Racial Disparities in Healthcare Costs and Utilization in Vulnerable ADRD Patients : A Racial Decomposition Analysis Based on a Unique Registry Data

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ABSTRACT

Background: In South Carolina (SC), Alzheimer's disease and related dementias (ADRD) are major public health concerns, contributing to substantial healthcare expenditures and economic strain on individuals and the healthcare system. Understanding these disparities is essential for improving healthcare equity and patient outcomes. However, limited research has examined the contribution of racial disparities to different healthcare costs, utilization, and antihypertensive medication (AHM) use among ADRD patients in the Medicaid population. This study aimed to address this gap by analyzing the contribution of racial disparities to different healthcare expenditures, utilization, and AHM use among Medicaid beneficiaries with ADRD in SC, utilizing data from the SC Medicaid program linked to the SC Alzheimer's Disease (AD) Registry.

Methods: A cross-sectional study was performed using SC Medicaid data linked with the SC AD Registry, the nation's oldest and most extensive statewide ADRD diagnosis database. Claims data usually only captures 50-60% of the true ADRD diagnosis and lacks information on specific subtypes of ADRD. The South Carolina Alzheimer's Disease registry data, on the other hand, is the oldest, most comprehensive AD registry data in the U.S. It collects demographic and diagnostic data to estimate ADRD prevalence statewide and can be linked with various health and social datasets with proper authorization. The study population was ADRD individuals aged 65 and older, and this study used data from the SC AD Registry covering 2005 to 2021 to identify ADRD patients. Healthcare costs were assessed across multiple domains, including inpatient, outpatient, emergency room (ER), and medication expenditures, with all costs adjusted to 2024 US dollars to account for inflation. Blinder-Oaxaca (BO) decomposition method was applied. This method deconstructs disparities into three key components: (1) explained

differences (characteristic differences), which account for variations in measurable characteristics; (2) unexplained differences (coefficient differences), which reflect potential racial disparities; and (3) interaction effects, which capture the combined influence of characteristic and coefficient differences. Patient characteristics in the analysis included age, sex, residence, and marital status.

Results: A total of 7,865 Medicaid beneficiaries with ADRD were included in the study. Among them, 48.53% were White, 42.05% were Black, and 9.42% belonged to other racial groups. Racial differences between White and Black ADRD beneficiaries significantly accounted for 23.52% ($P < 0.001$), 32.96% ($P = 0.009$), and 34.37% ($P < 0.001$) of the disparities in inpatient, outpatient, and medication expenditures, respectively. Additionally, racial disparities explained 33.58% ($P = 0.017$) of the differences in inpatient visits between White and Black individuals. The analysis also found that racial disparities contributed to 28.95% ($P < 0.001$) of differences in AHM use between these two groups. When comparing White and other racial ADRD beneficiaries, racial differences significantly accounted for 33.95% ($P < 0.001$) of inpatient cost disparities and 34.92% ($P < 0.001$) of outpatient cost disparities. In addition, racial disparities explained 38.67% ($P = 0.049$) of the differences in outpatient visits and 26.36% ($P = 0.042$) of differences in AHM use between the two racial groups.

Conclusion: This study highlights the significant contribution of racial disparities to different healthcare costs, utilization, and AHM use among SC Medicaid beneficiaries with ADRD. The findings reveal that racial differences contribute substantially to variations in inpatient, outpatient, and medication expenditures, as well as healthcare utilization patterns. These results suggest that addressing racial disparities in ADRD care is essential for promoting equitable healthcare access and improving patient outcomes.

Background:

Mortality from Alzheimer's Disease and Related Dementias (ADRD) has more than doubled over the past two decades, and we don't know why[1]. South Carolina ranks number one in crude Alzheimer's Disease deaths in the USA. [2,3] The unadjusted mortality of patients with Alzheimer's disease in the USA is 37 deaths per 100,000 people.[4] In South Carolina, this rate is 10-fold higher; with 350 per 100,000 people.[2-5]

South Carolina's unique demographic and socioeconomic factors contribute to the distinct nature of ADRD disparities in the state and minority groups. Of significance, African Americans are more likely to develop ADRD,[6] and racial/ethnic gaps have widened in the past 2 decades. African American South Carolinians are 64% more likely to develop ADRD compared to non-Hispanic whites. The high prevalence of chronic diseases such as hypertension among African American populations in South Carolina exacerbates the risk of developing ADRD. Despite not being the oldest or unhealthiest state, South Carolina has a rapidly aging population and significant racial disparities in health outcomes.

These alarming statistics highlight the urgent need to address racial disparities in ADRD to prevent further health inequities and improve outcomes for all affected individuals. In South Carolina (SC), Alzheimer's disease and related dementias (ADRD) represent significant public health challenges, contributing to substantial healthcare expenditures and economic strain on

both individuals and the healthcare system. As the prevalence of ADRD continues to rise, racial disparities in healthcare access, utilization, and treatment outcomes remain critical issues that need to be addressed to improve healthcare equity and patient outcomes. Despite the growing recognition of these disparities, limited research has examined the specific contribution of racial disparities to different healthcare costs, utilization, and antihypertensive medication (AHM) use among ADRD patients in the Medicaid population.

This study aims to fill the literature gap by analyzing the contribution of racial disparities to different healthcare expenditures, utilization, and AHM use among Medicaid beneficiaries with ADRD in SC, utilizing data from the SC Medicaid program linked to the SC Alzheimer's Disease (AD) Registry. The findings will inform targeted interventions to reduce health inequities and improve outcomes for minority populations with ADRD.

Methods:

The state's comprehensive Alzheimer's Disease Registry, the oldest and most extensive of its kind in the country, provides valuable data for understanding these disparities. The SC AD Registry is unique compared to other dementia registries due to its longevity, comprehensiveness, and extensive data collection. Established in 1988, the South Carolina Alzheimer's Disease Registry is the oldest, most comprehensive and accurate in the nation;[5] and is one of only three statewide population-based registries of ADRD in the nation (the other two are West Virginia state since 2008 and Georgia State since 2004). The registry collects detailed demographic information, including age, sex, race, and residence, as well as diagnostic data on ADRD subtypes, such as Alzheimer's disease, vascular dementia, and mixed dementia. This comprehensive data allows for a nuanced understanding of racial disparities in ADRD patients.

Additionally, the SC AD Registry's ability to link with Medicaid data enhances its utility for research. By linking the registry data to Medicaid data, the linkage allows for accurate identification and classification of ADRD patients based on diagnostic codes and clinical records. Third, the SC Medicaid data provides comprehensive information on prescription drug use, including antihypertensive medications (AHMs). By linking this data with the SC AD Registry, researchers can analyze medication adherence, patterns of AHM use, and potential disparities in drug utilization among different racial minority groups.

A cross-sectional study was performed using South Carolina (SC) Medicaid data linked with the SC Alzheimer's Disease (AD) Registry. The study population consisted of ADRD individuals aged 65 and older, and this study utilized data from the SC AD Registry covering the period from 2005 to 2021 to identify ADRD patients. The study population included ADRD individuals aged 65 and older, identified using data from the SC AD Registry covering 2005 to 20211. Patient characteristics in the analysis included age, sex, residence, and marital status. Healthcare costs were assessed across multiple domains, including inpatient, outpatient, emergency room, and medication expenditures, with all costs adjusted to 2024 US dollars to account for inflation. Healthcare utilization was measured based on the frequency of inpatient hospitalizations, outpatient visits, and emergency room visits. Additionally, this study specifically examined the utilization of AHMs, incorporating all FDA-approved AHMs. Races in this study were classified into three groups: Whites, Blacks, and other races.

To investigate the role of racial disparities in healthcare costs, utilization, and AHM use, the Blinder-Oaxaca (BO) decomposition method was applied. This method deconstructs disparities

into three key components: (1) explained differences (characteristic differences), which account for variations in measurable characteristics; (2) unexplained differences (coefficient differences), which reflect potential racial disparities; and (3) interaction effects, which capture the combined influence of characteristic and coefficient differences. This method provides insights into the underlying factors driving disparities and informs targeted interventions to address health inequities.

Results:

A total of 9,822 Medicaid beneficiaries with Alzheimer's disease and related dementias (ADRD) were included in the study. Among them, 48.40% were White, 41.66% were Black, and 9.94% belonged to other racial groups. The characteristics of Medicaid beneficiaries with Alzheimer's disease and related dementias (ADRD) are presented in Table 1. The analysis includes three racial groups: Whites, Blacks, and Other Races. Table 1 shows that the majority of beneficiaries are in the 65-74 age group, with Whites at 49.67%, Blacks at 49.71%, and other Races at 56.28%. The ≥85 age group is the smallest, with Whites at 6.84%, Blacks at 7.20%, and Other Races at 4.86%. Whites have 72.60% females, Blacks have 70.64%, and other Races have 71.26%. A significant difference is observed in the residence distribution. Whites and other races have a higher percentage of urban residents (63.79% and 66.26%, respectively), while Blacks have a higher percentage of rural residents (44.21%). A notable difference is seen in the percentage of divorced/separated individuals, with Whites at 14.07%, Blacks at 5.26%, and other races at 1.48%. The percentage of single individuals is higher among Blacks (36.17%) and other races (33.60%) compared to Whites (25.10%). The widow category shows a higher percentage among Whites (37.15%) compared to Blacks (28.33%) and other races (7.15%).

Table 2 illustrates how racial disparities contribute to health economic burden among ADRD patients using decomposition analyses. Specifically, racial differences between White and Black ADRD beneficiaries accounted for 23.52% ($P < 0.001$), 32.96% ($P = 0.009$), and 34.37% ($P < 0.001$) of the disparities in inpatient, outpatient, and medication expenditures, respectively. When comparing White and other racial ADRD beneficiaries, racial differences significantly accounted for 33.95% ($P < 0.001$) of inpatient cost disparities and 34.92% ($P < 0.001$) of outpatient cost disparities. These results underscore the importance of addressing racial disparities in healthcare costs among diverse racial groups. Additionally, racial disparities explained 33.58% ($P = 0.017$) of the differences in inpatient visits between White and Black individuals. This suggests that Black ADRD beneficiaries are more likely to experience higher inpatient utilization compared to their White counterparts.

Table 3 presents the decomposition analysis of racial disparities in healthcare costs, utilization, and antihypertensive medication (AHM) use among Medicaid beneficiaries with Alzheimer's disease and related dementias (ADRD). Specifically, racial disparities contributed to 28.95% ($P < 0.001$) of differences in AHM use between White and Black ADRD beneficiaries. In addition, racial disparities explained 38.67% ($P = 0.049$) of the differences in outpatient visits and 26.36% ($P = 0.042$) of differences in AHM use between White and other racial ADRD beneficiaries. These findings emphasize the need for targeted interventions to reduce racial disparities in healthcare utilization and medication use.

Conclusions and Discussions

The findings highlight significant racial differences in the characteristics of Medicaid beneficiaries with ADRD, which may contribute to disparities in healthcare costs, utilization, and outcomes. This highlights the significant impact of racial differences on medication utilization, which may affect the management of comorbid conditions such as hypertension. The study found that racial disparities contributed to 28.95% of differences in AHM use between White and Black ADRD beneficiaries. This underscores the importance of addressing medication adherence and utilization patterns to improve the management of comorbid conditions such as hypertension among minority populations. Future research should focus on exploring the underlying factors contributing to these disparities, such as socioeconomic status, healthcare provider biases, and systemic barriers, to inform effective strategies for mitigating racial inequities in ADRD management.

The findings of this study underscore the urgent need to address racial disparities in ADRD care in South Carolina. The significant contribution of racial differences to healthcare costs, utilization, and AHM use highlights the systemic inequities that minority populations face in accessing and receiving quality healthcare. The high prevalence of ADRD among African American South Carolinians, cupled with the state's unique demographic and socioeconomic factors, exacerbates the health crisis and underscores the importance of targeted interventions.

The SC Alzheimer's Disease (AD) Registry, with its comprehensive and longitudinal data, provides a valuable resource for understanding the nuances of ADRD disparities. The ability to link the registry data with SC Medicaid data allows for a detailed analysis of healthcare costs, utilization, and medication use, providing insights into the specific needs of minority populations. The Blinder-Oaxaca decomposition method used in this study offers a robust framework for deconstructing disparities and identifying the underlying factors driving these inequities.

It is important to acknowledge several limitations that may impact the interpretation and generalizability of the findings. First, the study relies on data from the South Carolina (SC) Medicaid program linked to the SC Alzheimer's Disease (AD) Registry, which may not be representative of the entire population of ADRD patients in the United States. The findings may be specific to the demographic and socioeconomic characteristics of the SC Medicaid population and may not be generalizable to other states or populations with different characteristics. Second, the cross-sectional design of the study limits the ability to establish causality between racial disparities and healthcare costs, utilization, and antihypertensive medication (AHM) use. The observed associations may be influenced by unmeasured confounding factors, such as socioeconomic status, healthcare provider biases, and systemic barriers, which were not accounted for in the analysis. Additionally, the study focuses on a specific set of healthcare costs and utilization measures among Medicaid population, which may not capture the full spectrum of healthcare experiences and outcomes for the general ADRD patients. Future research should consider a broader population for the underlying factors contributing to racial disparities in ADRD care. Lastly, the study's findings are based on data from 2005 to 2021, and healthcare practices, policies, and patient demographics may have

changed since then. The results should be interpreted in the context of the study period, and ongoing research is needed to monitor trends and assess the impact of recent changes in healthcare delivery and policy.

In conclusion, this study provides valuable insights into the contribution of racial disparities to healthcare costs, utilization, and AHM use among SC Medicaid beneficiaries with ADRD. The findings underscore the urgent need for targeted interventions to address health inequities and improve outcomes for minority populations with ADRD. By leveraging the comprehensive data from the SC AD Registry and SC Medicaid program, policymakers and healthcare providers can develop evidence-based strategies to promote equitable healthcare access and improve patient outcomes.

Table 1. Characteristics of Medicaid Beneficiaries with ADRD

	Whites (N = 3,817)	Blacks (N = 3,307)	Other Races (N = 741)	P value
Age, %				0.008
65-74	49.67	49.71	56.28	
75-84	43.49	43.09	38.87	
≥85	6.84	7.20	4.86	
Sex, %				0.182
Male	27.40	29.36	28.74	
Female	72.60	70.64	71.26	
Residence, %				< 0.001
Urban	63.79	55.79	66.26	
Rural	36.21	44.21	33.74	
Married Status, %				< 0.001
Married	10.82	9.37	6.88	
Divorced/Separated	14.07	5.26	1.48	
Single	25.10	36.17	33.60	
Widow	37.15	28.33	7.15	
Unknown	12.86	20.86	50.88	

ADRD: Alzheimer's disease and related dementias

Table 2. Contribution of Racial Disparities to Healthcare Costs by Blinder-Oaxaca Decomposition Analyses

		Characteristics	Proportion (%)	P value	Coefficient	Proportion (%)	P value	Interaction	Proportion (%)	P value
Blacks vs. Whites										
	Inpatient Costs	0.072	28.15	< 0.001	0.060	23.52	0.001	0.124	48.33	0.002
	Outpatient Costs	-0.001	-0.73	0.426	0.063	32.96	0.023	0.129	67.77	0.020
	ER Costs	0.049	-612.82	< 0.001	-0.020	255.44	0.269	-0.037	457.38	0.286
	Medication Cost	0.029	-2.90	0.009	-0.340	34.37	< 0.001	-0.678	68.53	< 0.001
Other Races vs. Whites										
	Inpatient Costs	0.234	23.29	< 0.001	0.341	33.95	< 0.001	0.430	42.76	< 0.001
	Outpatient Costs	0.016	1.70	0.267	0.332	34.92	< 0.001	0.603	63.37	< 0.001
	ER Costs	0.178	44.81	< 0.001	0.091	22.79	0.224	0.129	32.40	0.220
	Medication Cost	-0.018	-4.41	0.330	0.177	44.54	0.120	0.238	59.88	0.126

ER: emergency room

Table 3. Contribution of Racial Disparities to Healthcare Utilization and AHM Use by Blinder-Oaxaca Decomposition Analyses

		Characteristics	Proportion (%)	P value	Coefficient	Proportion (%)	P value	Interaction	Proportion (%)	P value
Blacks vs. Whites										
	Inpatient Visits	7.914	5.09	0.104	52.250	33.59	0.007	95.401	61.33	0.009
	Outpatient Visits	1.223	27.38	0.060	1.672	37.43	0.213	1.572	35.19	0.343
	ER Visits	-2.390	-2.62	0.298	31.423	34.41	0.058	62.286	68.21	0.045
	AHM Use	0.018	8.63	< 0.001	0.060	28.95	< 0.001	0.129	62.41	< 0.001
Other Races vs. Whites										
	Inpatient Visits	8.054	11.21	0.277	20.704	28.81	0.368	43.109	59.98	0.314
	Outpatient Visits	3.280	7.17	0.042	17.680	38.67	0.086	24.757	54.15	0.061
	ER Visits	-6.795	44.60	0.289	-11.821	77.58	0.425	3.379	-22.18	0.483
	AHM Use	0.034	16.85	< 0.001	0.053	26.36	0.055	0.115	56.79	0.007

AHM: antihypertensive medication; ER: emergency room

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