

# Using the Guidelines for Adolescent Preventive Services to Estimate Adolescent Depressive Symptoms in School-based Health Centers

Michael T. Kopec, MD; Jaclyn Randel, MD; Batool Naz, MD; Monina Bartoces, PhD; Joseph Monsur; Anne Victoria Neale, PhD; Kendra L. Schwartz, MD

**Background and Objectives:** *The study objective was to understand the relationship between depressive symptoms and demographic, behavioral, and environmental risk variables among adolescents attending school-based health centers (SBHCs) using the Guidelines for Adolescent Preventive Services (GAPS) questionnaires. **Methods:** Using GAPS questionnaires, we conducted a retrospective medical record review of 672 adolescents attending two Detroit-area school-based health clinics. Bivariate and multivariate analyses were conducted to determine which factors were associated with depressive symptoms while adjusting for other relevant factors. **Results:** Overall, 26.5% of adolescents reported depressive symptoms. Bivariate analysis revealed associations between depressive symptoms and female gender, older age, disordered eating, lack of physical activity, sexual activity, poor school performance, substance use of all types, violence, law trouble, and an abuse history. Multivariate regression models revealed that female gender, sexual activity, weapon carrying, law trouble, poor physical activity, and a history of abuse were most strongly related to self-reported depressive symptoms. Substance use was not a significant factor after controlling for potential confounders. **Conclusions:** Targeting the above factors during routine adolescent examinations may help providers at SBHCs and other clinics identify those at highest risk for depression and provide appropriate interventions.*

(Fam Med 2010;42(3):193-201.)

Adolescents have high rates of depressive symptoms and suicidal behavior. In the 2005 Youth Risk Behavior Survey (YRBS), 28.5% of adolescents reported feeling sad and hopeless for at least 2 weeks in the year preceding the survey. Nearly 17% had considered suicide, and 8.4% attempted suicide in that same year.<sup>1</sup> Other school-based, national surveys have produced similarly high rates of adolescent depressive symptoms and suicidal ideation.<sup>2-4</sup>

Adolescent depressive symptoms have been associated with demographic variables (female sex, older age, minority race, and lower socioeconomic status)<sup>3-6</sup>

and behavioral risk factors, including substance use, risky sexual activity, violence, eating disorders, and poor school performance.<sup>2,6-11</sup> Environmental and adverse life experiences are also associated with depressive symptoms, including a history of abuse, family composition, and divorce.<sup>3,4,12-14</sup> Early identification of adolescent depression by primary care providers is important because of the high prevalence of depressive symptoms and the potential morbidity and suicide risk associated with depression in this age group.

There are nearly 1,500 school-based health centers (SBHCs) nationwide.<sup>15</sup> These centers provide comprehensive care for children and adolescents with limited economic or health care resources and are an important provider of health care for many teens.<sup>16</sup> Having access to an SBHC is associated with benefits such as fewer emergency department visits, more health maintenance and preventive care visits, and improved screening for high-risk behaviors.<sup>17,18</sup> SBHCs are often staffed by

---

From the Department of Family Medicine and Public Health Sciences, Wayne State University (Drs Kopec, Naz, Bartoces, Neale, Schwartz, and Mr Monsur); and Department of Family Medicine, Oakwood Healthcare System, Dearborn, Mich (currently at Family Care Associates, Detroit Medical Center, Plymouth, Mich) (Dr Randel).

multidisciplinary teams, including nurse practitioners, social workers, and physicians, of which family physicians often play an important role. SBHCs also serve as an alternative setting for resident and medical student training and may complement traditional residency curricula and training environments.<sup>19,20</sup>

SBHCs are also effective in responding to adolescent mental health problems. More than 30% of adolescent SBHC attendees use mental health services,<sup>16,21</sup> and adolescents with access to an SBHC are more likely to make mental health visits.<sup>18</sup> Further, identification and treatment of mental health difficulties at SBHCs have resulted in improved adolescent well-being.<sup>19,22</sup>

The Guidelines for Adolescent Preventive Services (GAPS), developed by the American Medical Association (AMA), are frequently implemented in SBHCs.<sup>23</sup> GAPS questionnaires focus on social and behavioral factors contributing to adolescent illness, and implementation of the GAPS model can facilitate more effective risk identification and intervention by primary care clinicians.<sup>24,25</sup> Even though the GAPS questionnaires are widely used in SBHCs and other clinic settings, their use as a research tool remains to be realized. Few studies have used the GAPS questionnaires as survey instruments, and, to our knowledge, no studies have used the GAPS questionnaires to investigate factors related to adolescent depressive symptoms.

We used the GAPS questionnaire to investigate the prevalence of depressive symptoms and associated factors in adolescents attending two high school-based health centers near Detroit. We hypothesized that these adolescents would report high levels of depressive symptoms and that these symptoms would be associated with a number of demographic, behavioral, and environmental variables. By facilitating the identification of adolescents at risk for depression, we hope to aid family physicians and other health care providers in improving the mental well-being of their adolescent patients.

## Methods

### *Study Sample*

The two SBHCs participating in this study target teens who are uninsured or on Medicaid and provide a number of services, including acute and preventive care, education, counseling, and health promotion. Most adolescents seen at these SBHCs attend the high schools in which the clinics are located. In 2005, 1,732 students attended the two high schools: 51.8% were male, 72% were African American, 26.6% were white, and 1.3% were Hispanic or American Indian.<sup>26</sup> According to the US Census Bureau, up to 22% of families with children under the age of 18 years residing in the high schools' jurisdictions live at or below poverty level.<sup>27</sup>

### *Data Collection*

The SBHC medical records contained GAPS questionnaires. These were minimally modified from the AMA GAPS questionnaires<sup>28</sup> to fit the needs of the clinics, usually by rearranging the order of questions. At both clinics, adolescents seen for the first time completed an intake GAPS and completed a shorter version on an annual basis thereafter.

### *Study Procedures*

GAPS questionnaires and demographic data (ie, age, gender, race, height, weight, and health insurance status) at the time of GAPS completion were extracted from the medical records of adolescents ages 13–17 years who attended the SBHCs mainly during the school-year months of January through May and August through December in 2005. To abstract at least 300 cases from each SBHC, one site included an additional 4 months (January, March, August, and October) in 2006.

Student visits were identified from clinic encounter forms. Many students visited their SBHC multiple times between the annual completion of their GAPS forms. The SBHCs did not record nor could they determine the number of individual students seeking care in the clinics during the study period.

All personal identifiers were removed from the GAPS forms and no identifying information was entered into the research database. This study was approved by the Wayne State University Human Investigation Committee and the Oakwood Healthcare System Institutional Review Board.

### *Definition of Depressive Symptoms*

Adolescents were classified as having depressive symptoms if they answered positively to either or both of the following questions: "During the past few weeks, have you often felt sad or down or as though you have nothing to look forward to?" or "(In the past year) Have you ever seriously thought about killing yourself?" These questions are similar to those used in the YRBS: (1) During the past 12 months did you feel so sad or hopeless almost every day for greater than or equal to 2 weeks in a row that you stopped doing some of your usual activities? and (2) During the past 12 months did you ever seriously consider attempting suicide?

### *Study Variables*

Table 1 lists the study variables with their operational definitions. Demographic variables included gender, race, and insurance status. Height and weight were used to calculate sex- and age-specific body-mass index (BMI) percentiles.<sup>29</sup> Behavioral variables were as follows: disordered eating, poor physical activity, problems with school performance, sexual activity, violence, tobacco use, alcohol use and abuse, and drug use. A personal history of abuse, family composition,

and recent adverse family events were included as environmental variables.

*Data Analysis*

Chi-square tests were used to determine associations between depressive symptoms and risk variables as well as to investigate possible gender differences in the

prevalence of risk variables between males and females reporting depressive symptoms.

All factors significantly associated with depressive symptoms ( $P < .05$  on chi-square testing) for the entire sample were entered into a logistic regression procedure. The prevalence of the dependent variable (depressive symptoms) was  $>10\%$ , so we used log-binomial

Table 1  
 Definitions of Study Variables (From the Guidelines for Adolescent Preventive Services [GAPS] Questionnaires)

<i>Variable</i>	<i>Operational Definitions and Notes</i>
<b>Demographic Variables</b>	
Race	African American White Other: American Indian, Hispanic, Asian, and multiracial
Health insurance status	No insurance Government-funded insurance Private insurance  <i>Note:</i> In some cases, it was difficult to determine if the insurance was a Medicaid-purchased health maintenance organization (HMO) insurance; those teens were grouped into the “private” category to avoid overestimating those with government-funded insurance.
Body mass index (BMI) percentile	Teens with BMI $\geq$ 85th percentile were considered overweight or at risk for overweight.
<b>Behavioral variables</b>	
Disordered eating	Yes to “In the past year, have you tried to lose weight or control your weight by vomiting, taking diet pills or laxatives, or starving yourself?”
Inadequate physical activity	No to “Do you exercise or participate in sports activities that make you sweat and breathe hard for 20 minutes or more at least three or more times during the week?”
Sexual activity	Yes to “Have you ever had sexual intercourse?”
Declining grades	Yes to “Are your grades this year worse than last year?”
Learning problem/special education	Yes to “Have you been told you have a learning problem or do you think you have a learning problem?” or “Are you in special education classes?”
Suspension	Yes to “Have you been suspended from school this year?”
Tobacco use	Yes to “Do you ever smoke cigarettes/cigars, use snuff, or chew tobacco?”
Alcohol use	Yes to “(In the past year) Do you ever drink beer, wine, or other alcoholic beverages?”
Alcohol abuse/risky drinking behavior	Yes to “In the past month, did you get drunk or very high on beer, wine, or other alcohol?” or “Have you ever used alcohol and then done any of the following: driven a car/truck/van/motorcycle, gone swimming or boating, gotten into a fight, used tools or equipment, done something that you later regretted?”
Drug use	Yes to “(In the past year) Do you ever use marijuana, other drugs, or sniff inhalants?” or “(In the past year) Do you ever use non-prescription drugs to get to sleep, stay awake, calm down, or get high?”
Fighting	Yes to “Have you been in a physical fight in the past 3 months?”
Weapon carrying	Yes to “In the past year, have you carried a gun, knife, club, or other weapon for protection?”
Law trouble	Yes to “(In the past year) Have you ever been in trouble with the law?”
<b>Environmental Variables</b>	
History of abuse	Yes to “(In the past year) Have you ever been physically, sexually, or emotionally abused?”
Family composition	Living with: Mother and father Mother and no father Father and no mother Mother or father and a stepparent Neither mother nor father
Adverse family events	Yes to “During the last year, have there been major changes in your family such as: Separation or divorce? Serious illness or deaths? Move to a new school or a new neighborhood? Loss of job?”

regression models using generalized estimating equations (GEE, SAS PROC GENMOD version 9.1) (SAS Institute Inc, Cary, NC) to fit the models.<sup>30</sup> From these we computed crude and adjusted prevalence ratios and 95% confidence intervals rather than odds ratios, which may overestimate the risk ratio when the outcome is common (ie, >10%).<sup>31,32</sup> Bivariate regression models were first developed to establish factors associated with depressive symptoms. A series of multivariate analyses were performed to further describe the association between each variable and depressive symptoms while controlling for variables significantly associated with the outcome in the bivariate analyses. A backward stepwise regression retained those variables that changed the regression coefficient of the predictor variable by at least 10%.

## Results

### *Depressive Symptom Prevalence*

A total of 672 GAPS forms were collected. Overall, 25.1% (n=158) of adolescents answered positively to the question asking if they had felt sad or down or as though they had nothing to look forward to during the few weeks preceding the clinic visit, and 8.5% (n=55) reported a history of suicidal ideation. In all, 26.5% (n=177) answered positively to either or both questions and comprised the group with depressive symptoms.

### *Bivariate Results*

Females and older teens reported higher depressive symptom levels (Table 2). There were no differences in report of depressive symptoms by race or insurance status.

Weight was not related to depressive symptoms. The proportion reporting disordered eating and poor physical activity levels, however, were 2 and 1.5 times more likely, respectively, to report depressive symptoms. Declining grades and having a learning disability or being in special education classes were also associated factors. Sexually active adolescents reported depressive symptoms more than twice as often as non-sexually active teens. All forms of substance use (tobacco, alcohol, and drugs) and self-reported alcohol abuse were associated with depressive symptoms. Adolescents involved in fighting or who carried a weapon reported depressive symptoms at least 1.5 times more often. Students were almost twice as likely to report depressive symptoms if they also reported legal troubles.

Teens with a history of physical, sexual, or emotional abuse were highly likely to report depressive symptoms. Family composition and recent adverse family events were not associated factors.

### *Depressive Symptoms by Gender*

We compared females and males with depressive symptoms (females: n=129, males: n=48) to determine differences in factors associated with depressive symp-

toms between the two groups (data not shown). Females with depressive symptoms reported a higher prevalence of sexual activity (64.1%) compared to males (47.8%) ( $\chi^2=3.7$ ,  $P=.05$ ). Drug use was also more prevalent in females with depressive symptoms (28.9%) than in males (14.6%) ( $\chi^2=3.8$ ,  $P=.05$ ).

### *Multivariate Regression Analysis*

After adjusting for potential confounders, depressive symptoms were about twice as prevalent among females and among those reporting sexual activity (Table 3). Other associated factors included inadequate physical activity levels, weapon carrying, trouble with the law, and a personal history of abuse. Although bivariate analysis revealed an association between substance use and depressive symptoms, no measures pertaining to substance use were related to depressive symptoms after adjusting for other factors.

## Discussion

In this SBHC population, 25.1% of adolescents felt sad or down or as though they had nothing to look forward to; this compares to 28.5% in the 2005 YRBS national data (and 29.7% among Detroit adolescents). The proportion reporting a history of suicidal ideation (8.5%) was roughly half that reported at the national (16.9%) and other local (14.2%) levels.<sup>1</sup> The difference in suicidal ideation levels may be due to data collection methods. Unlike the school-based, anonymous survey methodology of the YRBS,<sup>1</sup> the GAPS forms were not anonymous and were placed in the SBHC medical record. It is possible that some adolescents may have concerns about revealing suicidal thoughts or other depressive symptoms to health care professionals at their SBHC or may seek mental health treatment from a different source. Our estimates may also underrepresent prevalence of depressive symptoms for the entire student body because not all students seek care at the SBHC.

Our findings support many previously reported associations between adolescent depressive symptoms and demographic and behavioral factors, including female gender,<sup>4,5,11</sup> risky sexual activity,<sup>2,5,7</sup> and a personal history of abuse.<sup>12,13</sup> Adolescent health providers should be alert to a history of sexual activity and abuse as important markers for depression risk, especially in adolescent women.

Several reports address the relationship between adolescent depressive symptoms and eating disorders and obesity.<sup>10,34</sup> Although a few studies have shown an inverse relationship between adolescent depressive symptoms and physical activity,<sup>34,35</sup> the role of physical activity has been less extensively investigated in this age cohort. Since physical inactivity is linked to obesity,<sup>36</sup> and overweight was not a related factor for depressive symptoms in our sample, other benefits of physical activity may be an important mechanism for

Table 2  
 Frequency Distribution of Factors Associated With Depressive Symptoms  
 at Two School-based Health Centers (SBHCs) Near Detroit

Variable	Depressive Symptoms <sup>†</sup>							$\chi^2$ P Value
	Total Sample* (n=672)			Yes (n=177)		No (n=491)		
	n	#	%	#	%	#	%	
SBHC Site	672							
Site A		358	53.3	101	28.5	253	71.5	.21
Site B		314	46.7	76	24.2	238	75.8	
Gender	672							
Female		376	56.0	129	34.3	247	65.7	<.01
Male		296	44.0	48	16.4	244	83.6	
Age (years)	672							
13		90	13.4	13	14.4	77	85.6	.03
14		148	22.0	46	31.3	101	68.7	
15		168	25.0	44	26.5	122	73.5	
16		140	20.8	44	31.7	95	68.3	
17		126	18.8	30	23.8	96	76.2	
17		126	18.8	30	23.8	96	76.2	
Race	604							
African American		443	73.3	114	25.9	326	74.1	.10
White		105	17.4	37	35.2	68	64.8	
Other		56	9.3	12	21.8	43	78.2	
Health insurance	559							
No insurance		62	11.1	15	24.2	47	75.8	.78
Government funded		219	39.2	60	27.5	158	72.5	
Private		278	49.7	69	25.0	207	75.0	
<u>Weight and body issues</u>								
BMI percentile	652							
< 85 <sup>th</sup> percentile		382	58.6	100	26.4	279	73.6	.85
≥ 85 <sup>th</sup> percentile		270	41.4	73	27.0	197	73.0	
Disordered eating	665							
Yes		54	8.1	27	50.0	27	50.0	<.01
No		611	91.9	150	24.7	457	75.3	
Physical activity	616							
Adequate		373	60.6	87	23.4	285	76.6	<.01
Not adequate		243	39.4	85	35.3	156	64.7	
Sexual activity	646							
Yes		254	39.3	104	41.1	149	58.9	<.01
No		392	60.7	70	17.9	321	82.1	
<u>School performance</u>								
Declining grades	609							
Yes		138	22.7	53	38.4	85	61.6	<.01
No		471	77.3	116	24.8	352	75.2	
Learning problem/special education	622							
Yes		82	13.2	33	40.7	48	59.3	<.01
No		540	86.8	141	26.2	397	73.8	
Suspended from school	614							
Yes		166	27.0	56	34.1	108	65.9	.05
No		448	73.0	115	25.7	332	74.3	
<u>Substance use</u>								
Tobacco use	667							
Yes		80	12.0	43	53.8	37	46.3	<.01
No		587	88.0	133	22.7	452	77.3	
Alcohol use	634							
Yes		112	17.7	54	48.2	58	51.8	<.01
No		522	82.3	120	23.1	400	76.9	

(continued on next page)

Table 2  
(Continued)

Variable	Total Sample* (n=672)			Depressive Symptoms†				$\chi^2$ P Value
	n	#	%	Yes (n=177)		No (n=491)		
				#	%	#	%	
Alcohol abuse/risky drinking behavior	658							
Yes		48	7.3	31	64.6	17	35.4	<.01
No		610	92.7	146	24.0	462	76.0	
Drug use	666							
Yes		80	12.0	44	55.0	36	45.0	<.01
No		586	88.0	132	22.6	453	77.4	
<u>Violence</u>								
Fighting	635							
Yes		121	19.1	47	38.8	74	61.2	<.01
No		514	80.9	127	24.9	384	75.1	
Weapons carrying	632							
Yes		50	7.9	32	64.0	18	36.0	<.01
No		582	92.1	142	24.5	437	75.5	
Law trouble	636							
Yes		97	15.3	45	46.4	52	53.6	<.01
No		539	84.7	130	24.3	406	75.7	
History of abuse	615							
Yes		57	9.3	41	71.9	16	28.1	<.01
No		558	90.7	126	22.6	432	77.4	
Family composition	506							
Mother and father		100	19.8	29	29.3	70	70.7	.10
Mother and no father		237	46.8	58	24.8	176	75.2	
Father and no mother		36	7.1	12	33.3	24	66.7	
Mother or father and stepparent		59	11.7	22	37.3	37	62.7	
Neither mother nor father		74	14.6	29	39.2	45	60.8	
<u>Adverse family events</u>								
Divorce or separation	344							
Yes		41	11.9	15	36.6	26	63.4	.65
No		303	88.1	99	33.0	201	67.0	
Serious illness or death	344							
Yes		113	32.8	43	38.1	70	61.9	.20
No		231	67.2	71	31.1	157	68.9	
New neighborhood or school	344							
Yes		200	58.1	66	33.2	133	66.8	.90
No		144	41.9	48	33.8	94	66.2	
Loss of job	344							
Yes		43	12.5	14	32.6	29	67.4	.90
No		301	87.5	100	33.6	198	66.4	

\* Summarizes the overall frequencies for each variable.

† Response was considered positive if adolescent either reported a history of suicidal ideation or reported often feeling sad or down or having nothing to look forward to for the few weeks preceding survey completion.

these teens. For example, sports participation is related to lower depressive symptom levels.<sup>37,38</sup> Other benefits include decreased stress hormone levels, better self-image, and improved social functioning.<sup>35,39</sup> Health care providers should continue to emphasize the importance of physical activity as a means of mental well-being during routine health visits.

Exposure to violence and demonstration of violent behavior are often reported to be associated with

adolescent depression in urban settings.<sup>8,9</sup> Weapon carrying by itself may also have an important impact on adolescent mental health. A few studies have linked weapon carrying in the adolescent years to depression and suicidal ideation.<sup>41,42</sup> The fact that weapon carrying, and not physical fighting, proved to be a significant correlate to depressive symptoms in our sample may indicate that the threat or fear of violence has an effect on the mental well-being of these teens and may

Table 3

## Unadjusted and Adjusted Prevalence Ratios for the Presence of Depressive Symptoms at Two School-based Health Centers near Detroit

Variable	Unadjusted Prevalence Ratio		Adjusted Prevalence Ratio	
	PR	95% CI	PR	95% CI
Gender				
Female	2.09*	1.56–2.80	2.18*	1.47–3.21
Male	1.00		1.00	
Age (years)				
13	1.00		1.00	
14	1.33	0.89–1.98	1.01	0.63–1.61
15	1.11	0.74–1.66	1.14	0.74–1.77
16	1.31	0.89–1.95	1.35	0.88–2.06
17	0.61	0.34–1.10	0.98	0.49–1.92
Disordered eating	2.02*	1.50–2.73	1.26	1.00–1.58
Inadequate physical activity	1.51*	1.17–1.94	1.32*	1.04–1.69
Sexual activity	2.30*	1.77–2.97	1.86*	1.40–2.46
Declining grades	1.55*	1.19–2.02	0.93	0.64–1.35
Learning problem/special education	1.55*	1.15–2.10	1.11	0.86–1.42
Tobacco use	2.36*	1.84–3.04	1.18	0.89–1.56
Alcohol use	2.09*	1.63–2.68	1.17	0.90–1.52
Alcohol abuse/risky drinking behavior	2.69*	2.09–3.46	1.19	0.88–1.59
Drug use	2.44*	1.90–3.13	0.95	0.65–1.40
Fighting	1.56*	1.19–2.05	0.84	0.61–1.16
Weapon carrying	2.61*	2.03–3.36	1.29*	1.02–1.63
Law trouble	1.91*	1.47–2.48	1.38*	1.04–1.83
History of abuse	3.19*	2.55–3.98	1.29*	1.11–1.49

Note: For each variable, the reference category is the negative response (ie, non-risky behavior or experience).

\* Significant at  $P < .05$ .

PR—prevalence ratio

CI—confidence interval

be more important than the outward demonstration of violent behavior in assessing depression risk. Teens reporting weapon carrying may face physical threats in their neighborhood or school, and a violence exposure assessment should be an important part of routine adolescent mental health screening.

We found that respondents with a history of law trouble were more likely to report depressive symptoms. The relationship between adolescent depression and legal problems has largely been assessed among incarcerated and detained adolescents,<sup>42,43</sup> a paucity of literature addresses a reported history of legal troubles as a risk variable. Problems with the law and high levels of criminal behavior during adolescence have predicted depression in adulthood.<sup>44</sup> Moreover, Tolou-Shams et al<sup>45</sup> noted that teens with an arrest history were more likely to attempt suicide or to have a psychiatric hospitalization, suggesting that contact with the legal system may be an indicator of mental health problems.

Querying about legal problems provides a segue to assess depression risk and to investigate other behaviors that might negatively influence mental health (eg, substance abuse or violence). More research is needed to characterize what type of legal troubles adolescents find themselves in and how those difficulties interact with depressive symptoms.

Since substance use is a well-recognized comorbidity with adolescent depressive symptoms,<sup>2,6</sup> it was surprising that substance use was not an associated factor in our adjusted analysis. Some of the discrepancy may be due to analytic technique; in adjusted analyses, significant associations between depressive symptoms and substance use may no longer be significant when controlling for potential confounders.<sup>5</sup> Substance use may also be more common among adolescents who report other indicators placing them at high risk for depressive symptoms, such as sexual activity,<sup>7</sup> abuse,<sup>12</sup> or violence.<sup>9</sup> Although not related to depressive symp-

toms in this analysis, substance use may still serve as an important marker for depression risk.

This study attempts to aid primary care providers in identifying at-risk youth who may need more in-depth evaluation for depression. We found that depressive symptoms in adolescents were associated with other risk variables, and by assessing these related risk variables in addition to depressive symptoms, we may more effectively stratify adolescents into high-risk groups that need further intervention. Other screening recommendations support this approach. Both the GAPS<sup>46</sup> and the Guidelines for Adolescent Depression in Primary Care<sup>47</sup> advocate annual depression risk screening among all adolescents and recommend stratifying patients into high-risk and low-risk groups by evaluating depressive symptoms, suicidality, and other risk factors (eg, substance use and a history of abuse). High-risk patients should then be evaluated and monitored for depression. The US Preventive Services Task Force recommends screening adolescents ages 12–18 years for major depression if adequate means of treatment and follow-up are available.<sup>49</sup> However, this recommendation does not take into consideration less severe forms of depression, and routinely screening all adolescent patients for major depression may not be realistic in a busy outpatient practice.

On another note, SBHCs are an important foundation for health care provision for at-risk adolescents, and family physicians and other health care providers can improve adolescent mental health through the SBHC framework. SBHCs can also serve as important resources that complement routine care provided by family physicians.<sup>19</sup> Use of the GAPS has resulted in improved adolescent outcomes<sup>25</sup> and can be utilized by family physicians in their practices. Because the GAPS are widely used among SBHCs and other clinics, the GAPS questionnaire could be a useful survey instrument. However, no normative GAPS data exist. More study is needed to realize the potential that the GAPS questionnaires can have on research initiatives.

### Limitations

Several limitations in our retrospective study design and approach are important to recognize. Given the study's cross-sectional nature, we were not able to explain possible causal or reciprocal effects of depressive symptoms on identified risk variables. Second, the GAPS forms were completed prior to the study, and the circumstances in which the questionnaires were completed could not be controlled by the investigators. Third, questionnaire collection was concentrated during the high-volume clinic months during the academic year, which may not be representative of visits throughout the entire year. Fourth, approximately 20 students had more than one questionnaire available for the study period. Because only anonymous data were

retained in our database, we were not able to identify and remove those duplicates from the analysis file. Additionally, we were unable to fully explore potential gender differences due to the low number of young men (n=48) reporting depressive symptoms.

### Conclusions

We found multiple factors associated with self-report of depressive symptoms, many of which were behavioral in nature. Depressive symptoms were most strongly associated with female gender, sexual activity, a history of abuse, weapon carrying, trouble with the law, and inadequate physical activity. Weapon carrying, law trouble, and physical activity are less frequently studied factors associated with adolescent depressive symptoms and may warrant further investigation. By targeting these factors during routine health visits, providers may be able to more effectively identify teens at highest risk for depression and create more appropriate interventions. SBHCs, because of their accessibility to teens and their success in improving mental health and other outcomes,<sup>17,22</sup> play an important role in adolescent health care and can complement care provided by family physicians.

*Acknowledgments:* This study was previously presented by Michael Kopec, MD, at the Michigan Family Medicine Research Day XXXII on May 21, 2009, in Brighton, Mich.

We thank Jason Booza and Amanda Overmyer, MD, for their important work on this project. This research was supported by a Student Award Program grant from the Blue Cross and Blue Shield of Michigan Foundation and a research award from the Wayne State University School of Medicine Alumni Association, both bestowed to Dr Kopec.

Corresponding Author: Address correspondence to Dr Schwartz, Wayne State University School of Medicine, Department of Family Medicine and Public Health Sciences, 101 E. Alexandrine, Detroit, MI 48201. 313-577-0880. Fax: 313-577-3070. kensch@med.wayne.edu.

### REFERENCES

- Eaton DK, Kann L, Kinchen S, et al. Youth risk behavior surveillance—United States, 2005. *MMWR Surveill Summ* 2006;55(5):1-8.
- Hallfors DD, Waller MW, Ford CA, Halpern CT, Brodish PH, Iritani B. Adolescent depression and suicide risk: association with sex and drug behavior. *Am J Prev Med* 2004;27(3):224-31.
- Rushon JL, Forcier M, Schectman RM. Epidemiology of depressive symptoms in the National Longitudinal Study of Adolescent Health. *J Am Acad Child Adolesc Psychiatry* 2002;41(2):199-205.
- Sen B. Adolescent propensity for depressed mood and help seeking: race and gender differences. *J Ment Health Policy Econ* 2004;7(3):133-45.
- Brooks TL, Harris SK, Thrall JS, Woods ER. Association of adolescent risk behaviors with mental health symptoms in high school students. *J Adolesc Health* 2002;31(3):240-6.
- Kubik MY, Lytle LA, Birnbaum AS, Murray DM, Perry CL. Prevalence and correlates of depressive symptoms in young adolescents. *Am J Health Behav* 2003;27(5):546-53.
- Shrier LA, Harris SK, Sternberg M, Beardslee WR. Associations of depression, self-esteem, and substance use with sexual risk among adolescents. *Prev Med* 2001;33(3):179-89.
- Fitzpatrick KM, Piko BF, Wright DR, LaGory M. Depressive symptomatology, exposure to violence, and the role of social capital among African American adolescents. *Am J Orthopsychiatry* 2005;75(2):262-74.
- Blitstein JL, Murray DM, Lytle LA, Birnbaum AS, Perry CL. Predictors of violent behavior in an early adolescent cohort: similarities and differences across genders. *Health Educ Behav* 2005;32(2):175-94.

10. Gardner RM, Stark K, Friedman BN, Jackson NA. Predictors of eating disorder scores in children ages 6 through 14: a longitudinal study. *J Psychosom Res* 2000;49(3):199-205.
11. Repetto PB, Caldwell CH, Zimmerman MA. Trajectories of depressive symptoms among high risk African American adolescents. *J Adolesc Health* 2004;35(6):468-77.
12. Arata CM, Langhinrichsen-Rohling J, Bowers D, O'Brien N. Differential correlates of multi-type maltreatment among urban youth. *Child Abuse Negl* 2007;31(4):393-415.
13. Diaz A, Simantov E, Rickert VI. Effect of abuse on health: results of a national survey. *Arch Pediatr Adolesc Med* 2002;156(8):811-7.
14. Aseltine RH Jr. Pathways linking parental divorce with adolescent depression. *J Health Soc Behav* 1996;37(2):133-48.
15. Center for Health and Health Care in Schools. 2002 State Survey of School-based Health Center Initiatives. [www.healthinschools.org/static/sbhcs/survey02.aspx](http://www.healthinschools.org/static/sbhcs/survey02.aspx). Accessed June 10, 2009.
16. Pastore DR, Juszczak L, Fisher MM, Friedman SB. School-based health center utilization: a survey of users and nonusers. *Arch Pediatr Adolesc Med* 1998;152(8):763-7.
17. Allison MA, Crane LA, Beaty BL, Davidson AJ, Melinkovich P, Kempe A. School-based health centers: improving access and quality of care for low-income adolescents. *Pediatrics* 2007;120(4):e887-94.
18. Kaplan DW, Calonge BN, Guernsey BP, Hanrahan MB. Managed care and school-based health centers. Use of health services. *Arch Pediatr Adolesc Med* 1998;152(1):25-33.
19. Weinstein J. School-based health centers and the primary care physician: an opportunity for collaborative care. *Prim Care Clin Office Pract* 2006;33:305-15.
20. Kalet AL, Juszczak L, Pastore D, et al. Medical training in school-based health centers: a collaboration among five medical schools. *Acad Med* 2007;82(5):458-64.
21. Santor DA, Poulin C, LeBlanc JC, Kusumakar V. Examining school health center utilization as a function of mood disturbance and mental health difficulties. *J Adolesc Health* 2006;39(5):729-35.
22. Armbruster P, Lichtman J. Are school-based mental health services effective? Evidence from 36 inner city schools. *Comm Ment Health J* 1999;35(6):493-504.
23. National Assembly on School-based Health Care. Screening and assessment. [www.nasbhc.org/site/c.jsjpkwpfjrh/b.3015369/k.9167/mh\\_screening.htm](http://www.nasbhc.org/site/c.jsjpkwpfjrh/b.3015369/k.9167/mh_screening.htm). Accessed June 10, 2009.
24. Klein JD, Allan MJ, Elster AB, et al. Improving adolescent preventive care in community health centers. *Pediatrics* 2001;107(2):318-27.
25. Gadomski A, Bennett S, Young M, Wissow LS. Guidelines for adolescent preventive services: the GAPS in practice. *Arch Pediatr Adolesc Med* 2003;157(5):426-32.
26. Center for Educational Performance and Information. 2005-2006 Pupil Headcount Data (SRSD). Building enrollment data: fall 05 K-12 enrollments. [www.michigan.gov/cepi/0,1607,7-113-21423\\_30451\\_30460-153640--,00.html](http://www.michigan.gov/cepi/0,1607,7-113-21423_30451_30460-153640--,00.html). Accessed July 24, 2008.
27. United States Census Bureau. American fact finder: summary file 1 and 3. [http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en). Accessed July 24, 2008.
28. American Medical Association. Guidelines for adolescent preventive services (GAPS). [www.ama-assn.org/ama/pub/category/1980.html](http://www.ama-assn.org/ama/pub/category/1980.html). Accessed July 24, 2008.
29. Centers for Disease Control and Prevention. A SAS Program for the CDC growth charts. [www.cdc.gov/nccdphp/dnpa/growthcharts/resources/sas.htm](http://www.cdc.gov/nccdphp/dnpa/growthcharts/resources/sas.htm). Accessed June 9, 2008.
30. Spiegelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios and differences. *Am J Epidemiol* 2005;162:199-200.
31. Zocchetti C, Consonni D, Bertazzi PA. Relationship between prevalence rate ratios and odds ratios in cross-sectional studies. *Int J Epidemiol* 1997;26(1):220-3.
32. Skov T, Deddens J, Petersen MR, Endahl L. Prevalence proportion ratios: estimation and hypothesis testing. *Int J Epidemiol* 1998;27(1):91-5.
33. Goodman E, Whitaker RC. A prospective study of the role of depression in the development and persistence of adolescent obesity. *Pediatrics* 2002;110(3):497-504.
34. Motl RW, Birnbaum AS, Kubik MY, Dishman RK. Naturally occurring changes in physical activity are inversely related to depressive symptoms during early adolescence. *Psychosom Med* 2004;66:336-42.
35. Kirkcaldy BD, Shephard RJ, Siefen RG. The relationship between physical activity and self-image and problem behaviour among adolescents. *Soc Psychiatry Psychiatr Epidemiol* 2002;37:544-50.
36. Berkey CS, Rockett HRH, Field AE, et al. Activity, dietary intake, and weight changes in a longitudinal study of preadolescent and adolescent boys and girls. *Pediatrics* 2000;105:56-64.
37. Desha LN, Ziviani JM, Nicholson JM, Martin G, Darnell RE. Physical activity and depressive symptoms in American adolescents. *J Sport Exerc Psychol* 2007;29(4):534-43.
38. Sanders CE, Field TM, Diego M, Kaplan M. Moderate involvement in sports is related to lower depression levels among adolescents. *Adolescence* 2000;35:793-7.
39. Nabkasorn C, Miyai N, Sootmongkol A, et al. Effects of physical exercise on depression, neuroendocrine stress hormones and physiological fitness in adolescent females with depressive symptoms. *Eur J Public Health* 2005;16(2):179-84.
40. Kulig J, Valentine J, Griffith J, Ruthazer R. Predictive model of weapon carrying among urban high school students: results and validation. *J Adolesc Health* 1998;22(4):312-9.
41. Muula AS, Rudatsikira E, Siziya S. Correlates of weapon carrying among high school students in the United States. *Ann Gen Psychiatry* 2008;7:8.
42. Pliszka SR, Sherman JO, Barrow MV, Irick S. Affective disorder in juvenile offenders: a preliminary study. *Am J Psychiatry* 2000;157(1):130-2.
43. Abram KM, Teplin LA, McClelland GM, Dulcan MK. Comorbid psychiatric disorders in youth in juvenile detention. *Arch Gen Psychiatry* 2003;60:1097-108.
44. Wiesner M, Kim HK, Capaldi DM. Developmental trajectories of offending: validation and prediction to young adult alcohol use, drug use, and depressive symptoms. *Devel Psychopathol* 2005;17:251-70.
45. Tolou-Shams M, Brown LK, Gordon G, Fernandez I, Project SHIELD Study Group. Arrest history as an indicator of adolescent/young adult substance use and HIV risk. *Drug Alcohol Depend* 2007;88(1):87-90.
46. American Medical Association. Guidelines for Adolescent Preventive Services (GAPS) recommendations monograph. [www.ama-assn.org/ama/upload/mm/39/gapsmono.pdf](http://www.ama-assn.org/ama/upload/mm/39/gapsmono.pdf). Accessed August 12, 2009.
47. Zuckerbrot RA, Cheung AH, Jensen PS, Stein REK, Laraque D, GLAD-PC Steering Group. Guidelines for Adolescent Depression in Primary Care (GLAD-PC): I. Identification, assessment, and initial management. *Pediatrics* 2007;120(5):e1299-312.
48. US Preventive Services Task Force. Screening and treatment for major depressive disorder in children and adolescents: US Preventive Services Task Force recommendation statement. *Pediatrics* 2009;123(4):1223-8.