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Adolescent & Family Health (A&FH) saw its debut nearly ten years ago. Over that period of time we have sought to add quality research to the literature regarding both adolescents and families, and particularly the interrelationship between the two. Because our sponsoring organization, the Institute for Youth Development, has experienced some challenging times over the past decade, we have not been as regular a publication as we had originally hoped. However, we now see smoother sailing ahead and plan to publish *A&FH* on a regular basis online.

But what compels one or a group of people in this case, to publish a peer-reviewed or “refereed” journal? Is it simply to publish data on youth and family behavior and their characteristics, or is it something else? Having given a great deal of thought to this proposition, I would venture to say the motivation is almost entirely in seeking better outcomes for children and their parents alike. We continually learn from the articles that are published, and in turn, give others through various information dissemination sources the opportunity to learn as well.

But learning is not enough. The articles that are published must inform those working with youth, in practical ways, how to use the information to improve their programs and/or teaching methods. This is accomplished through organizations like Child Trends, the Institute for Youth Development, Search Institute, and many, many others. Fortunately, the more research we can have published by this journal and others the better we can do at improving programs in the field.

There’s an expression that “one size fits all” which encapsulates what is often the problem with many programs aimed at affecting youth behavior. With such diversity among young people, it is difficult to comprehend that any one program can apply to all youth in all places at all times. In this issue alone we see differences in behaviors based on ethnicity, age, parental structure, and a number of other characteristics. This illustrates the value of the time researchers put into their various studies.

Young people of different ethnicities, for example, may process information differently; they may mature differently; and they may see various unhealthy risk behaviors differently. It is important that we gain a better understanding and appreciation of these differences in order for program delivery to be enhanced, thus more effectively improving the lives of the young people we seek to help.

So is there a silver bullet, a magic pill, or one size that fits all which will correct all problems youth face? Clearly the answer is no. Consequently, we are committed to publishing solid, informative research that will continually help improve programs and practices related to youth behavior and the strengthening of families. For it is the family that lies at the heart of all people being able to have healthy and productive futures.

Shepherd Smith

A&FH

Overlap Between Health Problems among Adolescents: Log-linear and Discriminant Analyses

Brent B. Benda, PhD, ACSW

Abstract

This study of a statewide, stratified random sample of 3,335 public high school students is designed to examine the % ages of youths that have problems with various combinations of alcohol consumption, other drug use, depression, and unprotected sex. This is one of the very few studies that determine the actual % ages of overlap in involvement with problems, and yet this information is vital to program planning and resource allocation.

Also vital to designing intervention is knowledge of assets and deficits that discriminate between various combinations of problems. Discriminant analysis indicates that resilience, social connectedness, religiosity, and high grades in school insulate adolescents from the problems studied. Analyses also show that various familial aspects, gender, and self-esteem discriminate between adolescents that have problems with alcohol and sex and others. Early forms of abuse, adverse feeling, lack of life satisfaction, and delinquent peer association are related to the comorbidity of all 4 problems studied.

Key words: alcohol and other drug misuse, risky sex, depression, assets and deficits, adolescent
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BACKGROUND

Nearly three decades ago, Richard and Shirley Jessor (1977) observed that many problems, such as substance misuse, risky sexual behavior, and depression, coexist among adolescents. The central tenet of the problem syndrome theory they formulated is that these coexisting, or comorbid, problems result from a worldview of non-conventionality inculcated in the familial context. Their theory has stimulated a huge volume of research documenting interrelationships between problematic behaviors and psychiatric conditions (e. g., Barnes, Welte, & Hoffman, 2002; Benda & Corwyn, 1998; Blum et al., 2000; Igra & Irwin, 1996; Kuperminc & Allen, 2001; Zweig, Lindberg, & McGinley, 2001).

The Jessors (1977) postulate that the co-occurring problems exhibited by adolescents represent a unitary syndrome or what Elliott (1993) labeled a "health-compromising lifestyle." This health-compromising lifestyle has been studied by examining assets that protect persons from and deficits that contribute to the emanation and worsening of problems (Bryan & Stallings, 2002; Clark & Bukstein, 1998; Dukes & Stein, 2001; Felix-Ortiz & Newcomb Pickett, 1992; Jessor, Van Den Bos, & Vanderryn, 1995; Schmid, Boyce, & Simpson, 2002). For example, Benson (1993) developed a list of 30 assets, 10 deficits, and 20 indicators of problematic behaviors. He administered a 152-item questionnaire to 46,799 students in grades 6 through 12 located in 111 communities in 25 states. His study indicates that the fewer the number of assets, and the greater the number of deficits, the higher the number of problem behaviors. Similarly, Jessor et al. (1995) examined the interaction between risk and protective factors for a longitudinal sample of 1,486 students in

grades seven, eight, and nine. A Protective Factor Index (PFI) included positive orientation toward school and toward health, intolerance of deviance, caring relations with adults, perceived regulatory controls, friends that primarily engage in conventional behavior, and involvement in prosocial activities. A Risk Factor Index (RFI) included limited expectation for success, low self-esteem, and feelings of hopelessness, friends that model problem behavior, low parent-friend agreement, and low grade point average (GPA). The PFI and the RFI were used to predict a Multiple Problem Behavior Index (MPBI) – an index that was made up of misuse of alcohol, delinquency, marijuana use, and sexual intercourse. Results showed that protective factors had a direct effect on problem behavior, and because they interacted with risk factors, protective factors moderated problem behavior. The impact of protective factors on the relation between risk factors and problem behavior was strongest when protection was high.

Recently, researchers have observed that problematic behaviors and psychiatric conditions among adolescents, instead of being manifestations of a unitary syndrome, are likely multidimensional (Enquist, Edmundson, & Parcel, 1995; Farrell, Danish, & Howard, 1992). For example, Basen-Engquist, Edmundson, and Parcel (1996) use multidimensional scaling and cluster analysis to identify five clusters of problems from a statewide sample of high school students (n = 5,537). Other researchers have identified different clusters of comorbid problems (Zweig et al., 2001).

CONCEPTUAL FRAMEWORK AND PURPOSE OF THE PRESENT STUDY

Among the different clusters of problems, the coexistence of alcohol misuse, other drug abuse, clinical depression, and risk-taking sexual behavior appears to be one of the most consistently observed forms of comorbidity (Clark & Bukstein, 1998; Jessor, 1998; Pickett, Schmid, Boyce, & Simpson, 2002). The purpose of the present study is twofold: 1. to examine what % ages of adolescents are experiencing various combinations of problems with alcohol, other drugs, depression, and sexual exploration, and 2. to identify what assets and deficits discriminate between various combinations of these problems. Knowing the actual % ages of adolescents involved in different combinations of these problems will provide useful information for planning interventions and allocating resources.

Most studies have examined comorbid problems with regression or factor analytic procedures and continuous data, and researchers report coefficients indicating interrelationships between problems. While these statistical approaches do provide coefficients that indicate the degree of interrelationships between measures of problems, the meaning of these interrelationships to problem syndrome theory is not axiomatic (Benda & Corwyn, 1998; Corwyn & Benda, 1999). For example, the majority of adolescents have low scores on measures of problems, scores below the level normally considered clinically problematic (Beck, Brown, Steer, Dahlggaard, & Grisham, 1999). These skewed data provide distorted coefficients, an issue rarely discussed in studies using statistical procedures that are based on the assumption of normal data. Aside the statistical issues, the interpretation of the coefficients also depends on how “problems” are defined. Often overlooked in studies is the distinction between “exposure to” and “problems with” substance use, sexual behavior, and depression. Many adolescents engage in behaviors, or experience adverse feelings, that are not normally considered to be clinically problematic.

At the same time, a case can be made that unprotected sex among unmarried adolescents is problematic in most instances because of exposure to sexually transmitted diseases and HIV. As well, the use of certain drugs can lead abruptly to addiction, and there is the possibility of lethal overdoses. However, it seems to violate the spirit of the Jessors’ (1977) problem syndrome theory to analyze any levels of alcohol and other drug use or depression as problematic.

The present study contributes to the literature on the problem theory syndrome by using established measures with strong validity and reliability, optimal cut-off scores derived from receiver operating characteristic (ROC) analyses (Gleitman, 1986), and a powerful multiple contingency table procedure (Bishop,

Fienberg, & Holland, 1975) to examine the precise amount of overlap between problems. Rarely have studies used empirically established “cutoffs” – or markers – to classify persons into dichotomous categories of “problem” versus “no problem” – for example, drinking alcohol is a problem versus is not a problem. Most research is based on continuous data derived from scales that have not been validated – this may contribute to the inconsistencies noted in the literature (Jessor, 1998). Log-linear analysis is an appropriate statistic because it is specifically designed for categorical data (Fienberg, 1991). The analytical approach and measures used in this study would seem to be a more useful - if not a more legitimate – means of testing the problem syndrome theory – at least for clinical purposes.

Based on previous research (Benda & Corwyn, 1998; Garnefski & Diekstra, 1997), the expectation is that a very small % age of adolescents will be involved in most combinations of problems. Therefore, the number of combinations with at least around 3% (N = 100 adolescents) of the sample will likely be small enough to do a discriminant analysis (Klecka, 1980) of assets and deficits associated with each combination. No studies have been located that examine factors that discriminate between combinations of problems. However, identifying factors that discriminate between comorbid problems could provide valuable information about potential targets for intervention. The potential value of discriminators is enhanced by selecting factors that theoretically influence problems. Theories provide explanations of how or why assets and deficits are related to problems (Lynch, 2001).

Problem syndrome theory per se provides an explanation of how assets serve to insulate adolescents from problems (see Jessor, 1991; Jessor, R., Donovan, & Costa, 1991, 1996). Indeed, persons with high self-esteem, self-efficacy, resilience, and life satisfaction typically make accomplishments that they do not want to jeopardize with risky behaviors, and their successes tend to elevate their mood and help them avoid depression (Dukes & Stein, 2001; Lerner, Lerner, De Stefanis, & Apfel, 2001). Caregiver attachment and one’s relationship to God, or religiosity, provide a sense of being loved, protected, and worthwhile. Caregiver attachment is the initial bonding that, to a large extent, forms a template for how persons feel about themselves and others throughout life (Benda, 2001; Bowlby, 1988). Religiosity is another source of identity and bonding to others and to a transcendent power (Benda, 2002; Jessor, 1998; Kirkpatrick & Shaver, 1990). The warmth and security found in caregiver attachments and religiosity are theorized to nurture self-esteem, self-efficacy, and resilience, which, in turn, encourage successes in school and life satisfaction. Caregiver monitoring also

lessens the likelihood of exposure to problem behaviors. Monitoring not only provides surveillance, but also conveys a sense of caring (Stein & Newcomb, 1999). The hypotheses tested are that caregiver attachment and monitoring, religiosity, self-esteem, self-efficacy, resilience, life satisfaction, and good grades in school do serve as buffers against problems with alcohol and other drug use, depression, and risky sexual exploration.

In contrast, emotional, physical, and sexual abuses are indicative of serious deficits in attachment or monitoring – the sequelae of abuses typically are anxiety and feelings of hopelessness that are associated with depression, alcohol and other drug misuse, and unprotected sexual adventures (Gibb et al., 2001; Grilo, Sanislow, Fehon, Martino, & McGlashan, 1999). Use of substances, depression, and risky sexual contacts often are ways of coping with victimization. Peers are especially influential on problematic behaviors during adolescence because of heightened concerns about acceptance and status during that stage of life (Benda & Corwyn, 1998; Jessor, 1998). The hypotheses tested are that the various forms of childhood abuse, anxiety, feeling of hopelessness, and delinquent peer associations will be positively associated with problems. No hypotheses are offered regarding what deficits will discriminate between specific combinations of problems because of the lack of conceptual or empirical precedence. However, it is assumed that delinquent peer association will be related to problems with substance use and sexual behavior, and not to clinical depression. The present study appears to be one of the few that examines overlap between problems in this amount of detail.

	Sample (N = 3395)		Rural (N = 2265)		Urban (N = 1130)	
	Number	%	Number	%	Number	%
Gender						
Female	1774	52.300	1123	49.6	651	57.6
Male	1612	47.500	1136	50.2	476	42.1
Missing	2	0.300	6	0.3	3	0.3
Race						
White	2375	70.000	1654	73.0	721	63.8
Black	901	26.500	539	23.8	362	32.0
Hispanic	52	1.500	34	1.5	18	1.6
Asian	24	0.700	19	0.8	5	0.4
Other	25	0.700	10	0.4	15	1.3
Missing	18	0.005	9	0.4	9	0.8
Father's Education*						
<9	226	6.700	200	8.8	26	2.3
10 -12	337	9.900	272	12.0	65	5.8
High school graduate	1023	30.000	723	31.9	310	27.5
Skill training	156	4.600	107	4.7	49	4.3
Some college	228	6.700	117	5.2	111	9.8
College graduate	582	17.100	294	13.0	288	25.5
Don't know	744	21.900	409	21.6	254	22.5
Missing	88	2.600	62	2.7	26	2.3
Father's job						
Full-time	2399	70.700	1506	68.9	834	74.2
Part-time	237	7.000	182	8.0	55	4.9
Home maker	23	0.700	17	0.8	6	0.5
Unemployed	117	3.400	87	3.8	30	2.7
Retired	106		72	3.2	34	3.0
Other	41		33	1.5	8	0.7
Don't know	324		215	9.5	109	9.6
Missing	148		99	0.3	49	0.4
Welfare receipt						
Yes	464		386	17.0	78	6.9
No	2679		1713	75.6	964	85.3
Don't know	220		142	6.3	98	6.9
Missing	34		24	0.1	10	0.9
* The distribution of mother's education was almost identical to that of father.						

METHOD**Sample**

All sixty school districts in a Midwest state were approached to take part in the study, and administrators in 55 (92%) of these districts agreed to participate. The participating districts included 20,366 enrolled students. To achieve a representative sample of students, a stratified random sample of 3,395 adolescents were selected to participate in the study. The stratification assured that 33% of the sample was from urban areas, and 67% was from rural communities. Sample characteristics are shown in Table 1 according to rural (< 10,000) and urban (> 10,000) residences. It may be observed in Table 1 that over 95% of the rural and urban adolescents are either white or black persons.

Only five parents refused their child's participation in the study, and another 41 students were excluded from the study based on missing data, gross inconsistencies in responses, logical errors, or range checks. An additional 16 persons provided basic demographic information, but they failed to complete scales measuring substance use, depression, suicide ideation, and delinquency. Those 60 dropouts from the study constituted 2% of the original sample. Hence, analyses were based on 3,335 students.

Procedures

Consent for the study was obtained from the State Board of Education, school district superintendents, principals, teachers, and parents. Student assent to participate in the study was obtained after receiving caregiver approval. Students were assured of confidentiality and anonymity by instructing them not to make any identifying marks on the questionnaire, and asking them to look for any of these marks. Students completed the self-report form during their homeroom period of about 60 minutes, and during an equivalent study period later in the day.

Measures of Problems

With each measure of problem behavior, optimal cut-off scores were derived from receiver operating characteristic (ROC) analyses (Gleitman, 1986). For example, with the 13-item (yes or no responses) Short Michigan Alcoholism Screening Test (SMAST) (Selzer, Vinokur, & van Rooijen, 1975), a summated score of three or above indicates alcohol use problems in the general population of adolescents (Williams & Ricciardelli, 1999). The scale has been shown to have "known groups" validity, and test-retest reliability above 0.80. The Cronbach's (1951) alpha (\pm)²⁴s study for the SMAST is 0.91 (alphas for this study are noted in parentheses). The Drug Abuse Screening Test for Adolescents (DAST-A) is a 27-item measure (yes or no responses), with a score of six or above

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indicating a problem in adolescent populations (Martino, Grilo, & Fehon, 2000). Martino et al. report that the DAST-A has a positive predictive power for substance use disorders of 79% ($\pm = 0.90$).

The Beck Depression Inventory (BDI) (Beck & Steer, 1993) has of 21 items, with each item consisting of four statements that are ranked from 0 to 3. An overall cutoff score of 16 resulted in high sensitivity (100%) and specificity (93.2%) for problems with depression in a sample of high school adolescents. The BDI also has good discriminant and convergent validity ($\pm = 0.92$) (Barrera & Garrison-Jones, 1988).

The problem of unprotected sexual intercourse was measured with an item that asked how many times persons had had sexual intercourse while unmarried (vaginal, oral, or anal) without a condom, or the condom slipped off or broke during intercourse (0 = none, 1 = once, 2 = twice, 3 = 3 to 5 times, 4 = more than 5 times). The analysis of this variable involved a dichotomy of none versus any. To check the accuracy of this response, study participants also were asked if they had had sexual intercourse without a condom (no versus yes response options) at another point on the questionnaire, and in a different location they were asked with how many partners they had had sexual intercourse without a condom (0 = none, 1 = 1 person, 2 = 2 persons, 3 = 3 to 5 persons, 4 = more than 5 persons). Cross tabulations indicated only five persons did not maintain consistent answers.

Measures of Deficits

Three subscales of Childhood Trauma Questionnaire (CTQ) (5-point Likert scales) were used to assess emotional ($\pm = 0.86$)($\pm = 0.92$)($\pm = 0.90$). The CTQ has strong convergent and discriminant validity (δ (Bernstein & Fink, 1998). Beck's Hopelessness Scale (HS), (Beck & Steer, 1993) is a 20-item true-false self-report questionnaire. The HS has strong concurrent validity with clinician's ratings of hopelessness ($\pm = 0.88$). The Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988) consists of 21 items (4-point scales). The BAI also has demonstrated adequate to excellent concurrent, construct, and discriminant validity ($\pm = 0.86$).

Peer association with delinquents is measured by five items (5-point Likert scale from none to four or more) asking how many close friends: 1. have been picked up by police, 2. use illegal drugs regularly, 3. drink three or more beers or glasses of liquor or wine in day regularly, 4. steal regularly, and 5. have used a weapon on someone δ ($\pm = 0.77$)s measure is reported by Akers and Sellers (2004).

Measures of Assets

The Inventory of Parent and Peer Attachment (IPPA) (Armsden & Greenberg, 1987) was used to assess veterans' perceived attachment to their parents

during childhood. This instrument consisted of three subscales (3-point Likert scales) measuring parental communication (three items), trust (three items), and alienation (four items). The IPPA has good test-retest reliability and predictive validity (Paterson, Pryor, & Field, 1995). Caregiver monitoring is measured by five items (4-point scales) asking how closely caregivers supervise: 1. spending money, 2. peer associations, 3. movies and parties, 4. how late you stay out, and 5. school activities ($\pm = 0.87$)). Four items (5-point scales) asking about: 1. private prayer, 2. Bible study, 3. sharing faith in God, and 4. seek God's will ($\pm = 0.88$). Monitoring and religiosity are measured with commonly used scales that have solid validity (Benda, 2002).

Adolescents' perception of how much parents, teachers, other adults, and friends care for them is measured by the Social Connectedness Scale (SCS), consisting of 10 items on a 5-point Likert scale (Blum, Harris, Resnick, & Rosenwinkel, 1989). The scale has been used extensively with adolescents with evidence of validity through factor analysis ($\pm = 0.86$). The 25 item (7-point scales) Resilience Scale (RS) has strong factorial validity ($\pm = 0.97$) (Wagnild & Young, 1993). Rosenberg's (1979) 10 item (4-point scales) Self-esteem Scale also is used ($\pm = 0.89$)). Predictive, and construct validity. The Satisfaction with Life Scale has five items (7-point Likert scales), and strong concurrent validity ($\pm = 0.92$) (Diener, 1984). Also, grades in school (1 = mostly Fs, 2 = mostly Ds, 3 = mostly Cs, 4 = mostly Bs, and 5 = mostly As) are considered as an asset.

Other factors analyzed include age (13 to 18 years, with mean of 15.1 and SD of 1.9), gender, race, family structure (0 = 2 caregivers in the home, 1 = other), region of residence (0 = rural, 1 = urban), caregivers' years of education, and annual family income. Race is coded 0 = white and 1 = African Americans. Adolescents from other racial groups are not included in analyses since they constituted less than 3% of the sample, and about 60% had to be dropped from the study due to missing or illogical responses.

Statistical Analyses

Measures of deficits and assets were entered into a Pearson product-moment correlation matrix. The only correlations above 0.35 were between attachment to caregivers and religiosity (0.66), between resilience and self-esteem (0.52), between self-esteem and grades (0.48), and between satisfaction with life and hopelessness (-0.70). Tolerance tests and variance inflation factors indicated that the only potential problem with multicollinearity was between the latter two factors. However, discriminant analyses with and without the satisfaction with life measure did not show much difference, so both measures were included in the analysis because they were useful to clinical work. No distributions of assets or deficits had a skew or

kurtosis above two. Most variables were missing less than 1% of the cases and none had more than 5% missing data. Maximum likelihood factor analysis, using oblique (oblimin) rotation, of each scale, indicated that items loaded on the respective scales with loadings of at least 0.40.

Log-linear procedures are especially designed for examining interactions (overlap) between dichotomous factors such as the problems behaviors studied. Succinctly stated, log-linear analysis tests multiple contingency tables for all possible main effects and levels of interactions, while deriving the most parsimonious model that minimizes the differences between expected and observed cell values (Fienberg, 1991). Likelihood chi-square allows a comparison of the fit of models. Comparisons are between hierarchical (or nested) models, where one model is a subset of the other. The aim is to identify the most parsimonious model that accounts for all of the significant (alpha 0.05) differences between expected and observed cell values.

Discriminant analysis is used to identify a set of predictors that discriminates between combinations of problem behaviors (Klecka, 1980). The procedure models a dependent variable as a function or functions of a weighted linear combination of discriminating variables and error. By maximizing between-group variance relative to within-group variance, the discriminant function(s) distinguish(es) between groups (for example, different combinations of problem behaviors) with minimization of errors.

FINDINGS

Shown in Table 2 is the log-linear analysis of risky sex and problems with alcohol consumption, use of other drugs, and depression. In the first row of Table 2, it may be observed that 1,026 youth, or 31% of the 3,320 persons on whom there are complete data, have no problems. Sixty-six individuals, or 6% of 1,092 adolescents who had no other problems, did have clinical depression. The last row of Table 2 shows that 197 youth, who engaged in risky sexual behavior and had problems with alcohol and drug use, did not have clinical depression. However, 156 individuals, or 44% of the 353 adolescents who had the same problems with sex and substances, had clinical depression. This means that 5% ($156/3,320 = 0.047$) of the sample on which there is complete data had all four problems studied. It may be observed that the percentages who have had unprotected sex increases with the addition of a problem throughout the table.

The iterative method for deriving expected cell values to compare with the observed counts seen in Table 2 is maximum likelihood estimation, since it has the least standard errors (Bishop et al., 1975). Hierarchical subsets (or nested models) of the fully saturated (DGAS) model are tested in an effort to find a

TABLE 2 Log-Linear Analysis of Risky Sex, Alcohol Misuse, Drug Problems, and Depression

Risky Sex (S)	Alcohol (A)	Drug (G)	Depression (D)		Total	Percent
			No	Yes		
No	No	No	1026	66	1092	6
		Yes	24	13	37	35
	Total		1050	79	1129	7
	Yes	No	371	91	468	21
		Yes	61	53	114	47
	Total		432	150	582	26
Yes	No	No	593	52	645	8
		Yes	38	31	69	45
	Total		631	83	714	12
	Yes	No	431	111	542	21
		Yes	197	156	353	44
	Total		628	267	895	30
Model	X ²	P-value	Resultant X ²	P-value		
DGAS	401.58	0.0000				
DA GAS	285.97	0.0000	115.61	0.0000		
DG GAS	216.77	0.0000	184.81	0.0000		
DS GAS	40.31	0.0000	361.27	0.0000		
DGA GAS	397.86	0.0000	3.72	0.4452		
DAS GAS	292.00	0.0000	108.68	0.0000		
DGS GAS	231.08	0.0000	108.68	0.0000		
DGAS	401.58	0.0000	000.00	1.0000		

NOTE: Observed frequency in the table is 3320, 15 cases had incomplete data. Best fit model is DGA GAS. Resultant X² if the difference between model X² and the X² for the model of independence (DGAS).

more parsimonious model that reduces the likelihood chi square to non-significance, minimizing the difference between the expected and observed cells values. The fully saturated model includes all possible relationships between various combinations of the problem behaviors, and the likelihood chi-square (401.58) for DGAS is significant (P = 0.0000).

Therefore, the question becomes whether a more parsimonious (or less complex) model actually accounts for all of the significant relationships (or differences between expected and observed cell values). For example, the first model tested in Table 2 is DA, GAS, which signifies the relationship (first-order interaction) between clinical depression (D) and problems with alcohol (A), and this model has a significant likelihood chi-square of 285.97 (P-value = 0.0000). The likelihood chi square difference (resultant Ç2) between this model, which is conditioned on drug (G) and alcohol (A) abuse and risky sex (S), and the fully saturated

Overlap Between Problems model is 115.61 (P < 0.0000). The resultant Ç2 is the likelihood chi-square left in the table after considering a model, and each first-order model leaves a significant Ç2 in the table. Hence, the hierarchical process continues with the second-order interactions, and model DGA, DAS becomes the model selected as the best fit because it accounts for all the significant likelihood Ç2 (note resultant Ç2 drug use, and alcohol consumption).

The frequencies and percentages of adolescents that have various combinations (comorbidities) of problems are shown in Table 3. To have sufficient numbers for a discriminant analysis of assets and deficits, I decided to select combinations that had at least three% of the sample. An asterisk in Table 3 identifies the combinations selected. A separate analysis of sociodemographic factors – which is not shown owing to space limits – indicates that caregivers’ education and annual household income are not significant (alpha = 0.05) discriminators. Sociodemographic factors that are significant discriminators are analyzed with the assets and deficits in Table 5.

Three canonical discriminant functions are calculated, exhibiting a combined (Functions 1-3) significant (P-value = 0.0001) chi-square (Ç2). After removing the first function, significant discriminating power is still observed in Functions 2 and 3. The first three significant functions accounted for 59.2%, 27.6%, and 13.7% of their respective between-group variability.

The first function discriminates between adolescents who have none of the problems studied and those who have at least one problem (Table 5). The discriminators show that high resilience, social connectedness, religiosity, and grades are associated with not having the problems. The second function shows that less caregiver monitoring, lower attachment to caregivers, low self-esteem, and being male and from a family with one adult missing from the home is

TABLE 3 Frequency and Percentages of Comorbidity

Comorbidity	Frequency	Percent
None	1026*	30.9
Drug misuse & depression	13	0.4
Alcohol misuse & depression	91	2.7
Risky sex & depression	52	1.6
Risky sex & alcohol	431*	12.9
Risky sex & drugs	38	1.1
Alcohol & drug misuse	85	2.5
Alcohol misuse, drug misuse & depression	53	1.6
Risky sex, drug misuse & depression	31	0.9
Risky sex, alcohol misuse & depression	111*	3.3
Risky sex, alcohol misuse, drug misuse & depression	156*	4.7

Note *These are the combinations of problems selected for the discriminant analysis.

Overlap Between Problems

TABLE 5 Discriminant Analysis of Groups with No Problems and Various Forms of Comorbidity

Canonical Discriminant Functions Evaluated at Group Means			
Group	Function 1	Function 2	Function 3
No problems	-0.624	-0.492	-0.302
Risky sex & alcohol	0.621	0.522	-0.219
Risky sex, alcohol & depression	0.351	-0.129	-0.044
Risky sex, alcohol, drug & depression	0.513	-0.196	0.159

Pooled Within-groups Correlation Between Discriminant Functions			
	Function 1	Function 2	Function 3
Resilience	-0.706*	-0.179	-0.298
Social connection	-0.622*	-0.129	-0.151
Religiosity	-0.523*	-0.100	-0.084
Grades	-0.403*	-0.056	-0.093
Caregiver monitoring	-0.119	-0.604*	-0.127
Attachment	-0.209	-0.559*	-0.126
Self-esteem	-0.171	-0.448*	-0.102
Gender ^a	-0.209	-0.440*	-0.147
Family structure ^b	-0.167	0.419*	-0.119
Sexual abuse	0.205	0.201	0.575*
Physical abuse	0.201	0.192	0.556*
Hopelessness	0.193	0.190	0.533*
Peer association	0.191	0.191	0.524*
Life satisfaction	-0.201	-0.183	-0.482*
Emotional abuse	0.120	0.180	0.426*
Anxiety	0.091	0.158	0.388*
Race ^c	0.101	0.101	-0.175
Residence ^d	0.019	0.053	0.156

Note: ^aGender (0 = male, 1 = female)
^bFamily structure (0 = 2 caregivers, 1 = other)
^cRace (0 = white, 1 = African American)
^dResidence (0 = rural, 1 = urban)
 *P < 0.01

TABLE 4 Summary of Canonical Discriminant Functions

Functions	Eigenvalue	Percent of Variance	Canonical Correlation	Tests of Functions	Wilks Lambda	X ²	P-value
1	0.301	59.2	0.462	1 - 3	0.743	376.91	0.0000
2	0.243	27.6	0.293	2 - 3	0.822	90.644	0.0021
3	0.221	13.7	0.201	3	0.911	15.99	0.0141

associated with having problems with unprotected sex and alcohol. Function 3 indicates that sexual abuse, physical abuse, hopelessness, association with delinquents, emotional abuse, and anxiety are positively related with to having all four problems.

DISCUSSION

A log-linear analysis shows that there is significant overlap (i.e., second-order interaction) between problems with alcohol consumption, drug use, and depression. This overlap between problems supports the problem syndrome argument (Jessor & Jessor, 1977). However, with the exception of adolescents who have problems with alcohol use and engage in risky sexual behavior (12.9%), or who exhibit all 4 problems studied (4.7%), the percentages of adolescents that have more than one problem are modest. These findings indicate that while there are statistically significant interactions, there is less overlap in adolescents who report more than one problem than implied in the syndrome theory.

At the same time, only 1,092, or 32.9% of the 3,320 cases with complete data, adolescents report either no problems ($n = 1092$) or one problem ($n = 66$). This means over two-thirds of the youth in this study indicate that they have at least two problems. Taken together, the findings suggest that the most vigorous interpretation of the problem syndrome theory that most adolescents have multiple problems is an overstatement. Instead, it would appear to be more accurate to state that the majority of adolescents do have more than one problem. As shown in Table 3, the majority of youth are thinly spread across several different combinations of problems. These findings suggest that agencies and programs set up for youth will need professionals and treatments that can address a myriad of combinations of problems.

Another noteworthy finding is that sex without a condom (risky sex) does not significantly overlap (i.e., third-order interaction) with these problems; however, unprotected sexual behavior is significantly related to depression as a main effect. It may well be that unprotected sexual behavior is not an important element of the comorbidity that includes problems with alcohol, drugs, and depression.

At the same time, it would be a critical mistake to assume that other problems are unrelated to unprotected sexual behavior. Indeed, Table 3 shows

that 431 youth, or 12.9% of the sample, report alcohol misuse and unprotected sex. There are 111 adolescents, or 3.3% of the sample, which report problems with sexual behavior, alcohol use, and depression. There is evidence in the literature that precocious risky sexual behavior is related to host of problems, including alcohol misuse, other drug use, smoking, poor grades, and delinquency (Whitbeck, Yoder, Hoyt, & Conger, 1999). Because this is a preliminary study in one state with a limited number of problems, more research is needed to examine overlap involving a larger number of problems in a national or international sample.

This study's findings offer preliminary details about some intricacies of comorbidity among adolescents, and provide useful information for planning specialized services for specific problems and for resource allocation. These figures should not be used to eliminate services, but rather as empirical criteria for informing clinical decisions about prioritizing treatments. The discriminant analysis presents some clues about viable targets for intervention. For instance, this analysis suggests that helping young persons establish a sense of social connection through various school and recreational activities, clubs, and community service can "buffer" them from problems. Social connectedness is likely enhanced by participation in religion, and together, these bonding experiences may bolster resilience and performance in school. Avoidance of dual problems of alcohol misuse and risky sexual adventures seems to be encouraged by family characteristics that include secure attachments and close monitoring by two caregivers. These familial characteristics may well nurture healthy self-esteem, and young females may be more responsive to these characteristics than are males. Family therapy would seem to be recommended.

In conclusion, pending further investigation, it is reasonable to assume that different forms of abuse lead to adverse feelings such as hopelessness and anxiety, association with delinquents, and lack of life satisfaction, and that these undesirable experiences and affiliations are associated with the comorbidity of all four problems studied (Lo, 2000; Zweig et al., 2001). Many of these latter cases may require extensive cognitive treatment, psychotherapy, and even multi-systemic family therapy (Henggeler, Schoenwald, Borduin, Rowland, Cunningham, 1998).

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Dr. Brent B. Benda is a Professor in the School of Social Work at the University of Arkansas at Little Rock. Correspondence concerning this manuscript should be addressed to: Dr. Brent B. Benda, Professor, School of Social Work, University of Arkansas at Little Rock, 2801 S University, Little Rock, AR 72204-1099. (email: bbbenda@ualr.edu)

A&FH

Familial Influences on Pubertal Development Among Mexican American and Euro-American Preadolescent Girls
Charlotte N. Markey, PhD, Andrea J. Ericksen, MA, Barbara J. Tinsley, PhD, and Alan Kwasman, MD

Abstract

Recent research suggests that social experiences influence the onset of puberty among Euro-American girls. This study investigated seventy-five (75) Mexican American and Euro-American girls (mean age = 9.74 years) to empirically examine relations between family structure and pubertal onset among a multi-ethnic sample in the beginning stages of puberty. Results suggest that even after controlling for girls' ethnicity, age, body mass index, and family income, pubertal development occurs earlier for girls residing in homes with a non-biological male (i.e., step-fathers or mothers' boyfriends) compared to girls residing in homes with only their biological mother or both biological parents. Implications of these findings are discussed in terms of possible negative consequences of early pubertal development for both Mexican American and Euro-American girls.

Key words: puberty, preadolescent girls, ethnicity, Mexican American families, family structure
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INTRODUCTION

Among humans, puberty is one of the most significant developmental events, characterized by considerable physical maturation as well as cognitive, social, and personal development. This transition is particularly consequential for girls, with substantial empirical research demonstrating a vast range of negative outcomes associated with early pubertal onset including academic failures, physical and psychological health problems. More specifically, girls who mature early are found to be at risk for negative health and psychosocial maladies such as breast cancer, eating disorders, and obesity (Brooks-Gunn, & Graber, 1994; Ellis, & Graber, 2000). Moreover, early-maturing girls are at risk for early sexual involvement, which in turn, predicts many outcome measures in adolescence and young adulthood including increased likelihood of contracting a venereal disease (Newcomb, & Bentler, 1988; Newcomb, & Bentler, 1993) and teenage pregnancy (Moore, & Brooks-Gunn, 2002; Rosenheim, 1992). In spite of increasing evidence suggesting the importance of the timing of puberty, relatively little is known about the factors influencing the onset of girls' pubertal development. The present study will examine familial predictors of the onset of pubertal development among Mexican American and Euro-American girls. This study contributes to our current understanding of puberty by investigating a multi-ethnic sample of girls in the beginning stages of puberty.

In animal research, it is well accepted that social experiences (e.g., conflict, stress, family structure, etc.) influence the onset of puberty (Draper, & Harpending, 1982). However, until fairly recently, it has been accepted that genetic differences account for much of the variability in human pubertal timing, with girls' onset of puberty significantly related to their

mothers' onset of puberty (Comings, Muhleman, Johnson, & MacMurray, 2002; Moffitt, Caspi, Belsky, & Silva, 1992). In recent years, a secular trend of decreasing age at onset of pubertal development has implicated the potential importance of environmental influences (i.e., the availability of nutrition and the presence of a familial environment conducive to development) on pubertal timing (Moffitt, Caspi, Belsky, & Silva, 1992). Newer evidence evaluating human girls' pubertal development suggests that conflict and family structure may serve a similar function (to accelerate or decelerate pubertal onset) as it does among other mammals (Ellis, Dodge, Pettit, & Bates, 1999). Further, evolutionary theorists propose that girls who experience familial stress (e.g., family conflict, presence of a step-parent) are more likely to experience earlier pubertal development; it is adaptive (in terms of the survival of the species) for them to become reproductively capable earlier than their peers who do not encounter similar stressors (Ellis, Dodge, Pettit, & Bates, 1999).

Belsky and colleagues (Belsky, Steinberg, & Draper, 1991) have proposed a comprehensive theory delineating relations among childhood experience, interpersonal development, and reproductive success. They suggest that evolution has designed humans to vary their mating and child-rearing behavior in accordance with the contextual conditions in which they develop in order to maximize their reproductive success. If others are perceived as untrustworthy, and if resources are scarce (e.g., due to parental divorce), female adolescents' are hypothesized to accelerate sexual activity and be uninterested in investing in long-term romantic relationships. Thus, family structure is a contextual factor potentially influencing girls' maturation.

Family Structure as a Factor in Girls' Pubertal Timing

Previous research consistently indicates that the residence of a non-related male in the home of a biological mother may influence her prepubertal daughter's maturation (Bogges, 1998). In particular, recent data suggests that the presence of unrelated males (i.e., step-fathers or mothers' cohabitating boyfriends) appears to accelerate pubertal development among preadolescent girls (Brooks-Gunn, & Graber, 1994). Ellis and Graber's (Ellis, & Graber, 2000) data even suggests an inverse relation between the length of time unrelated males reside in the home and girls' onset of pubertal development (i.e., the longer an unrelated male is present, the earlier girls' puberty occurs). However, the utility of these findings is limited by two methodological artifacts characteristic of the research conducted to examine these relations thus far: (1) the reliance on assessments of pubertal development during girls' final stages of puberty (most often using menstruation as an indicator of girls' pubertal development), and (2) the homogeneity of the ethnicity of the participants in these prior studies.

Measurement of Girls' Pubertal Timing in Prior Studies

Prior research has focused on exploring antecedents of pubertal development among girls who are in their adolescent years, and have almost completed pubertal development (Coleman, & Coleman, 2002). Most commonly, the first menstruation has been used as a marker of pubertal development because girls remember this event, rendering it relatively easy to obtain self-report information about it (Graber, Brooks-Gunn, & Warren, 1995; Moffitt, Caspi, Belsky, & Silva, 1992). However, menstruation is actually among the final experiences of pubertal development (Marshall, & Tanner, 1969). Assessing girls' pubertal status when they are experiencing the final physical pubertal changes creates difficulty in evaluating the potential importance of family influences prior to the initiation of pubertal development. Evaluation of girls in the early stages of pubertal development is necessary for researchers to substantiate that familial stress antedates pubertal maturation (and is not a consequence of pubertal development).

Composition of Samples in Prior Studies

Another major limitation of earlier research is the utilization of primarily Euro-American youths, and the inability of these studies, with very few exceptions (Benjet, & Hernandez-Guzman, 2002; Coleman, & Coleman, 2002; Ellis, Dodge, Pettit, & Bates, 1999), to explicate potentially unique processes experienced by young girls raised in families characterized by beliefs and behavioral patterns associated with other ethnicities. Because research suggests that family environments and family structure are influenced by

cultural processes (Hetherington, Bridges, & Insabella, 1998), it is important to examine familial influences on pubertal development utilizing multi-ethnic samples.

The Latino population in the U.S. is growing dramatically, and has become the largest minority group in the U.S. (United States Bureau of the Census, Census 2000). Families of Mexican origin comprise the largest subgroup of Latinos in the U.S. (United States Bureau of the Census, Census 2000 Redistricting Data), and this population is continuing to increase. Among the significant social dynamics created by these changing demographic patterns are health and social changes among families and youth. For example, it has been suggested that several traditional features of Mexican culture: *respeto* (respect for elders or those with experience), *familismo* (the centrality of the family), *modesty* and *simpatia* (caution in observing sexual and social prohibitions and an emphasis on maintaining harmony in family and interpersonal relations) may be among those factors contributing to the "Hispanic paradox". This paradox refers to the phenomenon in which Latinos, as a group, have mortality outcomes equal to or sometimes surprisingly better than non-Latinos in the U.S., despite the fact that they rank low on most socioeconomic indicators (Castro, Coe, Gutierrez, & Saenz, 1995; Franzini, Ribble, & Keddie, 2002; Marin, & Marin, 1991). Clearly, among Mexican Americans, traditionalism has been a strong aspect of family life, with Catholicism a core aspect of traditional culture (Castro, Coe, Gutierrez, & Saenz, 1996).

These strong religious and family orientations of the Mexican American culture suggest that, while experiencing step-parenting and maternal cohabitation with an unrelated male may be stressful situations for many youth, they may potentially be even more stressful and less normative circumstances for Latino youth. These culturally-influenced patterns of family dynamics experienced by Latino girls may both contribute to early maturation, and make the consequences of early development especially challenging for girls to deal with. Thus, research is first needed to test the extent to which familial stress, operationalized by family structure, is related to ethnically diverse girls' pubertal onset.

The Present Study

In order to respond to the limitations of the prior research as described above, and to expand the generalizability of these earlier findings, the present study will explore associations between family structure and Mexican American and Euro-American preadolescent girls' pubertal development. In order to better clarify the role of family structure in girls' pubertal development, other potentially confounding influences on pubertal development will be statistically controlled: girls' age, family income, and weight status (Ellis, & Graber, 2000; Moffitt, Caspi, Belsky, & Silva, 1992).

Consistent with previous findings, it is hypothesized that Euro-American and Mexican American girls residing in families including an unrelated male will experience earlier pubertal development than girls residing in families with one (i.e., single mothers) or two biological parents present.

METHOD

Participants

Seventy-five (75) girls (mean age = 9.74 years) and their families participated in this study as part of a larger longitudinal investigation of the relations among culture, family, and children’s health. Forty (40) participating families were Euro-American, and 35 were Mexican American. Of these 75 families, complete puberty data was available for 55 girls (Euro-American n = 30, mean age = 9.76; Mexican American n = 25, mean age = 9.71); the present analyses will focus on this subsample. Thirty-six (36) families consisted of two married, biological parents, 8 families were step-families or consisted of a cohabitating partner, and 11 mothers were single. All children were healthy (i.e., without any serious or chronic illnesses) and cognitively functioning at their approximate grade level (4th grade) at the time of assessment. Additional descriptive demographic characteristics of the sample are listed in Table 1.

Measures

Hypothesized influences on girls’ pubertal development investigated in this study include: age, ethnicity, family structure, family income, and girls’ body mass index.

Demographic Information

Demographic information, including household income, girls’ age, and ethnicity was provided by mothers. Family structure was determined by mothers’ reports specifying the parents who lived with the child, the relation between the parents and the child participating in this study, and any other individuals who lived in the home. For the present analyses, family structure was coded categorically with girls being placed in one of two groups: biological family (two biological parents or a single biological mother), or step/cohabitating family (a non-related male living in the home with the biological mother).

Body Mass Index

Measurements of girls’ height and weight were used to compute body mass index (BMI = weight(kg)/height²(m)).

Pubertal Development

The outcome of interest in this study, girls’ pubertal development, was assessed by a trained pediatrician using Tanner Growth Ratings of pubic and breast development (Marshall, & Turner, 1969). The pediatrician was blind to the hypothesis examined in this study and unaware of the literature examining family structure in relation to pubertal development. Separate ratings were given for girls’ breast and pubic hair development; however, pubertal development was included in the analyses as a composite score of breast and pubic development.

Procedures

All procedures were consistent with the ethical standards for the treatment of human subjects as described by the American Psychological Association, and were approved by the Institutional Review Board at the university where this research took place. Demographic information (i.e., household total income and ethnicity) was provided by mothers’ in their preferred language (English or Spanish) during a scheduled visit to the researchers’ laboratory (located on a university campus). All Spanish measures were translated and back-translated from English versions to assure their comparable meaning (Marin, & Marin, 1991). Measurements of the participants’ height and weight were also made by a trained researcher during a laboratory visit. In accordance with the recommendations of Lohman, Roche, and Martorell (Lohman, Roche, & Martorell, 1988), three (3) measurements of girls’ height and weight were made and an average was used to compute their BMI. Girls’ pubertal assessments were made by a

Table 1. Demographic characteristics for Mexican American and Euro-American girls on descriptor variables.	
Euro-American Girls (n = 30)	
Age	
Total Mean (SD)	9.76 (0.43)
Range	9.00 – 10.84
Total Household Income	
Means (SD)	\$49,107.64 (\$25,009.52)
Range	\$6,456.00 – \$100,000.00
Mexican American Girls (n = 25)	
Age	
Total Mean (SD)	9.71 (0.45)
Range	9.08 – 11.13
Total Household Income	
Means (SD)	\$28,115.48 (\$20,169.89)
Range	\$5,000.00 – \$100,000.00

bilingual pediatrician, trained in Tanner Growth Ratings, in the context of a pediatric well-visit.

RESULTS

No significant mean difference between Mexican American and Euro-American girls' pubertal development was found (Mexican American Tanner stage $M = 1.76, SD = 0.84$; Euro-American Tanner stage $M = 1.60, SD = 0.50; t(53) = -0.87, p > 0.05$). Because Mexican American and Euro-American girls' were at comparable stages of pubertal development, and due to the modest sample of participants, all additional analyses examined Mexican American and Euro-American girls together, but controlled for ethnicity when necessary.

In order to investigate relations among all constructs examined in this study, Pearson correlations were conducted (see Table 2). Results suggested that girls' pubertal development was positively associated with their BMI; girls with higher weight status (BMI) were at further stages of pubertal development. Results also indicated that girls' family structure was related to their pubertal development. Girls living in households with their biological mother and a non-related male were more advanced in pubertal development than girls living in families with one or two biological parents.

TABLE 2 Correlations Among Constructs Investigated

	Ethnicity	Age	BMI	Income	Family	Puberty
1. Ethnicity	—	-0.10	0.12	-0.35**	-0.08	0.12
2. Age		—	-0.14	-0.01	0.17	0.07
3. BMI			—	-0.01	-0.05	0.47**
4. Household Income				—	0.14	0.16
5. Family Structure					—	0.40**
6. Pubertal Development						—

Note: ** $p < 0.01$. Ethnicity is coded 0 = Euro-American, 1 = Mexican American

A simultaneous regression analysis was used to determine if girls' ethnicity, age at pubertal assessment (in months), body mass index, family income, and family structure predicted girls' pubertal development. Family structure was contrast coded (two biological parents [-0.25] or a single biological mother [-0.25] versus step/cohabitating family [0.50]) and the regression analysis was used to determine if girls living in step/cohabitating families exhibited a significantly different degree of pubertal development than girls living in families with a biological mother and father or a biological mother (single mothers). The simultaneous regression analysis indicated that, after controlling for girls' age, ethnicity, body mass index, and family income, girls living in a step/cohabitating family still exhibited significantly greater pubertal development than girls living in homes with single mothers or two biological parents ($b = 0.53, p < 0.05$; See Table 3).

Pubertal Development

TABLE 2 Regression Analysis Predicting Girls' Pubertal Development

Predictors	B	SE	Beta
Ethnicity	0.26	0.17	0.20
Age	-0.01	0.22	0.01
Family Income	0.03	0.00	0.10
Body Mass Index	0.06	0.02	0.37*
Family Structure	0.92	0.24	0.53**

Note: $R^2 = 0.46, p < 0.001, *p < 0.05, **p < 0.01$

DISCUSSION

This report marks one of the first attempts to examine familial influences on pubertal development among a multi-ethnic sample of girls at the beginning stages of puberty. Findings suggest that family structure, (i.e., the presence of a non-biologically-related male as the partner of a biological mother) is related to pubertal development among both Euro-American and Mexican American girls, even after controlling for other potential confounding influences including girls' age, body mass index, and family income.

These findings suggest that Mexican American girls, and not only Euro-American or African American girls (Ellis, Dodge, Pettit, & Bates, 1999), residing in step/cohabitating families, may be susceptible to earlier pubertal development. Although Latino girls' pubertal development has recently been discussed in relation to their socioeconomic circumstances (Oeidallah, Brennan, Brooks-Gunn, Kindlon, & Earls, 2000) and their mental health (Benjet, & Hernandez-Guzman, 2002), these results suggest that other influences, specifically family/social environment influences, appear to also be important predictors of Mexican American girls' pubertal development. Of course, potential influences on pubertal development (exposure to environmental chemicals, extreme climates, acculturative status, etc.) beyond those examined in the present study may provide a more complete picture of the antecedents of puberty among girls of diverse backgrounds.

Although this study is somewhat limited by its modest sample size, it indicates important future directions for researchers interested in understanding antecedents and consequences of pubertal development among multi-ethnic samples of young girls. Researchers (Ellis, Dodge, Pettit, & Bates, 1999) have documented the important consequences of early pubertal development among Euro-American girls, but less attention has been focused on understanding the influences on the onset

and outcomes linked to early pubertal development among Latino girls. This research suggests that Latino girls are also at risk for experiencing familial influences on pubertal development, which may in turn lead to earlier pubertal development and related negative social, academic, and health consequences in this dramatically increasing segment of the U.S. population. It is hoped that these findings will guide future efforts to understand the antecedents and consequences of pubertal development among larger samples of Latino girls.

The present findings may be of particular importance given that Latino girls appear to be at particular risk of experiencing problems associated with early puberty (e.g., depression) (Benjet, & Hernandez-Guzman, 2002). Further, the culturally-based values and belief systems that characterize Latino families may exacerbate the seriousness of Latino girls' experience of early pubertal development. Additional empirical research is necessary to determine if a cumulative risk model may be appropriate in trying to understand the combination of influences that render minority girls vulnerable to early pubertal development and its associated consequences.

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Charlotte N. Markey, PhD is associated with the Department of Psychology at Rutgers University. Andrea Ericksen, MA is associated with the Department of Social Sciences at San Juan University. Barbara Tinsley, PhD is associated with the Healthy Families Project, Department of Psychology, University of California, Riverside. Alan Kwasman, MD, is associated with both the Healthy Families Project, Department of Psychology, University of California, Riverside and the Pediatric Medical Group in Riverside CA. Correspondence concerning this manuscript should be sent to Charlotte N. Markey, Department of Psychology, Rutgers University, 311 N. 5th Street, Camden, NJ 08102. (email: chmarkey@camden.rutgers.edu)

A&FH

Timing of Initial Sexual Intercourse as a Mediating Factor Between White and Black Adolescent's Sexual Attitudes and Sense of Self

Paul Springer, MS, Scott A. Ketting, PhD, Jeffrey Hibbert, PhD, Connie J. Salts, PhD

Abstract

Based on the Normative Hypothesis, theorists have believed that differences in sexuality among black and white males would affect each group differently due to the disparate cultural norms. The current study evaluates the relationship between adolescent sexual attitudes and timing of first sexual intercourse as factors affecting problem behaviors, suicidal thoughts, and sense of security among black and white adolescents. The sample size comprised of 847 black and white adolescent males from rural Alabama. Results discovered that earlier sexual expression was dealt with differently for white and black adolescents, depending on timing of first intercourse. Most interestingly, it appears that the decision process for having sex is different for white and black adolescents. The model fits better for white adolescents.

Key Words: adolescent, sexuality, intercourse, male, black, white
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INTRODUCTION

Over the past 25 years adolescents have been engaging in first sexual intercourse at increasingly younger ages (Dickson, N., Paul, C., Herbison, P., & Silva, P., 1998; Rosenthal, D. A., Smith, A. M., & Visser, R., 1999; Carvajal, S.C., Parcel, G. S., Basen_Engquist, K., Banspach, S. W., Coyle, K. K., Kiirby, D., & Chan, W., 1999). One study found that almost 18% of white males and 49% of black males were sexually active before age 13 (Coker, A. L., Richter, D. L., Valois, R. F., Mckeown, R. E., Garrison, C. Z., & Vincent, M. L., 1994), while 60% of white and black males having intercourse by ages 18 and 16 respectively (Brooks-Gunn, J., & Furstenberg, F. F., 1989).

There is concern that sexual activities among immature younger children will have an effect on risky behavior and self-concept. One study suggests that the timing of an adolescent's first sexual intercourse is a key variable associated with negative behaviors among white males and females. It was found that earlier timing of first sexual intercourse was associated with a pattern of adjustments as measured by: problem behaviors such as shoplifting, truancy, and fighting; environmental systems such as the quality of family and peer relationship; and the personality system, such as self-esteem (Bingham, C.R., & Crocket, L. J., 1996).

Other studies have looked at the effects that early sexual, physical and emotional abuse may have on early initiation of sexual intercourse. Some studies have shown that sexual coercion, especially when it is the child's first sexual experience may lead to more risky sexual behavior for both males and females (Caceres, C.F., Marin, B.V., & Hudes, E.S., 2000; Zweig, J.M., & Crockett, L.J., 1999). Another study has shown that physical abuse also increases the likelihood of adolescent sexual activity (Small, S. A., & Luster, T., 1994). In fact, early abuse in children's lives may

actually precede early sexual behavior and lead to the child taking more risks in their adolescent years, such as initiating sex at a younger age.

Unfortunately, there is limited research on very early sexual intercourse and problem behaviors among males. Most of the data focuses on females and the negative psychological effects they may encounter when engaging in intercourse at very early ages (ages 11-12). Leitenberg and Saltzman (. Leitenberg, H., & Saltzman, H., 2000) discovered that girls who initiated sex early (ages 11-12) had more suicide attempts and more alcohol and drug abuse. Suicide attempts and drug abuse suggest that there is a link between early sexual behavior and psychological problems.

However, negative behaviors associated to early sexual intercourse among white adolescents should not necessarily be extrapolated to their black adolescent counterparts. According to the "Normative Hypothesis," there is no association between sexuality and psychological health when acting in accordance with culturally normative sexual behavior (Herold, E. S., & Goodwin, M. S., 1979, Jessor, S. L., & Jessor, R., 1975; Stratton, J., & Spitzer, S., 1967). It is only when the individual deviates from the cultural norm that the relationship between sexual activity and psychological health is created (Furstenberg, F. F., Morgan, S. P., Moore, K. A., Peterson, J. L., 1987; Stratton, J., & Spitzer, S., 1967).

The relationship between self-esteem and early sexuality seems dependant upon the adolescent's beliefs regarding appropriateness of the behavior (Miller, B. C., Christensen, R. B., & Olson, T. D., 1987). Self-esteem was negatively associated with early sexual intercourse for adolescent males who believed it was wrong (Herold, E. S., & Goodwin, M. S., 1979) but positively associated to early intercourse with those who believed it was acceptable (Miller, B. C.,

Christensen, R. B., & Olson, T. D., 1987). However, the relationship between self-esteem and sexual behavior differed depending on the subculture (Herold, E. S., & Goodwin, M. S., 1979; Perlman, D., 1967; Stratton, J., & Spitzer, S., 1967).

Findings support the hypothesis that the relationship between self-esteem and adolescent sexual attitudes and behaviors is dependant on cultural norms (Herold, E. S., & Goodwin, M. S., 1979; Jessor, S. L., & Jessor, R.; 1975; MacCorquodale, P., & DeLamater, J., 1979; Perlman, D., 1967). If Stratton and Spitzer's (Leitenberg, H., & Saltzman, H., 2000) theory is true then black males who typically hold more liberal views about sexuality would not experience the negative outcomes associated with sexual expression at early ages. This assumption was supported by Blume, Beuhring, Bearinger, Sieving, and Resnick (Blume, R. W., Beuhring, T., Shew, M. L., Bearinger, L. H., Sieving, R. E., & Resnick, M.D., 2000) in which they confirmed that black male adolescents, did not exhibit the same destructive behaviors as other teens of different ethnic origins who were engaging in sex or other risk behaviors.

Research evaluating the relationship between the Normative Hypothesis and sexual intercourse focuses on self-esteem (Jessor, S. L., & Jessor, R., 1975; Miller, B. C., Christensen, R. B., & Olson, T. D., 1987; Perlman, D., 1967; Stratton, J., & Spitzer, S., 1967). However, current research has begun to critically evaluate the use of self-esteem as a predictor of psychological health. This research suggests that self-esteem has no predictive value of positive behavior and that other factors may show stronger predictive qualities (Baumeister, R., Bushman, B., & Campbell, K., 2000; Emler, N., 2001; Crocker, J., (2002).

There is a real need to look at psychological factors other than self-esteem to understand the effects of early sexual behaviors. Such research could focus on sexual attitudes and age of sexual onset affecting multiple aspects of the individual among a more racially diverse sample, lending more credence to the Normative Hypothesis.

METHOD

Participants

The subjects for this study came from participants in the Teen Assessment Project (TAP) that encompassed five rural and urban counties in Alabama. TAP is a program developed by the Alabama Cooperative Extension System that assists in the purpose of educating and learning more about the experiences of adolescents. A total of twelve schools in five Alabama counties participated in the Teen survey, which were made up of various social, racial and ethnic backgrounds. Parents of these students were informed of this study in advance, and were given the option to exclude their children from participating. Only data for sexually active males were used in this study. Males

who inconsistently answered or did not provide answers to the questions used in this study were not included. Similarly, cases with coding errors and missing data on key variables in this study were also not included. The beginning sample size of all males in this data set was 1,122. After accounting for missing data and coding errors, 49 cases were removed. In addition, 226 of this sample indicated that they had not had sex, and considered themselves a virgin, and were subsequently removed from the study. As a result, the final sample size was 847. The sample consisted of adolescent males ranging from 12-18 years of age with 76.1% of the adolescents being white and 23.9% black. The mean age of males was 15.62 years.

Procedure

The surveys were administered and returned on a pre-determined day and time at twelve schools that encompassed five rural and urban counties in Alabama. Teachers did not help or instruct students on answering any of the surveys.

Endogenous Variables

Age at intercourse

Age at first intercourse was measured among participants using the question, "How old were you the first time you had intercourse?" Possible answers from the TAP survey included a space for each age group starting at "9 years old or younger," to "18 years old." Another possible answer included, "I have never had sex (intercourse)." For the purpose of this study, the "never having sex" group was excluded

Suicide

Suicide was used as a dependent variable in this study and consisted of one question. This question asked the participant to check the space that represents how often they have seriously thought about suicide. The specific questions states, "Have you ever seriously considered killing yourself?" The subjects responded on a four point Likert-type scale ranging from "Never," "Once or twice," "Several Times," "Many times," and "All of the time"

Sense of Security

The questionnaire contained 13 questions aimed at assessing what values were important in the adolescent's day-to-day life. The participants were asked to indicate the importance of each value on a six point Likert-type scale ranging from, (1) Not Important, to (6) Most Important. Examples of these questions were as follows: How important is, "Security: feeling safe in your life," "Family security: close relationships in your family," "Sense of belonging," and "Self-control." The Cronbach's alpha was .92 for all adolescents. Looking at the reliability of this scale by race, the

Cronbach alpha was .92 for white adolescents and .91 for black adolescent males.

The Cronbach alpha by race was .94 for white adolescent males and .92 for black adolescent males.

Behavioral Problems

Behavioral problems were also tested as a dependent variable in this study and consisted of 17 questions, asking participants to indicate how often they are involved in specific activities on a 5 point Likert-type scale ranging from "Never", "Once," "Twice," "Three times" to "Four or more times." Examples of these questions were: "How often have you, "Taken something from the store without paying?" "Broken into someone's house or business?" "Used any weapon to frighten or hurt someone to get money?" and "Suspended or expelled from school?" The Cronbach's alpha was .89 for all adolescents. The Cronbach alpha by race was .89 for white adolescents males and was .90 for black adolescent males.

SEM as Measure of Analysis Plan of Analysis

Structural equation models (SEM) are regression-based models with the same core assumptions as linear regression such as linearity in the parameters and normally distributed variables. The full potential of SEM lies in its ability to simultaneously test relationships of latent factors to observed variables (measurement models), as well as relationships among the different latent factors (structural models). As appealing as this complex structure can be, SEM can also be as simple as a path diagram simultaneously testing relationships among several factors. Strictly speaking, SEM encompasses more than path analysis; the terms structural equation modeling however have generally been loosely used to include path analysis (Schumacker, R.E. & Lomax, R.G., 1996).

Exogenous Variables

Reasons to Have Sex

The questionnaire contained 26 statements aimed at assessing what reasons would cause adolescents to choose to have sex. The participants were asked to circle the number that represents how important each value is to you. The subjects indicated their response on a six point Likert-type scale ranging from, (1) Strongly Disagree, to (6) Strongly Agree.

A Factor analysis was performed to find questions with factor loadings of .70 or higher. A total of 17 questions were used as a result of the Factor Matrix. Examples of these questions were as follows: "I want to have more sex experience," "I have sex to please my partner," "Sex makes me feel powerful," "Sex helps to relieve sexual tension," and "Sex is a way to show that I am an adult." The total Cronbach's alpha was .95 for all adolescents. The Cronbach alpha by race was .96 white adolescent males and was .94 for black adolescent males.

For the present study, SEM had two important advantages. First, the factors reasons to have sex, reasons not to have sex, suicide ideation, sense of security, and problem behaviors could all be tested in a path diagram with age at first intercourse used as a mediating variable. The factors reasons to have sex, reasons not to have sex, suicide ideation, sense of security, and problem behaviors are all summative scales established with an exploratory factor analysis during early research for this study. SEM could have just as easily simultaneously tested these latent factors with their respective factor structures while testing the causal relationships among the factors in a path diagram. However, because Cronbach's alpha values were so high for these factors and for the sake of parsimony, only the factors themselves were included in the SEM for this study. Second, SEM can be used to test a Multi-Group Model. Multi-Group Models determine if differences exist in a model taken in its entirety across different groups, in this case white versus black male adolescents. Whereas race could have been entered as a separate variable with paths specified to all the other variables in the present study, a single parameter estimate for race would not have been sufficient in determining if the entire structure of the model was different for blacks versus whites.

Reasons Not to Have Sex

The questionnaire contained twenty-two statements aimed at assessing what reasons would cause adolescents to choose to not have sex. The statements were placed on a six point Likert-type scale ranging from, (1) Strongly Disagree, to (6) Strongly Agree. Participants circled the number that represents the value which most applies.

A Factor analysis was performed to ascertain questions with factor loadings of .70 or higher. A total of 11 questions were used as a result of the Factor Matrix. Examples of these questions were as follows: "Having sex is not worth the risk," "I think it is morally wrong," "Having sex is against my religion," and "I have seen bad things happen to others who have sex." The total Cronbach's alpha was .94 for all adolescents.

Using AMOS 4.0 (Arbuckle, J. L., 1994-2001), a single chi-square is calculated that is used as a measure of absolute goodness of fit. The proposed model is considered to fit the data only if the chi-square is judged not to be statistically significant when compared to a critical value. In the case of Multi-Group Models, a chi-square is calculated for all the models while the parameter coefficients are allowed to freely vary. A second chi-square is then calculated while the parameter coefficients for the models across all the groups are constrained to equal each other. The difference between the two chi-squares is also distributed as a chi-

square to be tested for statistical significance. Theoretically, if the chi-square difference is judged statistically significant, the parameter coefficients are indeed different across the groups indicating that in the factor structures, causal paths, or both differ across the groups. In this case, a significant chi-square difference test would indicate that the models indeed differ for white male adolescents versus their black counterparts.

Plan of Analysis

A Structural Equation Model was used looking at (1) "Reasons to Have Sex," (2) "Reasons Not to have Sex," (3) "Suicide ideation," (4) "Sense of Security," (5) Problem Behaviors, and then combining these five factors to see how they are related to the latent variable of self concept, in relations to others. The model will evaluate the unconstrained (within group differences) and constrained models (between group differences) of the two groups. Using AMOS 4 (23) the model produces a single chi-square for the unconstrained model for both the black and white groups, followed by a chi-square for the constrained model.

When using a Multi-Group Model (MGM) it is important to understand that in theory, statistically significant differences in MGM indicate that the model actually differs for the groups being tested (blacks and whites). These differences may consist of a different factor structure, different structural relationship or both. The proposed model assumes that "reasons to have and not have sex" act as a moderating variable influencing not only age at first intercourse but also a sense of self. Our objective is to determine if the hypothesized relationship is consistent with the data, and determine the strength of the association.

RESULTS

Structural Equation Model

Two models were examined by AMOS version (4.0) (Benter, P. M., & Bonnett, D. G., 1980) of the two exogenous variables (Reasons to have sex, Reasons not to have sex) and the four endogenous variables (Age at first intercourse, Suicide ideation, Sense of Security and Problem behaviors) of black and white adolescents. This is done to determine if factors such as sexual attitudes affect the timing of black and white adolescent's first sexual experience, and to determine if sexual attitudes combine with sexual onset to create psychological turmoil. All of the measured variables had strong loadings indicating construct validity. In other words, the scales were actually measuring what they say they are measuring.

The first model (all free) looked at black and white adolescents separately with age of first sexual intercourse acting as a mediating variable. The second model (constrained) looked at within group differences of black and white adolescents with age of first

intercourse acting as a mediating variable. The model was evaluated in two ways. First, departure of the data from the hypothesized model was tested for significance by using a chi-square test. Second, goodness-of-fit between the data and model was estimated by using the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the CMIN, and the Root Mean Square Error of Approximation (RMSEA). The Comparative Fit Index is a revision of the Normal Fit Index that takes into account sample size. This scale yields values ranging from 0 to 1.00, and values of .95 are the revised cutoff, and considered very good. The Tucker-Lewis Index is similar to the CFI, and is used to validate the results of the CFI. Values close to .95 are also indicative of a good fit. The CMIN, is also known as minimum discrepancy. Results containing a CMIN close to 5.0 are considered very good. Finally, the Root Mean Square Error of Approximation (RMSEA) is considered the most important and informative criteria in structure modeling. Values ranging from .08 to .10 are indicative of a good fit.

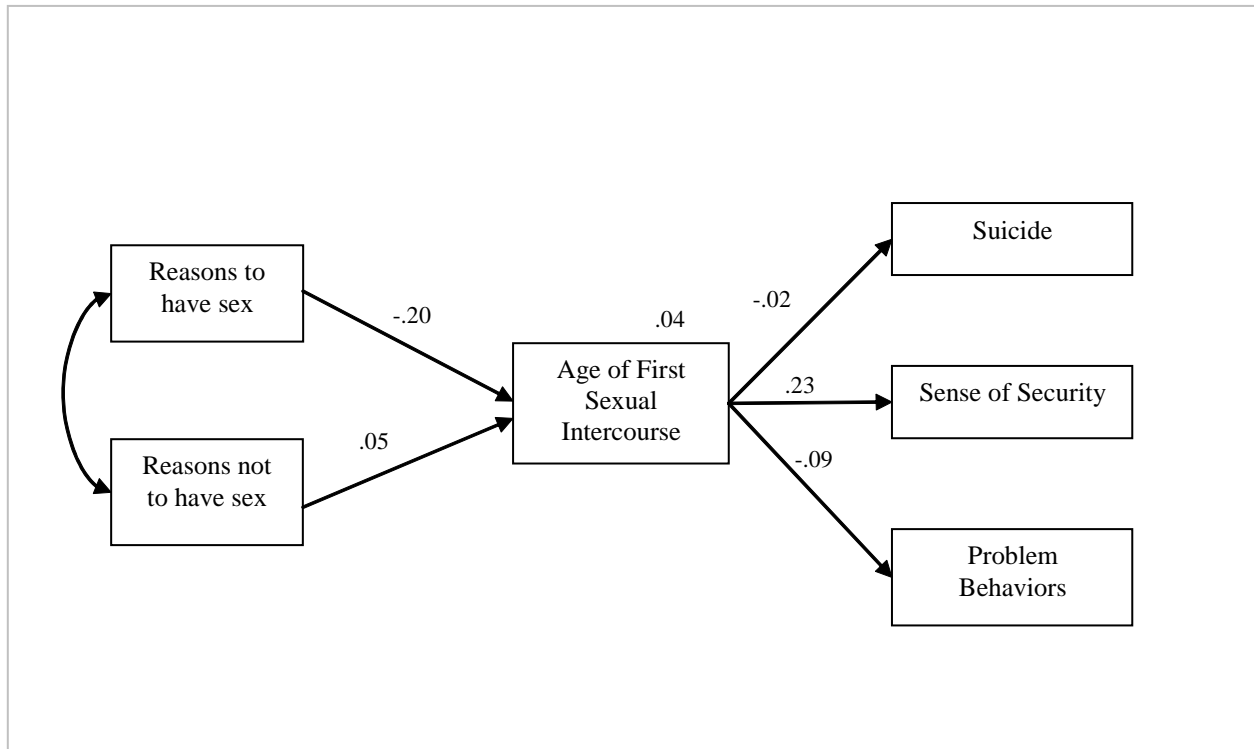
The sample summary for the unconstrained model or "all free" showed the following: The chi-square was 156.971 ($df=18$), the CFI was .988, the TLI was .973, the CMIN was 8.72 and the RMSEA was .096. Although the chi-square test was significant ($p<.05$), Bentler and Bonnett (24) advised against the sole use of the chi-square value in judging the overall fit of the model. This is to avoid chi-square inflation because of the sample size. Using the other measures of goodness of fit provides support for the chi-square test.

All Free Model-Black Adolescents

Two significant findings were discovered when looking at black adolescents in relation to this model (See Figure 1). First, reasons to have sex for black adolescent males were negatively associated with the age at first intercourse ($t = -3.44$). The results reported a Coefficient of Determination (R^2), explaining 4.4% of the variance of age of first sexual intercourse. This score suggests that the higher the score on reasons to have sex, the lower the age at first sexual intercourse for black adolescent males. No significant relationship was found between reasons not to have sex and the age at first intercourse with adolescent blacks.

Secondly, the model reported that the age at first intercourse was positively correlated to sense of security ($t = 3.81$). Again the results indicated a Coefficient of Determination (R^2), explaining 5.5% of the variance for Sense of security. This suggests that the longer blacks wait to have sex the greater their sense of security is in their lives, a finding inconsistent with the Normative Hypothesis. No significant relationships were found between age of first intercourse and suicide ideation or problem behaviors.

Figure 1 All Free Black



All Free Model-White Adolescents

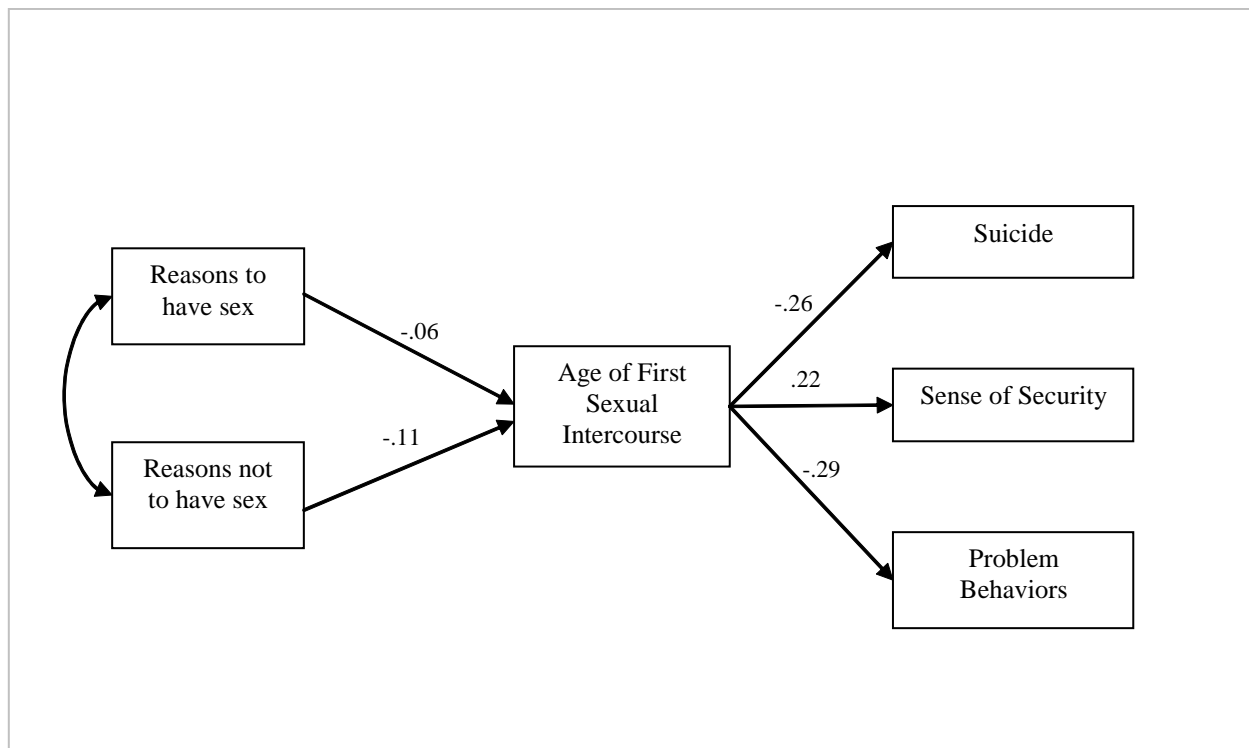
Four significant findings were discovered when looking at whites within the model (See Figure 2). First, the model demonstrated that reasons not to have sex were positively associated with age at first intercourse ($t = 2.41$). In other words, the model indicated that the higher scores of reasons not to have sex among white adolescents males is directly related with white adolescent males waiting longer before having first intercourse, which would seem logical. However, the inverse was not true. There was no significant relationship between reasons to have sex and the age at first intercourse.

Second, age at first intercourse is negatively correlated with suicidal ideation ($t = -6.366$), yielding a

Coefficient of Determination (R^2) explaining 6.8% of the variance. This finding indicated that the younger white males were at the age of their first sexual intercourse the more likely they were to experience suicidal ideation. Age at first intercourse was also positively correlated with sense of security ($t = 5.239$), explaining 4.9% of the variance. This suggests that the longer white males wait to have sex, the more sense of security they will possess.

Finally, age at first intercourse was negatively related to problem behaviors among white adolescent males ($t = -6.972$). The results reported a Coefficient of Determination (R^2) explaining 8.2% of the variance for problem behaviors. This finding indicates that the younger the age at which white males have sex, the more problem behaviors they will exhibit.

Figure 2 All Free White



Constrained Model-Black and White Participants

To assess if the two groups (black and white) are in fact different, all factor loadings were constrained equal to each other. The results of the constrained group provide a strong argument for our model that there are differences between the black and white groups. The chi-square for the constrained group is 180.211 ($df = 23$) with the probability level at .0000. The constrained group had a CMIN of 23.40, NFI = .002, RFI = -.003 and TLI = -.003. Constraining the model did worsen the fit.

DISCUSSION

The purpose of this study was to test the strength of the Normative Hypothesis, which suggests that cultural norms do affect how black and white male adolescents view timing of sexual intercourse. The analyses support the hypothesized assumptions that sexual attitudes combined with sexual onset did create psychological turmoil in white adolescents, while having limited impact on black adolescents. This study identified differences in how both black and white adolescents deal with sexual attitudes, timing of intercourse and psychological turmoil.

All Free Model-Black Adolescents

Black adolescents did not exhibit problem behaviors the younger they had sex. This is consistent with Blume et al. (Blume, R. W., Beuhring, T., Shew, M. L., Bearinger, L. H., Sieving, R. E., & Resnick, M. D., 2000) in which they confirmed that black teens did not

exhibit the same destructive behaviors, as teens of other ethnic origins that were engaging in sex. The pattern of black adolescents engaging in sex at younger ages is also well documented (Furstenberg, F. F., Morgan, S. P., Moore, K. A., Peterson, J. L., 1987; Samuels, H. P., 1997). This finding supports the Normative Hypothesis that the timing of sexual intercourse is mediated by the sub-culture of which they are a part (Stratton, J., & Spitzer, S., 1967). For black adolescents, it seems more acceptable to engage in sex at younger ages. In fact our study found that 43.6% of black adolescent males engaged in sex by the age of twelve, as opposed to 11.5% of white adolescent males. Similarly by the age of 14, 70.1% of black males have experienced sex, while only 29% of white males have. These findings provide support for the model, that timing of sexual intercourse is mediated by one's sub-culture.

No significant relationships were found among age of first intercourse and suicide ideation, thus confirming the Normative Hypothesis. However, black adolescents who were older when initiating sex showed increases in sense of security. There are several possibilities for why not having sex may create more of a sense of security among black adolescent males. Waiting to have sex may create a sense of security because of the less risks involved, such as AIDS, STD's and pregnancies. Similarly, not having sex may make relationships less complicating, and more "free" and as a result more enjoyable for younger teens. Therefore, adolescent security may be an important factor that needs to be researched further.

Finally, a relationship was found between positive reasons why one should have sex and timing of first sexual intercourse among black adolescents. This finding is interesting for two reasons. First, black adolescents seem to be persuaded to have sex because of the positive reasons associated with the sexual experience. However, it seemed that if the positive reasons to have sex were significant, then it would be a logical assumption that the reasons for not having sex would be statistically significant in a negative direction. Our assumption was that the two scales were on a continuum. It appears that this was a faulty assumption. We decided to return to the data and run correlations between reasons to have sex and reasons to not have sex. We found that for black adolescents these scales were not statistically related.

Because the negative reasons were not statistically correlated with deciding to have sex we must assume that this factor does not enter into the decision process for black adolescents. This would explain why black adolescents do not act out behaviorally or have increased suicide ideation. The finding fits our model's hypothesis that social norms influence how one thinks about sex. Hence, for blacks, who exhibit more liberal sexual attitudes than whites, it would be expected that they focus on more positive reasons to have sex. Consequently, more black adolescents engage in sex at a younger age as a result of the acceptance of sexuality.

All Free Model-White Adolescents

Among white adolescents, the opposite was found concerning a relationship with positive reasons why one should have sex. It was confirmed that white adolescents place emphasis on reasons not to have sex, in determining when they would engage in their first intercourse. In fact, the positive reasons to have sex did not enter into the decisions process for the white adolescents. This finding seemed confusing. It seemed that if reasons to not have sex were significantly related to timing of sexual intercourse, then it would be a logical assumption that the positive reasons for having sex would contribute to timing of sexual intercourse. Again we assumed that the two scales were on a continuum. For white adolescents this assumption holds moderately true. The correlations between reasons to have sex and reasons to not have sex for white adolescents were negatively correlated at the level of $-.284$.

Although, the two scales are negatively correlated the determining factor concerning sexual behavior is the strength of the reasons not to have sex. It would seem that when the reasons to not have sex are higher the adolescent is more likely to abstain from sex longer. Individuals, who are sexually active, contrary to their cultural norms, seem to recognize that they are deviating from what is acceptable for their group. Although these individuals have had sex, they will still

fall back to what they know is acceptable for the group. Ultimately, by going against cultural beliefs white adolescents seem to be psychologically harmed.

This is evident by the findings associated with self loathing. When going against the strong beliefs to not have sex, the white adolescents act out behaviorally and have increased suicide ideation. These findings are supported by previous research relating to sex and problem behaviors (9, 18), and sexuality and suicidal behaviors (Leitenberg, H., & Saltzman, H., 2000). Suicide may be associated with the timing of white adolescent sex. This racial difference provides additional support for the Normative Hypothesis, indicating that social norms among white teens internalize sexual activity at younger ages in a negative framework. Support was also found for white male adolescents feeling increased security when waiting to have sex. Obviously this correlation is significant to our study and coincides with past research on self-esteem (Herold, E. S., & Goodwin, M. S., 1979; Miller, B. C., Christensen, R. B., & Olson, T. D., 1987). The combination of all three variables demonstrates the overall negative impact of early sexual intercourse on white adolescent males. It would appear that the same statistical model does not fit black and white adolescents.

Constrained Black and White Participants

Constraining the model, allows us to test whether the statistical model fits both groups. Our reasoning was to ascertain if the two groups were in fact different, and if constraining the model would worsen or improve the fit. The findings showed that the goodness of fit was worsened, as the chi-squared was worsened. By constraining the two groups, we are blurring the findings of the two groups. These findings demonstrated strong support that the black and white adolescent groups are in fact different statistically. This clarifies that the emotional process of having sex is different for whites and black adolescent males. Also, it is important to note that more of the variance in the model was explained for the white adolescent males. This suggests that a different model would need to be developed to better explain the impact of sexually active behavior on black adolescents.

Limitations

Self Report

Because this study was based entirely on self-report, the findings include only what respondents are willing to share. There also exists the possibility that the questions used in the study were influenced by social desirability. A social desirability bias could potentially confound our results, particularly since adolescents may feel a desire to answer a question that they feel may be socially desirable.

Measurements

None of the measures used in this study came from previously tested assessments. As a result, the validity of the findings may be held in question. However, all measures demonstrated strong internal consistency.

Conclusions

In general the results suggest differences in why black and white adolescents choose to have sex. It appears that each groups sexual attitudes not only affect timing of first intercourse but how these groups view themselves and what behavioral problems they would exhibit. Black males tend to look at the positive reasons why they should have sex, which led them to have sex at a younger age than their white counterparts. Despite having sex at younger ages, this did not increase the likelihood of them exhibiting problem behaviors or suicide ideation. For white males, the opposite was found. White males tend to look at the reasons why they should not have sex, which led them to have sex at a later age. Those adolescents who had sex at younger ages were found to have higher suicidal ideation and greater problem behaviors than their white peers who had sex at a later age. This model

demonstrates support for the Normative Hypothesis (13) that those who deviate from the social sexual norms will evaluate themselves negatively.

Implications for Future Research

The findings suggest that it would be helpful to move away from the traditional measures of self-esteem affecting onset of first intercourse toward other variables that have not been looked at in understanding sexual onset and psychological problems. The hope is to find variables that may prove to have more predictive qualities, thus helping researchers understand what variables are associated to positive and negative outcomes for black and white adolescent males.

In addition future research needs to focus on developing models that are more culturally competent. Based on this study the normative theory has been shown to be effective in explaining sexual behaviors among the white population. However, it is unclear the explanatory power for black males in this study, as it was much weaker than for the white males. This may be due to the theory not taking into account cultural aspects that influence sexual behaviors among the black population. Therefore, the development of theoretical frameworks that are inclusive of multiple races would be an important area of future research.

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A&FH

Effectiveness of a Sex Education Program to delay Coital Debut among Public School Adolescents

Kristen A. Plastino, MD, Alan E. C. Holden, PhD, Robert S. Schenken, MD

Abstract

Sexual activity is frequent among adolescents, with consequences such as sexually transmitted diseases (STDs) and unintended pregnancy. We evaluated the University of Texas Health Science Center at San Antonio Sex Education Program (UTHSCSA SEP), our abstinence-focused intervention on knowledge, attitudes, and behavioral intentions of 1,118 predominantly Mexican-American middle school adolescents in grades 6-8. We hypothesized higher levels of knowledge of the potential consequences of sex, more positive attitudes towards delaying sexual activity, and increased commitment to abstinence. Students received 10 weekly, 45-minute sessions about the potential negative consequences of sex, methods of preventing STDs and pregnancy, and communication skills to negotiate lowest-risk relationships. We simultaneously conducted adult mentoring seminars for teachers presenting the curriculum and parents of participants, district-wide symposia, and a community-wide media campaign including establishment of a Program website. Effectiveness was evaluated from Pre-Test to Post-Test using Chi-Square, T-test, and multivariate logistic regression. Knowledge increased significantly (54% to 67%, $p < .01$). Attitudes reflected increased beliefs that sex is not a safe activity for teens, abstinence is the most effective means of preventing consequences, and that a person should practice abstinence until in a long-term relationship. At Pre-Test, 54% of participants were committed to abstinence and 67% at Post-Test ($p < .01$). This change was explained by increased knowledge and more positive attitudes. The intervention significantly increased knowledge about sexual activity and created more positive attitudes and increased commitment to abstinence. Shifts in knowledge and attitudes were significantly associated with intentions to abstain from sex until in a long-term relationship.

Keywords: adolescent health, adolescent sexuality, abstinence, minority youth, coital delay, sex education, contraception, sexually transmitted disease, intervention, evaluation.

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BACKGROUND

Adolescent sexual activity is a major national concern (Alan Guttmacher Institute, 2004). The CDC reported that approximately 19 million sexually transmitted diseases (STDs) occur annually, (Weinstock H, Berman S, Cates WJ., 2000) and approximately 3.8 million cases occurred among one in four sexually active teens in 2003 (American Social Health Association, 2005). From 2000-2003, gonorrhea increased among 16-19 year olds by 45% and chlamydia and genital warts by 53% and 25%, respectively (Centers for Disease Control and Prevention, 2003). The total costs associated with all STDs in this age group are estimated to have been 6.5 billion dollars in 2003 alone (Chesson HW, Blandford JM, Gift TL, Tao G, Irwin KL., 2000).

Contraceptive effectiveness is lowest among sexually active teens, (DiClemente RJ, Wingood GM, Harrington K, Davies S, Hook EW, 3rd, Oh MK, Crosby RA., 2002) who are 3 times more likely to become adolescent mothers if coital debut occurs prior to age 16 (Alan Guttmacher Institute, 2004; 1994). Despite recent declines, 9% of adolescent girls still become pregnant each year, of which 80% are unintended and half end in abortion (Alan Guttmacher Institute, 2004, Singh S, Darroch J., 2000). Oral and implant contraceptives provide the greatest protection from pregnancy. However, none protect against STDs and some may actually

increase the risk of cervicitis and other infections (Critchlow CW, Wolner-Hanssen P, Eschenbach DA, Kiviat NB, Koutsky LA, Stevens CE, Holmes KK., 1995; Ness RB, Soper DE, Holley RL, Peipert J, Randall H, Sweet RL, Sondheimer SJ, Hendrix SL, Amortegui A, Trucco G, Bass DC, Kelsey SF., 2001).

Adolescent motherhood has been linked to increased probability of single parenthood, dropping out of school, and underemployment (Woodward VM., 1995; Crosby RA, DiClemente RJ, Wingood GM, Sionean C, Cobb BK, Harrington K, Davies S, Hook EW, 2001). Sexually active teenagers are more likely to express feelings of regret (van der Pligt J, Richard R., 1994), and are at increased psychosocial risks including depression and suicide (Orr DP, Beiter M, Ingersoll G., 1991; Shrier LA, Harris SK, Sternberg M, Beardslee WR., 2001; Kosunen E, Kaltiala-Heino R, Rimpela M, Laippala P., 2003). Children of teen mothers more often are born into a single-parent household, live in poverty, experience suboptimal nutrition, receive inadequate health care, underachieve in school, and experience more abuse and neglect (Spear HJ. A., 2004; Page ME, Stevens AH., 2005; Cherlin AJ., 1999; Card J., 1999).

Sex education, therefore, mandates a high priority, yet it continues to be a strongly contested issue with opposing views centered on the appropriateness of teen sexual activity rather than reproductive health itself

(Vishio J., 2001). Some approaches to sex education containing medically inaccurate information with either abstinence or contraception as the cornerstones of sexual health promotion have manifestly failed (Card J., 1999; Landry DJ, Kaeser L, Richards CL., 1999; Haignere CS, Gold R, McDanel HJ., 1999; Thomas MH., 2000; Robinson AJ, Williams O., 2001). Inaccurate information from the news media and exposure to pressure from peers and the entertainment industry reduce the potential benefits of education programs that emphasize messages about the zero-risk status of delaying coital debut (Werner-Wilson RJ, Fitzharris JL, Morrissey KM., 2004; Escobar-Chaves SL, Tortolero SR, Markham CM, Low BJ, Eitel P, Thickstun P., 2005; Tayler LD., 2005). The need to deliver unambiguous messages about the potential consequences of adolescent sexual intercourse has been noted by the American Academy of Pediatrics, who in their Policy Statement on Sexuality Education for Children and Adolescents emphasize both the value of delaying coital debut and the role of physicians in educating teens regarding all aspects of reproductive health (American Academy of Pediatrics, 2001; 2005).

School-based prevention programs can influence teens' knowledge of and attitudes towards sexual activity, resulting in a delay of sexual debut and/or a reduction of sexual activity with associated declines in pregnancy and STD rates (Doniger AS., 2001; Bearman PS, Bruckner H., 2001; Jorgensen RS, Potts V, 1993; Caron F, Godin G, Otis J, Lambert LD., 2004; Denny G, Young M, Rausch S, Spear C.,). Effective school-based prevention programs have been documented in other areas such as smoking and substance abuse (Shegog R, McAlister AL, Hu S, Ford KC, Meshack AF, Peters RJ, Jr., 2005; Trudeau L, Spoth R, Lillehoj C, Redmond C, Wickrama KA., 2003). Recognizing the effectiveness of school-based prevention programs and the high incidence of teen pregnancy and STDs in Bexar County, the University of Texas Health Science Center at San Antonio implemented a sex education program (UTHSCSA SEP), a theory-based, culturally sensitive, age-appropriate multi-component program to provide information and skills to teens and adults.

Here we present an evaluation of program effectiveness in middle-school adolescent participants. We hypothesize that the program will delay adolescent sexual activity through increasing knowledge about sexuality and the potential consequences of it. Long-term program impact on STD and adolescent pregnancy rates will be reported as data become available.

METHODS

Overview

The Institutional Review Board of the University of Texas Health Science Center at San Antonio and the school board of the involved school district ap-

proved this study. All participants received the UTHSCSA SEP consisting of 10 lessons presented throughout the academic year in science classes, supplemented by targeted school-related activities such as a Creative Arts contest to reinforce the curriculum messages. The program included curriculum-based prevention information and life skills instruction, peer support, adult mentoring seminars for teachers presenting the curriculum and parents of participants, district-wide symposia, community involvement and a large media campaign including a Program website. Specific content was adopted from the Scott & White "Worth the Wait"[®] curriculum, emphasizing coital delay and adhering to stipulations outlined in Section 510 of Title V of the Social Security Act (Page ME, Stevens AH., 2005).

Recruitment

Students from participating middle schools were given an "opt-in" form before receiving the UTHSCSA SEP curriculum. A parent or guardian signed and returned the form if they wanted their child to "opt in" to the program. Approximately 1,132 students were invited to participate in the study and only 14 students (1.2 %) declined. There were no significant differences between participants and nonparticipants with respect to grade level or school.

Sample and Procedures

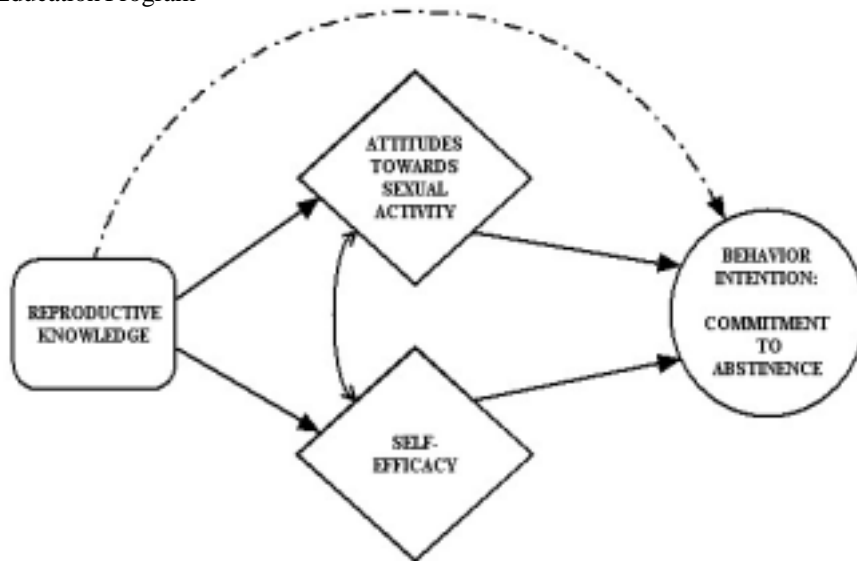
Tests were administered to 1,068 students before taking the curriculum (Pre-Test) and 1,095 following the curriculum (Post-Test). All participants received the curriculum and opportunity to participate in other program activities. No randomization was employed and no control group was utilized for comparison of program effects. All participants on each campus received a Pre-Test at the same time, attended classes according to regular scheduling routines, and received a Post-Test to measure changes in knowledge, attitudes, and beliefs after completing the curriculum. The tests were confidential and without identifiers. All questions were pilot tested throughout central Texas and elsewhere to ensure that they were clear and that the phrasing of all items was appropriate for the age, gender, and ethnic background of the target population (Sulak PJ, 2004).

The Pre-Test and Post-Test questionnaires assessed attitudes towards sexual intercourse during adolescence, knowledge of its potential consequences, demographic variables, and mediator constructs which we expected to explain observed changes in primary outcomes. We also assessed Pre-Test – Post-Test changes in other variables associated with the target outcomes, particularly smoking, alcohol, and drug use. Completed forms were collected by UTHSCSA SEP staff and scanned for data analysis.

The Intervention

The UTHSCSA SEP specifically seeks to (1) increase knowledge of teen pregnancy and STDs, including AIDS, by describing their potential negative consequences and the reduced risks of these associated with delaying sexual activity, (2) foster self-protective attitudes and beliefs regarding the benefits of abstinence, (3) increase self-efficacy and resiliency to resist pressure to engage in sexual intercourse and the ability to recognize risks and negotiate abstinence in relationships, and (4) evoke a decision among adolescents to remain abstinent until marriage. The conceptual model assumes that increased knowledge about reproductive health will influence beliefs and attitudes about adolescent sexual activity, leading to a decision to remain abstinent (Figure A). This conceptualization is based on findings in theoretical research in learning theory posited in Bandura’s Social Cognitive Theory (Bandura A., 1986), relational dynamics of attitudes and behavior intentions described in the Theory of Planned Behavior/Reasoned Action (Ajzen I., 1985), and particularly protective and preventive cognitive and behavioral constructs derived from Fisher and Fisher’s more recent Information-Motivation-Behavioral Skills Theory, tailored specifically to prevent HIV, STDs, and unplanned pregnancy (Fisher JD, Fisher WA, Bryan AD, Misovich SJ., 2002).

Figure A Conceptual Model of the UTHSCSA Sex Education Program



Primary Outcome Measures

The primary outcome variable was the adolescent’s decision to delay sexual activity until married. Based on our theoretical model, we assumed that behavior is volitional, i.e. subject to decisions by the actor (Ajzen I., 1985), and are reliable to the extent that we interpret intentions and recognize the possibility of external influences acting upon them (Flay BR, Graumlich S, Segawa E, Burns JL, Holliday MY, Aban Aya I., 2004). We did not collect data about specific behaviors, because

Effectiveness of a Sex Education Program

unlike intentions, reports of sexual behavior 1) lack validity in the sense that they do not reflect actual behavior and are subject to recall bias 2) are subject to reporting bias related to the social desirability of particular responses, and 3) may not be age-appropriate (comprehension may be compromised) (McArdle P. 2002).

Secondary Outcome Measures

The secondary outcomes included potential mediators of the effects of the SEP on volition decisions. These dealt with knowledge and attitudes (based on concrete information presented in the course of the program), beliefs (instilled ideas based on opinion rather than fact), and self-efficacy, or the confidence in one’s ability to organize and execute a course of action to attain a goal (Bandura A., 1986). Knowledge of and attitudes to sexual behavior, potential consequences, and effectiveness of pregnancy/STD prevention methods were measured using a formal test approach using age/grade appropriate questions. The Knowledge Test is presented in Figure B. The 6th grade test consisted of 10 questions; the 7th grade test consisted of the 10 6th grade questions plus 7 additional questions, and the 8th grade test consisted of the 17 6th-7th Grade questions plus 8 additional questions. Questions contained only one

correct response; scores were calculated as the number of correct responses divided by the total number of questions. We also measured four attitudes towards the safety of sexual intercourse among adolescents that we expected to change based on information about potential consequences of it presented in the curriculum. One item directly assessed adolescent generalized perceptions of the safety of sexual activity among teens. Three items measured

adolescent perceptions of specific potential consequences of sexual activity, focusing on pregnancy and STDs.

We assessed four beliefs about teen normative expectations of sexual behavior focused on the timing of initiation of sexual intercourse and the role of parents and physicians in this decision process. Finally, we evaluated two dimensions of self-efficacy. We asked a whether participants thought they could resist engaging in sexual intercourse if pressured to do so, and a second question if teens felt able to resist urges to have sex.

6th Grade Questions

1. The gland in the brain that releases hormones to start the changes of puberty is the pituitary.
2. The decision not to have sex until marriage is called abstinence.
3. The testes produce sperm and testosterone.
4. When an egg and sperm unite, it is called fertilization.
5. The chemicals released into the bloodstream by glands are hormones.
6. Ovulation is when an egg is released from a woman's ovaries.
7. Condoms are 100% effective in preventing STDs. False
8. STDs can be caused by both bacteria and viruses. True
9. Child abuse is usually committed by a stranger. False
10. You cannot get an STD or become pregnant the first time you have sex. False

7th Grade Questions

11. A person may have contracted an STD and not know it because many STDs have no visible symptoms. True
12. Date rape drugs usually have no taste when added to a drink, include Rohypnol & GHB, and effect the memory of the person taking them. ("All of the above")
13. The best way to avoid getting an STD is to not have sex. True
14. STDs caused by bacteria can be cured. True
15. Renewed abstinence is when someone stops having sex and decides to wait until marriage. True
16. A person infected with HIV may look and feel fine.
17. Human Papillomavirus causes genital warts.

8th Grade Questions

18. Some sexual activities are LEGAL for adults, but ILLEGAL for teens. True
19. At age 17 a person can legally consent to sex.
20. Children of teen mothers are more likely to grow up in a home without a father.
21. Fertilization occurs in the fallopian tube.
22. The number of high school students in the U.S. having sexual intercourse in the 1990s has decreased.
23. Most people get STDs from someone who has no symptoms.
24. The STD that can cause cancer in females is human papillomavirus (HPV).
25. Pelvic Inflammatory Disease (PID) can cause infertility.

Research Design

We assessed program effects on primary and secondary outcomes using a single-group Pre-Test – Post-Test quasi-experimental study design, where grouped subject Pre-Test measures served as their own control at Post-Test. Weaknesses in this approach include threats to validity by factors such as history, maturation, regression and testing, so a nonequivalent dependent variable (NED-V) “I will avoid drugs and alcohol in the future” was used (Shadish WR, Cook TD, Campbell DT. 2002).

Power and Sample Size

A proportional change of 10 percentage points from baseline was considered clinically significant. We calculated a range of possible Pre- Post-Test comparisons, using $p = .05$ (the maximum acceptable type I error rate) for a 2-tailed, one-sample Pre-Test – Post-Test

design (Box GEP, Hunter WG, Hunter JS. 1978). The estimated required sample size ranged from $n=665$ for Pre-Test response incidence of 33% to $n=328$ for Pre-Test response incidence of 65%. An estimated sample size of 665 was adequate to provide 80% power to detect a change at Post-Test of 10 percentage points for each variable.

Statistical Analyses

Chi-square or T-tests were used as appropriate for nominal or continuous measures to compare demographic characteristics at Pre-Test and Post-Test. Hypothesis regarding primary and secondary conceptual variables were tested with analysis of covariance (Knowledge Test) or multivariate logistic regression analysis (for nominal dependent measures) (Hosmer DW, Lemeshow S, 2000). We compared pre-Post-Test values using a time-of-administration factor (Pre-Test vs. Post-

Test), and controlled for participant age, gender, ethnicity, grade, and self-reported typical grades in school when necessary. Prior to analysis of covariance, Knowledge Test reliability was calculated using the Rulon Split-Half Formula and the Kuder-Richardson Reliability Formula 20 (KR-20) for dichotomous items (Kuder GF, Richardson MW, 1937). The Breslow-Day Test was used for stratified analysis of 2 × 2 tables to test the null hypothesis that the odds ratios for the 2 strata (represented by the target dependent variable compared to the nonequivalent dependent variable) were equal (Breslow NE, Day NE, 1994). In post-hoc analyses, we used multivariate logistic regression to model commitment to abstinence, testing the 8 secondary outcome measures as predictor variables. Sample sizes vary slightly (< 2%) because of missed classes or participants' failure to respond to questions.

RESULTS

Characteristics of the Sample

Subjects were primarily Hispanic adolescents (82%) from sixth, seventh, and eighth grade classes (mean age, 13.4 years) comprising a school district serving low-income neighborhoods in San Antonio, Texas. Gender was evenly distributed, 54% lived with both parents, and 67% and 83% reported having a “good” relationship with father and mother, respectively. Additionally, 63% reported watching 3+ hours of television on typical “school” nights, and 74% reported “typical” course grades of “A” or “B”.

Comparability of Pre-Test and Post-Test Samples

T-Test and Chi-Square analyses revealed no significant demographic differences between Pre-Test and Post-Test samples (Table 1). Use of illegal drugs, alcohol, or tobacco products were also equivalent: at Pre-Test, 17% of teens reported “ever” using illegal drugs compared to 18% at Post-Test; 19% used alcohol “now” or “in the past” compared to 21% at Post-Test; and 13% used tobacco “now” or “in the past” at Pre-Test vs. 16% at Post-Test. Tobacco use was the only measure that trended to be different between the two samples, p=0.098.

Program Effects

Program effects are presented in Table 2. Adolescents were significantly more likely to report a commitment to abstinence following program participation. About one-third of adolescents were committed to avoiding sexual activity at Pre-Test (34%), while almost half reported the same commitment at Post-Test (49%). The program accounted for a 45% increase in abstinence commitment, an adjusted odds ratio of 1.91

Variable	Pre-Test n = 1068	Post-Test n = 1095	t for Chi-Sq	Significance p
Age:				
12	10.4%	10.9%		
13	43.5%	47.8%		
14	39.6%	36.0%		
15	6.5%	5.1%		
Mean + SD	13.4 + 0.79	13.5 + 0.77	0.858	0.776
Grade				
6	21.2%	21.6%		
7	37.2%	37.9%		
8	41.6%	41.5%		
Mean + SD	7.4 + 0.44	7.3 + 0.41	0.645	0.872
Gender				
Male	48.1%	48.0%		
Female	51.9%	52.0%	0.006	0.941
Ethnicity				
Hispanic	82.0%	81.1%		
Other (3 groups)	18.0%	17.9%	0.019	0.890
Typical Grades				
A/B	73.6%	73.2%		
C/D or less	26.4%	26.8%	0.047	0.829
Use Tobacco once/wk				
Yes	13.2%	15.7%		
No	86.8%	84.3%	2.742	0.098
Use Alcohol once/wk				
Yes	18.8%	20.5%		
No	81.2%	79.5%	1.027	0.311
Ever used illegal drugs				
Yes	17.0%	17.9%		
No	83.0%	82.1%	0.329	0.566
Live with Both Parents				
Yes	54.1%	54.2%		
No	45.9%	45.8%	0.001	0.981
Good Relations w /Father				
Yes	66.6%	66.9%		
No	33.4%	33.1%	0.028	0.867
Good Relations w /Mother				
Yes	83.3%	84.8%		
No	16.7%	15.2%	0.942	0.332
Watch TV 3+ Hours/wk				
Yes	62.6%	64.2%		
No	37.4%	35.8%	0.660	0.417
Note: Due to missing values some cells may contain up to 3% missing values.				

Knowledge test scores were reliable. At Pre-Test, the Rulon split-half coefficient for the scale ranged from 0.69 – 0.71 for the 6th, 7th, and 8th grades and the KR-20 coefficient ranged from 0.68 – 0.72. We also estimated a Pre-Test – Post-Test Split-Half reliability for the scale, producing a coefficient ranging from 0.73 – 0.79 between the Pre-Test and Post-Test administrations. Average inter-item correlations ranged from $r = 0.16$ to $r = 0.31$ across all grades and time-of-administration points. At Pre-Test, participants answered 54% of knowledge test questions correctly. At Post-Test, the percentage of correct responses increased to 67%, a proportional increase of 23% over Pre-Test scores. Analysis of covariance indicated a strong program effect ($p < .001$).

Participants demonstrated significant shifts in all four measured attitudes from Pre-Test to Post-Test. Results reflected % changes ranging from 13.0% (“Sex is not a safe activity for teens”) to 21.5% (“Condoms do not always protect against pregnancy and STDs”). Breslow & Day Homogeneity of Odds Ratio tests were significant when comparing pre-Post-Test odds ratios for each of the attitude variables to the non-equivalent dependent variable (all $p < .001$). Significant increases also occurred with respect to beliefs. The largest changes occurred in “a person should wait until in a long-term relationship before engaging in sex” and “MDs should ask 14-year-old teens about sex, discourage sexual activity, and discuss contraceptive failure rates”. Each belief increased by approximately 25%, with the exception that “it is not okay for unmarried teens to get pregnant” (8.6%).

Results regarding self-efficacy measures were less than for Behavioral Intentions, Knowledge, Attitudes, and Beliefs. Slight increases occurred with respect to both measures of effectiveness; only one increased significantly (by statistical criteria) over baseline values. At Post-Test, significantly more teens than at Pre-Test felt that “If pressured, I know how to resist having sex” (81.0% vs. 76.5%, AOR=1.28, $p = .033$). Similarly, more respondents at Post-Test than Pre-Test felt that “I know how to resist my sexual urges” (70.9% vs. 68.4%, AOR=1.13, $p = .215$). However, the percent change in both of these measures (5.9% for resisting having sex if felt pressured and 3.7% for resisting one’s own sexual urges) was less than the 10% change that we considered to be clinically significant in our planning phase of the program.

Factors Associated with Abstinence Intentions at Post-Test

Our post-hoc analysis of factors associated with abstinence are presented in Table 3. Neither ethnicity (Hispanic vs. Others), grade level, gender,

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nor typical grades achieved in other academic work entered the model at $p < .05$. The model was dominated by all four Beliefs and one Attitude measure, which each entered the model in the expected direction, with the belief that a person should wait until in a long-term relationship before engaging sex (AOR=4.05, $p < .001$) and the attitude that sex is not a safe activity for teens (AOR=3.31, $p < .001$) accounting for approximately one-half of the likelihood of making a commitment to abstinence. Older participants were more likely to make a commitment to abstinence than younger participants ($p = .043$, AOR = 1.23).

DISCUSSION

Our results show that a medically accurate, culture- and gender-tailored cognitive intervention emphasizing abstinence can increase knowledge about reproductive health, alter attitudes towards sexual activity, and promote teen commitments to delay sexual activity. The intervention increased protective changes in several theory-based intermediate measures leading to abstinence decisions at the Post-Test assessment. We note a relatively weaker influence of the intervention on measures of perceived self-efficacy, and are exploring factors associated with increased self-efficacy in this population, with the intention to strengthen this aspect of our program. Nevertheless, the intervention demonstrated a consistently positive impact on targeted outcomes, especially regarding the potential negative consequences of sexual activity among young adolescents. Our findings are consistent with the formal evaluation of four Title V abstinence education programs, which suggests that abstinence pledges probably maintain their impact for 3 to 6 months (the maximum follow-up in the studies) (Maynard R, Trenholm C, Devaney B, Johnson A, Clark M, Homrighausen J, Kalay E, 2005). Accordingly, we anticipate substantial lagged (by approximately two to five years) declines in pregnancy and sexually transmitted disease rates in the target adolescent community.

To our knowledge, this is the first rigorous test of an ecological, school-based sexual education program emphasizing abstinence in a primarily Hispanic school-aged population. We explicitly sought to apply medically accurate information to our program design, and reviewed its content thoroughly to eliminate the possibility of misleading participants about the potential benefits of abstinence. From the standpoint of a multisystems approach to the problems of sexually transmitted infection and teen pregnancy, the UTHSCSA SEP meets the requirements of an ecological approach to “educate everyone” involved with the school community, including students, parents, educators, and health care providers.

From the perspective of research design, we have addressed issues of appropriate application of the scientific method at a school-wide level, compensating

Table 2. Percent Responses (Pre-Test vs. Post-Test) to Primary and Secondary Outcome Measures of Knowledge, Beliefs, and Attitudes of All Middle School Students						
Measure	Pre-Test	Post-Test	Adjusted O.R. 95% CI	Effect Size (%) (%)	P	Breslow-Day H.O.R. Sig. P
Behavioral Intention:						
Have made a commitment to abstinence	33.8%	49.3%	1.91 1.60 - 2.30	45.3%	< 0.001	< 0.001
Knowledge Test (% Correct):	54.1%	67.2%	N/A	23.1%	< 0.001	N/A
Attitudes:						
Sex is not safe activity for teens	74.4%	84.1%	1.88 1.50 - 2.37	13.0%	< 0.001	< 0.001
Condemn do not always protect against pregnancy and STDs	70.1%	85.2%	2.86 2.27 - 3.60	21.5%	< 0.001	< 0.001
Agree that abstinence will prevent STDs, pregnancy, and emotional problems	68.4%	81.3%	2.22 1.79 - 2.75	18.9%	< 0.001	< 0.001
Agree that abstinence is the only 100% effective means of preventing pregnancy and STDs	68.5%	78.6%	1.82 1.48 - 2.24	14.7%	< 0.001	< 0.001
Beliefs:						
It is not okay for unmarried teens to get pregnant	76.4%	83.0%	1.59 1.28 - 2.00	8.6%	0.003	< 0.001
Agree that a person should wait until in a long-term relationship before engaging in sex	48.1%	59.9%	2.15 1.79 - 2.58	24.5%	< 0.001	< 0.001
Agree that MDs should ask 14 year-old teens about sex and discourage sexual activity, and discuss contraceptive failure rates.	46.2%	57.9%	1.63 1.26 - 2.11	25.3%	< 0.001	< 0.001
Believe that when discussing sex with their children, parents should discourage sex prior to marriage	26.2%	33.3%	1.58 1.27 - 1.96	27.1%	< 0.001	< 0.001
Self-Efficacy:						
If pressured, I know how to resist having sex	76.5%	81.0%	1.28 1.02 - 1.60	5.9%	0.033	0.016
I know how to resist my sexual urges	68.4%	70.9%	1.13 0.93 - 1.39	3.7%	0.215	0.083
Non-equivalent dependent variable:						
From now on, I will avoid drugs and alcohol	51.6%	50.8%	0.93 0.78 - 1.11	-1.6%	0.423	N/A
* Effect size = the post-pre difference divided by the Pre-Test value * 100, representing the % change from Pre-Test ** Mean % correct of 10 items for 6th grade students, 17 items for 7th grade students and 25 items for 8th grade students						

Table 3. Multiple Logistic Regression Model of Factors Associated with Abstinence Intentions at Program Post-Test						
Variables	B	S.E. B	Wald	Sig P	Adjusted O.R.	95% C.I.
Participant Age	0.29	0.12	3.56	0.043	1.23	1.03 - 1.83
Sex is not a safe activity for teens	1.20	0.23	26.19	0.001	3.31	2.09 - 5.24
It is not okay for unmarried teens to get pregnant	0.50	0.22	5.36	0.021	1.65	1.08 - 2.51
Agree that a person should wait until in a long-term relationship before engaging in sex	1.40	0.15	82.89	< 0.001	4.05	3.00 - 5.48
Agree that MDs should ask teens about sex and discourage sexual activity, and discuss contraceptive failure rates.	0.32	0.15	4.64	0.031	1.40	1.03 - 1.85
Believe that when discussing sex with their children, parents should discourage sex prior to marriage	0.50	0.18	7.40	0.007	1.64	1.15 - 2.35
Constant	-2.3	0.25	87.38	0.000	0.101	

for the lack of a randomization scheme and control group by utilizing a “pledge for a pledge” comparison variable to validate results. More importantly, this intervention utilized strict scientific evidence that abstinence is equivalent to “zero exposure” in the sense of disease acquisition, and is therefore the most desirable strategy for teens to avoid infection and pregnancy. We grounded our intervention in sound theory, and supplemented it with information gathered during formative research with adolescents from the study population.

Moreover, our intervention has avoided many of the criticisms directed at abstinence education. We provided medically accurate information, did not portray sexual activity per se in a negative light, and the curriculum was neither judgmental nor moralistic. Future research must test the impact of the cognitive changes observed in this study against actual behavioral change, and understand the extent of these promising effects.

A limitation of this study was that participants self-report measured primary and secondary outcomes, which have been demonstrated to be inaccurate for a wide variety of reasons including predictive, concurrent, prospective, and retrospective validity, as well as social desirability and learning effects. Although these influences cannot be ignored, we believe that several aspects of our study render self-report bias less likely an

explanation for our findings. The inclusion of a non-equivalent dependent variable (NED-V) is an especially compelling reason to exclude self-report bias to explain our findings: whereas the comparison measure (pledge to avoid drugs and alcohol) was virtually stable from Pre-Test to Post-Test, we found changes in program-targeted measures. Additionally, by focusing on a particularly popular adolescent subject, sexual activity, we believe it likely that we reduced the probability of participant inaccuracy of self-reports.

Our results support a number of straightforward conclusions. Long-term, school-based, theoretically-grounded culture- and gender-sensitive interventions designed to influence mediators of making a commitment to avoid sexual activity are an effective mechanism to create a cognitive environment among adolescents that should reduce risks of teen pregnancy and sexually transmitted disease. Grounding prevention messages in theory and incorporating it into regular classroom curricula can achieve successful delivery of an intervention. These results must be replicated in other adolescent populations and settings. By conducting such research, it may be possible to prevent STDs and unwanted pregnancies that adolescents may face as they prepare for adulthood.

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Kristen A. Plastino, M.D., Alan E. C. Holden, Ph.D, and Robert S. Schenken, M.D. are at the Department of Obstetrics & Gynecology, The University of Texas Health Science Center at San Antonio.

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Dr. Brent B. Benda is a Professor in the School of Social Work at the University of Arkansas at Little Rock. Correspondence concerning this manuscript should be addressed to: Dr. Brent B. Benda, Professor, School of Social Work, University of Arkansas at Little Rock, 2801 S University, Little Rock, AR 72204-1099. (email: bbbenda@ualr.edu)

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