ARTICLE

Occult Depressive Symptoms in Adolescent Emergency Department Patients

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Objectives: To estimate the frequency of occult depressive symptoms in adolescent emergency department (ED) patients (aged 13-17 years) and to determine patient characteristics associated with depressive symptoms.

Design: A cross-sectional study of adolescent ED patients.

Setting: The pediatric ED of Hennepin County Medical Center in Minneapolis, Minnesota, and the EDs of the Children’s Hospitals and Clinics of Minnesota.

Patients: Medically stable adolescent ED patients with nonpsychiatric concerns.

Interventions: Patients completed the Beck Depression Inventory II and answered questions about their attitudes, activities, and lifestyle choices. Guardians were asked about family demographics, living situations, and other patient characteristics.

Main Outcome Measures: The frequency of moderate and severe depressive symptoms as measured by the Beck Depression Inventory II. Group results were analyzed with descriptive statistics; patient characteristics associated with depressive symptoms were determined by multivariate analysis.

Results: A total of 967 patients were enrolled. According to the Beck Depression Inventory II, 20% (197 patients) had moderate to severe depressive symptoms. Of these, 58% recognized their depressive symptoms and 50% were recognized by their guardians as having depressive symptoms. When compared with nondepressed patients, adolescents with depressive symptoms more often were female, were not involved in organized social activities, knew someone who intentionally hurt himself or herself or died a violent death, were currently involved in a sexual relationship, or used street drugs. Race, family income, family stability, and witnessing violence were not associated with a positive depression screen result.

Conclusions: Depressive symptoms occur frequently among adolescents and are often unrecognized. Efforts to increase awareness of depression among ED physicians, adolescents, and parents of adolescents may be beneficial.

Arch Pediatr Adolesc Med. 2008;162(8):769-773

The prevalence of depression among adolescents has been reported to range from 4% to 18%.1-4 These estimates include populations thought to be at risk for depression, such as Latino youth,5 adolescents with somatic concerns,6 or those with psychiatric concerns.5 The prevalence of occult depression among an undifferentiated population of adolescents may be inadequately understood.

Only about 30% of adolescents with serious mental illnesses are identified and treated.7 Yet, as many as 50% of adults with serious mental illnesses develop symptoms by age 14 years.8 Early recognition is essential to ensure adequate medical management. However, because of their overall robust health, most adolescents have little need for regular visits to a primary care provider. This leaves few opportunities for routine medical, public, and mental health screening. Depression, as well as other medical disorders, may go undiagnosed.

When adolescents need short-term medical care, they often present to the emergency department (ED). The ED may be an excellent location for screening adolescents for many medical conditions, including depression.9 We sought to determine the prevalence of unsuspected depression among adolescent ED patients (aged 13-17 years) and patient characteristics that are associated with adolescent depression. This information may help determine whether depression screening is worthwhile in the ED and identifies at-risk adolescents.

STUDY SETTING AND POPULATION

This was a cross-sectional study of a convenience sample of adolescent ED patients (aged
Adolescents seen in the ED of Hennepin County Medical Center (HCMC) or the EDs of the Children's Hospitals and Clinics of Minnesota (Children's) (Minneapolis and St Paul campuses) between September 29, 2005, and March 1, 2007, were eligible. This study was approved by the institutional review boards of HCMC, Children's, and the University of Minnesota School of Medicine. Adult guardians provided informed consent; patients provided assent. Hennepin County Medical Center is a level I trauma center in Minneapolis, Minnesota, with an annual ED census of 98 000 patients, including approximately 15 000 adolescents. Fifty-nine percent of the HCMC ED patients are underinsured, are self-insured, or receive medical assistance and identify the ED as their only source of medical care. Fifty percent describe themselves as African American or black, 33% as Caucasian or non-Hispanic white, and 16% as other or mixed race. Children's campuses are located in downtown Minneapolis and St Paul and serve similar patient populations. The annual combined ED patient volume is about 77 000. Approximately 40% of patients are underinsured, are self-insured, or receive medical assistance. The racial/ethnic distribution is 15% African American or black, 27% Caucasian or non-Hispanic white, and 54% other or unknown. Because of the similar patient populations, the data from the 2 Children's campuses are combined for this analysis.

Eligible patients were identified by trained research associates not involved with any aspect of the patients' clinical care. Enrollment occurred during high-patient-flow evening hours, 5 to 7 days per week. Included patients had nonpsychiatric medical concerns, could read and speak English, were medically stable, assented to enrollment, and had a guardian present who provided informed consent. Patients were excluded if they could not read the study materials, had been physically or sexually assaulted (deemed too distressed), or had a medical condition that precluded them from enrollment. Enrollment did not occur if it interfered with or interrupted patient care, and it was immediately discontinued if the patient's medical status deteriorated.

**PROTOCOL**

After informed consent and assent were obtained, the guardian completed a questionnaire about patient and family demographics. Concurrently, adolescents answered questions about their activities and lifestyle choices. Each questionnaire was based on previously reported predictors of depression in pediatric and adolescent patients. The questionnaires had been piloted on 108 patients and guardians (data not included); modifications were made based on the pilot study. The guardian questionnaire asked about the patient's demographic and other characteristics (ie, age, sex, race, health status, school attendance and performance, and family income and composition) and whether the guardian thought the patient had depression. The patient questionnaire related to lifestyle (ie, whether the patient smoked, drinks alcohol, and uses street drugs), social life (ie, is involved in a sexual relationship or organized social activities), and whether the adolescent thinks that he or she is depressed.

Once the questionnaires were completed, patients were given the Beck Depression Inventory II (BDI-II), which consists of 21 multiple-choice screening questions with 4 weighted answers (range, 0-3). Patients were told to respond regarding their thoughts and feelings during the previous 2 weeks. They were told that the results of the BDI-II but not their questionnaire responses would be shared with their guardians. Patients and guardians were assured that the results of the BDI-II and the questionnaires would otherwise be held confidential. However, they were also informed that if the BDI-II suggested current suicidal ideation (ie, a score $\geq 13$ on question 9 about suicidal thoughts or wishes and a score of $\geq 2$ on question 2 about pessimism), their ED medical provider would be notified.

The BDI-II responses were immediately scored by adding the weighted scores of the answers and comparing them against standard values, with higher scores suggesting more depressive symptoms. Patients who scored greater than “minimal depression” (score $\geq 14$) were provided with contact information for outpatient psychiatric resources. If results suggested the potential for current suicidal ideation, the attending ED physician was notified. If deemed appropriate, immediate referral was made for short-term psychiatric evaluation prior to ED discharge.

The numbers of patients who declined participation or did not meet inclusion criteria were tracked. No other information about nonparticipants was recorded. All of the screening was done anonymously; patient follow-up after ED discharge was not possible. It was also not possible to verify self-reported demographic and lifestyle information.

**STATISTICAL ANALYSIS**

Data were analyzed with SAS statistical software version 9.1 (SAS Institute Inc, Cary, North Carolina). Descriptive statistics for continuous variables and percentages for categorical variables were provided for the overall study population and for subgroup populations. Binary response multiple logistic regression was used to assess the association between a positive BDI-II screen result and possible risk factors, including patient demographic, lifestyle, and family environment variables. Adjusted odds ratios were determined by multiple logistic regression. Forward and backward selection methods were used for model selection, and both suggested the same model. The predictive ability of our model was measured by Goodman-Kruskal $\gamma$ statistics.

A total of 967 patients were enrolled. At HCMC, 1499 adolescents were screened and 508 (34%) were enrolled; at Children's, 651 patients were screened and 459 (70%) were enrolled. The most frequent reason for nonenrollment was the absence of a guardian in the ED to provide informed consent (53% of nonenrollers at HCMC; 27% at Children's). Others were excluded because the family did not speak English (13%), the family left the ED before the study was completed (7%), or the adolescent had an underlying medical condition that would interfere with survey completion (ie, autism, deafness, mentally challenged) (6%), was too sick (4%), had an altered mental status from alcohol or drug intoxication (3%), was the victim of assault (2%), or had a diagnosed psychiatric illness (2%). Of those otherwise eligible, 119 patients (6%) refused to provide assent and 129 guardians (6%) refused to provide informed consent. Of those enrolled, 47 patients (5%) identified themselves as emancipated minors (defined by our hospitals as living on their own, currently being married, and/or were parents) at the time of ED registration. They completed the BDI-II and both surveys but not the question related to the guardian's prediction of the patient's depression.

According to the BDI-II screening scores, 197 patients (20%) had symptoms of moderate depression (113 of 967 (REPRINTED) ARCH PEDIATR ADOLESC MED/VOL 162 (NO. 8), AUG 2008 WWW.ARCHPEDIATRICS.COM
patients (12%) to severe depression (82 of 967 patients [8%]). Of these, 114 patients (58%) believed they currently had depression and 99 guardians (50%) believed the patient was currently depressed. Only 77 (39%) of the confirmed 197 patients were acknowledged as having depression by both the adolescent and his or her guardian.

A total of 314 patients were positive for potential current suicidality (BDI-II question 9) and 114 were positive for pessimism (BDI-II question 2). Of these, 96 were positive on both questions. Further assessment of these 96 patients was immediately performed to determine whether short-term intervention was necessary, regardless of the patients’ final BDI-II scores.

Patient characteristics are presented in Table 1. More patients had moderate to severe depressive symptoms at HCMC than at Children’s (25% vs 15%, respectively; P < .001). Patients at HCMC were generally from less affluent families, engaged in more risk behaviors, were less socially involved, considered themselves to be poorer students, and had more unstable home situations. Although those at HCMC more often knew someone who had died a violent death, a large number (39%) at each site knew someone who had purposely hurt himself or herself. Results of multiple logistic regression modeling the probability of a positive screen result for moderate to severe depression are listed in Table 2.

Being female was highly associated with a positive screen result for moderate to severe depression, as were current involvement in a sexual relationship, using street drugs, knowing someone who purposely hurt himself or herself or died a violent death, and lack of involvement in an organized social activity. There was no association between a positive screen result and family income, family stability, or other family demographics.

The predictive ability of our model was assessed by the association of predicted probabilities and observed responses. For our model, the Goodman-Kruskal statistic was 0.61. Therefore, using the estimated probability, we would make 61% fewer errors in predicting which of any 2 patients would have a positive screen result for depression than if we randomly guessed an outcome.

We found a high level (20%) of depressive symptoms among adolescent ED patients. Moderate to severe depressive symptoms occurred more often among adolescents screened at HCMC (25%) than at Children’s (15%). However, even at Children’s, the rate of depressive symptoms was higher than many previously reported prevalence rates.

In a similar study, Scott et al screened 351 adolescent ED patients (aged 13-19 years) for depressive symptoms, including 88 who presented for mental health concerns. Using the BDI-II, they found that 22% had moderate to severe depressive symptoms. We specifically excluded adolescents with mental health issues to determine the occurrence of occult depressive symptoms. Had we included those who presented with psychiatric or behavioral concerns, it is likely that our measured rate would have been higher.

We also excluded patients (and guardians) who could not speak or read English, patients who were assaulted, or patients who were considered (by the patient, guardian, or physician) to be too sick for study participation. Inclusion of these patients may also have altered our results. For example, Latino youth have a higher incidence of depressive symptoms than non-Latino white youth. Adolescent perpetrators or recipients of bullying have increased rates of depression compared with those not involved in bullying. In addition, although patients with somatic concerns are thought to have higher

Table 1. Patient Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>HCMC (n = 508)</th>
<th>Children’s (n = 459)</th>
<th>Overall (N = 967)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>15 ± 1.4</td>
<td>15 ± 1.4</td>
<td>15 ± 1.4</td>
</tr>
<tr>
<td>Female</td>
<td>293 (59)</td>
<td>232 (51)</td>
<td>525 (54)</td>
</tr>
<tr>
<td>African American</td>
<td>238 (49)</td>
<td>102 (22)</td>
<td>340 (35)</td>
</tr>
<tr>
<td>Family income ≤ $20,000/year</td>
<td>252 (53)</td>
<td>84 (19)</td>
<td>336 (35)</td>
</tr>
<tr>
<td>Has a primary doctor</td>
<td>406 (80)</td>
<td>445 (97)</td>
<td>857 (88)</td>
</tr>
<tr>
<td>Living with both parents</td>
<td>134 (28)</td>
<td>245 (54)</td>
<td>379 (39)</td>
</tr>
<tr>
<td>School performance above average</td>
<td>113 (24)</td>
<td>209 (46)</td>
<td>322 (33)</td>
</tr>
<tr>
<td>Owns a bike</td>
<td>313 (62)</td>
<td>245 (54)</td>
<td>568 (60)</td>
</tr>
<tr>
<td>Owns a car</td>
<td>63 (13)</td>
<td>82 (18)</td>
<td>150 (16)</td>
</tr>
<tr>
<td>No involvement with organized social activities</td>
<td>152 (30)</td>
<td>35 (8)</td>
<td>187 (19)</td>
</tr>
<tr>
<td>Smokes cigarettes</td>
<td>109 (22)</td>
<td>46 (10)</td>
<td>155 (16)</td>
</tr>
<tr>
<td>Uses street drugs</td>
<td>153 (30)</td>
<td>86 (18)</td>
<td>239 (25)</td>
</tr>
<tr>
<td>Knows someone who has hurt himself</td>
<td>199 (39)</td>
<td>177 (39)</td>
<td>376 (39)</td>
</tr>
<tr>
<td>or herself on purpose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knows someone who died a violent</td>
<td>225 (45)</td>
<td>116 (25)</td>
<td>341 (35)</td>
</tr>
<tr>
<td>death</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currently in a sexual relationship</td>
<td>166 (33)</td>
<td>81 (18)</td>
<td>247 (26)</td>
</tr>
<tr>
<td>BDI-II score of moderate or severe</td>
<td>127 (25)</td>
<td>70 (15)</td>
<td>197 (20)</td>
</tr>
</tbody>
</table>

Table 2. Results of Multiple Logistic Regression Modeling the Probability of a Positive Screen Result for Moderate to Severe Depression

<table>
<thead>
<tr>
<th>Covariate</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>3.4 (2.2-5.3)</td>
</tr>
<tr>
<td>Uses street drugs</td>
<td>1.8 (1.2-2.6)</td>
</tr>
<tr>
<td>Knows someone who has hurt himself or her</td>
<td>2.2 (1.5-3.3)</td>
</tr>
<tr>
<td>or herself on purpose</td>
<td></td>
</tr>
<tr>
<td>No involvement in organized social activities</td>
<td>1.8 (1.2-2.9)</td>
</tr>
<tr>
<td>Knows someone who died a violent death</td>
<td>1.7 (1.2-2.6)</td>
</tr>
<tr>
<td>Currently in a sexual relationship</td>
<td>1.7 (1.1-2.5)</td>
</tr>
<tr>
<td>Owns a bike</td>
<td>0.6 (0.4-0.9)</td>
</tr>
<tr>
<td>Owns a car</td>
<td>0.6 (0.3-1.0)</td>
</tr>
<tr>
<td>School performance above average</td>
<td>0.4 (0.2-0.6)</td>
</tr>
</tbody>
</table>
rates of depression, it is difficult to differentiate somatic from other causes of illness in a single ED visit. We therefore did not look at specific chief concerns as predictors of depressive symptoms; including any of these high-risk groups may have suggested additional predictors. Children with chronic illness have higher rates of depression than those without chronic illness, although 32% of our patients reported chronic illness (most often asthma), our multivariate analysis did not identify this as a predictor of depressive symptoms.

Our questionnaire included queries about risk factors previously associated with adolescent depression. Like others, we found that depressive symptoms were strongly associated with being female, lack of social involvement, use of street drugs, or exposure to violence. Unlike other studies, we did not find a relationship between depressive symptoms and family income or stability. Patients screened at HCMC appear to have more difficult life circumstances than those screened at Children's. In general, they were poorer, had more unstable home situations, had less access to routine health care, and engaged in riskier behavior (Table 1). Our study was not designed to determine causes of depression; however, it seems intuitive that the more chaotic and unpredictable living environments of the HCMC patients contribute to additional stress that may precipitate or exacerbate depressive symptoms. Yet, even the seemingly increased family stability and less stressful life circumstances of patients at Children's did not prevent a substantial rate of occult depressive symptoms.

We also sought to determine how often depression is suspected and acknowledged. We asked both patients and guardians directly if they believed the adolescent was currently depressed. We did not define depression or describe depressive symptoms but assessed their self-report as a reflection of their current understanding of depression. Only half of the guardians of adolescents with depressive symptoms believed the patients were depressed, whereas slightly more than half of the patients recognized their own depressive symptoms. Guardians and adolescents appear to have poor insight into the presence of the disease (concordance 39%), which may result in a delay or failure in seeking necessary mental health care.

Our choice of the screening tool was based on a review of existing literature and consultation with adult and child psychiatrists. The BDI-II was developed to assess depressive symptoms and has excellent correlation with the clinical diagnosis of depression. It is validated, sensitive, and specific when used in patients aged 13 to 85 years and is consistent across ethnic groups, sex, and patients with medical comorbidities. It is an accepted method of depression screening in patients as young as 13 years. However, it relies on the patients' self-report and therefore depends on honest responses. It is a screening tool; although it is able to discriminate depressed from nondepressed patients when a criterion standard for Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition) diagnosis of depression is applied, we did not confirm the BDI-II results with formal clinical assessments for depression.

One strength of our study was the wide range of questions included in the questionnaires. Both questionnaires included questions on patient school performance, general health, lifestyle, and family environment. This information enabled us to assess which factors might be associated with the likelihood of an adolescent presenting with a positive screen result for moderate to severe depression.

Several subjects gave positive responses to the BDI-II screening questions concerning suicidality (32%), pessimism (12%), or both (10%), regardless of their final BDI-II scores. Although this may be an artifact of our patient population, many of whom are from disadvantaged backgrounds that may prompt feelings of hopelessness, high rates of suicidality have been reported for other adolescent populations. The Youth Risk Behavior Surveillance study found that 17% of high school students seriously considered suicide in the previous 30 days and 8% had made an attempt in the preceding year. Up to 60% of high school students may harbor some degree of suicidality. Mood disorders are considered risk factors for suicide among youth. Patients who scored positive on both questions (suicidality and pessimism) underwent further evaluation; because the responses were anonymous, we were not able to follow up these patients and we did not evaluate predictors of positive responses to specific BDI-II questions.

Our results are somewhat limited by the number of eligible patients not enrolled. Most nonenrollment (49%) was due to the absence of guardians who could provide informed consent. Although this was expected at HCMC, where patients reported more unstable family situations, the large number of adolescents who attend the ED alone at all of the sites was nevertheless surprising. Our study did not query why guardians were not present, and we were not able to collect information on nonenrollels. If the absence of guardians in attendance in the ED reflects a more chaotic home environment, our measured rate of occult depression may be lower than the actual rate in this patient age group. The use of the ED as a site for public health screening is controversial. Many patients use the ED as their only site for medical care; if not screened in the ED, they may not be screened at all. Conversely, such screening is usually unsupported and adds to an already large ED workload. The ED is only one of many sites where adolescents present for health care, and depression is only one of many public health issues that may currently be inadequately addressed. Whom to screen, where to screen, and what public health issues should have highest priority are questions worthy of further discussion. However, depression is a treatable disease; in hopes of reducing or preventing unsuspected depression, ED screening may identify adolescents in need of additional evaluation.

We found that the prevalence of occult depression is high among adolescent ED patients. Efforts to increase awareness of depression among ED physicians, adolescents, and guardians of adolescents may be beneficial. Consideration of depression screening of adolescents in the ED may be warranted.
Accepted for Publication: January 3, 2008.

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Author Contributions: Dr Biros 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: Biros, Hick, Cen, and Schimming. Acquisition of data: Biros, Hick, Mann, Gaetz, Hansen, and Schimming. Analysis and interpretation of data: Biros, Hick, Cen, and Mann. Drafting of the manuscript: Biros, Hick, Cen, Mann, and Hansen. Critical revision of the manuscript for important intellectual content: Biros, Hick, Cen, Mann, Gaetz, and Schimming. Statistical analysis: Cen. Obtained funding: Biros, Hick, and Gaetz. Administrative, technical, and material support: Biros, Mann, and Hansen. Study supervision: Biros, Hick, and Cen.

Financial Disclosure: None reported.

Funding/Support: This work was supported by competitive research grants awarded by U Care of Minnesota and the Children’s Hospitals and Clinics of Minnesota. Ms Gaetz was supported by a medical student research award from the Gold Foundation.

Role of Sponsors: U Care of Minnesota, Children’s Hospitals and Clinics of Minnesota, and the Gold Foundation were not involved with the design, execution, or analysis of the project and did not review the data or manuscript prior to submission.

Additional Contributions: Our research associates, in particular Emily Wielhe, BS, Bailey Lee, MD, Erin Austad, Amy Rust, BA, Jennifer Hovelsrud, BA, Julia Salazkin, BA, and Rebecca deTrujillo, BA, provided assistance in interviews and data collection.

REFERENCES