

EMOTIONAL AND BEHAVIORAL PHENOTYPES OF ADOLESCENT SURVIVORS IN THE  
CHILDHOOD CANCER SURVIVOR STUDY (CCSS) COHORT

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## EMOTIONAL AND BEHAVIORAL PHENOTYPES OF ADOLESCENT SURVIVORS IN THE CHILDHOOD CANCER SURVIVOR STUDY (CCSS) COHORT

**Purpose:** Survivors of childhood cancer are at-risk for developing social, emotional and behavioral disorders during adolescence. However, little is known about comorbidity of symptoms of these disorders.

**Methods:** Participants included 4,715 adolescent survivors (between the ages of 12-17) diagnosed with childhood cancer between 1970-1999 (mean[SD] age at baseline=14.9[1.6] years, time since diagnosis=12.4[2.1] years) whose parents completed the Behavior Problem Index as part of the CCSS. Age- and sex-adjusted z-scores were calculated using data from the CCSS sibling cohort. Clinically elevated symptoms were defined as scores >1 SD above the mean for anxiety/depression, antisocial, hyperactive, headstrong, and social withdrawal scales. Latent profile analysis identified groups of survivors based on symptom patterns. Odds ratios (OR) and 95% confidence intervals (CI) were calculated using multivariable logistic regression adjusted for age, sex, race, and household income to identify predictors of group membership.

**Results:** Four groups were identified: 1) average symptoms across all domains (“well-adjusted”; 67.0%); 2) elevated hyperactive and headstrong symptoms with average anxiety/depression, antisocial and social withdrawal (“externalizing”; 17.1%); 3) elevated anxiety/depression and social withdrawal with average antisocial, hyperactive and headstrong symptoms (“internalizing”; 10.5%); and 4) elevated symptoms across all domains (“global behavior problems”; 5.4%). Compared to the well-adjusted group, membership in the internalizing and global behavior problem groups was predicted by treatment with cranial irradiation (OR=2.9, 95% CI=2.3-3.7; OR=1.5, 95% CI=1.1-2.2, respectively). In separate late effect models, internalizing group membership was predicted by obesity (OR=1.9, 95% CI=1.5-2.5), growth hormone deficiency (OR=1.5, 95% CI=1.3-2.1), scarring/disfigurement to the head or face (OR=1.5, 95% CI=1.2-2.0), and sensory impairment (OR=2.3, 95% CI=1.7-3.1). Externalizing class membership was predicted by symptoms of pain.

**Conclusions:** Subgroups of adolescent survivors experience comorbid externalizing and internalizing symptoms. Medical late effects were strongly associated with internalizing symptoms. Understanding symptom patterns and their predictors may inform screening and intervention efforts.