

# Comorbidities Associated with Rhode Island’s Adults’ Hospitalizations, 2023

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## INTRODUCTION

In addition to principal diagnoses (main reasons) for hospital admissions, hospitals collect patients’ comorbidity information. It is crucial to identify and understand comorbidities, diseases or conditions that co-exist at the time of hospitalization. Literature reviews show that patients’ risk of prolonged and intensive care is strongly associated with their comorbidities.<sup>1</sup> Hospitals’ disease management strategies and resource allocations can be complicated by patients’ comorbidities and overall multi-morbidity.<sup>1</sup>

For specific and uniform measurements of comorbidities across the nation, the Agency for Healthcare Research and Quality (AHRQ), an agency in the U.S. Department of Health and Human Services, developed the “Elixhauser Comorbidity Index”. It identifies pre-existing conditions based on secondary diagnoses that are distinct from the principal diagnosis (a main reason for hospitalization). This tool was specifically designed to predict outcomes of inpatient stays, including length of stay, cost, readmission, and in-hospital mortality.<sup>2</sup>

The objectives of this report are to: (a) document the presence, extent and specific diagnoses of comorbidities that were reported with reasons for Rhode Island (RI) adults’ inpatient stays, (b) assess comorbidities by selective patient characteristics, (c) assess average length of inpatient stays by comorbidity status, and (d) discuss opportunities and future initiatives for improvement in management of comorbidities.

## METHODOLOGY

The data for this study were obtained from the RI Hospital Discharge Data (HDD).<sup>3</sup> All hospitals licensed by the RI Department of Health (RIDOH) are required to report financial and discharge data on a quarterly basis, using a statewide uniform reporting system. Data on inpatient admissions and ED encounters are currently submitted by 13 RI non-federal acute-care and specialty hospitals. Analytic dataset was created with ten (10) acute care hospitals’ inpatient hospitalization records in 2023, according to discharge dates between January 1, 2023, and December 31, 2023. Included patients were adults aged 55 years and older, which population accounted for a majority of the hospitalized patients (53%).

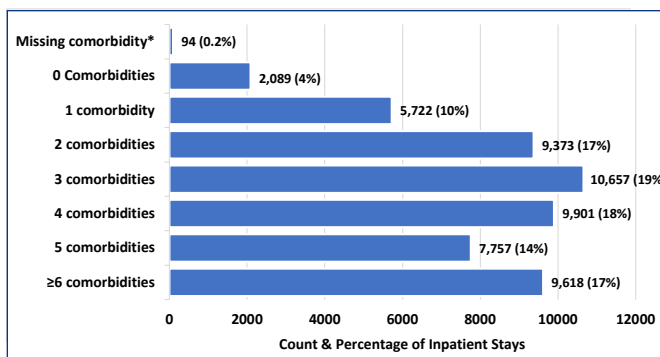
The Elixhauser Comorbidity Software Refined v2023 was used to define and measure 38 comorbidities (details are available: Elixhauser Comorbidity Software Refined for ICD-10-CM (ahrq.gov)). The presence, extent and specific diagnoses of comorbidities were summarized by selective patient characteristics (sex, age group, race/ethnicity, and expected primary payer), and principal diagnoses (using Medicare Severity-Diagnosis Related Group (MS-DRG)-based Major Diagnostic Categories (MDC)); An association between average days of inpatient stays and number of comorbidities was also assessed. Descriptive and analytic statistics were computed using SAS® v9.4. Categorical variables were compared using Chi-Squared tests, and statistical significance was assessed at p value <.05 level.

## RESULTS

In 2023, over 53,000 inpatient records, among patients aged ≥55 years, reported at least one comorbidity (95% of all hospitalization cases). Of these, over a half of the records (n=37,933) were among patients with three or more comorbid conditions (Figure 1).

The presence and number of comorbidities were distinct by patient characteristics (Table 1). As patient’s age

**Figure 1. Number and Percentage of Hospitalizations by Reported Comorbidity Among Adults Aged ≥55 years, RI HDD 2023 (Total = 55,211 records)**



\* To identify 18 comorbidity measures, variables indicating that the diagnosis was present on admission (POA) were used; the other 20 comorbidities are assumed to be present on admission. About 0.2% of the study records in 2023 HDD do not include POA indicators; for these discharges the comorbidity measures could not be determined.

**Table 1.** Presence and Number of Comorbidities by Patient Characteristics, RI HDD 2023

Patient Characteristic	Number of Comorbidities			Total counts of hospitalizations <sup>§</sup>	p-value <sup>‡</sup>
	No Comorbidities Count (%)	1–2 Comorbidities Count (%)	≥3 Comorbidities Count (%)		
All	2,089 (4)	15,095 (27)	37,933 (69)	55,211	
<b>Age Group (Years)</b>					
55–64	897 (7)	4,245 (31)	8358 (62)	13,547	<.0001*
65–74	716 (4)	4,809 (29)	11,301 (67)	16,854	
75–84	315 (2)	3,828 (25)	11,066 (73)	15,224	
85+	161 (2)	2,213 (23)	7,208 (75)	9,586	
<b>Sex</b>					
Male	1,014 (4)	7,421 (27)	18,709 (69)	27,196	0.5879
Female	1,075 (4)	7,672 (27)	19,222 (69)	28,011	
<b>Race/Ethnicity</b>					
Hispanic	117 (3)	980 (25)	2,760 (71)	3,865	<.0001*
Non-Hispanic White	1,786 (4)	12,700 (28)	31,280 (68)	45,843	
Non-Hispanic Black	47 (2)	611 (23)	2,049 (76)	2,709	
Non-Hispanic Other	60 (4)	398 (27)	1,011 (69)	1,472	
<b>Expected Payer<sup>†</sup></b>					
Commercial	612 (9)	2,466 (38)	3,353 (52)	6,461	<.0001*
Medicaid	202 (4)	1,368 (29)	3,085 (66)	4,666	
Medicare	1,161 (3)	10,658 (26)	29,940 (72)	41,800	
Self-Pay	36 (6)	209 (34)	360 (59)	611	
Other	78 (4)	394 (23)	1,195 (71)	1,673	

§ Due to missing POA indicators for which comorbidities could not be determined, the counts of each patient category do not add up to the total counts of hospitalizations.

‡ p-value based on Chi-square test.

\*Results of the Chi-square test were statistically significant ( $p < 0.05$ ).

† Expected primary source of payment identified in hospital's initial admission records.

increases, the percentage of inpatient stays with three or more comorbidities increased (62%, 67%, 73% and 75% in age groups 55–64, 65–74, 75–84 and  $\geq 85$  years, respectively). There were no significant differences by sex, as both males and females had similar distributions of comorbidities ( $p = 0.5879$ ). By patient's racial and ethnic background, distributions of comorbidity status are different: non-Hispanic Black had noticeably higher percentage (76%) of hospitalizations with three or more comorbidities, compared with non-Hispanic White adults (68%). Finally, patients with Medicare had the highest proportion of three or more comorbidities (72%), than Medicaid (66%) and commercially insured (52%).

We also assessed specific secondary diagnoses of comorbidities, related with the most common principal diagnostic groups. Of 25 MDCs, diseases and disorders of the circulatory (MDC 5), respiratory (MDC 4), musculoskeletal (MDC 8), digestive (MDC 6) and nervous (MDC 1) systems were chiefly responsible for approximately 65% of all hospitalizations among adults aged  $\geq 55$  years in the study year (Table 2). Hospitalizations for diseases and disorders of the circulatory system had the highest number of inpatient stays involving

patients with three or more comorbidities. Hypertension and diabetes were reported as pre-existing conditions across all five principal diagnostic groups (Figure 2). Additionally, chronic respiratory disease was a frequently reported comorbidity in four common principal diagnostic groups.

Figure 3 shows the average days of inpatient stays by top five (5) MDCs and number of comorbidities at the time of hospital admissions. Across the five (5) common principal diagnostic groups for hospitalizations, patients with three or more comorbidities consistently had longer stays, compared to those with one-two or no comorbidities. For example, patients who were admitted due to nervous system disorders and had three or more comorbidities stayed for seven (range: 1–346) days on average, compared to five (1–107) days with one-two comorbidities, and four (1–30) days with none. A similar trend was observed across other systems, including respiratory and circulatory disorders, where stays lengthened as comorbidity count increased. In musculoskeletal disorders, patients with three or more comorbidities stayed twice as long days as those without any comorbidities on average (six days (1–73) vs. three days (1–25)).

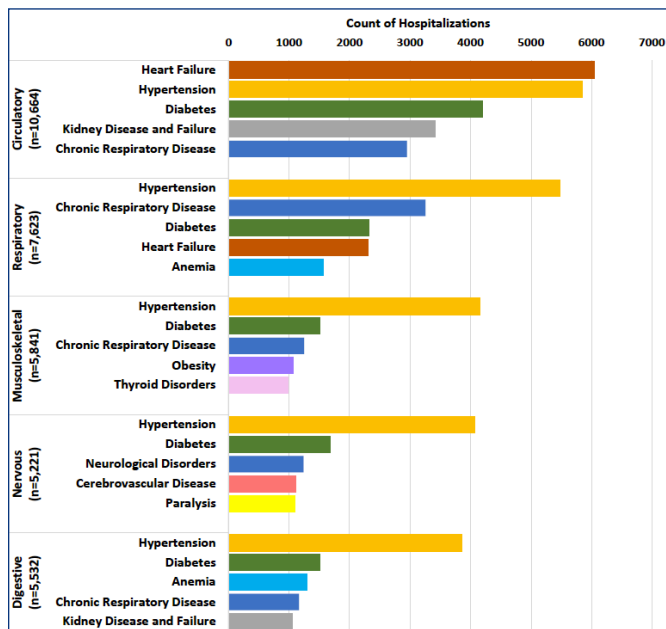
**Table 2.** Presence and Number of Comorbidities by the Most Common Principal Diagnostic Groups (MDCs)\*, RI HDD 2023

MDC	Number of Comorbidities			Total counts of hospitalizations <sup>‡</sup>
	No Comorbidities Count (%)	1–2 Comorbidities Count (%)	≥3 Comorbidities Count (%)	
Diseases and disorders of the circulatory system	196 (2)	2,400 (23)	8,060 (76)	10,664 (20)
Diseases and disorders of the respiratory system	213 (3)	1,955 (26)	5,452 (72)	7,623 (14)
Diseases and disorders of the musculoskeletal system and connective tissue	489 (8)	2,314 (40)	3,014 (52)	5,841 (11)
Diseases and disorders of the digestive system	390 (7)	1,859 (34)	3,250 (59)	5,532 (10)
Diseases and disorders of the nervous system	108 (2)	1,350 (26)	3,757 (72)	5,221 (10)

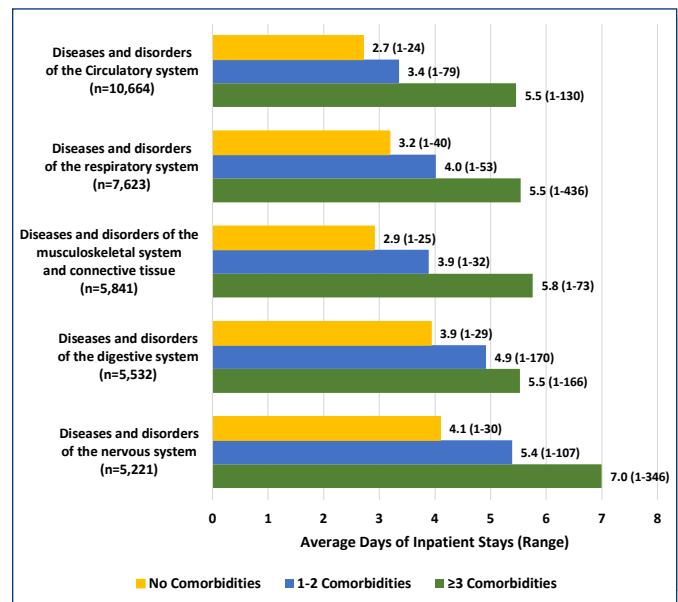
\* Major Diagnostic Categories (MDCs) are used in healthcare to group hospital inpatient diagnoses into broader categories, based on the primary reason for hospitalization. The MDCs are based on the Medicare Severity-Diagnosis Related Group (MS-DRG), which divides possible diagnoses into 25 mutually exclusive MDCs. MDC 5 (MS-DRGs 215-320): diseases and disorders of the circulatory system; MDC 4 (MS-DRGs 163-208): diseases and disorders of the respiratory system; MDC 8 (MS-DRGs 453-566): diseases and disorders of the musculoskeletal system and connective tissue; MDC 6 (MS-DRGs 326-395): diseases and disorders of the digestive system; MDC 1 (MS-DRGs 20-103): diseases and disorders of the nervous system.

‡Due to missing POA indicators for which comorbidities could not be determined, the counts of each patient category do not add up to the total counts of hospitalizations.

**Figure 2.** Most Frequent Five Comorbidities by MDCs, Hospitalizations Among Adults Aged ≥55 years, RI HDD 2023



**Figure 3.** Days of Inpatient Stays by MDCs and Number of Comorbidities, Hospitalizations Among Adults Aged ≥55 years, RI HDD 2023



## DISCUSSION

Our study examines the presence of comorbidities among adults aged 55 years and older in 2023. The high prevalence of comorbidities in this age group emphasizes the complex health profiles of these patients and highlights the necessity for comprehensive management strategies in hospital settings.

The results showed that comorbidities increased with age, with over 75% of patients aged 85 and older having three or more comorbidities. Interestingly, no significant differences were observed between males and females in the distribution of comorbidities suggesting that sex is not a major differentiating factor for the burden of chronic conditions among the study population. However, disparities were evident across racial/ethnic groups and insurance types. Non-Hispanic Black and Hispanic patients reported higher proportions of comorbidities compared to their non-Hispanic White counterparts. These differences may reflect broader health inequities, including access to care, socioeconomic status, and prevalence of chronic conditions within these populations. Patient with Medicare were more likely to have higher comorbidity counts than those with commercial insurance, reflecting the aging population served by this program.

The analysis of principal diagnostic groups revealed that circulatory, respiratory, musculoskeletal, digestive, and nervous system disorders accounted for the majority of hospitalizations, with circulatory disorders most frequently associated with multiple comorbidities. Hypertension and diabetes were prevalent across all diagnostic groups, consistent with the known prevalence of these conditions in the study population.<sup>5,6</sup> The association of chronic respiratory disease with four of the top diagnostic groups further highlights the interaction between comorbidities and primary conditions.

Finally, the relationship between comorbidity burden and length of hospital stay was evident across all major diagnostic groups. Patients with three or more comorbidities consistently experienced longer hospitalizations, particularly for nervous, respiratory, and musculoskeletal disorders. This trend suggests that managing multiple comorbidities not only complicates care but also extends recovery times, increasing healthcare utilization.

The findings suggest that the high prevalence of comorbidities, particularly hypertension and diabetes, among adults aged 55 years and older is reflective of broader socioeconomic inequities and the limited focus on primary prevention and health lifestyle choices. While multidisciplinary care teams and comprehensive discharge planning are already standard practices in many hospital settings, addressing the root causes of comorbidity burden requires a more robust emphasis on prevention.<sup>7</sup> Expanding access to preventive services such as regular screenings, community-based health programs, and telehealth, can significantly improve early detection and management of chronic

conditions, particularly in underserved populations.<sup>8,9</sup> Integrating assessments of social determinants of health (such as housing, food insecurity, and access to transportation) into patient care can help identify barriers that impact health outcomes and ensure patients receive the support that they need.<sup>10</sup> Additionally, targeted outreach to high-risk groups, coupled with educational programs that encourage patients and families to manage their conditions at home, can help reduce disparities.<sup>11</sup> These preventative comorbidity management strategies not only reduce healthcare costs but also improve quality of life, particularly for vulnerable populations disproportionately affected by chronic conditions.

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