

## Original Article

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# Utilization of inpatient palliative care services among adolescents and young adults with cancer: Evidence from National Inpatient Sample 2016–2019

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**Abstract**

**Objectives.** Palliative care can improve the quality of life of adolescents and young adults (AYA) with cancer. However, little is known about the utilization of palliative care among AYA cancer patients. Identifying factors associated with the utilization of palliative care could inform efforts to improve palliative care access among AYA patients living with cancer.

**Methods.** Using data from the National Inpatient Sample 2016–2019, a representative sample of US hospitalizations, we examined palliative care encounters and associated characteristics among hospitalizations of AYA with cancer and high inpatient mortality risk. Survey design-adjusted bivariate and multivariable logistic regression models were used to examine associations of patient- and hospital-level characteristics with palliative care.

**Results.** Of 10,979 hospitalizations by AYA cancer patients with high mortality risk, 19.9% received palliative care services between 2016 and 2019. After adjusting for all characteristics, independent predictors of palliative care use were as follows: older age (25–39 years old vs. 25–39 years; odds ratio [OR] 1.31, 95% confidence interval [CI] 1.15–1.49), Hispanic/Latinx (vs. non-Hispanic White; OR 1.16, 95% CI 1.01–1.34), female (vs. male; OR 1.27, 95% CI 1.14–1.41), public insurance (vs. private insurance; OR 1.23, 95% CI 1.10–1.38), hospital location in the US South (vs. Northeast; OR 0.78, 95% CI 0.66–0.94), and a large hospital (vs. small; OR 0.83, 95% CI 0.72–0.96).

**Significance of results.** Less than 20% of AYAs with cancer and high risk of mortality received inpatient palliative care services. Further research is needed to explore the reasons for lower palliative care utilization in the younger age groups.

**Introduction**

Every year approximately 87,000 new cancers are diagnosed among adolescents and young adults (AYAs) (15–39 years) in the United States (US) (National Cancer Institute 2020, 2022). There are nearly 9,180 cancer-related deaths among AYAs every year, making it one of the leading causes of disease-related mortality (National Cancer Institute 2020, 2022). AYAs have unique physical and psychological needs, and there is a higher prevalence of psychological distress and complex pain among AYAs with cancer (Devlin et al. 2019; Ellis et al. 2009; Kazak et al. 2010). Palliative care – which aims to relieve symptoms and psychological distress – is associated with improved quality of life, lower health-care costs, and increased survival with early integration in standard oncology care. (Bakitas et al. 2009, 2015; Yadav et al. 2020) Palliative care has been proven to have benefits and promising results in AYAs with advanced cancer when integrated early into their treatment (Abdelaal et al. 2021; Sansom-Daly et al. 2020). However, there have been relatively few studies investigating its availability and utilization (Donovan et al. 2015).

AYAs require focused palliative care services to fulfill their complex needs; for example, AYA cancer patients have developmental, psychological, and social needs that are specific to their age group, which may not be fully understood or addressed in general oncology settings (Cheng and Wangmo 2020; Clark and Fasciano 2015). Clinical guidelines encourage integrating



palliative care with standard oncology care for AYAs with cancer across the continuum of care, starting early on at the stage of diagnosis (National Comprehensive Cancer Network 2022). Despite the clinical recommendation, the integration of palliative care in the cancer care of AYAs remains suboptimal to date (Maciasz *et al.* 2013). Evidence has shown that patients diagnosed with cancer are not routinely referred to palliative care due to various barriers, including limited resources, and supportive care is prioritized for those with the highest need as defined by the oncology team (Abdelaal *et al.* 2021; Wolfe and Rosenberg 2013). Specifically, many AYA patients receive care in adult cancer centers, where the focus is primarily on treatment and cure, rather than on addressing the unique needs of this age group (e.g., psychosocial needs) (Cheng and Wangmo 2020; Clark and Fasciano 2015; Linebarger *et al.* 2014). Moreover, AYA cancer patients and their families may have limited knowledge and awareness of palliative care and its benefits, which can make it difficult for them to access palliative care or communicate in care coordination (Huo *et al.* 2019a; Ivey and Johnston 2022; Linebarger *et al.* 2014; Mallon *et al.* 2021).

Previous studies have primarily focused on palliative care delivery and utilization among the older adult population (Cheng and Wangmo 2020; Cohen-Gogo *et al.* 2011; Roeland *et al.* 2016; Ruck *et al.* 2018). A recent passing of the Childhood Cancer Survivorship, Treatment, Access, and Research (STAR) Act of 2018 highlights the need for AYA survivorship treatment and research and encourages the development of targeted interventions to improve quality of life and reduce the cancer burden for AYA cancer survivors and their families (Congress.Gov 2018). Population-based evidence is needed to better inform health systems' planning and implementation of palliative care programs for AYA patients. However, no known studies have been conducted to estimate palliative care use among the AYA cancer patient population. To address this gap, the current study aimed to (1) estimate the national prevalence of inpatient palliative care use and (2) determine predictors of inpatient palliative care use among AYAs with cancer using nationally representative data of hospital discharge records in the US.

## Methods

### *Data and study population*

We analyzed data from the 2016–2019 National Inpatient Sample (NIS), which provides information on hospitalizations across all payers in the US. The NIS is maintained by the Agency for Healthcare Research and Quality (AHRQ) as part of the Health-care Cost and Utilization Project (HCUP) (Agency for Healthcare Research and Quality 2021). The HCUP database can be accessed through the HCUP Central Distributor ([https://www.hcup-us.ahrq.gov/tech\\_assist/centdist.jsp](https://www.hcup-us.ahrq.gov/tech_assist/centdist.jsp)). De-identified NIS data were delivered for analysis following completion of a data–user agreement with AHRQ (S.Y., Z.X., and Y.-R.H. completed the agreement and had full access to all of the data in the study). The NIS provides a cross-sectional representative sample of discharges from US hospitals and is the largest inpatient database in the US. The data contain information about patient demographic and hospital characteristics related to inpatient admissions (Agency for Healthcare Research and Quality 2021).

A total of 10,979 hospitalizations were included in the analysis. We included patient admissions that met these criteria of (1) age between 15 and 39 years (National Cancer Institute 2020, 2022), (2) primary diagnosis of cancer, and (3) highest likelihood

of in-hospital mortality. Cases with a primary diagnosis of cancer were identified using the International Classification of Disease, Tenth Revision (ICD-10) codes C00–C96. Given the unknown pattern of palliative care use among AYA cancer patients, we focused on those with high-risk mortality, defined by All-Patient Refined Diagnosis-Related Group (APR-DRG) Risk of Mortality rating of 3–4 (Baram *et al.* 2008), likely to use palliative care. The APR-DRG rating calculates disease-specific mortality risk incorporating comorbidity conditions. With every one-unit increase in APR-DRG Risk of Mortality, there is a 3 times increase in in-hospital mortality (Baram *et al.* 2008). This approach is consistent with previous studies that have used mortality rating to indicate palliative care prioritization among pediatric and adult populations (Cheng and Wangmo 2020; Mulvey *et al.* 2016; Ruck *et al.* 2018). As the NIS data is de-identified, it does not constitute research involving human subjects; therefore, this study was exempted from review by the University of Florida Institutional Review Board. This study follows the Strengthening the Reporting of Observational Studies in Epidemiology guideline (von Elm *et al.* 2014).

### *Outcome variable: inpatient palliative care*

The primary outcome of this study was inpatient palliative care utilization, which was identified by the ICD-10 code Z51.5 (Ruck *et al.* 2018). This was coded as a binary variable indicating whether having palliative care encounter during hospitalization.

### *Independent variables: patient and hospital characteristics*

Patients' age in years (15–24 and 25–39), sex (male and female), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic/Latinx, other [including Asian, Native Hawaiian, Pacific Islander, Native American, and multiple races]), median household income quartiles based on patient's ZIP code (0–25th percentile [lowest quartile], 26th–50th percentile, 51st–75th percentile, and 76th–100th percentile [highest quartile]), health insurance type (defined as primary payer; private, public, self-pay, or no charge), length of stay (0–1, 2–4, and 5+ days), patient location (metropolitan, micropolitan, and rural), and elective admission (yes and no) were used as patient-level covariates. Hospital-level covariates included hospital region (Northeast, Midwest, South, and West), hospital location (rural and urban), hospital teaching status (teaching and non-teaching), and hospital size based on HCUP hospital bed size categorized based on hospital location and teaching status (categorized as small, medium, and large). For example, a large hospital size refers to a hospital with more than 100 beds in a rural area, 200 beds in an urban non-teaching hospital, and 500 beds in an urban teaching hospital (Agency for Healthcare Research and Quality 2006). We accounted for these patient- and hospital-level characteristics in the adjusted analysis to control for their direct or indirect effect on outcomes.

### *Statistical analysis*

We constructed 2 sequential multivariable regression models to examine patient and hospital characteristics associated with palliative care utilization. Both unadjusted and adjusted odds ratios (OR) with 95% confidence interval (CI) were calculated. The first model included patient characteristics including age, sex, race and ethnicity, zip code–level income, insurance type, patient location, admission type, and length of stay (Model 1). Model 2 then adjusted for hospital characteristics (hospital region, location, teaching status,

and bed size) in addition to the patient characteristics used in Model 1. Given a concern of potential residual confounding with sex-specific cancer types (e.g., female breast), we did not include cancer type in the multivariable model and only reported the results from the bivariate analysis (for most prevalent cancer types). We tested interactions of race and ethnicity, household income, insurance type, patient location, and hospital region by year; however, we did not find any significant interaction. All analyses were conducted in accordance with NIS national discharge-level estimates (Agency for Healthcare Research and Quality 2018) and the HCUP formal data use agreement. We applied recommended survey weights to account for patient discharge weights, hospital-level clusters, and survey strata (Agency for Healthcare Research and Quality 2018). All analyses were conducted using SAS Version 9.4 (SAS Institute). We determined statistical significance at a 2-sided  $p$ -value of less than 0.05.

## Results

### Sample characteristics

Of all the hospitalizations recorded in the NIS data between 2016 and 2019, 10,979 (equating to 54,895 national estimates) met our inclusion criteria (AYA patients with cancer and higher in-hospital mortality risk). Of the study sample, the majority (78%) were 25 to 39 years old, male (52%), and non-Hispanic White (50%). The most common cancer types identified were brain cancer (15.5%), leukemia (11.5%), and colorectal cancer (7.2%) (Table 1).

### Inpatient palliative care utilization patterns

Overall, 19.9% of the hospitalizations involved palliative care services use (Table 1). AYA cancer patients aged 25–39 years old (20.9%) were more likely to use palliative care than those aged 15–24 (16.1%) ( $p < 0.001$ ). Compared with non-Hispanic White (18.6%), patients of race or ethnicity other than White had more palliative care utilization (non-Hispanic Black, 21.9%, Hispanic, 21.2%, and other, 20.4%) ( $p = 0.045$ ). Female AYA patients (22.0%) had a higher palliative care use than male patients (17.8%) ( $p < 0.001$ ). AYA cancer patients who were covered with public insurance (22.6% vs. 17.6% with private), with emergent admission (22.7% vs. 9.1% in elective admission), and in the Northeast region (23.1% vs. 18.2% in West) had higher utilization of palliative care services. By cancer type (Figure 1), palliative care utilization rate was more commonly used among female breast cancer patients (27.7%), followed by lung (25.1%), other cancer types (24.4%), colorectal (22.9%), and multiple cancers (17.7%).

### Predictors of inpatient palliative care utilization

The results of multivariable logistic regression models are shown in Table 2. When adjusted for patient characteristics (Model 1), older age (25–39 years; OR 1.30, 95% CI 1.14–1.48) and female sex (OR 1.26, 95% CI 1.14–1.40) were significantly associated with palliative care utilization. Palliative care use was significantly less likely in patients with elective admissions (OR 0.34, 95% CI 0.28–0.41) than emergent admission type and covered under private insurance (reversed OR 0.81, 95% CI 0.72–0.91) or self-pay payor status (OR 0.69, 95% CI 0.52–0.90) than covered under Medicare.

After controlling for all patient- and hospital-related characteristics in the multivariable logistic regression model (Model 2), the independent predictors of palliative care use were age between

25 and 39 (OR 1.31, 95% CI 1.15–1.49), Hispanic/Latinx ethnicity (vs. non-Hispanic White; OR 1.16, 95% CI 1.01–1.34), female (vs. male; OR 1.27, 95% CI 1.14–1.41) sex, elective admission (vs. emergent admission; OR 0.34, 95% CI 0.28–0.41), length of stay of 2 to 4 days (vs. 0–1 day; OR 0.79, 95% CI 0.63–0.99), public insurance (vs. private insurance; OR 1.23, 95% CI 1.10–1.38), geographic region South (vs. Northeast; OR 0.78, 95% CI 0.66–0.94) and Western region (vs. Northeast; OR 0.72, 95% CI 0.60–0.86), and large hospital (vs. small hospital; OR 0.83, 95% CI 0.72–0.96).

## Discussion

Using a nationally representative sample of US hospital admissions, our study provides a population estimate of palliative care use in AYAs with cancer and a high risk of mortality. Overall, 19.9% of hospitalizations in the study cohort had a palliative care encounter. Significant predictors of palliative care included age, sex, race/ethnicity, type of insurance, length of stay, admission type, hospital region, and hospital size. A higher likelihood of palliative care use was observed for patients in the age group 25 to 39 years compared to patients 18 to 24 years. This finding suggests there are differences in palliative care practice between the age groups. Two previous population-based studies examined palliative care utilization in pediatric and adult populations with advanced cancer. Both studies found a lower prevalence of palliative care utilization among younger age groups and a relatively higher prevalence in the older age groups within their study cohorts (Cheng and Wangmo 2020; Mulvey et al. 2016). A possible explanation for these differences in referral practices could be the limited number of specialized AYA palliative care practitioners relative to adult palliative care practitioners, resulting in lower access to palliative care services for AYAs (Feudtner et al. 2013). Palliative care services are important for younger patients and their families as they need support to cope with the psycho-social-emotional needs (i.e., development continuum) by the advanced disease and during the end-of-life stage (Cheng and Wangmo 2020; Clark and Fasciano 2015; Linebarger et al. 2014). To meet the growing palliative care demands for AYA population, public health efforts should be focused on providing training to clinicians for providing specialist AYA palliative care services. Further research is required to explore the reasons for lower palliative care utilization in the younger age groups.

Our study found a positive association between female sex and inpatient palliative care use. This finding is consistent with prior literature on the adult cancer population (Ruck et al. 2018). Evidence across health-care utilization literature shows a greater consumption of health-care services by women. Previous studies on costs associated with palliative care use also suggest that female sex is associated with lower hospital daily costs (Cheng and Wangmo 2020). A possible explanation could be better knowledge of palliative care among women than men (Huo et al. 2019a). Studies suggest gender-based preference for palliative care services. According to a recent study, women were 3 times more likely than men to prefer palliative care services. These gender differences in awareness and preferences related to palliative care services may lead to disparities in cancer end-of-life care; therefore, interventions should be undertaken to promote awareness and utilization of palliative care among men (Saeed et al. 2018).

We also found a higher prevalence of palliative care use among non-Hispanic Black and Hispanic AYAs than non-Hispanic White AYAs. However, after controlling for both patient- and hospital-related characteristics, these differences in the use of inpatient

**Table 1.** Demographic characteristics of the sample population by inpatient palliative care, 2016 to 2019

	Total (N = 10,979)	No palliative care encounter (N = 8794)	Palliative care encounter (N = 2185)	% weighted prevalence of palliative care encounter (95% CI) <sup>a</sup>	p Value
Variable	Weighted N = 54895 <sup>a</sup>	Weighted N = 43,970 <sup>a</sup>	Weighted N = 10,925 <sup>a</sup>		
Year	No. (%)	No.	No.		0.9258
2016	2454 (22.4)	1957	497	20.3 (18.5–22.0)	
2017	2553 (23.3)	2059	494	19.3 (17.4–21.3)	
2018	2879 (26.2)	2305	574	19.9 (17.9–22.0)	
2019	3093 (28.2)	2473	620	20.0 (18.3–21.8)	
Age, years					<0.0001
15–24 years	2407 (22.0)	2019	388	16.1 (14.5–17.6)	
25–39 years	8572 (78.0)	6775	1797	20.9 (19.9–21.9)	
Race/Ethnicity					0.0446
Non-Hispanic White	5239 (50.0)	4260	979	18.6 (17.5–19.8)	
Non-Hispanic Black	1791 (17.0)	1397	394	21.9 (19.9–24.0)	
Hispanic	2132 (20.0)	1679	453	21.2 (19.3–23.1)	
Other <sup>b</sup>	1422 (13.0)	1131	291	20.4 (17.0–23.8)	
Sex					<0.0001
Male	5677 (52%)	4662	1015	17.8 (16.6–19.0)	
Female	5295 (48%)	4125	1170	22.0 (20.8–23.3)	
Household income <sup>c</sup>					0.1153
0–25 percentiles (lowest)	3009 (28%)	2379	630	20.9 (19.3–22.5)	
25–50 percentiles	2687 (25%)	2137	550	20.4 (18.8–22.1)	
50–75 percentiles	2691 (25%)	2165	526	19.5 (17.9–21.1)	
75–100 percentiles (highest)	2367 (22%)	1932	435	18.3 (16.6–20.0)	
Elective admission					<0.0001
Emergent	8709 (79%)	6731	1978	22.7 (21.6–23.7)	
Elective	2258 (21%)	2053	205	9.1 (7.7–10.4)	
Length of stay					0.055
0–1 days	652 (6%)	504	148	22.6 (19.4–25.9)	
2–4 days	2383 (22%)	1942	441	18.5 (16.8–20.1)	
5+ days	7942 (72%)	6347	1595	20.0 (18.9–21.1)	
Insurance type					<0.0001
Any private	5421 (49.5%)	4464	957	17.7 (16.5–18.8)	
Any public	4890 (44.6%)	3783	1107	22.6 (21.3–23.9)	
Self-pay/no charge	650 (5.9%)	535	115	17.7 (14.7–20.7)	
Patient location <sup>d</sup>					0.1228
Metro	9576 (88%)	7643	1933	20.1 (19.2–21.1)	
Micro	799 (7%)	652	147	18.3 (15.5–21.2)	
Rural	477 (5%)	397	80	16.7 (13.3–20.2)	
Hospital region					0.0039
Northeast	2055 (19%)	1579	476	23.1 (20.7–25.5)	
Midwest	2131 (19%)	1713	418	19.6 (17.8–21.3)	

(Continued)

**Table 1.** (Continued.)

	Total (N = 10,979)	No palliative care encounter (N = 8794)	Palliative care encounter (N = 2185)	% weighted prevalence of palliative care encounter (95% CI) <sup>a</sup>	p Value
South	4155 (38%)	3345	810	19.4 (17.9–21.0)	
West	2638 (24%)	2157	481	18.2 (16.6–19.8)	
Hospital location <sup>d</sup>					
Rural	154 (1%)	120	34	22.0 (15.6–28.5)	0.489
Urban	10,825 (99%)	8674	2151	19.8 (18.9–20.8)	
Hospital teaching status					
Teaching	9894 (90%)	7924	1970	19.9 (18.9–20.9)	0.9421
Non-teaching	085 (10%)	870	215	19.8 (17.4–22.1)	
Hospital size <sup>e</sup>					
Small	1028 (9%)	815	213	20.7 (17.7–23.6)	0.0739
Medium	2052 (19%)	1687	365	17.7 (15.9–19.6)	
Large	7899 (72%)	6292	1607	20.3 (19.2–21.4)	

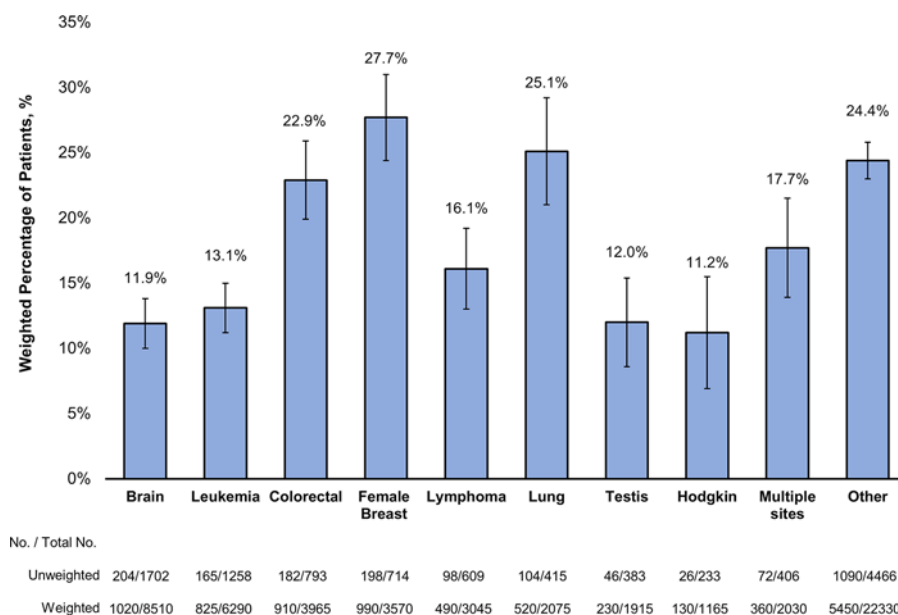
<sup>a</sup>Estimates were weighted to represent national discharge level.

<sup>b</sup>Includes Asian, Pacific Islander, Native American, and multiple races.

<sup>c</sup>Quartile classification of the estimated median household income of residents in the patient's ZIP code.

<sup>d</sup>Based on Rural–Urban Continuum Code (RUCC) and Urban Influence Code (UIC) of the Economic Research Service of the US Department of Agriculture.

<sup>e</sup>NIS bed size categories are determined based on hospital beds and are specific to the hospital's location and teaching status. For more details, see [https://www.hcup-us.ahrq.gov/db/vars/hosp\\_bedsiz/nisnote.jsp](https://www.hcup-us.ahrq.gov/db/vars/hosp_bedsiz/nisnote.jsp). For example, a large hospital size refers to a hospital with more than 100 beds in a rural area, 200 beds in an urban non-teaching hospital, and 500 beds in an urban teaching hospital.



**Fig. 1.** Weighted prevalence of inpatient palliative care use among AYA cancer patients with high-risk mortality, 2016–2019.

\*Error bars indicate 95% confidence intervals.

palliative care services were no longer significant for non-Hispanic Black AYAs. Previous studies of advanced cancer patients found that Black AYAs and Hispanic AYAs were more likely than White AYAs to use inpatient palliative care services and suggested that inpatient palliative care services are more accessible and equitable for these groups, compared to other settings (Griggs 2020; Sharma et al. 2015). It is important to consider that inpatient settings may not be the most appropriate or preferred setting for all patients, especially for AYA cancer patients who may wish to receive care in an outpatient setting or at home (Muni et al. 2011; Sharma et al.

2015). Additionally, while inpatient palliative care may be more accessible, it may not necessarily be the most effective or efficient way to deliver palliative care. Inpatient settings may also not be able to address all of the unique needs of AYA cancer patients, such as their developmental, psychological, and social needs (Cheng and Wangmo 2020; Clark and Fasciano 2015; Linebarger et al. 2014). There is also the possibility that the physician might disagree with families of critically ill non-White patients regarding end-of-life care, which may explain these differences (Muni et al. 2011; Sharma et al. 2015). Overall, more research is needed to investigate the



**Table 2.** Multivariate logistic regression analysis of variables associated with inpatient palliative care

Variable	Bivariable model		Multivariable model no. 1		Multivariable model no. 2	
	Unadjusted OR (95% CI)	p Value	Adjusted OR (95% CI) <sup>a</sup>	p Value	Adjusted OR (95% CI) <sup>b</sup>	p Value
<b>Year</b>						
2016	Ref		Ref		Ref	
2017	0.95 (0.80–1.11)	0.4933	0.93 (0.79–1.10)	0.3888	0.93 (0.79–1.10)	0.4095
2018	0.98 (0.83–1.16)	0.8167	0.95 (0.80–1.13)	0.5901	0.95 (0.80–1.13)	0.5611
2019	0.99 (0.85–1.47)	0.8664	0.96 (0.82–1.12)	0.5861	0.95 (0.81–1.11)	0.5251
<b>Age, years</b>						
18–24	Ref		Ref		Ref	
25–39	1.38 (1.22–1.55)	<0.0001	1.30 (1.14–1.48)	<0.0001	1.31 (1.15–1.49)	<0.0001
<b>Race/Ethnicity</b>						
Non-Hispanic White	Ref		Ref		Ref	
Non-Hispanic Black	1.22 (1.06–1.41)	0.0038	1.05 (0.90–1.21)	0.505	1.04 (0.90–1.21)	0.5418
Hispanic	1.17 (1.02–1.33)	0.017	1.10 (0.96–1.27)	0.139	1.16 (1.01–1.34)	0.0295
Other	1.12 (0.89–1.39)	0.314	1.09 (0.88–1.35)	0.414	1.10 (0.89–1.37)	0.3579
<b>Sex</b>						
Male	Ref		Ref		Ref	
Female	1.30 (1.18–1.43)	<0.0001	1.26 (1.14–1.40)	<0.0001	1.27 (1.14–1.41)	<0.0001
<b>Household income</b>						
0 to 25 percentiles (lowest)	Ref		Ref		Ref	
25 to 50 percentiles	0.97 (0.85–1.10)	0.672	0.99 (0.86–1.15)	0.992	0.99 (0.86–1.15)	0.9892
50 to 75 percentiles	0.91 (0.80–1.04)	0.197	0.96 (0.83–1.10)	0.586	0.96 (0.83–1.10)	0.5938
75 to 100 percentiles (highest)	0.85 (0.73–0.98)	0.025	0.89 (0.76–1.04)	0.171	0.88 (0.76–1.03)	0.1267
<b>Elective admission</b>						
Emergent	Ref		Ref		Ref	
Elective	0.34 (0.28–0.40)	<0.0001	0.34 (0.29–0.41)	<0.0001	0.34 (0.28–0.41)	<0.0001
<b>Length of stay</b>						
0–1 days	Ref		Ref		Ref	
2–4 days	0.77 (0.62–0.95)	0.018	0.79 (0.63–0.99)	0.0441	0.79 (0.63–0.99)	0.047
5+ days	0.85 (0.70–1.04)	0.121	0.91 (0.74–1.12)	0.410	0.91 (0.74–1.12)	0.3906
<b>Insurance type</b>						
Any private	Ref		Ref		Ref	
Any public	1.37 (1.23–1.51)	<0.0001	1.23 (1.10–1.38)	0.0003	1.23 (1.10–1.38)	0.0003
Self-pay/no charge	1.00 (0.81–1.24)	0.9807	0.86 (0.68–1.09)	0.2256	0.88 (0.69–1.11)	0.2763
<b>Patient location</b>						
Metro	Ref		Ref		Ref	
Micro	0.89 (0.73–1.09)	0.253	0.91 (0.73–1.13)	0.408	0.89 (0.71–1.12)	0.3355
Rural	0.79 (0.61–1.02)	0.077	0.80 (0.61–1.05)	0.116	0.79 (0.59–1.05)	0.1051
<b>Hospital region</b>						
Northeast	Ref		–		Ref	
Midwest	0.80 (0.67–0.96)	0.019	–		0.88 (0.73–1.05)	0.1675

(Continued)

**Table 2.** (Continued.)

Variable	Bivariable model		Multivariable model no. 1		Multivariable model no. 2	
	Unadjusted OR (95% CI)	p Value	Adjusted OR (95% CI) <sup>a</sup>	p Value	Adjusted OR (95% CI) <sup>b</sup>	p Value
South	0.80 (0.67–0.95)	<b>0.011</b>	–		0.78 (0.66–0.94)	<b>0.0084</b>
West	0.74 (0.62–0.87)	<b>0.001</b>	–		0.72 (0.60–0.86)	<b>0.0003</b>
Hospital location						
Rural	Ref		–		Ref	
Urban	0.87 (0.6–1.27)	0.490	–		0.75 (0.47–1.20)	0.2429
Hospital teaching status						
Teaching	Ref		–		Ref	
Non-teaching	0.99 (0.84–1.16)	0.942	–		0.89 (0.74–1.07)	0.242
Hospital size						
Small	Ref		–		Ref	
Medium	0.82 (0.66–1.03)	0.092	–		1.08 (0.89–1.32)	0.411
Large	0.97 (0.80–1.18)	0.815	–		0.83 (0.72–0.96)	<b>0.0137</b>

OR, odds ratio; Ref, reference.

<sup>a</sup>Model 1 adjusted for patient age, race/ethnicity, sex, household income, insurance type, location, admission type, length of stay, and year.

<sup>b</sup>Mode 2 adjusted for patient characteristics and admission type included in Model 1 plus hospital characteristics.

underlying causes of disparities or access barriers across races and ethnicities to ensure that all AYA cancer patients have access to adequate palliative care as part of their cancer treatment.

Although we did not observe significant racial and ethnic disparities in palliative care use, the overall proportion of utilization use in our AYA population was less than 20%. This is in the lowest end of the utilization range of older cancer populations (10%–70% by cancer type) (Huo et al. 2019b; Rubens et al. 2019; Ruck et al. 2018). The role of health-care providers in evaluating each patient individually and referring them for palliative care can be further strengthened to increase the uptake of palliative care services (Griggs 2020). Our analysis also revealed hospital characteristics associated with palliative care use among AYA cancer patients. Hospitals located in the South region or large bed sizes had lower utilization, contrasting with studies on inpatient palliative care use among the adult population (Lee et al. 2021; Singh et al. 2017; The Center to Advance Palliative Care 2020). For example, a recent report from the Center to Advance Palliative Care shows that the vast majority (>95%) of large hospitals with 300 or more beds have palliative care teams (The Center to Advance Palliative Care 2020). However, this study found that AYA patients in large hospitals were less likely to receive palliative care. It would be worthwhile to investigate further geographic variations and the availability of palliative care teams in hospital settings for AYA patients in future studies.

Our analysis has some limitations. First, our dataset is limited to inpatient palliative care services. However, there is evidence that the majority of palliative care services are provided in the inpatient setting (Roeland et al. 2016). A further study is needed to estimate how many palliative care consultations and home health or hospice referrals are provided in the outpatient setting to this population. Second, we used ICD-10 code Z51.5 for identifying patients who received palliative care services, which is subject to limitation of incomplete or inaccurate administrative coding. However, it has been used in previous studies utilizing the national inpatient

sample dataset (Ruck et al. 2018; Singh et al. 2017). Third, the dataset did not provide any information about the cancer stage; we tried to overcome this limitation by using the APR-DRG Risk of Mortality score to identify patients at high risk of mortality. This approach has been previously used to eliminate the different cancer stages among cancer patients (Cheng and Wangmo 2020; Ruck et al. 2018). Despite these limitations, to our knowledge, this is the first study to assess national estimates of inpatient palliative care utilization among AYAs in recent years. Our findings could inform efforts in health policy and clinical guidelines to improve the integration of palliative care into standard cancer care in AYAs.

### Conclusion

In this nationally representative sample population, less than 20% AYAs with cancer and a high risk of mortality received inpatient palliative care services. Predictors of palliative care included age, sex, race, type of insurance, length of stay, admission type, hospital region, and hospital size. These findings address an important gap in palliative care service use among AYAs with cancer and have implications for resource and personnel allocation and strategies for ensuring timely access to palliative care services. There is a need for future research to explain the barriers to the use of palliative care services and to develop policy and clinical guidelines for the wider adoption of palliative care services for AYA patients with cancer.

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