Longitudinal Patterns of Anxiety From Childhood to Adulthood: The Great Smoky Mountains Study

William E. Copeland, PhD, Adrian Angold, MRCPsych, Lilly Shanahan, PhD, E. Jane Costello, PhD

Objective: The aims of this study were 2-fold: to provide a brief introduction to the prospective longitudinal Great Smoky Mountains Study and review recent findings; and to use this sample to conduct an epidemiologic analysis of common childhood anxiety disorders. **Method:** The population-based Great Smoky Mountains Study assessed 1,420 participants from 11 counties in the southeastern United States up to 11 times between ages 9 and 26 years with the structured Child and Adolescent Psychiatric Assessment and its upward extension, the Young Adult Psychiatric Assessment. **Results:** The U-shaped age prevalence curve for any anxiety disorder was the product of high levels of childhood separation anxiety and adult panic, agoraphobia, and generalized anxiety. More than 1 in 5 subjects met criteria for an anxiety disorder by early adulthood. In terms of cumulative comorbidity, there was evidence of overlap between anxiety disorders, but the level of overlap was generally consistent with what is seen among other common childhood disorders. All childhood anxiety disorders were associated with adverse functioning in at least 1 young adult functional domain, with the poorest outcomes for childhood generalized anxiety and *DSM-III-R* overanxious disorder. **Conclusion:** Clinically significant anxiety is a common mental health problem to have had by adulthood. There was little evidence to support the consolidation of anxiety disorders, and some evidence to justify reintroduction of *DSM-III-R* overanxious disorder. The transition to young adulthood appears to be a key period for understanding the development of common adult anxiety disorders such as panic and agoraphobia. J. Am. Acad. Child Adolesc. Psychiatry, 2014;53(1):21–33. **Key Words:** anxiety, comorbidity, development, epidemiology, longitudinal

More than 50 years ago, Lapouse and Monk asserted that "One of the great psychiatric dilemmas of our time is the decision as to what is normal and what is abnormal in human behavior" (p. 1134).[1] The controversy surrounding the recent publication of *DSM-5* confirms that this question continues to bedevil child psychiatry and to motivate its investigators. Lapouse and Monk chose to address this dilemma by beginning 1 of the first epidemiological studies in child psychiatry in 482 children aged 6 to 12 years in Buffalo, NY. There is now a long history of such studies in child psychiatry, and they have gone far beyond the "mere counting of heads" (p. 646)[2] to inform our etiological models of psychiatric disorders, to describe continuities and discontinuities across development, and to link mental health with other areas of functioning.

This article will review 1 such study that was begun in the early 1990s to examine the development of childhood psychopathology in 11 rural counties in western North Carolina.[3] To date, the Great Smoky Mountains Study has been following the original subjects for close to 20 years. The first part of this article will provide a brief review of this study and draw attention to a number of recent findings that can be derived only from a prospective longitudinal study of this kind. The second part of the article uses this distinctive study to conduct a developmental epidemiologic analysis of individual anxiety disorders from childhood to adulthood.

The Great Smoky Mountains Study

The Great Smoky Mountains Study (GSMS) was originally designed to examine the prevalence of common childhood psychiatric disorders, their

development over time, and use of mental health services in a predominantly rural area of the southeastern United States. At the time that this study began, there was no national survey to estimate the public health burden of childhood mental health problems or to identify the extent of met and unmet need. Furthermore, none of the ongoing epidemiologic studies had focused on rural areas where children are often isolated from access to specialty mental health services.

Given these aims, the study design had to balance identifying psychiatric cases with producing population prevalence estimates. A random household design might produce accurate prevalence estimates but lack sufficient cases to develop risk models for individual psychiatric disorders. In contrast, a clinical sample would maximize case identification but would be of little use for epidemiologic prevalence and comorbidity estimates.[4] A screening-stratified sampling design achieves both aims by oversampling children scoring high on a screener, and then using sampling weights related to probability of selection to produce unbiased prevalence estimates.[5] Figure 1 shows how this design was implemented in the GSMS.

The GSMS area contains the Qualla Boundary, a federal reservation that is home to the Eastern Band of the Cherokee Indians, which has 8,000 enrolled members. Although they make up only about 3% of the population of the study area, they were oversampled using the same screening procedure but recruiting everyone irrespective of their screen score. This provided a sufficient sample of Native American/American Indian children for computing epidemiologic estimates and testing risk pathways within this understudied group.

The original sample of 1,420 children included 3 cohorts aged 9, 11, and 13 years at baseline. Originally, assessment interviews were completed with the child and 1 parent (primarily mothers) each year as close to the child's birthday as possible (Table 1). This strategy of annual assessments was continued through age 16 years, with a few exceptions due to financial restraints. Starting with age 16 years, the aim has been to interview all subjects at specific ages, a practice that is ongoing.

Originally, the primary assessment target was psychiatric function and service use, but the study also assessed related economic, psychosocial, and physical health constructs including family and community resources, family functioning, and exposure to adverse events, and physical health and development. Two finger-prick blood samples were collected with standardized collection paper at each in-person visit

FIGURE 1 Ascertainment figure for Great Smoky Mountains Study.