The Pubertal Development Scale:
A Rural and Suburban Comparison

Elizabeth B. Robertson
University of North Carolina at Greensboro
Martie L. Skinner
University of North Carolina at Chapel Hill
Margaret M. Love
University of Kentucky
Glen H. Elder, Jr.
University of North Carolina at Chapel Hill
Rand D. Conger
Iowa State University
Judith S. Dubas
Pennsylvania State University
Anne C. Petersen
University of Minnesota

The Pubertal Development Scale (PDS) is a noninvasive measure of pubertal development. The purpose of this study was to compare means and standard deviations on the PDS across samples of seventh graders from rural Iowa and suburban Chicago who were matched on gender, age, race, and grade in school. Matched samples of boys each comprised 50 subjects; those of girls each comprised 52 subjects. Results of MANOVAs showed that rural Iowa girls were more advanced on the five markers of pubertal development than were suburban Chicago girls. Rural Iowa boys were more advanced than their counterparts in the suburban Chicago sample on four of the five markers. Psychometric analysis of the five-item scale suggested adequate internal consistency for boys and girls (.66 to .81). The predictive validity of the PDS was satisfactory. Possible reasons for differences in rates of development are discussed.

Sophisticated assessments of pubertal development, such as hormone assays and physical examinations, may not be appropriate or welcomed in some settings. Adolescents, their parents, and school officials generally find self-

Journal of Early Adolescence, Vol. 12 No. 2, May 1992 174-186

report measures more acceptable. The Pubertal Development Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988) was designed in response to this need for a noninvasive assessment of pubertal status. With this short self-report instrument, adolescents rate their maturational status on five markers of pubertal development using a four-point scale.

The PDS has become widely used because of its ease in administration and apparent validity (Petersen et al., 1988; Petersen, Tobin-Richards, & Boxer, 1983), although no population-based samples have been used to establish norms by age, race, or gender. However, if previously reported data (Petersen et al., 1983, Petersen et al., 1988) are consistent with population norms, one would expect that data collected in another location, on a sample matched on relevant factors, would produce equivalent means and psychometric properties. This would constitute one step toward establishing generalizable means and standard deviations for the PDS. The present study was designed to accomplish three purposes. The primary purpose was to compare mean levels of development as reported on the PDS across matched samples of early adolescents from the same region of the country but with different residential and socioeconomic characteristics. Additional purposes were to compare psychometric properties of the scale with those found in a previous study of the measure (Petersen et al., 1988) and to assess predictive validity by comparing correlations between the PDS and measures of heterosexual peer involvement in this sample to those found in the literature.

When examining the psychometric properties of a scale, possible limitations of the measure must be considered. The two major criticisms of self-report measures are the likelihood of reporter bias and the relative nature of the reports. Data concerning reporter bias have been provided in the literature (Brooks-Gunn & Warren, 1985, Brooks-Gunn, Warren, Rosso, & Gargiulo, 1987) and cannot be addressed in this study because criterion measures of pubertal development were not collected.

The second issue, that of relative reporting, poses some interesting problems. First, adolescents might report their own development relative to some referent, such as peers, expected adult physique, or cultural norms based on magazines, television, or movies. Second, the impact of the relative nature of self-reports on comparisons of mean levels of development between samples depends on the nature of the reference group. If it is local (as in

---

This article is based on collaborative research involving the Iowa Youth and Families project at Iowa State University, Ames, and the Social Change Project at UNC-Chapel Hill. The combined research effort is currently supported by the National Institute of Mental Health (MH43270), the National Institute on Drug Abuse (DA0547), the John D. and Catherine T. MacArthur Foundation Program on Successful Adolescent Development Among Youth in High Risk Settings, the Bureau of Maternal and Child Health (MCJ-109572), a Research Scientist Award (MH00567), and the Adolescent Mental Health Study at Pennsylvania State University.

school peers), real differences in maturation between samples due to diet, ethnicity, medical care, social class, and so forth might be masked. For example, an average girl whose peers are all early maturing girls might rate her own development as *barely started* when, in fact, her development is *definitely under way*, whereas a girl of similar developmental status in a group of less advanced girls might rate her development as *completed*. On the other hand, if the reference for comparison is based on a larger cultural model (as a cover girl or a popular television character) real differences between samples might be reflected in relative self-ratings. In this case, most early adolescents are using the same or similar gender-appropriate references. Therefore, mean differences between self-reports from two samples would not be attributable to the relative nature of the measure.

Other methodological problems may account for mean score differences where real differences do not exist. For example, the complexity of social meanings attached to age and grade in school make it imperative that these factors be considered when examining differences across groups. Comparisons based on grade alone may ignore vast differences in the age distribution of the samples involved. Likewise, when samples are compared on the basis of age, the social context, as represented by grade in school, is ignored. More accurate comparisons can be made when samples are matched on both factors. Moreover, because girls mature earlier than boys (Marshall & Tanner, 1969, 1970) and there appear to be cross-cultural differences in development (Udry & Cliquet, 1982), gender and race must be taken into account. One purpose of the present study was to compare mean levels of development across two samples matched on race, gender, age, and grade in school. They were not matched on school structure (which grades are included in a particular school) or other contextual variables. Variances across the two groups also were compared to determine if development on particular markers varied substantially more in one sample than in the other.

The PDS has also been used to construct a scale in which the individual markers of development are combined into a mean score. The usefulness of such a scale depends on the correlations of individual items and the scale's predictive validity. Thus a second purpose of this study was to compare the psychometric properties of the scale with those found in a previous study of the measure (Petersen et al., 1988). Further, even when there is a problem with reporter bias, relative rankings on self-report measures may still be valid. If relative rankings on the PDS are valid, correlations between the PDS and other measures should be consistent with those found in the literature. Studies of self-rated maturation have found that pubertal status is associated with dating and the onset of sexual behavior (Smith, Udry, & Morris, 1985; Udry, 1988; Udry & Cliquet, 1982). The third purpose of this study was to

check for predictive validity by calculating correlation coefficients between the PDS and several measures of heterosexual peer involvement.

METHOD

Samples

Comparison groups used in these analyses came from two separate studies: the Iowa Youth and Families Project (Rural Iowa Sample) and the Early Adolescent Study (Suburban Chicago Sample; Petersen, 1984). The Rural Iowa Sample was composed of 451 White, seventh-grade children from intact families. The Early Adolescent Study was composed of 253 adolescents followed annually from sixth to eighth grade (Petersen, 1984). These adolescents were from White, middle- to upper-middle-class primarily intact families. For the present study, only those seventh graders for whom there were data on the PDS markers and age were included. This subsample consisted of 50 male and 52 female subjects of Cohort 2 of the Suburban Chicago Sample (Petersen, 1984).

To control for age, a subsample of 50 boys and 52 girls was selected from the Rural Iowa Sample. Subjects were matched using the following procedure. Suburban Chicago and rural Iowa subjects were subgrouped by gender and age in tenths of years. A count of the suburban Chicago boys at each tenth of a year was taken. A matching number of boys from the Rural Iowa Sample at each tenth of a year was then randomly selected to create a matched sample of boys. For example, 4 of the suburban Chicago boys were between 12.60 and 12.69 years of age. Four boys were randomly selected from the 11 boys who fell within that age range in the Rural Iowa Sample. The same procedure was used to create a matched sample of girls. Thus the two samples were matched on child's gender, age, race, and grade in school. They were not matched on school composition or other social context variables such as social class.

Demographic data on the rural Iowa matched sample and the suburban Chicago sample are presented in Table 1. Equivalent data on parents' occupations and family income for the suburban Chicago sample were not available. However, according to the United States Census Bureau, the 1980 median family income for the two communities comprising the Suburban Chicago Sample were $42,600 and $57,657. For the same time period, median family income for the eight rural counties from which the Rural Iowa Sample was drawn ranged from $18,240 to $20,719.

TABLE 1: Demographic Characteristics: Comparison of Suburban Chicago and Rural Iowa Matched Samples

	Suburban Chicago			*Rural Iowa*		
Index	$\bar{X}$	SD	*Range*	$\bar{X}$	SD	*Range*
		(n = 21)[a]			(n = 50)	
Boys						
Age	13.0	.3	12.3-13.8	13.0	.3	12.3-13.8
Father's education[a]	16.2	2.6	8-19	13.8	2.4	8-17
Mother's education	15.5	1.9	12-19	13.7	1.6	12-19
Father's occupation[c]				5.4	2.7	1-9
Mother's occupation				3.4	2.3	1-7
Father's age[d]	43.0	5.6	31-57	39.2	4.2	32-52
Mother's age	42.5	4.2	30-46	37.5	3.6	32-46
1988 family income[e]				41.0	21.5	6.5-100.5
		(n = 32)			(n = 52)	
Girls						
Age	13.0	.3	12.4-13.7	13.0	.3	12.4-13.7
Father's education[a]	16.7	1.8	14-19	13.3	2.2	10-19
Mother's education	14.6	2.0	8-19	13.2	1.7	12-19
Father's occupation[c]				5.1	2.6	1-10
Mother's occupation				3.9	2.4	1-7
Father's age[d]	43.7	5.6	35-56	39.3	6.3	31-68
Mother's age	38.0	6.2	30-52	37.2	4.4	29-50
1988 family income[e]				34.5	17.5	–9.4-112.5

a. Data are presented for suburban Chicago subjects for whom demographic data were available.
b. Range 8 (8th grade or less) to 19 (graduate or professional training).
c. Range 1 (professional, managerial) to 10 (laborer). Farmer (n = 90) is coded 9.
d. For the suburban Chicago sample, data on parents' ages were collected when children were in Grade 6.
e. $1,000s rounded to the nearest $500. Negative numbers indicate income losses (primarily due to farm bankruptcy and crop losses) greater than income.

Procedures

Families in the Iowa Youth and Families Project were recruited through the schools in eight agriculture-dependent counties of north central Iowa. Names and addresses of seventh graders were obtained from all schools in communities of 6,500 or fewer people. Families were contacted by letter and telephone; approximately 79% of those eligible for inclusion in the study agreed to participate. Data collection began in January 1989 and involved 451 intact families with a seventh grader and a sibling within 4 years of the age of the seventh grader.

Each family was visited twice, approximately 1 week apart, in the family's home. During these sessions, the four family members completed survey forms and participated in structured interviews and videotaped family interaction tasks. Between the first and second visits, family members individually completed questionnaires left for them by the interviewer. The PDS was included in the questionnaire administered during the second evening of data collection. Seventh graders completed questionnaires in private and then returned them to the interviewer. The interviewer was available to answer questions. Questionnaires were checked for missing data before the interviewer left the home. Families were reimbursed for their participation in the study. Procedures for the Suburban Chicago Sample were described in Petersen et al. (1988) and Richardson, Galambos, Schulenberg, and Petersen (1984).

Measures

Pubertal Development

The Pubertal Development Scale consisted of three questions for boys and girls about the development of body hair, the occurrence of a growth spurt, and changes in complexion. Two additional items were asked of girls, one about breast development and the other about the onset of menstruation. Boys were asked about changes in voice and growth of facial hair. With the exception of menarche (a dichotomy), all of the questions were answered on a 4-point scale (1 = *has not yet begun*, 2 = *has barely started*, 3 = *is definitely under way*, and 4 = *growth or development is complete*). Mean pubertal development scores were computed, and PDS categories were constructed (Crockett, 1988). In addition, all boys and girls from Rural Iowa and a subsample of subjects from suburban Chicago self-reported their height and weight.

Predictive Validity

Three questions regarding heterosexual peer relations were used to assess predictive validity. Children were asked "On the average, how often do you date?" Response categories ranged from 1 = *haven't yet dated* to 7 = *three times a week or more*. Friends' dating behavior was assessed with "How many of your friends date?" (from 1 = *none* to 5 = *all of them*). Finally, subjects were asked "Have you ever engaged in heavy petting?" (1 = *no*, 2 = *yes*).

RESULTS

The PDS was collected for all seventh-grade boys and girls of the rural Iowa sample. Each gender group was split into age groups at 6-month intervals (12 years to 12.5 years and so on). Percentages of same-gender individuals at each level on the markers of pubertal development were then calculated. As expected, girls generally were more developed at all ages than were boys. Moreover, the expected progression in developmental status with age was evident. However, as indicated in other studies (Brooks-Gunn et al., 1987; Dorn, Susman, Nottelmann, Inoff-Germain, & Chrousos, 1990; Frankowski et al., 1987), there appeared to be some inconsistencies at the extremes of the scales. For example, more boys in the 13.5- to 14-year age group reported that their height gain and voice change was completed than did boys in the 14- to 14.5-year age group. Moreover, for girls in the oldest group, the height gain measure did not perform as expected. Almost all girls in this group (92%) had begun to menstruate, yet only 25% reported that their height gain was completed. The end of the female adolescent growth spurt typically coincides with the onset of menarche (Marshall & Tanner, 1969). Thus the oldest girls in the Rural Iowa Full Sample appeared to be systematically overestimating their growth potential.

A primary purpose of this study was to determine whether means and standard deviations on the PDS could be replicated across samples. To this end a MANOVA was used to compare the average development of the rural Iowa matched sample to that of the suburban Chicago sample. Results indicated that rural Iowa boys were significantly more advanced on four of the five markers of pubertal development than were the suburban Chicago boys. Table 2 shows that the relative order of means was very similar for the two matched samples of boys. For example, body hair was the most advanced feature in each group, whereas facial hair was the least advanced. Moreover, the means of the three remaining characteristics (height gain, skin change, and voice change) were essentially the same within each group. Thus the

TABLE 2: MANOVA of Pubertal Indicators: Means and Standard Deviations

	Sample			
	Suburban Chicago		*Rural Iowa*	
Index[a]	$\bar{X}$	SD	$\bar{X}$	SD
Boys	(n = 50)		(n = 50)	
Body hair	2.5	.65	2.6[n.s.]	.70
Height gain	1.8	.78	2.2*	.82
Skin change	1.8	.82	2.2*	.71
Voice change	1.8	.91	2.3*	.80
Facial hair	1.3	.59	1.8*	.71
	$F(df = 5, 94) = 3.86, p = .003$			
Girls	(n = 52)		(n = 52)	
Body hair	2.6	.82	3.1*	.76
Height gain	2.2	1.17	2.9*	.73
Skin change	1.9	.92	2.7*	.77
Breast development	2.5	.67	2.8*	.41
Menarche[b]	2.1	1.46	3.0*	1.42
	$F(df = 5, 98) = 5.66, p = .0001$			

a. Indices coded 1 = no growth; 2 = barely begun; 3 = some growth; 4 = development completed.
b. Coded dichotomously from 1 = premenarcheal to 4 = postmenarcheal.
*Significantly different from the suburban Chicago sample, $p < .05$.

within-group pattern of means was preserved across groups, although the rural Iowa matched sample boys generally were more physically advanced than the suburban Chicago boys.

To determine if one sample varied significantly more on any of the pubertal markers, the C^2 statistic was used to determine confidence intervals for the variances (Wonnacott & Wonnacott, 1977) of each of the markers for boys in the suburban Chicago sample. The variances for the rural Iowa matched sample were then compared to these confidence intervals. No differences were found between the two samples of boys.

Girls in the rural Iowa matched sample were significantly more advanced on all five markers of the PDS than were the suburban Chicago girls. Important differences in the relative order of means for the girls were evident (Table 2). Although body hair was the most advanced and skin change the least advanced feature of pubertal development for the two samples, menarche was much more prevalent in the rural Iowa matched sample than in the suburban Chicago sample. Stability across samples in the relative timing of pubertal events for girls could not be concluded from this cross-sectional comparison. Rather, the relative order of means in the rural Iowa sample

suggested that menarche came earlier in the pubertal transition for these girls than was indicated by previous studies.

The C^2 statistic was used to compare the variances of four of the markers of pubertal development for girls in the matched samples. Two variances—those for height gain and breast development—differed across samples. In both cases, the rural Iowa matched sample girls had a higher mean score and a smaller variance than the suburban Chicago girls.

Height and weight data for the boys and girls of the rural Iowa matched sample were compared with those of the suburban Chicago sample. Rural Iowa matched sample boys weighed more ($\bar{X}$ = 111.6, SD = 28.8) than those in the suburban Chicago sample ($\bar{X}$ = 98.0, SD = 18.4), and this difference was significant (t[72] = 2.45, $p < .01$). Similarly, girls in the two samples differed significantly (t[87] = 2.57, $p < .01$) in weight (rural Iowa: $\bar{X}$ = 117.9, SD = 21.4; suburban Chicago: $\bar{X}$ = 107.5, SD = 17.4). Within gender, the two groups did not differ in height.

Psychometric analyses of the five-item scales showed adequate internal consistency for boys and girls in both samples (see Table 3). Cronbach's alpha ranged from .66 to .81 and was reasonably consistent across samples. Consistent with earlier findings on the Suburban Chicago Sample (Petersen et al., 1988), the strongest indicator of pubertal development in boys was voice change. For boys, item-total correlations were higher (with the exception of voice change) and less variable for the rural Iowa matched sample than for the suburban Chicago sample. The relative contribution of the five markers to the overall scale was less consistent across samples for the girls. Menarche made a stronger contribution to the overall scale in the rural Iowa matched sample than in the suburban Chicago sample. In fact, the ratio of postmenarcheal girls to premenarcheal girls was twice as large in the rural Iowa matched sample.

Polyserial[1] correlations between mean scores on the PDS and several measures of heterosexual peer involvement were examined. The issue addressed here was the extent to which correlations in the Rural Iowa Full Sample corresponded to those reported with other samples using the PDS or other measures of pubertal development. Perhaps one of the most consistent findings in the literature on pubertal development has been the association between the development of secondary sexual characteristics and sexual behavior (Crockett & Petersen, 1987; Smith et al., 1985; Udry & Billy, 1987). Consistent with other samples, the greater the self-reported physical development of the Iowa adolescents, the greater the heterosexual peer involvement. The polyserial correlation coefficients indicate that with increased physical maturation, boys were more likely to have reported that they frequently dated (r = .17, $p < .01$), have friends who have dated (r = .20, $p <$

TABLE 3: Item-Total Correlations and Alpha Coefficients for Pubertal Development Scale

	Sample	
Index	*Suburban Chicago*	*Rural Iowa*
Boys	(*n* = 50)	(*n* = 50)
Body hair	.42 (2)[a]	.54 (3)
Height gain	.39 (3)	.40 (5)
Skin change	.34 (5)	.53 (4)
Voice change	.63 (1)	.57 (1)
Facial hair	.35 (4)	.56 (2)
Alpha	.66	.75
Girls	(*n* = 52)	(*n* = 52)
Body hair	.69 (1)	.50 (4)
Height gain	.53 (4)	.57 (2)
Skin change	.54 (3)	.45 (5)
Breast development	.66 (2)	.54 (3)
Menarche	.46 (5)	.64 (1)
Alpha	.81	.77

a. Numbers in parentheses are the relative contributions of each marker within the overall scale.

.001), and have engaged in heavy petting ($r = .31, p < .001$). A similar pattern, but with stronger coefficients ($r = .20, p < .01$; $r = .24, p < .001$; $r = .52, p < .001$, respectively), was evident for girls.

DISCUSSION AND CONCLUSION

In summary, mean scores for boys and girls on the three overlapping measures of pubertal development (body hair, height gain, and skin change) indicated that, as expected, girls were more advanced than boys within and across samples. Moreover, data from the Rural Iowa Full Sample supported a general progression from less to more advanced physical development with age. Consistent with discrepancies found in other studies using other self-report measures, there were a few discrepancies at the high end of the scale. Comparisons of PDS mean scores indicated that the same pattern of development held for boys but not for girls across samples. Although body hair was the most advanced feature and skin change the least advanced feature in the two samples of girls, the relative ranking of breast development and menarche were different between the suburban Chicago and the rural Iowa

matched samples. Moreover, boys and girls in the rural Iowa matched sample reported more advanced physical development than did those in the suburban Chicago sample. Correlations between mean pubertal status scores as assessed by the PDS and several measures of heterosexual involvement showed good predictive validity.

It was suggested that the influence of local reference groups on self-reported pubertal status could mask real differences in development. Because real differences between the matched samples were identified with the PDS, this issue is of less concern. It is more likely that observed differences actually reflect dissimilar contexts. Prior studies of adolescent physical maturation in developing counties noted differences in rates of development between urban and rural youngsters (Cameron & Wright, 1990; Malina, Chumlea, Stepick, & Lopez, 1977; Zacharias & Wurtman, 1969). In contrast to the findings of the present study, earlier studies found that adolescents from rural areas were delayed in sexual maturation. One reason posited for this delay was the inadequate nutrition associated with rural living in developing countries.

Although the Rural Iowa Sample is less well off financially than the Suburban Chicago Sample, adequate nutrition is not a problem. The agricultural heritage of Iowans has resulted in a high dietary intake of fat from beef, pork, and dairy products. Moreover, the isolation of rural living has resulted in low levels of activity during the winter months (Iowa Department of Public Health, 1991). Diet and exercise can thus influence sexual maturation directly or indirectly through their effects on body weight. Consistent with comparisons of Iowans to national averages, male and female adolescents in the rural Iowa matched sample were significantly heavier than their counterparts in the suburban Chicago sample. However, boys and girls in the two samples did not differ significantly in height.

The Rural Iowa Sample also included a broad range of income and social class; sample differences may have been due to the incompatibility of the two samples on these variables. Furthermore, the Iowa Youth and Families Project focuses on the consequences of the current farm crisis in the rural midwestern United States. Families in this sample have experienced direct or indirect hardship due to the recent economic events in their region. It has been suggested by Belsky, Steinberg, and Draper (1991) that early maturation in girls is caused by stress or hardship. Although most of the current theory in this area focuses on early stressful experiences, it is conceivable that more current disruptive events might trigger the same mechanism.

Whatever the reasons, differences in means and standard deviations between the matched samples were found even after matching on age, gender, race, and grade in school. Thus developmental status across samples

cannot be generalized on the basis of these analyses; rather, a population-based sample on which to establish PDS norms for subpopulations is needed. Assuming that such a study finds subpopulation differences consistent with this study, further research should focus on the possible processes that would result in such differences. Diet and exercise have been suggested as two possible links between residential location and pubertal maturation. Other links could include socioeconomic status, ethnic heritage, and medical care. Further, if early stressful events are related to pubertal timing, residential location might be an indicator of that stress. Children growing up in rural and urban areas may be more likely to encounter family financial stress that results in marital and parent-child conflict than would children being reared in suburban settings. Thus a comparison between urban, suburban, and rural samples that considers factors such as nutrition, medical care, and socioeconomic status may give more insight into the link between social context and pubertal maturation.

NOTE

1. Measures of heterosexual involvement variables were ordinal level. The polyserial correlation is computed using the mean and variance of the continuous variable for each category of the ordinal variable (SPSS, 1990).

REFERENCES

Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development, 62,* 647-670.

Brooks-Gunn, J., & Warren, M. P. (1985). The effects of delayed menarche in different contexts: Dance and nondance students. *Journal of Youth and Adolescence, 14,* 285-300.

Brooks-Gunn, J., Warren, M. P., Rosso, J., & Gargiulo, J. (1987). Validity of self-report measures of girls' pubertal status. *Child Development, 58,* 829-841.

Cameron, N., & Wright, C. A. (1990). The start of breast development and age at menarche in South African black females. *South African Medical Journal, 78,* 536-539.

Crockett, L. J. (1988). *Pubertal Development Scale: Pubertal categories.* Unpublished manuscript, Pennsylvania State University, Department of Human Development and Family Studies, University Park.

Crockett, L. J., & Petersen, A. C. (1987). Pubertal status and psychosocial development: Findings from the early adolescent study. In R. M. Lerner & T. T. Fochs (Eds.), *Biological-psychosocial interactions in early adolescence* (pp. 173-188). Hillsdale, NJ: Lawrence Erlbaum.

Dorn, L. D., Susman, E. J., Nottelmann, E. D., Inoff-Germain, G., & Chrousos, G. P. (1990). Perceptions of puberty: Adolescent, parent, and health care personnel. *Developmental Psychology, 26,* 322-329.

Frankowski, B., Duke-Duncan, P., Guillot, A., McDougal, D., Wasserman, R., Young, P. (1987). Young adolescents' self assessment of sexual maturation. *American Journal of Diseases of Children, 141*, 385-386.

Iowa Department of Public Health. (1991). *Iowa health risk behaviors 1989: Final report.* Des Moines, IA: Author.

Malina, R. M., Chumlea, C., Stepick, C. D., & Lopez, F. G. (1977). Age of menarche in Oaxaca, Mexico schoolgirls, with comparative data for other areas of Mexico. *Annals of Human Biology, 4*, 551-558.

Marshall, W. A., & Tanner, J. M. (1969). Variations in the pattern of pubertal change in girls. *Archives of Disease in Childhood, 44*, 291-303.

Marshall, W. A., & Tanner, J. M. (1970). Variations in the pattern of pubertal change in boys. *Archives of Disease in Childhood, 45*, 13-23.

Petersen, A. C. (1984). The early adolescent study: An overview. *Journal of Early Adolescence, 4*, 103-106.

Petersen, A. C., Crockett, L., Richards, M., & Boxer, A. (1988). A self-report measure of pubertal status: Reliability, validity, and initial norms. *Journal of Youth and Adolescence, 17*, 117-133.

Petersen, A. C., Tobin-Richards, M., & Boxer, A. (1983). Puberty: Its measurement and its meaning. *Journal of Early Adolescence, 3*, 47-62.

Richardson, R. A., Galambos, N. L., Schulenberg, J. E., & Petersen, A. C. (1984). Young adolescents' perceptions of the family environment. *Journal of Early Adolescence, 4*, 131-153.

Smith, E. A., Udry, J. R., & Morris, N. M. (1985). Pubertal development and friends: A biosocial explanation of adolescent sexual behavior. *Journal of Health and Social Behavior, 26*, 183-192.

SPSS, Inc. (1990). *SPSS LISREL 7 and PRELIS user's guide and reference.* Chicago: Author.

Udry, J. R. (1988). Biological predispositions and social control in adolescent sexual behavior. *American Sociological Review, 53*, 709-722.

Udry, J. R., & Billy, J.O.G. (1987). Initiation of coitus in early adolescence. *American Sociological Review, 52*, 841-855.

Udry, J. R., & Cliquet, R. L. (1982). A cross-cultural examination of the relationship between ages at menarche, marriage, and first birth. *Demography, 19*, 53-63.

Wonnacott, T. H., & Wonnacott, R. J. (1977). *Introductory statistics for business and economics.* New York: Wiley.

Zacharias, L., & Wurtman, R. J. (1969). Age at menarche: Genetic and environmental influences. *New England Journal of Medicine, 280*, 868-875.

Requests for reprints should be addressed to Elizabeth B. Robertson, Carolina Population Center, University of North Carolina, CB 8120, Chapel Hill, NC 27516-3997.