

Depressive Symptoms and Health Risk Among Rural Adolescents

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ABSTRACT. *Objective.* To determine the stability of depression and its relationship with health risk factors among rural adolescents.

Methods. A clinic-based longitudinal study was conducted to test for depression and risk factors in 64 participants who attended a rural, primary care, adolescent medicine clinic. The primary measure of risk and depression was the Perkins Adolescent Risk Screen (PARS). Adolescent patients who were aged 12 to 18 years and had PARS assessments during a previous visit to the adolescent clinic were invited to complete a follow-up PARS assessment.

Results. The mean age of adolescents at baseline was 12.79 years; 14.59 years at follow-up. With age and gender being controlled, adolescent depression and various adolescent risk indices were significantly related at baseline. Longitudinally, baseline depression score on PARS were related to follow-up: depression, school problems, substance abuse, tobacco use, sexual activity, and violent behavior scores and a history of physical/sexual abuse. On multivariate analysis controlling for other significantly associated variables, the relationship persisted for baseline depression and follow-up: tobacco, substance abuse, depression, and history of physical/sexual abuse.

Conclusion. This study confirms a strong longitudinal relationship between baseline depressive symptoms and several important risk behaviors/factors measured at follow-up in a clinic population of rural adolescents. Also, longitudinal stability of depression over time is supported. *Pediatrics* 2004;113:1313-1320; *depression, health risk behaviors, rural adolescents, mental health services.*

ABBREVIATIONS. BMI, body mass index; PARS, Perkins Adolescent Risk Screen.

Recent reports find associations between depression and several health risk behaviors including sexual activity,¹⁻⁴ intentions to use violence,^{5,6} substance use,^{7,8} tobacco use,⁹⁻¹² and obesity.^{13,14} Community samples as well as clinical cases also report high comorbidity between depression and other psychiatric diseases, including conduct disorder, anxiety, attention-deficit/hyperactivity disorder, and substance abuse.¹⁵⁻¹⁷

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The association between depression and substance abuse is well supported in the clinical literature.¹⁸⁻²³ One report suggested that this may be stronger in adolescents than in adults.²⁴ Other studies demonstrated relationships between substance abuse and depression^{7,8,25} and substance abuse initiation after dysthymia.²⁶ Rao et al²⁷ found that adolescents who had unipolar major depression had earlier onset of substance use disorder and a higher percentage of substance abuse when compared with control subjects. Other studies, however, did not find a longitudinal relationship between depression and substance abuse.^{28,29}

Several studies found that depressive mood and stress are related to initiation and intensity of adolescent tobacco use.^{9-11,30} Depression is associated with sexual risk in several studies. Lower self-esteem is related to early sexual debut² and risky sexual activity.^{3,4,31} A national longitudinal survey of young women revealed that having intercourse at an early age, not using contraceptives, and having a child are linked with depression, low self-esteem, and little sense of control over their lives.¹ DiClemente et al⁴ found that "emotional distress," defined with measures of depression, is related to pregnancy, unprotected vaginal sex, nonmonogamous sex partners, and nonuse of any form of contraception.

Intentions to use violence among young adolescents is associated with depression and hopelessness.^{5,6} It is interesting that 1 report showed that teens who by other criteria were at high risk for violence but who exhibited less depression and high resilience had reduced self-report of violent behaviors.³²

Burns et al³³ presented data from a cross-sectional analysis of 753 adolescents who received risk behavior assessment in a rural outpatient adolescent clinic population. In this analysis, a significant relationship between depression scores and drug abuse, tobacco abuse, alcohol abuse, unsafe sexual activity, not wearing bike helmets/using seat belts, history of physical/sexual abuse, poor exercise, body mass index (BMI), and eating habits was found. In addition, depressive symptoms were associated with higher rates of violence, diminished functioning with peers, problems with family, and poor school performance. All relationships with depression were highly statistically significant ($P < .001$).

In addition to the relationship between depressive symptoms and risk factors/behaviors, it is of interest

to study the persistence of depressive symptoms in adolescents. Birmaher et al³⁴ in a comprehensive literature review on adolescent depression reported an average length of 7 to 9 months for major depressive disorder, with 90% resolution by 2 years but with 40% recurrence rate by 2 years and 70% recurrence at 5 years. Another longitudinal study demonstrated that depression in adolescence persists into adulthood.³⁵ Birmaher also discussed early-onset dysthymia having a chronic course with a mean of 4 years' duration with increased risk for development of other mood disorders.^{34,36-38} Fergusson and Woodward³⁹ presented a longitudinal study of depressed adolescents and found significantly increased risk of major depression, anxiety disorders, nicotine dependence, alcohol abuse, suicide attempt, educational underachievement, unemployment, and early parenthood later in life when there was depression in adolescence. It was noted, however, that although there was a direct link between early depression and subsequent major depression, it was found that the relationship between adolescent depression and the other subsequent outcomes was because of confounding variables, including family education, history of abuse, low IQ, peer relationships, neuroticism, and unemployment of parents, rather than a direct effect of depression. In this article, it was believed that similar longitudinal studies should be done in other settings.

There are few studies that focus on rural adolescents and depression. Some studies demonstrate significant problems. In Missouri, rural adolescents were shown to have significant problems with stress and coping.⁴⁰ This challenges the myth that rural regions experience less stress being removed from urban environments. Another report found that rural families are less likely to seek help for emotional problems than urban families and that there are greater levels of stigma associated with mental health problems in rural versus urban areas.⁴¹ Additional investigation on the mental health issues of this unique population is needed. This study therefore was undertaken to characterize further the longitudinal stability of depressive symptoms and the relationship over time between depressive symptoms and health risk behaviors on the basis of clinical assessments in a rural adolescent medicine clinic.

METHODS

Location

This study was conducted from July 2000 to September 2002 at the Pediatric and Adolescent Group Practice clinic, which is the outpatient teaching clinic for the West Virginia University School of Medicine. Approval was obtained by the West Virginia University Institutional Review Board for the Protection of Human Research Subjects.

Patient Selection

Clinic schedules from the West Virginia University Pediatric and Adolescent Group Practice from October 1997 to June 1999 were obtained by the medical records department, yielding 513 charts. Out of this chart review, 254 patients were considered eligible for study participation on the basis of having a previous Perkins Adolescent Risk Screen (PARS) in the chart and being in the age range of 12 to 18 years. Each candidate was mailed a letter

explaining the purpose of the research and its methods and an invitation to participate.

After the baseline mailing of an explanatory letter, parents/guardians of patients were called and asked whether they wished their teen to participate in study. When they answered yes, appointments were made. A total of 173 (68%) of those eligible were contacted successfully; 94 refused participation, and 79 gave permission to schedule a visit for participation in the study. Of the 79 who consented, 53 attended their appointment. Also, 11 adolescents who arrived in the clinic for other reasons and who met criteria for entry into the study (previous PARS in chart, aged 12-18) were invited to enroll while they were in the clinic. Thus, a total of 64 patients were enrolled.

Comparisons between characteristics of patients who refused participation and those who participated revealed higher "depression" scores for those who participated (mean: 1.38; standard deviation [SD]: 0.65; $N = 64$) versus those who refused (mean: 1.16; SD: 0.43; $N = 83$; $P < .05 = 0.023$). In addition, there were higher scores on "problems with family" for those who participated (mean: 1.16; SD: 0.41; $N = 64$) versus those who refused (mean: 1.01; SD: 0.11; $N = 83$; $P = .007$). No differences in other variables were noted.

Procedure

Written permission was obtained at the time of the visit from a parent and the adolescent. A repeat PARS was performed in the clinic by the principal investigator. Additional questions pertaining to mental health interventions were asked. Finally, depressive symptoms at follow-up were assessed using the Children's Depression Inventory for comparison and found to be highly correlated to PARS depression scores. At the conclusion of the visit, participants were given a \$10 gift certificate as compensation for participation.

The chart was then reviewed for the previous PARS, which was copied into the database. When >1 baseline PARS existed, the one with the highest depressive PARS subscore was used. At the time of selecting the baseline PARS, the investigator was blind to the follow-up PARS results at the time of the entry assessment, and, conversely, there was no knowledge of the baseline PARS at the follow-up assessment.

Study Population Description

Descriptive frequencies of participants are listed in Table 1. There were no differences in gender frequencies, with 46.9% female and 53.1% male. The mean age was 12.79 at baseline PARS and 14.59 at follow-up. The mean time interval between baseline and follow-up assessments was 1.8 years.

On the baseline PARS, 71.9% of participants had low depression scores, 18.7% had had moderate depression scores, and 9.4% had high depression scores. On the follow-up PARS, 68.8% had low, 14% had moderate, and 17.2% had high scores for depression.

Longitudinal changes in PARS sub-scores are presented in Table 2. On paired t test, there was a statistically significant increase in percentage of participants with moderate to high scores when baseline and follow-up PARS were compared for "safety" (baseline: 20.63%, $n = 18$; follow-up: 25%, $n = 16$; $P = .04$), "alcohol" (baseline: 4.70%, $n = 3$; follow-up: 14.06%, $n = 9$; $P = .05$), and "tobacco use" (baseline: 6.25%, $n = 4$; follow-up: 10.94%, $n = 7$; $P = .05$). No other variables showed significant change over the study period.

Calculated BMI scores >25 were found in 36.2% of participants on the baseline assessments and 42.5% of participants at follow-up. Approximately one third were not exercising enough at both baseline and final assessments, 28% were found on baseline and 31.2% were found on follow-up assessments to have either moderate or high depression PARS score, 20.6% at baseline and 25% at follow-up were not using seat belts or bicycle helmets, 29.5% at baseline and 23.4% at follow-up had poor eating habits, 14.3% at baseline and 20.3% at follow-up had moderate to high scores for family problems, and 17.2% at baseline and 21.9% at follow-up had school problems. Moderate to high follow-up PARS scores were found in 14.1% of participants for alcohol, 10.9% for tobacco, 8.1% for violence, and 7.8% for sexual activity.

TABLE 1. Descriptive Frequencies of Study Data

	N	%	Mean	SD
Gender				
Female, %		46.90		
Male, %		53.10		
Total, %		100.00		
Age				
At time of baseline assessment, y			12.79	1.4
At time of follow-up assessment, y			14.59	1.3
Mean time interval between baseline and follow-up, y			1.80	0.83
% of charts with at least 1 PARS		49.00		
Mental health intervention				
% ever had individual counseling		31.3		
% ever had psychological assessment		28.1		
% ever prescribed psychotropic medications		21.9		
% ever seen school counselor		18.8		
% ever had family counseling		7.8		
% ever had group therapy		6.3		
% ever admitted to inpatient psychiatric hospital		6.3		
% who have had no mental health intervention		56.25		
% baseline moderate/high depression with no mental health intervention		27.78		
% follow-up moderate/high depression with no mental health intervention		50		
Depression score at baseline assessment				
Low	46	71.9	1	
Moderate	12	18.7	2	
High	6	9.4	3	
Total	64	100	1.38	0.65
Depression score at follow-up assessment				
Low	44	68.8	1	
Moderate	9	14	2	
High	11	17.2	3	
Total	64	100	1.48	0.78

TABLE 2. Comparison of Frequencies of Those Who Scored Moderate or High on PARS at Baseline Versus Follow-up

Selected Variables	Baseline		Follow-up		Significance*
	n	%	n	%	
Not exercising enough	22	34.92	21	32.81	NS
Depression	18	28.13	20	31.25	NS
Problems being safe	13	20.63	16	25.00	<.05
Nutrition problems	18	29.51	15	23.44	NS
School problems	11	17.19	14	21.88	NS
Family problems	9	14.29	13	20.31	NS
Weight perception problems	8	14.29	10	18.52	NS
Alcohol abuse	3	4.70	9	14.06	<.05
Tobacco abuse	4	6.25	7	10.94	<.05
Violence	7	10.94	5	8.06	NS
Poor self-esteem	4	6.56	5	7.94	NS
Sexually active	2	3.20	5	7.81	NS
Physical/sexual abuse	6	9.50	4	6.25	NS
Peer problems	7	11.11	3	4.69	NS
Drug abuse	1	1.60	3	4.69	NS
Immunizations not up to date	5	9.26	2	3.28	NS
BMI measurements					
Had calculated BMI >25	21	36.21	20	42.55	NS
Had calculated BMI >30	12	20.69	12	25.53	NS

NS indicates not significant.

* Paired *t* test comparison of baseline versus follow-up.

Relationships Between Age and Gender and Risk Variables

Age was related to increased baseline depression ($P = .004$), follow-up nutrition ($P = .042$), follow-up exercise ($P = .013$), follow-up tobacco ($P = .005$), follow-up drugs ($P = .003$), follow-up alcohol ($P = .010$), follow-up violence ($P = .015$), and follow-up total risk score (the sum of all 17 items, $P = .002$). Comparison of mean risk scores using independent *t* test were made between male and female gender. In all cases, male participants were found to have higher risk scores compared with female participants for the following risk variables: baseline weight ($P = .04$), baseline BMI ($P = .09$), baseline school problems ($P = .02$), baseline depression rates ($P = .04$), follow-up weight

($P < .001$), follow-up BMI ($P = .02$), and follow-up problems with family ($P = .02$). There were no difference in mean ages for male or female participants in this study.

Data Analysis

Main Outcome Measures

The variables were baseline and follow-up PARS risk items (total of 17 items): BMI, nutrition, exercise, weight perception, depression, violence, tobacco, alcohol, illicit drug use, problems in school, problems in family, history of physical or sexual abuse, problems with peer relationships, sexual activity, unsafe living practices (seat belts, bike helmets, drunk driving), immunization

status, and good qualities (self-esteem). Each risk item is scored into 3 categories: 1 = low risk, 2 = moderate risk, 3 = high risk.

Statistics

All statistical calculations were performed using SPSS for Windows, Version 10.0 (SPSS, Inc, Chicago, IL). Mean scores and SDs were calculated for each variable at baseline and follow-up assessments. Independent-samples *t* test procedure in SPSS was used to compare the mean scores of risk variables between 2 populations (eg, comparing individuals who refused participation and those who participated). Tests for significance were calculated using the general linear model univariate analysis of variance procedure in SPSS. One independent variable and 1 dependent variable were entered for analysis of relationships. In each case, age and gender were controlled for by entering them as covariates. Means and SDs for each subgroup were also obtained using the descriptive statistics option in this procedure. Multivariate analysis on the longitudinal relationship between baseline depression and follow-up risk variable was conducted after all main relationships were analyzed. Using the general linear model univariate analysis of variance, the following were entered as covariates: all contributing baseline variables found to have relationships with each dependent follow-up risk variable, follow-up depression score (if found to be related), age, and gender.

Tools

The PARS, as noted in Fig 1, is a convenient clinical tool that is adaptable to the clinical environment.⁴² It requires only an average of 5 (± 3) minutes to perform and is comprehensive enough to cover the major health risk behaviors recommended by the American Medical Association's Guidelines for Adolescent Preventive Services.⁴³ It provides the clinician with a means to identify quickly teen risk behaviors. Overall internal consistency analysis yielded a Cronbach α coefficient of .74, very good interrater consistency, good correlation to the American Medical Association's Guidelines for Adolescent Preventive Services, and Children's Depression Inventory.⁴² Although the PARS relates to symptoms of depression, it does not evaluate comprehensively for the clinical subtypes of depression. In addition, all adolescents were asked whether they ever received school counseling, outpatient counseling, family counseling, individual counseling, group therapy, a psychological assessment, psychotropic medications, and inpatient admission.

RESULTS

Cross-Sectional Relationships Between Depression and Risk Variables (Univariate Analysis Controlled for Age and Gender)

Baseline depression score was related to the following health risk variables at baseline: not getting enough exercise ($P = .028$), history of physical/sexual abuse ($P = .001$), peer problems ($P = .002$), drug abuse ($P = .01$), violence ($P = .001$), tobacco ($P < .0001$), problems with school ($P < .0001$), problems with family ($P = .006$), and self-esteem ($P = .034$). Follow-up depression score was related to the following health risk variables on follow-up: violence ($P = .001$), problems with school ($P = .026$), and problems with family ($P < .001$; total risk score without depression subscale, $P = .001$).

Longitudinal Relationships Between Depression and Risk Variables (Univariate Analysis Controlled for Age and Gender)

Baseline depression score was related to the following variables at follow-up: depression ($P = .043$), history of physical/sexual abuse ($P = .006$), sexual activity ($P = .041$), drug abuse ($P < .0001$), violence ($P = .015$), tobacco ($P = .009$), and problems with school ($P < .0001$). In addition, baseline depression

scores were related to follow-up depression scores ($P = .001$; Table 3). Multivariate analysis controlling for other related risk variables found in PARS, age/gender, revealed persistent significant relationships between baseline depression and tobacco ($P = .010$), drugs ($P < .001$), depression ($P = .043$), and abuse ($P = .019$; Table 4).

DISCUSSION

Main Findings

The first main finding of this study is that baseline depressive symptoms are related longitudinally to follow-up depression. This indicates a persistent prevalence of depressive symptoms over the average study time of 1.8 years. This is consistent with existing literature as discussed previously.³⁴⁻³⁸

The other main study finding is that adolescents who have higher baseline depression scores have higher rates on follow-up of sexual activity, drug abuse, violence, tobacco, problems with school, history of physical/sexual abuse, and high total risk score. Also, those at follow-up who were sexually active, used drugs, were violent, used tobacco, had problems with school, and had history of physical/sexual abuse were found to have higher rates of baseline depression.

Multivariate analysis controlling for age/gender and other related risk variables found in PARS showed persisting relationships between depression at baseline and tobacco, drugs, depression, and history of sexual abuse at follow-up. This finding further supports coexistence of depressive symptoms with other risk behaviors/factors. That is, the teen who is depressed is more likely to have other risk behaviors/factors that have a significant impact on health. A topic for additional study should be the impact that interventions that are directed toward depressive symptoms including psychotherapy and antidepressant medication would have on these significant health risk behaviors/factors with the hypothesis being that teens might use drugs because they are experiencing depressive symptoms. As was found in the initial pilot study, there were strong cross-sectional relationships between depression and risk behaviors both at baseline and at follow-up.³³

Exploring the underlying mechanisms of adolescent health risk behaviors forms the basis for prevention and intervention and is widely accepted by the public health community as a priority for research.⁴⁴ It is unlikely that any 1 mechanism of health risk behavior, such as depression, is the sole factor in pathogenesis of risk behaviors. A more comprehensive approach is required using explanatory frameworks that combine various categories of underlying mechanisms, including decision-making processes, role models, attachments to family and school, and personality traits as well as the affective state of the adolescent.^{45,46} In addition, as was noted by Ferguson and Woodward,³⁹ confounding variables, including familial, economic, and individual factors, relate depression and risk behaviors/factors longitudinally. These concepts, however, do not refute the

If patient is High Risk, circle right column; if Low Risk, circle left column.

If undecided, circle center column.

Date _____ Zip code _____ Insurance Type _____

	Low Risk	Moderate Risk	High Risk
Body Mass Index	Between 15-85% (Normal weight/height per the growth chart)	Between 5-15%/85-95% (Just over or just under the normal range)	<5%/>95% (Much over or much under normal weight)
Weight perception	BMI normal and patient is satisfied	BMI normal and patient wants to lose.	BMI <15% and patient wants to lose.
Nutrition	Eats 3 meals/day; and eats fruits, vegetables, and foods with fiber	Eats less than 3 meals/day; or vegetarian without milk or eggs	Snacks a lot, eats fats and sugar, vomits or takes medication for weight loss.
Exercise	5 times/week for at least 20 min each, with increased heart rate and sweating	Exercises less than 5 times/week, not strenuously	No regular exercise to increase heart rate; excessive exercise
Tobacco use	No smoke or chew	Smoke or chew less than daily; or stopped less than 6 weeks ago	Smoke or chew regularly
Drug use	Never used	Previously used; not in the past 3 months	Recently used or currently uses marijuana, huffing, LSD, cocaine, heroin, etc.
Alcohol use	Has only tasted it, or used for religious purpose	Social only, not more than once/week; less than 3 beers or 2 liquor drinks at a time	Drunkenness, blackouts; drinking interferes w/school, family, etc.; 4 or more drinks at a time
Sexual activity	Never; or is married <u>and</u> faithful	Not in last 6 months; safe sex with condoms	Sex <u>without</u> regular use of condoms; first intercourse before age 16
School	B/C average or better; steady improvement in grades	Grades slipping; detention problem	Failing grades; suspension; often skips school
Depression	Usually happy	Often feels discouraged or down; cries a lot	Unhappy <u>most</u> of the time; feels hopeless; thoughts of suicide
Abuse	No physical or sexual abuse	Abuse reported and counseling received	Abuse still occurring or not treated with counseling
Safety	Uses seat belt/helmet; never rides with drunk driver	Usually uses seat belt/helmet; rarely rides with drunk driver	Does not use seat belt/helmet; has driven drunk; sometimes rides with drunk driver
Violence	No fights, no threats; does not carry a knife, gun, or rifle; no legal troubles	Threatens others; previous illegal acts (stealing, etc.) but not in past 3 months	Damages own or others' property; carries a gun, knife, or rifle; physical fights with peers; has had contact with police
Family relationships and Responsibility	Gets along with family; completes chores or work duties	Often argues with family; does not complete chores or work duties	Physical and/or intense verbal fights with family
Friends and Recreation	Has male and female friends; involved in clubs, activities, or hobbies	Has few friends; does things alone; has friends who often get into trouble	Has no friends; or belongs to gang or cult
Good qualities and Future plans	Can name 3 good qualities about self; has plans for the future	Hard to think of good qualities about self; has few interests; does not have future plans	No good qualities about self; no interests or activities
Immunizations	Has received second MMR, tetanus within 10 years, hepatitis series and had varicella or been vaccinated.	Lacks one item.	Lacks two or more items.

Main Diagnosis: _____

High risk: _____

Provider Initial: _____

Moderate risk: _____

Low risk: _____ ©TXU 703-577

Fig 1. The PARS.

relationship between baseline depression and follow-up risk behaviors.

Other Interesting Findings

The descriptive statistics provide insight into the population studied. There were 9.4% in the high

depression category at baseline PARS assessment and 17.2% at follow-up. This is similar to what is reported in the literature, where prevalence rates have been found ranging from 0.4% to 8.3%,^{34,47-49} with lifetime prevalence rates in adolescents from 15% to 20%.^{24,49}

TABLE 3. Baseline Depression Category (Low, Moderate, or High) Related to Mean PARS Scores for Variables at Follow-up

Follow-up PARS Variable	Baseline Depression Score						Significance*
	Low		Moderate		High		
	Mean	SD	Mean	SD	Mean	SD	
BMI (calculated)	25.32	6.88	27.48	8.57	28.38	10.47	NS
BMI (PARS)	1.55	0.82	1.45	0.82	1.80	0.84	NS
Weight perception problems	1.20	0.46	1.22	0.44	1.20	0.45	NS
Nutrition problems	1.25	0.60	1.50	0.80	2.00	0.89	NS
Not exercising enough	1.39	0.65	1.58	0.90	1.67	0.82	NS
Physical/sexual abuse	1.00	0.00	1.17	0.39	1.33	0.52	<.01
Peer problems	1.04	0.21	1.00	0.00	1.17	0.41	NS
Sexual activity	1.04	0.21	1.08	0.29	1.50	0.84	<.05
Alcohol abuse	1.17	0.44	1.08	0.29	1.17	0.41	NS
Drug abuse	1.00	0.00	1.00	0.00	1.67	0.82	<.001
Violence	1.05	0.21	1.08	0.29	1.67	1.03	<.05
Tobacco abuse	1.07	0.33	1.33	0.78	2.00	1.10	<.01
School problems	1.15	0.42	1.42	0.67	2.33	1.03	<.001
Family problems	1.17	0.49	1.33	0.49	1.83	0.98	NS
Problems being safe	1.37	0.71	1.58	0.90	1.33	0.82	NS
Poor self-esteem	1.09	0.28	1.00	0.00	1.20	0.45	NS
Immunization not up to date	1.05	0.21	1.00	0.00	1.00	0.00	NS
Depression	1.35	0.64	1.58	0.90	2.33	1.00	<.05
Total†	18.28	2.64	19.42	3.42	24.00	2.00	<.001

* Corrected for age (at time of measurement) and gender.

† Total risk score without depression subscale.

Only 49% of the charts reviewed were found to have PARS, indicating that large numbers of adolescents did not receive the recommended screening questions. This compares with a recent self-report survey of pediatricians that showed that 60% to 80% report screening for obesity, sexual intercourse, cigarette use, alcohol use, drug use, and seat-belt and helmet use but only 30% to 47% for suicide, eating disorders, depression, and drunk driving and fewer than 20% for abuse.⁵⁰

Age had several important relationships to risk variables, including follow-up tobacco, nutrition, exercise, drugs, alcohol, and violence. This has been reported extensively in the literature on health risk behaviors showing that adolescent risk involvement develops with regard to severity and complexity with time.^{51,52} There were no relationships between age and depression at baseline or follow-up, which has also been reported.⁵³ Boys had higher risk scores than girls for baseline depression, BMI at baseline and follow-up, problems with school at baseline, and problems with family at follow-up. The higher baseline depression seen in boys is not consistent with the preponderance of the literature; however, 1 study of working-class boys was found to have higher depression rates than girls.^{53,54} Most of the studies indicated that the differences between girls and boys

do not start to become significant until adolescence.³⁴ In this study, the younger ages may be a factor that precluded detecting a difference.

Another noteworthy finding in this study was the rate of mental health services both for individual psychotherapy and for psychotropic medications; 44% of participants ever received mental health intervention. However, among those with moderate or high depressive symptoms on PARS, 28% at baseline and 50% at follow-up had not received any mental health intervention. These relate to a number of factors, including access to mental health care in rural areas, patient resistance to getting services, and the stigma of mental health in rural areas.^{41,55} These percentages, however, are better than other reports in which 70%, 79%, and 82% of adolescents with mood disorders did not get mental health intervention.^{56,57}

The significant problem with obesity in West Virginia was underscored by the very high rates of BMI >25 and 30. The average of 23.1% obesity found in this population was essentially the same as that found in a year 2000 report by the West Virginia Department of Health and Human Services in which the overall rate was 23.2%.⁵⁸ Another study in fifth-grade students found that 24% were at >95th percentile for BMI.⁵⁹ Other problems identified were low rates of exercise at baseline and at final and poor eating habits.

Limitations

The study participants were composed of a non-random convenience sample of patients who attended the Pediatric and Adolescent Group Practice with 2 entry methods: clinic and database (see Methods). The study design is a longitudinal test-retest analysis comparing variables at study entry (follow-up) with baseline. The baseline scores each were

TABLE 4. Significant Longitudinal Relationships Between Baseline Depression and Follow-up Risk Behaviors After Multivariate Analysis

Baseline PARS Variable	Follow-up PARS Variable	Significance*
Depression	Physical/sexual abuse	<.01
	Drug abuse	<.001
	Tobacco abuse	<.01
	Depression	<.05

* Corrected for age (at time of measurement) and gender.

related to follow-up scores. Although there was no knowledge of the results of the baseline PARS at the time of study entry (follow-up assessment) and selection of baseline PARS from the chart occurred using uniformly applied criteria, this study design is not as reliable as double-blind, controlled, prospective analysis.

There were higher baseline depression scores and higher baseline family problems scores seen in participants versus those who refused. This is attributable to the clinic entry subgroup, which had higher baseline depression scores and higher follow-up depression and follow-up total risk scores compared with the database entry subgroup. These differences are expected because patients who entered via the clinic entry were selected on the basis of their high depression or risk scores at the time of study entry (follow-up assessment). The test-retest design of this study provides a control for the effects of these differences, with each patient's baseline being compared with his or her own follow-up. In addition, the difference between those who refused to participate and those who did was small.

Other limitations of this study are that the study population is drawn from patients who attend a clinic, and the sample size is small. Both limit the applicability of these results to the general population.

The rates of risk taking were lower than that observed in Youth Risk Behavior survey reports of ninth-grade students.⁶⁰ This is likely attributable to the lower age of the population (mean baseline age was 12.8 and at follow-up age was 14.6). It is unlikely that participants in this study had lower risk because of sample selection. As noted above, higher depression and family problem scores were found in both participants and in clinic entry patients when compared with those who refused.

Although the symptoms of depression are graded by severity using the 3-scale PARS score, no specific clinical category of *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* diagnosis was used in this analysis.⁶¹ Depression score on PARS could be high because of any number of clinical mood disorders, including major depressive disorder, bipolar, dysthymia, situational reaction with depressed mood, bereavement, psychotic depression, or depression as a result of medical causes. In addition, appropriate sadness is a common phenomenon in response to life events such as loss of boyfriend/girlfriend, divorce, separation, or death. It is unclear as to the contribution of these nonclinical depressive symptoms to the PARS scores. Finally, it is likely that many other variables, including familial, social, economic, and individual factors, are related longitudinally to risk variables as are the risk variables themselves related as noted in Problem Behavior Theory.⁶²

CONCLUSION

This study demonstrates significant longitudinal relationships between baseline depressive symptoms and health risk behaviors/factors at follow-up in a clinical population of rural adolescents. In addition,

longitudinal stability of depressive symptoms is demonstrated. Finally, many rural adolescent who are depressed lack adequate mental health interventions. Adolescents who are depressed should be screened for the presence of other health risk behaviors and receive mental health services when needed.

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MUSCLE-BOUND CHICKENS

"The chickens we eat today have been genetically selected for fast growth . . . and the skeleton quickly bends and sometimes breaks under the weight of the muscle mass. The way they are raised, in crowded conditions with no exercise, makes it worse."

Specter M. The extremist. *New Yorker.* April 14, 2003

Submitted by Student