


New Antipsychotic Prescribing Continued into Skilled Nursing Facilities Following a Heart Failure Hospitalization: a Retrospective Cohort Study



Melissa R. Riestler, PharmD^{1,2} , Parag Goyal, MD, MSc³, Lan Jiang, MS⁴,
Sebhat Erqou, MD, PhD^{4,5}, James L. Rudolph, MD, SM^{1,2,4,5}, John E. McGeary, PhD^{4,6,7},
Nicole M. Rogus-Pulia, PhD^{8,9}, Caroline Madrigal, PhD^{1,2,4}, Lien Quach, PhD⁴,
Wen-Chih Wu, MD, MPH^{4,5}, and Andrew R. Zullo, PharmD, PhD^{1,2,4,10}

¹Department of Health Services, Policy, and Practice, Brown University School of Public Health, Providence, RI, USA; ²Center for Gerontology and Healthcare Research, Brown University School of Public Health, Providence, RI, USA; ³Division of Cardiology and Division of General Internal Medicine, Department of Medicine, Weill Cornell Medicine, New York, NY, USA; ⁴Center of Innovation in Long-Term Services and Supports, Providence Veterans Affairs Medical Center, Providence, RI, USA; ⁵Department of Medicine, Warren Alpert Medical School, Brown University, Providence, RI, USA; ⁶Department of Psychiatry and Human Behavior, Alpert Medical School, Brown University, Providence, RI, USA; ⁷Center for Alcohol and Addiction Studies, Brown University School of Public Health, Providence, RI, USA; ⁸Department of Medicine, University of Wisconsin-Madison, Madison, WI, USA; ⁹Geriatric Research Education and Clinical Center, William S. Middleton Memorial Veterans Hospital, Madison, WI, USA; ¹⁰Department of Epidemiology, Brown University School of Public Health, Providence, RI, USA.

BACKGROUND: Multimorbidity and polypharmacy are common among individuals hospitalized for heart failure (HF). Initiating high-risk medications such as antipsychotics may increase the risk of poor clinical outcomes, especially if these medications are continued unnecessarily into skilled nursing facilities (SNFs) after hospital discharge.

OBJECTIVE: Examine how often older adults hospitalized with HF were initiated on antipsychotics and characteristics associated with antipsychotic continuation into SNFs after hospital discharge.

DESIGN: Retrospective cohort.

PARTICIPANTS: Veterans without prior outpatient antipsychotic use, who were hospitalized with HF between October 1, 2010, and September 30, 2015, and were subsequently discharged to a SNF.

MAIN MEASURES: Demographics, clinical conditions, prior healthcare utilization, and antipsychotic use data were ascertained from Veterans Administration records, Minimum Data Set assessments, and Medicare claims. The outcome of interest was continuation of antipsychotics into SNFs after hospital discharge.

KEY RESULTS: Among 18,008 Veterans, antipsychotics were newly prescribed for 1931 (10.7%) Veterans during the index hospitalization. Among new antipsychotic users, 415 (21.5%) continued antipsychotics in skilled nursing facilities after discharge. Dementia (adjusted OR (aOR) 1.48, 95% CI 1.11–1.98), psychosis (aOR 1.62, 95% CI 1.11–2.38), proportion of inpatient days with antipsychotic use (aOR 1.08, 95% CI 1.07–1.09, per 10% increase), inpatient use of only typical (aOR 0.47, 95% CI 0.30–0.72) or parenteral antipsychotics (aOR 0.39, 95% CI 0.20–0.78), and the day of hospital admission that antipsychotics were started (day 0–4 aOR 0.36, 95% CI 0.23–0.56; day 5–7 aOR 0.54, 95% CI 0.35–0.84 (reference: day > 7 of hospital admission)) were significant

predictors of continuing antipsychotics into SNFs after hospital discharge.

CONCLUSIONS: Antipsychotics are initiated fairly often during HF admissions and are commonly continued into SNFs after discharge. Hospital providers should review antipsychotic indications and doses throughout admission and communicate a clear plan to SNFs if antipsychotics are continued after discharge.

KEY WORDS: antipsychotic agents; heart failure; hospitalization; nursing homes; older adults.

J Gen Intern Med 37(13):3368–79

DOI: 10.1007/s11606-021-07233-2

© Society of General Internal Medicine 2021

INTRODUCTION

Heart failure (HF) is highly prevalent among older adults, affecting 6.9% of males and 4.8% of females 60–79 years old and 12.8% of males and 12.0% of females ≥ 80 years old, and is associated with significant healthcare utilization and costs.¹ Older adults hospitalized for HF who cannot return home due to medical, functional, or social vulnerabilities are frequently transferred to skilled nursing facilities (SNFs) and are particularly susceptible to poor clinical outcomes.^{2–5} Given that new medications are often added to older adults' medication regimens following a hospitalization,^{6–9} and multimorbidity and polypharmacy are common in older adults hospitalized for HF,¹⁰ increases in polypharmacy resulting from the hospitalization may further augment the risk of adverse drug events, drug interactions, or poor clinical outcomes. Of particular concern are medications started in the hospital and continued after discharge even when they are non-essential or are no longer indicated. Such medications are unlikely to provide additional benefits, but could

Received July 2, 2021

Accepted October 19, 2021

Published online January 3, 2022

potentially increase the risk for harms. Examining inpatient initiation of high-risk medications and predictors of medication continuation into SNFs post-hospital discharge may inform future strategies to reduce potentially harmful medication effects and improve outcomes for vulnerable older adults with HF.

Antipsychotics are commonly initiated during non-psychiatric hospital admissions.^{11–13} Due to the risk of severe medication adverse effects,^{14–21} limited evidence supporting antipsychotic use for several off-label indications,^{22–25} and concern that most new antipsychotic prescribing continued after hospital discharge is potentially inappropriate,²⁶ multiple studies have examined inpatient antipsychotic initiation and factors associated with continuing antipsychotics after hospital discharge.^{11–13,27–30} However, antipsychotic use across transitions of care has rarely been studied specifically among individuals discharged to SNFs, although this group may be particularly susceptible to medication-related harms. Additionally, several challenges have precluded prior studies from reliably and accurately ascertaining antipsychotic use prior to, during, and after a hospital admission. Many studies do not link data from multiple care settings because clinicians and researchers are often limited in their ability to access and obtain the resources necessary to conduct such sophisticated analyses appropriately. Using administrative claims-based datasets alone would not provide information on both inpatient and outpatient medication use, while hospital electronic medical records often rely on error-prone admission or discharge medication lists for medication use prior to hospital admission or after hospital discharge.^{31,32}

Using a data linkage that overcomes the aforementioned challenges, we aimed to describe patterns of new antipsychotic use in a national cohort of older adults hospitalized with HF and predictors of continuing antipsychotics into SNFs post-hospital discharge. Based on prior literature,^{11–13,27–30} we hypothesized that certain conditions (e.g., dementia, delirium), longer hospital length of stay, and inpatient drug characteristics such as antipsychotic type, route of administration, and duration of therapy would be important predictors of continuing antipsychotics into SNFs.

METHODS

Study Design and Data Sources

In this retrospective cohort study, we linked Veterans Health Administration (VHA) electronic medical records to VA outpatient pharmacy claims, Minimum Data Set (MDS) version 3.0 assessments, and Medicare claims using unique VA identifiers. VHA records include demographics, comorbidities, prior healthcare utilization, test results, outpatient medication dispensings, and inpatient barcode medication administration records. The MDS is a federally mandated, standardized resident assessment administered at scheduled intervals in Medicare- and Medicaid-certified SNFs.³³ Assessments

include information on clinical conditions, functional and cognitive status, and medications received in the facility. This study was approved by the Institutional Review Board at the Providence VA Medical Center.

Study Population

Our nationally representative study population included Veterans who were hospitalized for HF at a U.S. VA hospital between October 1, 2010, and September 30, 2015, and were subsequently discharged to a non-VA SNF. We examined non-VA SNFs as data restrictions prevented us from reliably ascertaining MDS records from VA-affiliated SNFs. Veterans were identified through hospitalization claims if an *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) code for HF was documented in the primary position, regardless of HF type (Appendix Table 4). Discharges to SNF were included if an admission MDS assessment was documented up to 14 days after the date of discharge from the index HF hospitalization since MDS admission assessments must be completed by day 14 of the SNF-stay.³³ Veterans were excluded if they resided in a nursing home prior to the index hospital admission, were dispensed antipsychotics in the 12 months before the index HF admission, were missing an admission or follow-up MDS assessment, or were missing variables derived from the MDS that were used during statistical modeling. For Veterans with multiple eligible HF hospitalizations with subsequent discharges to SNF, only the first hospital admission was included.

Antipsychotic Initiation During HF Hospitalization

Antipsychotic exposure was derived from three sources: (1) VA outpatient pharmacy dispensing claims (to identify and exclude individuals dispensed antipsychotics in the 12 months before the index admission), (2) VA barcode medication administration records for inpatient antipsychotic use, and (3) MDS assessments for antipsychotic use during the post-hospitalization SNF stay. Participants with antipsychotic initiation during hospitalization received at least one dose of an antipsychotic during the index HF admission.

Continuation of Hospital Antipsychotics into SNFs

Among participants with antipsychotic initiation during hospitalization, we classified individuals as those who discontinued antipsychotics at or prior to hospital discharge and those who continued antipsychotics into the SNF. Veterans were classified as continuing antipsychotics in the SNF if their admission MDS assessment reported receipt of an antipsychotic for at least one day out of the previous seven days in the SNF (or since SNF admission if the MDS assessment was completed prior to day 7 of SNF admission). For patients who continued antipsychotics into the SNF, we also examined the

next available MDS follow-up assessment (nearest to the 30-day scheduled assessment, but no later than 90 days after SNF admission) to better understand how frequently antipsychotics are continued long-term. Participants with no documentation of antipsychotic administration on their admission MDS assessment were classified as having discontinued antipsychotics at or prior to hospital discharge.

Patient Characteristics

Demographics (e.g., age, sex, race/ethnicity) were measured using VHA records. Comorbidities were ascertained from VHA records using ICD-9-CM code documentation on inpatient and outpatient encounters from the year prior to SNF admission. Medicare claims were also used to identify patients with dementia (Appendix). We measured multimorbidity by summing the number of conditions in the set of comorbidity measures developed by Elixhauser et al.³⁴ MDS assessments at SNF admission reported the cognitive function scale,³⁵ functional status using a 28-point scale of independence in activities of daily living (ADLs),³⁶ and presence of delirium using the Confusion Assessment Method.³³ We ascertained data from the index HF admission using VHA records, including length of hospital stay, admission type, critical care requirement, use of mechanical ventilation, and palliative care prior to or during the index hospital admission. Ejection fraction, measured nearest to the time of index HF admission, was obtained from electronic medical record notes using an automated information extraction application validated for the VA. Finally, healthcare utilization costs were extracted from VA administrative records, which totaled inpatient, outpatient (including emergency department), and pharmacy costs in the year prior to the index hospitalization.

Inpatient Antipsychotic Characteristics

Medication name, dose, and route of administration were available for antipsychotics administered inpatient through VA barcode medication administration records. We also ascertained the day of hospital admission that antipsychotics were started, the number and proportion of days that antipsychotics were administered, the type of antipsychotic (typical or atypical), and route of administration. Antipsychotic type was based on the Food and Drug Administration classification framework (Appendix Table 5).^{37,38} Similar to prior literature,¹³ we constructed a measure for potentially excessive antipsychotic dosing by summing the doses for a specific antipsychotic for a given day and comparing it to the daily dose thresholds set forth in the Centers for Medicare and Medicaid Services guidelines for antipsychotic use in nursing homes.³⁹ Any daily dose that exceeded this threshold was considered potentially excessive.

Statistical Analysis

We compared patient characteristics between participants with and without antipsychotic initiation during hospitalization. Among participants with antipsychotic initiation during hospitalization, we compared patient and inpatient antipsychotic characteristics between those who discontinued antipsychotics at or prior to hospital discharge and those who continued antipsychotics into the SNF. Characteristics were summarized in proportions, means and standard deviations, or medians with the first and third quartiles. Cohen's standardized mean differences were also reported.⁴⁰ Additionally, we constructed univariable and multivariable random effects regression models with random intercepts for hospitals and SNFs to estimate odds ratios (ORs) and 95% confidence intervals (CIs) for predictors of continuing antipsychotics into SNFs (versus discontinuing antipsychotics at or prior to hospital discharge). We checked variables for collinearity before entering them into the multivariable model based on variance inflation factors, all of which were less than 5. All analyses were conducted using SAS 9.4 (SAS Institute, Inc., Cary, NC).

RESULTS

Study Cohort

Our study cohort consisted of 18,008 older adults who were hospitalized for HF and were subsequently discharged to a SNF (Fig. 1). The mean (standard deviation) age of the overall cohort was 78.0 (10.1) years, 546 (3.0%) were female patients, and 14,269 (79.2%) were non-Hispanic White patients (Appendix Table 6). Antipsychotics were newly prescribed for 1931 (10.7%) individuals during their index hospitalization. Among participants with inpatient antipsychotic initiation, 415 (21.5%) received an antipsychotic in the SNF after hospital discharge, and of these, 328 (79.0%) also had antipsychotics documented at the next MDS follow-up assessment. Several patient characteristics differed between participants with and without antipsychotic initiation during hospitalization (Appendix Table 6).

Age was similar between participants who continued antipsychotics into SNFs versus discontinued antipsychotics at or prior to hospital discharge (Table 1). Individuals who continued antipsychotics into SNFs after hospital discharge generally had fewer comorbidities and lower prior healthcare utilization costs, but a greater proportion had diagnoses of dementia, delirium, and psychosis. During the index HF admission, hospital length of stay and the proportion of patients with a flag for palliative care were similar between groups. A smaller proportion of those who continued antipsychotics into SNFs had an admission to the ICU or required mechanical

Table 1 Characteristics of Veterans Hospitalized for Heart Failure and Discharged to a Skilled Nursing Facility among Participants with Inpatient Antipsychotic Initiation, 2010–2015

Characteristics	Total (N = 1931)	Antipsychotics discharge (n = 1516)	Antipsychotics continued into SNFs (n = 415)	Standardized mean difference
Age, years, mean (SD)	79.1 (9.6)	79.0 (9.5)	79.4 (9.8)	0.04
Female	55 (2.9)	41 (2.7)	14 (3.4)	− 0.04
Race/ethnicity				0.25
Non-Hispanic White	1522 (78.8)	1201 (79.2)	321 (77.4)	
Non-Hispanic Black	306 (15.9)	231 (15.2)	75 (18.1)	
Hispanic	64 (3.3)			
Other	39 (2.0)	26 (1.7)	13 (3.1)	
Heart failure type				0.10
EF 0–40%, reduced	432 (22.4)	339 (22.4)	93 (22.4)	
EF 40–50%, borderline	223 (11.6)	184 (12.1)	39 (9.4)	
EF > 50%, preserved	475 (24.6)	370 (24.4)	105 (25.3)	
EF missing	801 (41.5)	623 (41.1)	178 (42.9)	
Conditions				
Comorbidity index, mean (SD)*	4.0 (2.6)	4.0 (2.7)	3.7 (2.6)	− 0.14
Dementia	876 (45.4)	624 (41.2)	252 (60.7)	0.40
Delirium	148 (7.7)	103 (6.8)	45 (10.8)	0.14
Chronic lung disease	723 (37.4)	592 (39.1)	131 (31.6)	− 0.16
Diabetes	872 (45.2)	702 (46.3)	170 (41.0)	− 0.11
Hypothyroidism	220 (11.4)	169 (11.2)	51 (12.3)	0.04
Chronic kidney disease	131 (6.8)	109 (7.2)	22 (5.3)	− 0.08
Tumor history	294 (15.2)	238 (15.7)	56 (13.5)	− 0.06
Obesity	288 (14.9)	242 (16.1)	44 (10.6)	− 0.16
Weight loss	165 (8.5)	129 (8.5)	36 (8.7)	0.01
Anemia	588 (30.5)	478 (31.5)	110 (26.5)	− 0.11
Alcohol use disorder	143 (7.4)	119 (7.9)	24 (5.8)	− 0.08
Substance use disorder	48 (2.5)	33 (2.2)	15 (3.6)	0.09
Psychosis	257 (13.3)	180 (11.9)	77 (18.6)	0.19
Depression	383 (19.8)	307 (20.3)	76 (18.3)	− 0.05
Healthcare utilization in previous year, \$, mean (SD) [†]	23,024 (31,611)	24,024 (33,319)	19,373 (24,061)	− 0.16
Index hospitalization				
Admission LOS, days, mean (SD)	15.8 (11.6)	15.9 (11.6)	15.3 (11.6)	− 0.05
Type of admission				0.21
Medicine	1654 (85.7)	1298 (85.6)	356 (85.8)	
Surgery	245 (12.7)	202 (13.3)	43 (10.4)	
Psychiatry	32 (1.7)	16 (1.1)	16 (3.8)	
ICU stay during admission	475 (24.6)	395 (26.1)	80 (19.3)	− 0.16
Mechanical ventilation	286 (14.8)	244 (16.1)	42 (10.1)	− 0.18
Palliative care	364 (18.9)	284 (18.7)	80 (19.3)	0.01
SNF admission assessment				
Cognitive function [‡]				0.29
Intact	632 (32.9)	519 (34.4)	113 (27.4)	
Mild impairment	588 (30.6)	486 (32.2)	102 (24.7)	
Moderate impairment	592 (30.8)	426 (28.3)	166 (40.2)	
Severe impairment	109 (5.7)	77 (5.1)	32 (7.8)	
ADL dependency score, mean (SD) [§]	16.8 (5.2)	16.7 (5.2)	17.1 (5.1)	0.07

Characteristics reported as number (percent (%)) unless otherwise indicated. Some cells were left blank due to data use agreements that require the suppression of small cells (< 11 individuals)

D/C'd discontinued, SNF skilled nursing facility, SD standard deviation, EF ejection fraction, LOS length of stay, ICU intensive care unit, ADL activities of daily living

*Sum of the number of conditions listed in the set of comorbidity measures developed by Elixhauser et al.

[†]Sum of inpatient, outpatient (including emergency department), and pharmacy costs in the year prior to index hospitalization. Presents costs in terms of US dollars (not inflation adjusted)

[‡]Derived from the Minimum Data Set Cognitive Function Scale, where higher scores indicate greater impairment in cognition

[§]Derived from the Minimum Data Set 28-point scale of independence in activities of daily living, where higher scores indicate greater dependency in activities of daily living

ventilation. Once discharged to the SNF, admission MDS assessments for participants who continued antipsychotics reported greater cognitive impairment, but dependency in ADLs was similar to participants who discontinued antipsychotics at or prior to hospital discharge.

Inpatient Antipsychotic Characteristics

Among participants with antipsychotic initiation during hospitalization, antipsychotics were typically started around day

four of hospital admission and 44.4% of admissions included at least one potentially excessive daily dose of antipsychotics (Table 2). Antipsychotics were administered for a greater number of inpatient days and a greater proportion of inpatient days for individuals who continued antipsychotics into the SNF versus those who discontinued antipsychotics at or prior to hospital discharge. Individuals who continued antipsychotics into the SNF also had a greater proportion of inpatient days with potentially excessive antipsychotic dosing. Participants who continued antipsychotics into the SNF were less

Table 2 Inpatient Antipsychotic Use Characteristics Among Veterans Hospitalized for Heart Failure and Discharged to a Skilled Nursing Facility, 2010–2015

Antipsychotic characteristics during index HF admission	Overall (n = 1931)	Antipsychotics D/C'd prior to discharge (n = 1516)	Antipsychotics continued into SNFs (n = 415)	Standardized mean difference
Day of hospital admission antipsychotic started, median (Q1, Q3)	4.0 (2.0, 7.0)	4.0 (2.0, 7.0)	3.0 (2.0, 6.0)	– 0.14
Number of days antipsychotic administered, median (Q1, Q3)	3.0 (1.0, 7.0)	2.0 (1.0, 6.0)	8.0 (4.0, 13.0)	0.71
Proportion (%) of days antipsychotics administered, median (Q1, Q3)	26.7 (11.6, 57.1)	20.0 (10.0, 42.9)	62.9 (40.0, 82.4)	1.21
Type of antipsychotic, n (%)				0.78
Typical only	808 (41.8)	741 (48.9)	67 (16.1)	
Atypical only	657 (34.0)	479 (31.6)	178 (42.9)	
Both typical and atypical	466 (24.1)	296 (19.5)	170 (41.0)	
Antipsychotic route of administration, n (%)				0.08
Oral only	891 (46.1)	666 (43.9)	226 (54.5)	
Parenteral only	482 (25.0)	473 (31.2)	14 (3.4)	
Both oral and parenteral	528 (27.3)	377 (24.9)	175 (42.2)	
Admissions with at least one day of potentially excessive antipsychotic dosing, n (%)				
Any antipsychotic exposure	858 (44.4)	677 (44.7)	181 (43.6)	– 0.41
Exposure to typical antipsychotics only	447 (55.3)	418 (56.4)	29 (43.2)	– 0.49
Exposure to atypical antipsychotics only	68 (10.4)	36 (7.5)	32 (18.0)	0.20
Exposure to both typical and atypical antipsychotics	343 (73.6)	223 (75.3)	120 (70.6)	– 0.37
Number of days with potentially excessive antipsychotic dosing, mean (SD)*				
Any antipsychotic exposure	1.5 (3.5)	1.3 (3.2)	2.1 (4.4)	0.20
Exposure to typical antipsychotics only	1.4 (2.7)	1.3 (2.5)	2.1 (4.2)	0.23
Exposure to atypical antipsychotics only	0.6 (2.4)	0.3 (1.7)	1.2 (3.6)	0.30
Exposure to both typical and atypical antipsychotics	3.0 (5.2)	2.9 (5.3)	3.1 (5.1)	0.03
Proportion (%) of days with potentially excessive antipsychotic dosing, mean (SD)*				
Any antipsychotic exposure	9.7 (17.8)	8.6 (15.9)	13.4 (23.3)	0.24
Exposure to typical antipsychotics only	10.5 (16.9)	10.2 (15.9)	14.4 (25.1)	0.20
Exposure to atypical antipsychotics only	4.2 (16.3)	2.5 (11.9)	8.6 (24.1)	0.32
Exposure to both typical and atypical antipsychotics	15.9 (19.1)	14.7 (18.1)	17.9 (20.7)	0.16

HF heart failure, D/C'd discontinued, SNF skilled nursing facility, Q1 quartile 1, Q3 quartile 3, SD standard deviation

*Denominators are the corresponding cells from the "Type of antipsychotic" variable

likely to have been treated with only typical antipsychotics or only parenteral antipsychotics during their index HF admission.

Predictors of Continuing Hospital Antipsychotics into SNFs

In the univariable model, multiple characteristics were associated with continuing antipsychotics into SNFs after hospital discharge (Appendix Table 7). However, in the multivariable model, only dementia (adjusted OR (aOR) 1.48, 95% CI 1.11–1.98), psychosis (aOR 1.62, 95% CI 1.11–2.38), proportion of inpatient days with antipsychotic use (aOR 1.08, 95% CI 1.07–1.09, per 10% increase), inpatient use of only typical (aOR 0.47, 95% CI 0.30–0.72) or parenteral antipsychotics (aOR 0.39, 95% CI 0.20–0.78), and the day of hospital admission that antipsychotics were started (day 0–4 aOR 0.36, 95% CI 0.23–0.56; day 5–7 aOR 0.54, 95% CI 0.35–0.84 (reference: day > 7 of hospital admission)) remained significant predictors of continuing antipsychotics into SNFs after hospital discharge (Table 3).

DISCUSSION

In this national retrospective cohort study, several important findings emerged. First, one in ten older adults hospitalized for HF and eventually discharged to a SNF were newly prescribed an antipsychotic medication during their hospitalization. Second, one in five patients who were newly prescribed an antipsychotic continued the medication upon discharge to a SNF, and of these individuals, nearly 80% remained on antipsychotics at the time of their MDS follow-up assessment. Third, several patient and medication characteristics were associated with continuing antipsychotics after hospital discharge, which could guide future interventions to reduce the potentially harmful continuation of antipsychotics during transitions from hospitals to SNFs. Taken together, these findings highlight important opportunities to evaluate and improve the clinical care provided to older adults hospitalized for HF as they transition across care settings.

Prior studies reported that antipsychotics were initiated in 5–9% of non-psychiatric hospital admissions,^{11–13} although these studies did not focus specifically on individuals

Table 3 Multivariable Model Estimating Odds of Continuing an Antipsychotic into a Skilled Nursing Facility After Hospital Discharge, Among Participants with Inpatient Antipsychotic Initiation

Characteristic	Odds ratio	95% confidence interval		p value
Age, per 5 years	1.01	0.93	1.10	0.78
Female	1.53	0.73	3.18	0.26
Race/ethnicity				
Non-Hispanic White	Reference			
Non-Hispanic Black	1.03	0.72	1.48	0.86
Hispanic	0.40	0.15	1.03	0.06
Other	1.78	0.77	4.13	0.18
Heart failure type				
EF 0–40%, reduced	Reference			
EF 40–50%, borderline	0.76	0.46	1.25	0.28
EF > 50%, preserved	1.07	0.73	1.56	0.74
EF missing	0.70	0.49	1.01	0.06
Conditions				
Comorbidity index*				
Comorbidity index ≥ 6	Reference			
Comorbidity index 3–5	0.88	0.58	1.35	0.57
Comorbidity index 0–2	0.80	0.44	1.46	0.48
Dementia	1.48	1.11	1.98	0.008
Delirium	1.14	0.73	1.81	0.56
Chronic lung disease	0.86	0.63	1.17	0.32
Diabetes	0.97	0.72	1.30	0.82
Hypothyroidism	0.96	0.64	1.46	0.86
Chronic kidney disease	0.89	0.49	1.61	0.70
Tumor history	0.98	0.67	1.44	0.93
Obesity	0.85	0.55	1.30	0.45
Weight loss	1.15	0.71	1.88	0.57
Anemia	0.82	0.58	1.14	0.24
Alcohol use disorder	0.69	0.38	1.22	0.21
Substance use disorder	1.77	0.76	4.09	0.19
Psychosis	1.62	1.11	2.38	0.01
Depression	0.80	0.55	1.15	0.23
Healthcare utilization in previous year, per \$5000†	0.98	0.95	1.01	0.18
Index hospitalization LOS				
≥ 15 days	Reference			
8–14 days	1.02	0.72	1.44	0.92
1–7 days	1.25	0.83	1.88	0.30
Type of admission				
Medicine	Reference			
Surgery	0.93	0.62	1.40	0.73
Psychiatry	1.46	0.61	3.48	0.40
ICU stay during index hospitalization	1.02	0.73	1.42	0.92
Mechanical ventilation during index hospitalization	0.82	0.52	1.30	0.41
Cognitive function‡				
Intact	Reference			
Mild impairment	0.72	0.50	1.02	0.07
Moderate impairment	1.12	0.77	1.63	0.57
Severe impairment	0.97	0.53	1.79	0.93
ADL dependency score§				
≥ 20	Reference			
15–19	0.95	0.70	1.30	0.76
0–14	0.82	0.56	1.18	0.29
Day of index hospital admission antipsychotic started				
Day > 7 of hospital admission	Reference			
Day 5–7 of hospital admission	0.54	0.35	0.84	0.007
Day 0–4 of hospital admission	0.36	0.23	0.56	< 0.001
Proportion of days antipsychotics administered, per 10% increase	1.08	1.07	1.09	< 0.001
Type of antipsychotic during index hospitalization				
Both typical and atypical	Reference			
Typical only	0.47	0.30	0.72	< 0.001
Atypical only	0.73	0.46	1.15	0.18
Antipsychotic route of administration during index hospitalization				
Both oral and parenteral	Reference			
Oral only	1.08	0.70	1.65	0.74
Parenteral only	0.39	0.20	0.78	0.009
Potentially excessive antipsychotic dosing during admission	0.75	0.49	1.16	0.20

Model adjusted for random effects of hospitals and skilled nursing facilities

EF ejection fraction, LOS length of stay, ICU intensive care unit, ADL activities of daily living

*Sum of the number of conditions listed in the set of comorbidity measures developed by Elixhauser et al.

†Sum of inpatient, outpatient (including emergency department), and pharmacy costs in the year prior to index hospitalization. Presents costs in terms of US dollars (not inflation adjusted)

‡Derived from the Minimum Data Set Cognitive Function Scale, where higher scores indicate greater impairment in cognition

§Derived from the Minimum Data Set 28-point scale of independence in activities of daily living, where higher scores indicate greater dependency in activities of daily living

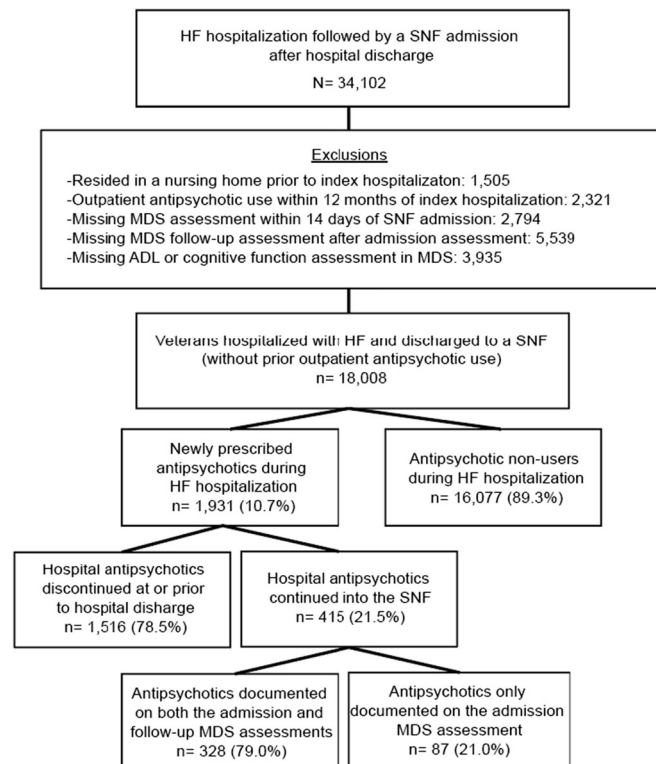


Figure 1 Flow diagram of Veterans hospitalized for heart failure and discharged to a skilled nursing facility by antipsychotic exposure, 2010–2015. Abbreviations: HF, heart failure; SNF, skilled nursing facility; MDS, minimum data set; ADL, activities of daily living.

discharged to SNFs or those with a diagnosis of HF. Examining patients with HF separately may be beneficial since HF is a chronic, progressive disease associated with tremendous healthcare utilization and costs, with the potential for worse clinical outcomes due to antipsychotic-related adverse effects. It may be especially important to study the post-acute care period for older adults discharged to SNFs since the risk for some antipsychotic-related adverse outcomes is greater for new or short-term antipsychotic users.^{16,19,41–44} A more thorough understanding of the risks of new inpatient antipsychotic use on outcomes during the post-acute care period is necessary to guide safe prescribing practices, including when and for whom to initiate this medication class, as well as the appropriate duration of therapy. Such information would be particularly useful for deprescribing efforts.

The finding that 21.5% of participants with inpatient antipsychotic initiation continued antipsychotics into SNFs is

similar to previous studies examining antipsychotic continuation after hospital discharge.^{11,12,27–30} Although antipsychotics may be intended for short-term therapy, patients discharged on antipsychotics often remain on the medications long-term.⁴⁵ In our study, nearly 80% of participants who continued antipsychotics from the hospital into the SNF also received the medications at their next follow-up assessment. Since a majority of antipsychotic use in nursing homes may be inappropriate,^{46,47} there is a need to improve medication review processes across transitions of care. The hospital is an important setting where antipsychotics are started for nursing home residents,⁴⁸ and continuing the medication after hospital discharge may have unintended consequences such as long-term continuation. If discharge documentation provided to SNFs by the hospitals is inaccurate or incomplete, SNF staff may not recognize the indication for antipsychotic use, and

Table 4 International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) Codes Used to Identify Index Heart Failure Hospitalizations

International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) Codes	402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9
--	---

Index heart failure admissions were identified if one of the above International Classification of Diseases, Ninth Revision, Clinical Modification codes was listed in the primary position on the inpatient claim

Table 5 Antipsychotics Included in the Study, by Antipsychotic Type

Typical antipsychotics	Atypical antipsychotics
Haloperidol	Quetiapine
Chlorpromazine	Lurasidone
Perphenazine	Olanzapine
Fluphenazine	Risperidone
Thiothixene	Aripiprazole
Trifluoperazine	Clozapine
Loxapine	Paliperidone
Thioridazine	Asenapine
Pimozide	Ziprasidone
Molindone	Amisulpride
	Iloperidone

Table 6 Characteristics of Veterans Hospitalized for Heart Failure and Discharged to a Skilled Nursing Facility Overall and by Antipsychotic Exposure During Hospitalization, 2010–2015

Characteristics	Total (n = 18,008)	No inpatient antipsychotic exposure (n = 16,077)	Inpatient antipsychotic initiation (n = 1931)	Standardized mean difference
Age, years, mean (SD)	78.0 (10.1)	77.9 (10.2)	79.1 (9.6)	0.12
Female	546 (3.0)	491 (3.1)	55 (2.9)	0.01
Race/ethnicity				0.00
Non-Hispanic White	14,269 (79.2)	12,747 (79.3)	1522 (78.8)	
Non-Hispanic Black	2848 (15.8)	2542 (15.8)	306 (15.9)	
Hispanic	506 (2.8)	442 (2.8)	64 (3.3)	
Other	385 (2.1)	346 (2.2)	39 (2.0)	
Heart failure type				0.20
EF 0–40%, reduced	4599 (25.5)	4167 (25.9)	432 (22.4)	
EF 40–50%, borderline	2572 (14.3)	2349 (14.6)	223 (11.6)	
EF > 50%, preserved	4715 (26.2)	4240 (26.4)	475 (24.6)	
EF missing	6122 (34.0)	5321 (33.1)	801 (41.5)	
Conditions				
Comorbidity index, mean (SD)*	4.6 (2.7)	4.7 (2.7)	4.0 (2.6)	– 0.29
Dementia	5254 (29.2)	4378 (27.2)	876 (45.4)	0.38
Delirium	691 (3.8)	543 (3.4)	148 (7.8)	0.19
Chronic lung disease	7597 (42.2)	6874 (42.8)	723 (37.4)	– 0.10
Diabetes	9151 (50.8)	8279 (51.5)	872 (45.2)	– 0.13
Hypothyroidism	2576 (14.3)	2356 (14.7)	220 (11.4)	– 0.09
Chronic kidney disease	1689 (9.4)	1558 (9.7)	131 (6.8)	– 0.11
Tumor history	3141 (17.4)	2849 (17.7)	294 (15.2)	– 0.07
Obesity	3689 (20.5)	3401 (21.2)	288 (14.9)	– 0.16
Weight loss	1652 (9.2)	1487 (9.3)	165 (8.5)	– 0.02
Anemia	6745 (37.5)	6157 (38.3)	588 (30.5)	– 0.17
Alcohol use disorder	1257 (7.0)	1114 (6.9)	143 (7.4)	0.02
Substance use disorder	557 (3.1)	509 (3.2)	48 (2.5)	– 0.04
Psychosis	2040 (11.3)	1783 (11.1)	257 (13.3)	0.07
Depression	3934 (21.9)	3551 (22.1)	383 (19.8)	– 0.06
Healthcare utilization in previous year, \$, mean (SD)†	29,160 (37,147)	29,897 (37,691)	23,024 (31,612)	– 0.20
Index hospitalization				
Admission LOS, days, mean (SD)	10.5 (8.8)	9.9 (8.1)	15.8 (11.6)	0.60
Type of admission				0.17
Medicine	15,591 (86.6)	13,937 (86.7)	1654 (85.7)	
Surgery	1774 (9.8)	1529 (9.5)	245 (12.7)	
Psychiatry	643 (3.6)	611 (3.8)	32 (1.7)	
ICU stay during admission	2585 (14.4)	2110 (13.1)	475 (24.6)	0.30
Mechanical ventilation	794 (4.4)	508 (3.2)	286 (14.8)	0.42
Palliative care	2244 (12.5)	1880 (11.7)	364 (18.9)	0.20
SNF admission assessment				
Cognitive function‡				0.53
Intact	9466 (52.7)	8834 (55.2)	632 (32.9)	
Mild impairment	5212 (29.0)	4624 (28.8)	588 (30.6)	
Moderate impairment	2776 (15.5)	2184 (13.6)	592 (30.8)	
Severe impairment	495 (2.8)	386 (2.4)	109 (5.7)	
ADL dependency score, mean (SD)§	16.2 (5.1)	16.1 (5.1)	16.8 (5.2)	0.14

Characteristics reported as number (percent (%)) unless otherwise indicated

ADL activities of daily living, EF ejection fraction, ICU intensive care unit, LOS length of stay, SNF skilled nursing facility

*Sum of the number of conditions listed in the set of comorbidity measures developed by Elixhauser et al.

†Sum of inpatient, outpatient (including emergency department), and pharmacy costs in the year prior to index hospitalization. Presents costs in terms of US dollars (not inflation adjusted)

‡Derived from the Minimum Data Set Cognitive Function Scale, where higher scores indicate greater impairment in cognition

§Derived from the Minimum Data Set 28-point scale of independence in activities of daily living, where higher scores indicate greater dependency in activities of daily living

may perceive the medication as chronic rather than short-term therapy.

Documenting the indication for antipsychotics, the intended duration of therapy, and a written plan if antipsychotics are intended for use after hospital discharge may help to reduce the inappropriate long-term continuation of antipsychotics. Clear communication is especially important since little evidence supports off-label antipsychotic prescribing for

indications such as delirium and behavioral and psychological symptoms of dementia,^{22–25} and if needed, the lowest effective dose should be administered for a short duration.^{25,49–52}

Guidelines recommend discontinuing inpatient antipsychotics when the severe or distressing symptoms of delirium resolve, ideally before hospital discharge.^{51,52} The treatment duration for behavioral and psychological symptoms of dementia is less clear, although a trial of antipsychotic therapy may last several

Table 7 Univariable Model Estimating Odds of Continuing an Antipsychotic into a Skilled Nursing Facility After Hospital Discharge, Among Participants with Inpatient Antipsychotic Initiation

Characteristic	Odds ratio	95% confidence interval		P value
Age, per 5 years	1.02	0.96	1.08	0.50
Female	1.29	0.70	2.40	0.42
Race/ethnicity				
Non-Hispanic White	Reference			
Non-Hispanic Black	1.17	0.88	1.57	0.28
Hispanic	0.38	0.16	0.90	0.03
Other	1.83	0.93	3.60	0.08
Heart failure type				
EF 0–40%, reduced	Reference			
EF 40–50%, borderline	0.77	0.51	1.17	0.23
EF > 50%, preserved	1.03	0.75	1.42	0.84
EF missing	1.04	0.78	1.38	0.81
Conditions				
Comorbidity index*				
Comorbidity index ≥ 6	Reference			
Comorbidity index 3–5	1.27	0.96	1.68	0.10
Comorbidity index 0–2	1.39	1.04	1.86	0.03
Dementia	2.21	1.77	2.76	< 0.001
Delirium	1.67	1.15	2.42	0.007
Chronic lung disease	0.72	0.57	0.91	0.006
Diabetes	0.79	0.64	0.99	0.04
Hypothyroidism	1.12	0.80	1.57	0.50
Chronic kidney disease	0.73	0.46	1.18	0.20
Tumor history	0.85	0.62	1.16	0.30
Obesity	0.62	0.44	0.87	0.006
Weight loss	1.03	0.70	1.51	0.90
Anemia	0.78	0.61	1.00	0.05
Alcohol use disorder	0.73	0.46	1.15	0.17
Substance use disorder	1.71	0.92	3.18	0.09
Psychosis	1.69	1.26	2.27	< 0.001
Depression	0.89	0.67	1.18	0.42
Healthcare utilization in previous year, per \$5000†	0.97	0.95	0.99	0.009
Index hospitalization LOS				
≥ 15 days	Reference			
8–14 days	1.04	0.81	1.35	0.74
1–7 days	1.19	0.91	1.56	0.21
Type of admission				
Medicine	Reference			
Surgery	0.79	0.55	1.12	0.18
Psychiatry	3.57	1.77	7.22	< 0.001
ICU stay during index hospitalization	0.68	0.52	0.89	0.005
Mechanical ventilation during index hospitalization	0.59	0.42	0.84	0.003
Cognitive function‡				
Intact	Reference			
Mild impairment	0.96	0.72	1.29	0.79
Moderate impairment	1.78	1.36	2.34	< 0.001
Severe impairment	1.91	1.21	3.02	0.006
ADL dependency score§				
≥ 20	Reference			
15–19	0.85	0.66	1.10	0.21
0–14	0.81	0.61	1.09	0.17
Day of index hospital admission antipsychotic started				
Day > 7 of hospital admission	Reference			
Day 5–7 of hospital admission	1.03	0.72	1.47	0.87
Day 0–4 of hospital admission	1.54	1.16	2.04	0.003
Proportion of days antipsychotics administered, per 10% increase	1.09	1.08	1.10	< 0.001
Type of antipsychotic during index hospitalization				
Both typical and atypical	Reference			
Typical only	0.16	0.11	0.21	< 0.001
Atypical only	0.65	0.50	0.83	< 0.001
Antipsychotic route of administration during index hospitalization				
Both oral and parenteral	Reference			
Oral only	0.73	0.58	0.93	0.01
Parenteral only	0.06	0.04	0.11	< 0.001
Potentially excessive antipsychotic dosing during admission	0.34	0.25	0.47	< 0.001

Model adjusted for random effects of hospitals and skilled nursing facilities

EF ejection fraction, LOS length of stay, ICU intensive care unit, ADL activities of daily living

*Sum of the number of conditions listed in the set of comorbidity measures developed by Elixhauser et al.

†Sum of inpatient, outpatient (including emergency department), and pharmacy costs in the year prior to index hospitalization. Presents costs in terms of US dollars (not inflation adjusted)

‡Derived from the Minimum Data Set Cognitive Function Scale, where higher scores indicate greater impairment in cognition

§Derived from the Minimum Data Set 28-point scale of independence in activities of daily living, where higher scores indicate greater dependency in activities of daily living

weeks to months.⁵⁰ Regardless of the treatment response, an attempt should be made to taper and withdraw (i.e., deprescribe) antipsychotics due to the risk of severe medication adverse effects. If antipsychotics are intended for use after hospital discharge, hospital providers should provide a written plan to the SNF for tapering and withdrawing therapy so the medications are not continued long-term unnecessarily. Future research should examine if the factors driving antipsychotic continuation after hospital discharge differ by indication to guide future interventions that reduce potentially inappropriate antipsychotic continuation into SNFs.

Describing characteristics associated with continuing antipsychotics into SNFs after hospital discharge is an essential step toward guiding future quality improvement interventions. Based on our results, patients with a diagnosis of dementia or psychosis and a higher proportion of inpatient days with antipsychotic use, and those who start antipsychotics after day 7 of the hospital stay, are more likely to continue antipsychotics into SNFs after hospital discharge. Developing and validating formal risk stratification tools may be highly useful to identify such patients who may benefit most from antipsychotic medication review and/or deprescribing interventions. These interventions may include “timeouts,” which have been previously described in relation to antibiotic stewardship,⁵³ where clinicians would reassess antipsychotic doses and the continued need for antipsychotics over the course of the hospitalization. Implementing structured antipsychotic tapering and discontinuation protocols may also be beneficial.⁵⁴ Integrating these reminders, protocols, and risk stratification tools into the electronic medical record systems of both the hospital and the SNF involved in a patient’s care may be a potential approach to improve an intervention’s efficiency and uptake into routine workflow.

Our results should be interpreted in light of several limitations. First, our results may not generalize to female patients, individuals hospitalized outside of the VA health system, or those discharged to VA-affiliated SNFs. Second, we did not have information on some variables that may influence the decision to start antipsychotics inpatient or continue them after hospital discharge, including the indication for antipsychotics, behavioral problems during hospitalization (e.g., physically abusive to staff), inpatient consultative services (e.g., psychiatry), or facility-level characteristics.^{13, 55} Third, our study was not designed to examine antipsychotic polypharmacy for individuals receiving more than one antipsychotic in a given day. Finally, a large proportion of admissions were missing a recent ejection fraction, which limits the interpretation of HF type in our study population. Despite these limitations, to our knowledge, this is the first study describing antipsychotic use patterns and predictors of antipsychotic continuation for patients hospitalized with HF and discharged to SNFs.

In conclusion, we found that antipsychotics were initiated fairly often during HF admissions and were commonly continued into SNFs after discharge. A majority of participants who continued antipsychotics into SNFs remained on the

medications at their next SNF follow-up assessment. To reduce the potentially inappropriate and harmful continuation of antipsychotics into SNFs after hospital discharge, future interventions should focus on improving processes to review and communicate antipsychotic indications, doses, and plans to continue therapy throughout the hospital admission and at transitions of care.

Corresponding Author: Melissa R. Riester, PharmD; Department of Health Services, Policy, and Practice, Brown University School of Public Health, Providence, RI, USA (e-mail: Melissa_riester@brown.edu).

Funding VA Health Services Research and Development (CIN 13-419).

Role of the Funding Source The funding organization was not involved in the design or conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

Financial Support Some authors are VA employees (L.J., S.E., J.L.R., J.E.M., N.M.R-P., C.M., L.Q., W-C.W., and A.R.Z.). The content and views expressed in this article are those of the authors and do not necessarily reflect the position or official policies of the United States Government or the US Department of Veterans Affairs. This work was also partially supported by the William S. Middleton Veteran Affairs Hospital, Madison, WI (Dr. Rogus-Pulia, GRECC Manuscript 010-2021); Center of Innovation in Long-term Services and Supports at the Providence VA Medical Center via the Office of Academic Affiliation’s Advanced Fellowship in Health Services Research (Dr. Madrigal); and National Institute on Aging (R21AG061632, R01AG065722, RF1AG061221, R24AG064025, and R01AG062492 to Dr. Zullo).

Declarations:

Conflict of Interest: The authors declare that they do not have a conflict of interest.

REFERENCES

1. **Virani S. S., Alonso A., Benjamin E. J., et al.** Heart Disease and Stroke Statistics-2020 Update: A Report From the American Heart Association. *Circulation*. 2020;141(9):e139-e596.
2. **Allen L. A., Hernandez A. F., Peterson E. D., et al.** Discharge to a skilled nursing facility and subsequent clinical outcomes among older patients hospitalized for heart failure. *Circ Heart Fail*. 2011;4(3):293-300.
3. **Orr N. M., Boxer R. S., Dolansky M. A., et al.** Skilled Nursing Facility Care for Patients With Heart Failure: Can We Make It “Heart Failure Ready?”. *J Card Fail*. 2016;22(12):1004-14.
4. **Orr N. M., Forman D. E., De Matteis G., et al.** Heart Failure Among Older Adults in Skilled Nursing Facilities: More of a Dilemma Than Many Now Realize. *Curr Geriatr Rep*. 2015;4(4):318-26.
5. **Orr NM, Jones CD, Daddato AE, et al.** Post-acute Care for Patients with Heart Failure. *Curr Cardiovasc Risk Rep*. 2018;12(18).
6. **Mansur N., Weiss A., Beloesky Y.** Relationship of in-hospital medication modifications of elderly patients to postdischarge medications, adherence, and mortality. *Ann Pharmacother*. 2008;42(6):783-9.

7. **Harris C. M., Sridharan A., Landis R., et al.** What happens to the medication regimens of older adults during and after an acute hospitalization? *J Patient Saf.* 2013;9(3):150-3.
8. **Weir D. L., Lee T. C., McDonald E. G., et al.** Both New and Chronic Potentially Inappropriate Medications Continued at Hospital Discharge Are Associated With Increased Risk of Adverse Events. *J Am Geriatr Soc.* 2020;68(6):1184-92.
9. **Goyal P., Kneifati-Hayek J., Archambault A., et al.** Prescribing Patterns of Heart Failure-Exacerbating Medications Following a Heart Failure Hospitalization. *JACC Heart Fail.* 2020;8(1):25-34.
10. **Unlu O., Levitan E. B., Reshetnyak E., et al.** Polypharmacy in Older Adults Hospitalized for Heart Failure. *Circ Heart Fail.* 2020;13(11):e006977.
11. **Herzig S. J., Rothberg M. B., Guess J. R., et al.** Antipsychotic Use in Hospitalized Adults: Rates, Indications, and Predictors. *J Am Geriatr Soc.* 2016;64(2):299-305.
12. **Loh K. P., Ramdass S., Garb J. L., et al.** From hospital to community: use of antipsychotics in hospitalized elders. *J Hosp Med.* 2014;9(12):802-4.
13. **Herzig S. J., Rothberg M. B., Guess J. R., et al.** Antipsychotic medication utilization in nonpsychiatric hospitalizations. *J Hosp Med.* 2016;11(8):543-9.
14. **Muench J., Hamer A. M.** Adverse effects of antipsychotic medications. *Am Fam Physician.* 2010;81(5):617-22.
15. **Salvo F., Pariente A., Shakir S., et al.** Sudden cardiac and sudden unexpected death related to antipsychotics: A meta-analysis of observational studies. *Clin Pharmacol Ther.* 2016;99(3):306-14.
16. **Liu Y., Xu J., Fang K., et al.** Current antipsychotic agent use and risk of venous thromboembolism and pulmonary embolism: a systematic review and meta-analysis of observational studies. *Ther Adv Psychopharmacol.* 2021;11:2045125320982720.
17. **Zivkovic S., Koh C. H., Kaza N., et al.** Antipsychotic drug use and risk of stroke and myocardial infarction: a systematic review and meta-analysis. *BMC Psychiatry.* 2019;19(1):189.
18. **Gareri P., De Fazio P., Manfredi V. G., et al.** Use and safety of antipsychotics in behavioral disorders in elderly people with dementia. *J Clin Psychopharmacol.* 2014;34(1):109-23.
19. **Basciotta M., Zhou W., Ngo L., et al.** Antipsychotics and the Risk of Mortality or Cardiopulmonary Arrest in Hospitalized Adults. *J Am Geriatr Soc.* 2020;68(3):544-50.
20. U.S. Food and Drug Administration. FDA Issues Public Health Advisory for Antipsychotic Drugs used for Treatment of Behavioral Disorders in Elderly Patients. Available at: <http://psychrights.org/drugs/ANS01350.html>. Accessed March 2, 2021.
21. FDAnews. FDA Expands Mortality Warnings on Antipsychotic Drugs. Available at: <https://www.fdanews.com/articles/107752-fda-expands-mortality-warnings-on-antipsychotic-drugs>. Accessed March 2, 2021.
22. **Flaherty J. H., Gonzales J. P., Dong B.** Antipsychotics in the treatment of delirium in older hospitalized adults: a systematic review. *J Am Geriatr Soc.* 2011;59 Suppl 2:S269-76.
23. **Nikooie R., Neufeld K. J., Oh E. S., et al.** Antipsychotics for Treating Delirium in Hospitalized Adults: A Systematic Review. *Ann Intern Med.* 2019;171(7):485-95.
24. **Oh E. S., Needham D. M., Nikooie R., et al.** Antipsychotics for Preventing Delirium in Hospitalized Adults: A Systematic Review. *Ann Intern Med.* 2019;171(7):474-84.
25. **Tampi R. R., Tampi D. J., Balachandran S., et al.** Antipsychotic use in dementia: a systematic review of benefits and risks from meta-analyses. *Ther Adv Chronic Dis.* 2016;7(5):229-45.
26. **Morandi A., Vasilevskis E., Pandharipande P. P., et al.** Inappropriate medication prescriptions in elderly adults surviving an intensive care unit hospitalization. *J Am Geriatr Soc.* 2013;61(7):1128-34.
27. **Marshall J., Herzig S. J., Howell M. D., et al.** Antipsychotic utilization in the intensive care unit and in transitions of care. *J Crit Care.* 2016;33:119-24.
28. **Tomichek J. E., Stollings J. L., Pandharipande P. P., et al.** Antipsychotic prescribing patterns during and after critical illness: a prospective cohort study. *Crit Care.* 2016;20(1):378.
29. **Johnson K. G., Fashoyin A., Madden-Fuentes R., et al.** Discharge Plans for Geriatric Inpatients with Delirium: A Plan to Stop Antipsychotics? *J Am Geriatr Soc.* 2017;65(10):2278-81.
30. **Flurie R. W., Gonzales J. P., Tata A. L., et al.** Hospital delirium treatment: Continuation of antipsychotic therapy from the intensive care unit to discharge. *Am J Health Syst Pharm.* 2015;72(23 Suppl 3):S133-9.
31. **Corbett C. F., Setter S. M., Daratha K. B., et al.** Nurse identified hospital to home medication discrepancies: implications for improving transitional care. *Geriatr Nurs.* 2010;31(3):188-96.
32. **King B. J., Gilmore-Bykovskiy A. L., Roiland R. A., et al.** The consequences of poor communication during transitions from hospital to skilled nursing facility: a qualitative study. *J Am Geriatr Soc.* 2013;61(7):1095-102.
33. Centers for Medicare and Medicaid Services. Minimum Data Set (MDS) 3.0 Resident Assessment Instrument (RAI) Manual. Available at: <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/MDS30RAIManual>. Accessed March 2, 2021.
34. **Elixhauser A., Steiner C., Harris D. R., Coffey R. M.** Comorbidity measures for use with administrative data. *Med Care.* 1998;36(1):8-27.
35. **Thomas K. S., Dosa D., Wysocki A., Mor V.** The Minimum Data Set 3.0 Cognitive Function Scale. *Med Care.* 2017;55(9):e68-e72.
36. **Morris J. N., Fries B. E., Morris S. A.** Scaling ADLs within the MDS. *J Gerontol A Biol Sci Med Sci.* 1999;54(11):M546-53.
37. U.S. Food and Drug Administration. Information on Conventional Antipsychotics. Available at: <https://wayback.archive-it.org/7993/20170722033234/https://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm107211.htm>. Accessed March 2, 2021.
38. U.S. Food and Drug Administration. Atypical Antipsychotic Drugs Information. Available at: <https://www.fda.gov/drugs/postmarket-drug-safety-information-patients-and-providers/atypical-antipsychotic-drugs-information>. Accessed March 2, 2021.
39. Centers for Medicare and Medicaid Services. National Partnership to Improve Dementia Care in Nursing Homes; Interim Changes to Appendix P State Operations Manual (SOM). Available at: <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertificationGenInfo/Downloads/SC-Letter-13-35-Advanced-Copy.pdf>. Accessed March 2, 2021.
40. **Sullivan G. M., Feinn R.** Using Effect Size-or Why the P Value Is Not Enough. *J Grad Med Educ.* 2012;4(3):279-82.
41. **Pariente A., Fourrier-Réglat A., Ducruet T., et al.** Antipsychotic use and myocardial infarction in older patients with treated dementia. *Arch Intern Med.* 2012;172(8):648-53; discussion 54-5.
42. **Brauer R., Smeeth L., Anaya-Izquierdo K., et al.** Antipsychotic drugs and risks of myocardial infarction: a self-controlled case series study. *Eur Heart J.* 2015;36(16):984-92.
43. **Wu C. S., Tsai Y. T., Tsai H. J.** Antipsychotic drugs and the risk of ventricular arrhythmia and/or sudden cardiac death: a nation-wide case-crossover study. *J Am Heart Assoc.* 2015;4(2).
44. **Straus S. M., Bleumink G. S., Dieleman J. P., et al.** Antipsychotics and the risk of sudden cardiac death. *Arch Intern Med.* 2004;164(12):1293-7.
45. **Loh K. P., Ramdass S., Garb J. L., et al.** Long-term outcomes of elders discharged on antipsychotics. *J Hosp Med.* 2016;11(8):550-5.
46. **Stock K. J., Amuah J. E., Lapane K. L., et al.** Prevalence of, and Resident and Facility Characteristics Associated With Antipsychotic Use in Assisted Living vs. Long-Term Care Facilities: A Cross-Sectional Analysis from Alberta, Canada. *Drugs Aging.* 2017;34(1):39-53.
47. **Levinson D.** Medicare atypical antipsychotic drug claims for elderly nursing home residents. Department of Health and Human Services Office of Inspector General; 2011.
48. **Zhang Y., Letuchy E. M., Carnahan R. M.** Where Are Antipsychotics Prescribed in Nursing Homes Initiated? *J Am Geriatr Soc.* 2018;66(6):1082-8.
49. **Targum S. D.** Treating Psychotic Symptoms in Elderly Patients. *Prim Care Companion. J Clin Psychiatry.* 2001;3(4):156-63.
50. **Reus V. I., Fochtman L. J., Eyler A. E., et al.** The American Psychiatric Association Practice Guideline on the Use of Antipsychotics to Treat Agitation or Psychosis in Patients With Dementia. *Am J Psychiatry.* 2016;173(5):543-6.
51. **Thom R. P., Levy-Carrick N. C., Bui M., et al.** Delirium. *Am J Psychiatry.* 2019;176(10):785-93.
52. **Devlin J. W., Skrobik Y., Gélinas C., et al.** Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation,

Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU. *Crit Care Med.* 2018;46(9):e825-e73.

53. CDC. Core Elements of Hospital Antibiotic Stewardship Programs. Atlanta, GA: US Department of Health and Human Services, CDC; 2019. Available at: <https://www.cdc.gov/antibiotic-use/core-elements/hospital.html>.
54. D'Angelo R. G., Rincavage M., Tata A. L., et al. Impact of an Antipsychotic Discontinuation Bundle During Transitions of Care in Critically Ill Patients. *J Intensive Care Med.* 2019;34(1):40-7.

APPENDIX

Enhanced definition of dementia diagnosis using Medicare claims data

Based on prior experience working with these data, we hypothesized that dementia diagnoses would be underreported in Veterans Health Administration electronic medical records. Therefore, we used an enhanced definition that ascertained dementia diagnoses from *International Classification of Diseases, Ninth Revision, Clinical Modification* code documentation on inpatient and outpatient encounters in the year prior to the index skilled nursing facility admission using both

Veterans Health Administration electronic medical records and Medicare claims data. Among 18,008 participants without previous outpatient antipsychotic use, 17,165 (95.3%) were Medicare eligible during the year of the index heart failure admission/skilled nursing facility stay. Of the 1931 participants with inpatient antipsychotic initiation in the study population, 1861 (96.4%) were Medicare eligible. Medicare eligibility during the year of the index heart failure admission/skilled nursing facility stay was evenly distributed among participants who continued antipsychotics into skilled nursing facilities versus discontinued antipsychotics at or prior to hospital discharge (96.14% vs. 96.44%).

Publisher's Note: Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.