



Infection risk among long-term pediatric cancer survivors: conceptual framework for health promotion and call for inquiry

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Chehab and colleagues' recent article, "A Population-Based Study of the Long-Term Risk of Infections Associated with Hospitalization in Childhood Cancer Survivors", highlights long-term infection risk among children and adolescents who were diagnosed with cancer at age 20 or younger (1). Although 5-year survival rates for pediatric cancer survivors have surpassed 80%, this vulnerable population experiences late effects including immune constitution delay, leaving them susceptible to infection long after treatment. Chehab and colleagues aimed to determine the incidence of infections requiring hospitalization in pediatric cancer survivors at least five years post-diagnosis. To achieve this aim, the study retrospectively analyzed data from pediatric cancer survivors in Washington State who were diagnosed before age 20 and survived at least five years after diagnosis, age and sex matched with individuals without cancer at a 10:1 ratio.

Chehab and colleagues found that pediatric cancer survivors were more likely to be hospitalized for infections compared to the general population, and this increased risk persisted for years to decades after diagnosis. Specifically, pediatric cancer survivors in their study had a five-fold increased risk of developing hospitalized infections starting

five years post-diagnosis compared to the control group [incidence rate ratio (IRR): 5.1, 95% CI: 4.5–5.8]. A higher infection rate was observed in the 5–10-year-post-diagnosis period but persisted in the >10-year-post-diagnosis period. Although survivors of hematologic malignancy tended to have higher infection risk, survivors of both hematologic and nonhematologic malignancy had significantly increased risks for inpatient infections for most pathogen groups and organ systems assessed. Pediatric cancer survivors also had a far greater risk of vaccine-preventable infections specifically (IRR: 13.1, 95% CI: 7.2–23.9). However, as the study included >80% non-Hispanic White, Washington State-born children and adolescents, knowledge gaps remain in understanding long-term infection risk among racially, ethnically, and geographically diverse pediatric cancer survivors.

Despite the study's limitations, these findings provide preliminary information that can inform health care communication with patients and their families. The purpose of this commentary is to present a framework to understand the findings from Chehab and colleagues and inform future research and practice in this area. Previous work by Quillin and colleagues [2009] outlined a healthcare

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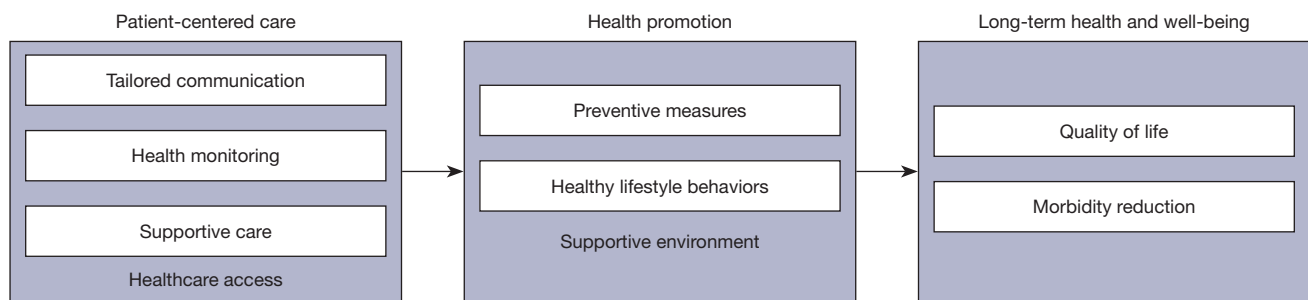


Figure 1 Conceptual framework for health promotion in pediatric cancer survivors.

system approach to cancer patient communication, focusing on links between macro-level variables, system tools, interpersonal dynamics and intrapersonal characteristics, and cancer control and outcomes (2). More recently, Graetz and colleagues [2022] proposed communication framework for culturally adaptive patient-centered care among pediatric cancer survivors identified several necessary constructs related to interaction between the health care environment and the patient, family, and community (3) based on the World Health Organization (WHO) model for health system responsiveness (4). Graetz and colleagues also proposed a functional model for pediatric cancer communication, emphasizing the importance of elements such as building relationships, managing uncertainty, and responding to emotions. As these models do not incorporate behavior change, we propose a preliminary conceptual framework that links patient-centered care, including culturally centered, age-appropriate communication, to behavioral and health outcomes to inform future health outcomes and behavior research for this population.

Conceptual framework as a call for inquiry

We propose that tailored communication should include all elements outlined by Graetz and colleagues (3) and be considered in conjunction with health monitoring and supportive care to mitigate immune reconstitution delay among these patients. Health monitoring and supportive care are warranted throughout the cancer continuum to facilitate early intervention if any symptoms develop. Importantly, these constructs should theoretically be linked to behavioral and long-term health outcomes. Moreover, such constructs are embedded in the patient and family's social ecological context (5,6), influenced by factors such as access to care and supportive family and community environment. Our proposed conceptual framework is

depicted in *Figure 1*.

Patient-centered care

Patient-centered care centers patients' preferences, needs, and values (7) and may include elements such as tailored communication, health monitoring, and supportive care, which are dependent on one's access to care. Tailored communication should come from coordinated interdisciplinary sources and be age-appropriate and culturally centered. These efforts should be appropriate for the unique developmental and social needs of these survivors and prioritize patient (and caregiver) education to empower patients with knowledge to promote seeking necessary care when symptoms develop (8-11). Health monitoring should involve proactive surveillance through medical follow-ups and exposure-driven, risk-based screenings to facilitate opportunities for communication (12,13). Supportive care includes a range of strategies, such as symptom management, nutrition and reproductive health counseling, psychosocial support, and access to sufficient resources for one's healthcare needs to address supportive care needs such as infection, metabolic dysfunction, and patient-reported outcomes and health-related quality of life (13,14).

Health promotion

We hypothesize that patient-centered care plays a crucial role in health promotion in this population, contributing to behavioral outcomes related to preventive measures (e.g., vaccination, hygiene practices, sun protection) and healthy lifestyle behaviors (e.g., healthy eating, physical activity, and adequate sleep). The study by Chehab and colleagues indicated that pediatric cancer survivors face a substantially higher risk of vaccine-preventable infections, highlighting

the importance of targeted vaccination and health promotion strategies to protect their health. Adoption of these proposed behavioral outcomes is linked to one's broader family and community environment, wherein a supportive environment serves as a facilitator of these behaviors.

Long-term health and well-being

In line with the WHO definition of health as “*complete physical, mental and social well-being*” (15), our proposed focus on long-term health and well-being involves measurable outcomes such as quality of life and morbidity reduction rather than merely absence of mortality. This domain may involve a range of more specific outcomes, such as those related to functional status, cognitive function, cardiovascular health, metabolic health, reproductive health, psychosocial and emotional health, symptom burden, and coping/resilience.

Recommendations

The proposed conceptual framework serves as a call for inquiry to further develop a research focus on health promotion in pediatric cancer survivors and examine associations between patient-centered care and behavioral and health outcomes. The proposed framework can also be integrated with other existing frameworks, creating a layered approach that combines elements of cultural adaptation and patient-centered care for diverse populations. Based on the striking results of Chehab and colleagues' recent article, we recommend the following areas of further exploration and action: (I) increased surveillance of underrepresented groups to provide insights into their experience and inform tailored intervention strategies; (II) further research on individual, interpersonal, community, and societal factors to inform multi-level approaches to health promotion; and (III) interventions that assess the impact of patient-centered care on behavioral and health outcomes for pediatric cancer survivors to inform healthcare practices and policies. Considerations for implementing interventions based on the proposed conceptual framework include cultural competence training to improve tailored communication, community outreach efforts to reach populations with limited access to care, and building trust among patients and their families to enhance active involvement and engagement. The proposed framework suggests a comprehensive, patient-centered approach to guide further

research and action aimed at enhancing health promotion and long-term health and well-being in this vulnerable population.

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