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Editorial

# Poverty and Survival in Childhood Cancer: A Framework to Move Toward Systemic Change

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As cure rates have risen among children with cancer, racial and ethnic disparities in cancer-related outcomes have become apparent (1-14). Although biology explains a portion of these disparities (15,16), it is evident that socioeconomic status (SES) is associated with outcome (1-4, 6-14) and mediates the effect of race and ethnicity in acute leukemias, lymphomas, and neuroblastoma (5). These SES studies often used population-level data without the granularity to understand how the complex multilayered construct of poverty influences survival, thus lacking pragmatic application. A holistic approach that considers neighborhood- and household-level poverty alongside individual factors is necessary to understand the interplay of poverty and cancer-related outcomes in children.

Several neighborhood-level poverty frameworks suggest how characteristics of the social and built environment provide context (17) for individual patient behavior (18-23). Some frameworks reflect the direct influence of community economic deprivation (24) on health status [census measures of household income, unemployment, overcrowded housing, car access (17)]; others focus on how the environment influences behaviors (exercise accessibility, healthy food availability, walkability, crime). These are associated with general health outcomes [including mortality (17,25-31)]. Cancer-related studies of contextual characteristics among adult, solid-tumor patients have included racial and ethnic enclaves, neighborhood segregation (32-42), urbanicity (43), population and traffic density (32), neighborhood amenities, food and restaurant environment (32), predicted foreclosure (28), perceived neighborhood characteristics (43-46), social isolation (47), and spatial oncology access (38). Similarly, household poverty can be operationalized using household material hardship (HMH); this represents concrete resource needs, linking income to poverty. Child health research conceptualizes HMH using insecurity of food (48,49), housing (50, 51), and energy (52). Sensitive and specific measures can screen for these domains, which have the potential to be remediated, unlike markers of poverty such as income (53,54). Among children, these domains are associated with health outcome (48-53,55) and are prevalent among cancer patients (56-58). Evaluating such neighborhood and household contextual factors in childhood cancer patients is essential if we are to improve disparate survival.

In this issue of the *Journal*, Bona et al. present (59) an association between poverty and survival in high-risk neuroblastoma (HR NBL), a challenging disease with uncommonly low survival rates among childhood cancers (60,61). The authors categorize neighborhood poverty by utilizing zip-code level household income, a staple of population-based research. However, to move from describing a problem to addressing it requires one to consider the mechanism by which neighborhood poverty influences survival. The authors use eligibility for US public insurance (Medicaid and/or Children's Health Insurance Program) as a surrogate for household poverty. Medicaid and/or Children's Health Insurance Program eligibility varies state to state, with income cutoffs ranging from 130% to more than 300% of the federal poverty limit (62); therefore, the daily reality of this level of poverty for a family varies. Using insurance as a proxy also adds variability to the mechanism by which poverty influences survival because Medicaid, or public insurance (and insurance discontinuity), is itself associated with outcome disparities and unmet needs among children (63,64) and adults (61,65). Nevertheless, using the best available surrogate predictors, the authors present a powerful story of disparate outcomes in children being treated for cancer in the setting of neighborhood and household poverty.

To date, investigations of the influence of social factors on childhood cancer survival have been limited by using either registry-level SES data (lacking granular treatment data) or retrospectively analyzed clinical trial data, combining multiple treatment arms and studies (introduction of participation bias, heterogeneity of exposures, and limitation of SES analysis to retrospective review of therapeutic trial data) (4,9,66,67). Despite being confined to historical data, Bona and colleagues (59) created a near-perfect natural experiment. To ensure uniformity to therapy and supportive care, they examined only the treatment arm of a randomized controlled trial. To utilize linked hospital-level data, they only included patients enrolled from 52 sites

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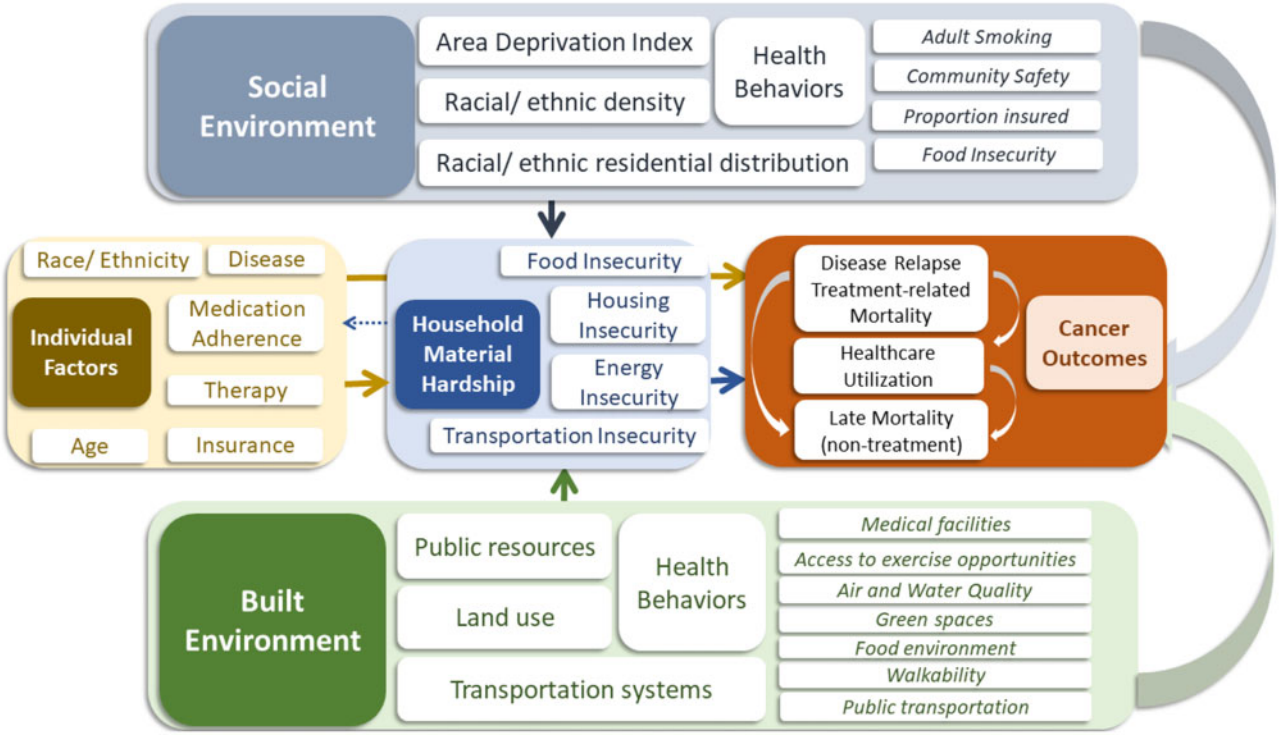


**Figure 1.** Conceptual model: child and adolescent cancer outcomes, contextual factors, and hardship.

that participate in the Pediatric Health Information System, which focuses on health-care quality controls for innumerable variables in health-care delivery that potentially influence outcome, thereby allowing for de facto adjustment for treatment site (6,68-70). One expects survival parity to emerge in the setting of comparable access to life-saving therapy such as the treatment in this study; for example, in a study where all adult head and neck cancer patients received radiation, racial outcome disparities disappeared (71), whereas disparities persist among lung cancer patients without comparable access to immunotherapy (72). The novel therapy received by this HR NBL cohort has shown more survival improvement than was seen in decades (2-year event-free survival = 46% vs 66%; $P$ = .01) and was stopped early for efficacy. Nevertheless, patients in this cohort experiencing poverty faced an increased risk of disease progression or death as compared with those who did not experience poverty, specifically a 2.2-fold increased risk among those with neighborhood- and individual-level poverty and a 1.8-fold increased risk among those with individual-level poverty only (59). Thus, the complex relationship between poverty and cancer-related outcomes in children needs detailed examination.

Of the 16 000 children diagnosed with cancer annually, 20% live in poverty (73), a percentage likely to increase in the current pandemic-related economic landscape. Bona and colleagues' poverty-related findings add perspective to prior descriptions of socioeconomically related outcomes (4,9,66,67), underscoring the importance of understanding the mechanism by which poverty influences childhood cancer outcomes. To facilitate systemic change and impact poverty-related outcome disparities, it is crucial to move beyond descriptive studies and surrogate measures. Millions of dollars are spent developing and administering novel therapies that are critical to cure difficult-to-treat diseases like HR NBL but fall short when not considered in the context of a holistic model of cancer outcomes. We propose one such model (Figure 1).

Over a decade, the proportion of childhood asthma studies capturing SES doubled (74), and SES and poverty data were leveraged to advantageously inform relevant federal and payer policy (74, 75). Pediatric oncology is positioned to accomplish swifter change thanks to a unique infrastructure built to facilitate collaborative research across more than 200 sites (61), the majority of which enroll most eligible patients on a clinical trial (76). Thus, concrete poverty data (HMH) can be systematically captured for all trial enrollees to delineate the framework by which poverty is associated with mortality, facilitating systemic change. Bona et al. previously showed that capturing self-reported HMH was feasible through the cancer-care trajectory (56-58). Investigations are underway regarding contextual factors, but encouraging examination beyond traditional measures of neighborhood-poverty is crucial. To avoid leaving the oncologists in utero to bring this to the finish line, pragmatic solutions are necessary to move beyond describing disparities and effect systemic change.

## Notes

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## Data Availability

Not applicable.

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