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Use of complementary medicines among older adults living in 23 residential aged care facilities in Australia

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Abstract

Background There is limited information on complementary medicine (CM) use among older adults living in residential aged care facilities (RACFs). This study aimed to determine the prevalence and predictors of CM use and to examine differences in CM use by facility for residents of RACFs.

Methods We conducted a retrospective study using routinely collected electronic data about permanent residents aged ≥ 65 years in December 2021 from 23 RACFs in Sydney. The prevalence of CM product use was estimated, and modelling was used to determine factors associated with CM use. Funnel plots visualised differences in prevalence of CM use between facilities.

Results A total of 1,873 residents were included in the analysis with 78.4% (95% CI: 76.5–80.3) using at least one CM product and 41.2% (95% CI: 39-43.4) using 2 or more CMs. The most frequently used CM products were vitamin D (61.4%), magnesium (18.0%) and calcium (13.1%). Certain diagnoses were associated with both the likelihood of using a CM as well as the number of CMs used. For example, individuals with fractures were more likely to use ≥ 2 CMs (OR 1.29; 95% CI 1.05–1.58), as were those with an endocrine disorder. Residents with circulatory conditions and dementia were less likely to use ≥ 2 CMs. The prevalence of residents using at least one CMs ranged from 54 to 88% between facilities.

Conclusions The prevalence of CM use is high in RACFs. Research to investigate the appropriateness of CM use to ensure their safe and effective use in RACFs is needed.

Keywords Complementary medicine, Residential aged care, Older adults, Vitamin D

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Background

According to World Health Organisation (WHO), complementary medicines (CMs) refer to group of various medical and health care practices and products that are not generally part of conventional medicines. CMs are classified into one of two subgroups, natural products (i.e., vitamins, minerals) and mind body practices (i.e., acupuncture, meditation) [1]. However, different terms and definitions are used for defining CMs such as traditional medicine, traditional and complementary medicine, or complementary and alternative medicine [2]. The use of complementary medicines is increasing worldwide [3]. It is estimated that between 70 and 95% of the global population use CMs [4]. Studies of community-dwelling older adults report frequent CM use. A study of 15,732 community-dwelling older adults in Australia and the United States found 66.2% had used CMs (e.g. vitamin D, fish oil, calcium, glucosamine, and multivitamin) over a month period [5]. Similarly, a study of 4,985 community-dwelling older adults in Singapore found 54% had used CMs including herbal medicines and acupuncture in the previous 12 months [6].

In Australia, the use of CMs has increased over the last ten years and the expenditure on CMs in 2010 was reported to be $3.5 billion annually [7]. A survey conducted in 2017 of 2,019 community-dwelling adults in Australia estimated that 63.1% of adults nationally used a CM product or consulted a CM practitioner in the last 12-months with 36% of CMs prescribed by CM practitioners [8]. Another study conducted in 2017 of 800 Australian adults visiting eight general practices found 66% of participants used a CM product or consulted a CM practitioner in the previous 12-months [9].

Despite CMs being viewed as 'safe', they may interact with conventional medicines and have adverse effects [10]. Thus the growing use of CMs alongside prescribed medicines may contribute to potentially inappropriate polypharmacy in older adults. Many older adults experience polypharmacy i.e., the concurrent use of multiple medicines, including those living in residential aged care facilities (RACFs) [11].

Older people in RACFs (also called care homes, nursing homes or long-term care) are among the frailest members of our society with a high prevalence multimorbidity [12, 13]. According to the Australian National Aged Care Quality Indicator Program data published in 2023, 36% of people living in residential aged care (RAC) were on nine or more medicines [14]. To date, no studies have explored the prevalence of CMs use in RACFs in Australia. A review in 2012 highlighted a significant scarcity of evidence on the use of CMs in RACFs internationally and there continues to be scant evidence on CMs in RACFs [15] despite residents being significant consumers of medicines due to their complex medical needs and concerns about polypharmacy in this population. Few studies have investigated the use of CMs in Australia, but these were mostly cross-sectional studies conducted among community-dwelling older adults which does not necessarily reflect the prevalence in nursing homes/residential aged care [5, 16, 17].

To our knowledge, this was the first study that utilised a longitudinal medication administration database to measure the extent of use of CMs in RACFs. Our objectives were to report the prevalence and types of CM used, identify factors associated with the use of CMs and explore facility variation in CM prevalence use among older adults in 23 RACFs.

Methods

Study design and setting

We used retrospective, routinely collected demographic and clinical data from 23 RACFs operated by a large not-for-profit aged care provider in Sydney, New South Wales (NSW), Australia. The study was approved by the Macquarie University Human Research Ethics Committee (reference no. 52019614412614).

Participants

All permanent residents aged ≥ 65 who were present in the RACFs at any time from 1st – 31st December 2021 were included. Non-permanent residents (interim or respite care residents) were excluded.

Data source

We extracted de-identified data from the electronic systems by the aged care provider. We used data from two sources: residential profile data and medication administration data. The residential profile data contained information about residents, including demographics (age, gender), health conditions, and entry and departure dates. Residents' health conditions were documented in the electronic health records (EHRs) [18].

Medication administration data consisted of details of each medicine administered, including product name, dosage form, route, whether the medicine was administered, and administration date and time. The dataset includes all over the counter medicines and CMs. Medicines which were not administered to residents were not included in the analysis. All administered medicines in the dataset were prescribed by health professionals. Medicine names were mapped to the World Health Organization's Anatomical Therapeutic Chemical (ATC) classification system [19].

Identifying CMs and outcome measures

In this study, we defined a CM as medicine which contained ingredients including vitamins, minerals, herbal material, aromatherapy and homoeopathic preparations

[20]. All the administered CMs were included in the analysis, which were prescribed by health professionals. Non-prescribed CMs were not included in the analysis. CMs were identified and coded by reviewing all records of medicines administered to residents in December 2021. The medicine administration data contains doses of medicinal products by brand name. We reviewed each product to identify the key ingredient and grouped products into fifteen categories [16, 21]. Combination CMs were classified under one CM category, based on their main ingredient. There can be several kinds of ingredients in one CM but categorisation was done according to main ingredient of the CM. Table 1 shows the CM categories and examples of key CM product ingredients in each category.

Statistical methods

Our outcomes of interest were the number of CM products used by a resident, and the percentage of residents using at least one or greater than one CM product. Descriptive statistics were used to summarise the use of CMs in RACFs. Categorical data were described using frequencies and percentages. Continuous data were expressed using medians and interquartile ranges (IQR). Logistic regression was used to examine factors associated with any CM use. Socio-demographics (age, sex) and baseline health conditions (e.g., dementia status) were considered as the independent variables of interest in the model. Results of the logistic regression are presented as odd ratios (OR) and 95% confidence intervals (CIs). OR > 1 indicates positive association between dependent and independent variable.

We used a zero-inflated negative binomial (ZINB) regression model to determine factors associated with the number of CM products used. ZINB was applied due to over-dispersion (variance greater than mean) and excessive zeros in our data [22]. The ZINB generates two separate models. First, it generates a logit model for assessing zero values followed by a negative binomial model to evaluate counts among the predicted users. In our study, the predictors variables considered for logit and negative binomial model of ZINB were socio-demographics (age, sex) and baseline health conditions (e.g., dementia status). The strength of the association between independent and dependent variables was presented with adjusted incidence rate ratios (IRR) and OR with 95% CIs for negative binomial and logit model in ZINB respectively. An IRR > 1 indicates increased number of CMs use (i.e., the factor is positively associated with an increased number of CMs use), while an IRR < 1 suggests decreased number of CMs use. An IRR of 1 signifies that the factor does not have a significant effect on the expected number CMs used.

We also determined the variation in the prevalence of CM use at facility-level. We determined the facility-level adjusted prevalence of each outcome via logistic regression modelling with clustered standard errors on the facility [23]. Covariates used in calculating the adjusted prevalence included age, sex and health status such as circulatory, arthritis, dementia, pain, depression, endocrine disorders, fracture, peptic ulcer, osteoporosis, urinary tract infection, respiratory condition and visual impairment. Funnel plots were generated by plotting the adjusted prevalence of residents in each facility that used at least one CM and two or more CMs as a scatterplot relative to their size. The 95% and 99.8% control limits for each chart were superimposed on the scatter plot. Data were analysed using the Stata software version 17.

Table 1 Categorisation of complementary medicines (CMs)

Product categories	CM product ingredients
Vitamin D	Vitamin D alone
Magnesium	Magnesium alone or in combination with other ingredients
Calcium (alone or in combination with vitamin D or other minerals)	Calcium, calcium with vitamin D, calcium in combination with other minerals (e.g., magnesium)
Multivitamins	Multivitamins, multivitamins, and minerals
Iron	Iron, iron combinations (e.g., iron, and folic acid, iron, and vitamin C)
Vitamin B	Single ingredient vitamin B products (e.g., vit B1, B6, B12), vitamin B combinations (vitamin B complex, with or without other ingredients)
Folic Acid	Folic acid alone
Herbal products	Garlic, horseradish, ginkgo, turmeric, and all other herbal products
Omega 3	Fish oil, krill oil, omega-3 products
Cranberry	Cranberry alone or in combination with other ingredients
Probiotic	Probiotic alone or in combination with cranberry
Glucosamine	Glucosamine, glucosamine combinations (e.g., glucosamine with chondroitin and other ingredients)
Vitamin C	Vitamin C alone
Zinc	Zinc alone or in combination with other ingredients
Others	Lecithin

Results

Participants

A total of 1,873 unique residents were included in the study. The median age was 85 (IQR 79–90) years, with residents aged 85–94 accounting for 45.3% of the sample. The most common health conditions were circulatory conditions (86.8%), followed by arthritis (55.7%), dementia (51.2%), pain (48.9%), and depression (46.2%). Table 2 shows baseline resident characteristics.

Table 2 Baseline characteristics of residents of 23 residential aged care homes ($n = 1873$)

Sex, *n* (%)	
Male	578 (30.8)
Female	1295 (69.1)
Age, median (IQR)	85 (79–90)
Age category in years, n (%)	
65–74	269 (14.3)
75–84	610 (32.5)
85–94	850 (45.3)
≥ 95	144 (7.6)
Health status, n (%)	
Circulatory	1626 (86.8)
Arthritis	1045 (55.7)
Dementia	960 (51.2)
Pain	917 (48.9)
Depression	866 (46.2)
Endocrine disorder	710 (37.9)
Fracture	649 (34.6)
Peptic ulcer, gastroesophageal reflex	595 (31.7)
Osteoporosis	532 (28.4)
History of urinary tract infections	350 (18.6)
Chronic respiratory conditions	331 (17.6)
Visual impairment	314 (16.7)

Prevalence of CM use

Of the 1,873 residents, 78.4% (95% CI: 76.5–80.3) residents used at least one CM product and 41.2% (95% CI: 39-43.4) used two or more CM products during the study month. The percentage of residents who were taking two, three, four and five CMs were 20.9%, 10.8%, 3.26% and 1.28% respectively (supplementary Table S1).

The most frequently used CM category was vitamin D, accounting for 61.4% of all residents, followed by magnesium (18.0%), calcium (13.1%), multivitamins (12.2%), and iron preparations (9.93%) (Fig. 1; Supplementary Table S2).

Factors associated with the use of CMs

Table 3 presents the results of a zero-inflated negative binomial regression model and logistic regression model, showing factors associated with the use of CM products. Socio-demographic factors including sex and age were not significantly associated with the use of CM products. However, significant associations were found between resident diagnoses and CM use in terms of whether or not a resident used a CM (shown by the OR values) as well as the number of CMs (shown by the IRR values) that were used by individuals. A history of fracture was associated with a higher odds of any CM use (OR 1.40; 95% CI 1.09–1.79), the number of CMs used (IRR 1.15; 95% CI 1.06–1.26) and two or more CM use (OR 1.29; 95% CI 1.05–1.58). Circulatory conditions and dementia were associated with lower odds of number of CMs used (IRR 0.88; 95% CI 0.78–0.99, IRR 0.80; 95% CI 0.73–0.99) and two or more CMs use (OR 0.67; 95% CI 0.50–0.89, OR 0.59; 95% CI 0.48–0.71). Endocrine disorders were associated with a greater odds of using two or more CMs (OR 1.25; 95% CI 1.03–1.53).

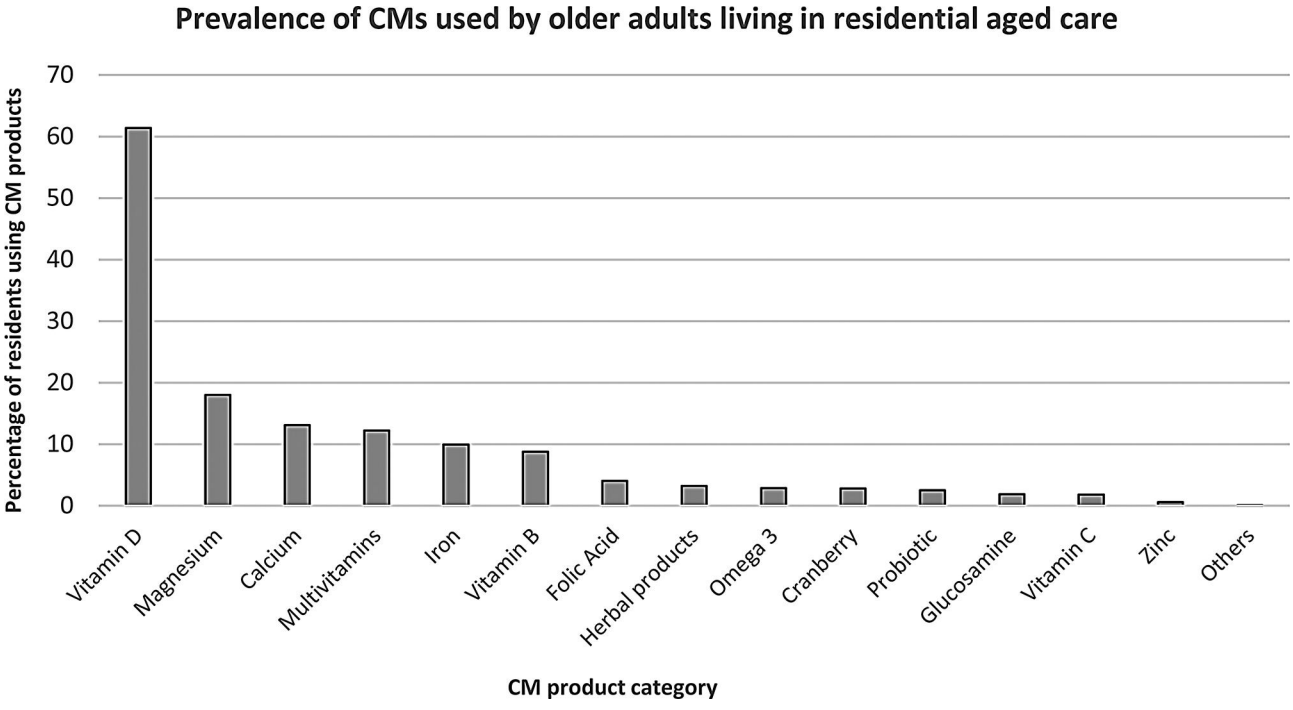

Fig. 1 Distribution of complementary medicine (CM) product categories used by older adults living in residential aged care

Table 3 Factors associated with the use of complementary medicines (CMs) in older adults living in residential aged care

	ZINB		Logistic model	
	Unique number of CM use Negative binomial Logit model		At least one CM	Two or more CMs
	IRR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Sex				
Female vs. Male	1.06 (0.97–1.17)	0.72 (0.50–1.09)	1.00 (0.78–1.29)	1.01 (0.82–1.26)
Age [Ref = 65–74 years]				
75–84	0.92 (0.81–1.05)	0.82 (0.54–1.23)	0.83 (0.58–1.20)	0.79 (0.58–1.07)
85–94	0.94 (0.83–1.07)	0.97 (0.93–1.01)	0.91 (0.64–1.31)	0.92 (0.68–1.23)
≥ 95	0.89 (0.73–1.07)	0.89 (0.85–1.07)	0.91 (0.54–1.55)	0.78 (0.51–1.21)
Health status				
Circulatory	0.88 (0.78–0.99)*	0.52 (0.34–0.79)*	0.74 (0.52–1.06)	0.67 (0.50–0.89)*
Arthritis	1.05 (0.96–1.14)	0.70 (0.41–1.19)	1.03 (0.82–1.30)	1.14 (0.93–1.39)
Dementia	0.80 (0.73–0.99)*	1.08 (0.70–1.67)	0.86 (0.68–1.08)	0.59 (0.48–0.71)*
Depression	0.99 (0.91–1.07)	0.89 (0.71–1.12)	1.11 (0.88–1.40)	1.00 (0.83–1.22)
Pain	1.00 (0.92–1.09)	0.68 (0.39–1.17)	1.07 (0.85–1.35)	1.08 (0.88–1.31)
Cognitive impairment	0.98 (0.90–1.07)	0.99 (0.96–1.02)	1.01 (0.80–1.27)	0.90 (0.74–1.10)
Endocrine disorder	1.06 (0.97–1.15)	0.97 (0.94–0.99)*	1.24 (0.97–1.56)	1.25 (1.03–1.53)*
Fracture	1.15 (1.06–1.26)*	0.83 (0.71–0.97)*	1.40 (1.09–1.79)*	1.29 (1.05–1.58)*
PUD, GORD	1.06 (0.97–1.16)	0.98 (0.94–1.02)	1.05 (0.82–1.34)	1.16 (0.95–1.43)
Osteoporosis	1.13 (1.03–1.24)*	0.67 (0.35–1.30)	1.21 (0.92–1.57)	1.33 (1.07–1.65)*
UTI	1.03 (0.93–1.15)	0.46 (0.20–1.06)	1.04 (0.77–1.40)	1.09 (0.86–1.40)
Chronic respiratory	1.00 (0.90–1.11)	0.89 (0.69–1.14)	0.89 (0.67–1.20)	1.17 (0.91–1.50)
Visual impairment	0.99 (0.88–1.10)	0.97 (0.95–1.01)	0.79 (0.58–1.06)	0.90 (0.70–1.17)

ZINB= zero–inflated negative binomial regression model, OR= odd ratio, IRR= incidence rate ratios, CI= confidence interval, *= p–value <0.05

Variation in patterns of CMs use across facilities

Variations in the percentage of CMs use by residents between facilities are shown in Fig. 2a and b. The adjusted percentage of residents who used at least one CM product ranged from 54 to 88% across the 23 facilities. When CM use percentages were adjusted for age, sex, and health conditions, one facility had CM use rates outside the lower 99.8% control limit (facility no. 4 in Fig. 2a). Thus, facility no. 4 had a lower-than-expected prevalence of residents on at least one CMs. The adjusted percentage of residents who used 2 or more CMs ranged from 23 to 52% across the facilities (Fig. 2b) and there were no outliers with all facilities within the control limits.

The circles represent facilities, and the solid line shows the mean prevalence of CM product use. Covariates used in calculating the risk–adjusted prevalence included age, sex, and health status, as shown in Table 2.

Discussion

Statement of principal findings

To our knowledge, this is the first study to describe the prevalence of CM use and factors associated with their use among older adults in Australian RACFs, and one of the few internationally that has investigated CM use in a residential aged care population. We observed high use of CMs with 78.4% of residents using at least one CM product, and 41.2% using two or more. However, the most frequent CM used in this population was vitamin D, with 61.4% of residents using vitamin D. Other frequently used CM products included magnesium, calcium, and multivitamins.

Interpretation within the context of the wider literature

The prevalence of CM use in our study is higher than that reported in previous studies conducted in RACFs internationally. A six-month study of 230 older adults in two RACFs in Turkey reported that 59.1% used at least one CM (e.g. garlic, vitamin B, vitamin C, fish oil, vitamin D) [24]. Another study of 189 older adults in a long term care home in Canada found 48.7% were using at least one CM in a year [25]. Our prevalence is also higher than findings from Australian studies conducted in settings other than RACFs which have used a similar definition of CMs as applied in this study. A cross sectional study among 341 adults found 44.3% had used a CM such as, multivitamin, magnesium, fish oil, vitamin D and calcium in the last fortnight [16]. Another study of 14,757 community-dwelling older adults observed 74.3% of CMs usage either daily or occasionally over four years [26].

Our results also show a higher prevalence of CM use than studies conducted in community- dwelling populations globally. In a survey of 560 participants in Jordan, three month use of CM was 64.1% [27]. Similarly, a survey of CM use in 1,008 adults in Norway reported 67% had used a CM in the three month period [28]. Older adults in RACFs often have multi-morbidity which may

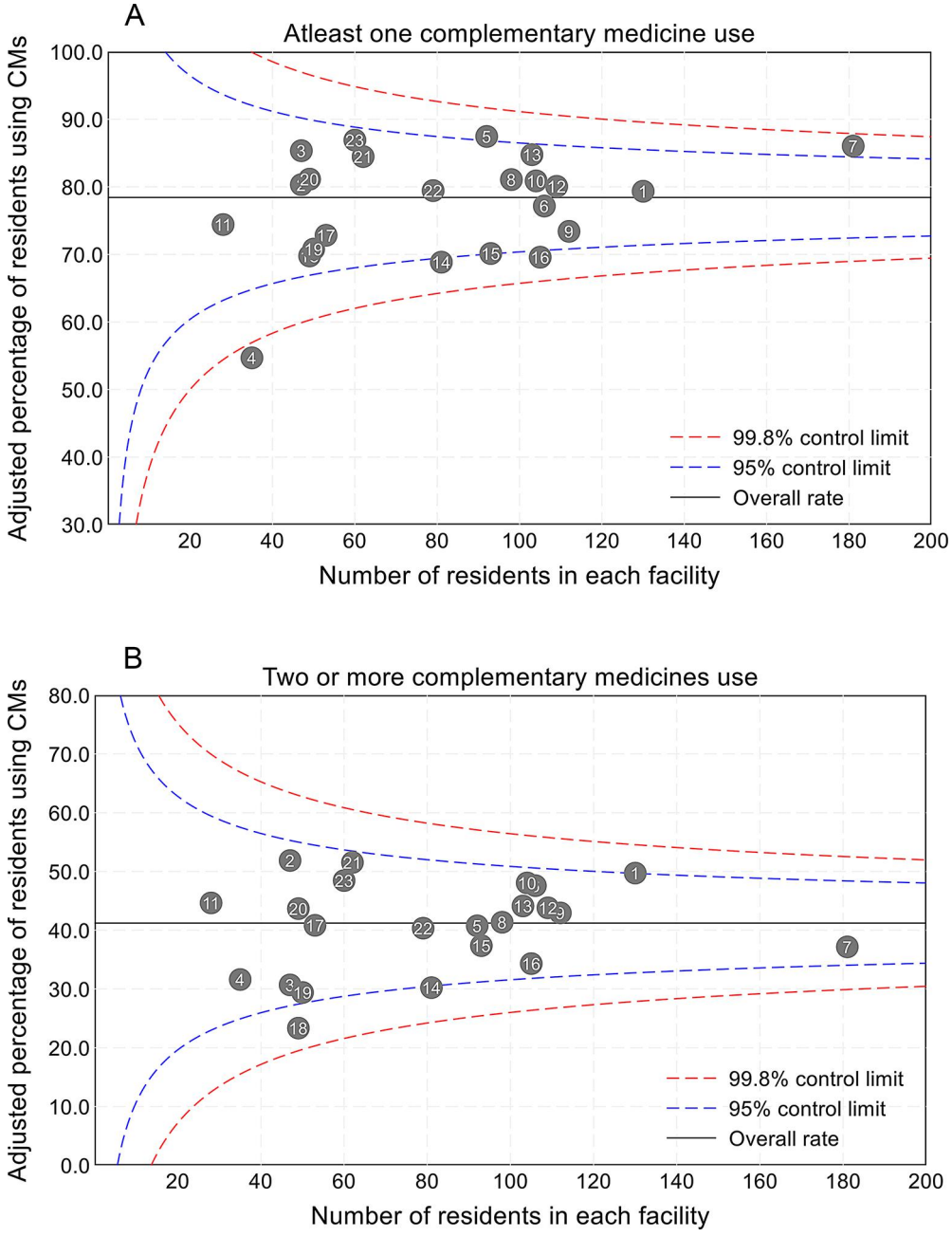

Fig. 2 Funnel plots of adjusted percentage of residents on (**a**) at least one CM product (**b**) two or more CM products

contribute to their higher rate of CM use compared to older people in the community [29].

In our study, vitamin D emerged as the most frequently used CM. The higher utilisation of vitamin D in RACFs could be attributed to the common deficiency of this essential vitamin observed among this population worldwide. Numerous studies have consistently reported vitamin D insufficiency among older adults in RACFs [30, 31]. Furthermore, vitamin D supplements are commonly used for fracture prevention in RACFs. According to recommendations from the Consensus Conference on the treatment of osteoporosis, falls, and fractures in RACFs in Australia, the use of vitamin D and calcium supplements is recommended for all residents in RACFs, to support bone health, given the prevalence of osteoporosis and associated fracture risks in this population [32–34]. Thus, despite the high levels of vitamin D use (61.4%) in our study this is lower than the recommendation that all residents receive vitamin D.

Evidence of the potential benefits from many of the CMs identified in this study is equivocal or largely absent in the literature such as, herbal products, glucosamine,

magnesium, cranberry, omega 3, folic acid, zinc, and others. Omega 3 products and herbal products such as ginkgo biloba are potentially inappropriate medicine if used by residents with dementia, as evidence of their efficacy is absent [35]. Similarly, cranberry has uncertain evidence of its effectiveness for UTI prevention among the RACF residents [36, 37]. The use of CMs with limited evidence to support their efficacy could be a concern in the context of the high levels of polypharmacy experienced by RACF residents, which may increase risk of harm. There is evidence that some CMs may interact with prescription medicines, impacting drug metabolism and interactions with transport proteins [38]. For example, interactions can occur between warfarin and ginkgo biloba, garlic, cranberry, glucosamine, and fish oil, increasing bleeding risk [39]. There are also documented interactions between the antivirals used for the treatment of COVID-19 and CMs [10].

We found the proportion of residents on CM products varied widely between facilities, from 54 to 88% of residents using at least one CM product, and 23–52% using more than one CM product. However, only one out of 23 facilities had a CM utilisation percentage outside the control limits indicating that the use was lower than would be expected due to statistical variation. Given that vitamin D was the predominant CMs used in our population, the low use of any CM products in this facility could be a trigger to review whether vitamin D is being used in accordance with guidelines for the RACF population.

Implications for practice and research

The study highlights the importance of medication reviews for CMs, to ensure their desired effects (safety and efficacy) and monitor potential interactions with other medications carefully. The high prevalence of CM use in RACFs could lead to dug drug interaction. For example, drug interactions were seen with self-medication like glucosamine and warfarin elevates risk of bleeding. Thus, the high frequency of CM use among residents of RACFs needs to be incorporated as a part of comprehensive medication review. In addition to this further research needs to investigate the appropriateness of CM usage to ensure its safer and more effective utilisation in RACFs. Despite the high usage of CMs and important part of health care, Australian government has undertaken little research regarding policy point of view. Our study has revealed the high use of CMs in residents with osteoporosis and fracture. So, it would be good to regulate the information regarding CMs by the government, as consumers mostly get the information on CM from family, friends, and internet.

Strengths and limitations

The strength of the study is that it is the first to investigate the prevalence of CMs among older people in Australian RACFs using routinely collected aged care data. The use of electronic health data offers a valuable advantage in identifying CM usage without the need for time-consuming chart reviews or primary data collection. This streamlined approach enables researchers to access comprehensive information efficiently, enhancing the study's efficiency and reducing potential biases associated with data collection methods. Furthermore, the study's strength lies in its multi-centre design, involving a substantial cohort of 1873 residents from 23 different RACFs. This large sample size increases the study's statistical power and generalizability of findings, allowing for a more robust and representative examination of CM usage patterns.

The limitation of the study is that it included RACFs from one aged care provider in a metropolitan area, thus the results of study may not be representative of all RACFs in Australia. Furthermore, our study did not consider other demographic variables such as ethnicity, education status, country of birth and language that may influence residents' use of CMs, due to lack of data on these variables. We were also not able to examine the indications for CMs or ascertain the reasons for their use from the residents' perspectives [40]. Moreover, it should be noted that CMs which were taken by residents in private space that did not cause severe consequences, might be missing in the medication administration data set because it might not be self-reported by residents to aged care staff. In addition to this, we have used data from December 2021 to determine the prevalence of CM use among residents in RACFs. Self-medication and misuse of drugs was common during COVID-19. Vitamins (C, D, Zinc), minerals, herbs, natural and dietary supplements were also popular during COVID-19. Seasonal allergies are commonly treated by CMs. It could impact the findings with increasing use of CMs by residents at that time.

Conclusions

The study revealed that nearly four in five residents were taking at least one CM product. Vitamin D emerged as the most used CM and residents with osteoporosis and fracture had high use of CMs. Nevertheless, it is crucial to incorporate CMs into medicine reviews to ensure their desired effects and monitor potential interactions with other medicines carefully. Our results underscore the importance of further research to assess the appropriateness of CM usage for safer and more effective implementation in RACFs.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12906-025-04811-3.

Supplementary Material 1

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Author contributions
N.W., M.Z.R., K.L.S. and J.I.W were involved in the conception and design of the study.N.B. was involved in the data analysis with input from other team members.N.B. was involved in the initial manuscript drafting; all authors were involved in the data interpretation, the critical revision and the final approval for publication.

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Data availability
The data that support the findings of this study are not publicly available. Data are however available from the authors upon reasonable request and with permission of the data custodian.

Declarations

Ethics approval and consent to participate
The study has received ethical approval from the Macquarie University Human Research Ethics Committee (reference no. 52019614412614). The ethics committee granted us a waiver of consent since the study utilized de-identified retrospective data, and obtaining consent from the participants was deemed impracticable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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