Original Investigation

Adult Functional Outcomes of Common Childhood Psychiatric Problems
A Prospective, Longitudinal Study

William E. Copeland, PhD; Dieter Wolke, PhD; Lilly Shanahan, PhD; E. Jane Costello, PhD

IMPORTANCE  Psychiatric problems are among the most common health problems of childhood.

OBJECTIVE  To test whether these health problems adversely affect adult functioning even if the problems themselves do not persist.

DESIGN, SETTING, AND PARTICIPANTS  Prospective, population-based study of 1420 participants from 11 predominantly rural counties of North Carolina who were assessed with structured interviews up to 6 times during childhood (9-16 years of age, for a total 6674 observations) for common psychiatric diagnoses and subthreshold psychiatric problems. The period for this study was from 1993 to 2010.

MAIN OUTCOMES AND MEASURES  A total of 1273 participants were assessed 3 times during young adulthood (19, 21, and 24-26 years of age, for a total of 3215 observations) for adverse outcomes related to health, the legal system, personal finances, and social functioning.

RESULTS  Participants with a childhood disorder had 6 times higher odds (odds ratio [OR], 5.9 [95% CI, 3.6-9.7]) of at least 1 adverse adult outcome (ie, indicator) compared with those with no history of psychiatric problems and 9 times higher odds (OR, 8.7 [95% CI, 4.3-17.8]) of 2 or more such indicators (1 indicator: 59.5% vs 19.9% [P < .001]; ≥2 indicators: 34.2% vs 5.6% [P < .001]). These associations persisted after statistically controlling for childhood psychosocial hardships and adult psychiatric problems. Risk was not limited to those who received a diagnosis; participants with subthreshold psychiatric problems had 3 times higher odds (OR, 2.9 [95% CI, 1.8-4.8]) of adverse outcomes and 5 times higher odds (OR, 5.1 [95% CI, 2.4-10.7]) of 2 or more outcomes (1 indicator: 41.9% vs 19.9% [P < .001]; ≥2 indicators: 23.2% vs 5.6% [P < .001]). The best diagnostic predictor of adverse outcomes was cumulative childhood exposure to psychiatric disorders.

CONCLUSIONS AND RELEVANCE  Common, typically moderately impairing, childhood psychiatric problems are associated with a disrupted transition to adulthood even if the problems do not persist into adulthood and even if the problems are subthreshold. Such problems provide a potential target for public health efforts to ameliorate adult suffering and morbidity.

Published online July 15, 2015.

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According to a 2010 analysis of the global burden of disease, neuropsychiatric disorders among youths 10 to 24 years of age were the leading cause of disease burden. Unlike many chronic physical health problems, most psychiatric disorders are first diagnosed in childhood. This allows such disorders and their sequelae to affect the entire life spans of people. Some portion of this burden is due to a few rare, but highly impairing, chronic psychiatric disorders (eg, schizophrenia and pervasive developmental disorders). The vast majority of this burden, however, is due to more common (point prevalence >1%), typically moderately impairing emotional and behavioral disorders. These common disorders create a substantial burden within childhood. Herein we report on how these common childhood disorders affect adverse functional outcomes during the transition to adulthood.

Prospective studies that observe children into early adulthood and retrospective studies of adults confirm that most adults with psychiatric disorders previously had a disorder in childhood. Optimal adult functioning, however, includes much more than psychiatric status. A successful transition to adulthood involves a bevy of developmental challenges: staying healthy, avoiding risky behaviors, completing one's education, getting and maintaining a job, avoiding or desisting illegal behavior, and developing and maintaining a social support network. Failure in any area can be a major barrier to a successful transition to adulthood. In the British National Child Development Study, it was found that having any type of recorded psychological problem could predict adult income and marriage stability at 50 years of age. Other studies have looked at the long-term functional outcomes of individuals with childhood disorders. These apparent long-term effects may simply be accounted for by continued psychiatric problems. Our study uses a prospective, longitudinal community sample of individuals to test (1) whether childhood psychiatric problems predict adverse outcomes related to health, the legal system, personal finances, and social functioning in early adulthood and (2) whether any such effects persist when adjusting for adult psychiatric status.

Studying only children meeting full criteria for psychiatric disorders, however, may severely underestimate the burden. Subthreshold problems do not meet full diagnostic criteria but are often significantly impairing. As many as half of clinically referred patients who are children with a psychiatric disorder do not meet criteria for a well-specified DSM diagnosis. This is not a minor problem. A complete understanding of the burden of childhood psychiatric problems must include such subthreshold cases. Our study defines subthreshold cases as cases of individuals with significant impairment resulting from psychiatric symptoms that do not meet full DSM criteria for a disorder.

Which early psychiatric problems have the most severe long-term consequences? Some specific childhood disorders may have a worse prognosis than others (ie, the specificity hypothesis). However, recent work suggests that the propensity to common psychiatric disorders may be summarized by 1 or more underlying dimensions. This is not surprising given the shared genetic liability commonly observed among common psychiatric disorders, the nonspecific patterns of familial transmission of psychiatric problems, and the considerable concurrent and sequential comorbidity of psychiatric diagnoses. Alternatively, the accumulation of multiple/repeated exposures to psychiatric distress throughout childhood (ie, the cumulative exposure hypothesis) may be more important than the specific disorders themselves.

Methods

Participants

The Great Smoky Mountains Study is a longitudinal, representative study of children in 11 predominantly rural counties of North Carolina. Three cohorts of children, 9, 11, and 13 years of age, were recruited from a pool of some 12,000 children using a 2-stage sampling design, resulting in 1420 participants (49% of whom were female participants). The 2-stage sampling design involved oversampling of participants at risk for psychopathology. In addition, American Indians were also oversampled to constitute 25% of the sample. Sampling weights are applied to adjust for the differential probability of selection.

Annual assessments were completed for the 1420 children until they turned 16 years of age and then again at 19, 21, and 25 years of age for a total of 9941 assessments. Interviews were completed by a parent or parental guardian and the participant until the participant turned 16 years of age and then by the participant only thereafter. Before all interviews, the parent and child signed informed consent/assent forms. The study protocol and consent forms have been approved by the Duke University Medical Center institutional review board. The period for our study was from 1993 to 2010.

Childhood/Adolescent Psychiatric Status

Psychiatric disorders were assessed using the structured Child and Adolescent Psychiatric Assessment (CAPA) until the participant turned 16 years of age. A 3-month primary period was used to assess psychiatric symptoms. A symptom was counted as being present if reported by either the parent or the child, or both. Scoring programs written in SAS (SAS Institute Inc) combine information about the date of onset, the duration of symptoms, and the intensity of each symptom to create DSM-IV diagnoses. A 2-week test-retest reliability study of CAPA-based diagnoses for children 10 to 18 years of age found k values that ranged from 0.5 for conduct disorder to 1.0 for substance dependence. The CAPA-based diagnoses are associated with higher scores on well-established behavioral scales, higher levels of psychosocial impairment, and the use of specialty mental health services.

The common childhood psychiatric disorders assessed included anxiety disorders (separation anxiety, generalized anxiety, social phobia, specific phobia, agoraphobia, panic disorder, obsessive-compulsive disorder, and posttraumatic stress disorder), mood disorders (major depression, dysthymia, mania, and hypomania), conduct disorder, oppositional defiant disorder, attention-deficit/hyperactivity disorder, and substance disorders.

Childhood impairment was assessed in 17 areas of functioning using definitions and rules specified in the CAPA...
Table 1. Definitions and Prevalence of Young Adult Outcomes

<table>
<thead>
<tr>
<th>Domain</th>
<th>Definition</th>
<th>Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>Multiple psychiatric problems Meeting full criteria for ≥2 different DSM disorders across all adult assessments</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Multiple addictions Meeting full criteria for DSM substance dependence for ≥2 substances across all adult assessments</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Suicidality Reporting recurrent thoughts of death (not just fear of dying), recurrent ideation, a suicide attempt, or specific plan for committing suicide</td>
<td>7.1</td>
</tr>
<tr>
<td></td>
<td>Serious physical event Diagnosis with serious physical illness, involved in serious accident or death; physical illness and accidents had to involve risk of death or chronic disability</td>
<td>3.4</td>
</tr>
<tr>
<td>Legal</td>
<td>Serious criminal activity Official record of felony charge between 16 and 25 y</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>Incarceration Participant reported time spent in jail or prison across adult assessments</td>
<td>3.3</td>
</tr>
<tr>
<td>Financial</td>
<td>High-school dropout Had not received high school diploma, equivalent degree, or GED by last adult assessment</td>
<td>12.4</td>
</tr>
<tr>
<td></td>
<td>Unable to keep job Participant reported being fired from ≥3 jobs over the course of adult assessments</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>Residential instability Moved ≥6 times in 5 y</td>
<td>5.2</td>
</tr>
<tr>
<td>Social</td>
<td>Early parenthood Participant reported becoming a parent prior to age of majority or legal adulthood (18 y)</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>No social support Participant reported no best friend/confidante, little to no relationship with parents, and rare contact with peers across all adult assessments</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>Relational instability Multiple divorces</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Abbreviation: GED, General Education Development.

* All percentages are weighted.

Adult Health, Legal, Financial, and Social Outcomes

Our aim was to identify a broad range of outcomes that typically impede functioning for an extended period of time, across many domains, and for most individuals. These outcomes covered 4 domains: health, legal, financial, and social. Table 1 provides a full list of outcomes, their definitions, and their prevalence. All outcomes, except when noted (eg, official criminal records), were assessed using the Young Adult Psychiatric Assessment, an upward extension of the CAPA interview administered to the participants. In most cases, an individual was positive for an outcome if it was reported during any adult assessment. In some cases, the thresholds for indicators were self-evident (eg, dropping out of high school). When such thresholds were not available, indicators were defined to identify approximately 5% of participants or fewer (eg, unable to keep a job is defined as fired from ≥3 jobs) to ensure that the outcome was deviant. Additional information about outcomes is available in eTable 1 in the Supplement.

Adult Covariates

To clarify that the long-term effects of childhood psychiatric status are independent of adult psychiatric disorder status and subthreshold status, Adult psychiatric and subthreshold status was
assessed using the Young Adult Psychiatric Assessment. 28 Adult subthreshold status was defined exactly as it was for childhood (positive for symptom-related impairment), but the impairment categories were adapted to apply to adult relationships and functioning in the home, school, employment, and community settings.

**Analytic Strategy**

Childhood diagnostic status was based on 6674 assessments of the 1420 Great Smoky Mountains Study participants between 9 and 16 years of age. Participants were coded as psychiatric cases if they met criteria for a childhood psychiatric disorder at any assessment. If they never met criteria for a psychiatric disorder in childhood but met criteria for symptomatic impairment during an assessment, then they were coded as subthreshold cases. The remaining participants who had never met criteria for either a psychiatric disorder or symptomatic impairment were coded as noncases. Sampling weights were applied in all analyses to ensure that the results represent unbiased estimates for the original sample population. Consistent with common conventions, all the percentages provided in the Results are weighted percentages, but the numbers (ie, sample sizes) are unweighted. Weighted regression models were used to look at differences in outcomes between these 3 groups. All models used SAS PROC GENMOD with robust variance (sandwich-type) estimates derived from generalized estimating equations to adjust the standard errors for the stratified design. A Bonferroni correction was applied to unadjusted models to account for the number of adult outcomes (with a Bonferroni-corrected $\alpha$ level of $0.05/12 = 0.004$). After bivariate models were tested, adjusted models tested group differences while accounting for sex, race, childhood family hardship variables, and adult psychiatric and subthreshold status.

### Results

#### Descriptive Information

Of the total sample of 1420 participants, 26.2% (unweighted $n = 527$) met criteria for a common behavioral or emotional disorder at some point in childhood/adolescence (9-16 years of age), 31.0% ($n = 446$) displayed subthreshold psychiatric problems only, and 42.7% ($n = 427$) never met criteria for a psychiatric disorder in childhood but met criteria for symptomatic impairment during an assessment. If they never met criteria for a childhood psychiatric disorder at any assessment, then they were coded as noncases. Sampling weights were applied in all analyses to ensure that the results represent unbiased estimates for the original sample population. Consistent with common conventions, all the percentages provided in the Results are weighted percentages, but the numbers (ie, sample sizes) are unweighted. Weighted regression models were used to look at differences in outcomes between these 3 groups. All models used SAS PROC GENMOD with robust variance (sandwich-type) estimates derived from generalized estimating equations to adjust the standard errors for the stratified design. A Bonferroni correction was applied to unadjusted models to account for the number of adult outcomes (with a Bonferroni-corrected $\alpha$ level of $0.05/12 = 0.004$). After bivariate models were tested, adjusted models tested group differences while accounting for sex, race, childhood family hardship variables, and adult psychiatric and subthreshold status.

#### Table 2. Prevalence and Unadjusted Associations Between Childhood Diagnostic Groups and Young Adult Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Prevalence, $%$</th>
<th>Cases vs Noncases</th>
<th>Impairment only vs Noncases</th>
<th>Cases vs Impairment Only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Noncases</td>
<td>Subthreshold</td>
<td>Psychiatric</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>Any</td>
<td>19.9</td>
<td>41.9</td>
<td>59.5</td>
<td>5.9 (3.6-9.7)</td>
</tr>
<tr>
<td>Multiple</td>
<td>5.6</td>
<td>23.2</td>
<td>34.2</td>
<td>8.7 (4.3-17.8)</td>
</tr>
<tr>
<td>Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple psychiatric problems</td>
<td>1.9</td>
<td>1.6</td>
<td>10.0</td>
<td>5.8 (1.7-20.3)</td>
</tr>
<tr>
<td>Multiple addictions</td>
<td>1.6</td>
<td>5.4</td>
<td>11.1</td>
<td>7.8 (2.0-30.4)</td>
</tr>
<tr>
<td>Suicidality</td>
<td>4.3</td>
<td>6.6</td>
<td>11.9</td>
<td>3.0 (1.2-7.8)</td>
</tr>
<tr>
<td>Serious physical event</td>
<td>2.1</td>
<td>1.1</td>
<td>8.4</td>
<td>4.2 (1.4-12.8)</td>
</tr>
<tr>
<td>Legal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serious criminality</td>
<td>2.9</td>
<td>10.6</td>
<td>12.2</td>
<td>4.7 (1.9-12.1)</td>
</tr>
<tr>
<td>Incarceration</td>
<td>0.4</td>
<td>5.3</td>
<td>5.3</td>
<td>13.8 (2.2-36.6)</td>
</tr>
<tr>
<td>Financial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-school dropout</td>
<td>3.4</td>
<td>19.4</td>
<td>18.0</td>
<td>6.2 (2.7-14.0)</td>
</tr>
<tr>
<td>Unable to keep job</td>
<td>1.9</td>
<td>8.6</td>
<td>11.4</td>
<td>6.5 (2.0-21.6)</td>
</tr>
<tr>
<td>Residential instability</td>
<td>1.4</td>
<td>4.8</td>
<td>11.7</td>
<td>9.4 (2.8-31.6)</td>
</tr>
<tr>
<td>Social</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early parenthood</td>
<td>1.6</td>
<td>5.6</td>
<td>8.2</td>
<td>5.7 (1.6-19.7)</td>
</tr>
<tr>
<td>No social support</td>
<td>1.0</td>
<td>2.1</td>
<td>7.4</td>
<td>7.9 (1.5-40.3)</td>
</tr>
<tr>
<td>Relational instability</td>
<td>4.0</td>
<td>3.5</td>
<td>7.9</td>
<td>2.1 (0.8-5.4)</td>
</tr>
</tbody>
</table>

Abbreviation: OR, odds ratio.

* Bolded values are significant at a Bonferroni-corrected $\alpha$ level (.05/12 = .004).

* All percentages are weighted.
disorder or subthreshold problems. For the purposes of this analysis, we did not include children or adolescents meeting criteria for a tic or elimination disorder—2 categories of disorders that are relatively common and have been included in past analyses. Follow-up rates into adulthood (19, 21, and 24-26 years of age) were similar across groups (psychiatric cases: 475 of 527 participants [90.1%]; subthreshold only cases: 423 of 466 participants [90.8%]; noncases: 375 of 427 participants [87.8%]), with no differences between the case group’s follow-up rates and either control group’s follow-up rates (cases vs noncases, \( P = .23 \); impairment cases vs noncase controls, \( P = .18 \)). Childhood psychiatric cases were more likely to be male and American Indian and to have all types of family adversities compared with noncases (eTable 2 in the Supplement). A similar pattern was observed for subthreshold cases vs noncases. There were no demographic differences between subthreshold and psychiatric cases, but full cases had higher levels of family dysfunction and maltreatment.

**Discussion**

The adult outcomes examined herein—educational failure, criminality, addiction, suicidality, teenage parenthood, mental and physical health problems, untimely death, and social isolation—are the focus of considerable public policy efforts. Only about 1 in 5 individuals without a history of childhood psychiatric problems reported such an adverse outcome. This rate increased to 6 in 10, however, for those who met criteria for a common childhood psychiatric disorder. This risk persisted when accounting for childhood psychosocial adversities, such as maltreatment, that have long been linked with both childhood psychiatric disorder and disrupted development (eg, see Herrenkohl et al\(^29\)). Most importantly, this risk was evident even after accounting for adult psychiatric diagnostic and subthreshold problems, suggesting that there are long-term effects of childhood problems that are independent of current psychiatric status.

It is not surprising that those with a history of childhood psychiatric problems continue to display continued impairment into adulthood. 268 had only 1 childhood/adolescent disorder diagnosed, 135 had 2 childhood disorders diagnosed, and 125 had 3 or more childhood disorders diagnosed. The eFigure in the Supplement shows associations between specific childhood disorders and having an adverse outcome. In adjusted models, childhood depression and conduct disorder were associated with a higher likelihood of having an adverse outcome, and only conduct disorder predicted having 2 or more adverse outcomes.

Of the 527 childhood psychiatric cases followed up into adulthood, 268 had only 1 childhood/adolescent disorder diagnosed, 135 had 2 childhood disorders diagnosed, and 125 had 3 or more childhood disorders diagnosed. The eFigure in the Supplement shows the likelihood of having an adult outcome based on childhood psychiatric status. Error bars indicate standard error.

All models were retested to account for sex, race, low socioeconomic status, family dysfunction, family instability, maltreatment, adult psychiatric status, and adult subthreshold status. **Table 3** shows the associations in these adjusted models. Both psychiatric and subthreshold cases continued to predict greater risk for having an adult outcome or for having 2 or more such outcomes in models adjusted for other psychosocial risk factors. Low socioeconomic status during childhood, adult psychiatric functioning, and adult symptomatic impairment were significant covariates in each of these models.

**Specificity and Cumulative Burden**

Adult outcomes may be accounted for by specific childhood disorders or one’s cumulative psychiatric burden. eTable 3 in the Supplement shows associations between specific childhood disorders and having an adverse outcome. In adjusted models, childhood depression and conduct disorder were associated with a higher likelihood of having an adverse outcome, and only conduct disorder predicted having 2 or more adverse outcomes.

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The long-term outcomes were not limited to those meeting full criteria for a childhood diagnosis. Subthreshold cases had 3 times higher odds of having an adult outcome and 5 times higher odds of 2 or more such outcomes compared with those with no psychiatric history. We have previously argued that our diagnostic system needs to find a means to accommodate such individuals because they make up a significant proportion of children seeking treatment.14,15 Such efforts need not require diluting the threshold for mental health problems or mislabeling normal distress.30 Moderately impairing physical health concerns often require clinical attention, and psychiatric problems are no different. Our study suggests that recognizing subthreshold cases needs to be a public health priority and that intervention for these individuals may forestall future impairments, distress, and societal costs.32

Specific individual disorders did not predict adverse adult outcomes after accounting for cumulative psychiatric dose or burden. The initial specificity analysis identified a pattern of associations that was largely consistent with existing long-term outcomes studies of depression33,34 and conduct disorder.33,34 These specific effects of depression and conduct disorder, however, were attenuated in models accounting for cumulative exposure. This cumulative burden variable may indicate comorbidity, severity of psychiatric problems, or persistence of psychiatric disorders or all 3 together.35 For the purpose of estimating adult functioning, a single dimension of overall childhood psychiatric risk may be more useful than the less parsimonious DSM approach.35,36

The Great Smoky Mountains Study has many strengths, but it is not representative of the US population. Childhood...
cases may have been missed if participants met criteria prior to study involvement, between assessments, or after their last assessment. If this is the case, these analyses may underestimate the number of children affected by psychiatric illness and the adult burden of childhood psychiatric illness. Similarly, adult functioning was only assessed 3 times between 19 and 26 years of age. Adverse physical health effects may not be evident until later in life. The study design does not allow for definite conclusions about causal effects because unmeasured factors may account for observed associations. Many of the adult outcomes studied are related to individual symptoms of antisocial personality disorder, although associations persisted in analyses accounting for individual symptoms of antisocial personality disorder. Finally, although the CAPA intervention has been the subject of extensive validity analyses, the upward extension has not been studied independently.

Conclusions

Common childhood psychiatric disorders are costly, and often a source of great distress for the child and a burden to others. Many children will experience impairing psychiatric problems over the course of their childhood. These common early disorders are often associated with a disrupted transition to adulthood, even if the psychiatric problems do not persist into adulthood and even if the problems do not meet full criteria for a psychiatric disorder. And with each additional exposure to childhood psychiatric problems, the prognosis becomes more dire. If the goal of public health efforts is to increase opportunity and optimal outcomes, and to reduce distress, then there may be no better target than the reduction of childhood psychiatric distress—at the clinical and subthreshold levels.

ARTICLE INFORMATION

Submitted for Publication: October 29, 2014; final revision received March 27, 2015; accepted April 13, 2015.


Author Contributions: Dr Copeland had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Copeland, Wolke, Shanahan. Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Copeland, Shanahan. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: Copeland, Wolke. Obtained funding: Wolke, Shanahan, Costello. Administrative, technical, or material support: Costello. Study supervision: Wolke, Costello.

Conflict of Interest Disclosures: None reported.

Funding/Support: This work was supported by the National Institute of Mental Health (grants MH080230, MH63761, MH63671, MH48085, MH075766, and MH094650), the National Institute on Drug Abuse (grants DA/MA1301, DA011301, DA016977, DA011301, and DA36523), the Brain and Behavior Research Foundation (Early Career Award to Dr Copeland), and the William T Grant Foundation.

Role of the Funder/Sponsor: The funding organizations had no role in the design and conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

REFERENCES