Dental Care for Survivors of Adolescent and Young Adult Cancer: Special Considerations

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Purpose: Oral health is important for quality of life, but may be undermanaged for survivors of cancer. We examine dental care use and barriers among long-term survivors of adolescent and young adult (AYA) cancer in comparison to individuals without a history of cancer.

Methods: The 2008–2012 Medical Expenditure Panel Survey (MEPS) identified 1216 individuals diagnosed with cancer at AYA ages (15–39 years), who were at least 5 years from diagnosis. A comparison group was matched using age, sex, and other factors. We evaluated self-reported dental visits in the previous 12 months, and inability and delay in receiving necessary dental care among survivors and the comparison group. Furthermore, individual factors associated with dental care use were identified using multivariable logistic regressions.

Results: Of survivors, 60.86% reported no dental visits in the previous year compared to 51.96% of the comparison individuals ($p < 0.001$). Survivors were more likely to report inability (10.71% vs. 6.29%, $p = 0.001$) and delay (8.12% vs. 4.45%, $p = 0.001$) in getting necessary dental care than the comparison group. Notably, survivors without dental insurance were more likely to report inability and delay. Female survivors were more likely to use dental care than males (odds ratio = 1.76, 95% confidence interval 1.15–2.71, $p = 0.01$). Hispanic survivors, those diagnosed at younger ages, and uninsured survivors were less likely to have at least one dental visit.

Conclusion: Survivors of AYA cancer need timely surveillance to manage late effects, including dental complications. Yet, these survivors, particularly those who are uninsured, delay dental care more often than individuals from the general population. Survivor-specific interventions are needed to reduce dental care barriers.

Keywords: dental care, dental use barriers, MEPS, survivors of AYA cancer

Introduction

OVER 70,000 ADOLESCENTS AND YOUNG ADULTS (AYAs) are diagnosed with cancer between 15 and 39 years of age each year in the United States and the majority of these patients transition to survivorship.^{1–3} Survivors of AYA cancer may be at risk for developing chronic health conditions due to their disease or treatment.^{4–6} Among these conditions are oral complications such as oral mucositis, infection, salivary gland dysfunction, and taste alterations.^{7–9} While tumor location in the head, neck, and face region and undergoing local therapy (radiation or surgery) may heighten the risk of dental late effects,¹⁰ survivors of other cancers may also be prone to oral health complications.^{9,11} Oral complications may greatly diminish cancer survivors' quality of life.¹² Furthermore,

poor dental health may impact the development of other diseases (e.g., cardiovascular diseases and diabetes)^{13,14} and affect survivors psychologically by influencing how they look, enjoy life, and socialize, as well as their feelings of social well-being.¹⁵

Earlier reports demonstrate that nonelderly survivors of cancer diagnosed at any age in the United States report skipping or delaying dental care because of cost.¹⁶ However, issues related to dental care use have not been examined specifically among the survivors of AYA cancer. There are strong reasons to believe that this age group may be at particular risk for poor dental care as the recent AYA Hope Study detailed several healthcare gaps for survivors, of AYA cancer including report of unmet medical needs for more than 50% of the sample.¹⁷ In general, these survivors report

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foregoing medical care due to cost barriers more often than individuals without a history of cancer.⁴

Insurance coverage is a particularly important determinant of dental care access.¹⁸ In earlier assessments, uninsured survivors of AYA cancer reported skipping medical care more often than insured survivors, although dental care was not specifically investigated.⁴ While the Affordable Care Act (ACA) is expected to enhance medical insurance availability for cancer survivors,¹⁹ dental coverage is not part of the ACA's required essential health benefits, and Medicaid coverage of adult dental benefits varies state by state.²⁰ As a result, it is projected that the number of adults without dental benefits will only be reduced by a marginal 5% relative to 2010 figures.²⁰ Without adequate dental insurance, survivors of AYA cancer may be at particular risk for skipping dental care. The Children's Oncology Group (COG) and other national cancer organizations recommend dental check-ups for AYA survivors every 6 months regardless of cancer type or treatment.^{21,22} Yet, to our knowledge, no study has evaluated the gaps in receiving necessary dental care among long-term survivors of AYA cancer in comparison to individuals without a history of cancer.

Using the Medical Expenditure Panel Survey (MEPS) data, we identified survivors of AYA cancer in the United States, currently aged between 20 and 64 years, who were at least 5 years from their cancer diagnosis. We hypothesized that survivors would not meet national recommendations for dental care and report fewer dental visits than a matched comparison group from MEPS without a history of cancer. We also compare delays in dental care and inability to receive necessary dental care among survivors and the comparison group. Furthermore, we identified characteristics associated with higher or lower dental care use, such as age at diagnosis and insurance coverage, to help identify high-risk groups of survivors for future study.

Materials and Methods

Data

MEPS is a nationally representative survey of a civilian noninstitutionalized population in the United States.^{23–26} MEPS uses a subsample of households who participated in the previous year's National Health Interview Survey to create a sampling frame each year. An overlapping panel design is used in which each family is followed for 2 years. To conduct our analyses, we used the full year consolidated MEPS data files from 2008 to 2012. Selected variables were vertically concatenated across survey years to create a cross-sectional data set.

Using publicly available data such as MEPS for research purposes does not require human research approval according to the University of Texas Medical Branch Institutional Review Board.

Study sample

Survivors of AYA cancer and matched comparison group. MEPS provides information on whether respondents were ever diagnosed with cancer or any other malignancy, including their diagnosis type and age at diagnosis. From 2008 to 2012, data were available on 95,430 adults, aged 20–64 years, with nonmissing information on cancer diagnosis. Of these, 4918 were diagnosed with any cancer or malignancy at any age. We focused on individuals ($N=1533$) who were diagnosed with cancer at AYA ages, that is, between 15 and

39 years. Individuals diagnosed with nonmelanoma skin and unknown skin cancers were excluded.¹⁶ Our final sample was restricted to 1216 survivors of AYA cancer who were at least 5 years from diagnosis.

Adults ($N=90,512$) between 20 and 64 years of age who had no history of cancer were used to create a comparison group. A logistic regression was estimated with the pooled sample of survivors and adults with no history of cancer. The dependent variable was cancer diagnosis (i.e., 1 for survivors and 0 for comparison group) and independent variables included sex, age at survey, race/ethnicity, census-region, and survey year (please see the section below on demographics for the definition of these independent variables). These variables have been used in a prior study on the matched comparison group for cancer survivors using MEPS data.²⁶ Furthermore, we did not match survivors and comparison group on factors (i.e., insurance and marital status) that could be influenced by cancer exposure. We used one-to-one nearest-neighbor matching with predicted logistic regression and identified $N=1216$ comparison group individuals. The post-matching *t*-test revealed that the averages of independent variables did not differ significantly across survivors and the comparison group.

Dental care measures. Our key outcome variable was total dental visits in the previous 12 months. The household component of MEPS collects data on healthcare use for services such as office- and hospital-based care and dental services in each survey round. For each individual, these data are summed to produce yearly utilization (e.g., total dental visits). We examined dental care use in two ways. First, we created a variable to identify whether survivors reported two or more visits in the past year, to indicate their adherence to national recommendations for survivors.²² Then, as few survivors reported two or more visits, we created a binary variable (0 vs. ≥ 1 visit in the previous year) to identify risk factors associated with nonuse of dental services. We also included report of delays in receiving necessary dental care and if they were unable to receive necessary dental care.

Demographic and cancer-related measures. Demographic variables in our study included sex, age at survey (20–29, 30–39, 40–49, and 50–64 years), race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black, non-Hispanic Asian, and non-Hispanic others), marital status (never married, married, divorced/separated, and widowed), poverty categories (high: $>400\%$, middle: $200\%–400\%$, and poor/near-poor/low: $<200\%$ of poverty line), medical and dental insurance in the previous year (private medical and dental, private medical and no dental insurance, public insurance, and uninsured), census-region (Northeast, Midwest, South, and West), and survey year (2008 to 2012). Census-regions were included to adjust for regional differences in demographics and access to medical care, as well as cancer incidence rates.^{27–29}

Cancer diagnosis information for survivors included diagnosis frequency (one or multiple cancers), age at initial diagnosis, and initial diagnosis. For confidentiality reasons, MEPS combines cancer types with low frequencies and reports a separate category (i.e., Other Unspecified). Because of low frequencies, we also combined some specified cancer types into a category named “Other Specified.”

Statistical analyses

Weighted summary statistics and χ^2 test compared demographics across survivors and the comparison group. Delay and inability in receiving necessary dental care were also compared among survivors and the comparison group using a χ^2 test. For survivors, cancer diagnosis variables (number of cancer diagnoses, age at initial diagnosis, and diagnosis type) were summarized.

Weighted multivariable logistic regressions examined individual characteristics (e.g., sex, age at survey, race and ethnicity, marital status, poverty categories, medical and dental insurance coverage, survey year, and census-region) associated with dental care use. Age at diagnosis, survey

year, and census-region were included as continuous variables in the regression analysis. Age at diagnosis was used as a predictor only for cancer survivors. Existing studies on health services use among survivors and general population guided the selection of these variables for our regression model.^{16,26,30,31} In addition, we estimated regression with varying specifications (e.g., leave one variable out at a time) and our results were found to be robust.

All statistical analyses were weighted and conducted in Stata 13 S.E. (StataCorp, College Station, TX). Appropriate strata, primary sampling unit, and sampling weights were specified to account for the complex MEPS sampling design.^{32,33} MEPS sampling weights from 2008 to 2012 were divided by 5 (number of years of MEPS data being pooled)

TABLE 1. CHARACTERISTICS OF SURVIVORS OF ADOLESCENT AND YOUNG ADULT CANCER AND INDIVIDUALS FROM COMPARISON GROUP

	Survivors (N = 1216)		Comparison group (N = 1216)		p
	N	Weighted% ^a	N	Weighted% ^a	
Sex					
Male	199	20.67	199	19.06	0.53
Female	1017	79.33	1017	80.94	
Age at survey (in years)					
20–29	79	5.40	79	6.1	0.86
30–39	274	20.74	274	19.95	
40–49	422	34.25	422	35.60	
50–64	441	39.62	441	38.35	
Race and ethnicity					
Hispanic	195	8.76	195	7.06	0.32
Non-Hispanic white	775	78.46	775	81.85	
Non-Hispanic black	172	7.39	172	7.20	
Non-Hispanic Asian	33	1.61	33	1.17	
Non-Hispanic others (multirace or other)	41	3.78	41	2.72	
Marital status					
Never married	226	16.37	224	16.36	0.01
Married	593	55.02	701	62.62	
Divorced or separated	363	26.18	254	18.60	
Widowed	33	2.42	30	2.43	
Poverty categories ^b					
High (>400% of poverty line)	343	38.32	434	46.06	0.005
Middle (200–400% of poverty line)	331	28.28	343	27.67	
Poor/near-poor/low (<200% of poverty line)	542	33.40	439	26.27	
Medical and dental insurance					
Private medical and dental	461	45.07	506	47.14	<0.001
Private medical and no dental	238	21.81	309	28.90	
Public medical	302	17.66	153	8.73	
Uninsured	215	15.46	248	15.22	
Census-region					
Northeast	142	11.39	142	10.84	0.95
Midwest	312	26.22	312	27.55	
South	431	36.81	431	36.66	
West	331	25.58	331	24.95	
Survey year					
2008	236	19.74	236	20.40	0.90
2009	262	20.54	262	21.16	
2010	236	20.36	236	19.34	
2011	232	19.20	232	20.07	
2012	250	20.16	250	19.03	

^aThe Medical Expenditure Panel Survey design was taken into consideration for estimating the weighted %.

^bPoverty is categorized using the US Census Poverty Level or Current Population Survey.

for analytic adjustments.^{26,32} Two-sided significance was considered at $\alpha=0.05$.

Results

Of survivors and the comparison group, close to 80% were female, more than 70% were 40–64 years of age at survey, and the majority was non-Hispanic white (Table 1). More survivors were divorced and separated than the comparison group (26.18% vs. 18.60%, $p=0.01$). Fewer survivors belonged to the high and middle poverty categories in comparison to individuals from the general population ($p=0.005$). Among survivors, 45.07% had private medical and dental insurance (vs. 47.14% for the comparison group), 21.81% had private insurance but no dental insurance (vs. 28.90% for the comparison group), and 17.66% had public insurance vs. 8.73% for the comparison group ($p<0.001$). Of the publically insured survivors and comparison group, less than 1% had dental insurance. Therefore, we did not differentiate between public insurance with and without dental coverage.

Among survivors, more than 85% were diagnosed at 20–39 years of age, and common cancers were cervix, breast, and melanoma (Table 2). Time since diagnosis ranged from 5 to 43 years with the median of 16 years (not shown).

Of survivors, 60.86% reported no dental visits in the previous 12 months compared to 51.96% of the comparison group individuals ($p<0.001$, not shown). Roughly 22% of the survivors reported 2 or more dental visits during the past year, indicating that few AYA survivors meet COGs rec-

ommendation of dental visits every 6 months. Of survivors who had at least one visit in the previous year, 55.98% had private medical and dental insurance, 23.62% had private medical and no dental insurance, 11.29% were publically insured, and 9.11% were uninsured, which differed from the comparison group (59.20%, 32.5%, 3.31%, and 4.98%, respectively). In Figure 1, survivors were more likely to report inability (10.71% vs. 6.29%, $p=0.001$) and delay (8.12% vs. 4.45%, $p=0.001$) in getting necessary dental care than the comparison group. Among survivors who reported inability in receiving dental care, 81.71% had no dental insurance ($p<0.001$). Similarly, among those who reported delay, 73.82% were without dental insurance ($p=0.01$).

Multivariable regression results (Table 3) show that female survivors were 76% more likely to have had at least one dental visit in the previous 12 months than male survivors (odds ratio (OR) = 1.76, 95% confidence interval (CI) 1.15–2.70, $p=0.01$). Older ages at diagnosis were positively associated with having at least one visit (OR = 1.34, 95% CI 1.01–1.76, $p=0.04$). Non-Hispanic white survivors were more likely to have dental care than Hispanic survivors (OR = 1.70, 95% CI 0.98–2.96, $p=0.06$). Poor/near-poor/low (OR = 0.50, 95% CI 0.32–0.79, $p=0.003$) and middle (OR = 0.68, 95% CI 0.46–1.00, $p=0.05$) poverty category survivors had dental visits less often than survivors in the high category. Uninsured (OR = 0.38, 95% CI 0.22–0.65, $p=0.001$) and publically insured (OR = 0.56, 95% CI 0.34–0.95, $p=0.03$) survivors were less likely to have dental visits than privately insured survivors with dental insurance. Notably, associations between these demographic factors and dental care use were similar among survivors and the comparison group individuals.

TABLE 2. CANCER-RELATED FACTORS FOR SURVIVORS OF ADOLESCENT AND YOUNG ADULT CANCER

	N	Weighted% ^a
Number of cancer diagnoses		
One	1131	93.41
Two or more	85	6.59
Age at initial cancer diagnosis (in years)		
15–19	171	13.90
20–29	515	42.54
30–39	530	43.56
Initial cancer diagnosis ^b		
Breast	115	9.51
Cervix	392	31.38
Colon/rectum	16	0.85
Leukemia/lymphoma	69	5.89
Melanoma	93	10.95
Ovary	46	4.2
Testicular	30	3.67
Thyroid	56	5.56
Uterus	97	6.85
Other specified	65	5.65
Other unspecified	152	15.50

^aThe Medical Expenditure Panel Survey design was taken into consideration for estimating the weighted %.

^bCancer type is summarized for survivors who were diagnosed with a unique cancer (total = 1131). For confidential reasons, MEPS combines cancer types with low frequencies and reports a separate category (i.e., other unspecified). We further combined cancer types with low frequencies with <10 observations each as other specified.

MEPS, Medical Expenditure Panel Survey.

Discussion

There is an increasing national emphasis on evaluating age-appropriate healthcare needs of survivors of AYA cancer.^{34–36}

FIG. 1. Barriers to dental care for survivors of adolescent and young adult cancer and individuals from the comparison group. MEPS asked respondents whether they were unable to get necessary dental care and whether there was a delay in getting necessary dental care. This figure summarizes yes responses to these two questions for the subsamples examined in our study. The MEPS design was taken into consideration for estimating the weighted %. MEPS, Medical Expenditure Panel Survey.

TABLE 3. MULTIVARIABLE ANALYSES FOR DENTAL VISITS IN THE PREVIOUS 12 MONTHS

	Survivors			Comparison group		
	Odds ratio ^a	95% CI	p	Odds ratio ^a	95% CI	p
Sex						
Male				Ref		
Female	1.76	1.15–2.70	0.01	2.21	1.47–3.34	<0.001
Age at survey (in years) ^b	1.05	0.81–1.36	0.72	1.06	0.87–1.27	0.57
Age at diagnosis (in years) ^b	1.34	1.01–1.76	0.04	—	—	—
Race and Ethnicity						
Hispanic				Ref		
Non-Hispanic white	1.70	0.98–2.96	0.06	2.03	1.22–3.38	0.01
Non-Hispanic black	1.52	0.71–3.27	0.28	1.07	0.54–2.12	0.85
Non-Hispanic Asian	1.61	0.63–4.10	0.32	2.01	0.78–5.14	0.14
Non-Hispanic others	0.76	0.25–2.35	0.63	2.14	0.79–5.81	0.13
Marital status						
Never married				Ref		
Married	0.81	0.46–1.42	0.46	0.99	0.61–1.63	0.98
Divorced or separated	0.72	0.42–1.25	0.25	0.92	0.49–1.72	0.79
Widowed	1.06	0.41–2.74	0.90	0.87	0.21–3.55	0.85
Poverty categories						
High (>400% of poverty line)				Ref		
Middle (200–400% of poverty line)	0.68	0.46–1.00	0.05	0.59	0.42–0.83	0.002
Poor/near-poor/low (<200% of poverty line)	0.50	0.32–0.79	0.003	0.34	0.23–0.50	<0.001
Medical and dental insurance						
Private medical and dental				Ref		
Private medical and no dental	0.82	0.51–1.32	0.41	0.85	0.60–1.20	0.35
Public medical	0.56	0.34–0.95	0.03	0.28	0.14–0.52	<0.001
Uninsured	0.38	0.22–0.65	0.001	0.20	0.12–0.32	<0.001
Survey year ^b	1.01	0.91–1.13	0.83	1.02	0.92–1.14	0.66
Census-region ^b	1.08	0.92–1.26	0.35	0.93	0.78–1.10	0.39

^aThis table presents results from a logistic regression. The dependent variable is an indicator for no dental visit versus one or more visits. MEPS sampling weights were used to estimate these regressions.

^bAge at survey, age at diagnosis, survey year, and census-region categories were included as linear terms. Age at diagnosis does not apply to comparison group individuals.

This study examined dental care among long-term survivors of AYA cancer in comparison with matched individuals without a history of cancer using the MEPS data. Existing evidence suggests that there is a high prevalence of untreated dental complications among cancer survivors.¹¹ Yet, we found that more than 60% of survivors of AYA cancer had not seen a dentist in the previous 12 months, compared to 50% of participants matched from the general population. Importantly, the national guidelines recommend that survivors of AYA cancer see their dentist a minimum of once every 6 months,^{22,37} and only 22% of survivors had two (or more) visits in the past year.

Survivors were also significantly more likely to report inability and delay in obtaining needed dental care than our comparison group. Moreover, more than 80% of survivors who reported inability in receiving necessary dental care had no dental insurance. Insurance coverage is a key driver of dental care among the general population in the United States.^{18,38} In comparison to survivors who had any private medical and dental insurance in the previous year, uninsured survivors or those with public insurance were at a much greater risk for foregoing annual dental visits. This is concerning as about 34% of the survivors of AYA cancer had either public insurance or they were uninsured in the previous year.

While cancer diagnosis and treatment may be an immutable risk factor for poor oral health, the low rate of dental visits of survivors of AYA cancer suggests that oral healthcare interventions may be particularly important for this population—especially for uninsured survivors who may be at a higher risk for foregoing dental care. It remains questionable whether the ACA will substantially increase dental coverage.²⁰ Survivors who buy insurance on the exchanges may opt out of dental coverage as adult dental benefits are neither included in essential health benefits nor mandated. Also, if states do not provide Medicaid expansion for adult dental benefits,²⁰ cancer survivors with Medicaid may continue to face substantial dental care barriers. Similarly, survivors of AYA cancer who had poor/near-poor/low and middle income were less likely to have had at least one dental visit in the previous 12 months, and may need additional support for using preventive dental care.

As was the case among the comparison group individuals, male survivors were less likely to report at least one dental visit in the previous year than female survivors of AYA cancer. Other studies have observed this trend among the general population in the United States.^{39,40} Patients who were older at diagnosis were more likely to have had any dental visits in the past year than patients diagnosed at younger ages. While the cause of this relationship is unclear,

incidence of cancer and treatment use may be different among younger and older patients, which may affect the likelihood of dental late effects during survivorship. Future studies should evaluate why dental services use varies by survivors' age.

Consistent with other study findings on general medical use,¹⁶ we report for the first time that Hispanic AYA cancer survivors were less likely to use dental care than non-Hispanic white survivors, which may be influenced by several factors. In other studies, Hispanic patients have lower insurance coverage and are less likely to have a usual source of care (personal doctors or nurses), which can limit their access to specialized care.^{38,41} In addition, lower education and economic disparities (e.g., higher poverty rates) may negatively impact oral healthcare use among Hispanics.⁴² Acculturation could also influence dental care among these minority groups,⁴³ which is concerning as Hispanics who are less acculturated have been found to have higher levels of oral diseases.^{44,45}

A few limitations exist with our analysis. MEPS data are self-reported. Cancer diagnosis in MEPS includes malignancy of any kind that may lead to inclusion of patients with preinvasive cancer reports. Our data had more female cancer respondents than males. This distribution has been observed in other national studies with cancer survivors.^{16,26} Another limitation is that the survey does not inquire about specific treatment history, which would allow risk stratification of survivors. Along the same lines, because the MEPS does not query regarding dental complications or dentist recommendations for frequency of follow-up, we cannot comment on whether survivors who have greater oral health needs are obtaining recommended dental health visits and our analysis did not differentiate the type of dental visits. Finally, due to sample size restrictions, we could not conduct subanalyses by cancer types.

In summary, this study found that survivors of AYA cancer report greater barriers to dental care and are less likely to have annual dental visits in comparison to individuals without a history of cancer despite the fact that survivors are at greater risk for developing oral health-related complications. More targeted and individualized interventions such as outreach programs and preventive health education for survivors who are younger at diagnosis and those without medical or dental insurance may play a part in overcoming the potential barriers to receiving necessary dental care.⁴⁶

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Disclaimer

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Author Disclosure Statement

No competing financial interests exist.

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