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Review article

The impact of assisted living facilities on hospitalization, length of stay, and mortality rates among the elderly: A systematic review and meta-analysis

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ABSTRACT

BACKGROUND: With 21.3% of the global population aging, the demand for assisted living facilities (ALFs) for individuals with complex medical conditions has surged. However, residing in ALFs may be associated with higher hospital admission rates, longer hospital stays, and increased mortality compared to living at home. The exact relationship between ALFs and these adverse health outcomes remains unclear.

OBJECTIVES: To determine the correlation between ALFs—including nursing homes (NH), home care (HC), and residential care (RC)—and hospitalization rates, length of hospital stay, and mortality compared to community-dwelling individuals.

METHODS: A literature search was conducted across five databases, focusing on risk ratios for hospitalization and mortality, as well as mean changes in hospital duration. This study compared interventions involving NH, HC, and RC with community dwelling. Quality appraisal was performed using the Newcastle-Ottawa Scale (NOS), and a forest plot was generated using a random-effects model with 95% confidence intervals (CI).

RESULTS: Community-dwelling individuals had a 1.21 times higher likelihood of hospitalization compared to those in ALFs (RR 1.21, 95% CI: 0.97–1.51, I^2=100%, p=0.10). Subgroup analysis showed that individuals receiving HC and NH had lower hospitalization rates than those in community settings, while RC residents had a higher risk. Additionally, ALF residents experienced longer hospital stays compared to the control group [MD: -1.21 (95% CI: -3.06 to 0.65, I^2=99%, p=0.20)]. Mortality rates were 2.83 times higher among community dwellers than ALF residents (RR 2.83, 95% CI: 1.43–5.61, I^2=100%, p=0.003). Subgroup analysis also indicated lower mortality risks among individuals receiving RC, NH, and HC compared to those in community settings.

CONCLUSION: ALFs are associated with an increased risk of hospitalization and mortality, as well as a shorter length of hospital stay.

KEYWORDS: Nursing home; home care; residential care; hospitalization; mortality.

INTRODUCTION

Population forecasts suggest that the population of elderly in developed countries will significantly increase, thereby triggering a parallel increase in the population of frail persons who will require informal and formal care.[1] Population trends foresee that, by the year 2030, the population of older people will rise by around 50%, significantly impacting health care systems, long-term care homes, and family caregivers. This shift will bring with it new challenges in delivering adequate medical care, social care, and community care for older populations.[2] Mortality among elderly residents is influenced by a combination of patient determinants and environmental determinants. Age is a strong determinant, since aging is inherently associated with physiological

decline and an increased risk of chronic disease.[3] Additionally, evidence suggests that male gender correlates with higher mortality in the elderly, possibly due to biological variation, lifestyle, and lower utilization of healthcare relative to women. Functional impairment, particularly in the activities of daily living (ADLs) such as bathing, dressing, and mobility, also contributes to higher risk of mortality, since individuals with compromised self-sufficiency are at higher risk for infections, falls, and chronic disease complications.[4] Furthermore, poorer physical health, with co-morbidity of cardiovascular disease, diabetes, and respiratory disease, increases mortality risk in older populations. Low nutritional status, as malnutrition or unintentional weight loss, is also significant, since inadequate nutrient intake weakens the immune system, impairs healing, and increases susceptibility to infection.[5] Environmental conditions, such as deprivation of access to health care services, social isolation, and substandard housing, compound these risks.[6] In view of these issues, active intervention—such as increased geriatric care, nutrition, physical rehabilitation, and social activity programs—is required to optimize the well-being and longevity of older individuals in both institutional and community settings.[7]

Aged patients referred to nursing homes (NHs) form a very vulnerable group, with increased physical frailty, cognitive dysfunction, and comorbidity of depression than those in the community. This population also has exceedingly high levels of multimorbidity and disease complexity, which includes high utilization of healthcare services and leads to increased hospitalization and mortality.[8] Studies using the Fried criteria have established that 68.8% of residents in NHs are frail and malnourished, underlining the key position of nutrition status in outcomes for health.[9,10] Malnutrition has a close linkage with sarcopenia, an ongoing loss of muscle that exacerbates disability, dependence, and mortality risk.[5] In addition, studies have determined that healthcare-associated infections rise as age increases, further compromising the health of residents in NHs. Whereas independent living in turn is associated with better physical function and quality of life, how much advantage remains is uncertain since community-dwelling elderly are still at significant health risk.[11,12] Although the well-publicized hazards in NHs have been well described, thus far, no direct comparison study of healthcare-associated mortality rates in elderly NH residents and their independent-living counterparts in the community has been performed. This study intends to bridge this gap through examination of mortality rates within the setting of hospital admission and hospitalization, with a view to providing information on the healthcare burden and outcomes of different living conditions among the elderly. Knowledge of these variations is crucial in the formulation of specific interventions aimed at improving geriatric care and care support systems, eventually the quality of life and survival of the elderly.

METHODS

Design

A systematic review and meta-analysis was conducted based on the PRISMA checklist and the Cochrane Handbook for Systematic Reviews of Interventions, version 6.3, 2022.

Eligibility criteria

Before conducting the literature search, inclusion and exclusion criteria were established to enhance the review's specificity. The PICOS model guided the inclusion criteria, which included the population of 65 years and above and intervention as assisted living facilities (ALFs). The comparison group included those living in community homes, day care facilities, or non-institutionalized settings. The outcomes

of interest were hospital admission, hospital length of stay, and mortality, and the study designs eligible were cross-sectional, cohort, and case-control studies. The intervention criteria were geriatric long-term care facilities providing supervision and assistance with ADLs, as well as medical and nursing care as needed. On the other hand, the comparison group consisted of settings that support independence and self-determination, such as community-based housing and day care facilities where patients return home in the evenings. The exclusion criteria were applied on studies that fell outside the research question scope, non-human trials, trials with no control group, non-English papers, review articles, literature that was restricted by access, and trials with unknown design or data that could not be extracted.

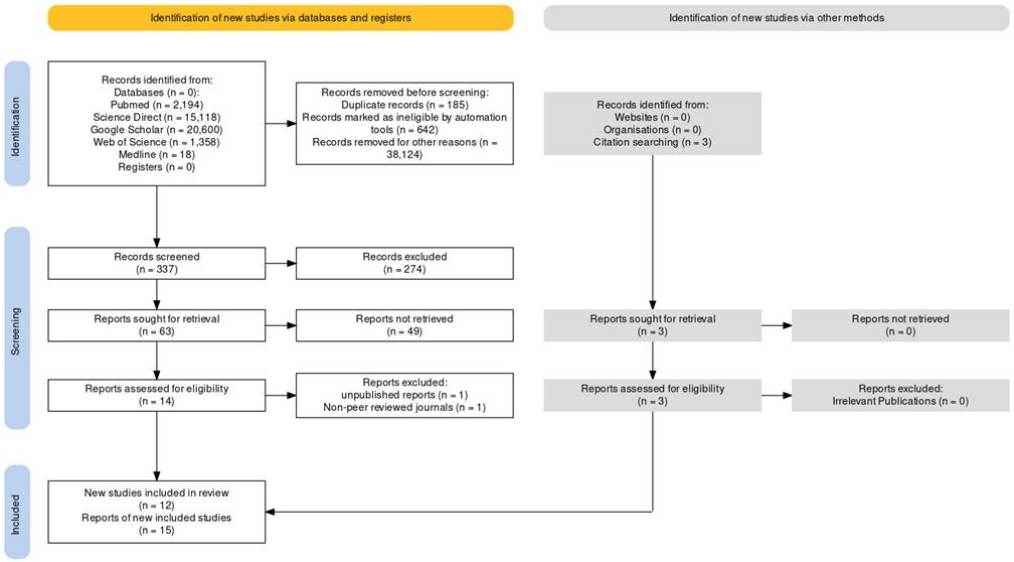

Figure 1. A flowchart of article selection in our study.

Search strategy

The literature search and selection process were independently conducted by AS and AFH from April 24 to 30, 2024. The study utilized multiple databases, including PubMed, ScienceDirect, Medline, Web of Science, and Google Scholar, to ensure comprehensive coverage of relevant studies. Boolean operators and keywords were applied, with search terms adjusted using the Medical Subject Headings (MeSH) Browser for precision. The key search terms included “Aged,” "Nursing Home," "Home Care Services," "Institutionalization," "Adult Day Care," "Residential Facilities," "Independent Living," "Hospitalization," “Length of Stay,” and "Mortality." A detailed visual representation of the search process is provided in Figure 1.

Quality of the included study

Bias risk appraisal was conducted in the included studies using the Newcastle-Ottawa Scale (NOS) Quality Assessment for Cohort Studies.[13] The instrument evaluates three essential categories: selection, compatibility, and outcome. Raters evaluated every study based on these categories and assigned it a score within one of three categories: high, moderate, or low quality. Research that was assigned ≥6 star rating was regarded as high-quality, studies given a rating of 5 to 3 stars were medium-quality, while research with <3 star rating was designated as low-quality.

Data extraction and analysis

The shortlisted studies were all imported in Rayyan (https://new.rayyan.ai) and screened, deduplicated, and data extracted separately by AS, AFH, and SS. After extraction, study profiles and results were tabled in a spreadsheet and double-checked

by the authors to establish accuracy and study eligibility. Subsequently, data extracted were reported and analyzed appropriately. In any event of discrepancies in the course of screening and extraction, disagreement was resolved via authors' discussion.

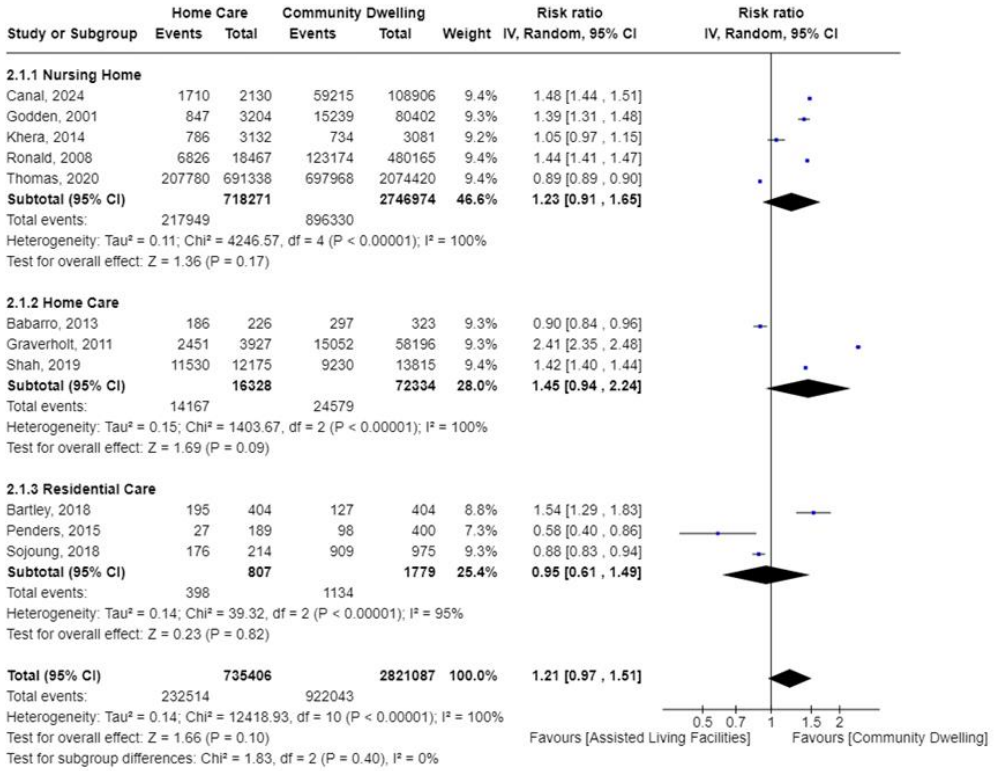

Figure 2. Forest plot of the association between ALF and hospital admission in our study.

Risk of bias assessment

Assessment of publication bias among the studies chosen was through visually inspecting the funnel plot to identify any noted asymmetry. This was done through comparing the location of studies on the graph along the relative risk (RR) and SE(log[RR]) axes. This plot was done using data relating to the type of intervention used by participants as well as hospitalization occurrence so that selection and reporting imbalances by studies could be observed.

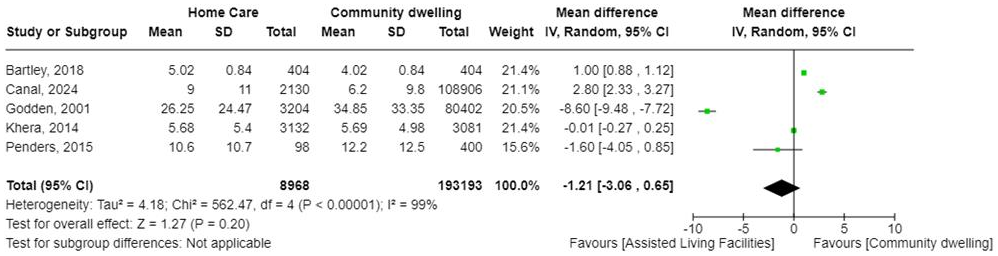

Figure 3. Forest plot of the association between ALF and length of hospital stay in our study.

Outcome of interest

The primary objective of this review was to compare the RR of hospital admission rates, hospital length of stay, and mortality among the elderly residing in ALFs with those residing in the community. Another objective was to compare rates of hospital admissions, hospital length of stay, and mortality for each type of intervention, providing a closer examination of how the different environments of care influenced these parameters.

Quantitative analysis

The meta-analysis was conducted using Review Manager 5.4.1 (The Nordic Cochrane Center, The Cochrane Collaboration, Copenhagen). Hospital admission and mortality data were analyzed based on counts and rate data, while length of stay was evaluated as continuous data, all with a 95% confidence interval (CI).[14] The inverse variance model was employed as the statistical method, and due to substantial heterogeneity in effect sizes, a random-effects model was applied for outcome analysis. Heterogeneity was assessed using the I^2 statistic, with thresholds of 0%, 25%, 50%, and 75% indicating no, low, moderate, and high heterogeneity, respectively, and a p-value of <0.05 denoting significant heterogeneity.[15] A subgroup analysis was performed to examine and categorize each intervention based on the intensity of medical services received by participants. Additionally, a test for significance among subgroups was conducted, with $p < 0.05$ considered statistically significant.

RESULTS

Study selection and identification

After the literature search, a total of 39,228 articles were identified across five databases. Several articles were excluded due to duplication (n = 178). Additionally, 642 articles were removed due to ineligible data, including review articles, books, and inaccessible studies requiring subscriptions. Furthermore, 38,124 articles did not align with the intended study design or failed to meet the inclusion criteria and were subsequently excluded. As shown in Figure 1, the PRISMA flowchart illustrates the study selection process. Ultimately, 15 articles were included in the systematic review and meta-analysis.[16-30]

Risk of bias assessment

Based on the risk of bias assessment, fourteen studies were determined to have a low risk of bias. Upon evaluation using the NOS Quality Assessment for Cohort Studies, the majority of studies received eight out of nine stars (Supplementary files). This was primarily due to the lack of propensity cohort matching and the inability to adequately assess follow-up adequacy in retrospective cohort studies. As a result, these studies did not fully meet the criteria for the compatibility and outcome domains outlined in the NOS Critical Appraisal Tools. While the quality scores of the included studies varied, extensive discussions were conducted to address most of the analyzed data. Reviewers concluded that this level of scrutiny rendered the data sufficiently reliable for the present analysis.

Summaries of the included studies

This review included fifteen studies with three types of study designs: two prospective cohort studies, twelve retrospective cohort studies, and one case-control study. A summary of the study results was presented in Table 1. The total study population comprised 7,496,134 individuals, with 783,241 in the experimental group and 6,712,893 in the comparison group. Eleven studies evaluated hospital admission events, five examined the length of hospital stays, and eight assessed mortality. The patient demographics and outcomes were globally representative, with studies conducted in America (n=6), Europe (n=7), East Asia (n=1), and Australia (n=1), with observation periods ranging from 1 to 7 years. The study population primarily consisted of elderly individuals over the age of 75 with chronic and age-related diseases. The interventions were categorized into three types: NH (n=7), which were long-term residential facilities staffed 24/7 by skilled nurses and aides, providing comprehensive care for individuals requiring more assistance than assisted living but not hospitalization; home care (HC)

(n=4), in which nurses or qualified professionals visited seniors' homes to provide medical care and companionship on a flexible basis; and residential care (RC) (n=4), which referred to facilities assisting with daily activities such as bathing, dressing, and meal preparation but typically did not offer skilled nursing care, serving more independent residents with lower medical supervision needs than NH.

Table 1. Baseline characteristics of article included in our study.

References & design	Country & duration(y)	Group	Sample Size (n)	Age (y)	Population characteristics	Outcome of Interest		
						H (%)	LHS (day)	M (%)
Thomas 2020; CR	US, 1	NH	691,338	>75	HT, DM, HL	30.0	-	30.0
		CD	2,074,420	>75	HT, DM, HL	34.0	-	15.0
McCan 2009; CP	Ireland, 5	NH	2,112	>75	PGH, LTI	-	-	64.0
		CD	205,566	>75	PGH, LTI	-	-	22.0
Shah 2013; CR	England, 1	NH	9,772	>75	DM, CHD	-	-	26.2
		CD	354,306	>75	DM, CHD	-	-	3.3
Godden 2002; CR	UK, 1	NH	3,204	-	-	26.4	26.6±24.5	-
		CD	80,402	-	-	19.0	34.9±33.4	-
Inacio 2020; CR	Australia, 1	NH	35,316	>75	-	-	-	35.0
		CD	3,330,987	>75	-	-	-	4.0
Bartley 2018; CR	US, 1	NH	404	86.8(6.4)	DM, CHF, dementia	48.3	5.0±0.8	20.3
		CD	404	86.8(6,4)	DM, CHF, dementia	31.4	4.0±0.8	9.4
Sojoung 2018; CR	US, 10	NH	214	83.3(5.2)	MCC	82.2	-	-
		CD	975	82.4(5.0)	MCC	93	-	-
Shah 2019; CR	US, 2	NH	12,175	>75	TAVI, HT, DM, HL	94.7	-	-
		CD	13,815	>75	TAVI, HT, DM, HL	67	-	-
Penders 2015; CR	Netherlands, 2	NH	98	87.0±7.0	Malignancy, CHD, old	27.5	10.6±10.7	-
		CD	400	81.0±23.0	Malignancy, CHD, old	47	12.2±12.5	-
Khera 2014; CR	US, 7	NH	3,132	86.3±6.1	STEMI	25.1	5.7±5.4	30.5
		CD	3,081	85.8±5.8	STEMI	23.8	5.7±4.9	27.6
Babarro 2013; CR	Spain, 1	NH	226	>65	Malignancy	82.3	-	-
		CD	323	>65	Malignancy	92.0	-	-
Canal 2024; CC	Switzerland, 1	NH	2,130	82.0±13.0	Systemic disease	80.0	9.0±11.0	5.8
		CD	108,906	55.0±21.0	Systemic disease	54.0	6.2±9.8	1.1
Ronald 2008; CR	Canada, 3	NH	18,467	>75	-	36.9	-	
		CD	480,165	>75	-	26.0	-	
Graverholt 2011; CR	Norway, 2	NH	3,927	>80	-	26.0	-	28.0
		CD	58,196	>80	-	15.1	-	-
Kuzuya 2006; CP	Japan, 2	NH	726	80.7±7.7	DM, HT dementia	-	-	13.0
		CD	947	80.7±7.6	DM, HT dementia	-	-	18.0

Note; CR, cohort retrospective; CC, cross-sectional; CP, cohort prospective; NH, nursing home; CD, community dwelling; HT hypertension; DM diabetes mellitus; HL, hyperlipidemia; PGH, poor general health; LTI, long term illness; CHD, coronay heart disease; CHF, congestive heart failure; MCC, multiple chronic condition; H, hospitalization; LHS, length of hospital stay; M, mortality.

The association between ALFs and hospital admission

Eleven studies evaluated the association between ALFs and hospital admission in the elderly (Figure 2). Overall, hospital admission was 1.21 times more likely in individuals living in community dwellings compared to those in ALFs (RR 1.21, 95% CI: 0.97-1.51,

I^2=100%), (p=0.10). To further investigate the relationship between risk ratio and population characteristics, a subgroup analysis was conducted by categorizing patients based on the type of intervention received. The subgroup analysis for NH indicated that individuals in the control group were 1.23 times more likely to be hospitalized (RR 1.23, 95% CI: 0.91-1.51, I^2=100%), (p=0.17). Similarly, elderly individuals living in the community were found to be 1.45 times more likely to be hospitalized than those receiving HC (RR 1.45, 95% CI: 0.94-2.24, I^2=100%), (p=0.09). Additionally, hospital admission was 0.95 times less likely in individuals living in communities compared to those in RC (RR 0.95, 95% CI: 0.61-1.49, I^2=95%), (p=0.182). However, no significant differences were found between the groups (p=0.40).

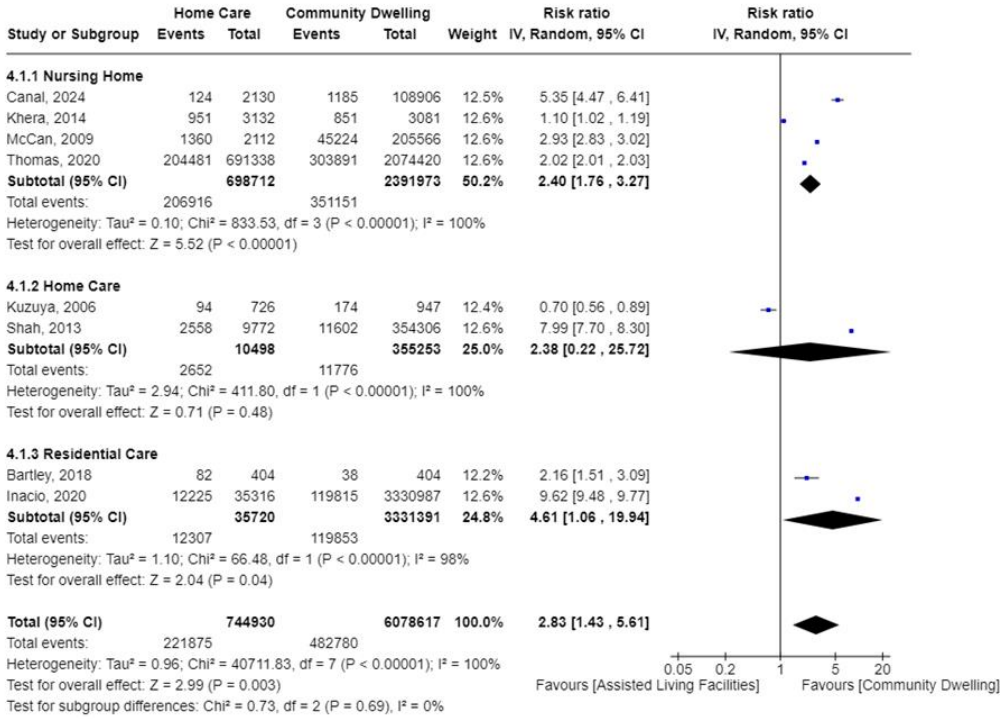

Figure 4. Forest plot of the association between ALD and the risk of morality in our study

The association between ALFs and to length of hospital stays

Five studies evaluated the association between ALFs and the length of hospital stay in the elderly (Figure 3). Overall, the findings suggested that individuals residing in ALFs had a longer hospital stay compared to those in the control group, with a mean difference (MD) of -1.21 (95% CI: -3.06 to 0.65, I^2=99%). However, the results were not statistically significant (p=0.20).

The association between ALFs and mortality

Eleven studies evaluated the association between ALFs and mortality in the elderly (Figure 4). Overall, mortality was 2.83 times more likely in individuals living in the community compared to those in ALFs (RR 2.83, 95% CI: 1.43-5.61, I^2=100%), (p=0.003). To further explore the relationship between risk ratio and population characteristics, a subgroup analysis was conducted by categorizing patients based on the type of intervention received. The subgroup analysis for NH indicated that individuals in the control group were 2.40 times more likely to die compared to those in the intervention group (RR 2.40, 95% CI: 1.76-3.27, I^2=100%), (p<0.00001). Additionally, elderly individuals without HC were found to be 2.38 times more likely to die than those receiving HC (RR 2.38, 95% CI: 0.22-25.72, I^2=100%), (p=0.48). Moreover, mortality was 4.61 times more likely in individuals living in the community compared to those in RC

(RR 4.61, 95% CI: 1.06-19.94, I^2=98%), (p=0.04). However, no significant differences were found between the groups (p=0.69).

Publication bias

The funnel plot showed an asymmetrical distribution of the included studies on the graph between the RR and the standard error of the log-transformed RR (SE[logRR]), indicating the presence of publication bias, likely due to small study effects.

DISCUSSION

The geriatric population is especially susceptible to hospital admissions for medical services, extended hospital stays, and enhanced mortality, further emphasizing the pivotal role of ALFs in managing their health condition. This meta-analysis and systematic review proved the decreased risk of hospitalization for ALF residents. This decline can be explained on the basis of the reason that ALF residents normally have a delayed hospitalization due to delayed detection of symptom severity, transportation problems, and absence of caregiver care, resulting in poor prognoses and a higher readmission rate to hospitals. In contrast, ALF residents had a lower risk of hospitalization due to constant monitoring, immediate medical care, and environmental modifications targeting falls and injuries prevention. Preventive measures such as environment evaluation, furniture repair, issue of shoes that fit correctly, avoidance of clutter, equipment maintenance, management of psychotropic medication, increased supervision, and transfers also contributed to the risk reduction.[31] Since falls and injury have been reported to triple hospital admission risk, ALFs contributed significantly to preventing such risks.[32]

Subgroup analysis indicated that subjects who resided in HC and NH environments were less likely to be hospitalized compared to community, whereas RC subjects were at higher risk for hospitalization. The increased risk in RC facilities could be attributed to decreased medical oversight and the potential for neglect or inadequate staffing.[33] In addition, the residential closeness of residents in RC facilities raised the infection risk. The elderly were similarly very prone to illnesses such as pneumonia, which was the second most frequent cause of hospitalization, contributing to their susceptibility.[34] NH residents, however, although with a higher hospitalization rate, had more severe and stable comorbidities, which required complex medical treatment and surveillance than patients treated with HC. The increased risk of hospitalization in NH might have been confounded by differences in baseline medical conditions between populations of NH and HC studies such that the NH group was made to appear at greater risk of hospitalization.[35]

Hospital stay length is one of the most commonly assessed outcomes while studying hospitalization among ALF residents. The findings indicated that longer hospital stays were encountered by the ALF residents than those residing in communities. The outcome, however, was not statistically significant and was extremely heterogeneous. Further, the analysis did not yield subgroup analysis due to the limited number of studies, and therefore, it was not possible to evaluate the underlying causes for longer hospital stays precisely. This limitation was due to differences in medical supervision and interventions in different settings. In spite of this, Canal's study showed that long-term hospitalization was typically related to the complications of pneumonia, urinary retention, urinary tract infection, sepsis, arrhythmias, and ileus, which were severe conditions. The prevalence of these complications varied with the kind of medical procedure performed, patient age, and presence or absence of comorbidities.[18]

The higher risk of death in the control group may be due to several factors, such as severity of comorbidities, comorbidities, older age, severity of medical care, and frequency of intervention.[36] In addition, infections and chronic diseases as complications, and even potential delays in the diagnosis and treatment of acute health issues, may have contributed to an increased risk of death.[37]

Subgroup analysis revealed that RC, NH, and HC recipients were at reduced risk of mortality compared with individuals residing in the community. The reduced risk of mortality for each intervention group could be attributed to differences in baseline medical conditions of populations being studied. RC residents were healthier and more independent before admission, which resulted in their reduced mortality risk.[38] However, on the contrary, patients admitted to NH tended to have poorer health status prior to admission compared with patients in other studies, and this may have influenced outcomes.[39]

The limitations of this study included the prevalence of retrospective cohort designs and the heterogeneity of medical conditions amongst the included studies. Moreover, the paucity of studies that could be used for subgroup analysis limited further detailed analysis of the association between ALFs and hospitalization. In the future, there should be a higher number of studies included and certain factors like diseases/comorbidities, age, and socioeconomic status should be investigated to achieve a better understanding of these associations.

CONCLUSION

Residents in community care were 1.21 times more likely to be hospitalized compared to those in ALFs. Subgroup analysis indicated that residents who received HC and nursing HC were less likely to be hospitalized compared to those in community care, whereas those in RC had a higher risk of hospitalization. Additionally, the population in ALFs had longer hospitalization durations compared to the control group. Mortality was 2.83 times higher among community dwellers than ALF dwellers. Moreover, subgroup analysis revealed that patients receiving RC, nursing HC, and HC had reduced risks of mortality when compared with community settings.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

None

CONFLICTS OF INTEREST

We have no conflict of interest

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AUTHOR CONTRIBUTION

Conceptualization: AS, AFH; Data Curation: AS, AFH; Formal Analysis: AS, AFH; Investigation: AS, AFH; Project Administration: AS, AFH; Resources: AS, AFH; Methodology: AS, AFH; Software: AS, AFH; Visualization: AS, AFH; Supervision: SS; Validation: AS, AFH; Writing – Original Draft Preparation: AS, AFH; Writing – Review & Editing: SS. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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