Socioeconomic Factors and Adherence to Healthcare Recommendations in Adolescent and Young Adult Cancer Survivors

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Abstract

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Introduction: The majority of adolescent and young adult (AYA) cancer survivors do not receive recommended healthcare surveillance after completing cancer therapy. The impact of socioeconomic status and social support factors such as income, education, marital status, and insurance on healthcare adherence among AYA cancer survivors is unknown.

Methods: Five cancer centers invited eligible survivors diagnosed between ages 18-39 years who were 1-5 years from cancer therapy completion. Participants completed online surveys including sociodemographic factors, patient-reported outcomes, and the Healthcare Adherence (HCA) measure to assess healthcare services and screening test utilization. Diagnosis and treatment data were abstracted from medical records. Using the standard adherence cutpoint based on AYA survivorship guidelines, nonadherence was defined as a score <0.80 (range 0-1.0). We used multivariable logistic regression to calculate odds ratios (ORs) and 95% confidence intervals (CI) for adherence in relation to socioeconomic status and social support factors.

Results: Of 344 participants, 36% were adherent to healthcare recommendations. Nonadherence was associated with having less education (OR 0.43; 95% CI: 0.23-0.80 for < 4-year college degree), and relatively low household income (OR 0.51; 95% CI: 0.28-0.95 for $41,000-$80,000; OR 0.40; 95% CI: 0.19-0.86 for ≤ $40,000). Decreased adherence was

observed in those not identifying as Non-Hispanic White among breast cancer survivors (OR 0.39, 95% CI: 0.16-0.99). Nonadherence was increasingly associated with lower income levels among survivors <3 years after diagnosis (OR 0.25; 95% CI: 0.07-0.93 for $81,000-$120,000; OR 0.24; 95% CI: 0.07-0.84 for $41,000-$80,000; OR 0.13; 95% CI: 0.03-0.60 for ≤ $40,000). **Conclusion:** Nonadherence to healthcare guidelines was associated with lower income and education levels in general, and with reported Non-White status among AYA breast cancer survivors. Identification of barriers to adherence in AYA cancer survivors will help in the design of interventions to meet the needs of these high-risk groups, particularly during the first years after diagnosis.

Background:

Approximately 70,000 new invasive cancers are diagnosed annually in adolescents and young adults (AYA) in the United States, as reported for 1995-2015 (1). Historically, the AYA population has not benefited from the same improved survival rates compared to their younger pediatric cohorts. Identification of this survival disparity has led to research and subsequent improvement in the survival outcomes in AYAs with cancer, with increases in 5-year AYA cancer survival rates now paralleling those of childhood cancers (1). With improved treatments, there is an increasing number of AYA cancer survivors. Ensuring their continued participation in recommended healthcare surveillance and screening is important to reduce subsequent cancer treatment- and disease-related morbidity and mortality.

Compared to peers without a history of cancer, AYA cancer survivors have greater rates of heart disease, diabetes, asthma, and high blood pressure (2). Despite this, the majority of AYA cancer survivors do not receive recommended healthcare surveillance after completing cancer therapy (3). For example, in a cross-sectional survey of > 8500 patients conducted through the Childhood Cancer Survivor Study, only 28% of survivors with increased risk of cardiomyopathy had undergone a recommended echocardiogram within a two-year period; only 41% of those with increased breast cancer risk had undergone a recommended mammogram within a two-year period (3).

The Institute of Medicine (IOM) recommends risk-based healthcare for all cancer survivors, with the goal of early detection and prevention. For cancer survivors, this entails tailored recommendations for screening and surveillance based on cancer history (4). Patient adherence describes the concordance between an individual's actions (e.g., visiting healthcare provider, taking medications, obtaining recommended imaging) and their tailored

recommendations. Adherence is a critical component in risk-based healthcare, and the health consequences of nonadherence can be severe.

Low socioeconomic status and lack of social support have the potential to decrease quality of life and survival in AYA cancer survivors, at least partly due to reduced utilization of health care services. These factors are particularly of interest in this patient population given the challenges surrounding re-entry into school and workforce, and challenges related to financial independence during transitional years into full adulthood. Furthermore, young adults represent the highest percentage of uninsured among Americans by age group (5). For AYA patients with active cancer, having public insurance or no insurance has been associated with increased mortality (6). In AYA cancer survivors, cancer-related financial concerns may affect future health care utilization, including screening for cancer and conditions such as hypertension that are more common among adults. Despite current knowledge of this as a deterrent to adequate follow-up care, the impacts of socioeconomic and social support factors such as income, education, marital status, and insurance status on adherence to healthcare recommendations among AYA cancer survivors have not been well described, nor have possible racial/ethnic disparities in adherence.

To address this knowledge gap regarding the effects of socioeconomic and social support status on adherence to healthcare recommendations, we used Patient Reported Outcome surveys (PROs) paired with treatment data from four national comprehensive cancer centers that participate in the Livestrong Survivorship Centers of Excellence Network (7). Our objective was to measure the relationship of self-reported socioeconomic and social support factors on adherence to recommended healthcare surveillance among AYA cancer survivors.

Methods:

Study Setting and Participants:

This multi-center, cross-sectional study of AYA cancer survivors was conducted through the LIVESTRONG Survivorship Center of Excellence Network (COEN). COEN includes five geographically diverse sites, including the Fred Hutchinson Cancer Research Center in Seattle, Abramson Cancer Center at the University of Pennsylvania in Philadelphia, Dana Farber Cancer Institute of Boston, the Jonsson Comprehensive Cancer Center at the University of California in Los Angeles, and the University of North Carolina in Chapel Hill. Surveys were performed after approval by the relevant Institutional Review Board at each institution.

Study eligibility included being 18-39 years old at time of diagnosis with invasive malignancy, and having received treatment (surgery, cytotoxic chemotherapy, biological or targeted agents, and/or radiation therapy) at one of the COEN centers or their community affiliates. Participants were required to be within 1-5 years from completion of active cancer-directed therapy and to still be in active follow-up, defined as being seen for a follow-up visit in the participating center at least once in the 2 years prior to enrollment and/or scheduled to be seen for follow-up in the upcoming 6 months. Eligible participants were also able to read and speak English adequate to complete the PRO assessment.

All eligible participants were contacted via postal mail and/or telephone by their respective care centers, with information describing the study and requesting that they either visit the study website to register for the study or return a response form requesting follow-up from the study coordinator or opting out of the study. Registered and consented participants were directed to a secure online portal to complete an online consent prior to receiving a unique link to the baseline PRO survey. Participants were also given the choice of receiving and returning the consent and baseline PRO survey by postal mail.

Enrollment occurred at 5 different sites. Of 2,797 potentially eligible survivors identified, 464 survivors registered and completed consent forms for the study (Figure 1). Of these 464 tentatively eligible and registered subjects, 388 (84%) answered the baseline PRO survey after receiving the electronic link. More than 90% of participants completed the entire questionnaire; 34 (9%) responses were incomplete and not included in this analysis. In the interests of maintaining patient confidentiality, eight participants from a single site were excluded due to failure to accrue. Two additional patients were found to be ineligible after closer review and were removed from the final cohort, leaving 344 total participants for this analysis.

Assessment of Health Care Adherence:

The Healthcare Adherence (HCA) PRO survey was used to assess adherence to recommended health care guidelines for cancer survivors. The HCA has been standardized and tested with > 1,000 hematopoietic stem cell transplant and cancer survivors (8,9). Each item response included in scoring is converted to a 0 (nonadherent) or 1 (adherent) score, based on guideline standards for the test frequency by age, sex, and treatment exposure. A response of "don't know" is scored as 0 (nonadherent), since a goal of survivorship care is for patients to understand what tests are needed for their own health maintenance. When guidelines are not specific to recommendations for a test, standard adult recommendations based on United States Preventive Services Taskforce (USPSTF) or other relevant US national guidelines are used to determine the age at which surveillance testing should be initiated, and the frequency of testing. Additionally, some tests are only indicated starting at a certain age (e.g. colorectal cancer) or after certain treatment (e.g. mammograms after chest radiation). If a participant does not meet the recommended age or treatment criteria for when a test is recommended, the item is scored 1 (adherent) regardless of participant response. Composite scores are then transformed to the proportion of recommended tests completed within the recommended time frame (range 0.0-1.0). Based on previous adherence studies, subjects were classified as

adherent if they had a minimum composite score of 0.8, or meeting at least 80% of recommendations (10). Among AYA cancer survivors, 125 (36%) were adherent to healthcare guidelines and 219 (64%) were nonadherent.

Treatment Data:

Subjects had their full treatment data abstracted from medical records using a standardized protocol and entered into a secure online Survivorship Informatics Management System database. Treatment data included clinical diagnosis, cancer type, and time elapsed since diagnosis.

Assessment of Factors Associated with Socioeconomic Status and Social Support:

The survey included questions about highest level of education achieved (less than high school, high school degree or GED, some vocational or college credit, 2-year college degree or trade degree, 4-year college degree, post-graduate degree), annual household income ($0-20,000, $21,000-40,000, $41,000-60,000, $61,000-80,000, $81,000-100,000, $101,000-120,000, $121,000 or more), marital status (single, married, living with partner, separated, widowed, divorced), and insurance coverage (yes/no) and type (private, Medicaid/Medicare, Veteran's Administration, Other). The survey also included items about race (American Indian or Alaska Native, Asian, White/Caucasian, Black or African American, Native Hawaiian or other Pacific Islander, Other), ethnicity (Hispanic or Latino, not Hispanic or Latino), which due to small numbers were combined to create a composite race/ethnicity variable (Non-Hispanic White, Other).

Other variables obtained include: diagnosis category (re-categorized as breast cancer, leukemia/lymphoma, and other solid tumors), sex (female, male), time elapsed since diagnosis

(<3, 3+ years), age at diagnosis (continuous), and age at time of survey completion (continuous).

Statistical Analysis:

Demographic and disease characteristics, socioeconomic status, and social support factors were described among those who were and were not adherent to survivorship plan health care guidelines. Levels of missing data were assessed; data were complete for all variables except race (5% missing in adherents, 4% in nonadherents), ethnicity (1% missing in both adherents and nonadherents), and income (1% missing in adherents, 3% in nonadherents). Adherence to healthcare guidelines was then assessed by levels of each of the socioeconomic status and support factors using multivariable logistic regression to calculate odds ratios (ORs) and Wald-based 95% confidence intervals (CI). The likelihood ratio test for trend was used to evaluate for possible linear trends in ordinal factors with three or more levels. Analyses were first conducted for all subjects and subsequently by diagnosis category, time elapsed since diagnosis, and sex in order to assess possible differences in adherence by these characteristics. We *a priori* adjusted for study center. We used the change in estimate approach to evaluate possible confounding by diagnosis category, sex, age at diagnosis, and age at time of survey completion (11). Only age at time of survey had an important effect (>10%) and so was also retained in all analyses. All analyses were performed in RStudio (Version 1.2.5019; RStudio, Inc, Boston, MA) (12).

Results:

Adherent and nonadherent participants had similar proportions of female survivors (~70%) and similar age distributions at the time of survey (Table 1). A slightly greater proportion of adherents were <3 years from time of cancer diagnosis (34%) compared to non-adherents

(27%). A majority of both groups (79%) self-identified as White and 9%; 10% identified as Hispanic.

Adherence was negatively associated with educational level of < a 4-year college degree (OR 0.43; 95% CI: 0.23-0.80) relative to having a post-graduate degree (Table 2). There was a trend of increased adherence with increased educational level (trend test p=0.01). Lower levels of reported annual household incomes of $41,000-$80,000 or ≤ $40,000 were also inversely associated with adherence to healthcare guidelines (OR 0.51; 95% CI: 0.28-0.95, and OR 0.40; 95% CI: 0.19-0.86, respectively) relative to highest income level. There was a trend of decreasing adherence with decreasing annual household income (trend test p<0.01). Insurance, marital status, and race/ethnicity were not significantly associated with adherence among these respondents.

Diagnosis Category:

Adherence to healthcare guidelines varied by cancer type, being 34% among the 140 participants with breast cancer, 52% among 108 with leukemia/lymphoma, and 23% among 95 with solid tumors (Table S1). Adherence among breast cancer survivors was inversely associated with educational level (OR 0.26; 95% CI: 0.08-0.88 for less than a 4-year college degree, Table 3). Breast cancer survivors with annual household income $41,000-$80,000 were also significantly less likely to be adherent (OR 0.14; 95% CI: 0.03-0.72) relative to survivors with annual income ≥$121,000, as were those self-identifying as not being Non-Hispanic White (OR 0.39, 95% CI: 0.16-0.99). Adherence was not associated with insurance or marital status in this group. Among participants with leukemia/lymphoma or solid tumors, adherence was not associated with insurance, education, marital status, income, or race/ethnicity, although small numbers may have reduced our ability to examine these associations.

Time since Diagnosis:

In total, 101 participants completed the survey "early" or between 1 and 3 years after diagnosis (43% adherent), and 236 completed the survey "late" or at least 3 years after diagnosis (33% adherent) (Table S2). Among early survey respondents, the associations of adherence to healthcare recommendations decreased with decreasing annual household income (OR 0.25; 95% CI: 0.07-0.93 for income $81,000-$120,000, OR 0.24; 95% CI: 0.07-0.84 for $41,000-$80,000, OR 0.13; 95% CI: 0.03-0.60 for ≤ $40,000) relative to those with an annual household income ≥ $121,000 (Table 4). Among late survey respondents, the associations of adherence decreased with decreasing educational level (OR 0.40; 95% CI: 0.19-0.85 for less than a 4-year college degree). There were no other associations observed among respondents 3 or more years after diagnosis.

Sex:

The majority (70%) of survey participants were female, with similar proportions of adherence in both groups (37% among females; 35% among males, Table S3). Among females, adherence was inversely associated with educational level (OR 0.37; 95% CI: 0.17-0.82 for less than a 4-year college degree, Table 5). Adherence among females was also inversely associated with household income (OR 0.34; 95% CI: 0.16-0.74 for $41,000-$80,000; OR 0.25; 95% CI: 0.09-0.69 for < $40,000). There was also a suggestion of decreased adherence in relation to identifying as being other than Non-Hispanic White (OR 0.70, 95% CI: 0.38-1.01). Among males, adherence was also inversely associated with educational level (OR 0.35; 95% CI: 0.12-0.99 for 4-year degree), although the CI for less than a 4-year degree included one (OR 0.49, 95%CI: 0.16-1.52).

Discussion:

In this cross-sectional study of AYA cancer survivors, adherence to healthcare recommendations decreased with decreasing educational level and annual household income. In subgroup analyses, adherence was inversely associated with education and income in AYA breast cancer survivors and among females. In subgroup analysis by time elapsed since diagnosis, adherence was inversely associated with income in early survivors and with educational levels in late survivors.

AYA cancer survivors are not only at risk for cancer recurrence, late effects from therapy, and secondary malignancies, but also have been shown to be at increased risk of other serious comorbidities when compared to peers without history of cancer. In a study of 2009 Behavioral Risk Factor Surveillance System (BRFSS) data, > 4000 AYA cancer survivors were found to have greater prevalence of cardiovascular disease, obesity, hypertension, asthma, disability, and poor mental and physical health, compared to respondents without cancer (13). Given this, lifelong follow up care is recommended for AYA cancer survivors, and improved adherence to established follow-up guidelines may lead to improved health outcomes in these patients. However, educational levels and income are not easily modifiable and thus, knowledge gained from this analysis is more relevant to identifying groups where more vigorous efforts at outreach may be warranted and to understanding barriers to nonadherence.

Many of our results are consistent with earlier studies. Prior data in melanoma patients (ages 18-39 years) indicated that higher socioeconomic status is associated with improved adherence to healthcare screening recommendations. A study of 128 AYA survivors of melanoma identified through the Los Angeles County cancer registry found that higher socioeconomic status was positively associated with annual physician-conducted skin examination (14). Our study builds on these previous findings by evaluating discrete socioeconomic status factors and identifying educational level and income as important

considerations in understanding adherence in AYA cancer survivors. In this same study of AYA melanoma survivors, Hispanic ethnicity was negatively associated with annual physician-conducted skin examination when compared to non-Hispanic survivors (14). Although there is a suggestion in our data that nonadherence may be greater among females who are not Non-Hispanic White, this is in contrast to our general lack of associations between adherence and race/ethnicity.

Several studies have demonstrated that AYA survivors have increased risk of disruptions in both work and education due to treatment and treatment sequelae. In a study of AYA survivors in Australia, survivors reported difficulties reintegrating into school and work after treatment, possibly due to fatigue, physical impairments, or concentration deficits (15). Guy, et. al. used Medical Expenditure Panel Survey (MEPS) data and observed that compared to adults without a history of cancer, AYA cancer survivors were more likely to report an increased number of missed workdays as a result of illness or injury and an increased number of additional days spent in bed as a result of poor health (16). Similar findings are reported in the Childhood Cancer Survivor Study; adult survivors of childhood cancer reported higher levels of unemployment or being between jobs more often than their siblings (17). Derailment of education and employment opportunities during cancer treatment can also contribute to lower income in AYA cancer survivors. In the same study of MEPS data, AYA cancer survivors had greater annual medical expenditures and greater annual productivity losses when compared to peer adults without a history of cancer (16).

It is likely that all these factors affect adherence to healthcare guidelines in AYA survivors. Compared with individuals without a history of cancer, cancer survivors have been shown to be more likely to delay and forgo recommended medication use due to cost. National Health Interview Survey data was used to evaluate approximately 1000 AYA cancer survivors

and a comparison group of adults with no history of cancer. Participants reported if they had skipped any medication, taken less medication, or delayed filling medication to save money. AYA cancer survivors were more likely to report cost-related medication nonadherence and more likely to report they could not afford medication. Uninsured survivors in this study were also more likely to report medication nonadherence (18). This is concordant with studies of income and adherence in other cancer survivor populations and these results support our findings that survivors with lower income were more likely to be nonadherent to healthcare recommendations (19, 20). Our results suggest this may be particularly relevant for survivors who are still within 1-3 years of diagnosis, a critical time period when loss of income secondary to treatment and treatment complications may be especially impactful. Furthermore, our study indicates that increasing nonadherence is associated with lower levels of income in this group of survivors, increasing the risk of poor health outcomes in an already vulnerable population.

The results of this study should be interpreted in the context of several limitations. This was a cross-sectional study using data from a single timepoint. The sample size was relatively small, and it is possible that we did not detect some associations, especially in sub-analyses. Although we included patients from four diverse metropolitan areas, the majority were Non-Hispanic White, with most having private insurance and a college education. Participants living in urban areas such as the primary site locations in this study may generally have higher income than survivors living in rural areas. Similarly, participants were required to speak English, therefore missing an important segment of AYA cancer survivors that may also be at increased risk of nonadherence to recommended healthcare guidelines due to language barriers. Another limitation is the possibility of selection bias in this study, as the AYA survivors who did not complete the survey may have differed from those who completed the survey with respect to the factors we were examining. Participants in research studies are more likely to be non-Hispanic White, concordant with our study population (21), and this may have led to an underestimation

of the impact of socioeconomic status factors on adherence in our results. Finally, all healthcare adherence scoring was based on self-reported responses and it is possible that AYA survivors may have received recommended surveillance tests but were unaware or did not recall receipt. This may have led to a greater nonadherent study population. Despite this, knowledge of recommended healthcare screening is a critical factor for adherence. Similar knowledge deficits have been identified in studies from the Childhood Cancer Survivor Study (22), as childhood cancer survivors are often unaware of the details of their cancer therapy and may not recognize that they are at increased risk for certain comorbidities. However, knowledge of healthcare recommendations is only one part of the spectrum of reasons why AYA survivors may not adhere to guidelines.

This is one of the first studies to describe associations between adherence to healthcare recommendations in relation to socioeconomic status and social support factors in a multi-center cohort of AYA cancer survivors. Our results suggest that lower levels of educational attainment and annual household income decrease adherence. Despite our study's limitations, our findings are important to consider when caring for cancer survivors in this age group. Poverty is a public health crisis, and AYA cancer survivors with lower income and lower educational levels may be at increased risk of poor adherence and subsequent health complications. Our data suggest it is possible that women are more vulnerable to nonadherence with respect to these factors as well. Further research is needed to identify barriers to care for AYA cancer survivors, and to design strategies and improve outreach in order to assist all survivors in achieving optimal follow-up care.

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