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## Incidence of Homelessness among Veterans Newly Diagnosed with Alzheimer's Disease and Related Dementias

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### Abstract

**BACKGROUND:** To determine the incidence of homelessness among Veterans diagnosed with Alzheimer's disease and related dementias (ADRD).

**METHODS:** We used Veterans Affairs (VA) administrative records to identify Veterans with a new ADRD diagnosis anytime between 2010–2019. Among these Veterans, we calculated the incidence of homelessness, and estimated the association between demographics, comorbidities and hazard of homelessness.

**RESULTS:** The incidence rate of homelessness was highest for Veterans diagnosed with ADRD between 18–49 years of age (14.9 per 1,000 person-years; 95%CI: 13.6, 16.3) and lowest for Veterans diagnosed with ADRD at 90+ years (0.3 per 1,000 person-years; 95%CI: 0.2, 0.4). The adjusted hazard ratio of homelessness was higher for unmarried Veterans, and those with alcohol use disorder, substance use disorder, liver disease, depression, hypertension, lung disease, post-traumatic stress disorder and psychoses.

**CONCLUSIONS:** Younger age and being unmarried at the time of ADRD diagnosis are associated with a greater risk of experiencing homelessness.

### Keywords

housing insecurity; veterans; dementia; ADRD

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## INTRODUCTION

In 2019 approximately 37,085 Veterans in the US experienced homelessness, which is almost 50% less than the 73,362 Veterans who experienced homelessness in 2009.<sup>1</sup> The reduction in homelessness among Veterans is credited to US Department of Veterans Affairs' (VA) investments in outreach, supportive housing, and specialized clinical services.<sup>2,3</sup> Although the VA has made substantial progress in reducing homelessness, Veterans remain overrepresented among the US homeless population.<sup>4</sup> Homelessness continues to be a costly public health challenge that is associated with poor health outcomes and mortality.<sup>5-7</sup> In addition, the homeless Veteran population is aging,<sup>8,9</sup> which presents new challenges to manage the long-term care needs of housing insecure Veterans.

VA providers proactively screen and document Veterans' housing status in their medical record;<sup>10</sup> however, there is still much unknown about the factors affecting homelessness among Veterans. One study found that 3.7% of Veterans experienced a homeless episode within 5 years of military discharge.<sup>11</sup> Younger age, lower military pay grade, and a mental health condition (including substance disorder) or traumatic brain injury documented at the time of discharge were associated with an increased risk of experiencing homelessness. Another study found that the one-year incidence of homelessness among Veterans referred to specialty mental health care was highest (9.3%) for Veterans between 46–55 years of age.<sup>12</sup> This group's largest risk factors for homelessness was a diagnosed substance use disorder and not being married. Work to further understand Veteran circumstances and populations most at-risk of experiencing homelessness can inform the targeting of resources.

Many of the risk factors for homelessness are also risk factors for Alzheimer's disease and related dementias (ADRD).<sup>4,11,13</sup> For example, low-socioeconomic status, traumatic brain injury, post-traumatic stress disorder, and substance use are highly correlated with homelessness and ADRD.<sup>13</sup> Furthermore, Black, indigenous, and persons of color are over-represented in both homeless and ADRD populations.<sup>14,15</sup> In certain circumstances ADRD may be a risk factor for homelessness. People living with ADRD experience losses in cognition and functional independence.<sup>16</sup> Family caregivers may need to help manage finances and assist with bathing, dressing, and toileting.<sup>17</sup> Without a family caregiver, people living with ADRD may be unable to live safely in the community, navigate their care needs, and manage their finances. These factors may increase their risk of becoming homeless.

We used VA data to provide the first estimates on the risk of Veterans newly diagnosed with ADRD subsequently experiencing homelessness. We expected that age of ADRD diagnosis is inversely associated with incidence of homelessness. Consistent with prior studies, we also expected that Veterans unmarried at the time of their ADRD diagnosis, or those with a diagnosis for alcohol use disorder, substance use disorder, psychoses, post-traumatic

stress disorder, or traumatic brain injury are at a greater risk of eventually experiencing homelessness.

## METHODS

### Data

We used the U.S. Department of Veterans Affairs (VA) Corporate Data Warehouse and the Medicare Chronic Conditions ADRD algorithm (See Appendix 1, at end, for list of ADRD ICD-9/10 codes) to identify whether a Veteran ever received an ADRD diagnosis between 2010 and 2019. The VA Corporate Data Warehouse includes encounter coded diagnoses by VA providers and from contracted community providers. The first occurrence of an ADRD diagnosis served as the cohort entry or index date. We followed Veterans after their first ADRD diagnosis to determine whether they ever received a diagnosis for homelessness, died (either before or after a homeless diagnosis), or survived the entire follow-up period with or without a homeless diagnosis. We excluded Veterans who ever had a homeless diagnosis before an ADRD diagnosis and Veterans <18 years of age. We used ICD9 (V60.0) and ICD10 (Z59.0) codes (“Homelessness”) to determine a Veteran’s housing status (1 = ever homeless in the follow up period; 0 = never homeless in the follow up period).

### Demographic Characteristics and Comorbidities at Time of ADRD Diagnosis

We determined the age, sex, race, marital status, degree of service-connected disability (Priority 1 or other), prior combat service, and rural or urban residential area of Veterans at the time of cohort entry. Service-connected disability determines a Veteran’s eligibility for VA paid long-term care and disability pension. At cohort entry, we also determined whether a Veteran had a diagnosis in the previous year for comorbidities associated with ADRD and homelessness including alcohol dependence, substance abuse, rheumatic disease, kidney disease, liver disease, depression, diabetes, hypertension, congestive heart failure, lung disease, stroke, post-traumatic stress disorder, schizophrenia/psychosis, or traumatic brain injury.

### Statistical Analysis

We calculated descriptive characteristics of the sample at cohort entry, and we compared the demographic characteristics of Veterans who experienced homelessness after an ADRD diagnosis to those who remained stably housed using  $\chi^2$  and *t* tests. We calculated the crude incidence rate of homelessness by age of ADRD diagnosis (18–49 years, 50–59 years, 60–69 years, 70–79 years, 80–89 years, 90+ years) per 1,000 person-years. To estimate incidence rates, we calculated the denominator as the number of person-years from cohort entry until a Veteran received a homeless ICD-9/10 code (event of interest), death (prior to a homeless ICD-9/10 code), or reached the end of the follow-up period. The numerator was the number of Veterans who received a homeless diagnosis during the follow up period. Finally, we estimated a cox proportional hazards model to determine the association between demographic characteristics, comorbidities, and risk of homelessness. We graphically examined the proportional hazards assumption.

Our study was approved by the Providence VAMC Institutional Review Board and Research and Development committees.

## RESULTS

We identified 383,478 with a new ADRD diagnosis between 2010 and 2019. The average (SD) age of Veterans at time of ADRD diagnosis was 78.5 (10.9), most were men (97.5%), white (77.2%), and married (63.3%) (Table 1). Among these Veterans, 3,200 (0.83%) eventually received a homeless diagnosis. There were notable differences between Veterans who received a homeless diagnosis compared to those who remained stably housed (Table 1). At cohort entry, Veterans who eventually received a homeless diagnosis were significantly younger (63.7 [SD = 15.2] vs. 78.7 [SD = 10.8];  $p < 0.001$ ), more likely to be Black (22.7% vs. 10.4%;  $p < 0.001$ ), and more likely to be unmarried (71.6% vs. 36.4%;  $p < 0.001$ ) than their stably housed counterparts. In addition, Veterans who received a homeless diagnosis were more likely to have a diagnosis for alcohol abuse (14.7% vs. 2.9%;  $p < 0.001$ ), substance abuse (6.1% vs. 1.0%;  $p < 0.001$ ), liver disease (6.0% vs. 2.2%;  $p < 0.001$ ), depression (35.7% vs. 16.5%;  $p < 0.001$ ), hypertension (55.5% vs. 53.6%;  $p = 0.001$ ), lung disease (17.8% vs. 14.9%;  $p < 0.001$ ), post-traumatic stress disorder (19.3% vs. 8.5%;  $p < 0.001$ ), psychosis (30.6% vs. 9.1%;  $p < 0.001$ ), traumatic brain injury (8.6% vs. 2.4%;  $p < 0.001$ ), and valvular disease (3.7% vs. 4.8%;  $p = 0.003$ ) than Veterans who remained stably housed.

The crude incidence rate of homelessness decreased as age of ADRD diagnosis increased (Table 2). Specifically, the incidence rate of homelessness among Veterans diagnosed with ADRD between 18–49 years of age was 14.9 (95% CI: 13.6, 16.4) per 1,000 person-years. For Veterans diagnosed with ADRD who were 90+ years, the incidence of homelessness was 0.3 (95% CI: 0.2, 0.4) per 1,000 person-years.

The adjusted hazard ratios (HR) for age and being unmarried at the time of an ADRD diagnosis were 0.94 (95%CI: 0.93, 0.94) and 3.30 (95%CI: 3.04, 3.58), respectively. (Table 3). The hazard of homelessness was higher for Black Veterans (HR 1.67, 95%CI: 1.52, 1.82) compared to White Veterans. In addition, the hazard of homelessness was higher for Veterans who had a diagnosis for alcohol use disorder (HR 1.87, 95%CI: 1.67, 2.10), substance use disorder (HR 2.15, 95%CI: 1.84, 2.53), liver disease (HR 1.24, 95%CI: 1.06, 1.45), depression (HR 1.41, 95%CI: 1.30, 1.53), hypertension (HR 1.22, 95%CI: 1.12, 1.33), lung disease (HR 1.12, 95%CI: 1.02, 1.24), post-traumatic stress disorder (HR 1.26, 95%CI: 1.13, 1.40) and psychoses (HR 1.63, 95%CI: 1.49, 1.77).

## DISCUSSION

We provide the first estimates on the incidence of homelessness among Veterans following a new ADRD diagnosis. Only a few studies have examined the incidence of homelessness among Veterans and they do so in a population referred to mental health services and a population discharged from the military.<sup>11,12</sup> Compared to these studies, we find high absolute rates of homelessness among younger Veterans diagnosed with ADRD and low rates of homelessness among older Veterans diagnosed with ADRD. We also find similar

sociodemographic (e.g., not being married) and comorbid (e.g., alcohol and drug diagnoses) risk factors are strongly correlated with experiencing homelessness.

There were noticeable differences between Veterans who eventually received a homeless diagnosis compared to those who remained stably housed. As hypothesized, we found that age of ADRD diagnosis was inversely associated with homelessness, and unmarried Veterans had a greater risk of experiencing homelessness. Younger Veterans with an ADRD diagnosis may have less time to accumulate financial and social/family resources to safely age in the community. For example, a younger Veteran with alcohol use disorder and ADRD may lack strong social supports (e.g., children not old enough to provide caregiving; not married). Limited social ties is a notable risk factor for homelessness,<sup>18</sup> and risks may be amplified among people who cannot independently engage in community activities. Providing Veterans with resources to build social supports may reduce the risk of homelessness. Finally, younger people with an ADRD diagnosis may not have health insurance outside of their VA benefits, they may not have stable income, and because of their care needs may be prone to spend down their assets. Furthermore, their cognitive impairments and potentially limited family resources may make it challenging to navigate Medicaid and Social Security Disability benefits.

Our findings highlight the importance of screening for housing instability for Veterans living with ADRD. The VA has integrated a homeless screening instrument into clinical practice,<sup>10</sup> but screening is dependent on a Veteran seeking care or being identified during outreach efforts. Not all Veterans regularly receive their care from the VA. In addition, Veterans with ADRD and without a family caregiver may be less likely to engage with the healthcare system;<sup>19</sup> yet, these are the Veterans at greatest risk of experiencing homelessness. Systematically identifying whether a Veteran has a caregiver may help pinpoint those with minimal social support. The importance of identifying strategies to mitigate homelessness among potentially isolated people living with ADRD is highlighted by changing demographics. In the coming decades more people are expected to be living alone with ADRD.<sup>20,21</sup> Finally, we examined the risk of homelessness after an ADRD diagnosis. An important next step is understanding the risk of ADRD following a homeless diagnosis.

As ADRD is a disease of progressive functional decline, people living with ADRD eventually need full-time care. Full-time in-home care is costly and may not be possible without family caregivers, adequate financial resources, or stable housing.<sup>22</sup> For some Veterans living with ADRD and without family/financial resources, nursing homes could provide housing and care needs. Nursing homes must be prepared for the unique needs of Veterans at risk for homelessness.<sup>23</sup> This includes being able to manage substance abuse and complex mental health diagnoses. The VA also has home and community-based services which could help Veterans with ADRD and at-risk for homelessness live in the community longer.

Our study has several limitations. We used administrative data to identify Veterans with an ADRD and homeless diagnosis. ADRD is underdiagnosed in administrative data, providers do not systematically screen for ADRD, and diagnosed ADRD is different than true disease

prevalence.<sup>24</sup> In addition, an ADRD diagnosis code may be used as a catch-all for multiple cognitive disorders. Finally, ADRD diagnosis codes do not reflect severity of cognitive or functional activity limitations. The VA proactively seeks to identify Veterans experiencing homelessness, but we still likely underestimate the true incidence of homelessness because receiving a diagnosis is dependent on seeking care or being identified during outreach efforts. Importantly, administrative data does not have measures on contextual factors (availability caregivers, number/age of children, financial resources) which may contribute to the risk of becoming homeless. Finally, we do not have data on healthcare utilization or diagnoses outside the VA.

## CONCLUSIONS AND IMPLICATIONS

In conclusion, age at time of ADRD diagnosis is inversely associated with the risk of eventually experiencing homelessness. Not being married, diagnosis for alcohol use disorder, substance use disorder, post-traumatic stress disorder, and psychoses are also associated with a greater risk of a Veteran living with ADRD experiencing homelessness. Efforts should be made to systematically identify family resources of Veterans at the time of an ADRD diagnosis. Nursing homes or community housing with wraparound clinical services could help prevent homelessness among Veterans with ADRD and less family/financial resources.

## Conflict of Interest Disclosures

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## Appendix 1.: Chronic Condition Warehouse Alzheimer's Disease and Related Dementias (ADRD) ICD-10 Codes

ICD-10 Code	Description
F01.50	Vascular dementia without behavioral disturbance
F01.51	Vascular dementia with behavioral disturbance
F02.80	Dementia in other diseases classified elsewhere without behavioral disturbance
F02.81	Dementia in other diseases classified elsewhere with behavioral disturbance
F03.90	Unspecified dementia without behavioral disturbance
F03.91	Unspecified dementia with behavioral disturbance
F04	Amnesic disorder due to known physiological condition
G13.8	Systemic atrophy primarily affecting central nervous system in other diseases classified elsewhere
F05	Delirium due to known physiological condition

F06.1	Catatonic disorder due to known physiological condition
F06.8	Other specified mental disorders due to known physiological condition
G30.0	Alzheimer's disease with early onset
G30.1	Alzheimer's disease with late onset
G30.8	Other Alzheimer's disease
G30.9	Alzheimer's disease, unspecified
G31.1	Senile degeneration of brain, not elsewhere classified
G31.2	Degeneration of nervous system due to alcohol
G31.01	Pick's disease
G31.09	Other frontotemporal dementia
G94	Other disorders of brain in diseases classified elsewhere
R41.81	Age-related cognitive decline
R54	Age-related physical debility
<b>ICD-9 Code</b>	
331.0	Alzheimer's disease
331.11	Pick's disease
331.19	Other frontotemporal dementia
331.2	Senile degeneration of brain
331.7	Cerebral degeneration in diseases classified elsewhere
290.0	Senile dementia, uncomplicated
290.10	Presenile dementia
290.11	Presenile dementia with delirium
290.12	Presenile dementia with delusional features
290.13	Presenile dementia with depressive features
290.20	Senile dementia with delusional features
290.21	Senile dementia with depressive features
290.3	Senile dementia with delirium
290.40	Vascular dementia, uncomplicated
290.41	Vascular dementia, with delirium
290.42	Vascular dementia, with delusions
290.43	Vascular dementia, with depressed mood
290.0	Senile dementia, uncomplicated
294.10	Dementia in conditions classified elsewhere without behavioral disturbance
294.11	Dementia in conditions classified elsewhere with behavioral disturbance
294.20	Dementia, unspecified, without behavioral disturbance
294.21	Dementia, unspecified, with behavioral disturbance
294.8	Other persistent mental disorders due to conditions classified elsewhere
797	Senility without mention of psychosis



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**Table 1.**

Demographic Characteristics of Veterans at Time of ADRD Diagnosis

	Total	Veterans with ADRD who Eventually Received a Homeless Diagnosis	Veterans with ADRD who Never Received a Homeless Diagnosis
	N=383,478	N=3,200	N=380,278
Age, mean (SD)	78.55 (10.93)	63.70 (15.16)	78.67 (10.80)***
Male, n (%)	373,716 (97.45%)	3,047 (95.22%)	370,669 (97.47%)***
Race, n (%)			
White	296,027 (77.20%)	2,195 (68.59%)	293,832 (77.27%)***
Black	40,219 (10.49%)	727 (22.72%)	39,492 (10.39%)***
Other	47,232 (12.32%)	278 (8.69%)	46,954 (12.35%)***
Not Married, n (%)	132,641 (36.66%)	2,156 (71.56%)	130,485 (36.37%)***
Service-Connected Disability (Priority 1 Status), n (%)	82,786 (21.67%)	620 (19.53%)	82,166 (21.69%)**
Served in Combat, n (%)	48,802 (12.73%)	535 (16.72%)	48,267 (12.69%)***
Rural, n (%)	123,327 (32.18%)	742 (23.21%)	122,585 (32.26%)***
<b>Comorbidities, n (%)</b>			
Alcohol	11,732 (3.06%)	471 (14.72%)	11,261 (2.96%)***
Substance abuse	4,011 (1.05%)	196 (6.12%)	3,815 (1.00%)***
Rheumatic disease	6,140 (1.60%)	46 (1.44%)	6,094 (1.60%)
Renal disease	41,479 (10.82%)	244 (7.62%)	41,235 (10.84%)***
Liver disease	8,511 (2.22%)	193 (6.03%)	8,318 (2.19%)***
Depression	63,689 (16.61%)	1,143 (35.72%)	62,546 (16.45%)***
Diabetes	101,978 (26.59%)	835 (26.09%)	101,143 (26.60%)
Hypertension	201,905 (52.65%)	1,775 (55.47%)	200,130 (52.63%)**
Congestive Heart Failure	34,650 (9.04%)	244 (7.62%)	34,406 (9.05%)**
Lung Disease	57,179 (14.91%)	570 (17.81%)	56,609 (14.89%)***
Post-Traumatic Stress Disorder	32,746 (8.54%)	618 (19.31%)	32,128 (8.45%)***

	Total	Veterans with ADRD who Eventually Received a Homeless Diagnosis	Veterans with ADRD who Never Received a Homeless Diagnosis
	N=383,478	N=3,200	N=380,278
Psychoses	35,434 (9.24%)	978 (30.56%)	34,456 (9.06%) <sup>***</sup>
Traumatic Brain Injury	9,464 (2.47%)	274 (8.56%)	9,190 (2.42%) <sup>***</sup>
Valvular disease	18,271 (4.76%)	117 (3.66%)	18,154 (4.77%) <sup>**</sup>
Stroke	47,771 (12.46%)	470 (14.69%)	47,301 (12.44%) <sup>**</sup>

Notes: P-values compare homeless to stably housed and at-risk to stably housed:

\* p<0.05

\*\* p<0.01

\*\*\* p<0.001

**Table 2.** Incidence Rates of Homelessness Among Veterans Diagnosed with Alzheimer’s Disease and Related Dementias

Age at ADRD Diagnosis	Number of Veterans Diagnosed with ADRD	Number of Veterans with a Homeless Diagnosis following an ADRD Diagnosis	Person-years	Homeless Incidence Per 1,000 Person-Years (95% CI)
18–49 Years	7,300	466	31,277	14.9 (13.6, 16.3)
50–59 Years	10,479	602	48,255	12.5 (11.5, 13.5)
60–69 Years	53,082	984	251,041	3.9 (3.7, 4.2)
70–79 Years	105,189	670	462,265	1.4 (1.3, 1.6)
80–89 Years	159,507	414	807,070	0.5 (0.4 0.6)
90+	47,921	64	209,854	0.3 (0.2, 0.4)

**Table 3.**

Hazard ratio for the Association between Sociodemographic Characteristics, Comorbidities, and Homelessness (N=383,478)

	Hazard Ratio (95% Confidence Interval)
Age	0.94 (0.93, 0.94)
Male	1.34 (1.13, 1.59)
Race (ref = white)	
Black	1.67 (1.52, 1.82)
Other	0.89 (0.78, 1.02)
Not married	3.30 (3.04, 3.58)
Service-Connected Disability (Priority 1 Status)	0.54 (0.49, 0.60)
Combat experience	0.69 (0.62, 0.78)
Rural	0.67 (0.62, 0.73)
<b>Comorbidities</b>	
Alcohol use disorder	1.87 (1.67, 2.10)
Substance use disorder	2.15 (1.84, 2.53)
Rheumatic disease	0.99 (0.73, 1.34)
Renal disease	0.78 (0.67, 0.90)
Liver disease	1.24 (1.06, 1.45)
Depression	1.41 (1.30, 1.53)
Diabetes	1.08 (0.98, 1.18)
Hypertension	1.22 (1.12, 1.33)
Congestive heart failure	0.95 (0.82, 1.11)
Lung disease	1.12 (1.02, 1.24)
Post-traumatic stress disorder	1.26 (1.13, 1.40)
Psychoses	1.63 (1.49, 1.77)
Traumatic brain injury	0.98 (0.86, 1.13)
Valvular disease	0.91 (0.74, 1.11)
Stroke	0.95 (0.85, 1.05)