Published in final edited form as:

Cancer Causes Control. 2015 August ; 26(8): 1153–1162. doi:10.1007/s10552-015-0609-1.

US trends in survival disparities among adolescents and young adults with non-Hodgkin lymphoma

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Abstract

Purpose—Improvement in US survival rates among adolescents and young adults (AYAs, ages 15 through 39 years inclusive) diagnosed with non-Hodgkin lymphoma (NHL) has been documented over the last two decades. We examined national trends in survival disparities for AYAs with NHL by race/ethnicity and socioeconomic status (SES, county-level poverty) to further understand NHL and to begin monitoring health outcome disparities for this disease.

Methods—Surveillance Epidemiology and End Results data were used to calculate 5-year relative survival rates of AYAs diagnosed with NHL from 1992 to 2007 and followed through 2011. Absolute and relative disparities were computed using HD*Calc. Whether a significant linear trend was present was evaluated using Joinpoint. Analyses were replicated after excluding individuals with known HIV infection.

Results—The study sample included 9,573 total and 7,121 non-HIV cases of NHL. Five-year survival rates improved for all groups over time. Significant decreases were found in absolute disparities for race/ethnicity (non-HIV), in relative disparities for SES (total) and race/ethnicity (total and non-HIV) (all $p < 0.05$). Survival rates of non-Hispanic Blacks and Hispanics remained below than those of non-Hispanic Whites throughout the time period.

Conclusion—Absolute and relative disparities in 5-year survival narrowed for AYAs with NHL over the time period. To continue to promote this trend, future research should investigate factors, particularly diagnostic delays and barriers to care, which continue to contribute to SES and racial/ethnic differences in survival. These factors may be particularly relevant to identify given the recent Affordable Care Act, which is designed to increase access to medical services, particularly for young adults.

Keywords

Non-Hodgkin lymphoma; Adolescents and young adults; Relative survival; Cancer health disparities; Surveillance

Introduction

Non-Hodgkin lymphoma (NHL) is one of the most common cancers diagnosed among adolescents and young adults (AYAs; individuals diagnosed with cancer between ages 15 and 39) [1]. Five-year survival rates for NHL have increased over the past 10 years. Relative survival for AYAs has increased from 55.6 % (1992–1996) to 76.2 % (2002–2006); however, survival rates have not achieved those observed for children ages 14 and under [2].

Population-based cancer registry data provide an opportunity to examine changes in survival rates over time, as well as investigate the existence and types of health disparities. Recent analyses of survival in adult patients with NHL using Surveillance Epidemiology and End Results (SEER) registry data documented decreasing racial/ethnic absolute disparities [3, 4] but increases in absolute differences by area poverty status [5]. Analyses using California Cancer Registry data have shown socioeconomic disparities in survival for AYAs with NHL [6]. Little is known about racial/ethnic or socioeconomic disparities in survival outcomes among AYAs and whether these disparities are changing over time. However, racial/ethnic disparities in survival have been shown to vary across NHL subtype [4]. Additionally, there are documented differences in survival for individuals with NHL and for individuals with co-occurring HIV infection [7]. Following the introduction of highly active anti-retroviral therapy (HAART), NHL incidence rates stabilized by the year 2000 [8]. Whether the magnitude of disparities in NHL survival differs among individuals with and without HIV is not well understood.

The Health Disparities Calculator (HD*Calc) developed by the Applied Research and Surveillance Research Programs of the National Cancer Institute (NCI) calculates an array of indices that summarize trends in disparities for a given health outcome [9]. This tool facilitates comparison of relative and absolute disparities and can account for different subgroup sizes. Results can then be exported to other software, such as Joinpoint, to evaluate trends over time. This approach has been used to measure health disparities in studies of breast cancer incidence and outcomes [10] and incidence of HIV/AIDS [11].

In this study, we selected data from SEER to calculate 5-year survival rates of AYAs diagnosed with NHL from 1992 to 2007 and used HD*Calc to examine absolute and relative disparity indices calculated for race/ethnicity and socioeconomic status (SES). We then

evaluated whether changes in disparities in survival over the time period were statistically significant. We examined the following research questions:

1. Have racial/ethnic or SES-based disparities in survival for AYAs with NHL status decreased or increased during this time period?
2. Do the trends change when individuals with known HIV status are removed from the analysis?

Methods

Data source

Data from the SEER program of the US National Cancer Institute (NCI) released in November 2013 were used for the current analyses. Ten population-based cancer registries were selected based on when they became part of the SEER program (1992 or earlier) and whether they demonstrated stable coding of HIV: San Francisco–Oakland, Connecticut, the metropolitan area of Detroit, Hawaii, New Mexico, Seattle (Puget Sound), Utah, the metropolitan area of Atlanta, San Jose–Monterey, and Los Angeles [8].

Patients aged 15–39 at diagnosis of a first primary case of NHL in 1992 through 2007 and followed for vital status through 2011 were included in analyses. The SEER program created a cancer site recode for AYA cancer patients [12]. Primary International Classification of Disease (ICD-O-3) site codes C000–C809 and histology codes 9590–9591, 9596, 9670–9671, 9673, 9675, 9678–9680, 9684, 9687, 9689–9691, 9695, 9698–9702, 9705, 9708–9709, 9714, 9716–9719, and 9727–9729 were included [13].

Analysis variables

Race/ethnicity—The SEER race recode variable designates the following categories: White, Black, American Indian/Alaska Native, Asian or Pacific Islander, other unspecified, and unknown. The origin recode from the National Hispanic/Latino Identification Algorithm (NHIA) [14] distinguishes between non-Spanish–Hispanic–Latino and Spanish–Hispanic–Latino. We combined race and Hispanic ethnicity to create the following analytical categories: non-Hispanic White (NH White), non-Hispanic Black (NH Black), nonHispanic Asian/Pacific Islander (NH Asian/Pacific Islander), Hispanic, and other. The other category included individuals of mixed race/ethnicity and non-Hispanic American Indian/Alaska Natives; there were too few cases of individuals of American Indian/Alaska Native descent to ascertain separate annual survival rates.

Socioeconomic status (SES)—We classified individuals as living in either a high or low SES area (two-level variable) based on whether their residence at diagnosis was in a county with at least 20 % of the population living at 200 % of the Federal Poverty Level (FPL) for 2000, an approach used in a similar study [10].

HIV status—Two SEER datasets were available for analysis: all individuals and individuals without known HIV infection or death due to AIDS-related causes. Information on individuals with known HIV infection was not available. We examined the relative impact of the health disparity indices using the two datasets (total and non-HIV) separately.

Relative survival rates

Relative survival represents the survival of cancer patients compared to the expected survival of sex-, age-, and race-matched individuals in the general population. We focused on relative survival as opposed to relative mortality because survival is sensitive to earlier detection and improvements in treatment, areas for which equitable healthcare access is extremely important. We performed sensitivity analyses using cancer-specific survival as the endpoint, rather than relative survival and found negligible differences in disparities between the outcome of relative survival and cancer-specific survival among the two population groups (total and non-HIV) and two predicting variables (race/ethnicity and SES) under investigation; thus, we decided to include only relative survival in the paper. Relative survival rates were calculated using standard population-based cancer registry survival analysis methodology using the Ederer II method [15].

Health disparities calculations

In our analyses, absolute health disparity indices represent differences (subtractions) in relative 5-year survival rates by either race/ethnicity or SES. In contrast, relative health disparities represent proportionate differences (quotients) in these rates. We used HD*Calc [16] to calculate standard indices of relative and absolute disparities. We chose the measures based on careful review of recommendations published for monitoring cancer health disparities [17]. We used two indices to calculate absolute disparities and two indices to calculate relative disparities, all by SES and race/ethnicity:

Measures of Absolute Disparity: Between-Group Variance and Rate Difference

1. The *Between-Group Variance* (BGV) summarizes squared deviations from a population average, where y = individual survival time, μ = population average survival time, and $p = j$'s group population size. It represents the variance that would exist if each individual had the mean survival probability of his/her social group. The BGV is weighted based on population size and is sensitive to differences in large deviations from population averages [18]. This index is recommended for comparison across multiple unordered groups (e.g., race/ethnicity) [17].

$$BGV = \sum_{j=1}^J p_j (y_j - \mu)^2$$

2. *Rate Difference* (RD) is an absolute measure of the difference in rates between two groups:

$$RD = y_j - y_w$$

where y_j = the rate for the group of interest and y_w = the rate for the non-Hispanic White population. Given previously documented disparities in survival between both NH White versus NH Black and NH White versus Hispanic AYA cancer patients [3], we examined pairwise comparisons in RD across these two sets. Given

this index reflects a simple difference and is both intuitive and easily interpretable, we used this measure for pairwise comparisons.

Measures of Relative Disparity: Mean Log Deviation and Rate Ratio

1. The *Mean Log Deviation* (MLD) is a measure of general disproportionality that summarizes the difference between the natural logarithm of shares of survival and shares of population, where r = ratio of survival of group j relative to the total survival and $p = j$'s group population size. It is population-weighted and sensitive to large deviations [18].

$$MLD = \sum_{j=1}^J p_j (-\ln r_j)$$

2. *Rate Ratio* (RR) is a relative measure of the ratio of rates between two groups:

$$RR = y_j / y_w$$

where y_j = the rate for the group of interest and y_w = the rate for the non-Hispanic White population. This was used to determine yearly ratios in relative survival between NH White and both NH Blacks and Hispanics. Rate ratio is a commonly used metric in public health research and effective for communicating proportional differences.

Data analysis

Annual 5-year survival rates by each race/ethnicity and SES group were calculated using SEER*Stat [19]. The health disparity indices were calculated HD*Calc [16] and entered into Joinpoint [20] to calculate direction and magnitude of average annual percentage change (AAPC) and 95 % confidence intervals, a method used to characterize and compare the magnitude of survival rate trends across cancer patient groups [21]. The number of inflection points was constrained to zero so to focus the analysis on overall linear trends of the time period of investigation. The magnitude, direction, and significance of a linear trend over the entire study period were assessed at the $p < 0.05$ level.

Results

The total number of AYA cases of NHL diagnosed between 1992 and 2007 in the SEER registries selected for this study was 9,573. When known cases of HIV were removed from the analysis subset, 7,121 NHL cases remained (74 %). Table 1 presents the total number of cases over the study period by area SES and race/ethnicity. The largest racial/ethnic group for NHL was non-Hispanic Whites ($n = 5,345$), followed by Hispanics ($n = 1,860$). Relative 5-year survival over the entire study period for all groups was 63.3 [95 % confidence interval (CI): 62.3, 64.3, data not shown]. Figure 1 shows 5-year relative survival rates by race/ethnicity and poverty. Results indicate improvement in survival over the study period.

Absolute and relative health disparity indices (BGV, MLD, RD, and RR) by SES and race/ethnicity over the entire study period are presented in Table 2 (disparity indices for each study year are given in “Appendix”). Disparities among racial/ethnic and SES groups are shown in the top panel of Table 2, and pairwise disparity indices comparing NH Whites to NH Blacks and Hispanics are shown in the bottom panel. Over the entire time period, multigroup disparity indices were smaller for the non-HIV population, indicating that disparities in survival had a smaller impact on individuals without versus with HIV. These data generally showed a decrease in the average annual percentage change (AAPC) for the health disparity indices by both race/ethnicity and to a smaller extent SES.

Absolute disparity

Absolute SES disparity, as measured by BGV, decreased, but not significantly [AAPC = -3.8 (95 % CI $-7.6, 0.2$)] over time, and when known cases of HIV were removed from the study sample, there was still no significant change in absolute disparity over time. By race/ethnicity, in the total sample there was no decrease in disparity, but removing known cases with HIV resulted in a significant reduction in absolute disparity over time [AAPC = -7.4 ($-11.7, -2.8$)].

A significant decrease in the RD was evident between NH Black and NH White survival rates for the non-HIV population [AAPC = -4.8 ($-8.3, -1.2$)] and between Hispanic and NH White for both the total [AAPC = -3.9 ($-6.2, -1.5$)] and non-HIV populations [AAPC = -3.6 ($-6.2, -0.9$)].

Relative disparity

For relative disparity, as measured by MLD, a significant decrease was evident by SES [AAPC = -8.0 (95 % CI $-12.2, -3.7$)]. This decrease did not remain significant when known cases of HIV were removed. For race ethnicity, the total population [AAPC = -7.5 (95 % CI $-11.3, -3.6$)] and non-HIV population [AAPC = -8.6 (95 % CI $-13.3, -3.6$)] both experienced significant decreases in relative disparity. Survival rate ratios between NH Blacks and NH Whites and between Hispanics and NH Whites, both overall and with HIV cases removed, were <1 , indicating higher relative survival for the two minority groups versus NH Whites. Over the study period, these ratios increased (i.e., became closer to 1), indicating possible proportional improvement in survival relative to NH Whites; however, these increases were not statistically significant.

Discussion

We found some declines in absolute and relative disparities in 5-year relative survival for adolescents and young adults diagnosed with non-Hodgkin lymphoma. Specifically, relative disparities by SES overall declined. Absolute difference in racial/ethnic disparity for patients without HIV and a relative difference by race/ethnicity overall and without HIV declined. Including individuals with HIV attenuated the changing effects of race/ethnicity on survival rates, such that the magnitude of an absolute decline decreased when individuals with HIV were removed from the analysis. Rate differences decreased significantly for Hispanics versus NH Whites in both the total and non-HIV population and in NH Blacks versus NH

Whites for the non-HIV population only. Rate ratios between NH Blacks and His-panics versus Whites did not decline significantly, however. To our knowledge, ours is the first study to document trend in racial/ethnic and socioeconomic disparities for AYAs diagnosed with NHL and to examine the differential impact of co-occurring HIV.

Discrepancies in relative and absolute measures indicate the importance of calculating both kinds of measures when evaluating changes in disparity over time [18]. Although relative indices are more commonly reported in epidemiologic research, they may be misleading for diseases or events with low prevalence. Absolute measures, on the other hand, give an indication of improvement or decline in relation to the overall survival rate. In the case of NHL, we found rather dramatic improvements in 5-year survival over the study period. These improvements have not been experienced to the same extent across social groups, however, and this is obvious from the findings presented in Fig. 1. For example, across all study years, 5-year survival rates remain lower for NH Blacks than NH API and NH Whites for the total population. Survival rates for Hispanics are also lower than NH API and NH Whites for most study years. Removing individuals with known HIV infection reduces, but does not eliminate, these racial/ethnic disparities. For SES, the disparities are less pronounced, but after removal of HIV cases, the difference in survival between the high and low SES groups was nonsignificant. The fact that removing HIV cases attenuated the improvement in disparity by SES suggests that this improvement may have been driven by improvements in care provided to NHL cases with HIV, although more research is needed to investigate this phenomenon.

A nationwide Danish study of survival among adult (age 25 and over) patients with NHL ($n = 6,234$), all-cause mortality was 40 % higher in those with lower versus higher educational status for those diagnosed between 2000 and 2004 and 63 % higher in the period from 2005 to 2008, indicating an increase in disparity. Patients with lower socioeconomic position were less likely to receive radiation therapy, which may in part explain these disparities [22]. Given vastly different healthcare systems and racial/ethnic composition between Denmark and the USA, it is not surprising that the Danish results differ from our study. As found in our study, however, Hispanic and NH Black patients continued to have lower relative survival over the study period, regardless of whether HIV-positive cases were excluded, which indicates both the persistence of certain social group disparities and the importance of viewing both absolute and relative measures of health disparity.

Explanations for the mechanisms which underlie these persistent disparities, for both minority patients and those living in under-resourced areas, are clearly multifactorial and cannot be understood with surveillance data alone. Other research has pointed to lack of healthcare access and delays in diagnosis, which can lead to later stages at diagnosis and worse health outcomes [23]. A study of the Ohio Cancer Incidence Surveillance System found that patients ages 15–54 diagnosed with NHL from 1996 to 2002 who were Medicaid beneficiaries have worse survival than non-Medicaid patients [24]. Survival disparities by race/ethnicity and SES in patients with diffuse large B cell lymphoma (DLBCL), one of the most common NHL histologies in AYAs [25], have in part been attributed to presentation at more advanced stages. The importance of differential treatment is evident in reports that DLBCL survival varies by race/ethnicity dependent receipt of rituximab [26] as well as

delayed chemotherapy or chemoimmunotherapy [27]. Rituximab was approved for relapsed/refractory B cell low-grade NHL treatment in 1997 [28], and a SEER-based patterns of care analysis on patients diagnosed with NHL in 1999 found that approximately 12 % received rituximab, although no socio-demographic factors were associated with its receipt [29]. Given that our analyses are retrospective and do not contain treatment history, however, we can only speculate.

Strengths and limitations

A major strength of the current analysis is the use of the SEER cancer registry, which allows for the inclusion of a large number of AYAs with NHL. In addition, we removed known HIV cases, which most population-based studies of lymphoma are unable to do [30], and this enabled the examination of health disparities among the non-HIV population of NHL patients. When possible, we recommend that future research include HIV status as a main predictor or covariate on outcomes in NHL patients. There may be important differences in the factors that shape the disease and treatment experiences of HIV-infected and non-infected NHL patients, and ongoing work should consider the ways in which the HIV population may be experiencing larger outcome disparities.

Limitations of the current work include the inability to determine which specific patient-level factors may contribute to outcome disparities, such as delays in diagnosis and course of treatment. Small sample sizes did not permit us to examine differences across NHL subtypes prevalent in AYAs, such as DLBCL and follicular lymphoma, and recent research has documented differential survival patterns by race/ethnicities across those subtypes [4]. In addition, general limitations of using SEER data for analyses (for example, age of the data, the need to use white life tables for both Hispanics and APIs, and slight over-representativeness of affluence in SEER versus the general population average [31]) apply to our study. In addition, using county-level socioeconomic status may introduce some misclassification of individuals, but individual-level SES variables are not currently recorded in SEER. It is difficult to determine the appropriate poverty line benchmark, so sensitivity analyses using 100 % of the FPL were conducted and yielded negligible differences on survival disparities. Future work examining composite indices of census-tract level socioeconomic status is warranted and now possible [32].

Health disparity surveillance efforts should complement and support investigations of potentially modifiable factors more proximate to patients. Understanding variation in access to efficacious treatment and delivery of high-quality care is critically important to improve health outcomes of all social groups [33]. There has been a notable deficit in attention to health outcome disparities among AYAs with cancer, and it is clear that despite overall improvements in prognosis and survival, disparities persist and warrant careful attention. Adolescents and young adults face unique challenges that accompany their cancer diagnosis, including a lack of life experience and resources juxtaposed with the recent independence that accompanies young adulthood [34]. They may face increased financial burden [35] and challenges obtaining or maintaining health insurance [36]. Furthermore, a recent study reported that uninsured young adult cancer patients were more likely to present with metastatic disease and have higher all-cause mortality [37]. How these challenges and others

differ between different social groups is an important topic for ongoing study in the AYA population.

In summary, our analyses demonstrate a general decline in survival disparities for AYAs with NHL. Although this study examined only one cancer site, the findings have research implications for population-based studies of AYAs with other cancers. As the demographic distributions of the US continue to change, particularly with an increase in the Hispanic youth population [38], we may expect new demographic trends in cancer incidence, mortality, and survival. Future research should investigate how individual, healthcare system, and regional factors may contribute to the decline of these disparities where present, as well as how we can continue these downward trends. Future work should also consider the potential impact of specific components of the Affordable Care Act which target young adults, including the ability to stay covered on parents' insurance until age 26, coverage for select preventive services, and removal of preexisting conditions barriers to enrollment.

Acknowledgments

The authors would like to acknowledge Mandi Yu and Steve Scoppa for assistance in obtaining data.

Disclaimer Findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Cancer Institute.

Appendix

See Table 3.

Table 3

Measures of racial/ethnic and area poverty level disparities in 5-year relative survival for AYAs with NHL, diagnosed 1992–2007, using data from the November 2013 release of SEER^a

Year of diagnosis	1992	1993	1994	1995	1996	1997	1998	1999	2000
<i>Multigroup comparisons</i>									
Absolute disparities									
SES, BGV (×100)									
Total	0.75	0.39	0.61	0.16	0.24	0.27	0.09	0.19	0.00
Non-HIV	0.03	0.07	0.07	0.00	0.04	0.05	0.00	0.05	0.01
R/E, BGV (×100)									
Total	0.85	1.06	0.78	0.38	0.44	0.37	0.82	0.56	0.45
Non-HIV	1.14	0.78	0.25	0.30	0.07	0.39	0.25	0.44	0.21
Relative disparities									
SES, MLD (×100)									
Total	1.87	0.95	1.26	0.37	0.41	0.35	0.10	0.18	0.00
Non-HIV	0.03	0.07	0.07	0.00	0.04	0.04	0.00	0.04	0.01
R/E, MLD (×100)									
Total	2.83	3.59	1.93	0.87	0.76	0.55	0.92	0.60	0.47

Year of diagnosis	1992	1993	1994	1995	1996	1997	1998	1999	2000
Non-HIV	1.32	0.96	0.26	0.28	0.06	0.40	0.21	0.39	0.17
Pairwise R/E comparisons									
NH Black–NH White RD									
Total	0.21	0.09	0.17	0.12	0.11	0.16	0.18	0.20	0.20
Non-HIV	0.30	0.08	0.08	0.04	0.00	0.08	0.10	0.14	0.06
Hispanic–NH White RD									
Total	0.16	0.25	0.15	0.04	0.04	0.08	0.20	0.12	0.04
Non-HIV	0.15	0.24	0.13	0.08	0.05	0.04	0.12	0.07	0.01
NH Black–NH White RR									
Total	0.54	0.81	0.66	0.76	0.80	0.75	0.76	0.74	0.75
Non-HIV	0.61	1.11	0.89	0.95	1.00	0.89	0.88	0.83	0.93
Hispanic–NH White RR									
Total	0.66	0.49	0.70	0.91	0.94	0.88	0.73	0.84	0.96
Non-HIV	0.80	0.67	0.83	0.89	0.94	0.95	0.86	0.91	0.98
Year of diagnosis	2001	2002	2003	2004	2005	2006	2007		
Multigroup comparisons									
Absolute disparities									
SES, BGV (×100)									
Total	0.01	0.64	0.06	0.09	0.07	0.24	0.51		
Non-HIV	0.08	0.33	0.05	0.14	0.01	0.11	0.36		
R/E, BGV (×100)									
Total	0.39	1.39	0.17	0.46	1.04	0.83	0.84		
Non-HIV	0.11	0.78	0.10	0.34	0.63	0.50	0.28		
Relative disparities									
SES, MLD (×100)									
Total	0.01	0.55	0.05	0.07	0.06	0.19	0.36		
Non-HIV	0.07	0.25	0.04	0.10	0.01	0.08	0.24		
R/E, MLD (×100)									
Total	0.41	1.38	0.15	0.40	0.94	0.73	0.68		
Non-HIV	0.09	0.66	0.07	0.25	0.48	0.37	0.20		
Pairwise R/E comparisons									
NH Black–NH White RD									
Total	0.16	0.29	0.06	0.16	0.25	0.24	0.23		
Non-HIV	0.07	0.23	0.02	0.15	0.20	0.16	0.14		
Hispanic–NH White RD									
Total	0.09	0.20	0.06	0.13	0.15	0.15	0.11		
Non-HIV	0.07	0.16	0.07	0.10	0.14	0.14	0.07		
NH Black–NH White RR									
Total	0.78	0.66	0.92	0.81	0.71	0.72	0.74		
Non-HIV	0.92	0.73	1.03	0.83	0.77	0.82	0.85		
Hispanic–NH White RR									
Total	0.88	0.76	0.93	0.85	0.82	0.83	0.87		

Year of diagnosis	2001	2002	2003	2004	2005	2006	2007
Non-HIV	0.92	0.82	0.91	0.89	0.84	0.85	0.92

NHL non-Hodgkin lymphoma, *AAPC* average annual percentage change, *CI* confidence interval, *SES* socioeconomic status, *R/E* race/ethnicity, *BGV* between-group variance, *MLD* mean log deviation, *RD* rate difference, *RR* rate ratio, *HIV* human immunodeficiency virus, *NH* non-Hispanic

^aSEER registries included were San Francisco–Oakland, Connecticut, the metropolitan area of Detroit, Hawaii, New Mexico, Seattle (Puget Sound), Utah, the metropolitan area of Atlanta, San Jose–Monterey, and Los Angeles

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Fig. 1.

Five-year relative survival rates of adolescents and young adults diagnosed with NHL from 1992 to 2007 using November 2013 SEER release. *NH* non-Hispanic, *API* Asian/Pacific Islander, *SES* socioeconomic status

Table 1

Number of adolescents and young adults (ages 15–39) diagnosed with non-Hodgkin lymphoma in selected SEER registries^a, diagnosed from 1992 to 2007

	Total	Non-HIV	
		N	Percentage of total
Area-level SES ^b			
High	2,836	2,348	82.8
Low	6,734	4,770	70.8
Missing	3	3	–
Race/ethnicity			
NH White	5,345	4,080	76.3
NH Black	1,426	890	62.4
NH API	762	717	94.1
Hispanic	1,860	1,276	68.6
Other ^c /unknown	180	158	87.8
Total	9,573	7,121	74.4

SEER Surveillance Epidemiology and End Results, HIV human immunodeficiency virus, NH non-Hispanic, SES socioeconomic status, API Asian/Pacific Islander

^a SEER registries included in this analysis are San Francisco–Oakland, Connecticut, the metropolitan area of Detroit, Hawaii, New Mexico, Seattle (Puget Sound), Utah, the metropolitan area of Atlanta, San Jose–Monterey, and Los Angeles

^b Residence at diagnosis was in a county with at least 20 % of the population living at 200 % or below the Federal Poverty Level (Low SES)

^c Other includes American Indian/Alaska Natives

Table 2

Measures of racial/ethnic and area poverty level disparities in 5-year relative survival for AYAs with non-Hodgkin lymphoma, diagnosed 1992–2007, using data from the November 2013 SEER release^a

	Disparity Index 1992–2007	AAPC ^b	95 % CI	p
<i>Multigroup comparisons</i>				
Absolute disparities				
SES, between-group variance (×100)				
Total	0.26	–3.8	(–7.6, 0.2)	0.06
Non-HIV	0.04	–0.8	(–14.4, 15.0)	0.91
Race/ethnicity, between-group variance (×100)				
Total	0.44	–3.1	(–6.5, 0.5)	0.09
Non-HIV	0.18	–7.4	(–11.7, –2.8)	<0.01
Relative disparities				
SES, mean log deviation (×100)				
Total	0.31	–8.0	(–12.2, –3.7)	<0.01
Non-HIV	0.03	–0.6	(–12.6, 13.0)	0.92
Race/ethnicity, mean log deviation (×100)				
Total	0.59	–7.5	(–11.3, –3.6)	<0.01
Non-HIV	0.15	–8.6	(–13.3, –3.6)	<0.01
<i>Pairwise race/ethnicity comparisons</i>				
NH Black–NH White rate difference				
Total	0.15	–0.6	(–3.2, 2.1)	0.65
Non-HIV	0.10	–4.8	(–8.3, –1.2)	0.01
Hispanic–NH White rate difference				
Total	0.10	–3.9	(–6.2, –1.5)	<0.01
Non-HIV	0.09	–3.6	(–6.2, –0.9)	0.01
NH Black–NH White rate ratio				
Total	0.77	0.4	(–1.0, 1.8)	0.51
Non-HIV	0.88	–0.7	(–2.3, 0.8)	0.30
Hispanic–NH White rate ratio				
Total	0.85	0.7	(–0.7, 2.2)	0.30
Non-HIV	0.89	0.2	(–0.7, 1.1)	0.70

AAPC average annual percentage change, CI confidence interval, SES socioeconomic status, HIV human immunodeficiency virus, NH non-Hispanic

^aSEER registries included were San Francisco–Oakland, Connecticut, the metropolitan area of Detroit, Hawaii, New Mexico, Seattle (Puget Sound), Utah, the metropolitan area of Atlanta, San Jose–Monterey, and Los Angeles

^bAAPC values that are significant at $p < 0.05$ are bolded