Disparities in End-of-Life Care: Intensive Care Utilization in the Colorado All-Payer Claims Database

Darcy Holladay Ford PsyD, MA, LPC, RDN; Kimberly Landry MPH; Megha Jha MPH; Martha Meyer PhD

All authors are affiliated with:
The Center for Improving Value in Health Care (CIVHC)
4500 Cherry Creek S Dr, Suite 350
Denver, CO 80246
DHolladay@civhc.org / *KLandry@civhc.org*
720-583-2095

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Author Contributions

Darcy Holladay Ford served as the Principal Investigator and lead author, contributing to the conceptualization, formal analysis, funding acquisition, investigation, methodology, project administration, supervision, validation, and writing of the original draft and review.

Kimberly Landry, as a co-author, contributed to the conceptualization, formal analysis, visualization, investigation, methodology, project administration, supervision, validation, and writing of the original draft and review.

Megha Jha, the lead analyst, was responsible for data curation, formal analysis, investigation, methodology, software, and validation.

Martha Meyer, as co-analyst, contributed to data curation, formal analysis, investigation, methodology, and software.

Statements and Declarations

Ethical Considerations

The CO APCD is a covered entity, and research using its data falls under the category of retrospective studies involving de-identified and suppressed data. Therefore, this study did not require Institutional Review Board (IRB) approval or ethical oversight. All patient information was de-identified in compliance with HIPAA regulations.

Consent to Participate

Consent to participate was not applicable for this study, as the research exclusively analyzed de-identified claims data from deceased individuals. Obtaining consent was deemed impossible under these circumstances.

Consent for Publication

This study does not include any identifiable individual data, images, or videos. Therefore, consent for publication is not applicable.

Declaration of Conflicting Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Data Availability Statement

The data analyzed in this study is available within the tables presented in this manuscript. These tables provide the summarized results derived from the CO APCD. Due to data privacy regulations and restrictions, the raw data cannot be shared publicly. For further inquiries about data access, please contact the CIVHC.

Keywords: End-of-life care, Advance Care Planning (ACP), Hospice care, Johns Hopkins ACG system, Health care disparities, Claims data

Abstract (250 words)

Background

Intensive end-of-life (EOL) care is emotionally and financially burdensome, disproportionally negatively impacting racial and ethnic minorities, rural residents, and lower socioeconomic seniors.

Objectives

To evaluate the impact of race, ethnicity, and rural residency on EOL Intensive Care Unit (ICU) stays, emergency department (ED) visits, 30-day readmissions, and Advanced Care Planning (ACP) in Colorado residents when controlling for comorbidities.

Methods

This retrospective cohort study analyzed data from the Colorado All-Payer Claims Database for 92,975 severely or chronically ill individuals (2018–2021). It used logistic regression models to evaluate associations between demographic variables and EOL healthcare utilization outcomes.

Results

ICU Stays: Hispanic/Latino, Asian, and Black members had increased ICU stays compared to Whites (Adj. OR: 1.24;1.34;1.28: 95% CI). However, members without ACP and rural residents had lower ICU stays (Adj. OR: 0.67; 0.89: 95% CI).

ED Visits: Hispanic/Latino, Asian, Black members, non-dually eligible members (Medicare Fee for Service (MFFS) + Medicaid), and rural residents had increased ED visits (Adj. OR: 1.29; 1.39; 1.19; 1.17; 2.04: 95% CI). Meanwhile, members without ACP or hospice care had lower ED visits (Adj. OR: 0.70; 0.75: 95% CI).

30-day Readmissions: Asian members and rural residents had increased 30-day readmissions (Adjusted OR: 2.42; 1.06: 95% CI). In contrast, those on MFFS and not on Medicaid, members without ACP, and those not in hospice care had decreased 30-day readmissions (Adj. OR: 0.69; 0.47; 0.83: 95% CI).

Conclusion

EOL racial, geographic, and socioeconomic disparities exist in Colorado, requiring urgent interventions for a more equitable healthcare system.

Introduction and Background

End-of-life (EOL) care for individuals with chronic conditions often spans weeks or months, either in a hospital or at home.[1] Around 70% of people express they want to die at home rather than in a hospital.[1] Intensive care at the end of life, including intensive care unit (ICU) stays, emergency department (ED) visits, and 30-day readmissions, are emotionally burdensome and costly for patients and families.[2-4] Despite efforts to ensure equitable EOL care, significant racial and ethnic disparities persist, particularly in the last year of life, leading to preventable ED visits and ICU stays.[3,5-15]

Advanced care planning (ACP) facilitates advance directives, encourages patient-centered care, and reduces undesired medical interventions.[7,16-18] Earlier ACP conversations are associated with lower intensive care utilization and increased hospice use, which supports pain management and reduces emotional distress for patients and families.[19-24] Racial and ethnic equitable ACP and hospice care may be the solution to decrease unwanted medically intrusive intensive EOL care.[3,13,14,17,21] However, limited studies have examined racial and ethnic inequities in intensive EOL care utilization and ACP adaptation, underscoring the urgent need for further research.

Purpose and Objectives

This study examines demographic drivers of EOL care utilization, including ICU stays, ED visits, 30-day hospital readmissions, and ACP among Colorado residents. Medicare Fee-for-Service (MFFS) data leads the EOL care research, and only a few commercial insurance and Medicare Advantage (MA) studies exist, limiting our understanding of care inequalities.[1,7,14,25-27] Using CO APCD claims (covering 75% of insured Coloradans), this study explores intensive EOL care patterns to identify disparities in care intensity.

Key research questions:

I. Is there a relationship between patient demographics and the intensity of EOL care measured by ICU stays, ED visits, and 30-day hospital readmissions?
II. Does the intensity of EOL care differ for different populations, even when controlling for comorbidities?
III. To what extent does EOL care vary between insurance payer types?
IV. Is there a relationship between ACP rates and EOL care intensity influenced by patient demographics?

Methods

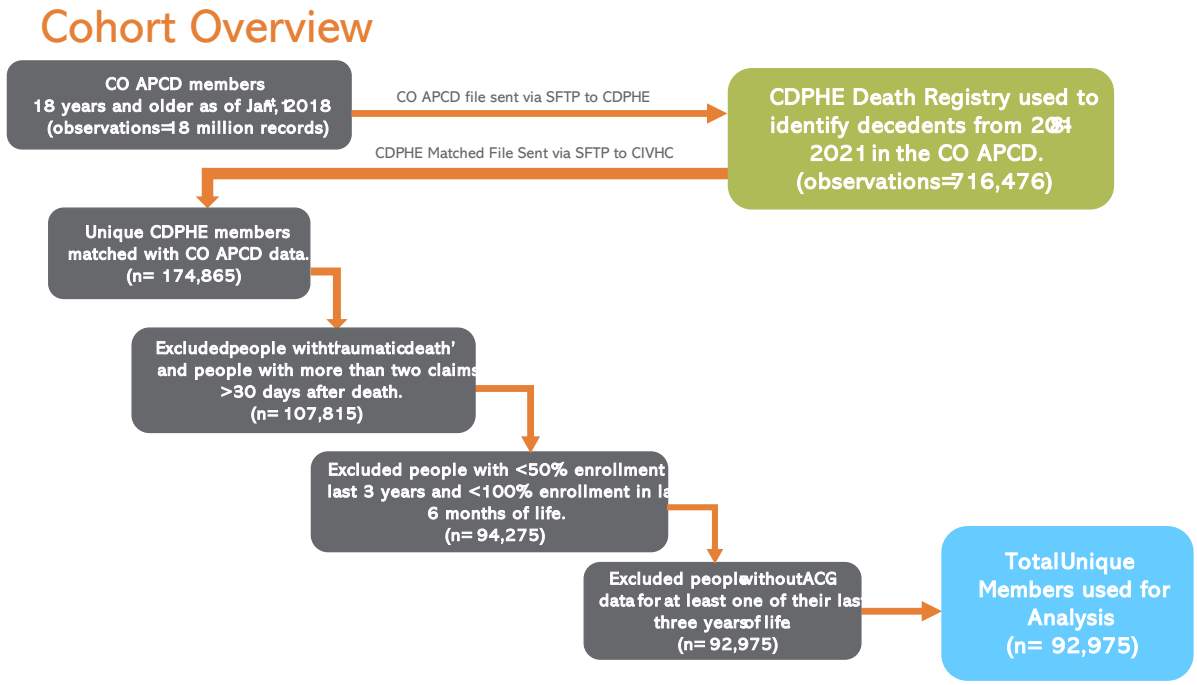
Study Population

This retrospective cohort study analyzed ICU stays, ED visits, and 30-day readmissions within 12 months of death using Colorado death records (2018–2021) matched to CO APCD claims (2017–

2021). The final population included 92,975 individuals. Inclusion criteria used Johns Hopkins ACG RUB scores, ensuring representation of healthcare needs from moderate to very high morbidity levels, aligning trends with severe chronic illness.[28] Refer to Figure 1 for specific exclusion and inclusion criteria.

Figure 1

Caption: Cohort Selection Overview for End-of-Life Care Analysis
This flowchart illustrates the cohort selection process for analyzing end-of-life care in Colorado using the Colorado All-Payer Claims Database (CO APCD) and CDPHE Death Registry data from 2018 to 2021. Starting with over 18 million records, 174,865 unique decedents were matched between CO APCD and death records. Exclusions included individuals with traumatic deaths, post-mortem claims beyond 30 days, insufficient enrollment, or missing Johns Hopkins ACG data. The final analytic cohort included 92,975 individuals.



Covariate Variables

Because of their relative completeness, the researchers identified sex, ethnicity, race, and age through insurance enrollment forms, urban/rural residence, and hospice use through death records. This study includes commercial, MFFS, MA, or Medicaid and dual eligibility (MFFS + Medicaid) insurance payer types.

To tease out the impact of demographic factors on healthcare needs at the end of life. [28] The ACG system generated a member-level healthcare predictive (RUB) score to assess the risk of ICU stays, ED visits, and 30-day readmissions independent of race, ethnicity, and insurance type. The ACG system categorizes members into six RUB groups based on Aggregated Diagnosis Groups (ADG) and Expanded Diagnosis Clusters (EDG): non-utilizer (RUB 0), healthy user (RUB 1), low morbidity (RUB 2), moderate morbidity (RUB 3), high morbidity (RUB 4), and very high complexity (RUB 5). This classification was paired with age and sex to control for comorbidities, aiming to

identify drivers of EOL care utilization.[29-34] RUB assignment requires 11 months of eligibility data from the prior calendar year. The researchers used the highest score in the events of a midyear death, resulting in two RUB scores or the closest calendar year preceding death. The researchers adhered to the STROBE cohort reporting guidelines for study methods and findings.[35]

Outcome Measures

The member-level outcome measures included ICU stays and ED visits to understand the intensity and complexity of care and 30-day hospital readmissions as a quality-of-care measure. Each qualifying outcome measure was an exclusive combination of provider, patient, and service date. We counted unique members with a qualifying claim, which allowed for 1-3 outcomes in the twelve months before death. The researchers counted one qualifying outcome claim per person outside of Table 2, where each member could have more than one unique qualifying event and more than one insurance payer type. Each outcome reflects subsets of the study population with ICU stays, ED visits, 30-day hospital readmissions, and members without qualifying events. The secondary ACP analysis counted any ACP claim within 4 years of death.

The researcher used the following codes to identify outcome measures ICU stays (revenue codes 0200–0209), ED visits (revenue codes 0450, 0452, 0459; procedure codes 99281–99288; place of service code 23; and surgery codes 10040–666792), and 30-day readmissions (bill type codes 11x, 12x, 41x). Advance Care Planning (ACP) claims were identified using procedure codes 99497, 99498, 1123F, and 1124F).

Statistical Analysis

The researchers used SAS software (version 9.4) to perform analyses, and a p-value of ≤0.05 was considered significant. Descriptive statistics, including counts, percentages, and chi-squared significance tests, were performed to analyze bivariate and categorical demographic data at the member level (Table 1). Table 2 uses a chi-squared significance test to explore the total qualifying claims and insurance payer combination. Binary logistic regression models estimated the likelihood of ICU stays, ED visits, and 30-day readmissions (Table 3), controlling for factors such as RUB risk score, age, race/ethnicity, sex, dual eligibility, urban/rural residence, COVID-19 years, hospice care, and ACP claims. A secondary logistic regression analysis examined factors influencing the probability of having an ACP claim among members with at least one ACP claim (n = 28,856; 31.04%) (Table 4).

The researchers included all potential covariates in the model to minimize bias while eliminating collinear covariates as appropriate. The teams used Advance Care Planning (ACP) as a covariate in the primary analysis and an outcome measure to isolate the role of ACP while preventing potential over-adjustment in the primary models. The Johns Hopkins ACG Resource Utilization Bands (RUBs) adjust utilization expectations based on the member's comorbidities, allowing for an informal sensitivity analysis. Results were stratified and adjusted for demographics, residence (urban/rural), insurance payer type, and healthcare utilization patterns to minimize bias further.

Data Security

To ensure HIPAA compliance, the researchers assigned a deidentified unique patient identifier and removed and encrypted all PHI elements. They utilized a secure file transfer portal for data transfers between CDPHE and the CO APCD, using a safe environment managed by NORC.

Results

Descriptive Analysis

Table 1

Caption: Descriptive statistics for the study population of CO APCD member deaths by natural causes (2018-2022), end-of-life intensive healthcare use: ICU stays, ED visits, and 30-day readmissions.
SOURCE: [Author's calculations using CO APCD data for members matched to Colorado Vital Death Records. The authors analyzed CO APCD health care claims 12 months before death, 2018-2022.]
NOTES [N=92,975. We counted the unique member identifier with a qualifying claim for 1-3 outcomes. Not all individuals in the study experienced a qualifying end-of-life event (e.g., ICU stay, ED visit, or 30-day hospital readmission). The count for ICU stays, ED visits, and 30-day readmissions represent subsets of the population who met the criteria for these specific outcomes. Some individuals may have experienced multiple events (e.g., an ICU stay and an ED visit). An ICD 10, HCPCS, or Revenue code defines an EOL intensive health care claim. ACG RUBs are a part of the Johns Hopkins Adjusted Clinical Group ® (ACG®) case-mix system. Categorized as 0-Non-user, 1-Healthy User, 2-Low Morbidity, 3-Moderate Morbidity, 4-High Morbidity, 5- Very High Morbidity. We calculated statistical significance at a 95% confidence interval.]

Individual Characteristics	Total Population	ICU Stays	ED Visits	30-day Readmissions
	(n=92,975)	(n=24,378)	(n=47,479)	(n=16,493)
Adjusted Clinical Grouper, Resource Utilization Band				
RUB 0, Non-User	5760, 6.20% ref	253, 1.04%, ref	972, 2.05%, ref	280, 1.70%, ref
RUB 1, Healthy User	4227, 4.55%	212, 0.87%	965, 2.03%, *	277, 1.68%, *
RUB 2, Low Morbidity	1426, 1.53%	226, 0.93%, *	508, 1.07%, *	83, 0.50%
RUB 3, Moderate	11427, 12.29%	968, 3.97%, *	3979, 8.38%, *	993, 6.02%, *
RUB 4, High	14462, 15.55%	1927, 7.0%, *	6359, 13.39%, *	1506, 9.13%, *
RUB 5, Very High	55673, 59.88%	20792, 85.29%, *	34696, 73.08%, *	13354, 80.97%, *
Advanced Care Planning Claim				
Yes, Claim	28964, 31.15% ref	14988, 61.48%, ref	17130, 36.08%, ref	7788, 47.22%, ref
No, Claim	64011, 68.85%	9390, 38.52%, *	30349, 63.92%, *	8705, 52.78%, *
Sex^				
Male	47689, 51.29% ref	13196, 54.13%, ref	23774, 50.07%, ref	8484, 51.44%, ref

Female	44519, 47.88%	10948, 44.91%, *	23250, 48.97%	7879, 47.77%
Unknown	767, 0.82%	234, 0.96%, *	455, 0.96%	130, 0.79%
Age Group				
<45	2707, 2.91% ref	757, 3.11%, ref	1388, 2.92%, ref	401, 2.43%, ref
45-55	4038, 4.34%	1237, 5.07%	2136, 4.50%	624, 3.78%
55-65	10450, 11.24%	3370, 13.82%	5154, 10.86%, *	1894, 11.48%, *
65-75	20531, 22.08%	6916, 28.37%, *	10093, 21.26%, *	4477, 27.14%, *
75-85	26206, 28.19%	7419, 30.42%	13892, 29.26%, *	5015, 30.41%, *
>85	29043, 31.24%	4679, 19.19%	14816, 31.21%	4082, 24.75%
Member Residency (157 missing)				
Urban	78542, 84.62% ref	20948, 86.06%, ref	38545, 81.31%, ref	14063, 85.38%, ref
Rural	14276, 15.38%	3392, 13.94%, *	8859, 18.69%, *	2408, 14.62%, *
COVID Effect				
COVID Year	52952, 56.95% ref	13275, 54.45%, ref	25787, 54.31%, ref	8440, 57.17%, ref
Non-COVID Year	40023, 43.05%	11103, 45.55%, *	21692, 45.69%, *	8053, 48.83%, *
Dual Eligible				
Yes	30632, 32.95% ref	8072, 33.11%, ref	15145, 31.90%, ref	6624, 40.16%, ref
No	62343, 67.05%	16306, 66.89%, *	32334, 68.10%, *	9869, 59.84%, *
Hospice care at death (313 missing)				
Yes, in care at death	47039, 50.76% ref	10094, 41.64%, ref	25174, 53.23%, ref	8598, 52.35%, ref
No, not in hospice	45623, 49.24%	14149, 58.36%, *	22122, 46.77%, *	7826, 47.65%, *
Race				
White Non-Hispanic/Latino	62557, 67.28% ref	15701, 64.41%, ref	32059, 67.52%, ref	10685, 64.79%, ref
Hispanic/Latino	5495, 5.91%	1781, 7.31%, *	3057, 6.44%, *	1179, 7.15%, *
American Indian/Alaska Native Non-Hispanic/Latino	371, 0.40%	116, 0.48%	206, 0.43%	61, 0.37%
Asian Non-Hispanic/Latino	940, 1.01%	302, 1.24%, *	531, 1.12%, *	320, 1.94%, *
Black/African American Non-Hispanic/Latino	2825, 3.04%	920, 3.77%	1434, 3.02%, *	595, 3.61%, *

Native Hawaiian or other Pacific Islander or Other Race	4104, 4.41%	1183, 4.85%	2077, 4.37%	744, 4.51%
Non-Hispanic/Latino Unknown race	14127, 15.19%	3749, 15.3%, *	6959, 14.66%	2509, 15.21%
Unknown race and ethnicity	2556, 2.75%	626, 2.57%, *	1156, 2.43%	400, 2.43%
Place of Death				
Residence	31840, 34.25% ref	5449, 22.35%, ref	15056, 31.71%, ref	4803, 29.17%, ref
Hospice (Institute only)	8295, 8.92%	2616, 10.73%, *	4875, 10.27%, *	1841, 11.16%, *
Inpatient facilities	21668, 23.31%	11474, 47.07%, *	11774, 24.80%, *	5059, 30.67%, *
Nursing	26023, 27.99%	3865, 15.85%	12487, 26.30%	4029, 24.43%
Other/Unknown/Dead on Arrival	2443, 2.63%	419, 1.71%, *	1214, 2.56%	362, 2.19%
Outpatient/ED	2706, 2.91%	555, 2.28%, *	2073, 4.37%	399, 2.42%

Significant at p ≤ 0.05
Notes: Reference if the condition or treatment is present. The significant test will show the within-variable variation and effect of the absence of the condition or treatment.

Table 1 summarizes the demographic characteristics of the study population, highlighting clinically significant findings.

Comorbidities, ACP, and Hospice Care

Members categorized as RUB 5 (Very High comorbidities) represented 59.9% of the study population and accounted for 85.3% of ICU stays, 73.1% of ED visits, and 81% of 30-day hospital readmissions. The 65-75 age group, comprising 22.1% of the population, accounted for 28.4% of ICU stays and 27.1% of 30-day hospital readmissions. Additionally, those without an ACP claim four years preceding death (68.9%) accounted for 38.5% of the ICU stays, 63.9% of the ED visits, and 52.8% of the 30-day hospital readmissions. Finally, most members were enrolled in hospice care at the time of death (50.8%), although those not in hospice care accounted for 58.4% of the total ICU stays.

Racial, Ethnic, and Sex Differences

White individuals comprised 67.3% of the population, serving as the reference group for racial and ethnic comparisons. Hispanic individuals, who constitute 5.9% of the population, utilized 7.3% of ICU days, 6.4% of ED visits, and 7.2% of 30-day readmissions. Asian individuals, representing 1% of the population, utilized 1.2% of ICU days, 1.1% of ED visits, and 1.9% of 30-day readmissions. Lastly, Black/African American individuals, comprising 3% of the population, accounted for 3.8% of ICU stays and 3.6% of 30-day hospital readmissions. Females comprised 47.9% of the population and utilized 44.9% of ICU stays.

Access to Care

Various factors likely influenced the member's access to care (rural, socioeconomic, and COVID-19) within this analysis. Rural members comprised 15.4% of the population but accounted for 14%

of ICU stays, 14.6% of 30-day hospital readmissions, and 18.7% of ED visits. Non-dually eligible members (MFFS and Medicaid), comprising 67.1% of the population, exhibited higher ED utilization (68.1%) and a lower proportion of 30-day hospital readmissions (59.8%). Members from non-COVID years (43.1%) accounted for 45.6% of ICU days, 45.7% of ED visits, and 48.8% of 30-day hospital readmissions.

Insurance Payer Analysis

Table 2

Caption: Count of claims by Insurance Type with a qualifying ICU Stay, ER Visit, and 30-day Hospital Readmission 12 months before death, 2018-2022.
Source/Notes: SOURCE [Author's calculations using CO APCD member and claims data, 2018-2022.] NOTES [N=99,089 claims. We counted the unique member identifier and insurance type. To account for a change in insurance type during the 12 months before death, we relaxed the constraint and allowed a member to be counted multiple times in each outcome. We counted the unique combination of member and insurance type, which allowed members to be counted multiple times for each outcome and numerous outcomes.]

Claim Count by Insurance Type	ICU Stays	ED Visits	30-day readmissions
MFFS	10,960 (39.54%)	21,642 (37.7%)	7,341 (52.6%)
Medicaid	6,115 (22.1%)	13,592 (23.7%)	1891 (13.5%)
MA	9,613 (34.7%)	19,985 (34.8%)	4,119 (29.5%)
Commercial	1034 (3.7%)	2,189 (3.8%)	608 (4.4%)
Total	27,722	57,408	13,959
Percent change distinct member to member* LOB	14.4%	21.9%	8.8%
Count Member, 1 LOB	20,778, (85.75%)	36,995, (78.6%)	11,704, (91.26%)
Count Member, 2 LOB	3,418, (14.11%)	9,848, (20.9%)	1,108, (8.64%)
Count Member, 3 LOB	36, (0.15%)	239, (0.5%)	13, (0.10%)
Total distinct member count	24,232	47,082	12,825

Table 2 presents an overview of claims by insurance type for ICU stays, ED visits, and 30-day hospital readmissions to understand the volume of claims and identify the primary payers for these outcomes of interest.

The qualifying claims include 27,722 ICU claims, 57,408 ED claims, and 13,959 30-day readmissions. Medicare Fee-For-Service (MFFS) was the primary payer for 39.5% of ICU claims, 37.7% of ED claims, and 52.6% of 30-day readmissions. Factoring in distinct member-to-member insurance payer types, 14.4% of ICU visits, 21.9% of ED visits, and 8.8% of 30-day readmissions had more than one insurance type.

Adjusted Odds Analysis

Table 3

Caption: Adjusted odds ratio of qualifying ICU stays, ER visits, or 30-day hospital readmission in the 12 months before death, CO APCD, 2018-2022.

Source/Notes: SOURCE [Author's calculations using CO APCD claims data, 2018-2022.] NOTES [Models are logistic regression models adjusted for all variables shown in Table 1. Members may have more than one outcome. We noted the reference value in the table. The researcher used chi-squared for statistical significance, indicated by an asterisk (*), with an estimated 95% confidence interval. Each outcome represents distinct members rather than claims counts per person.]

Individual Characteristics	ICU Stays	ED Visits	30-day Readmissions
	(n=24,205)	**(n=47,221)**	**(n=16,402)**
Adjusted Clinical Grouper, Resource Utilization Band			
RUB 0, Non-User	*reference*	*reference*	*reference*
RUB 1, Healthy User	1.299, *	1.393, *	1.376, *
RUB 2, Low Morbidity	3.253, *	2.298	1.157, *
RUB 3, Moderate	2.189, *	2.369	1.744
RUB 4, High	3.280, *	3.449, *	1.992, *
RUB 5, Very High	9.954, *	7.471, *	4.686, *
Advanced Care Planning Claim			
Yes Claim	*reference*	*reference*	*reference*
No Claim	0.666, *	0.703, *	0.471, *
Sex			
Male	*reference*	*reference*	*reference*
Female	0.922, *	1.108, *	0.965
Unknown	1.196, *	1.536, *	0.957
Age Group			
< 45 years	*reference*	*reference*	*reference*
45-55	1.169	0.982, *	0.895, *
55-65	1.097, *	0.860, *	1.058, *
65-75	1.413, *	0.812, *	1.233, *
75-85	1.173, *	0.940	1.069, *
>85	0.679, *	0.954, *	0.809
Member Residency			
Urban	*reference*	*reference*	*reference*
Rural	0.894, *	2.042, *	1.064, *
COVID Effect			
Non-COVID year	*reference*	*reference*	*reference*
COVID Year	0.748, *	0.786, *	0.685, *
Dual Eligible			
Yes	*reference*	*reference*	*reference*
No	0.971	1.166, *	0.691, *

Hospice care at the time of death			
Yes	*reference*	*reference*	*reference*
No	0.959	0.751, *	0.830, *
Race			
White	*reference*	*reference*	*reference*
Hispanic/Latino	1.242, *	1.294, *	1.211
American Indian/Alaska Native	1.188	1.061	0.955
Asian	1.340, *	1.391, *	2.415, *
Black/African American	1.276, *	1.186, *	1.217
Native Hawaiian or other Pacific Islander or Other Race	1.058	1.004, *	1.013, *
Non-Hispanic/Latino Unknown race	0.973, *	0.921, *	0.983, *
Unknown race and ethnicity	1.039	0.924, *	1.130
Place of Death			
Residence	*reference*	*reference*	*reference*
Hospice (Institute only)	1.598, *	1.080, *	1.118, *
Inpatient facilities	3.981, *	1.024, *	1.350, *
Nursing	0.741, *	0.793, *	0.769, *
Other/Unknown/Dead on Arrival	1.012, *	1.153, *	0.998
Outpatient/ED	1.075, *	4.105, *	0.973
***Significant at p ≤ 0.05**			

Table 3 presents the primary regression analysis of key outcomes.

Comorbidities, ACP, and Hospice Care

When RUB scores increased, member utilization also increased, with RUB 5 (very high) demonstrating the highest odds across all outcomes: ICU stays (OR: 9.95), ED visits (OR: 7.47), and 30-day readmissions (OR: 4.69). Members aged 65-75 had the highest adjusted ICU admissions odds of any age group (OR:1.41), while those over 85 had the lowest adjusted odds (OR: 0.68). Members without an ACP claim had lower adjusted odds of all outcomes, with the most significant reduction observed in 30-day hospital readmissions (OR: 0.47). Members not enrolled in hospice had significantly lower adjusted odds of ED visits (OR: 0.75) and 30-day readmissions (OR: 0.83).

Racial, Ethnic, and Sex Differences

Race and ethnicity differences continued in our regression analysis compared to White individuals. Hispanic individuals had significantly higher adjusted odds of ICU stays (OR: 1.24) and ED visits (OR: 1.29). Asian individuals had higher utilization of ICU days (OR: 1.34), ED visits (OR: 1.39), and 30-day readmissions (OR: 2.42). Black/African American individuals had higher odds of ED visits (OR: 1.19) and ICU stays (OR: 1.28). Native Hawaiian/Other Pacific Islander individuals had adjusted odds of 1.00 for ED visits and 1.01 for 30-day hospital readmissions. Unknown or non-binary individuals had higher adjusted odds of ED visits (OR: 1.54).

Access to Care

The following factors increased the adjusted odds of our outcomes of interest, which seemed to be impacted by a member's access to care. Individuals in rural areas had lower adjusted odds of ICU stays (OR: 0.89) but increased adjusted odds of ED visits (OR: 2.04). Non-dually eligible individuals had lower adjusted odds of 30-day readmissions (OR: 0.69) and higher adjusted odds of ED visits (OR: 1.17). During COVID-19 years, individuals had lower adjusted odds of ICU stays (OR: 0.75), ED visits (OR: 0.79), and 30-day readmissions (OR: 0.69) compared to non-COVID years.

Advance Care Planning

Table 4

Caption: Adjusted odds ratio of an Advance Care Planning (ACP) claims 4 years before death, CO APCD 2015-2022. Source/Notes: SOURCE [Author's calculations using CO APCD claims data, 2015-2022.] NOTES [N=28,856.The researchers restricted the study to unique members with at least one ACP claim (procedure codes 99497, 99498, 1123F, 1124F). To estimate whether an ACP claim was related to disease burden (ACG Score) or demographics, we used logistic regression models adjusted for all variables shown in Table 1, with statistical significance calculated at 95%.]

Individual Characteristics	Members with Advanced Care Planning Claim (n= 28,856)
Adjusted Clinical Grouper, Resource Utilization Band	
RUB 0, non-user	*reference*
RUB 1, Healthy User	1.581, *
RUB 2, Low Morbidity	1.661, *
RUB 3, Moderate	2.030
RUB 4, High	2.865, *
RUB 5, Very High	4.856, *
Sex	
Male	*reference*
Female	1.073, *
Unknown	0.444, *
Age Group	
<45 years	*reference*
45-55	1.231, *
55-65	1.531, *
65-75	2.801, *
75-85	3.043, *
>85	3.168, *
Member Residency	
Urban	reference
Rural	0.524, *
COVID Effect	
Non-COVID year	*reference*
COVID Year	1.386, *
Dual Eligible	
Yes	*reference*
No	0.861, *

Hospice care at the time of death	
Yes	*reference*
No	0.768, *
Race	
White	*reference*
Hispanic/Latino	0.949
American Indian/Alaska Native	0.664, *
Asian	0.905
Black/African American	0.914
Native Hawaiian or other Pacific Islander or Other Race	0.905
Non-Hispanic/Latino of Unknown Race	1.061, *
Unknown race and ethnicity	0.879
Place of Death	
Residence	*reference*
Hospice (Institute only)	1.145
Inpatient facilities	1.170
Nursing	1.1736, *
Other/Unknown/Dead on Arrival	1.155
Outpatient/ED	0.847, *
Significant at p ≤ 0.05	

Table 4 presents the logistic regression analysis of ACP claims as the outcome, involving 28,856 members (31.04% penetration rate amongst the study cohort), to identify demographic factors influencing ACP adoption.

Higher healthcare needs were associated with increased adjusted odds of ACP claims. Each RUB level had increased adjusted odds of ACP claims, with RUB 5 (very high) having the highest (OR:4.86). However, the individuals in RUB 3 were not statistically different. Age was a significant factor, with increasing age associated with higher odds of having an ACP claim, with individuals over 85 showing the highest odds (OR: 3.17). Finally, individuals in COVID years had higher adjusted odds of having an ACP claim (OR: 1.39 American Indian/Alaska Native members had lower odds of ACP claims (OR: 0.66), and non-dually eligible individuals had lower odds (OR: 0.86).

Discussion

Our study supports previous research indicating ethnic and racial disparities exist in both end-of-life care, utilization, and ACP engagement.[3,8-15,36] Our findings confirm earlier EOL research that Black individuals had a higher rate of 30-day readmissions in EOL care, and observed additional notable inequities such as increased adjusted odds of ICU stay for Black individuals, higher adjusted odds of ICU stays and ED visits for Hispanic/Latino members, and the substantially increased adjusted odds of 30-day hospital admission for Asian members. .[3,8,9,15] These findings are crucial for understanding and addressing disparities in EOL care.

Utilizing the validated ACG system's RUB classification shows an increased comorbidity burden with advancing age.[31,32,34] Members categorized as RUB 5 exhibited the highest utilization of ICU stays, ED visits, and 30-day readmissions. Utilization generally declined alongside RUB scores, except for ICU use among RUB 2 members. The 65-75 age group had the highest number of care utilizers, while those aged 85 and older used less.

ACP is a care indicator that fosters high-quality patient-centered care and more efficient healthcare.[7,16,20,36] Our study found that 31.04% of members had at least one ACP claim within four years of death. The oldest and sickest members had the highest rate of ACP claims, giving them more autonomy in making healthcare decisions and setting goals, avoiding potentially unwanted intensive care. . A previous meta-analysis of published studies reported a 38% adoption of ACP in individuals with chronic conditions, based on self- or surrogate reports or medical chart reviews.[37,38] Additionally, ACP CPT studies cite a 2-11% rate of ACP in mostly Medicare claims, increasing year after year since Medicare reimbursement started in.[36-38] Our study utilized CPT codes as precise indicators of ACP conversations in chronically ill, mostly older adults with all insurance payer types. However, not all ACP discussions have a corresponding CPT code, likely leading to an underestimation of ACP in our study cohort.[36,39]

Patients in hospice care spend less time in the hospital in the last year of life than they otherwise would have and have a better quality of life.[22-24, 40, 41] Other studies have found that MA members with ACP are more likely to be enrolled in hospice care and have higher hospitalization rates.[42] Our study found that members not enrolled in hospice care had lower adjusted odds of ACP, ED visits, and 30-day readmissions, likely in line with fewer chronic conditions and more acute care needs.

Although nationally, MA holds 51% of the United States Medicare-eligible population,[43] of the primary payers in this EOL study were MFFS, supporting the frequent use of MFFS in previous EOL studies.[7,25,26] The MFFS 30-day readmission rates were the highest among payers (52.6%), while commercial payers had the lowest (4.4%). Our findings paralleled those of Weiss and Jiang, who found hospital readmissions in 60.3% of MFFS and 8.7% of commercial payers.[44] About a third (32.95%) of the EOL population in this study was dually eligible for MFFS and Medicaid. MFFS requires 20% coinsurance and has no out-of-pocket maximum; therefore, highly intensive healthcare needs, coinciding with a fixed retirement income, might necessitate Medicaid to access care. Those not on Medicaid and MFFS had decreased adjusted odds of ICU stay and 30-day readmissions, potentially indicating a historically healthier population. At the same time, those who were dually eligible may have had longer-standing chronic conditions, increasing the odds of intensive EOL care.

Finally, rural individuals had a higher rate of ED visits and 30-day inpatient readmissions but a lower rate of ACP and ICU stays, possibly due to rural communities' limited healthcare facilities and hospice programs, leading to delayed or less optimal care.[44,45] Inadequate access to transportation and long distances to healthcare facilities may further contribute to access disparities.[46]

Limitations and Implications for Policy and Practice

This study utilized administrative claims data representing insured Coloradans in the CO APCD, which may not capture all EOL care utilization. Missing either race and ethnicity data (17.9%) or incomplete claims coverage (31% of the population not captured) may have introduced bias, particularly for underrepresented groups.[47,48] Claims data reflect billing practices rather than clinical intent, leading to potential misclassification of events like hospice care, primarily identified through death records in this study. Another example is the reliance on CPT codes 99497 and 99498 to identify ACP discussions. Prior studies have demonstrated that these codes are not consistently utilized by providers.[36] These limitations may affect the accuracy and generalizability of findings.

The data also reflects healthcare utilization during the COVID-19 pandemic, which may have influenced patterns of care, including lower odds of ICU stays, ED visits, and 30-day readmissions. These shifts could reflect changes in healthcare access, delivery, or patient decision-making during this period.

Addressing disparities in EOL care requires expanding access to rural healthcare, improving payer-specific care coordination, and increasing ACP discussions in underserved populations.

Conclusion

Racial, urban, and sex disparities exist in the intensity of care during the last year of Colorado residents' lives. These disparities also exist among ACP adoption. Individuals used hospice and ACP at a higher rate as they aged when they had intensive health care needs and during COVID-19. Comprehensive ACP discussions among all chronically ill individuals could potentially align medical interventions that adhere to an individual's wishes and reduce unwanted EOL intensive care, specifically ICU stays, emergency department (ED) visits, and 30-day readmissions.

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