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Title: Symptom Burden Classes and Health Care Utilization in Long-term Survivors of Childhood Cancer Survivor Study (CCSS)

Background: Physical and psychological symptoms co-occur among survivors of childhood cancer, and subgroups with certain profiles of symptom burden may be at increased risk for problematic healthcare utilization (HCU).

Methods: Childhood Cancer Survivor Study participants (N=17,231; Mean [SD] age=27.4 [5.98]; 79% non-Hispanic White; 48% female) self-reported sensory, motor, cardiac, respiratory, pain, gastrointestinal, fatigue, memory, depression, and anxiety symptoms at baseline evaluation and latent class analysis identified symptom burden profiles. Chronic health conditions (CHCs) at baseline (graded per CTCAE 1-2 [mild or moderate; reference] vs. 3-4 [severe-life threatening or disabling]). HCU (no health care, general care, oncology-focused, long-term follow-up, emergency room visit) for the past 2 years was assessed 6.3 median years after baseline. Logistic regressions examined associations between symptom class membership and follow-up HCU, adjusted for sex, age, health insurance and CHCs.

Results: Five symptom classes were identified: 1) Global symptoms (global; 7.7%); 2) emotional distress and pain (distress-pain; 13.3%); 3) neurologic and pain (neuro-pain; 10.6%); 4) cardiopulmonary and pain (cardio-pain; 5.3%); 5) non-elevated symptoms (norm; 63.1%). Bone tumor survivors had higher risk of falling into global, neuro-pain and cardio-pain groups ($p < .001$), and CNS tumor survivors had higher risk of falling into global and neuro-pain group (all $p < .001$) compared to leukemia survivors. Radiation, Grade 3-4 CHCs, female sex, and older age increased risk of global, distress-pain, neuro-pain and cardio-pain membership compared to norm (all $p < .001$). Oncology-focused care was more common in cardio-pain and global symptom groups, while long-term follow-up care was more common in neuro-pain and global groups (Table). All elevated symptoms groups were more likely to have emergency room visits compared to norm group.

Conclusion: Elevated symptoms at baseline are associated with increased future HCU including emergency room use. Pain is prevalent in all high symptom groups, and suggests an important intervention target.

Symptom Class	No Health Care	Oncology-Focused	Long-term Follow-up	Emergency Room
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Norm	Ref	ref	ref	ref
Distress-Pain	.88 (.73, 1.08)	.94 (.78, 1.15)	1.06 (.88, 1.27)	1.42 (1.27, 1.59)
Cardio-Pain	.82 (.58, 1.17)	1.41 (1.08, 1.85)	1.08 (.80, 1.44)	1.52 (1.30, 1.78)

Neuro-Pain	1.18 (.95, 1.46)	.94 (.75, 1.18)	1.30 (1.06-1.59)	1.36 (1.20, 1.54)
Global	1.05 (.80, 1.37)	1.34 (1.05, 1.71)	1.37 (1.09, 1.74)	1.82 (1.61, 2.06)

Odds Ratio (OR) and 95% confidence intervals (CI) predicting health-care utilization vs. general health care by symptom class. Models adjusted for age, sex, health insurance and CHCs.