comparable to the 30 μg per cigarette reported in mainstream smoke,[11] but much less is inhaled. The side-stream smoke, however, is the principal source of eye irritation, and the irritants in the smoke may add to the risk of bronchial cancer.

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A Longitudinal Study of Blood Pressure in a National Survey of Children

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Abstract: Blood pressure changes over a three- to four-year period were studied in a cohort of 2,168 children examined during the US Health Examination Survey. The sample used is a representative subset of a national probability sample. Significant positive correlations between initial and follow-up blood pressures were observed. In addition, relatively obese children tended to demonstrate higher blood pressures within age-race-sex specific subgroups. (*Am J Public Health* 1982; 72:1285–1287.)

Previous studies have demonstrated the relationship between successive blood pressure measurements obtained over a pre-determined time interval.[1–4] In this report, we explored blood pressure changes over time and also investigated the relationship between adolescent blood pressure levels and childhood obesity. The data were derived from a unique data base, a national probability sample chosen to be representative of the population of children in the United States.[5–7] Accordingly, the results derived from this study are more generalizable than previous results obtained from the examination of other geographically localized, or otherwise limited populations.

Methods

Data were obtained from 2,168 children who were examined during both Cycle II and Cycle III of the US Health Examination Survey (HES), conducted by the National Center for Health Statistics (NCHS). The Cycle II examinations were conducted from 1963 to 1965, Cycle III examinations from 1966 to 1970. Overall, 7,119 children 6–11 years old were seen during Cycle II; 6,768 children 12–17 years old were seen during Cycle III. The same controlled sampling technique utilizing the same sampling units was used in the selection of participants of both cycles.[7] Only 2,177 children sampled during Cycle II either responded to

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TABLE 1—Interval, in Years, between Examinations for HES Cohort Children

Interval between Examinations (years)	Number of Children (%)	
1	0	(0)
2	69	(3.2)
3	913	(42.1)
4	1137	(52.4)
5+	49	(2.3)
Total	2168	(100.0)

an invitation or were still living at the same location when the Cycle III sample was selected. No attempt was made to trace and evaluate the blood pressures of the other 4,942 children seen in Cycle II but not Cycle III. Only White and Black children were evaluated, leaving an effective sample cohort of 2,168 children eligible for analysis.

The cohort of 2,168 children had the same age, race, and sex characteristics as the overall Cycle II and Cycle III samples. Thus, the cohort was considered to be representative of these two national probability samples. Table 1 shows the distribution of HES cohort children according to the interval, in years, between respective Cycle II and Cycle III examinations. For most children (94.5 per cent), that interval was three to four years.

The standardized method of measuring blood pressure in HES has been described.[6] Supine readings were taken at the beginning and end of the examination. A standard clinical sphygmomanometer was used. Diastolic pressure was recorded at the complete cessation of Korotkoff sounds. The average systolic and diastolic measurement of each cycle was used.

Weight was measured to the nearest .5 pound and converted to kilograms; height was measured to the nearest centimeter. Body mass was estimated by "Quetelet's Index" (weight/height^2).

It should be noted that the blood pressure distributions at Cycle III appeared shifted to the right of what had been expected *a priori*. These data have been published by NCHS without explanation of the shift.[5] Therefore, non-parametric methods were employed in the analysis; these analyze the relative positions of individuals with respect to the entire sample (ranks) as opposed to analyzing the actual magnitude of their blood pressure.

TABLE 2— Spearman Rank Correlations: Blood Pressures at Two Time Periods and in Relation to Quetelet's Index

Cycle III Age-Race-Sex Subgroup	N	SBP2/ SBP3	DBP2/ DBP3	QI2/ SBP3	QI2/ DBP3	QI3/ SBP3	QI3/ DBP3
Whites							
Males							
12 years	279	.41**	.25**	.44**	.35**	.48**	.34**
13 years	298	.53**	.23**	.40**	.42**	.48**	.41**
14 years	275	.45**	.12**	.29**	.24**	.41**	.30**
15 years	140	.42**	.29**	.21*	.19*	.31**	.25**
Females							
12 years	239	.51**	.18**	.34**	.30**	.38**	.37**
13 years	263	.49**	.36**	.31**	.39**	.38**	.40**
14 years	270	.50**	.39**	.22**	.31**	.31**	.37**
15 years	113	.52**	.23**	.43**	.21*	.48**	.29**
Blacks							
Males							
12 years	40	.47**	.15	.10	.22	.29	.24
13 years	29	.65**	.60**	.23	.08	.52**	.16
14 years	36	.36*	.34*	.26	.28	.34*	.35*
15 years	25	.61**	.70**	.33	.17	.31	.24
Females							
12 years	38	.53**	.14	.55*	.28	.52**	.23
13 years	38	.25	.09	.13	.49**	.30	.42**
14 years	42	.32	.29	.24	.34*	.29	.36*
15 years	23	.49*	.24	.51*	.18	.55**	.01

SBP2/SBP3 : Cycle II Systolic BP vs. Cycle III Systolic BP
DBP2/DBP3 : Cycle II Diastolic BP vs. Cycle III Diastolic BP
QI2/SBP3 : Cycle II Body Mass vs. Cycle III Systolic BP
QI2/DBP3 : Cycle II Body Mass vs. Cycle III Diastolic BP
QI3/SBP3 : Cycle III Body Mass vs. Cycle III Systolic BP
QI3/DBP3 : Cycle III Body Mass vs. Cycle III Diastolic BP

**$p < .01$
*$p < .05$

Results

Table 2 summarizes Spearman rank correlation coefficients computed to explore the relationships of blood pressure and obesity in early childhood with resulting blood pressure during adolescence. Analyses were performed only on those subgroups with 20 or more subjects.

For White children, all correlations were significantly greater than zero. In all subgroups, the magnitude of the relationship between systolic blood pressures was greater than that between diastolic blood pressures. The significant relationship between obesity (as measured by Quetelet's Index) and blood pressure during adolescence is also of interest. Relatively more obese children (at Cycles II and III) have higher adolescent (Cycle III) blood pressures than do less obese children.

The consistency of the relationships noted among the White subgroups is not maintained among the Black subgroups. Statistical significance of the correlation coefficients is not as common although this may, in part, be a function of the smaller sample sizes in the various Black subgroups. It is interesting that the direction of all correlations is again positive and that the relationship between the Cycle II and Cycle III systolic blood pressures is again stronger than the relationship between the diastolic blood pressures.

Discussion

The data presented in this report confirm the results of previous studies in children that have demonstrated the relationship between successive measurements of blood pressure. The strength of this time-dependent association appears stronger for systolic than diastolic blood pressure (Table 2). Following a similar protocol for measuring blood pressure as that used in this study and looking up, for example, the percentile level for a child's blood pressure in published tables[6] might allow the clinician to identify children at increased risk of developing hypertension as adults.

Increased body mass as measured by "Quetelet's Index" also appears to be correlated with adolescent blood pressure levels. The lack of statistical significance for this correlation in some Black age-sex subgroups may have been a consequence of small sample size. However, two other studies have found either less of an effect[8] or no effect of body weight on blood pressure in Blacks.[9]

Although the data presented in this report merely corroborate the findings of previous investigations, the results demonstrate that what has, until now, been observed only in localized populations is generalizable to the entire US child population.

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1983 Scholarship Program for Undergraduate Nursing Students

Over $70,000 in scholarships for undergraduate nursing students will be available in the 1983 Scholarship Program of the Foundation of the National Student Nurses' Association. The scholarships are available to nursing students based on need, academic achievement, and demonstrated commitment to nursing through involvement in the NSNA and/or school and community activities.

Applications will be available in September 1982 and awards will be made in April 1983. Deadline for applications is February 1, 1983. Applications and complete details are available from the Foundation of the National Student Nurses' Association, 10 Columbus Circle, New York, NY 10019. Telephone 212/581–2211.