

# The Influence of Oxidative Stress on Symptom Occurrence, Severity, and Distress During Childhood Leukemia Treatment

Marilyn J. Hockenberry, PhD, RN, PPCNP, FAAN, Olga A. Taylor, MPH, Alice Pasvogel, PhD, Cheryl Rodgers, PhD, RN, CPNP, Kathy McCarthy, BSN, RN, Patricia Gundy, MS, David W. Montgomery, PhD, Phillip Ribbeck, Michael E. Scheurer, PhD, MPH, and Ida M. (Ki) Moore, PhD, RN, FAAN

Children with cancer experience multiple symptoms resulting from their disease and treatment. Pain, fatigue, nausea, and vomiting are among the most frequently reported symptoms during childhood cancer treatment (Kestler & LoBiondo-Wood, 2012). Any treatment-related symptom can create significant toxicity leading to complications, therapy-dose reductions, and treatment delays, which compromise long-term survival. Children with cancer report treatment-related symptoms as the worst part of treatment because they create difficulties with completing daily activities and are remembered a long time after treatment ends (Woodgate & Degner, 2003).

To date, most oncology symptom research describes single symptoms related to their occurrence, severity, and distress with limited effort aimed at analyzing factors associated with these symptoms (Henly, Kallas, Klatt, & Swenson, 2003; Van Cleve et al., 2012). Pediatric oncology researchers are now beginning to focus on the interaction and synergy of multiple symptoms. As this work continues to develop, the combined effect of multiple symptoms will provide a more comprehensive picture of the child's cancer treatment experience.

Limited research exists on the role oxidative stress biomarkers may play in evaluating the severity of symptoms experienced by pediatric patients with cancer (Pierce, McCabe, White, & Clancy, 2012). This study advances the understanding of childhood cancer treatment symptoms, their interactions, and changes in symptom severity over time. Even more critical to understanding symptom experiences during childhood leukemia treatment is the need for exploring why individual symptom differences occur; this will allow identification of who may be most susceptible to treatment toxicities. The purpose of this study was to explore the influence of the oxidative stress pathway on symptom severity during the first 16 months of childhood leukemia treatment.

**Purpose/Objectives:** To explore the symptom trajectory during the first 16 months of childhood leukemia treatment and any associations with the oxidative stress pathway measured by cerebrospinal fluid (CSF) concentration of oxidized phosphatidylcholine (PC), the predominant glycerophospholipid in the brain and cell membranes.

**Design:** Prospective, longitudinal design.

**Setting:** Two cancer centers in the southwestern United States.

**Sample:** 36 children (aged 3–14 years) newly diagnosed with acute lymphoblastic leukemia.

**Methods:** Symptoms were measured using the Memorial Symptom Assessment Scale at six specific time points during treatment. Biochemical changes in oxidative stress were measured by oxidized PC in the CSF.

**Main Research Variables:** Childhood cancer symptoms, oxidized PC.

**Findings:** Significant differences were found in the number of symptoms experienced during the three phases of treatment. Symptom trajectory changes and influence of the oxidative stress pathway on symptom experiences were identified.

**Conclusions:** Symptoms experienced during treatment for childhood leukemia are associated with increased oxidative stress.

**Implications for Nursing:** Children with leukemia experience symptoms throughout treatment. Physiologic measures indicate the influence of oxidative stress on symptoms.

**Key Words:** fatigue; leukemia/lymphomas/hematology; symptoms

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## Literature Review

### Symptom Severity and Childhood Cancer Treatment

Symptom investigation in pediatric oncology is a relatively new area of exploration. Studies of adults