age-related physiological change (Musi and Hornsby, 2021). However, age did not increase the probability of membership to the low wellbeing group. This finding supports the view that heightened vulnerability and high mortality risk are associated with biological rather than chronological age (Jylhävä *et al.*, 2017; Hamczyk *et al.*, 2020) and are not an inevitable result of advancing age (Lowsky *et al.*, 2014).

Our findings revealed a strong association between pain, injurious falls, limited ability to prepare meals, physical activity and low wellbeing. The cross-sectional nature of our study, however, precludes us from inferring that these are causal factors for low wellbeing. It is possible that low wellbeing due to sensory deficits or difficulty with mobility may be the reason for falls, or that low wellbeing as a consequence of depression or chronic illness may result in physical inactivity. With regards to causality and temporal relationships, it is recognised that ageing involves a complex interplay of bidirectional associations between a myriad of factors contributing to health outcomes at older ages (Steptoe and Fancourt, 2020). For example, there are bidirectional relationships between subjective wellbeing and physical health (Steptoe *et al.*, 2015), mental health and physical activity (Steinmo *et al.*, 2014), nutrition and cognitive and physical function (Engelheart and Brummer, 2018), mental health and pain (Arola *et al.*, 2010), and social isolation and falls (Petersen *et al.*, 2020). Causal inferences cannot be drawn from our study; however, the risk factors identified, whether they be a cause or an effect and likely both, are plausibly linked to adverse or positive impacts on older people. The following discussion will cover the implications for practice in addressing these potential risk factors.

Difficulty with preparing meals can compromise nutritional health leading to poor health outcomes (Shlisky *et al.*, 2017). One in five study participants reported difficulty with meal preparation. Mobility limitations, impaired dexterity due to osteoarthritis or pain, and cognitive decline may affect meal planning and preparation. Other factors contributing to poor nutritional intake include low appetite, social isolation, polypharmacy, and limited food knowledge and skills (Shlisky *et al.*, 2017). Retirement communities could proactively support residents to maintain adequate nutrition through food and cooking education, social meal gatherings, advice on assistive devices such as jar openers and easy-pour kettles, and information on grocery and meal delivery services (Vesnaver *et al.*, 2012).

Chronic pain, a common and sometimes under-treated problem in older persons, can impact on the capacity to engage in activities of daily living, exercise and on quality of life (Brown *et al.*, 2011). In keeping with other studies reporting on the negative effects of chronic pain (Brown *et al.*, 2011; Park and Hughes, 2012), our findings showed that living with pain that restricts daily activities was strongly

associated with low wellbeing. Polypharmacy was evident in almost half of our respondents. Education in retirement communities on non-pharmacological approaches to managing pain (Park and Hughes, 2012) could be of value in minimising the number of medications and the risk of adverse drug events.

One-third of survey respondents reported one or more falls in the previous 12 months, consistent with falls prevalence for community-dwelling older adults (Lord *et al.*, 2007). Falls are a leading cause of injury among older adults (Paul *et al.*, 2017), and almost 11 per cent of our participants reported receiving medical treatment after falling. However, those not requiring medical attention may still have suffered minor injuries including bruises or abrasions. Provision of falls prevention and exercise programmes including balance training within retirement communities may reduce the risk of injurious falls (Sherrington *et al.*, 2008; Tricco *et al.*, 2017).

We found that low levels or lack of physical activity were significantly associated with low wellbeing. These were also associated with moderate wellbeing, and although this finding was not statistically significant at the 0.05 level, it is clinically meaningful given the benefits of physical activity in healthy ageing (Australian Government Department of Health, 2019). Physical activity guidelines recommend older adults engage in at least 30 minutes of moderately intense physical activity on most, preferably all, days of the week (Australian Government Department of Health, 2019), which may be difficult for some to achieve (Franco *et al.*, 2015). Our results indicate that a lower amount of physical activity may still be beneficial; 1–2 days per week of moderately intense physical activity reduced the risk of low wellbeing by over 50 per cent.

Key aspects to promoting physical activity are the provision of a physical environment, facilities and programmes that enable and encourage physical activity participation. Previous research on use of physical activity facilities in retirement communities found that less than 50 per cent of the interviewed residents utilised the amenities or attended physical activity programmes at their village (Holt *et al.*, 2016). Pettigrew *et al.* (2020) reported that among community-dwelling older adults, those living in retirement villages engaged in less physical activity and were significantly less likely to meet physical activity guidelines than those living in separate houses in the wider community (Pettigrew *et al.*, 2020). Suggested barriers to physical activity by retirement village residents are mobility limitations, an unfavourable physical environment (*e.g.* slopes or hills), the lack of open spaces, and facilities and exercise programmes that do not cater to the range of resident needs (Holt *et al.*, 2016; Pettigrew *et al.*, 2020). To maximise opportunities to engage residents in physical activity, retirement village operators could offer a range of programmes tailored to varying abilities and interests (Hawley-Hague *et al.*, 2016). As noted by Pettigrew *et al.* (2020), it is important to include residents in the planning of initiatives which support older people's physical activity.

The modifiable factors associated with the moderate and low wellbeing groups have been discussed individually, however, they are inter-related. Undernutrition is associated with increased falls, and loss of energy and mobility (Leslie and Hankey, 2015), limiting an older person's ability to be physically active. Exercise may assist with pain management (Park and Hughes, 2012), and balance and strength training may reduce the risk of falls (Sherrington *et al.*, 2008). Regular exercise has also been shown to help maintain independent function in

instrumental activities of daily living such as cooking (Stessman *et al.*, 2002). An intervention targeting one factor associated with low wellbeing may also have a positive impact on other determinants of wellbeing.

A strength of our study is the high level of resident engagement, with a survey response rate of almost 60 per cent across 14 retirement communities. This contrasts with other Australian retirement village surveys reporting response rates of 12 per cent (McDougall and Barrie, 2017) and 26 per cent (Australian Online Research, 2018). Village-specific reports were provided to the manager of each of the 14 retirement communities so that interventions can be tailored for individual settings. Awareness of the factors leading to decline can assist staff to be vigilant for signs of decline in their residents. Several study limitations must be considered. We did not have information on the gender of respondents so were unable to use gender as a confounder. Previous studies have shown a gender difference in lifestyle behaviours of older adults and their self-rated health (Södergren *et al.*, 2012), and that males aged older than 60 years are more sedentary than their female counterparts (Matthews *et al.*, 2008). Additionally, it is acknowledged that, compared to men, women have greater longevity but may experience poorer health in older age (Hubbard and Rockwood, 2011). Overall wellbeing of the survey respondents may have been influenced by gender. The indicator variables utilised to represent the domains of physical, cognitive and social health were self-reported, and were therefore prone to under- or over-reporting. Respondents may not be representative of all Australian retirement village residents. The cross-sectional study design limited our ability to make a causal inference between risk factors and wellbeing status. Finally, the study was susceptible to sampling bias, as completing a voluntary survey may have appealed more to healthier than unwell individuals. With regards to this last issue, our analyses revealed a clinically plausible low wellbeing profile with a sufficient number of respondents falling into this group, indicating that a non-response bias was unlikely. The survey discussed in this report is the first in a series of surveys to be conducted on a regular basis, with future longitudinal studies of retirement village residents that will explore trajectories of wellbeing and consolidate our understanding of a pathway to successful ageing.

To support positive ageing, efforts should be directed towards maintaining a favourable level of wellbeing in older adults. This study identified several modifiable factors to consider as potential targets for early interventions against low wellbeing. The goal is to forestall or reverse the course of functional decline in retirement village residents and optimise wellbeing and independence into later life.

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