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## Multilevel socioeconomic effects on quality of life in adolescent and young adult survivors of leukemia and lymphoma

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### Abstract

**Purpose**—Cancer registry survival analyses have shown that adolescent and young adult patients with low socioeconomic status (SES) have reduced survival compared to those with higher SES.

**Conflict of interest:** The ideas expressed in the following paper are those of the authors and endorsement by the State of California, Department of Health Services, the National Cancer Institute, the Centers for Disease Control and Prevention, and/or the Genetic Epidemiology Research Institute of the University of California, Irvine is not intended, nor should it be inferred The SEOOL study was approved by the UC Irvine Institutional Review Board under Human Subjects Numbers 2006-4958 and 2009-7130. The authors have no financial interests to disclose.

The objective of this study was to determine whether neighborhood- (nSES) and/or individual-level SES (iSES) also predicted current quality of life in adolescent and young adult survivors.

**Methods**—The Socioeconomics and Quality of Life study surveyed adolescent and young adult survivors of leukemia and lymphoma at least one year post-diagnosis using population-based ascertainment. Factor analysis was used to create a multidimensional age-relevant iSES score and compared with a preexisting census-block-group derived nSES score. Four quality of life domains were assessed: physical health, psychological and emotional well-being, social relationships, and life skills. Nested multivariable linear regression models were run to test the associations between both SES measures and quality of life and to compare the explanatory power of nSES and iSES.

**Results**—Data from 110 individuals aged 16–40 were included in the final analysis. After adjustment for sociodemographic confounders, low nSES was associated only with poorer physical health, whereas low iSES was related to poorer quality of life in all four domains with iSES accounting for an additional 14, 12, 25, and 10 % of the variance, respectively.

**Conclusions**—Measures of SES at the individual as compared to the neighborhood level may be stronger indicators of outcomes in adolescents and young adults, which has important implications for SES measurement in the context of cancer surveillance.

### Keywords

Adolescents and young adults; Quality of life; Socioeconomic status; Health disparities; Leukemia; Lymphoma; Cancer; Cancer survivorship

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### Introduction

Newer conceptualizations of socioeconomic status (SES) in the domain of health outcomes tend to argue for the need to move beyond the limited traditional usage of income, education, and occupational status [1]. Oakes and Rossi's capital SES includes the realization that socioeconomic status involves access to material resources (owned goods, such as cars and computers), human capital (advantages that individuals themselves possess such as skills and earning potential), and social capital (the bidirectional flow of information and ideas from others as well as relational support) [2]. This conceptualization of SES may apply to adolescent and young adult health more closely than previously used economic indicators, which generally apply to individuals further in the life span, who are likely more influenced by the sum total of income, years of schooling, and aggregate socioeconomic resources [3].

In oncology, adolescents and young adult cancer survivors, who are recognized by the National Cancer Institute as being between the ages of 15 and 39 at diagnosis [4], are recognized as an age population that is distinct from younger children and older adults because of unique life events, age-specific differences in cancer incidence, age-specific treatment considerations (for example, whether these individuals should be treated at a pediatric- or adult-focused institution), fertility preservation considerations, and clinical trial enrollment [4]. Adolescents and young adults may be uniquely vulnerable in the ways that socioeconomic factors are related to health outcomes [5]. Individuals with low SES who develop cancer are at risk for lower quality of life, but the cancer experience itself may also

lower SES [6], a sort of “double-whammy” effect that shrinks social networks, interrupts educational and occupational trajectories, and costs patients sizeable portions of their net worth. These pathways may be uniquely powerful for the members of this age group, who tend to be at critical crossroads in their lives but often lack social safety nets [7]. Although a few studies have measured quality of life in adolescent and young adult cancer survivors [8–10], little is known about the relationship of SES and quality of life in this age group.

Socioeconomic status has differential health effects on both the individual and neighborhood level. The California Cancer Registry, which has collected information on all tumors diagnosed in the state since 1988 and has provided data to the Surveillance, Epidemiology, and End Results program since 2001, includes a categorical score of neighborhood-level SES based on census indicators at the block group level [11]. These data source alone, though, does not have information on individual-level SES. While there are occupational variables, they are seldom collected and are not very explanatory of SES for young patients. Understanding the relative impacts of *both* individual-level SES (iSES) and neighborhood-level SES (nSES) on health outcomes in cancer survivors requires data sources outside cancer registries.

Although improvements in cancer survival for adolescents and young adults have been hindered for many reasons, most young adults not only survive cancer, but live for decades beyond diagnosis [12]. Because survival is influenced by both physical and psychological health, it is important for epidemiological studies to consider not solely the number of years of survival, but also the quality of those years. The present study measured the quality of life on four domains, based on the World Health Organization’s conceptualization of quality of life: physical health, psychological and emotional well-being, social relationships, and life skills [13].

We address whether lower iSES and nSES predict lower quality of life across four quality of life domains in adolescents and young adults with leukemia and lymphoma. In addition, we examine whether iSES has a stronger relationship with quality of life than nSES, and whether it improves our understanding of health disparities in this age group.

## Patients and methods

### Study design

The Socioeconomics and Quality of Life study simultaneously examined iSES factors and quality of life in adolescent and young adults with leukemia and lymphoma. Questionnaires were distributed to recently diagnosed leukemia and lymphoma cases recruited from the California Cancer Registry. Individual-level variables related to socioeconomic status and quality of life were collected and analyzed. Survivors recruited for the study were diagnosed with primary cancer (January 1, 2006–December 31, 2007) while between the ages of 15 and 40 and residing in the southern California—Orange, Imperial, and San Diego Counties.

### Protocol and procedures

Study procedures closely approximated protocol developed for the Kids, Adolescents, and Young Adults Cancer survey described elsewhere [14]. Data collection spanned from

December, 2008 to December, 2009. Potential participants were sent a study packet that included: a cover letter describing the study and explaining how identification was accomplished through the cancer registry, the study questionnaire, a study information sheet that served as a waiver of written informed consent, a decline form to opt out, and a prepaid reply envelope. If a patient had a Spanish surname, as listed in the registry's data dictionary, a certified bilingual (Spanish-English) letter was sent with the packet, followed by study materials in Spanish upon patient request. Project staff made follow-up phone calls to verify receipt of the study packet and answer any questions. Before any contact attempts, efforts were made to determine whether a patient had passed away, using tracing methods such as the Social Security Death Index and Alumni Finder ([www.alumnifinder.com](http://www.alumnifinder.com)). All survivors who participated were sent a thank you letter and a \$20 money order to compensate them for their time.

### Participation rates

Population recruitment included 320 young adult cancer survivors (see Appendix 1, Fig. 1) for a flow diagram of the population-based recruitment). A total of 104 survivors from this recruitment with first-primary leukemia or lymphoma completed participation in the study. An additional six participants who fit eligibility criteria were recruited through a university-based cancer center to participate in an ancillary focus group study also completed the survey and were included to increase sample size. One of the population-based participants completed less than half of the survey with questionable data quality; therefore, these participant's data were removed from further analyses. A total of 110 participants were included in the final analyses, which reflects 77 % of the participants who either participated or declined. However, only 43 % of the identified participants completed the survey. Quality control was performed by having the data recorders double-check each questionnaire entry and data completion with a sample (15 %) of questionnaires triple-checked by the first author.

### Socioeconomic status

Socioeconomic status was measured at two geographic scales, neighborhood-level (nSES) and individual-level (iSES), and conceptualized as a multidimensional construct following Galobardes et al.' [15] definition: "the social and economic factors that influence which positions individual or groups will hold within the structure of a society". The nSES measure included in the California Cancer Registry was originally created from census 2000 indicators for the California Teacher's Study, an ongoing prospective cohort study aimed primarily at examining breast cancer etiology. Yost et al. [11] used principle components analysis to create a composite index of SES, selecting seven final indicators at the census-block group level for the measure: an educational attainment index, proportion with blue-collar job, proportion older than 16 in the workforce without a job, median household income, proportion below 200 % of the poverty level, median rent, and median house value, which all loaded as a single component, accounting for 59.7 % of the variance in the original data. This measure has been widely used in the analyses of health outcomes in California Cancer Registry data [16-23]. Quintiles of this measure were used in the current study [11].

Individual SES (iSES) was created in the current study using factor analysis (using SAS PROC FACTOR) from participants' responses to iSES questions (see Appendix 2, Table 6). The number of factors retained was based principally on the prior assumption of a tridimensional structure of iSES from Oakes and Rossi's identification of human-, material-, and social capital [2] and examination of scree plots, which indicated a parallelism between the second and third factor, further supporting our theoretical approach of keeping three factors. Oblique rotation was used to allow for correlation among factors [24], given the correlation of socioeconomic indicators like income, education, and social class. Items with loadings greater than 0.3 on at least one factor were retained. The analysis revealed one dominant factor which accounted for two-thirds of the common variance among the items. Indicators representing human capital (skills and knowledge) and material capital (tangible goods and economic resources) [2] had high factor loadings on this factor, which suggested a commonality between these two dimensions and was thus labeled 'material and human capital'. Among young adults, particularly those suffering from a chronic disease, it may be that these dimensions are intertwined, as the cancer experience may impede educational goals and limit social mobility [25].

Indicators of social capital did emerge as representative of two distinct constructs: social support and social connections. Items including the ability to obtain a lawyer if needed, general trust in others, and reliance on family and neighbors all appear to indicate a measure of social support (Factor 2: Social Support). Income may be a more transient indicator of access to material resources, whereas wealth may reflect more stable access over time [15]. Net worth, which had a moderate loading on social capital, helps establish social strata and defines social boundaries, thus in part determining one's level of social support, an important buffer during a stressful time [26].

Finally, Factor 3, described as social connections, had moderate-to-strong loadings on the number of professional friends, relationships with community leaders, and involvement in social groups. This factor seems to relate more to the size, rather than the quality, of the social network. Granovetter's "strength of weak ties" theory [27] asserts the power of casual acquaintances over deeper bonds for transmitting information through a social network. In this way, having many social connections may provide more access to resources, and in terms of experiencing cancer, this could benefit an individual in terms of care-seeking and quality of life. Formal participation in social groups has also been found to be related to good health among adolescents [28].

The three inter-factor correlations (Appendix 3, Table 7) were weak to moderate, further justifying the three-factor solution. The overall Kaiser–Meyer–Olkin measure of sampling adequacy was 0.80 indicating a commonality among the variables selected, and the correlation matrix was singular and identifiable. The three-factor scores were summed with weights equal to unity to create a final composite iSES score for each participant [2] and quintiles of the score were generated for regression analyses. As expected, raw iSES scores were moderately correlated with the raw nSES score ( $r = 0.49$ ). Individual SES items were all under 12 % missing except household income and net worth, which were 32 and 33 % missing, respectively. Missing values were imputed using the expectation maximization algorithm (using SAS version 9.2 PROC MI) with five imputations at each run [29],

following a three-stage process. There was little evidence of bias due to the missing data. All further analyses of iSES were conducted on the final imputed dataset.

### Quality of life

The Socioeconomics and Quality of Life survey included quality of life items developed by the investigators to address the specific domains central to the adolescent and young adult population. Previously published and validated quality of life scales did not appear to adequately address the specific concerns of adolescent and young adult cancer survivors, but rather young adult survivors of childhood cancers [30]. This is, perhaps, due to the dearth of quality of life research in this age group relative to younger and older counterparts [31]. As such, items were chosen to address age-specific issues such as identity, independence, relationships with family/friends, and the development of life skills. The four domains measured were physical health, psychological and emotional well-being, social relationships, and life skills. Several items from the Functional Assessment of Cancer Therapy-General [32] and the Youth Quality of Life Survey [33] were adapted to address global quality of life issues such as having pain or worrying about death. Respondents were asked to rate how much they agreed with each statement at the time of the survey using a Likert scale with possible responses of “not at all,” “a little,” “quite a bit,” “very much,” and “don’t know.” Negative items were reverse-coded in the analysis to create monotonic dimensions. Subscale scores of the four quality of life domains were examined. A draft of the survey was pretested in a mailed small pilot survey study of 15 AYA cancer survivors selected from the cancer registry. Pretest participants were asked to provide feedback on the survey items, which was incorporated into the final version of the survey. Cronbach’s alpha for the subscales were as follows: physical health = 0.71, psychological and emotional well-being = 0.70, social relationships = 0.65, and life skills = 0.67 and are consistent with levels deemed acceptable by a recent review on scales used in quality of life research [34].

### Statistical analysis

Ordinary least-squares regression models were run on quality of life subscale mean scores. All analyses were conducted using SAS (version 9.2) PROC REG and PROC GLM functions. Preliminary analysis was conducted to ensure that assumptions for regression modeling were met. Regression diagnostics revealed no evidence of outliers (using Mahalanobis distances) or problems of multicollinearity (using variance inflation factors). Regression coefficients and adjusted  $r^2$  values were compared from nested multiple regression models. Nested regression models were analyzed to examine the utility of iSES and nSES after other demographic covariates were entered to ensure that these measures of SES significantly contributed to the models. We were interested in comparing the relative contributions of both SES measures to determine whether collecting patient-level iSES data are worth the financial expense and administrative burden. All results were considered significant where  $P < 0.05$ .

### Results

Of the 110 total leukemia and lymphoma survivors who participated in the survey, three individuals with missing nSES information were excluded from the analysis. Table 1 shows

sociodemographic information on the remaining 107 participants. In the sample, there were slightly more females than males (54.2 %), non-hispanic whites (63.6 %) than other race/ethnicities, and nearly half (47.7 %) were between 30 and 39 years old. Approximately half of the sample was either married or living with a partner at the time of interview, 5.5 % were either separated or divorced, and 44.0 % were unmarried and not living with a partner. More individuals reported having high or highest neighborhood SES (61.7 %) than the lower three quintiles combined. Stage at diagnosis (reported only for lymphoma patients) varied, with 18 (23.4 %) diagnosed at Stage I and 10 (13.0 %) diagnosed at Stage IV. Time between diagnosis and interview for all participants ranged from 16 to 48 months, with a mean of 31.1 months.

### Comparison of SES across QOL domains

In all four domains, the level of iSES was significantly associated with quality of life in the reduced and full models ( $P < 0.05$ ). Yet, nSES was only significantly associated ( $P < 0.05$ ) with physical health. The preliminary regression models revealed that domestic partner status (currently married/living with partner or otherwise), time since diagnosis, and receiving first-course chemotherapy or radiation treatment did not significantly predict quality of life; thus, they were not included in the final models.

### Relative effects of individual- and neighborhood SES on quality of life

The relative importance of both iSES and nSES on quality of life while accounting for demographic variables (age at diagnosis, gender, and race/ethnicity) was assessed through multiple linear regression using nested models. Models also adjusted for health insurance status at diagnosis, which is often more readily available and sometimes used as a proxy for SES [35], to control for potential confounding. Tables 2, 3, 4, 5 give unstandardized parameter estimates and adjusted  $r^2$  values for models comparing the relative influence of SES variables on quality of life.

For each of the domains, the biggest improvement in model fit, as measured by changes in the adjusted  $r^2$  values and log-likelihood ratio tests, occurred with the addition of the iSES score (changes in  $r^2$ : physical health: +14 %; psychological and emotional well-being: +12 %; social relationships: +25 %; and life skills: +10 %). The addition of nSES to the reduced model did improve model fit, but only substantial changes were observed for physical health (physical health: +13 %; psychological and emotional well-being: +1 %; social relationships: +1 %; and life skills: -0.07 %). The multivariate nested model analysis suggests that iSES is more strongly related to QOL than nSES and that nSES likely does not provide much additional information on variation in QOL among young adults with leukemia and lymphoma, except perhaps for physical health.

## Discussion

Variations in socioeconomic status (SES) indicators appear significantly associated with quality of life in adolescent and young adult survivors of leukemia and lymphoma. Although all four domains examined—physical health, psychological and emotional well-being, social relationships, and life skills—(0.07 %) showed significant SES effects, individual SES



(iSES) had the biggest impact on healthy social relationships. Individual SES was associated to a larger extent with all four domains of quality of life than neighborhood SES (nSES), health insurance status, and other demographic covariates.

Although iSES has been shown to be more predictive of health outcomes than area-level SES [36, 37], it is often unavailable in population-based registries [11]. Studies with large sample sizes and comprehensive information on SES have found smaller, significant effects of area SES, after accounting for individual-level SES [38], suggesting the importance of both individual circumstances and neighborhood context in shaping health. Including social capital variables in the iSES measurement likely increased its association with social functioning. In previous work, a similar approach identified the relationship between social advantage and obesity risk [39]. Public health intervention efforts may be better guided when SES is conceptualized in a multidimensional model, as exemplified in this study.

Young adult cancer survivors often face long-lasting side effects from their illness and/or treatment that may affect their physical functioning for years afterward [30, 40]. Individuals with better access to resources may have more ability to ameliorate those symptoms [40]. Being unemployed, retired, or disabled has been associated with decreased physical functioning in long-term survivors of breast cancer [41]. Most studies of emotional functioning in young cancer survivors find comparable or better coping mechanisms than general population controls [30], but quality of life disparities among cancer patients occur. Economic stress has been associated with lower emotional quality of life in women with breast or gynecological cancer [42]. In one study, long term effects to psychological well-being in cancer patients with lower educational attainment and access to material resources were not observed [43]. However, findings from the Childhood Cancer Survivor Study indicated that lower levels of education, income, and employment predicted increases in distress for solid tumor patients [44]. The Socioeconomics and Quality of Life study findings were consistent with the literature showing lasting impairments to psychological quality of life in patients with lower SES.

Difficulties in maintaining or making new social relationships are often cited as one of the most important long-term issues in young adult cancer survival [30, 45, 46]. Lower marriage rates have been reported for young adult cancer survivors [47]. Being married has also been shown to be protective of survival in young adults with lymphoma [19]; however, partner status did not significantly alter any of the quality of life domains in the present study. Very little research has been conducted on the influence of SES on social functioning in young adults; yet, this domain emerged as the most strongly associated with iSES in the current study.

### **Strengths and limitations**

The multidimensional approach used herein to operationalize iSES is a strength of the current study and responds to several recommendations about the measurement of SES in health research put forward by Braveman et al. [48]. These are the use of items appropriate for measuring the chosen study population; careful consideration of the mechanisms by which lower iSES negatively impacts quality of life; inclusion of a multitude of resource-

relevant items in addition to the traditional measures of education, income, and occupation; and specification of separate dimensions of SES along with comparison to single indicators.

The iSES variable under analysis was derived with exploratory factor analysis, and more rigorous psychometric testing should be undertaken to ensure it is a robust measure. The small sample size limited our statistical power overall and the ability to conduct analyses stratified by age groups, gender, or race/ethnicity. Only leukemia and lymphoma survivors were included in the analysis, and further research should include survivors of other cancer types as well as make comparisons to healthy control populations. The quality of life measure developed for this study had weak-to-modest inter-item correlations and was not validated due to budgetary and time constrictions. While the current study made use of items from two well-validated scales, future research would benefit from a quality of life scale and is validated for adolescent and young adult cancer populations [34]. Longitudinal studies measuring change in quality of life as well as change in relevant SES predictors would provide more complete information for guiding clinical intervention efforts.

Participation rates in the current study appeared to be reasonable compared with other cancer survivor studies [49–52]. Utilizing bilingual recruitment materials helped to decrease non-participation rates among Hispanics in a population-based study of non-Hodgkin's lymphoma survivors [53]. Because some information is available through the California Cancer Registry for all potential participants, demographic variables were compared for study responders and non-responders. More females (49 %) responded than males (36 %), but no other significant differences in terms of stage at diagnosis (lymphoma only), time since diagnosis, race/ethnicity, gender, age, or neighborhood SES in the current study were found. However, if individuals from high iSES backgrounds and better health were more likely to participate, it is possible we underestimated the impact of iSES on quality of life.

Cancer registries are a vital source of data for conducting population-based cancer studies, particularly in age groups with relatively low incidence or in rare tumor types. Populations may be better served if cancer registries were to include indicators of individual-level SES. The California Cancer Registry's census-derived nSES measure is more precise than what is available in most cancer registries, which tend to measure SES at the county level. Registries may widely underestimate the impact of SES on health outcomes if area-level measurements are the sole indicator of SES.

### **Implications for cancer survivors**

Although there was no comparison group in this analysis, the relatively high mean domain scores suggest that, overall, young adult leukemia and lymphoma survivors do experience positive quality of life. The failure of many other quality of life studies to account for variations in social and economic factors eschews the importance of identifying health disparities and ignores the accumulated embodiment of socioeconomic stress [54]. The approach undertaken in this analysis assumes direct effects of SES on quality of life in this population, although more complex models with mediating pathways conducted on larger samples could further elucidate key potential points for intervention. Intervention studies designed to target SES poor survivors, perhaps with longer and more regular follow-up, should be developed. However, addressing these immediate needs should not supplant

recognition of the inequitable impact of chronic health conditions on individuals with weak or nonexistent socioeconomic buffers.

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## Abbreviations

<b>SES</b>	Socioeconomic status
<b>iSES</b>	individual-level socioeconomic status
<b>nSES</b>	neighborhood-level socioeconomic status

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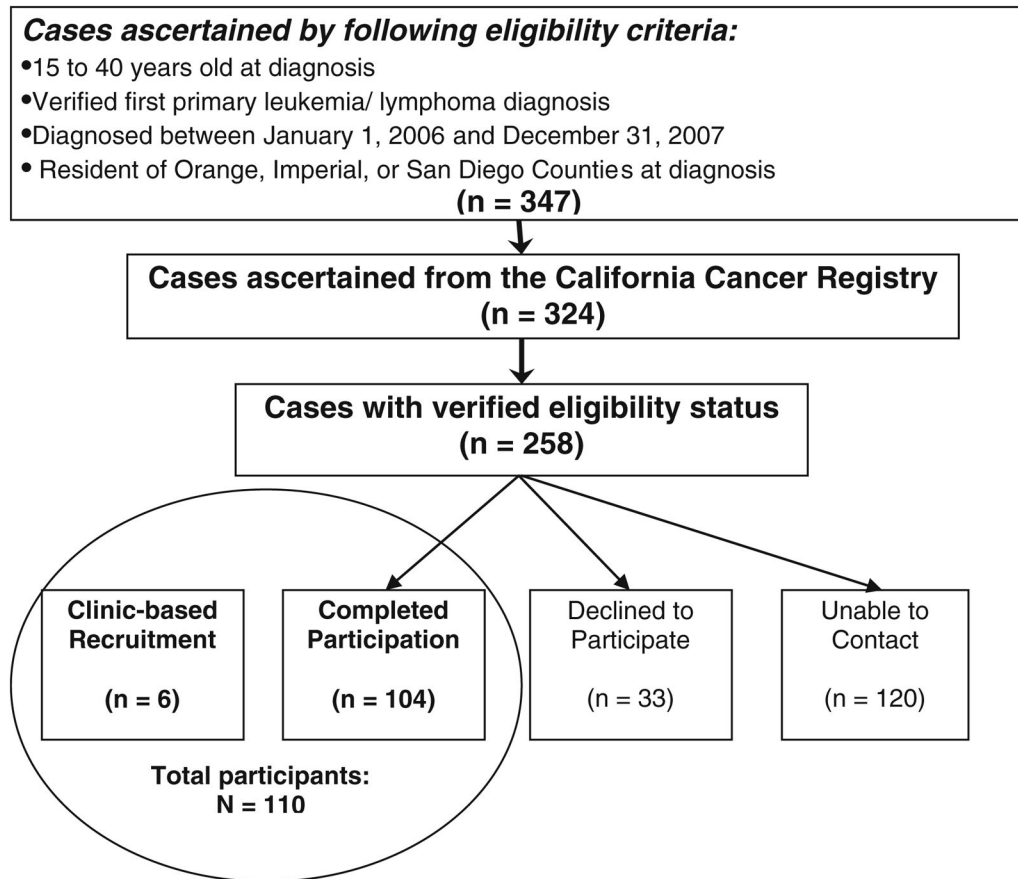
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### Appendix 1

See Fig. 1.



**Fig. 1.** Population-based case ascertainment flow diagram. An additional six participants from a clinic-based recruitment were also added to the analysis

### Appendix 2

See Table 6.

**Table 6**

Factor loadings (&gt;0.3) for individual SES indicators after oblique rotation

Variables	Factor 1: material and human capital	Factor 2: social support	Factor 3: social connections
Human capital			
Education			
Educational attainment	0.80		
Family educational attainment	0.54		
Labor experience			
Occupation (higher values = lower status)	-0.72		
Material capital			
Household net worth	0.58	0.39	
Household income	0.87		
Access to car (no/yes)	0.60		
Computer ownership (no/yes)	0.69		
Home ownership (ever, no/yes)	0.47		
Economic insecurity (higher values = higher insecurity)	-0.51		
Social capital			
Number of professional friends (higher values = fewer)	-0.45		-0.33
Ability to obtain a lawyer (higher values = more difficulty)	-0.45	-0.32	
General trust in people (higher values = lower trust)		-0.46	
Reliance on neighbors		0.59	
Reliance on family		0.54	
Involvement in politics			
Relationships with community leaders			0.59
Involvement in clubs/groups			0.34
Eigenvalues (proportion of variance explained)	5.19 (0.66)	0.97 (0.12)	0.86 (0.11)

Eigenvalues and proportion of common variance explained given for each factor. Human capital, material capital, and social capital refer to Oakes and Rossi's conceptualization of SES

### Appendix 3

See Table 7.

**Table 7**

Interfactor correlations for individual SES factors

	Factor 1: material and human capital	Factor 2: social support	Factor 3: social connections
Factor 1: material and human capital	1.00		
Factor 2: social support	0.46	1.00	
Factor 3: social connections	0.13	-0.19	1.00

**Table 1**

Sociodemographics of participants by cancer type

	Diagnosis		Total			
	Lymphoma		Leukemia			
	N	%	N	%		
<i>Gender</i>						
Male	34	44.2	15	50.0	49	45.8
Female	43	55.8	15	50.0	58	54.2
<i>Age at diagnosis</i>						
16–19	4	5.2	6	20.0	10	9.4
20–24	17	22.1	4	13.3	21	19.6
25–29	18	23.4	7	23.3	25	23.4
30–34	17	22.1	6	20.0	23	21.5
35–40	21	27.3	7	23.3	28	26.2
Mean (SD)	30.0 (6.7)		28.1 (7.1)		29.5 (6.8)	
<i>Race/ethnicity</i>						
Non-hispanic white	53	68.8	15	50.0	68	63.6
Hispanic/Latino	14	18.2	11	36.7	25	23.4
Other	10	13.0	4	13.3	14	13.1
<i>Partner status</i>						
Married/living together	39	49.4	16	53.3	55	50.4
Separated/divorced	5	6.3	1	3.3	6	5.5
Never married	35	44.3	13	43.3	48	44.0
<i>Neighborhood SES</i>						
Lowest	5	6.5	4	13.3	9	8.4
Low	12	15.6	5	16.7	17	15.9
Middle	8	10.4	7	23.3	15	14.0
High	20	26.0	5	16.7	25	23.4
Highest	32	41.6	9	30.0	41	38.3
<i>Individual SES</i>						
Lowest	17	22.1	5	16.7	22	20.6



	Diagnosis		Leukemia		Total	
	Lymphoma		Leukemia		Total	
	N	%	N	%	N	%
Low	15	19.5	6	20.0	21	19.6
Middle	14	18.2	8	26.7	22	20.6
High	15	19.5	7	23.3	22	20.6
Highest	16	20.8	4	13.3	20	18.7
<i>Stage at diagnosis</i>						
Stage I	18	23.4	-	-	-	-
Stage II	29	37.7	-	-	-	-
Stage III	11	14.3	-	-	-	-
Stage IV	10	13.0	-	-	-	-
Missing/unknown	13	16.9	-	-	-	-

**Table 2**  
Parameter estimates and squared multiple correlations of nested regression models on physical health quality of life

Variable	Models															
	No SES, $\text{adj-}r^2 = 0.03$ LL = -78.91			No iSES, $\text{adj-}r^2 = 0.16$ LL = -67.86, ***			No nSES, $\text{adj-}r^2 = 0.17$ LL = -68.33, ***			Full, $\text{adj-}r^2 = 0.24$ LL = -59.46, ***						
	$\beta$	SE	t	P	$\beta$	SE	t	P	$\beta$	SE	t	P				
Intercept	2.71	0.28	9.51	***	2.85	0.27	10.38	***	3.16	0.31	10.11	***	3.03	0.30	9.96	***
<i>Individual SES</i>																
Low iSES					-0.67	0.16	-4.25	***	-0.54	0.18	-3.01	**				
iSES2					-0.35	0.16	-2.14	**	-0.20	0.18	-1.12	0.26				
iSES3					-0.19	0.15	-1.23	0.22	-0.05	0.16	-0.31	0.76				
iSES4					-0.15	0.16	-0.94	0.35	-0.08	0.16	-0.49	0.62				
High iSES					ref				ref							
<i>Neighborhood SES</i>																
Low nSES					-0.10	0.22	-0.44	0.66	0.10	0.22	0.45	0.66				
nSES2					-0.47	0.15	-3.10	**	-0.24	0.17	-1.43	0.16				
nSES3					-0.57	0.15	-3.90	**	-0.45	0.16	-2.88	*				
nSES4					-0.17	0.12	-1.35	0.18	-0.01	0.13	-0.04	0.97				
High nSES					ref				ref							
Health insurance at diagnosis (any vs. none)	0.38	0.15	2.53	*	0.29	0.15	1.98	0.05	0.24	0.14	1.68	0.10	0.24	0.14	1.69	0.09
Gender (female vs. male)	0.04	0.10	0.44	0.66	0.01	0.10	0.13	0.90	0.04	0.09	0.37	0.71	0.01	0.09	0.12	0.91
Age at diagnosis (by year)	0.00	0.01	0.09	0.93	0.01	0.01	0.93	0.35	0.00	0.01	-0.17	0.86	0.00	0.01	0.64	0.52
<i>Race/ethnicity</i>																
Hispanic/Latino	0.17	0.13	1.28	0.20	0.18	0.14	1.24	0.22	0.26	0.12	2.13	*	0.20	0.14	1.44	0.15
Other	0.15	0.15	0.99	0.32	0.22	0.14	1.54	0.13	0.11	0.15	0.78	0.44	0.13	0.14	0.93	0.36
Non-hispanic white	ref				ref				ref				ref			

Adjusted  $r^2$  and log-likelihood ratio tests comparing models against reduced (no SES) given

LL log-likelihood,  $\beta$  unstandardized regression coefficients, SE standard error,  $\text{adj-}r^2$  adjusted  $r^2$  (squared multiple correlation), SES socioeconomic status,  $N = 107$  (three cases had unknown neighborhood SES values and were therefore excluded from the analyses)

\*\*\* significant at  $P < 0.001$ ,

\*\* significant at  $P < 0.01$ ,

\* significant at  $P < 0.05$

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**Table 3**

Parameter estimates and squared multiple correlations of nested regression models on psychological and emotional well-being quality of life

Variable	Models																
	No SES, $\text{adj-}r^2 = 0.04$ LL = -77.29			No iSES, $\text{adj-}r^2 = 0.05$ LL = -74.69, $P = 0.27$			No nSES, $\text{adj-}r^2 = 0.16$ LL = -67.12, ***			Full, $\text{adj-}r^2 = 0.12$ LL = -67.86, **							
	$\beta$	SE	t	P	$\beta$	SE	t	P	$\beta$	SE	t	P	$\beta$	SE	t	P	
Intercept	3.36	0.28	11.92	***	3.53	0.29	12.04	***	3.81	0.31	12.11	***	3.83	0.33	11.76	***	
<i>Individual SES</i>																	
Low iSES																	
iSES2					-0.61	0.16	-3.81	**									
iSES3					-0.28	0.16	-1.72	0.09									
iSES4					-0.35	0.16	-2.23	**									
High iSES					-0.12	0.16	-0.78	0.44									
<i>Neighborhood SES</i>																	
Low nSES																	
nSES2					-0.29	0.24	-1.20	0.23									
nSES3					-0.21	0.16	-1.28	0.20									
nSES4					-0.28	0.16	-1.77	0.08									
High nSES					-0.20	0.13	-1.54	0.13									
<i>Race/ethnicity</i>																	
Health insurance at diagnosis (any vs. none)	0.33	0.15	2.20	0.03	0.25	0.16	1.60	0.11	0.20	0.15	1.39	0.17	0.20	0.15	1.29	0.20	
Gender (female vs. male)	-0.09	0.10	-0.92	0.36	-0.10	0.10	-0.98	0.33	-0.11	0.10	-1.17	0.25	-0.11	0.10	-1.17	0.25	
Age at diagnosis (by year)	-0.01	0.01	-1.85	0.07	-0.01	0.01	-1.62	0.11	-0.02	0.01	-2.11	**	-0.02	0.01	-2.00	*	
<i>Race/ethnicity</i>																	
Hispanic/Latino	-0.02	0.13	-0.17	0.87	0.03	0.15	0.20	0.84	0.05	0.13	0.39	0.70	0.06	0.15	0.37	0.71	
Other	0.05	0.15	0.35	0.73	0.07	0.15	0.45	0.66	0.04	0.15	0.26	0.79	0.02	0.15	0.15	0.88	
Non-hispanic white	ref	-	-	-	ref	-	-	-	ref	-	-	-	ref	-	-	-	

Adjusted  $r^2$  and log-likelihood ratio tests comparing models against reduced (no SES) given

LL log-likelihood,  $\beta$  unstandardized regression coefficients, SE standard error,  $\text{adj-}r^2$  adjusted  $r^2$  (squared multiple correlation), SES socioeconomic status,  $N = 107$  (three cases had unknown neighborhood SES values and were therefore excluded from the analyses)

\*\*\* significant at  $P < 0.001$ ,

\*\* significant at  $P < 0.01$ ,

\* significant at  $P < 0.05$

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**Table 4**

Parameter estimates and squared multiple correlations of nested regression models on social relationships quality of life

Variable	Models					
	No SES, $\text{adj-}r^2 = 0.07$ LL = -65.86	No iSES, $\text{adj-}r^2 = 0.08$ LL = -63.26, $P = 0.27$	No nSES, $\text{adj-}r^2 = 0.32$ LL = -43.60, ***	Full, $\text{adj-}r^2 = 0.31$ LL = -39.98, ***		
	$\beta$	$\beta$	$\beta$	$\beta$	$P$	$P$
Intercept	3.02	3.05	3.23	3.17	***	***
<i>Individual SES</i>						
Low iSES			-0.58	0.15	***	***
iSES2			0.00	0.13	0.98	0.88
iSES3			-0.23	0.13	-1.77	0.08
iSES4			0.14	0.13	1.07	0.29
High iSES			ref			
<i>Neighborhood SES</i>						
Low nSES		-0.02	0.21	-0.10	0.92	0.30
nSES2		-0.30	0.15	-2.05	*	0.61
nSES3		-0.12	0.14	-0.87	0.39	0.68
nSES4		-0.07	0.12	-0.58	0.56	0.42
High nSES		ref				
Health insurance at diagnosis (any vs. none)	0.43	0.14	3.21	**	0.38	0.14
Gender (female vs. male)	0.01	0.09	0.09	0.93	0.04	0.97
Age at diagnosis (by year)	0.00	0.01	-0.45	0.65	0.00	1.00
<i>Race/ethnicity</i>						
Hispanic/Latino	-0.02	0.12	-0.18	0.86	0.00	0.14
Other	0.07	0.14	0.53	0.60	0.12	0.14
Non-hispanic white	ref					

Adjusted  $r^2$  and log-likelihood ratio tests comparing models against reduced (no SES) given

LL log-likelihood,  $\beta$  unstandardized regression coefficients, SE standard error,  $\text{adj-}r^2$  adjusted  $r^2$  (squared multiple correlation), SES socioeconomic status,  $N = 107$  (three cases had unknown neighborhood SES values and were therefore excluded from the analyses)

\*\*\* significant at  $P < 0.001$ ,

\*\* significant at  $P < 0.01$ ,

\* significant at  $P < 0.05$

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**Table 5**  
Parameter estimates and squared multiple correlations of nested regression models on life skills quality of life

Variable	Models				$\beta$	SE	t	P	No SES, $\text{adj-}r^2 = 0.01$ LL = -70.58				No iSES, $\text{adj-}r^2 = 0.003$ LL = -68.90, $P = 0.50$				No nSES, $\text{adj-}r^2 = 0.11$ LL = -61.63, **				Full, $\text{adj-}r^2 = 0.08$ LL = -60.79, *			
	$\beta$	SE	t	P					$\beta$	SE	t	P	$\beta$	SE	t	P	$\beta$	SE	t	P	$\beta$	SE	T	P
Intercept	3.17	0.27	11.69	***	3.25	0.28	11.53	***	3.32	0.31	10.83	***	3.35	0.32	10.54	***								
<i>Individual SES</i>																								
Low iSES									-0.45	0.15	-2.91	**	-0.44	0.18	-2.41	**								
iSES2									-0.01	0.16	-0.03	0.97	-0.01	0.18	-0.04	0.97								
iSES3									-0.11	0.15	-0.70	0.48	-0.12	0.17	-0.73	0.47								
iSES4									0.03	0.15	0.21	0.83	0.02	0.16	0.11	0.91								
High iSES									ref	-	-	-	ref	-	-	-								
<i>Neighborhood SES</i>																								
Low nSES					-0.33	0.23	-1.46	0.15					-0.19	0.23	-0.83	0.41								
nSES2					-0.23	0.16	-1.46	0.15					-0.07	0.17	-0.38	0.70								
nSES3					-0.07	0.15	-0.48	0.63					0.03	0.16	0.19	0.85								
nSES4					-0.06	0.13	-0.47	0.64					0.05	0.14	0.39	0.70								
High nSES					ref	-	-	-					ref	-	-	-								
Health insurance at diagnosis (any vs. none)	0.18	0.14	1.26	0.21	0.10	0.15	0.65	0.51	0.07	0.14	0.48	0.63	0.04	0.15	0.25	0.81								
Gender (female vs. male)	0.08	0.10	0.83	0.41	0.08	0.10	0.83	0.41	0.08	0.09	0.86	0.39	0.08	0.09	0.82	0.41								
Age at diagnosis (by year)	0.00	0.01	-0.12	0.91	0.00	0.01	0.06	0.96	0.00	0.01	0.13	0.90	0.00	0.01	0.09	0.93								
<i>Race/ethnicity</i>																								
Hispanic/Latino	-0.15	0.12	-1.25	0.21	-0.03	0.15	-0.23	0.82	-0.12	0.12	-1.01	0.31	-0.04	0.14	-0.25	0.80								
Other	0.07	0.15	0.48	0.64	0.11	0.15	0.74	0.46	0.00	0.15	0.01	0.99	0.02	0.15	0.13	0.90								
Non-hispanic white	ref	-	-	-	ref	-	-	-	ref	-	-	-	ref	-	-	-								

Adjusted  $r^2$  and log-likelihood ratio tests comparing models against reduced (no SES) given

LL log-likelihood,  $\beta$  unstandardized regression coefficients, SE standard error,  $\text{adj-}r^2$  adjusted  $r^2$  (squared multiple correlation), SES socioeconomic status,  $N = 107$  (three cases had unknown neighborhood SES values and were therefore excluded from the analyses)

\*\*\* significant at  $P < 0.001$ ,

\*\* significant at  $P < 0.01$ ,



\* significant at  $P < 0.05$

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