JAMDA 26 (2025) 105533

JAMDA

journal homepage: www.jamda.com

Original Study - Brief Report

Discharge Disposition in Veterans with Heart Failure: Impact of Dementia and Severe Mental Illness

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Keywords:
Alzheimer disease
heart failure
hospitalization
mental disorders
patient discharge
skilled nursing facilities

A B S T R A C T

Objectives: Post-acute heart failure (HF) care presents significant management challenges, particularly among veterans with cognitive and behavioral impairments due to Alzheimer disease and related dementias (AD/ADRD) or severe mental illness (SMI). We hypothesized that comorbid AD/ADRD and SMI would reduce the likelihood of discharge home following HF hospitalization. In addition, we explored how AD/ADRD and SMI influence discharge to Veterans Affairs (VA) Community Living Centers (CLCs) compared with Medicare Skilled Nursing Facilities (SNFs).
Design: Retrospective cohort study spanning January 1, 2011, to September 30, 2019.
Setting and Participants: Veterans hospitalized with acute HF at VA hospitals (n = 291,117).
Methods: We examined VA administrative data from HF hospitalizations to assess how AD/ADRD and SMI impact post-hospital discharge location. Using diagnostic codes from the prior year, we stratified participants by the presence of AD/ADRD and/or SMI, then employed logistic regression models to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) for discharge location, adjusted for demographics, comorbidities, and health care utilization.
Results: Participants were predominantly older (mean age: 78.1 ± 11.1 years), male (97.5%), and self-identified as white (72.7%). Those with AD/ADRD alone (n = 16,212) or SMI alone (n = 33,194) outnumbered those with both conditions (n = 3612). Compared with neither condition, the presence of AD/ADRD alone [adjusted OR (aOR), 0.523; 95% CI, 0.505–0.542], SMI alone (aOR, 0.869; 95% CI, 0.843–0.896), and both conditions (aOR, 0.505; 95% CI, 0.47–0.542) all reduced likelihood of discharge home. Participants with AD/ADRD and SMI were more likely to be discharged to a CLC than a SNF (aOR, 1.225; 95% CI, 1.064–1.411).
Conclusions and Implications: Our findings indicate that AD/ADRD and SMI are major barriers to discharge home for patients with HF, suggesting a need for enhanced supervision during health care transitions. This study calls for further research into how discharge location affects short- and long-term clinical outcomes in patients with cognitive and behavioral impairment.
Published by Elsevier Inc. on behalf of Post-Acute and Long-Term Care Medical Association.

This research was supported by the VA Health Services Research and Development Center of Innovation in Long-Term Services and Supports (CIN-13-419) and the Providence Evidence Synthesis Program (ESP-22-116). J.W.B. is supported by VA Rehabilitation Research and Development (IK1RX003904, IK2RX005010). J.L.R. is supported by the CPIC QUERI Evidence Evaluation Center (EBP 22-105). M.D.H., J.W.B., T.A.B., Z.J.K., J.E.M., W.C.W., C.M.K., J.D.L., J.L.R., and L.J. are employees of the Department of Veterans Affairs.

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https://doi.org/10.1016/j.jamda.2025.105533
1525-8610/Published by Elsevier Inc. on behalf of Post-Acute and Long-Term Care Medical Association.

Acute heart failure (HF) is a leading cause of hospitalization, morbidity, and mortality among US veterans and the aging population more broadly.[1,2] Despite improvements in survival rates during hospitalization, post-discharge outcomes remain poor, with 30-day readmission rates of 25% in veterans aged 65 years and older using non-VA hospitals and 1-year mortality averaging up to 30% overall.[1,3,4] Although no single reason has been identified, the progressive nature of HF, complex medication regimens, challenging lifestyle modifications, and burden of outpatient visits may contribute to these poor outcomes.[2,3] These factors may lead to clinicians discharging patients to skilled nursing facilities (SNFs), yet others have identified cognitive and behavioral barriers to HF management as key considerations in envisioning better care in SNFs.[5] As such, there is a need to better understand the impact of cognitive and behavioral impairment on post-hospitalization outcomes in HF, which may inform pre-discharge planning in at-risk patients.

Rates of severe mental illness (SMI) are rising in older adults, which can significantly impact cognition and behavior during the aging process, and may also be a risk factor for Alzheimer disease and related dementias (AD/ADRD).[6,7] Although understudied, AD/ADRD and SMI may impact post-discharge outcomes via multiple mechanisms; a recent meta-analysis found that AD/ADRD predicted poor self-care adequacy in HF—patients with cognitive impairment were less likely to seek assistance with self-care, and those with depression had worse self-care abilities.[8] Similarly, our prior analyses indicate that schizophrenia is associated with decreased likelihood of successful community discharge, defined as remaining in the community without death, hospital readmission, or hospice services within 30 days of HF hospitalization.[9,10] Taken together, these data indicate that AD/ADRD and SMI are clinically important factors in discharge planning; however, their additive burden on post-discharge outcomes remains understudied.

By simultaneously investigating how SMI and AD/ADRD influence discharge location, the current study aims to better characterize clinical decision-making in veterans with cognitive and/or behavioral impairment. The primary outcome was likelihood of discharge home after HF hospitalization. We hypothesized that SMI and AD/ADRD would reduce the likelihood of discharge home, instead favoring transfer to short-term rehabilitation facilities, including Medicare SNFs and Veterans Affairs (VA) Community Living Centers (CLCs). To better understand how these factors may influence discharge location within the VA health care system, we also conducted a secondary analysis examining the odds of CLC vs SNF placement.

Methods

This retrospective, observational cohort study was conducted using electronic health records (EHR) data from the VA and the Centers for Medicare and Medicaid Services (CMS), accessed through the VA Corporate Data Warehouse. Approval was obtained from the local institutional review board, which waived informed consent for this secondary analysis.

Participants

The study included veterans admitted to VA Medical Centers with a primary diagnosis of acute HF from January 1, 2011, to September 30, 2019. We excluded transfers from other hospitals or nursing homes, patients who died during hospitalization, and hospice patients. Given that multiple admissions were possible for veterans in the cohort, one admission was selected at random for each veteran.

Outcomes

The primary outcomes were defined as binary variables: (1) discharge to home vs a rehabilitation facility, and (2) discharge to a CLC vs an SNF.

Diagnostic Codes

International Classification of Diseases, Ninth Revision and 10th Revision codes were used to classify participants by AD/ADRD and/or SMI diagnoses (schizophrenia/schizoaffective, bipolar, or recurrent major depressive disorders), using a 1-year lookback period from the date of index admission (see Supplementary Tables 1 and 2 for coding).[9-12] Participants were grouped into 4 categories: AD/ADRD$^{(-)}$ SMI$^{(-)}$, AD/ADRD$^{(+)}$ SMI$^{(-)}$, AD/ADRD$^{(-)}$ SMI$^{(+)}$, and AD/ADRD$^{(+)}$ SMI$^{(+)}$ (both conditions).

Cohort Definitions

The overall sample was used to assess likelihood of discharge home (Figure 1). To examine odds of discharge to CLCs vs SNFs, additional exclusions were applied to select hospitalizations requiring discharge to acute rehabilitation facilities from hospitals with an affiliated CLC (Supplementary Figure 1).

Covariates

To adjust for potential confounders of functional status, the Elixhauser comorbidity index was used to capture the presence of 30 individual medical conditions from claims data.[13] Given that we considered SMI as a grouping variable, index scores were calculated without depressive or psychotic disorders.[10] In addition, demographic data (age, sex, race/ethnicity), ejection fraction (EF), and prior year health care utilization (expenses, hospital length of stay) were recorded.[9,10,14]

Statistical Analysis

Data analysis was conducted using SAS Enterprise Guide 8.3. Logistic regression models evaluated the impact of AD/ADRD and SMI on discharge location. The first model assessed discharge home vs rehabilitation. The second model, applicable only to the subset discharged to rehabilitation facilities, analyzed the odds of CLC vs SNF discharge. Both models incorporated group classifications as independent variables (AD/ADRD$^{(+/-)}$SMI$^{(+/-)}$) and adjusted for the above covariates as well as fixed effects of hospital location and admission date. To control for potential confounding effects of age on insurance status and discharge location, a sensitivity analysis was conducted in Medicare-eligible participants aged 65 and older. Mean, standard deviation (SD), adjusted odds ratios (aOR), and 95% confidence intervals (CIs) were calculated.

Results

Participant Characteristics

After applying exclusion criteria, the study included a total of 291,117 participants hospitalized with HF (Figure 1). Participants were generally older than 65 years [mean (SD): 71.8 (11.1) years], male (97.5%), self-identified as white (72.7%), and had multiple medical comorbidities [mean (SD): 5.2 (2.7); Table 1]. Most participants were discharged home [n = 223,081 (76.6%)]. To analyze the impact of AD/ADRD and SMI on discharge location, participants were stratified into 4 groups: neither condition [AD/ADRD$^{(-)}$SMI$^{(-)}$; n = 238,099 (81.8% of cohort)], AD/ADRD [AD/ADRD$^{(+)}$SMI$^{(-)}$; n = 16,212 (5.6%)], SMI [AD/

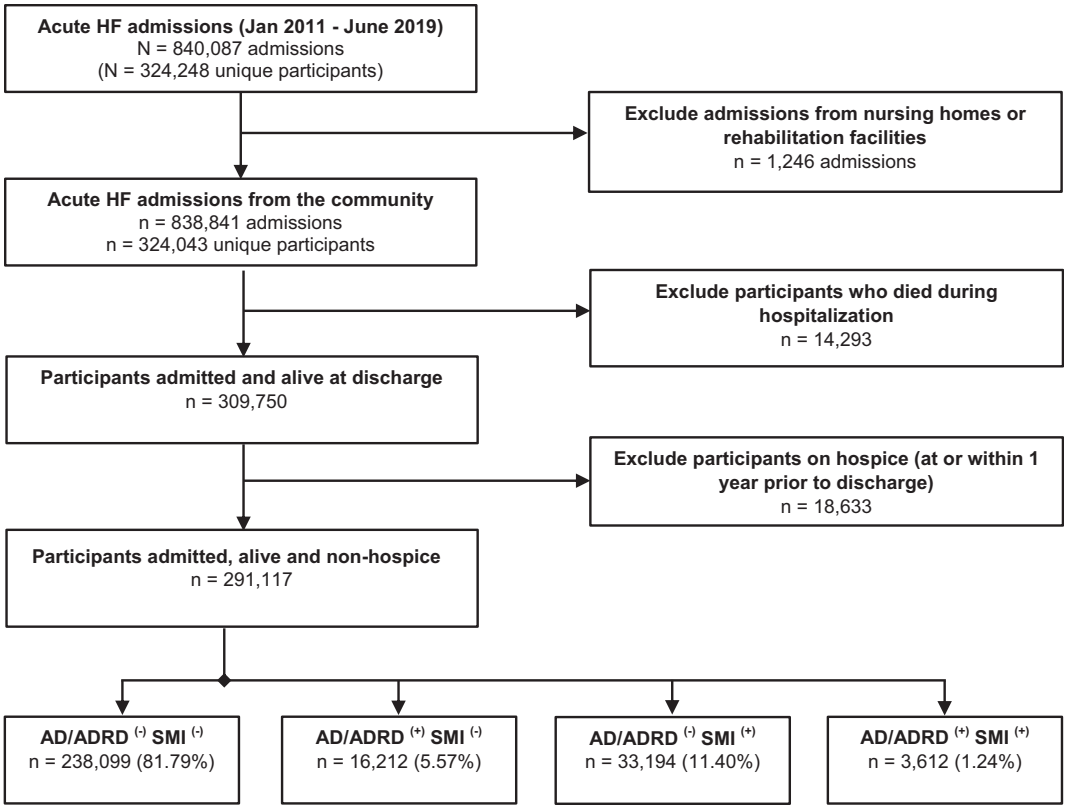

Fig. 1. Cohort creation flowchart.

ADRD$^{(-)}$SMI$^{(+)}$; n = 33,194 (11.4%)], and both [AD/ADRD$^{(+)}$SMI$^{(+)}$; n = 3612 (1.2%); Table 1]. Participants with AD/ADRD were older [mean (SD): 81.8 (9.0) years] compared with those with neither condition [71.8 (10.9) years]. In addition, the presence of both AD/ADRD and SMI together was associated with increased comorbidities [Elixhauser score: 6.6 (2.7); Table 1].

Likelihood of Discharge Home

We first sought to examine how cognitive or behavioral impairment may influence likelihood of discharge home (Table 2). After covariate adjustment, we found reduced likelihood of discharge home for participants with AD/ADRD only (aOR, 0.523; 95% CI, 0.505–0.542) and for those with both conditions (aOR, 0.505; 95% CI, 0.47–0.542) compared with those who had neither condition. Participants with SMI only also showed a reduced likelihood of home discharge, although the effect was smaller (aOR, 0.869; 95% CI, 0.843–0.896; Table 2). Overall, these findings confirm that AD/ADRD and SMI are negatively associated with discharge home. Full reporting of model results, as well as confirmation in veterans 65 years or older, are shown in Supplementary Tables 3 and 4.

Likelihood of Discharge to VA CLCs

For participants discharged to a short-term rehabilitation facility, we next examined how AD/ADRD and SMI might impact choice of VA CLC or Medicare SNF. To generate this sub-cohort, we applied additional exclusions to select participants discharged to short-term rehabilitation from hospitals with an affiliated VA CLC (n = 34,258; Supplementary Table 5; Supplementary Figure 1). Within this subgroup, VA CLCs were selected in a minority [n = 12,126 (35.4%)]. Following adjustment for covariates, we found that AD/ADRD reduced likelihood of CLC discharge (aOR, 0.823; 95% CI, 0.759–0.892). SMI was not associated with CLC vs SNF discharge (aOR, 0.967; 95% CI, 0.892–1.049). We observed a paradoxical increase in the likelihood of CLC discharge for those with both SMI and AD/ADRD (aOR, 1.225; 95% CI, 1.064–1.411; Table 2). Full model results are listed in Supplementary Table 6.

Discussion

Leveraging administrative data from the extensive VA health care system, this large, retrospective analysis indicates that AD/ADRD and SMI predict reduced likelihood of discharge home following a HF hospitalization. In addition, we found that participants with both conditions were more likely to be discharged to VA CLCs than Medicare SNFs. These novel findings underscore the major, yet understudied, influence that cognitive and behavioral impairment play in discharge planning, with relevance for a growing number of patients with HF in our aging population. This study identifies a complex recovery trajectory requiring short-term rehabilitation for many patients with these conditions. This care transition serves as a critical functional assessment, and one that is further complicated by the presence of AD/ADRD and SMI. Given the intricacies of care transitions, HF provides a valuable context to examine these dynamics.

Although we are unable to draw firm conclusions about why AD/ADRD and SMI decreased likelihood of discharge home, prior work has shown that lower functional status and higher number of medical comorbidities are major drivers of placement to acute rehabilitation, both of which are characteristic of this population and replicated in our models (see Supplementary Table 3).[15] Furthermore, studies conducted in more than 3 million veterans found heightened odds of nursing home admission for those with dementia, schizophrenia, and other psychotic disorders.[16] Similarly, our prior work showed higher

Table 1
Demographics and Clinical Characteristics

Variable	Overall	AD/ADRD (−) SMI (−)	AD/ADRD (+) SMI (−)	AD/ADRD (−) SMI (+)	AD/ADRD (+) SMI (+)
	(n = 291,117)	(n = 238,099)	(n = 16,212)	(n = 33,194)	(n = 3612)
Age, y	71.8 (11.1)	71.8 (10.9)	81.8 (9.0)	65.9 (9.4)	75.4 (9.6)
18–64	76,154 (26.2)	60,412 (25.4)	691 (4.3)	14,624 (44.1)	427 (11.8)
65–74	105,120 (36.1)	87,139 (36.6)	2929 (18.1)	13,672 (41.2)	1380 (38.2)
75–84	64,814 (22.3)	54,867 (23.0)	5303 (32.7)	3598 (10.8)	1046 (29.0)
85+	45,023 (15.5)	35,677 (15.0)	7288 (45.0)	1299 (3.9)	759 (21.0)
Sex, male	283,795 (97.5)	233,030 (97.9)	15,930 (98.3)	31,303 (94.3)	3532 (97.8)
Race/Ethnicity					
White	211,734 (72.7)	174,016 (73.1)	11,536 (71.2)	23,504 (70.8)	2678 (74.1)
Black	57,981 (19.9)	46,465 (19.5)	3422 (21.1)	7417 (22.3)	677 (18.7)
Hispanic	20,370 (7.0)	16,709 (7.0)	1228 (7.6)	2180 (6.6)	253 (7.0)
Elixhauser comorbidity index*	5.2 (2.7)	5.1 (2.7)	5.9 (2.6)	5.9 (2.7)	6.6 (2.7)
Medical history					
Hypertension	243,990 (83.8)	197,221 (82.8)	14,310 (88.3)	29,172 (87.9)	3287 (91.0)
Diabetes mellitus, overall	150,824 (51.8)	121,468 (51.0)	8012 (49.4)	19,230 (57.9)	2114 (58.5)
Arrhythmia	147,111 (50.5)	119,498 (50.2)	9751 (60.1)	15,783 (47.5)	2079 (57.6)
Chronic pulmonary disease	122,241 (42.0)	97,355 (40.9)	6570 (40.5)	16,462 (49.6)	1854 (51.3)
Renal failure	92,447 (31.8)	74,593 (31.3)	6551 (40.4)	9897 (29.8)	1406 (38.9)
Fluid and electrolyte disorders	78,200 (26.9)	59,713 (25.1)	5898 (36.4)	11,052 (33.3)	1537 (42.6)
Peripheral vascular disorders	74,175 (25.5)	60,042 (25.2)	4746 (29.3)	8304 (25.0)	1083 (30.0)
Obesity	73,007 (25.1)	58,019 (24.4)	2085 (12.9)	12,023 (36.2)	880 (24.4)
Valvular disease	47,572 (16.3)	39,093 (16.4)	3196 (19.7)	4698 (14.2)	585 (16.2)
Solid tumor without metastasis	42,441 (14.6)	35,425 (14.9)	2551 (15.7)	3990 (12.0)	475 (13.2)
Hypothyroidism	36,968 (12.7)	28,428 (11.9)	3114 (19.2)	4706 (14.2)	720 (19.9)
Blood loss anemia	33,643 (11.6)	25,948 (10.9)	2660 (16.4)	4335 (13.1)	700 (19.4)
Pulmonary circulation disorders	29,576 (10.2)	23,780 (10.0)	1685 (10.4)	3704 (11.2)	407 (11.3)
Alcohol abuse	26,618 (9.1)	17,907 (7.5)	1208 (7.5)	6882 (20.7)	621 (17.2)
Liver disease	23,953 (8.2)	18,108 (7.6)	946 (5.8)	4520 (13.6)	379 (10.5)
Weight loss	20,946 (7.2)	15,350 (6.4)	2359 (14.6)	2692 (8.1)	545 (15.1)
Coagulopathy	19,638 (6.7)	15,474 (6.5)	1333 (8.2)	2487 (7.5)	344 (9.5)
Drug abuse	18,364 (6.3)	11,205 (4.7)	507 (3.1)	6265 (18.9)	387 (10.7)
EF					
0–40%	78,316 (26.9)	64,714 (27.2)	4054 (25.0)	8670 (26.1)	878 (24.3)
40%–50%	42,781 (14.7)	34,312 (14.4)	2571 (15.9)	5307 (16.0)	591 (16.4)
50%+	84,476 (29.0)	66,645 (28.0)	5126 (31.6)	11,389 (34.3)	1316 (36.4)
Missing	85,544 (29.4)	72,428 (30.4)	4461 (27.5)	7828 (23.6)	827 (22.9)
Total hospital length of stay, prior year (days)	4.3 (9.7)	3.8 (8.8)	7.0 (13.0)	5.9 (11.9)	9.3 (17.6)
No. of hospitalizations, prior year	0.9 (1.4)	0.8 (1.3)	1.2 (1.5)	1.2 (1.7)	1.5 (1.7)
Total health care utilization, prior year (USD)	42,446.4 (67, 512.3)	37,898.5 (62, 611.8)	57,309.5 (80, 433.9)	61,917.6 (78, 879.2)	96,587.9 (118, 139.0)

Values are n (%) unless otherwise indicated.
*Index score calculated without psychiatric disorders (psychoses, depression).

HF readmission rates for veterans with SMI and lower rates of successful community discharge for veterans with schizophrenia.[9,10] More work is needed on long-term outcomes in this population.

Our study also indicates that veterans with both AD/ADRD and SMI were more likely to be placed in a CLC than other groups. Although we are unable to determine the mechanism, prior research suggests this may be due to complex care needs; one study of VA CLCs found that AD/ADRD and schizophrenia were both associated with increased length of stay (>90 days), with cognitive impairment predicting stay >365 days.[17] Team-based training has been shown to improve staff safety and reduce dementia-related agitation in CLCs,[18] yet a recent study identified a need for SMI-specific training in CLCs.[19] As such, there is a need to compare how CLC vs SNF placement may impact long-term clinical outcomes for patients with cognitive and behavioral impairment, and to explore whether additional training could improve patient outcomes in CLC settings.

To reduce facility burden and enable post-acute care in a less restrictive environment, there is a need to develop tools to mitigate the risks of community discharge for patients with cognitive or behavioral impairment. Both home-based and telehealth services are associated with reduced HF re-hospitalization; however, further prospective studies in this population are needed.[20–23] Within the VA, home-based primary care programs can offer comprehensive medical, nursing, and behavioral support in a less restrictive environment; however, eligibility criteria and wait times may limit access for new patients immediately after hospitalization.[24–26] In addition, providing training resources to caregivers can empower them to manage care at home more effectively, potentially reducing institutionalization.[27] However, severity of caregiver burden and distress appear to mediate this relationship, pointing toward a need for tailored caregiver interventions that are becoming more available.[28,29] Although understudied, adopting these innovative strategies may create more effective and responsive care pathways to improve health outcomes and quality of life for HF patients with cognitive and behavioral impairment.

The robustness of this study is supported by its large sample size and the comprehensive data derived from VA health records, enabling a detailed examination of the impacts of multiple comorbidities on discharge outcomes. However, the retrospective design limits our ability to establish causality, and issues with representativeness of the sample (ie, primarily male, non-Hispanic white veterans) may affect the generalizability of these findings to non-veteran populations and non-VA hospital systems. Furthermore, although we adjusted for clinical-demographic variables and performed a sensitivity analysis to confirm our findings in participants above the cutoff for Medicare eligibility, there remains a potential impact of unobserved confounders, such as housing instability, patient/family preferences, or insurance status. Finally, although these cross-sectional

Table 2
Effects of AD/ADRD and SMI on Discharge Location

Predictors	Outcome, n (%)	OR*	95% CI	aOR†	95% CI
Outcome 1: Discharge home (n = 291,117)‡					
AD/ADRD (+) SMI (−)	8740 (53.9)	0.319	0.309–0.330	0.523	0.505–0.542
AD/ADRD (−) SMI (+)	25,919 (78.1)	0.974	0.947–1.002	0.869	0.843–0.896
AD/ADRD (+) SMI (+)	1987 (55.0)	0.326	0.305–0.348	0.505	0.47–0.542
AD/ADRD (−) SMI (−)	186,435 (78.3)	—	—	—	—
Outcome 2: Discharge to VA CLC (n = 34,258)§					
AD/ADRD (+) SMI (−)	1290 (29.4)	0.739	0.685–0.797	0.823	0.759–0.892
AD/ADRD (−) SMI (+)	1665 (43.7)	1.52	1.411–1.638	0.967	0.892–1.049
AD/ADRD (+) SMI (+)	464 (43.9)	1.504	1.317–1.718	1.225	1.064–1.411
AD/ADRD (−) SMI (−)	8707 (34.8)	—	—	—	—

*OR: Adjusted for VA hospital location only.
†aOR: Adjusted OR for sex, age, race, comorbidity, EF category, acute hospitalization length of stay, and total cost during the 1 year prior, as well as VA hospital location and date of admission.
‡Model variable: discharge home (see Supplementary Table 3 for covariates).
§Model variable: discharge to VA CLC, among hospital admissions resulting in discharge to an acute rehabilitation facility (see Supplementary Table 6 for covariates).

administrative data provide a wealth of information, they are limited by details on the severity/timing of cognitive and behavioral impairment, which requires further prospective studies to evaluate.

Conclusions and Implications

In conclusion, this study contributes valuable insights into the choice of discharge location for HF patients with cognitive and behavioral impairment. By understanding these interactions, health care providers can advocate for a shift from short-term rehabilitation to more personalized approaches for this vulnerable population. Future research should investigate the interaction of specific cognitive-behavioral diagnoses, which would enable prospective studies examining the long-term effectiveness of less restrictive environments in improving outcomes.

Disclosure

The authors declare no conflicts of interest.

Acknowledgments

The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the US government or Department of Veterans Affairs.

Supplementary Data

Supplementary data related to this article can be found online at https://doi.org/10.1016/j.jamda.2025.105533.

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