Infants

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Deaths Attributable to Injuries in Infants, United States, 1983-1991

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Objective To describe risk factors for injury death among infants in the United States by the specific external cause of death.

Methods. Data were analyzed from the US-linked birth/infant death files for the years 1983-1991. Potential risk factors for injury death were identified from birth certificate data and included both maternal and infant factors. Injury rates were calculated by external cause of death. Characteristics of infants who died from an injury were compared with those of the entire birth cohort. The independent effect of potential risk factors was assessed in multivariate analyses using a case-control study design.

Results. A total of 10 370 injury deaths were identified over the 9-year study period (29.72/100 000 live births). The leading causes of death were homicide, suffocation, motor vehicle crashes, and choking (inhalation of food or objects). There was no significant temporal trend in the overall rate of injury death; however, this was because significant increases in the rates of death from homicide (6.4%/year) and mechanical suffocation (3.7%/year) were offset by decreases in rates of death from fires (−4.7%/year) and choking (−4.6%/year). In adjusted analyses, infants born to mothers with no prenatal care, <12 years of education, two or more previous live births, Native American race, or <20 years of age were at twice the risk of injury death compared with the lowest risk groups (initiation of prenatal care in the first trimester, ≥16 years of education, no previous live births, white, or ≥25 years of age). When analyzed by the specific cause of death, the factors that were associated most strongly with death varied. For example, Native Americans were at greatest risk of a motor vehicle related death (compared with whites: OR: 3.6; 95% CI: 1.8-7.1), and infants with birth weights of <1500 g were at greatest risk of death attributable to inhalation of food (compared with ≥2500 g: OR: 9.6; 95% CI: 3.3-28.0) or objects (OR: 11.8; 95% CI: 4.5-30.5).

Conclusion. A number of sociodemographic characteristics are associated with an increased risk of injury-related death in infants. The strength of associations between specific risk factors and death varies with the external cause of death, thus identifying high-risk subgroups for targeting of cause-specific interventions and simultaneously increasing our understanding of the individual and societal mechanisms underlying these tragedies.infant, injury, suffocation, motor vehicle, homicide, drowning, inhalation, fire. .

Homicide leading cause of injury death in infants

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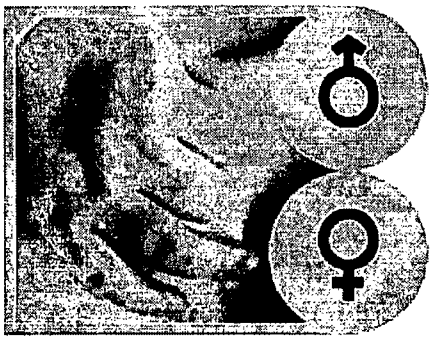

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From Medical Correspondent Rhonda Rowland

BETHESDA, Maryland (CNN) -- Homicide has been identified for the first time as the leading cause of death by injury in children less than 1 year old, according to a government study.

"We usually don't think of infants as being at risk of death from injuries," said Mary Overpeck, a researcher with the National Institute of Child Health and Development. "But infants between the ages of 1 month to 1 year are at highest risk of injury death than at any other time during childhood until age 15, when they start learning to drive."

Researchers looked at the birth and death certificates of more than 10,000 infants between 1983 and 1991. They found homicide, including battery, shaking and throwing the child, accounted for 23 percent of all injury deaths. The results are published in the May issue of the journal Pediatrics.

"Another 27 percent of the injury deaths were classified as 'suspicious' by medical examiners, which means more than half of these deaths could be due to homicide," Overpeck said.

Risk factors vary

Infants were more likely to die from an injury if they weighed little at birth or were premature or male.

CAUSES OF EARLY CHILDHOOD DEATH FROM INJURY

"We also found the infants were more likely to die if their mothers began to bear

Homicide	22.6 percent
Suffocation	17.7 percent
Motor vehicle accident	15.2 percent
Fire	9.5 percent
Drowning	7.2 percent
Choking on food	7.1 percent
Choking on objects	5.9 percent
Other unintentional injuries	10.6 percent
Injuries of undetermined intent	4.2 percent

Source: National Institute of Child Health and Human Development

their mothers began to bear children before age 17, were unmarried, with lower educational levels and if they had older children," Overpeck said. "After the first week of life, infants are more likely to be killed by a male, but we only have information on the mothers."

Other risk factors include having received late or no prenatal care, and being Native American or African American.

Choking deaths common in smallest babies

Death due to choking on food was the sixth leading cause of injury death, accounting for 7 percent of all injury deaths.

"We were surprised to see a high rate of death due to choking on food, which was most prevalent in premature and low-birth-weight babies," Overpeck said. "It occurred primarily during the first 12 weeks of life and crossed all population groups."

Researchers hope the study's findings can be used to identify infants at risk and develop prevention strategies.

Injury deaths overall are the third leading cause of infant death. Sudden Infant Death Syndrome (SIDS) is first, followed by deaths due to birth defects.

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ınts, United States, 1983–1991

Ruth A. Brenner, MD, MPH; Mary D. Overpeck, DrPh; Ann C. Trumble, PhD; Rebecca DerSimonian, ScD; and Heinz Berendes, MD, MHS

ABSTRACT. *Objective* To describe risk factors for injury death among infants in the United States by the specific external cause of death.

Methods. Data were analyzed from the US-linked birth/infant death files for the years 1983–1991. Potential risk factors for injury death were identified from birth certificate data and included both maternal and infant factors. Injury rates were calculated by external cause of death. Characteristics of infants who died from an injury were compared with those of the entire birth cohort. The independent effect of potential risk factors was assessed in multivariate analyses using a case–control study design.

Results. A total of 10 370 injury deaths were identified over the 9-year study period (29.72/100 000 live births). The leading causes of death were homicide, suffocation, motor vehicle crashes, and choking (inhalation of food or objects). There was no significant temporal trend in the overall rate of injury death; however, this was because significant increases in the rates of death from homicide (6.4%/year) and mechanical suffocation (3.7%/year) were offset by decreases in rates of death from fires (−4.7%/year) and choking (−4.6%/year). In adjusted analyses, infants born to mothers with no prenatal care, <12 years of education, two or more previous live births, Native American race, or <20 years of age were at twice the risk of injury death compared with the lowest risk groups (initiation of prenatal care in the first trimester, ≥16 years of education, no previous live births, white, or ≥25 years of age). When analyzed by the specific cause of death, the factors that were associated most strongly with death varied. For example, Native Americans were at greatest risk of a motor vehicle related death (compared with whites: OR: 3.6; 95% CI: 1.8–7.1), and infants with birth weights of <1500 g were at greatest risk of death attributable to inhalation of food (compared with ≥2500 g: OR: 9.6; 95% CI: 3.3–28.0) or objects (OR: 11.8; 95% CI: 4.5–30.5).

Conclusion. A number of sociodemographic characteristics are associated with an increased risk of injury-related death in infants. The strength of associations between specific risk factors and death varies with the external cause of death, thus identifying high-risk subgroups for targeting of cause-specific interventions and simultaneously increasing our understanding of the individual and societal mechanisms underlying these tragedies. *Pediatrics* 1999;103:968–974; *infant, injury, suffocation, motor vehicle, homicide, drowning, inhalation, fire.*

In the United States, injuries are the leading cause of death among persons between the ages of 1 and 44 years.[1] Although injuries account for <5% of deaths in the first year of life, they are the third leading cause of death during the postneonatal period, exceeded in number only by deaths caused by congenital malformations and the sudden infant death syndrome.[1] Although researchers have long sought an overarching conceptual framework that would allow the development of interventions that would address multiple causes of injuries, primary prevention efforts are largely cause-specific, such as the use of infant car seats to prevent injuries sustained in motor vehicle crashes.[2,3]

Previous national studies on fatal injuries in infants have relied primarily on information available on death certificates and therefore have been unable to examine the association between maternal, sociodemographic, and birth characteristics and injury death. However, regional studies have identified associations between maternal factors, such as young maternal age or high parity, and the risk of death from an intentional or unintentional injury in infancy.[4–10] Many of these studies have either grouped all injuries together or dichotomized them to intentional and unintentional groupings. Yet, risk profiles probably vary by cause of death, for example the highest risk group for death attributable to a motor vehicle crash is likely to differ from the highest risk group for death attributable to a residential fire. This information is crucial for appropriate targeting of cause-specific interventions.

The purpose of this study is to identify risk factors for injury death in infants <1 year of age using data from the National Center for Health Statistics linked infant birth/death certificate datasets. By using this large, national dataset we are able to provide data on injury rates and risk factors for injury death by the specific external cause of death.

METHODS

Data were analyzed from the national linked birth/infant death datasets for the years from 1983–1991.[11] These datasets include birth certificate information for all live births occurring in the United States as well as death certificate information for all deaths that occur within the first year of life linked to that individual's birth certificate information. Injury deaths were identified as deaths for which the underlying cause of death was coded as an injury on the death certificate (external cause of injury codes [E codes] E800 to E999 in the 9th revision of the World Health

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Organization's *International Statistical Classification of Diseases*).[12] Deaths caused by surgical or medical procedures or misadventures (E870–E879) and deaths attributable to adverse effects of medicine and biologics in therapeutic use (E930–E949) were excluded. Deaths caused by late effects of a particular injury were classified with the original injury; for example, a death attributable to late effects of accidental poisoning would be included with poisonings.

Potential risk factors for injury death were identified from birth certificate information and included maternal factors (age, education, race, trimester of first prenatal visit, number of previous live births, and marital status) and infant factors (gender, birth weight, and gestational age). Cases were first compared with the entire birth cohort. Overall rates and cause-specific injury rates were calculated as deaths per 100 000 live births and reflect true rates in the population. Crude relative risks were calculated with data from the entire birth cohort. Significance testing was not performed because there were no statistical adjustments and the entire population was represented. Overall trends and cause-specific trends in injury rates were analyzed with Poisson regression techniques using the SAS statistical software logistic procedure.[13]

One control was selected randomly for each eligible case. Cases and controls were matched on year of birth. Crude ORs were determined for each potential risk factor. To determine the independent contribution of maternal and infant factors, those factors that were statistically significant (χ^2; $P < .05$) in bivariate analyses were entered into multiple logistic regression models.[14] All variables were entered initially into the model, as each variable was significant in bivariate analyses. For all injuries combined, each risk factor remained significant after adjusting for all others. For some specific causes of injury a single risk factor (such as gender in the case of motor vehicle-related injuries) was not statistically significant; however, these instances were rare and thus for consistency all variables are retained in the final models. Missing data were reported for at least one variable in 21% of cases and 19% of controls. The majority of missing responses were for maternal education (missing data for 18% of cases and 17% of controls) which was not reported in Washington and was reported only in the final 3 years of the study in California and Texas. In multivariate analyses, missing data were handled in two ways. In the first set of analyses, observations with missing responses were excluded. In the second set of analyses, missing responses were set to unknown and retained as a separate classification level. These two sets of analyses yielded similar results. Results reported in this study are for models in which observations with missing responses were excluded. The SAS statistical software package was used for all analyses.

RESULTS

Cause of Injury

From 1983–1991, there were 10 370 deaths attributable to injury in infants <1 year of age, resulting in an injury fatality rate of 29.72/100 000 live births (Table 1). Of these deaths, 7594 (73%) were classified as unintentional injuries, 2345 (23%) were classified as intentional injuries, and 431 (4%) were classified as undetermined intent. The leading causes of injury death in this age group, in descending order, were: homicide, suffocation, motor vehicle-related incidents, fire, drowning, food inhalation, and object inhalation. Each of these causes accounted for ≥5% the total number of injury deaths.

Temporal Trends

Over the 9-year study period, there was no significant temporal trend in the overall rate of injury death; however, there were significant trends for some specific causes of death (Fig 1). From 1983–1991, homicide rates increased by 6.4% per year ($P < .001$) and rates of death from mechanical suffocation increased by 3.7% per year ($P < .001$), whereas fatality rates from fires decreased by 4.7% per year ($P < .001$) and fatality rates for inhalation of objects and inhalation of food decreased by 4.8% and 4.4% per year, respectively ($P < .01$). There was no significant change in fatality rates for motor vehicle-related injuries or for drownings.

Associations Between Birth Characteristics and Injury Death

Characteristics of infants who died from an injury are compared with characteristics of the birth cohort and controls in Table 2. Controls were comparable with the birth cohort for all variables examined. Infants who died from an injury were more likely to be low birth weight, premature, and male. In addition, they were more likely to have mothers who were young, unmarried, with lower educational levels, higher numbers of previous live births, and late or no prenatal care. Infants born to mothers who were black or Native American were at greater risk of injury death than white infants, whereas infants born to Asian mothers were at lower risk. For all injuries combined, the highest rates were among infants born to mothers who had no prenatal care (116/100 000 live births), were <15 years of age (80/100 000), or were Native American (82/100 000).

The results of multivariate analyses for all injury deaths are shown in the last column of Table 2. Gestational age was omitted from multivariate models, because it is highly associated with birth weight and birth weight is measured more reliably. After adjusting for all other variables in the model, the following maternal characteristics increased the risk of death by twofold or more: young maternal age (OR: 2.51; 95% CI: 2.23–2.82 for 15 to 19 years vs ≥25 years and OR: 2.10; 95% CI: 1.29–3.42 for <15 years

TABLE 1. Causes of Injury Death in Infants <1 Year of Age, United States, 1983–1991

Cause of Injury	ICD-9 Code	Deaths (%)	Mortality Rate (Deaths/100 000 Live Births)
Homicide	E960.0–969	2345 (22.6)	6.72
Unintentional			
Mechanical suffocation	E913.0–913.9	1839 (17.7)	5.27
Motor vehicle (traffic)	E810.0–819.9	1580 (15.2)	4.53
Fires and flames	E890.0–899	990 (9.5)	2.84
Drowning	E910.0–910.9	745 (7.2)	2.13
Suffocation caused by food inhalation	E911	734 (7.1)	2.10
Suffocation caused by object inhalation	E912	609 (5.9)	1.75
Other unintentional		1097 (10.6)	3.14
Injury of undetermined intent	E980.0–989	431 (4.2)	1.24
Total	E800.0–999	10370 (100)	29.72

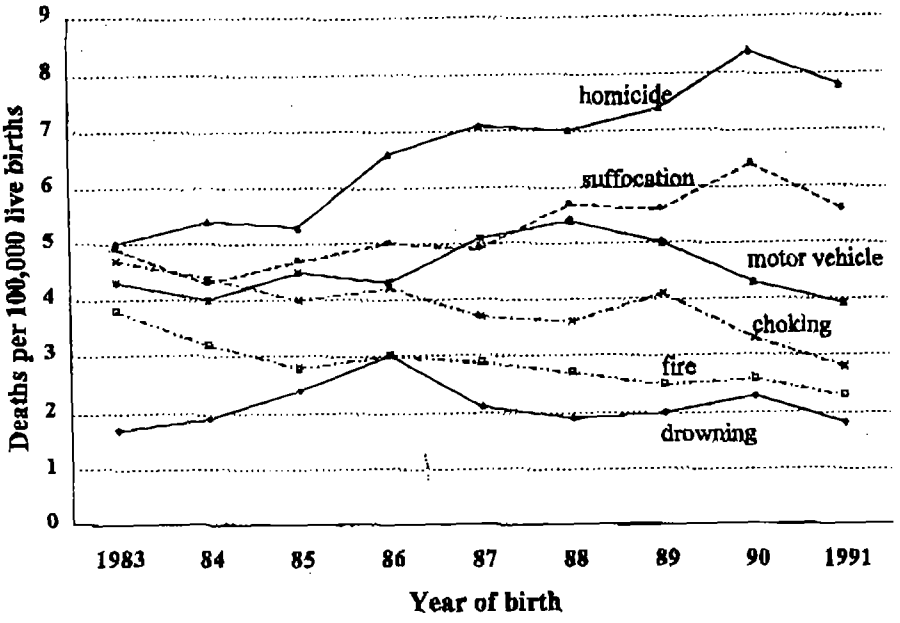

Fig 1. Trends in rates of fatal injuries among infants in the United States from 1983–1991.

vs ≥25 years), maternal education <12 years (compared with maternal education ≥16 years; OR: 2.31; 95% CI: 2.01–2.66), no prenatal care (compared with initiation of prenatal care in the first trimester, OR: 2.11; 95% CI: 1.74–2.54), Native American race (compared with white race, OR: 2.12 95% CI: 1.63–2.75) and ≥2 previous live births (compared with no previous live births, OR: 2.14; 95% CI: 1.95–2.36).

Cause-Specific Analyses

Cause-specific injury rates, relative risks, and adjusted ORs are shown in Table 3. Key findings by the specific external cause of death are presented below.

Homicide

Homicide rates were greatest in infants born to mothers who had received no prenatal care (38/100 000), were <20 years (17/100 000), single (16/100 000), black (16/100 000), or Native American (17/100 000). Homicide rates were also high among infants with birth weights <2500 g (20 and 16/100 000 in infants with birth weights <1500 g and 1500 g to 2499 g, respectively). In adjusted analyses, factors associated with an OR ≥2 included: black or Native American race, single marital status, no prenatal care, and birth weight of 1500 g to 2499 g compared with ≥2500 g.

Mechanical Suffocation

Rates of death attributable to suffocation were also highest among infants born to mothers who had received no prenatal care (17/100 000). However, in adjusted analyses only previous live births and young maternal age were associated with a doubling of the risk of suffocation. Of the 1839 deaths in this category, 1098 (60%) were classified as accidental suffocation in a bed or cradle, 167 (9%) as suffocation by a plastic bag, and 3 (<1%) were classified as lack of air in a closed place. The remainder, 571 (31%), were in the other and unspecified categories (E-codes 913.8 and 913.9).

Motor Vehicle-Related Deaths

Infants born to mothers who were Native American were at greatest risk for motor vehicle-related deaths with a fatality rate of 14/100 000 live births. Native American race was the strongest predictor in adjusted analyses (OR: 3.6; 95% CI: 1.8–7.1).

Fires and Flames

For deaths caused by fires, the highest mortality rates were among infants born to mothers who had received no prenatal care (11/100 000), <12 years of education (8/100 000), and infants born to mothers who were black (7/100 000) or Native American (8/100 000). In adjusted analyses, each of these factors was associated with an OR ≥2, with ORs ranging from 2.1 to 2.6. However, due in part to the very low rate of death from fires in first born children, birth order was the strongest predictor of fire-related deaths. As compared with firstborn children, second and later born children had over four times the risk of dying in a fire (OR: 4.4; 95% CI: 3.2–5.9).

Drowning

Rates of death from drowning were highest among infants born to mothers who had received no prenatal care (9/100 000) and among Native Americans (6/100 000). Native Americans were the highest risk group in adjusted analyses (OR: 4.8; 95% CI: 1.0–22.0). Other factors with an OR of ≥2 included; maternal age <20 years, one or more previous live births, single marital status, and no prenatal care.

Choking

Although deaths caused by inhalation of objects and food were the fifth and sixth leading cause of death attributable to unintentional injury, when viewed as a single phenomenon (choking), they combine to become the third leading cause behind mechanical suffocation and motor vehicle-related deaths. Fatality rates from choking were highest

TABLE 2. Characteristics of Births, Injury Deaths, and Selected Controls, United States, 1983–1991

Characteristic*	Percent of Births† (N = 34 895 012)	Percent of Controls† (N = 10 370)	Percent of Injuries (N = 10 370)	Relative Risk	Adjusted OR‡ (95% CI)
Maternal					
Marital status					
Unmarried	24.7	24.8	48.0	2.81	1.55 (1.42–1.68)
Married	75.3	75.2	52.0	1.0	1.0
Age					
<15 y	.3	.3	.7	4.43	2.10 (1.29–3.42)
15–19 y	12.6	13.0	25.4	3.32	2.51 (2.23–2.82)
20–24 y	28.5	28.4	38.2	2.20	1.88 (1.74–2.05)
25+ y	58.6	58.3	35.7	1.0	1.0
Education§					
≤11 y	17.9	17.8	36.0	6.36	2.31 (2.01–2.66)
12 y	33.3	33.8	31.1	2.96	1.59 (1.40–1.81)
13–15 y	16.6	16.9	10.3	1.95	1.36 (1.19–1.56)
16+ y	14.1	14.6	4.5	1.0	1.0
Previous live births					
2+	25.8	25.9	34.3	1.69	2.14 (1.95–2.36)
1	32.5	31.8	31.7	1.24	1.69 (1.55–1.84)
0	41.1	41.7	32.4	1.0	1.0
Initiation of prenatal care					
None	1.8	2.1	7.2	5.34	2.11 (1.74–2.54)
7th–9th mo	4.0	4.5	8.1	2.77	1.34 (1.16–1.54)
4th–6th mo	17.6	17.6	26.7	2.08	1.35 (1.24–1.46)
1st–3rd mo	74.3	73.5	54.2	1.0	1.0
Race					
Black	16.0	16.4	31.7	2.46	1.43 (1.31–1.56)
Native American	.9	1.0	2.6	3.44	2.12 (1.63–2.75)
Asian	3.1	2.6	1.7	.68	1.16 (0.91–1.49)
White/Other	79.9	80.0	64.1	1.0	1.0
Infant					
Gender					
Male	51.2	50.3	54.7	1.15	1.20 (1.12–1.28)
Female	48.8	49.7	45.3	1.0	1.0
Birth weight (g)					
<1500	1.2	1.3	3.2	2.91	1.91 (1.51–2.42)
1500–<2500	5.7	5.6	12.3	2.42	1.98 (1.75–2.24)
≥2500	93.0	93.0	83.2	1.0	1.0
Gestation (wk)					
<28	.7	.9	1.8	2.88	N/A
28–36	9.1	8.8	15.5	1.95	N/A
≥37	87.0	87.5	76.2	1.0	N/A

* Comparison group in italics.
† Columns do not total 100% because the "not stated" category is not shown.
‡ Adjusted for all characteristics shown with the exception of gestational age.
§ Education not reported in Washington or in California and Texas (1983–1988).

among infants with birth weights <1500 g; 15/100 000 for inhalation of objects and 10/100 000 for inhalation of food. In multivariate models, infants weighing <1500 g were at almost 12 times the risk of death caused by object inhalation, and infants weighing 1500 g to 2499 g were at three times the risk as compared with infants weighing ≥2500 g. Similar associations were seen for inhalation of food with adjusted ORs of 9.6 and 4.1 for infants weighing <1500 g and 1500 g to 2499 g, respectively. In comparison, other factors played a less important role.

DISCUSSION

During the 9-year study period 10 370 injury-related deaths were identified yielding a fatality rate of 29.72 deaths per 100 000 live births. For all injuries combined, factors associated with at least a twofold increase in the risk of death from injury included maternal age <20 years, less than a high school education, no prenatal care, Native American race, and ≥2 previous live births. The strength of associations between specific risk factors and death varied with the specific external cause of death, providing important information for targeting of cause-specific interventions.

Study Limitations

The limitations of studies that rely on information obtained from linked birth/infant death datasets have been well documented.[4,5,15] First, the only variables available for consideration are those collected on birth and death certificates. Therefore, we were unable to assess the contribution of other important factors such as household income, parenting style, the adequacy of social support networks, the use or nonuse of protective devices, or the effects of legislative and regulatory measures such as primary seatbelt laws. Second, data obtained from birth and death certificates are not always reliable. Inaccuracies are known to exist in both the assignment of the cause of death on death certificates and in the documentation of maternal and infant factors on birth

TABLE 3. Rates, Relative Risks, and Adjusted OR for Infant Death by the Specific Cause of Injury, United States, 1983–1991

Characteristic*	Homicide			Suffocation			Motor Vehicle			Fires/Flames		
	Rate†	RR‡	Adjusted OR§ (95% CI)	Rate†	RR‡	Adjusted OR§ (95% CI)	Rate†	RR‡	Adjusted OR§ (95% CI)	Rate†	RR‡	Adjusted OR§ (95% CI)
Maternal												
Maternal age												
<20 y	16.5	3.1	1.5 (1.3–1.9)	9.6	2.1	2.0 (1.5–2.5)	9.0	2.3	1.7 (1.3–2.1)	4.9	2.0	1.7 (1.2–2.5)
≥20 y	5.3	1.0	1.0	4.6	1.0	1.0	3.9	1.0	1.0	2.5	1.0	1.0
Race												
Black	16.5	3.5	2.2 (1.9–2.7)	10.0	2.3	1.2 (1.0–1.5)	5.8	1.4	1.2 (0.9–1.5)	7.2	3.6	2.2 (1.7–3.0)
Native American	16.9	3.6	2.9 (1.6–5.4)	14.5	3.4	1.7 (0.9–3.1)	14.5	3.5	3.6 (1.8–7.1)	7.7	3.8	2.1 (0.9–5.1)
Asian	3.4	0.7	0.9 (0.6–1.6)	2.3	0.5	0.9 (0.5–1.8)	3.9	0.9	1.7 (1.0–2.9)	0.4	0.2	0.2 (0.0–0.8)
White/Other	4.8	1.0	1.0	4.3	1.0		4.2	1.0		2.0	1.0	
Previous live births												
1+	6.6	1.0	1.1 (0.9–1.2)	6.9	2.3	3.2 (2.7–3.9)	4.2	0.9	1.0 (0.9–1.2)	4.1	3.7	4.4 (3.2–5.9)
0	6.4	1.0	1.0	2.9	1.0	1.0	4.9	1.0	1.0	1.1	1.0	1.0
Marital status												
Unmarried	15.9	4.3	2.0 (1.7–2.3)	9.8	2.6	1.9 (1.5–2.3)	6.7	1.8	1.3 (1.0–1.6)	6.0	3.3	1.8 (1.3–2.3)
Married	3.7	1.0	1.0	3.8	1.0	1.0	3.8	1.0	1.0	1.8	1.0	1.0
Education‖												
<12 y	13.3	2.9	1.7 (1.5–2.1)	11.3	3.0	1.9 (1.6–2.3)	7.2	1.9	1.5 (1.3–1.9)	7.5	4.3	2.6 (2.1–3.4)
≥12 y	4.6	1.0	1.0	3.7	1.0	1.0	3.7	1.0	1.0	1.7	1.0	1.0
Prenatal care												
None	38.0	8.7	2.7 (1.8–3.9)	17.3	4.3	1.5 (0.9–2.2)	8.7	2.3	2.2 (1.3–4.0)	11.4	6.2	2.4 (1.3–4.6)
4–9 mo	10.8	2.5	1.7 (1.5–2.0)	8.3	2.1	1.3 (1.1–1.6)	6.5	1.7	1.3 (1.1–1.6)	5.5	3.0	1.7 (1.4–2.2)
<4 mo	4.4	1.0	1.0	4.0	1.0	1.0	3.9	1.0	1.0	1.8	1.0	1.0
Infant												
Birth weight (g)												
<1500	20.1	3.5	1.3 (0.8–2.1)	6.7	1.4	0.7 (0.4–1.3)	4.9	1.1	0.5 (0.2–0.9)	1.8	0.7	1.5 (0.4–6.3)
1500–2499	16.2	2.8	2.0 (1.5–2.6)	10.1	2.1	1.4 (1.0–1.8)	7.0	1.6	1.7 (1.2–2.4)	6.6	2.5	2.3 (1.5–3.5)
≥2500	5.7	1.0	1.0	4.9	1.0	1.0	4.4	1.0	1.0	2.6	1.0	1.0
Gender												
Male	7.0	1.1	1.1 (1.0–1.3)	5.8	1.3	1.3 (1.1–1.5)	4.6	1.0	1.0 (0.9–1.2)	2.8	1.0	1.1 (0.9–1.4)
Female	6.5	1.0	1.0	4.7	1.0	1.0	4.5	1.0	1.0	2.9	1.0	1.0

Characteristic	Drowning			Food Inhalation			Object Inhalation		
	Rate†	RR‡	Adjusted OR§ (95% CI)	Rate†	RR‡	Adjusted OR§ (95% CI)	Rate†	RR‡	Adjusted OR§ (95% CI)
Maternal									
Maternal age									
<20 y	4.3	2.4	2.1 (1.4–3.1)	3.4	1.8	1.1 (0.7–1.6)	3.5	2.3	2.1 (1.4–3.3)
≥20 y	1.8	1.0	1.0	1.9	1.0	1.0	1.5	1.0	1.0
Race									
Black	3.1	1.6	0.9 (0.6–1.2)	4.1	2.4	1.3 (0.9–1.8)	2.8	1.9	1.1 (0.7–1.5)
Native American	5.9	3.0	4.8 (1.0–22.0)	5.2	3.1	2.0 (0.8–5.1)	6.5	4.4	2.2 (0.8–6.1)
Asian	1.4	0.7	1.7 (0.7–4.1)	1.1	0.7	0.6 (0.3–1.6)	1.5	1.0	1.1 (0.4–2.8)
White/other	1.9	1.0	1.0	1.7	1.0	1.0	1.5	1.0	1.0
Previous live births									
1+	2.8	2.4	3.8 (2.8–5.2)	2.4	1.5	1.6 (1.2–2.1)	1.9	1.3	2.0 (1.5–2.8)
0	1.2	1.0	1.0	1.7	1.0	1.0	1.4	1.0	1.0
Marital status									
Unmarried	4.0	2.6	2.3 (1.6–3.1)	3.6	2.3	1.6 (1.2–2.2)	2.8	2.1	1.4 (1.0–2.0)
Married	1.5	1.0	1.0	1.6	1.0	1.0	1.4	1.0	1.0
Education‖									
<12 y	3.9	2.7	1.7 (1.3–2.3)	4.1	2.6	1.9 (1.4–2.6)	3.3	2.5	1.4 (1.0–2.0)
≥12 y	1.5	1.0	1.0	1.6	1.0	1.0	1.3	1.0	1.0
Prenatal care									
None	8.7	5.8	2.3 (1.1–4.4)	3.7	2.3	1.3 (0.5–3.1)	6.4	4.8	2.2 (1.0–5.1)
4–9 mo	3.5	2.3	1.3 (1.0–1.8)	3.6	2.2	1.9 (1.4–2.6)	2.8	2.1	1.5 (1.1–2.1)
<4 mo	1.5	1.0	1.0	1.6	1.0	1.0	1.3	1.0	1.0
Infant									
Birth weight (g)									
<1500	2.8	1.4	1.2 (0.4–3.7)	10.2	5.7	9.6 (3.3–28.0)	14.6	10.4	11.8 (4.5–30.5)
1500–2499	3.3	1.7	1.4 (0.8–2.3)	5.7	3.2	4.1 (2.6–6.6)	4.6	3.3	3.0 (1.9–4.8)
≥2500	2.0	1.0	1.0	1.8	1.0	1.0	1.4	1.0	1.0
Gender									
Male	2.4	1.3	1.1 (0.9–1.4)	2.5	1.5	1.7 (1.3–2.1)	2.0	1.4	1.6 (1.2–2.1)
Female	1.9	1.0	1.0	1.7	1.0	1.0	1.5	1.0	1.0

* Comparison group in italics. †Rate = number of deaths per 100 000 live births. ‡RR = relative risk. §OR, adjusted for all characteristics shown. ‖Education not reported in Washington or in California and Texas (1983–1988).

certificates.[16–20] Finally, the study period for the current manuscript was from 1983–1991. Linked datasets were not created for 1992–1994. The 1995–linked dataset was not included in the current analysis because of the lack of continuity that this would create and because there were methodologic differences in the manner in which the datasets were created. Results of preliminary analyses of data from the 1983– to 1986–linked datasets[21] were similar to those reported in this study, confirming that associations identified in this article have remained consistent over time.

Relation to Previous Studies

In Tennessee, researchers found that low maternal education, young maternal age, and higher birth order were all associated with at least a doubling of the risk of injury-related death among children between the ages of 0 and 4 years.[5] In the state of Washington, young maternal age, higher parity, black race, maternal smoking, and rural residence were independently associated with death caused by injury and, in Colorado, young maternal age and single marital status were important predictors of injury-related deaths.[4,8] The consistency with which these sociodemographic factors are found to be associated with injuries in infants indicate that these characteristics identify high-risk populations for targeted interventions reliably. In the current study, infants born to mothers who had received no prenatal care experienced particularly high rates of death attributable to injury. Although prenatal care is unlikely to be causally linked to the risk of injury, it may serve as a proxy for a number of complex issues eg, wantedness of the pregnancy or overall use of the health care system. In any event, the first opportunity for intervention in this high-risk group may be in the hospital at the time of delivery.

Cause-Specific Analyses: Implications for Interventions

Homicide was the leading cause of death with 2345 deaths over the 9-year study (6.72/100 000 live births). This rate is probably lower than the true homicide rate as an additional 431 deaths were coded as undetermined intent, a designation that is often used for deaths that are suspicious in nature.[17] In addition, a small fraction of deaths assigned to unintentional injury codes or noninjury codes may be intentional in nature.[22–26] Although certain groups, such as infants born to young or single mothers were at increased risk of homicide, even in low-risk groups, homicide was generally the leading cause of traumatic death. For example, homicide was the leading cause of death for infants born to mothers who had >12 years of education or were >20 years of age. A number of primary prevention methods including home visiting, social support, and interventions aimed at improving parenting skills were reviewed recently.[27] Of these, home-visiting interventions, conducted primarily in high-risk populations, showed the most promise.[27–29] However, these studies focused primarily on the reduction of nonfatal child abuse and neglect, probably because fatal child abuse is relatively infrequent.[30] There is a need to expand home-visiting interventions to enable evaluation of their effectiveness in preventing fatal outcomes. In addition, other approaches should be evaluated more thoroughly and new approaches should be considered.[27]

Native American infants experienced particularly high rates of motor vehicle-related deaths (14/100 000) and in adjusted analyses were over three times more likely to die from a motor vehicle-related death than were white infants. It is estimated that, when used properly, child safety seats reduce the risk of fatal injury in a motor vehicle crash by 69% in infants.[31] Although all 50 states have laws mandating the use of child restraints, Native Americans who live on reservations are exempt from state regulations, and tribal laws vary from one reservation to another.[32] In places where legislation is not sufficient, efforts should focus on the enactment of new laws or the strengthening of existing laws. To ensure that car seats are universally available, lender programs such as those used by the Navajo nation should be established (Richard Smith, Indian Health Service, written communication, May 1998). Finally, it is estimated that >80% of child safety seats are used improperly.[33] Although parents and other caregivers should receive instructions on the correct use of child safety seats and the need to use the safety-seat every ride, the high rates of misuse also demonstrate the urgent need for products that are more user-friendly.

Birth order was an important predictive factor for deaths attributable to drownings, fires, and mechanical suffocation. This may be related to a decrease in parental supervision as the parents' attention is divided among more children. Alternatively, parents may overestimate the maturity and capabilities of older siblings and inappropriately expect them to supervise the infant. In two separate studies of bathtub drownings, >30% of victims were being supervised in the bathtub by an older sibling.[34,35] Another study found that, among infants, 11% of injuries that resulted in an emergency department visit occurred while the infant was being supervised by an older sibling.[36] These findings emphasize the need to counsel caregivers, not only on the risks of leaving children unattended, but also on the need for appropriate adult supervision.

Consistent with findings in the current study, researchers in Tennessee identified an independent association between maternal age, education, and birth order and fire-related deaths among children <5 years of age.[10] Although the specific role of siblings in fire-related deaths is unknown, it is estimated that, in the 0- to 5-year age group, ~40% of deaths resulting from residential fires are caused by the actions of children.[37,38] In addition to the installation and maintenance of smoke detectors, parents should be reminded to store matches and lighters out of the reach of young children.[38]

One unexpected finding was the strong association between low birth weight and deaths attributable to choking. This association was seen for deaths caused by inhalation of food and for deaths caused by inhalation of objects. Of interest, 40% of deaths attributable to food inhalation and 33% of deaths caused by

inhalation of objects occurred during the first 12 weeks of life, before the usual recommended age for the introduction of solid foods and before the attainment of developmental skills that would allow an infant to obtain and place an object in his/her mouth independently. Thus, although there may be a physiologic explanation for this finding, eg, oral pharyngeal coordination problems predisposing premature infants to choking episodes, it is possible that these deaths represent errors in classification. Further research is needed in this area.

From 1983–1991, the infant mortality rate in the United States decreased by 20%.[11] In contrast rates of death attributable to intentional injuries and unintentional mechanical suffocation increased, and there was no change in rates of motor vehicle-related deaths or drownings. A reduction in the rate of death from injury in any one of the identified high-risk groups to the level of its comparison group would result in the saving of many lives. For example, if infants of young mothers had experienced the same rate of death from injury as infants born to mothers ≥25 years of age, 4062 lives would have been spared over the 9-year study period. Clearly, there is no single intervention that will address all causes of injury. Continued efforts should focus on the implementation of proven strategies, such as proper use of child restraints for the prevention of motor vehicle-related injuries or installation and maintenance of smoke detectors for the prevention of deaths caused by fires. For some causes of injury, such as homicide, there is a need to identify and evaluate new preventive strategies. Additionally, there is a need to identify the most effective means of communicating prevention messages to high-risk populations as well as a need to identify and reduce the barriers faced in implementing prescribed preventive strategies. Although all caregivers should receive counseling in injury prevention our findings identify high-risk subgroups for enhanced, cause-specific efforts.

REFERENCES

1. Anderson RN, Kochanek KD, Murphy SL. *Report of Final Mortality Statistics, 1995*. Monthly vital statistics report, Vol 45, No 11 (suppl 2). Hyattsville, MD: National Center for Health Statistics; 1995
2. Scheidt PC and Workshop Participants. Behavioral research toward prevention of childhood injury. *Am J Dis Child*. 1988;142:612–617
3. Rivara FP, Grossman DC. Prevention of traumatic deaths to children in the United States: how far have we come and where do we need to go? *Pediatrics*. 1996;97:791–797
4. Cummings P, Theis MK, Mueller BA, Rivara FP. Infant injury death in Washington state, 1981 through 1990. *Arch Pediatr Adolesc Med*. 1994; 148:1021–1026
5. Scholer SJ, Mitchel EF, Ray WA. Predictors of injury mortality in early childhood. *Pediatrics*. 1997;100:342–347
6. Wicklund K, Moss S, Frost F. Effects of maternal education, age, and parity on fatal infant accidents. *Am J Public Health* 1984;74:1150–1152
7. Winpisinger KA, Hopkins RS, Indian RW, Hostetler JR. Risk factors for childhood homicides in Ohio: a birth certificate-based case-control study. *Am J Public Health*. 1991;81:1052–1054
8. Siegel CD, Graves P, Maloney K, Norris JM, Calonge BN, Lezotte D. Mortality from intentional and unintentional injury among infants of young mothers in Colorado, 1986 to 1992. *Arch Pediatr Adolesc Med*. 1996;150:1077–1083
9. Emerick SJ, Foster LR, Campbell DT. Risk factors for traumatic infant death in Oregon, 1973 to 1982. *Pediatrics*. 1986;77:518–522
10. Scholer SJ, Hickson GB, Mitchel EF, Ray WA. Predictors of mortality from fires in young children. *Pediatrics* 1998;101(5). URL: http://www.pediatrics.org/cgi/content/full/101/5/e12
11. National Center for Health Statistics. Linked Birth/Infant Death Data Set: Public Use Data File Documentation for 1983 to 1991. Hyattsville, MD; US Public Health Service: 1988–1995
12. World Health Organization. *World Health Classification: Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, Ninth Revision*. Geneva, Switzerland: World Health Organization; 1977
13. SAS/STAT User's Guide, *Version 6, Vol 2*. 4th ed. Cary, NC: SAS Institute Inc; 1990
14. Breslow NE, Day W. *Statistical Methods in Cancer Research. Volume 1—The Analysis of Case-Control Studies*. Lyon, France: IARC Scientific Publication 32. 1980
15. Bennett T, Braveman P, Egerter S, Kiely J. Maternal marital status as a risk factor for infant mortality. *Fam Plann Perspect*. 1994;26:252–256; 271
16. Lapidus GD, Gregorio DI, Hansen H. Misclassification of childhood homicide on death certificates. *Am J Public Health*. 1990;80:213–214
17. Jason J, Carpenter MM, Tyler CW. Underrecording of infant homicide in the United States. *Am J Public Health*. 1983;73:195–197
18. Beal SM, Byard RW. Accidental death or sudden infant death syndrome? *J Pediatr Child Health*. 1995;31:269–271
19. Piper JM, Mitchel EF, Snowden M, Hall C, Adams M, Taylor P. Validation of 1989 Tennessee birth certificates using maternal and newborn hospital records. *Am J Epidemiol*. 1993;137:758–768
20. Buescher PA, Taylor KP, Davis MH, Bowling M. The quality of the new birth certificate data: a validation study in North Carolina. *Am J Public Health*. 1993;83:1163–1165
21. Brenner R, Overpeck M, Toretsky E, Trumble A, Berendes H. Risk factors for injury mortality in infants: United States, 1983–1986. *Am J Dis Child*. 1993;147:460. Abstract
22. Reece R. Fatal abuse and sudden infant death syndrome: a critical diagnostic decision. *Pediatrics*. 1992;91:423–428
23. Bass M, Kravath RE, Glass L. Death-scene investigation in sudden infant death syndrome. *N Engl J Med*. 1986;315:100–105
24. Emery JL. Child abuse, sudden infant death syndrome, and unexpected infant death. *Am J Dis Child*. 1999;3:147:1097–1100
25. Griest KJ, Zumwalt RE. Child abuse by drowning. *Pediatrics*. 1989;83: 41–46
26. Kemp AM, Mott AM, Sibert JR. Accidents and child abuse in bathtub submersions. *Arch Dis Child*. 1994;70:435–438
27. Harborview Injury Prevention and Research Center. Childhood Injury Prevention Interventions: Cochran Collaboration. URL: http://www.weber.u.washington.edu/hiprc/topic/abuse/cochrane.htlm
28. Olds DL, Henderson CR, Chamberlin R, Tatelbaum R. Preventing child abuse and neglect: a randomized trial of nurse home visitation. *Pediatrics*. 1986;78:65–78
29. Olds DL, Eckenrode J, Henderson CR, et al. Long-term effects of home visitation on maternal life course and child abuse and neglect: fifteen-year follow-up of a randomized trial. *JAMA*. 1997;278:637–643
30. Overpeck MD, Brenner RA, Trumble AC, Trifiletti MA, Berendes HW. Risk factors for infant homicide in the United States. *N Engl J Med*. 1998;339:1211–1216
31. National Highway Traffic Safety Administration. *Buckle Up America—First Report to Congress*. Washington, DC: US Department of Transportation, National Highway Traffic Safety Administration, Report No. DOT 888–667. 1998
32. Safety-belt use and motor-vehicle-related injuries, Navajo Nation, 1988–1991. *Morb Mortal Wkly Rep*. 1992;41:705–708
33. National Highway Traffic Safety Administration. *Patterns of Misuse of Child Safety Seats: Final Report*. Washington, DC: US Department of Transportation, National Highway Traffic Safety Administration; Report No. DOT-HS-808-440. 1996
34. Rauchschwalbe R, Brenner R, Smith G. The role of bathtub seats and rings in infant drowning deaths. *Pediatrics* 1997;100(4). URL: http://www.pediatrics.org/cgi/content/full/100/4/e1
35. Jenson LR, Williams SD, Thurman DJ, Keller PA. Submersion injuries in children younger than 5 years in urban Utah. *West J Med*. 1992;157: 641–644
36. Rivara FP, Kamitsuka MD, Quan L. Injuries to children younger than 1 year of age. *Pediatrics*. 1988;81:93–97
37. Squires T, Rusuttil A. Can child fatalities in house fires be prevented? *Inj Prev*. 1996;2:109–112
38. Deaths resulting from residential fires—United States, 1991. *MMWR Morb Mortal Wkly Rep*. 1994;43:901–904

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Decrease in Infant Mortality and Sudden Infant Death Syndrome Among Northwest American Indians and Alaskan Natives -- Pacific Northwest, 1985-1996

Although the infant mortality rate (IMR) has steadily declined in the United States since the early 1900s, the rate varies among racial/ethnic populations (1). A goal of the national health objectives for 2010 is to eliminate racial/ethnic health disparities (U.S. Department of Health and Human Services, unpublished data, 1999). Historically, IMRs among American Indians and Alaskan Natives (AI/AN) have been high (2). In addition, IMRs have varied among AI/AN populations (3). To determine recent trends in infant mortality among Northwest AI/AN, the Northwest Portland Area Indian Health Board (NPAIHB) analyzed annual IMRs among AI/AN in Idaho, Oregon, and Washington. In addition, because sudden infant death syndrome (SIDS) is the major contributor to excess infant mortality in Northwest AI/AN (4,5), NPAIHB analyzed SIDS rates to determine whether the decline in SIDS rates in the United States also was occurring among Northwest AI/AN. This report summarizes the results of this analysis and documents dramatic decreases in both SIDS and non-SIDS infant mortality.

Annual vital statistics data for 1985-1996 were analyzed from the state health departments of Idaho, Oregon, and Washington and from CDC. Numerators for IMRs were all resident deaths for which the decedent was aged less than 365 days and for which the death certificate was linked to a birth certificate on which the race of the mother was AI/AN, regardless of whether the death occurred in the same calendar year as the birth. Denominators for IMRs were all resident live-born infants for each year for which the race of the mother on the birth certificate was AI/AN. Comparison rates for SIDS and overall infant mortality for all other races (non-AI/AN) were calculated by subtracting the AI/AN births and infant deaths annually for each state from the all-races totals obtained from CDC. Hispanic ethnicity was not considered in the analysis. Annual rate changes were compared with combined rates for 1985-1988, 1989-1992, and 1993-1996. These periods were selected for comparison because of the introduction in 1993 of several programmatic initiatives that might have influenced IMRs among Northwest AI/AN. Deaths attributed to SIDS were those for which the underlying cause of death was listed as International Classifications of Diseases, Ninth Revision, code 798.0. Statistical analysis was conducted using chi square tests for trends using EpiInfo (6).

From 1985 through 1996, IMRs and SIDS rates decreased among Northwest AI/AN (Table_1). In particular, IMRs for Northwest AI/AN decreased from 20.0 per 1000 live-born infants during 1985-1988 to 7.7 during 1993-1996, a rate difference of 12.3 per 1000 population. During the same period, SIDS mortality rates decreased from 8.9 to 3.0, a rate difference of 5.9. Approximately half (48.0%) of the decline in AI/AN IMRs was attributable to the decline in SIDS.

For the same three time periods, IMRs and SIDS rates also decreased for non-AI/AN in Idaho, Oregon, and Washington. For non-AI/AN, IMR declined from 9.6 during 1985-1988 to 6.3 during 1993-1996, a rate

difference of 3.3, and the SIDS rate decreased from 2.5 to 1.4, a rate difference of 1.1. Approximately one third of the decrease in infant mortality in non-AI/AN resulted from the decline in SIDS.

Annual SIDS rates and overall IMRs decreased substantially for both AI/AN and non-AI/AN during the study period (Figure_1). IMRs for Northwest AI/AN is approaching that for non-AI/AN in the same states. The small increase in deaths attributed to SIDS in 1996 did not differ significantly from the trend.

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Editorial Note

Editorial Note: The findings in this report document a dramatic decline in IMR among Northwest AI/AN during 1985-1996. Decreases in both SIDS and non-SIDS cases were observed across each of the last two time periods, but decreases were greatest during 1993-1996. The decline in SIDS among Northwest AI/AN is consistent with, but of a greater magnitude than, the substantial decreases in SIDS nationally that have been attributed to the success of the national Back to Sleep campaign (7).

Multiple factors may have caused the decreases in SIDS and non-SIDS cases among Northwest AI/AN. Important risk factors that have been associated with SIDS include prone sleeping position and exposure to environmental tobacco smoke (ETS). In 1993, to reduce the risk for SIDS among Northwest AI/AN, the Portland Area Indian Health Service (IHS) (covering Idaho, Oregon, and Washington) initiated programs for parental education on nonprone infant sleep position and reduction of infant exposure to ETS. However, many Northwest AI/AN receive part or all of their health-care services outside the IHS health-care delivery system. As a result, the extent that Northwest AI/AN were exposed to these IHS programs is uncertain. As early as 1992, there was publicity in the Seattle area about increased risk for SIDS among infants sleeping prone, and in 1994 the national Back to Sleep program began. However, it is unknown whether there were substantial changes in the prevalence of prone sleeping position or exposure to ETS among Northwest AI/AN during the time periods.

Factors that may have helped reduce non-SIDS IMRs among Northwest AI/AN include 1) structured activities by Portland area IHS programs initiated in 1993 to identify and manage high-risk pregnancies, 2) state programs such as the Washington State First Steps Medicaid expansion program for pregnant women and infants, 3) improved access to tertiary care for very low birth weight (less than 1500 g {less than 3 lbs, 3 oz}) newborns, and 4) improvements in technology (e.g., introduction of surfactant use in neonatal intensive-care units).

The findings in this report are subject to at least four limitations. First, infant race was defined using the CDC's National Center for Health Statistics definition of race for infant mortality (i.e., for calculation of rates, the infant is assigned the mother's race), which differs from the IHS method (i.e., considering the race of the infant as AI/AN if either the mother or father is AI/AN); thus, these findings cannot be directly compared with published IHS data. Second, determining race for AI/AN from vital statistics data is problematic (8); however, using linked records as in this analysis can minimize this problem (9). Third, diagnostic shift could have occurred, resulting in infant deaths that formerly would have been attributed to SIDS being ascribed to other causes. However, this possibility has been examined recently in other populations (7) and was not found to be a substantial factor. Finally, a small number of infant death records could not be linked to a birth certificate and were excluded.

More extensive analysis is needed to determine factors associated with the dramatic decreases in IMRs and SIDS rates among Northwest AI/AN. Further understanding of the protective factors would be useful

for developing and implementing programs to reduce infant mortality in other AI/AN populations in which high rates of SIDS and non-SIDS cases have been documented (10).

References

1. MacDorman MF, Atkinson JO. Infant mortality statistics from the 1996 period linked birth/infant death data set. Mon Vital Stat Rep 1998;46(12).

2. Indian Health Service. Trends in Indian health, 1996. Rockville, Maryland: US Department of Health and Human Services, 1997;40.

3. Indian Health Service. Regional differences in Indian health, 1997. Rockville, Maryland: US Department of Health and Human Services, 1998;50.

4. Spiers PS, Santos V, Steinschneider A, Robertson LD. Race and risk for SIDS: final report to the Maternal and Child Health and Crippled Children's Services Research Grants Program. Springfield, Virginia: US Department of Health and Human Services, Public Health Service, 1988.

5. Irwin KL, Mannino S, Daling J. Sudden infant death syndrome in Washington state: why are Native American infants at greater risk than white infants? J Pediatr 1992;121:242-7.

6. Dean AG, Dean JA, Coulombier D, et al. Epi Info, version 6: a word processing, database, and statistics program for epidemiology on microcomputers {Software documentation}. Atlanta, Georgia: US Department of Health and Human Services, CDC, 1994.

7. CDC. Sudden infant death syndrome -- United States, 1983-1994. MMWR 1996;40:859-63.

8. Frost F, Tollestrup K, Ross A, Sabota E, Kimball E. Correctness of racial coding of American Indians and Alaska Natives on the Washington state death certificate. Am J Prev Med 1994; 10:290-4.

9. CDC. Classification of American Indian race on birth and infant death certificates -- California and Montana. MMWR 1990;42:220-3.

10. Oyen N, Bulterys M, Welty TK, Kraus J. Sudden unexplained infant deaths among American Indians and whites in North and South Dakota. Paediatr Perinat Epidemiol 1990;4:175-83.

Table_1

To print large tables and graphs users may have to change their printer settings to landscape and use a small font size.

TABLE 1. Number of sudden infant death syndrome (SIDS) and non-SIDS cases and SIDS rate among American Indians and Alaska Natives, by year--Idaho, Oregon, and Washington, 1985-1996

Characteristic	1985-1988	1989-1993	1993-1996
No. live-born infants	9,410	10,775	10,350
No. SIDS cases	84	71	31
No. Non-SIDS cases	104	115	49
SIDS rate*	8.9	6.6	3.0
Non-SIDS rate*	11.1	10.7	4.7

* Per 1000 live-born infants.

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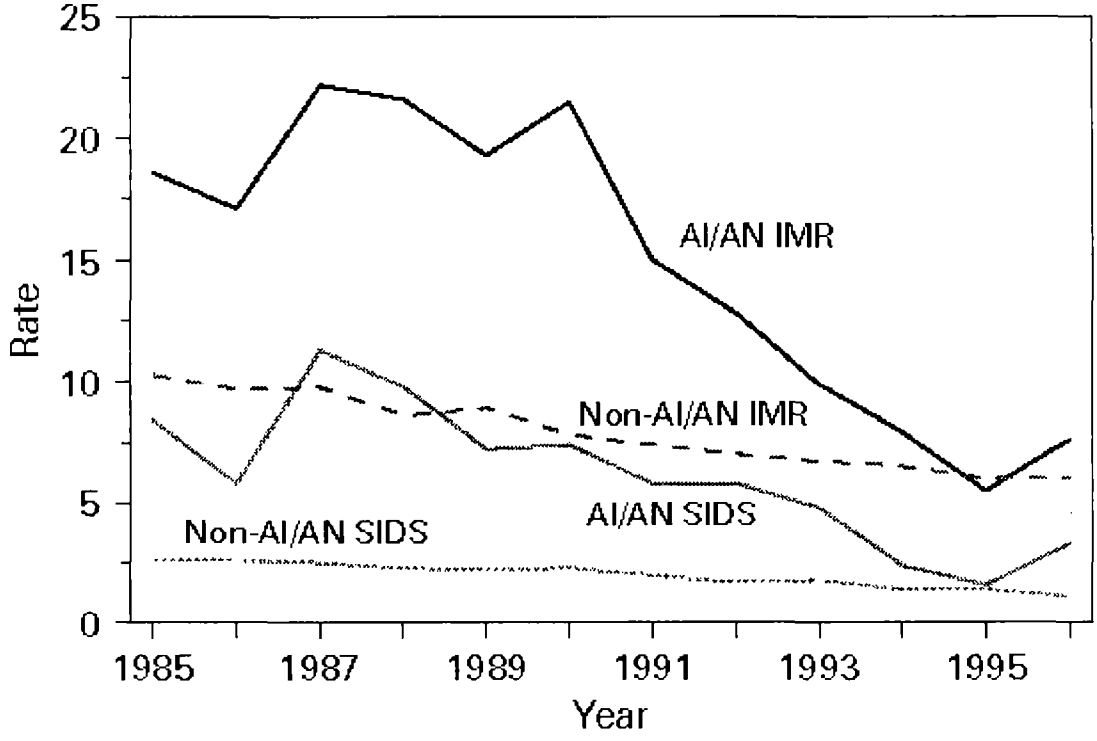
Figure_1

FIGURE 1. Infant mortality rates (IMRs)* and sudden infant death syndrome (SIDS) rates among American Indians and Alaskan Natives (AI/AN) and non-AI/AN — Idaho, Oregon, and Washington, 1985–1996



*Per 1000 live-born infants.

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Preterm Singleton Births -- United States, 1989-1996

Preterm birth (birth at less than 37 completed weeks of gestation) is the second leading cause of neonatal mortality in the United States (1). Preterm birthrates differ by race; in 1996, black infants were 1.8 times more likely than white infants to be preterm (2). From 1989 through 1996, the overall rate of preterm birth (per 1000 live-born infants) increased 4% (2), and the rate of multiple births (e.g., twins, triplets, or other higher-order births) increased 19% (2). Multiple births are associated with preterm birth (3); trends in preterm births independent of the influence of multiple births have not been fully explored. To characterize race- and ethnicity-specific trends in preterm birth independent of multiple births, data from U.S. birth certificates for 1989-1996 were analyzed for singleton births only. This report summarizes the results of this analysis and indicates that although singleton preterm birthrates are stable overall, substantial changes in rates occurred in some racial/ethnic subgroups.

For this report, preterm birth was defined as a live birth occurring at 17-36 completed weeks of gestation and was subgrouped by weeks of gestation: moderately preterm (33-36 weeks), very preterm (29-32 weeks), extremely preterm (20-28 weeks), and ultra preterm (17-19 weeks). Gestational age was determined from information on the birth certificate by one of two methods (2,4): 1) the interval between the first day of the mother's last normal menstrual period (LMP) and the date of birth, or 2) a clinical estimate by the birth attendant of gestational age when the month or year of the LMP was missing or when the gestational age based on this date was inconsistent with the infant's birth weight. Approximately 1% of singleton infants were excluded because of missing or implausible estimates of gestational age. Infants were imputed as singletons for the 0.02% of live-born infants for which the number of fetuses in a given pregnancy was unreported. Maternal race and ethnicity were based on self-report and categorized as non-Hispanic white, non-Hispanic black, Hispanic, American Indian/Alaskan Native, or Asian/Pacific Islander. Stratification by gestational age was not performed for American Indians/Alaskan Natives and Asians/Pacific Islanders because the number of preterm births, when broken down into gestational age subgroups, was too small for meaningful analysis.

From 1989 through 1996, the preterm birthrate (per 1000 live-born infants) among singletons increased 0.3% (from 97.0 to 97.3) (Figure_1). Among moderately preterm singleton infants, the birthrate increased 2% (from 74.8 to 76.5). Among very preterm singleton infants, the birthrate decreased 8% (from 14.4 to 13.2) and among extremely preterm infants, decreased 4% (from 7.6 to 7.3) (Table_1). The singleton preterm birthrate increased 8% among non-Hispanic whites but decreased 10% among non-Hispanic blacks, 4% among Hispanics, 3% among American Indians/Alaskan Natives, and 2% among Asians/Pacific Islanders (Table_1). Among non-Hispanic whites, the moderately preterm birthrate increased 10%, and minor changes were observed in very and extremely preterm birthrates. Among non-Hispanic blacks and Hispanics, the preterm birthrate decreased in the moderately, very, and extremely preterm subgroups (Table_1).

Maternal factors that may affect observed trends in preterm birthrates were analyzed. The percentage of singleton infants born to women aged greater than or equal to 35 years increased 43% (from 8.4% in 1989

to 12.0% in 1996), the percentage born to women who entered prenatal care during the first trimester increased 8% (from 75.6% to 81.8%), and the percentage born to unmarried women increased 20% (from 27.0% to 32.5%). Similar trends were observed in all racial/ethnic groups.

To control for changes in maternal factors, preterm birthrates were directly standardized for each racial/ethnic group to the combined 1989 and 1996 singleton live birth distributions for maternal age, time of entry into prenatal care, and marital status. After standardization, the change from 1989 to 1996 in the preterm birthrate among non-Hispanic whites was 3.8 per 1000 live-born infants, 37% lower than the crude rate change of 6.0 (Table_2). For other racial/ethnic groups, the standardized rate was lower than the crude rate by 50% among non-Hispanic blacks, 29% among Hispanics, and 78% among American Indians/Alaskan Natives.

In addition to changes in maternal factors, changes in obstetric practices occurred during the study period that may have influenced preterm birthrates. For example, the percentage of singleton infants born to women whose labor was medically induced increased from 9.1% to 17.1%. To determine whether changes in preterm birthrates were independent of the change in induction practices, medically induced births were excluded from the analysis and rates were again standardized for maternal age, marital status, and time of entry into prenatal care. In this restricted group, the standardized preterm birthrate increased 9% among non-Hispanic whites, decreased 4% among non-Hispanic blacks, and changed less than 2% among Hispanics, American Indians/Alaskan Natives, and Asians/Pacific Islanders.

The proportion of births for which gestational age estimates were based on clinical evaluation increased slightly during the study period (from 3.6% in 1989 to 4.7% in 1996). Because the method of determining gestational age may influence identification of a birth as preterm, an analysis was conducted that excluded births for which gestational age was clinically estimated. The standardized preterm birthrate for the study period increased 6.3% among non-Hispanic whites, decreased 5.0% among non-Hispanic blacks, and changed less than 2% among Hispanics, American Indians/Alaskan Natives, and Asians/Pacific Islanders.

Reported by: Div of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion; Div of Applied Public Health Training, Epidemiology Program Office; Div of Vital Statistics, National Center for Health Statistics; and an EIS Officer, CDC.

Editorial Note

Editorial Note: The findings in this report indicate that preterm birthrates among singletons are stable; however, the overall rate masks differences in trends by race/ ethnicity and among gestational age subgroups. The rate for singleton preterm births increased among non-Hispanic whites mainly because of an increase in the birthrate of moderately preterm infants. Among non-Hispanic blacks, the decline in moderately, very, and extremely preterm singleton births was substantial, and more modest declines were observed in overall preterm birthrates for Hispanics, American Indians/Alaskan Natives, and Asians/Pacific Islanders. The increase in singleton preterm birthrates among non-Hispanic whites and the decrease among non-Hispanic blacks are not explained entirely by changes in maternal age distribution, marital status, time of entry into prenatal care, induction rates, or use of clinical estimates of gestational age.

The findings in this study are subject to at least three limitations. First, LMP and clinical-based gestational age may be misclassified (e.g., because of imperfect maternal recall, postconception bleeding, delayed ovulation, or intervening early miscarriage); such errors may occur more frequently in some subpopulations, especially at shorter gestations (5). Second, changes in the reporting of preterm live births with the shortest gestations (ultra preterm) could have affected the preterm birthrates (6). However, these infants represent a small fraction of total preterm infants and do not contribute substantially to overall

trends. Finally, because fetal deaths were not evaluated, the contribution of changes in fetal survival to the increase in preterm birthrates for non-Hispanic whites could not be assessed.

The disparity in preterm birthrates between blacks and whites is decreasing because of an increase in preterm births among non-Hispanic whites and a decrease among non-Hispanic blacks. The racial disparity in singleton preterm birth between non-Hispanic blacks and non-Hispanic whites decreased 17% from 1989 to 1996; however, in 1996, the risk for singleton preterm birth among blacks was still twice that for whites. Although many risk factors for preterm delivery have been identified, specific etiologies are not well characterized (7). In addition, many potential risk factors for preterm birth, such as urogenital tract infections (8) and history of subfertility or infertility (9) cannot be examined using the standard certificate of live birth. Additional studies exploring why preterm births are increasing among non-Hispanic whites and decreasing among non-Hispanic blacks may further understanding of how to prevent preterm birth.

References

1. Peters KD, Lochanek KD, Murphy SL. Deaths: final data for 1996. Hyattsville, Maryland: US Department of Health and Human Services, Public Health Service, CDC, National Center for Health Statistics, 1998. National Vital Stat Rep 1998;47(9).

2. Ventura SJ, Martin JA, Curtin SC, Mathews TJ. Report of final natality statistics, 1996. Mon Vital Stat Rep 1998;46(11, suppl).

3. Keith LG, Cervantes A, Mazela J, Oleszczuk JJ, Papiernik E. Multiple births and preterm delivery. Prenat Neonat Med 1998;3:125-9.

4. National Center for Health Statistics. Instruction manual part 12, Computer edits for natality data, 1989. Hyattsville, Maryland: US Department of Health and Human Services, CDC, 1991.

5. Alexander GR, Himes JH, Kaufman RB, Mor J, Kogan M. A United States national reference for fetal growth. Obstet Gynecol 1996;87:163-8.

6. Phelan ST, Goldenberg R, Alexander G, Cliver SP. Perinatal mortality and its relationship to the reporting of low-birthweight infants. Am J Public Health 1998;88:1236-9.

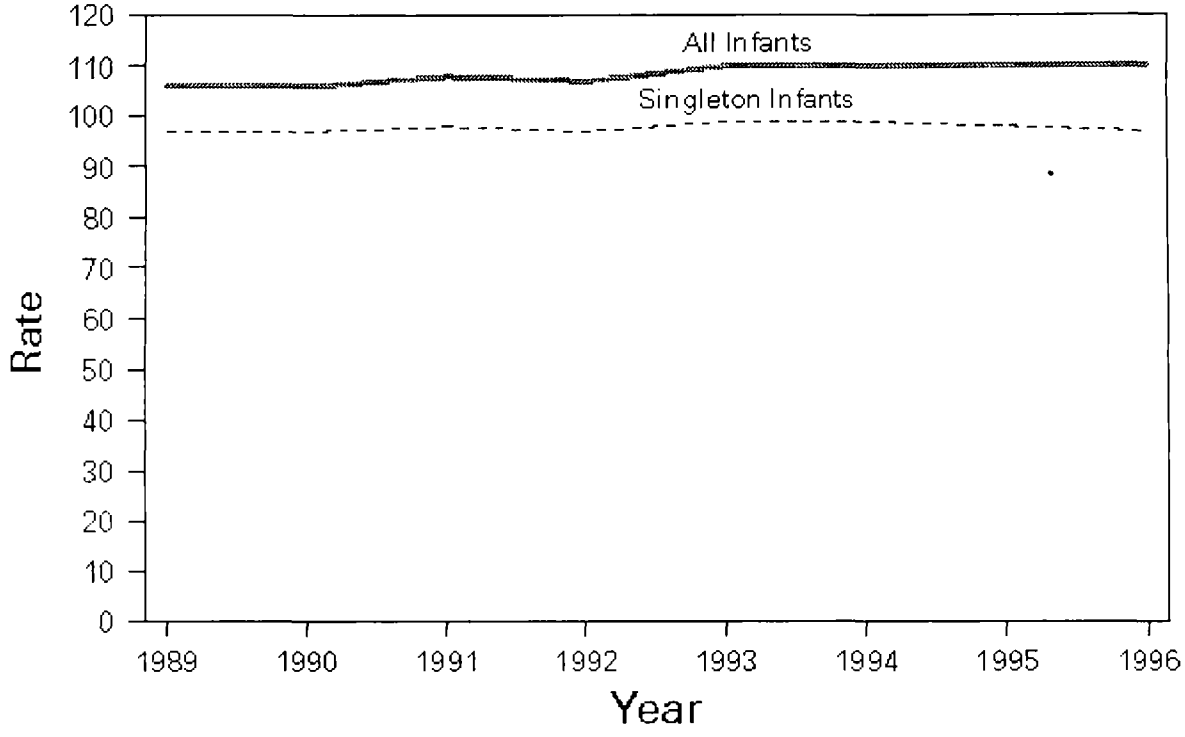
7. Berkowitz GS, Papiernik E. Epidemiology of preterm birth. Epidemiol Rev 1993;15:414-43.

8. Fiscella K. Racial disparities in preterm births. The role of urogenital infections. Public Health Rep 1996;111:104-13.

9. Henriksen TB, Baird DD, Olsen J, Hedegaard M, Secher NJ, Wilcox AJ. Time to pregnancy and preterm delivery. Obstet Gynecol 1997;89:594-9.

Figure_1

FIGURE 1. Rate* of preterm† birth among singleton infants — United States 1989–1996



*Per 1000 live-born infants.
†<37 completed weeks of gestation.

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Table_1

To print large tables and graphs users may have to change their printer settings to landscape and use a small font size.

TABLE 1. Rate* of preterm† birth among singleton infants, by maternal race/ethnicity&, gestational age group, and year -- United States, 1989 and 1996

Race/Ethnicity/ Gestational age	1989	1996	% Change
Non-Hispanic white			
<20 weeks	0.1	0.1	7.7
20-28 weeks	4.8	4.9	2.1
29-32 weeks	9.9	9.9	0
33-36 weeks	60.0	65.9	9.8
Total	74.8	80.8	8.0
Non-Hispanic black			
<20 weeks	0.7	0.7	0
20-28 weeks	20.5	19.1	- 6.8
29-32 weeks	32.6	27.1	-16.9
33-36 weeks	126.6	115.6	- 8.7
Total	180.4	162.5	- 9.9
Hispanic			
<20 weeks	0.2	0.1	-23.5
20-28 weeks	6.5	6.4	- 1.5
29-32 weeks	14.5	13.4	- 7.6
33-36 weeks	83.3	80.8	- 3.0
Total	104.5	100.7	- 3.6
American Indian/ Alaskan Native	112.9	109.7	- 2.8
Asian/Pacific Islander	94.8	92.6	- 2.3
All races			
<20 weeks	0.2	0.2	- 4.2
20-28 weeks	7.6	7.3	- 3.9
29-32 weeks	14.4	13.2	- 8.3
33-36 weeks	74.8	76.5	2.3
Total	97.0	97.3	0.3

* Per 1000 live-born infants, rounded to the nearest tenth.
+ <37 completed weeks of gestation.
& Stratification by gestational age was not performed for American Indians/Alaskan Natives and Asians/Pacific Islanders because the number of preterm births, when broken into gestational age subgroups, was too small for meaningful analysis.

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Table_2

Note: To print large tables and graphs users may have to change their printer settings to landscape and use a small font size.

TABLE 2. Crude and standardized rates* of preterm+ birth among singleton infants and change in rate, by maternal race/ethnicity -- United States, 1989 and 1996

	Crude				Standardized&			
	Rate		Change 1989 to 1996		Rate		Change 1989 to 1996	
Race/Ethnicity	1989	1996	Absolute	(%)	1989	1996	Absolute	(%)
Non-Hispanic white	74.8	80.8	6.0	(8.0%)	81.4	85.2	3.8	(4.6%)
Non-Hispanic black	180.4	162.5	17.9	(-9.9%)	154.6	145.6	9.0	(-5.8%)
Hispanic	104.5	100.7	3.8	(-3.6%)	99.8	97.1	2.7	(-2.8%)
American Indian/ Alaskan Native	112.9	109.7	3.2	(-2.8%)	101.3	102.0	0.7	(0.7%)
Asian/Pacific Islander	94.8	92.6	2.2	(-2.3%)	102.5	99.3	3.2	(-3.1%)

* Per 1000 live-born infants.
+ <37 completed weeks of gestation.
& Calculated by direct standardization using the combined 1989 and 1996 singleton live birth distributions for maternal age, entry into prenatal care, and marital status.

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Report of Final Natality Statistics, 1996. Vol. 46, No. 11 supplement . 100 pp. (PHS) 98-1120

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Birth Data Web Page

The latest birth statistics for the United States

The latest birth statistics for the United States show a continued decline in smoking during pregnancy, an improvement in prenatal care, and a drop in the birth rate for unmarried women, according to a new report released today by the Department of Health and Human Services. The final 1996 birth statistics from HHS' National Center for Health Statistics document improvements in some key indicators of maternal and infant health.

Cigarette smoking during pregnancy continued to decline in 1996, to 13.6 percent of women giving birth that year. Tobacco use has fallen steadily since 1989, when about 20 percent of pregnant women smoked.

"We're getting the word out to women that one of the best things they can do for their baby is to never smoke, or to quit if they do smoke," said HHS Secretary Donna E. Shalala. Women who smoke during pregnancy are almost twice as likely to have a low birthweight infant and low birthweight is a leading cause of infant mortality or disability.

However, for young teenage mothers--those under 18--smoking actually increased 5 percent between 1995 and 1996, although rates are still lower than a few years ago. "Just like all teenagers, teenage moms need special efforts to help them stay away from tobacco and its legacy of disease and death," Secretary Shalala said.

The rates of timely prenatal care have improved for women in all race and ethnic groups in the 1990's.

women in all race and ethnic groups in the 1990's. The proportion of women who receive prenatal care in the first trimester climbed to 81.9 percent in 1996, and it is during these visits that women are often warned against smoking. Although early care has also improved for teens, they are less likely than older women to receive care beginning in the first trimester and thus could miss these vital warnings.

The birth rate for unmarried women in 1996 was 1 percent lower than in 1995 and 4 percent lower than the highest level, recorded in 1994. The rate for non-Hispanic white women increased slightly, but the rate for Hispanic and black women each declined 2 percent. The rate for black women reaching the lowest rate since 1969, when data were first available specifically for black women. The rate for black women has now dropped 18 percent since 1989. The actual number of unmarried births in 1996 rose slightly to 1,260,306, accounting for 32.4 percent of all births.

The report also documents a dramatic increase in multiple births to an unprecedented high, due in part to the increased use of fertility enhancing therapies and to the shift in delayed childbearing. The number of live births in triplet, quadruplet, quintuplet and other higher-order multiple deliveries rose 19 percent in a single year between 1995 and 1996 and was up 344 percent just since 1980. In 1980, there were just over 1,300 higher-order multiple births compared with an all-time high of 5,939 in 1996. Over that time, the rate jumped from 37.0 births per 100,000 women to 152.6 per 100,000. The rate of twin births has increased but less dramatically, up 4 percent in 1996 from the previous year and 37 percent from 1980.

The rise in multiple births has had a direct impact on low birthweight and preterm infants. Both of these measures have increased during the 1990's, due at least in part, to the rise in multiple births, which are at greater risk of being born at low birthweight and prior to full term.

Overall, births in the United States declined slightly in 1996 to 3,891,494, the smallest number recorded since 1987. The birth rate is at the lowest

level reported in two decades. The teenage birth rate continued to decline while the birth rates for women in the peak childbearing years increased slightly. The pace of increase for births to women in their 30's and 40's has slowed considerably in recent years.

"Report of Final Natality Statistics, 1996," by Stephanie Ventura, Joyce Martin, Sally Curtin, and T. J. Mathews is available from the National Center for Health Statistics and can be viewed and downloaded from the NCHS home page at http://www.cdc.gov/nchswww/ NCHS is a part of the Centers for Disease Control and Prevention, within HHS.

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Vol. 46, No. 12, Supplement, Infant Mortality Statistics From the 1996 Period Linked Birth/Infant Death Data Set

433 KB **(This report can be viewed only with Adobe Acrobat 3.0.)**

In 1996 the infant mortality rate declined to 7.3 deaths per 1,000 live births, the lowest rate ever recorded and a decline of 3 percent from 1995. Infants with low birthweight, born preterm, or in multiple births have a higher risk of dying in the first year of life. Babies born to teenagers and to women in their forties and to mothers who did not complete high school, were unmarried, did not receive timely prenatal care, or smoked during pregnancy also have higher infant mortality rates.

A new report from the National Center for Health Statistics, Centers for Disease Control and Prevention, presents infant mortality statistics from the latest linked birth/infant death data set to identify factors that impact infant mortality or survival. The report is a special analysis of birth and death information provided through the Nation's vital statistics system and follows up an earlier report released last February.

Birthweight is one of the most important predictors of an infant's subsequent health and survival. In 1996, 7.4 percent of infants were low birthweight, defined as less than 2,500 grams (5 lbs, 8 oz); however, 64 percent of all infant deaths were among low birthweight babies. Survival of low birthweight infants has improved

Survival of low birthweight infants has improved however. The largest declines (8 to 10 percent) in bodyweight-specific infant mortality rates from 1995-96 were for infants born weighing 750-1,250 grams and 1,500-1,999 grams.

The infant mortality rate for male infants was 8.0 in 1996, 21 percent higher than the rate of 6.6 for females. Babies born in multiple births have an infant mortality rate 5 times that of single births. Infant mortality rates are highest for teenagers and for women in their 40's and lowest for women in their 20's and early 30's. The infant mortality rate was nearly twice as high for unmarried women as for married women. In general, infant mortality declined with increasing education of the mother. Mothers who had not completed high school had infant mortality rates which were twice that of women with a college education.

Analysis of the vital statistics data also showed that mortality rates varied considerably by race of mother. In 1996 the overall infant mortality rate from the linked file was 7.3 deaths per 1,000 live births. Mortality rates were lowest for infants born to Asian and Pacific Islander mothers (5.2), followed by white (6.1), American Indian (10.0), and black (14.1) mothers. The mortality rate for infants of Hispanic mothers (6.1) was similar to the rate for non-Hispanic white mothers (6.0) and ranged from 5.0 for infants of Central and South American mothers to 8.6 for infants of Puerto Rican mothers.

For infants of American Indian mothers, death rates were highest in the postneonatal period with death rates from sudden infant death syndrome and accidents more than 3 times the rate for white infants. For black infants, disorders related to short gestation and low birthweight was the leading cause of death, with black infants more than 4 times as likely to die from this cause as white infants.

"Infant Mortality Statistics from the 1996 Period Linked Birth/Infant Death Data Set" by Marian F. MacDorman and Jonnae O. Atkinson is based on information from the death certificate linked to the corresponding birth certificate for each infant under 1 year of age who died in 1996.

The purpose of the linkage is to use the additional information from the birth certificate to conduct more detailed analyses of infant mortality patterns to provide better information for prevention, research, and medical care. Birth and death certificates are linked by the State vital statistics offices where the original records are filed and reported to NCHS through the National Vital Statistics System. Copies of the report are available from NCHS.

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Table 11. Low-birthweight live births, according to mother's detailed race, Hispanic origin, and smoking status: United States, selected years 1970-96

[Data are based on the National Vital Statistics System]

Birthweight, race of mother, Hispanic origin of mother, and smoking status of mother	*1970*	*1975*	*1980*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*
Low birthweight (less than 2,500 grams)	Percent of live births[1]										
All races	7.93	7.38	6.84	6.72	6.75	6.81	6.90	6.93	7.05	6.97	7.12
White	6.85	6.27	5.72	5.61	5.65	5.66	5.70	5.67	5.72	5.70	5.80
Black	13.90	13.19	12.69	12.58	12.65	12.77	12.98	13.26	13.51	13.25	13.55
American Indian or Alaskan Native	7.97	6.41	6.44	6.15	5.86	5.94	6.15	6.00	6.26	6.11	6.15
Asian or Pacific Islander	---	---	6.68	6.57	6.16	6.47	6.41	6.31	6.51	6.45	6.54
Chinese	6.67	5.29	5.21	5.05	4.98	4.85	5.02	4.63	4.89	4.69	5.10
Japanese	9.03	7.47	6.60	5.91	6.21	6.03	6.49	6.69	6.67	6.16	5.90
Filipino	10.02	8.08	7.40	7.78	6.95	7.42	7.30	7.15	7.35	7.30	7.31
Hawaiian and part Hawaiian	---	---	---	---	---	---	---	---	7.29	7.24	6.73
Other Asian or Pacific Islander	---	---	---	---	---	---	---	---	6.61	6.65	6.74
Hispanic origin											

(selected States)[2,3]	- - -	- - -	6.12	6.15	6.16	6.13	6.24	6.17	6.18	6.06	6.15
Mexican American	- - -	- - -	5.62	5.68	5.77	5.62	5.74	5.60	5.60	5.55	5.60
Puerto Rican	- - -	- - -	8.95	8.88	8.69	9.22	9.30	9.42	9.50	8.99	9.42
Cuban	- - -	- - -	5.62	5.86	6.02	5.46	5.89	5.94	5.77	5.67	5.57
Central and South American	- - -	- - -	5.76	5.81	5.68	5.69	5.74	5.58	5.81	5.84	5.87
Other and unknown Hispanic	- - -	- - -	6.96	6.89	6.83	6.87	6.91	6.85	6.74	6.87	7.25
White, non-Hispanic (selected States)[2]	- - -	- - -	5.67	5.53	5.60	5.58	5.63	5.62	5.62	5.61	5.72
Black, non-Hispanic (selected States)[2]	- - -	- - -	12.71	12.54	12.61	12.85	13.10	13.28	13.61	13.32	13.62
Cigarette smoker[4]	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	11.36	11.25	11.41
Nonsmoker[4]	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	6.02	6.14	6.36
Very low birthweight (less than 1,500 grams)											
All races	1.17	1.16	1.15	1.19	1.21	1.21	1.24	1.24	1.28	1.27	1.29
White	0.95	0.92	0.90	0.93	0.94	0.93	0.94	0.93	0.95	0.95	0.96
Black	2.40	2.40	2.48	2.60	2.71	2.73	2.79	2.86	2.95	2.92	2.96
American Indian or Alaskan Native	0.98	0.95	0.92	1.02	1.01	0.99	1.13	1.00	1.00	1.01	1.07
Asian or Pacific Islander	- - -	- - -	0.92	0.93	0.85	0.86	0.83	0.84	0.90	0.87	0.85
Chinese	0.80	0.52	0.66	0.70	0.57	0.63	0.65	0.57	0.61	0.51	0.65

Japanese	1.48	0.89	0.94	0.81	0.84	0.86	0.80	0.92	0.86	0.73	0.62
Filipino	1.08	0.93	0.99	0.97	0.86	0.87	0.94	0.91	1.12	1.05	0.97
Hawaiian and part Hawaiian	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	1.13	0.97	1.02
Other Asian or Pacific Islander	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.89	0.92	0.87
Hispanic origin (selected States)[2,3]	- - -	- - -	0.98	1.01	1.01	1.02	1.06	1.01	1.05	1.03	1.02
Mexican American	- - -	- - -	0.92	0.93	0.97	0.94	0.96	0.89	0.94	0.92	0.92
Puerto Rican	- - -	- - -	1.29	1.49	1.30	1.47	1.63	1.61	1.71	1.62	1.66
Cuban	- - -	- - -	1.02	1.04	1.18	1.09	0.97	1.17	1.13	1.20	1.15
Central and South American	- - -	- - -	0.99	1.04	1.01	1.04	1.02	0.97	1.05	1.05	1.02
Other and unknown Hispanic	- - -	- - -	1.01	1.05	0.96	1.08	1.15	1.11	1.04	1.09	1.09
White, non-Hispanic (selected States)[2]	- - -	- - -	0.86	0.88	0.90	0.89	0.91	0.89	0.93	0.93	0.94
Black, non-Hispanic (selected States)[2]	- - -	- - -	2.46	2.56	2.66	2.68	2.73	2.82	2.97	2.93	2.97
Cigarette smoker[4]	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	1.75	1.73	1.73
Nonsmoker[4]	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	1.16	1.18	1.21

- - - Data not available.

[1] Excludes live births with unknown birthweight. Percent based on live births with known birth

[2] Trend data for Hispanics and non-Hispanics are affected by expansion of the reporting area birth certificate and by immigration. These two factors affect numbers of events, composition

maternal and infant health characteristics. The number of States in the reporting area increas District of Columbia (DC) in 1983-87, 30 and DC in 1988, 47 and DC in 1989, 48 and DC in 1 50 and DC in 1993 (see Appendix I, National Vital Statistics System).

[3] Includes mothers of all races.

[4] Percent based on live births with known smoking status of mother and known birthweight. In District of Columbia (DC) in 1989, 45 States and DC in 1990, and 46 States and DC in 1991- York City (NYC) in 1994-96. Excludes data for California, Indiana, and New York (but include Dakota (1989-96), Oklahoma (1989-90), and Louisiana and Nebraska (1989), which did not r tobacco use during pregnancy on the birth certificate (see Appendix I).

NOTES: The race groups, white and black, include persons of Hispanic and non-Hispanic ori Hispanic origin may be of any race.

SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics. Health and Utilization Analysis from data compiled by the Division of Vital Statistics; Ventura TJ. Report of final natality statistics, 1996. Monthly vital statistics report; vol. 46. Hyattsville, natality statistics, for each data year 1970-95. Monthly vital statistics report. Hyattsville, Maryl

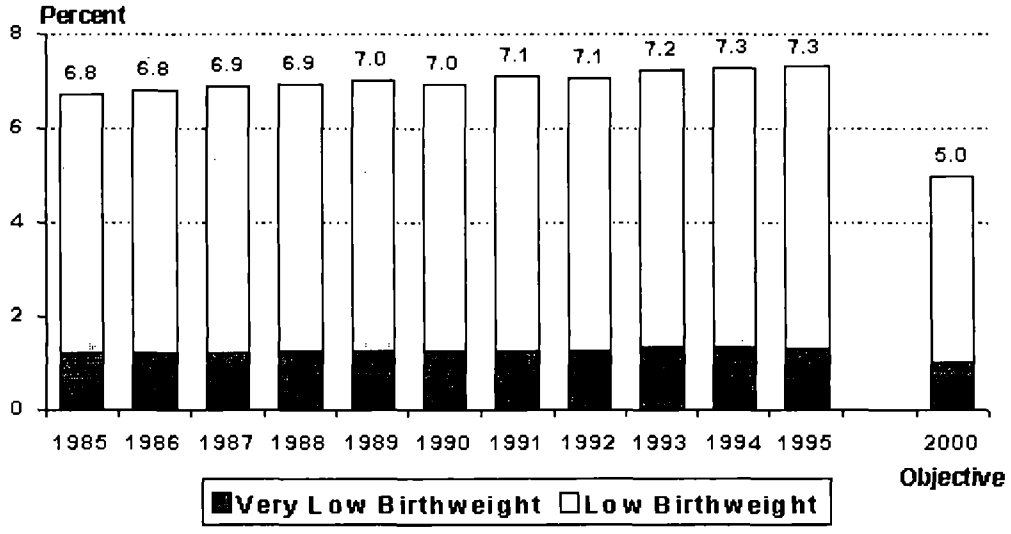
Suggested citation: National Center for Health Statistics. **Health, United States, 1998** With Socioeconomic Status and Health Chartbook. Hyattsville, Maryland: Public Health Service, p 181. 1998. (The NCHS Web site contains **instructions** to download the Acrobat® reader required to view this publication.)

March of Dimes
Infant Health Statistics

Between 1985 and 1995 the low birthweight (less than 2500 grams) rate increased 7 percent from 6.8 percent to 7.3 percent. The very low birthweight (less than 1500 grams) rate also rose from 1.2 percent in 1985 to 1.3 percent in 1995.

The 1995 low birthweight rate of 7.3 percent was 46 percent higher that the Health People Year 2000 Objective of 5 percent. This means that had the target been attained, low birthweight in nearly 90,000 of the 285,152 low birthweight infants born in 1995 could have been prevented. Similarly, very low birthweight could have been prevented in more than 12,000 of the 52,420 very low birthweight births in 1995 had the Year 2000 Objective of 1.0 percent been met.

Low and Very Low Birthweight Births
United States, 1985-1995



Source: National Center for Health Statistics
Prepared by March of Dimes Perinatal Data Center, 1998

For more details see the 1997 March of Dimes Statbook

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May-98

March of Dimes
Infant Health Statistics

Quick Stats
for the United States

- Every eight seconds a baby is born in the United States.
- Every hour four babies die.
- Black infants are more than twice as likely to die before their first birthday as white infants.
- Birth defects are the leading cause of infant mortality.
- One in five infant deaths is due to birth defects.
- Every 3 ½ minutes a baby is born with a birth defect.*
- Every two minutes a low birthweight baby is born.
- Every year more than 5,500 babies are born weighing less than one pound.
- Every minute a baby is born to a teen mother.
- Each day 466 babies are born to mothers who started prenatal care in the third trimester or received no prenatal care at all.
- One in nine infants is born preterm (less than 37 weeks gestation).
- The US infant mortality rate is higher than 24 other nations.

Based on 1994 final data from the National Center for Health Statistics and *estimates from the CDC.
Calculations by the March of Dimes Perinatal Data Center 1997

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Apr-98

How little is too little for a baby's safety? UT Southwestern researchers shed new light on size and morbidity/mortality in newborns

Contact: Ann Harrell
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DALLAS - April 22, 1999 - The smallest 3 percent of infants born at term and of the same gestational age are at the greater risk of death or disability - compared to the 10 percent previously believed to be in danger, UT Southwestern Medical Center at Dallas researchers report.

The study in the April 22 *New England Journal of Medicine* brings good news to many parents worried about undersized newborns.

"The good news is that babies apparently need to be a lot smaller than originally thought to be at greatest risk," said Dr. Steven Bloom, assistant professor of obstetrics and gynecology, who conducted the study with Drs. Donald McIntire and Brian Casey, assistant professors of obstetrics and gynecology, and Dr. Kenneth Leveno, professor of obstetrics and gynecology.

The study included approximately 127,000 newborns at Parkland Memorial Hospital. They were grouped according to gestational age and weight. Infants were compared to others in their gestational age group. A baby born at 40 weeks, for example, would be in the lowest 3 percent in size if it weighed below 5 pounds 13 ounces. It would be in the lowest 10 percent if it weighed less than 6 pounds 6 ounces.

For pre-term infants, the researchers did not find a specific threshold below which infants fared poorly. Instead the risk of adverse outcomes for pre-term babies, such as respiratory disease and neonatal death, increased as the baby's growth decreased.

Although it has been known that babies born too early are in danger, this latest study showed that babies born both too early and too small are in double jeopardy, researchers said. According to the National Institutes of Health, about 250,000 low-birth weight infants are born in the United States annually. While most low-birth weight infants are born prematurely, about 40,000 born at term suffer from intrauterine growth restriction.

"No one has known for sure before whether there is a threshold weight below which morbidity and mortality are significantly greater or whether that threshold varies at different developmental stages," Bloom said. "We suspect that the tenth percentile is too high a threshold because too many babies normally destined to have lower birth weights are included instead of just those who are small due to problems with the pregnancy."

Because the serious problems common in term and pre-term infants differ, the researchers worked out appropriate standards for the two groups. Among the indications of trouble in the term babies were a need for a mechanical ventilator, low Apgar scores, infection and seizures.

Pre-term infants, who face special difficulties because of delivery before development is complete, were monitored for respiratory failure, intracranial hemorrhaging and the necessity of intestinal surgery.

"Normal"-sized babies were used for comparison to the two groups.

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The New England Journal of Medicine -- April 22, 1999 -- Vol. 340, No. 16

ORIGINAL ARTICLE

Birth Weight in Relation to Morbidity and Mortality among Newborn Infants

Donald D. McIntire, Steven L. Bloom, Brian M. Casey, Kenneth J. Leveno

Abstract

Background. At any given gestational age, infants with low birth weight have relatively high morbidity and mortality. It is not known, however, whether there is a threshold weight below which morbidity and mortality are significantly greater, or whether that threshold varies with gestational age.

Methods. We analyzed the neonatal outcomes of death, five-minute Apgar score, umbilical-artery blood pH, and morbidity due to prematurity for all singleton infants delivered at Parkland Hospital, Dallas, between January 1, 1988, and August 31, 1996. A distribution of birth weights according to week of gestation at birth was created. Infants in the 26th through 75th percentiles for weight served as the reference group. Data on preterm infants (those born at 24 to 36 weeks of gestation) were analyzed separately from data on infants delivered at term (37 or more weeks of gestation).

Results. A total of 122,754 women and adolescents delivered singleton live infants without malformations between 24 and 43 weeks of gestation. Among the 12,317 preterm infants who were analyzed, there was no specific birth-weight percentile at which morbidity and mortality increased. Among 82,361 infants who were born at term and whose birth weights were at or below the 75th percentile, however, the rate of neonatal death increased from 0.03 percent in the reference group (26th through 75th percentile for weight) to 0.3 percent for those with birth weights at or below the 3rd percentile ($P<0.001$). The incidence of five-minute Apgar scores of 3 or less and umbilical-artery blood pH values of 7.0 or less was approximately doubled for infants at or below the 3rd birth-weight percentile ($P=0.003$ and $P<0.001$, respectively). The incidence of intubation at birth, seizures during the first day of life, and sepsis was also significantly increased among term infants with birth weights at or below the 3rd percentile. These differences persisted after adjustment for the mother's race and parity and the infant's sex.

Conclusions. Mortality and morbidity are increased among infants born at term whose birth weights are at or below the 3rd percentile for their gestational age. (N Engl J Med 1999;340:1234-8.)

Source Information

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March of Dimes
Infant Health Statistics

INFANT MORTALITY

International Comparisons of Infant Mortality Rates, 1993

The United States infant mortality rate ranked 25th among selected countries* in 1993. The 1993 US infant mortality rate of 8.4 per 1,000 live births was nearly twice as high as the number 1 ranked country, Japan, with a rate of 4.4. The 1995 preliminary US infant mortality rate was 7.5 per 1,000 live births.

Rank	Country	Rate
1	Japan	4.4
2	Finland	4.4
3	Singapore	4.7
4	Hong Kong	4.8
5	Sweden	4.8
6	Norway	5.1
7	Denmark	5.4
8	Switzerland	5.6
9	Germany	5.8
10	Ireland	6.0
11	Australia	6.1
12	England and Wales	6.2
13	Netherlands	6.3
14	Canada	6.3
15	Austria	6.5
16	Scotland	6.5
17	France	6.8
18	Northern Ireland	7.1
19	Italy	7.2
20	Spain	7.2
21	New Zealand	7.2
22	Israel	7.8
23	Belgium	8.2
24	Greece	8.3
25	**UNITED STATES**	8.4

26	Czech Republic	8.5
27	Cuba	9.4
28	Portugal	9.6
29	Kuwait	12.3
30	Hungary	12.5
31	Chile	13.1
32	Poland	13.4
33	Puerto Rico	13.4
34	Costa Rica	13.8
35	Bulgaria	15.5
36	Russian Federation	20.3
37	Romania	23.3

* Includes countries that reported infant mortality rates to the World Health Organization
Rates are per 1,000 live births
Note: Rankings are based on more than one decimal place
Source: National Center for Health Statistics
Prepared by March of Dimes, Perinatal Data Center 1997

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Apr-98

NIAID NEWS Office of Communications and Public Liaison

National Institute of Allergy and Infectious Diseases • National Institutes of Health

FOR RELEASE
Tuesday, Jan. 12, 1999

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Reassuring Findings About Infants Exposed to Zidovudine

Children exposed to zidovudine (ZDV, AZT) *in utero* and as newborns and who escaped acquiring HIV from their infected mothers show no cancers or other adverse health effects up through preschool age, according to a new study from the National Institutes of Health (NIH). It is the first report to assess the late effects of AZT exposure in healthy HIV-uninfected children born to mothers who took the drug to prevent transmitting HIV to their offspring.

The study, sponsored by the Pediatric AIDS Clinical Trials Group (PACTG) and funded by the National Institute of Allergy and Infectious Diseases (NIAID) and the National Institute of Child Health and Human Development (NICHD), appears in the Jan. 13 issue of the *Journal of the American Medical Association*.

"These data are critically important because the current recommendation is to treat HIV-infected pregnant women with regimens that include AZT to prevent perinatal HIV transmission," says NIAID Director Anthony S. Fauci, M.D. "Although these findings are reassuring," he adds, "we need to continue to monitor these children for long-term adverse effects of the drug." The investigators plan to follow these children until at least age 21.

The 234 HIV-uninfected children evaluated in this report are part of PACTG 219, a long-term follow-up study that includes more than 2,200 children who have been enrolled in PACTG prevention and treatment protocols. The 234 children were born to mothers who participated in PACTG 076. This landmark NIH study showed that AZT can reduce HIV transmission from an infected woman to her infant by approximately two-thirds. The children in PACTG 076 were exposed to AZT or a placebo *in utero* and during labor and delivery, and also as newborns for six weeks.

The randomized design of PACTG 076 and subsequent follow-up in this study makes it easier to clearly evaluate AZT's potential toxicity, the investigators note. The health of children who received AZT (122 children) can be compared with that of a similar number of children (112) who received a placebo.

For the current study, the investigators evaluated the children at regular intervals. The main measures of interest included physical growth, cognitive and development milestones, immunologic function, cardiac and ophthalmologic evaluations, the occurrence of malignancies, and mortality.

"The good news is that there are no differences in growth and cognitive development between the children exposed to AZT versus the children who were not," comments lead author Mary Culnane, M.S., C.R.N.P, of NIAID's pediatric medicine branch in the Division of AIDS. "It also is reassuring that none of the

children have developed cancers or died."

The *JAMA* article reports on data collected through February 1997. The median age of the children was 4.2 years (range 3.2 to 5.6 years). They continue to be followed in the PACTG clinics.

The authors conclude that their findings complement the earlier findings of PACTG 076, which found no evidence of AZT toxicity in children up to 18 months of age, and are consistent with the limited other early safety data concerning perinatal exposure to AZT. Future evaluations of these and other children in PACTG 219 will help define the long-term safety of AZT use during the perinatal period. Pediatric HIV specialists also hope to establish a registry to track the health of all children exposed to antiretrovirals, a proposal that is being actively discussed within the medical community.

NIAID and NICHD are components of the National Institutes of Health (NIH). NIAID conducts and supports research to prevent, diagnose and treat illnesses such as HIV disease and other sexually transmitted diseases, tuberculosis, malaria, asthma and allergies.

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Reference:
M Culnane, MG Fowler, SS Lee, G McSherry, M Brady, K O'Donnell, L Mofenson, SL Gortmaker, DE Shapiro, G Scott, E Jimenez, EC Moore, C Diaz, PM Flynn, B Cunningham and J Oleske. Lack of long-term effects among uninfected children exposed to zidovudine. *The Journal of the American Medical Association* 281(2), 151-57 (1999).

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Early EDucation

INDICATOR OF THE MONTH

NATIONAL CENTER FOR EDUCATION STATISTICS

Early literacy experiences in the home

December 1998

Family participation in literacy activities provides valuable developmental experiences for young children. In addition to developing an interest in reading, children who are read to, told stories, and visit the library may start school better prepared to learn. Engaging young children in literacy activities at home also enables parents and other family members to become active participants in their children's education at an early age.

- In 1996, more than 80 percent of children ages 3–5 were read to three or more times or told a story in the past week by a parent or family member, while 38 percent had visited a library in the past month. The percentage of children who were read to or told a story increased between 1991 and 1996.
- Children ages 3–5 who were not enrolled in preprimary education were just as likely to have been told a story by a parent or family member in the past week as their peers who were enrolled in kindergarten in 1996. However, children ages 3–5 who were not enrolled in preprimary education were less likely to have been read to three or more times in the past week or to have visited a library in the past month than children who were enrolled in kindergarten.
- White children ages 3–5 were more likely to have been read to three or more times in the past week than their black or Hispanic counterparts in 1996. Additionally, white children were more likely to have visited a library in the past month than their black and Hispanic peers.
- In 1996, children ages 3–5 whose parents' highest education level was a bachelor's degree or higher were more likely to have been read to at least three times in the past week or to have visited a library in the past month than children whose parents' highest education level was a high school diploma or GED.

Percentage of children ages 3–5 who participated in various literacy activities with a parent or family member, by selected characteristics: 1991, 1995, and 1996

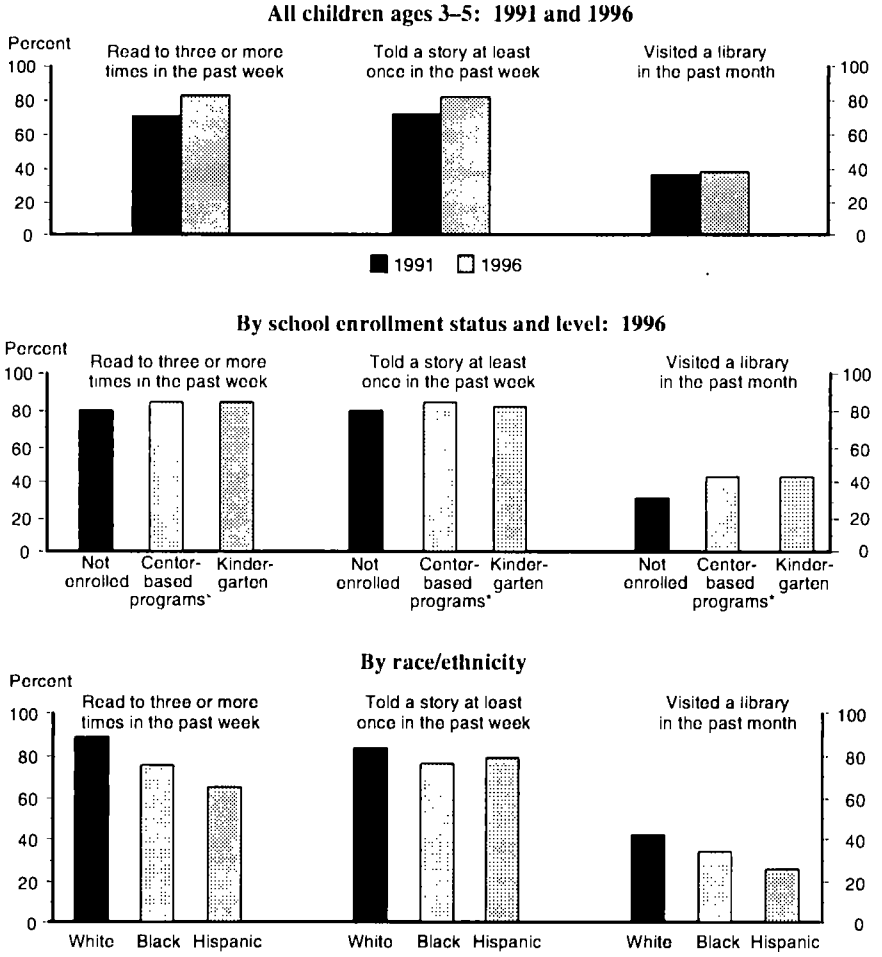
	Read to three or more times in the past week			Told a story at least once in the past week			Visited a library in the past month		
Selected characteristics	1991	1995	1996	1991	1995	1996	1991	1995	1996
Total	**71.4**	**83.1**	**82.9**	**72.0**	**81.4**	**82.0**	**36.6**	**41.2**	**38.2**
School enrollment status and level									
Not enrolled	68.8	81.5	80.0	72.3	80.3	80.0	30.5	32.0	31.5
Center-based programs*	75.2	85.8	85.2	74.1	82.7	84.0	41.0	46.3	42.6
Kindergarten	71.1	81.3	83.8	68.8	81.0	81.9	41.7	47.3	42.1
Race/ethnicity									
White	77.7	89.0	88.9	73.8	83.9	83.9	40.7	45.1	42.5
Black	59.0	73 7	75.9	66.0	74.4	76.6	27.8	34.1	34.1
Hispanic	53.0	61.5	65.3	68.4	75.1	79.3	24.5	28.0	25.9
Parents' highest education level									
Less than high school diploma	53.8	64.4	58 8	67.4	71.9	72.8	18.3	18 3	19.4
High school diploma or GED	63.5	77.9	77 4	68.2	77.6	79.9	26.0	31.5	30.1
Some college/vocational/technical	74.0	85 3	86.5	74.2	82.9	84.6	38.5	40 9	37.1
Bachelor's degree	82.1	89.7	90 9	74.7	85.0	83 2	52.0	53.5	51.9
Graduate/professional school	88.3	94.0	96.1	78.4	88.2	85.8	59.1	62.8	59.5

* Center-based programs include Head Start, nursery school, and prekindergarten.

NOTE: This analysis includes children ages 3–5 who were not enrolled in first grade. Included in the total but not shown separately are children from other racial/ethnic groups.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Household Education Survey (NHES), 1991 (Early Childhood Education File), 1995 (Early Childhood Program Participation File), and 1996 (Parent and Family Involvement in Education File).

Percentage of children ages 3–5 who participated in various literacy activities with a parent or family member, by selected characteristics: 1991, 1995, and 1996



* Center-based programs include Head Start, nursery school, and prekindergarten.

NOTE: This analysis includes children ages 3–5 who were not enrolled in first grade.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Household Education Survey (NHES), 1991 (Early Childhood Education File) and 1996 (Parent and Family Involvement in Education File).

INDICATOR OF THE MONTH

NATIONAL CENTER FOR EDUCATION STATISTICS

Preprimary education enrollment

January 1999

Participating in early childhood programs such as Head Start, nursery school, prekindergarten, and kindergarten can better prepare a child to enter first grade. Many policymakers and educators believe that it is important to help all children start elementary school on an equal footing with other children. Involving students in preprimary programs beginning at earlier ages may provide these students with valuable experiences that will help them start elementary school better prepared to learn.

- Preprimary enrollment rates for 3-, 4-, and 5-year-olds were higher in 1996 than in 1991. In 1996, 37 percent of 3-year-olds, 58 percent of 4-year-olds, and 90 percent of 5-year-olds were enrolled in preprimary education.
- In 1996, similar percentages of white and black 3- and 4-year-olds were enrolled in center-based programs, while their Hispanic peers were less likely to be enrolled.
- Three- and 4-year-olds from families with incomes of more than $50,000 were more likely than 3- and 4-year-olds from families with incomes of $50,000 or less to be enrolled in preprimary education.
- There was a positive relationship between parents' educational attainment and the enrollment rates of 3- and 4-year-olds: as parents' educational attainment increased, so did the preprimary enrollment rates of their children. However, enrollment rates of 5-year-olds were similar, regardless of their parents' educational attainment.

Percentage of 3-, 4-, and 5-year-olds enrolled in center-based programs or kindergarten, by selected student characteristics: 1991, 1993, 1995, and 1996

	3-year-olds				4-year-olds				5-year-olds			
Selected student characteristics	1991	1993	1995	1996	1991	1993	1995	1996	1991	1993	1995	1996
Total	**31.4**	**34.1**	**37.4**	**36.7**	**52.7**	**55.3**	**60.9**	**57.7**	**86.4**	**90.0**	**90.3**	**90.2**
Race/ethnicity												
White	33.4	33.7	40.2	39.6	52.4	53.7	60.8	58.8	85.7	88.9	88.6	88.8
Black	31.6	41.9	41.1	40.5	57.4	62.9	68.2	67.8	92.3	93.2	93.7	94.1
Hispanic	19.8	27.2	21.2	22.1	47.5	48.9	49.0	45.3	85.3	91.4	93.4	90.4
Household income												
$10,000 or less	25.4	32.7	26.2	26.0	43.3	52.6	54.3	52.7	86.1	89.2	90.9	92.7
10,001–20,000	23.2	21.6	27.0	28.0	45.0	47.2	52.3	45.3	84.6	90.4	89.7	87.6
20,001–35,000[1]	21.3	22.2	27.7	30.8	48.0	47.8	49.7	50.6	85.1	86.8	90.7	87.8
35,001–50,000[1]	33.4	37.9	38.1	42.2	52.3	57.2	59.5	58.2	87.3	90.6	88.5	89.7
50,001 or more	52.9	58.7	61.2	55.0	74.8	73.2	80.7	75.8	89.0	93.7	90.9	92.8
Parents' highest education level												
Less than high school diploma	17.3	17.1	16.0	[2]22.0	33.1	42.8	[2]42.4	[2]47.3	85.5	79.9	92.5	90.3
High school diploma or GED	23.0	23.0	26.3	28.9	40.8	43.2	51.1	47.3	84.8	89.0	89.2	89.9
Some college/vocational/technical	31.0	35.9	35.6	34.5	56.3	61.1	63.3	59.8	87.7	91.1	90.2	88.6
Bachelor's degree	41.5	41.1	51.7	49.6	67.2	64.1	70.7	62.6	88.1	92.5	91.6	92.6
Graduate/professional school	53.0	61.9	[2]60.8	60.4	72.0	73.3	77.9	78.1	87.0	94.3	89.8	92.1
Family structure												
Two biological or adoptive parents	—	34.4	38.6	38.0	—	55.1	61.3	57.8	—	89.1	88.8	89.0
One biological or adoptive parent	—	33.8	36.9	37.3	—	57.2	63.0	58.4	—	92.1	94.0	91.9
One biological/adoptive and one step parent	—	[2]32.7	[2]23.1	[2]14.7	—	[2]49.5	[2]46.9	[2]45.8	—	87.3	89.4	93.2
Other relatives	—	[2]34.8	[2]20.8	[2]23.1	—	[2]52.2	[2]61.3	[2]55.9	—	[2]92.6	[2]88.0	96.5

— Not available.

[1] The middle two income ranges in 1991 were $20,001–30,000 and $30,001–50,000, respectively.

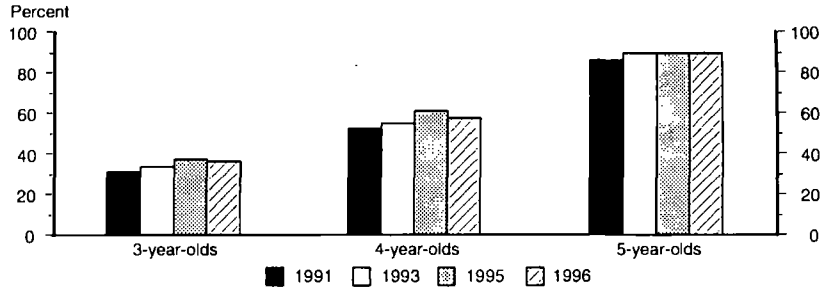
[2] Interpret with caution; standard errors are large due to small sample sizes.

NOTE: Included in the total but not shown separately are children from other racial/ethnic groups and other types of family structures. This analysis includes children ages 3–5 who were not enrolled in first grade. Age is as of December 31 of the prior year.

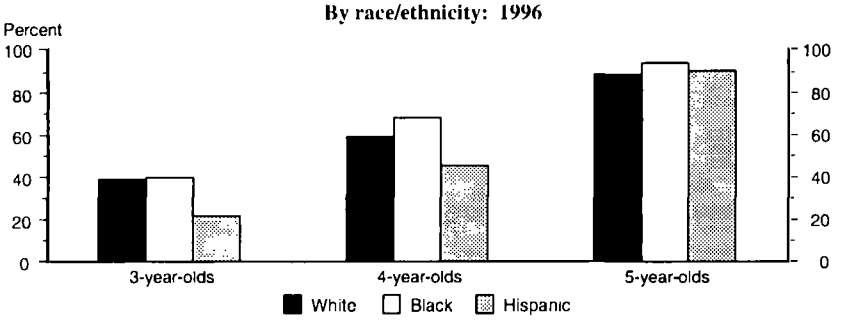
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Household Education Survey (NHES), 1991 (Early Childhood Education File), 1993 (School Readiness File), 1995 (Early Childhood Program Participation File), and 1996 (Parent and Family Involvement in Education File).

Percentage of 3-, 4-, and 5-year-olds enrolled in center-based programs or kindergarten

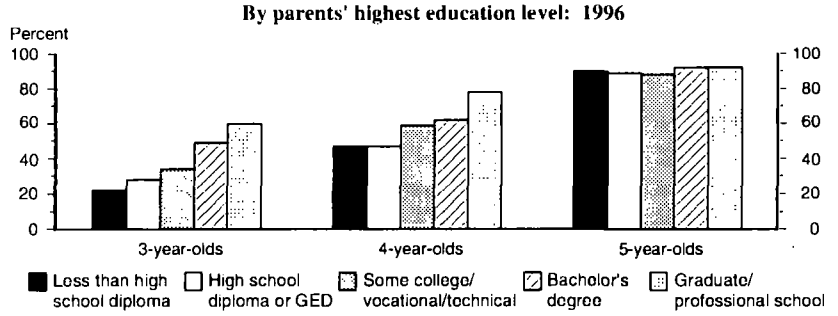
Total enrollment rate: 1991, 1993, 1995, and 1996



By race/ethnicity: 1996

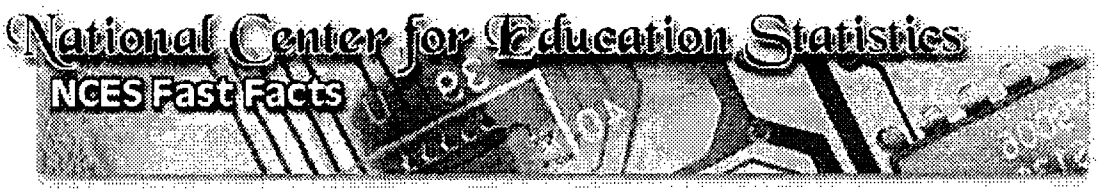


By parents' highest education level: 1996



NOTE: Included in the total but not shown separately are children from other racial/ ethnic groups. This analysis includes children ages 3–5 who were not enrolled in first grade. Age is as of December 31 of the prior year.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Household Education Survey (NHES), 1991 (Early Childhood Education File), 1993 (School Readiness File), 1995 (Early Childhood Program Participation File), and 1996 (Parent and Family Involvement in Education File).



Question: What are the characteristics of the children attending early childhood programs?

Response: According to the 1997 *The Condition of Education*, children from higher income families are more likely to attend early childhood programs. Overall, white and black children are more likely to attend programs than Hispanics. In 1995, of the 37 percent of three year olds enrolled in center-based programs, a smaller proportion of Hispanic students (21 percent) participated in these programs than their white (40 percent) or black (41 percent) counterparts.

In both 1993 and 1995, blacks and Hispanics were more likely than whites to be enrolled in kindergarten at age five. In 1991, 1993, and 1995, 3-and 4-year-olds from families with incomes of more than $50,000 were more likely to be enrolled than 3-and 4-year-olds from families with incomes of $50,000 or less. There was a positive relationship between parents' educational attainment and preprimary education enrollment rates of 3-and 4-year olds. As parents' educational attainment increased, so did the preprimary enrollment rates of their children. Additionally, in both 1993 and 1995, preprimary education enrollment rates for children aged 3 and 4 who lived with one biological or adoptive parent were similar to those children who lived with two biological or adoptive parents.

Percentage of Three Year Olds Enrolled in Center- based Programs , by Race: 1991, 1993, 1995

Characteristics	1991	1993	1995
Total students	31.4	34.1	37.4
White	33.4	33.7	40.2
Black	31.6	41.9	41.1
Hispanic	19.8	27.2	21.2

Source: National Center for Education Statistics, U. S. Department of Education, *The Condition of Education,* 1997, Indicator 1, page 48.

For the complete version of the table, please click here.

Percentage of Three Year Olds Enrolled in Center- based Programs, by Income: 1991, 1993, 1995

Income	1991	1993	1995
$10,000 or less	25.4	32.7	26.2
10,001-20,000	23.2	21.6	27.0
20,001-35,000 [1]	21.3	22.2	27.7
35,001-50,000 [1]	33.4	37.9	38.1
50,001 or more	52.9	58.7	61.2

[1] The middle two income ranges in 1991 were $20,001-$30,001 and $30,001-$50,001, respectively.

Source: National Center for Education Statistics, U. S. Department of Education, *The Condition of Education,* 1997, Indicator 1, page 48.

For the complete version of the table, please click here.

Percentage of Three Year Olds Enrolled in Center- based Programs, by Family Structure: 1991, 1993, 1995

Family Structure	1991	1993	1995
Two biological or adoptive parents	-	34.4	38.6
One biological or adoptive parent	-	33.8	36.9
One biological and one step parent	-	32.7	23.1
Other relatives	-	34.8	20.8

- Data not available.

Source: National Center for Education Statistics, U. S. Department of Education, *The Condition of Education,* 1997, Indicator 1, page 48.

For the complete version of the table, please click here.

Related Tables and Figures:

Children of Prekindergarten through Second Grade Age, by Enrollment Status, Maternal Characteristics, and Household Income: 1991, 1993, and 1995

Enrollment of 3-, 4-, and 5-year-old Children in Preprimary Programs, by Level and Control of Program and By Attendance Status: October 1965 to October 1996

Other Resources:

Characteristics of Children's Early Care and Education Programs: Data from the 1995 National Household Education Survey

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Friday, April 30, 1999

Small Classes Early On Give Lasting Gains

By RICHARD T. COOPER, RICHARD LEE COLVIN, Times Staff Writer

WASHINGTON--Students who attended small classes in their first few years of school performed significantly better through high school than students who began in larger classes, according to fresh data released Thursday from a landmark study of public school students in Tennessee.

Even though they returned to larger classrooms after third grade, high school students who attended smaller classes beginning as early as kindergarten were less likely to drop out, more likely to graduate from high school on time, more likely to take advanced-level courses and more likely to earn superior grades and go to college than students who began their education in larger classes, researchers said.

Gains were especially great for minority students. Princeton economist Alan B. Krueger found that, in particular, the difference between the percentage of black and white students taking college entrance exams was cut in half for blacks who started out in smaller classes. Those who take the exams are considered more likely to enroll in college.

Study May Bode Well for California

The new report, part of a long-term study that helped spark the current nationwide movement toward smaller classes, may bode well for California's ongoing program, the nation's largest, to cut class sizes. After a $4-billion-plus investment over the last three years, more than 80% of all California students in kindergarten through third grade now attend classes of 20 or fewer pupils.

Early analysis of test scores in California suggests students in smaller classes may be starting to make gains that parallel the Tennessee findings. But experts cautioned that the size and complexity of conditions in California schools make the challenge far greater and the results less certain than for a smaller, less diverse state.

"One can't help but be encouraged by the lasting impact of the experiment," said Brian Stecher of the Rand Corp., who is conducting a large-scale study of California's experience in reducing class sizes. "But I am cautious about whether it will generalize to California."

Stecher, along with Eric Hanushak, a professor of economics and public policy at the University of Rochester in New York, also suggested that other kinds of reform might be equally effective and less disruptive.

"From all evidence I've seen, the effects of teacher quality are just much, much larger than any effects you ever see from differences in class size," said Hanushak, who in the past has questioned the policy implications of the Tennessee study. "Couldn't we do even better if we had put the money for smaller class sizes into making sure there were a higher quality teaching force available?"

Researchers in Tennessee's STAR, or Student/Teacher Achievement Ratio, experiment, have faced such questions before. They acknowledge that cutting class size is expensive, but they argue that it can produce benefits without additional staff training, new curricula or other complex changes.

Charles M. Achilles, an education professor at Eastern Michigan University and a lead STAR researcher, said Thursday that, while quality teaching is unquestionably important, it is not easy to achieve throughout a school system, whereas cutting class size is a clear-cut reform with proven results.

Students who begin their school careers in small classes "establish a trajectory of success," he said.

Earlier findings from the STAR study played a role in California's decision to embark on class size reduction and helped shape President Clinton's push for federal funds to help local schools cut class sizes by hiring an additional 100,000 teachers across the country.

What has given the STAR findings unusual credibility is that they rest on something close to a scientific experiment.

Over a four-year period beginning in 1985, more than 6,000 students a year were randomly assigned to classes in grades K through 3. Some were sent to classrooms with no more than 15 students. Others were assigned to classes of up to 27 students. Teachers for these small and regular-sized classes were also chosen at random. Participating schools reflected a cross-section of urban, suburban, rural, poor, middle-class and other student populations.

Then, after third grade, students who had been in small classes went back to larger classes. Using standardized test scores and other data, researchers have been tracking their progress ever since.

New analysis of data shows that, by the end of the eighth grade, students who had smaller classes from kindergarten through third grade were more than a year ahead of those who began in regular-sized classes when tested in reading, math and science.

The gains persisted through high school, researchers said.

California Data Show Gains

In California, an analysis of last year's standardized test scores suggested that smaller class sizes already are showing a modest payoff. A higher percentage of students in classes of only 20 students scored above the national average than did those in classes with more than 20 students.

But the California data also showed that students who spoke English may have benefited more from smaller classes than youngsters with limited English skills. And California, unlike Tennessee, has large numbers of students who do not speak English.

The debate over whether smaller class sizes or the quality of teachers play a greater role in learning has raged with particular intensity in California.

California launched its experiment with smaller class sizes three years ago. But the policy fueled a demand for teachers that the market could not supply.

About 30,000 teachers in the state are now working with so-called emergency permits, meaning that they have yet to complete the state's required teacher preparation courses.

Reassessing the View That American Schools Are Broken

Alan B. Krueger

A growing number of scholars and political commentators have concluded that the U.S. public school system is flawed, and that it can only be corrected by fundamental changes in the institutions that govern education. Chubb and Moe (1990, p. 3), for example, argue that the "existing [educational] institutions cannot solve the problem, because they are the problem." Widespread belief that the current educational system is flawed, rather than any concrete or systematic evidence indicating that an alternative system performs better than the current one, has motivated frequent calls for radical "institutional reforms" of schools.

The view that the U.S. school system has failed, or is "broken," is commonly supported by three arguments: (1) there has been a steady decline in the performance of American students on standardized tests, (2) American children perform worse on international comparisons than foreign children, and (3) the existing system fails to convert school resources (such as smaller classes) into school outputs (such as better test performance).[1]

This paper reassesses the claim that American schools are broken. The first section examines trends in National Assessment of Educational Progress (NAEP) test scores, and the relationship between average test score performance and school resources on an aggregate level. Although the aggregate data show a surprisingly strong, *positive* relationship between educational spending and student achievement, one should be cautious about drawing any causal inference from such a relationship because of changes in the composition of students over time and changes in the focus of educational spending. More convincing evidence comes from the randomized experiment on class size, which I describe in the subsequent section. Next, I infer the influence of schooling on student performance by considering gains in student achievement by socioeconomic status (SES) during the school year and during the summer months. The paper's final

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section summarizes evidence on the increasing economic rewards associated with completing high school.

The main conclusion from this review is that the widely held belief that American schools have failed—that they are performing worse today than they have in the past, that a high school degree is no longer valuable, and that additional resources yield no benefits in the current system—is not supported by the evidence. The evidence suggests that the perceived crisis in education has been greatly exaggerated, if indeed there is a crisis at all. Nonetheless, major changes in U.S. schooling might produce more desirable results. However, it would not be prudent to radically restructure the U.S. education system out of misplaced frustration that the current system has failed miserably or out of an unsupported presumption that progress cannot be made in the context of the existing system. In light of these findings, the conclusion offers incremental proposals to improve our schools.

What Do the Aggregate Achievement Test Data Tell Us?

Aggregate Time Trends

Concern over the deteriorating performance of U.S. students is often based on time-series trends in the Scholastic Aptitude Test (SAT). For example, Chubb and Moe (1990, pp. 7-8) write, "the single most important symbol of the underlying problem came to be the monotonic decline, from the mid-1960s through 1980, in the scores of high school students on the national Scholastic Aptitude Test, or SAT." The emphasis on the average SAT score is odd because the exam is not designed to measure students' current levels of acquired skills, but instead their potential to perform well in college. Even more important, the students who take the SAT are a self-selected lot, and the selection has changed dramatically over time. As a wider segment of American students has attended college, the percentage of high school seniors taking the exam has increased. This increase has been particularly strong among students who rank in the bottom half of their high school class (see Berliner and Biddle [1995]). Because the composition of students taking the SAT has changed over time, the College Entrance Examination Board, which publishes the test, has repeatedly warned against inferring trends in school or student performance from the SAT (see, for example, College Entrance Examination Board [1988]).

To the extent that one can correct for the changing mix of students who take the SAT, there is little cause for alarm. For example, Berliner and Biddle (p. 22) show that between 1976 and 1993, the average SAT score has gone up for every demographic group except whites, and it declined only slightly for whites. The authors (p. 32) also summarize evidence that shows an upward trend in the 1980s in the California Achievement Test (CAT), the Stanford Achievement Test, the Comprehensive Test of Basic Skills, and other commercial tests. There is little support in these data for the claim made by the National Commission on Excellence in Education (1984, p. 8) that "average achievement of high school students on most standardized tests is now lower than 26 years ago when Sputnik was launched."

Most analysts probably agree that the NAEP exam provides a more meaningful assessment of trends in student performance than the SAT. Like the SAT, the NAEP is conducted by the Educational Testing Service. But unlike the SAT, the exam is administered to a representative sample of students and is intended to assess progress on basic math, reading, and science skills. The NAEP exam has been administered to nine-, thirteen-, and seventeen-year-olds in selected years since 1970. There are a total of nine time trends that can be analyzed with the NAEP data. Chart 1 presents the average NAEP exam scores for each year, after age and subject main effects have been removed.[2] For most of the subjects and age groups, the NAEP data display a modest upward time trend after an initial dip in the early 1970s. Indeed, the correlation between the average NAEP score and time (that is, the year in which the test was given) is positive for eight of the nine age-by-subject cases, and it is statistically significant at the 10 percent level for seven of the nine cases. The median of these nine linear trends indicates that test scores are rising by .06 standard deviation per decade.[3] It is also possible that the unadjusted NAEP data understate the upward trend in student performance because the composition of students has changed over time. In particular, the rising proportion of students who are immigrants and minorities,

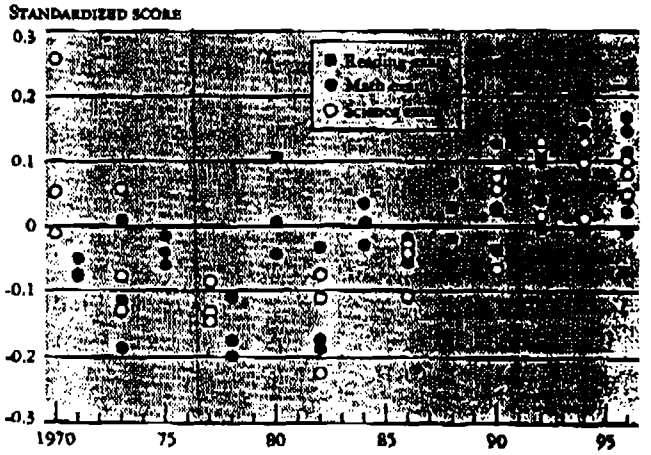
and raised in poverty and by single parents, might be expected to lower average test scores over time.[4]

Chart 2 displays trends in average NAEP mathematics test scores for seventeen-year-old black students and for all students who live in disadvantaged urban communities.[5] The scores are expressed as deviations from the 1973 overall NAEP score, divided by the 1996 cross-sectional standard deviation. Perhaps surprisingly, the chart shows that the most disadvantaged students have made the greatest gains. The gap in math scores between students in disadvantaged communities and all communities narrowed by approximately one-half of one standard deviation in the 1980s. Moreover, between the early 1970s and 1990, the black-white NAEP mathematics test-score gap for seventeen-year-olds decreased by nearly half, although the gap has expanded in the 1990s. These findings are inconsistent with the popular stereotype that inner-city schools are in decline.

Is the upward trend in the aggregate NAEP scores big or small? To some extent, the significance of the trend is in the eye of the beholder. Hanushek (1996, p. 51), for one, argues that "there is no way to conclude that aggregate performance has increased significantly over the past quarter-century." The following calculation, however, suggests that the time trend is not trivial. Over a twenty-five-year period, the average NAEP score is predicted to have increased by .15 standard deviation, based on the median of the nine linear trends for all subjects and age groups. What does it mean for the average test score to rise by .15 standard deviation? If the distribution of scores is normal, an increase of .15 standard deviation implies that the average (or median) student would have advanced six percentile ranks. In other words, the student scoring in the fiftieth percentile today would perform as well as the fifty-sixth-percentile student did twenty-five years ago. Although this is not a dramatic improvement, it is difficult to find well-evaluated, large-scale educational innovations that have produced equally large gains for the average student.

Chart 1

STANDARDIZED NAEP SCORES OVER TIME

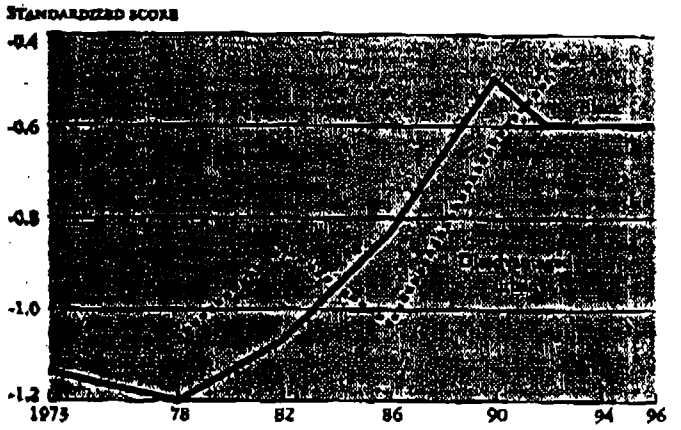


Source: Author's calculations, based on National Center for Education Statistics (1997).

Note: Each point corresponds to an average adjusted for subject and age group; see endnote 2 for more details.

Chart 2

STANDARDIZED NAEP MATH SCORES FOR SEVENTEEN-YEAR-OLD BLACK AND DISADVANTAGED URBAN STUDENTS



Source: National Center for Education Statistics (1994, 1997).

Note: Each score was standardized by subtracting the 1973 score for all students and dividing by the 1996 standard deviation across all students.

THE RELATIONSHIP BETWEEN AGGREGATE TEST SCORES AND SCHOOL RESOURCES

Hanushek (1996) presents two notable figures. The first shows a near-exponential growth in expenditures per student from 1890 to 1990. The second shows the average NAEP score for seventeen-year-olds on the math, reading, and science tests for available years since 1970. On the basis of these figures, Hanushek (p. 51) concludes, "the aggregate data provide a *prima-facie* case that school spending and school resources are not linked to performance."

To my surprise, a straightforward statistical analysis of these data is more supportive of the opposite conclusion (Table 1). Specifically, I pooled the NAEP data across the three age groups and three subject tests and estimated an ordinary least squares (OLS) regression of the form:

$$Y = a + b\,(spending/student) + subject\ dummies + age\ dummies,$$

where Y is the average score on the NAEP exam measured in standard deviation units, and spending/student is current school spending in constant 1995-96 dollars divided by the number of enrolled students.[6] In some specifications, dummy variables are also included for the age of students (nine and thirteen, with seventeen omitted) and for the subject (math and reading, with science omitted).

The regression results in column 1 exclude the subject and age dummies, while the results in column 2 include these explanatory variables. In either model, an increase in expenditures per student has a positive and statistically significant association with average test scores. A $2,000 increase in expenditures per student is associated with an increase of about .11 standard deviation in the average NAEP score.[7]

The science exam may be more difficult to compare over time than the math or reading exams because of major breakthroughs in basic science in the last thirty years and the diversity of science curricula across schools. In column 5, the sample is limited to the math and reading exams. Here, we find a larger effect of school spending: a $2,000 increase is associated with an increase of .14 standard deviation in the mean achievement score.

A great deal of work on "educational production functions" has focused on class size. Therefore, in columns 3, 4, and 6 of Table 1 the pupil-teacher ratio is used as a measure of school resources instead of expenditures per student.[8] These results are also consistent with the view that resources matter. According to the model in column 4, a reduction in the pupil-teacher ratio of eight students—from, say, twenty-three to fifteen—would be associated with an increase in the average score of .176 standard deviation. This is the equivalent of the average student moving up seven percentile ranks, again assuming normality.

To increase the sample size, I pool together all three subject tests and all three age groups in the results reported in Table 1. Perhaps aggregating across age groups and subjects

Table 1
EFFECT OF SCHOOL RESOURCES ON STANDARDIZED TEST SCORES: POOLED SAMPLE OF MATH, READING, AND SCIENCE SCORES ACROSS NINE-, THIRTEEN-, AND SEVENTEEN-YEAR-OLDS
OLS Coefficient Estimates, with Standard Errors in Parentheses

					Math and Reading Only	
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Spending per enrolled student	.054 (.013)	.037 (.011)	—	—	.072 (.012)	—
Pupil-teacher ratio	—	—	-.015 (.005)	-.022 (.006)	—	-.030 (.007)
Math	—	-.080 (.025)	—	-.078 (.027)	-.132 (.021)	-.131 (.023)
Reading	—	.031 (.024)	—	.031 (.026)	—	—
Age nine	—	-.033 (.024)	—	.032 (.035)	-.060 (.026)	.059 (.038)
Age thirteen	—	-.032 (.024)	—	-.032 (.026)	-.043 (.026)	-.042 (.028)
R^2	.182	.439	.118	.361	.622	.548
Sample size	78	78	78	78	51	51

Sources: National Center for Education Statistics (1997); U.S. Department of Education (1997, Tables 63 and 166).

Notes: Scores have been scaled by subtracting the 1996 score and dividing by the 1996 cross-sectional standard deviation. Spending per enrolled student is in thousands of 1995-96 dollars. Each equation also includes an intercept.

distorts the results. If a separate regression of test scores on expenditures per student is estimated for each of these nine series, however, a positive association is found for eight of the nine cases. Even with a short time series of data, this relationship is statistically significant at the .10 level for seven of the nine cases. The weakest relationships arise for seventeen-year-olds, especially in science (which is negative, with a t-ratio of -.77).

I must confess to being surprised by the consistently positive association between NAEP test scores and school resources. To see if my priors were unusual, I e-mailed a short questionnaire to each of the eight other presenters at the "Excellence in Education" conference to assess their expectations of these correlations. Six presenters replied. The median respondent expected six of the nine correlations between NAEP scores and expenditures per student to be positive, with four and a half of the nine correlations statistically significant and positive, and one statistically significant and negative.[9] Thus, the actual correlations are somewhat more supportive of the view that resources are associated with achievement than this small sample of experts anticipated.

How did Hanushek conclude from the aggregate NAEP data that achievement and school resources are not linked? First, he displayed the NAEP data on a scale ranging from 280 to 310. This is a very wide scale, equivalent to 1 standard deviation on the 1996 NAEP math exam. Under normality, if the average student increased his or her performance by 1 standard deviation, the student would move up thirty-six percentile ranks in the distribution. With such a wide scale, any change in the NAEP score appears visually attenuated. Second, Hanushek only displayed trends for seventeen-year-olds; these students exhibit a weaker relationship between test scores and resources than the other age groups. If the model in column 2 of Table 1 is estimated just for nine- and thirteen-year-olds, for example, the coefficient on spending per student is 33 percent larger.

An analysis of the NAEP scores more thorough than mine—conducted by Grissmer et al. (1997) and based on regional-level data over time—reaches the same qualitative conclusion as that suggested by Table 1. But I do not wish to extol the findings based on the aggregate NAEP data very much, if at all. Obviously, many relevant factors have changed over time that may bias (either upward or downward) the relationships estimated in Table 1. In addition, to the extent that the generosity of resources is partially determined by low test performance (as in compensatory education), simultaneity bias will attenuate the relationships found in the table. Suffice it to say that my interpretation of the aggregate data is that they provide *prima facie* evidence that student achievement may be linked to school resources. In my view, a far more compelling test of whether resources matter in the current system is discussed in the next section.

The Tennessee Student-Teacher Achievement Ratio Experiment

There has been considerable debate over whether devoting more resources to schools in the current system would improve student outcomes.[10] Research has been unable to resolve this debate, in part because it is unclear which variables (family background, innate ability, and so forth) should be held constant when the effect of school resources on student performance is estimated. Additionally, when education production functions are estimated with observational data, there is concern about reverse causality: more resources may be assigned to some schools or classes because of low achievement. Finally, there is no consensus as to the appropriate specification of the education production function. For example, some researchers have related the change in test scores to the level of resources in any given year, some have related the change in test scores to the change in resources, and others have related the level of test scores to the level of resources.

An experiment in which children are randomly assigned to classes with high and low levels of resources would help to overcome many of these statistical problems. Because children are already assigned to teachers and schools, controlled experimentation is more feasible in education than in many other fields. Yet the education field lags behind medicine, job training, and agricultural research in the extent to which controlled experiments are utilized. The Food and Drug Administration requires convincing

evidence from a well-designed experiment before new drugs that influence life and death can be put on the market; but when it comes to new educational innovations, weaker standards of evidence are required.

The Tennessee Student-Teacher Achievement Ratio (STAR) experiment is an exception in the education field. In this experiment, 11,600 Tennessee students in eighty participating schools were randomly assigned to varying sized classes in kindergarten and grades 1 through 3. Mosteller (1995) describes Project STAR as "a controlled experiment which is one of the most important educational investigations ever carried out and illustrates the kind and magnitude of research needed in the field of education to strengthen schools." Although the experiment was not perfect (what study is?), the results strongly suggest that smaller class sizes help students, especially low-income and minority students.

The key features of the experiment include the following.[11] The experiment began in 1986 and included the wave of students who were enrolled in kindergarten that year. Within each participating school, kindergarten students were randomly assigned to a small class (an average of 15.1 students), a regular-size class (an average of 22.4 students), and a regular-size class with a teacher's aide (an average of 22.8 students). The original plan called for the students to remain in their original class-size assignment until the third grade. After the third grade, the experiment was concluded and all students were assigned to regular-size classes. As noted below, with one important exception, the experiment went largely as planned.

Another feature of the experiment is that additional waves of students entered the experiment in the first grade, the second grade, and the third grade. In particular, because kindergarten attendance was not mandatory in Tennessee at the time of the study, many new students entered the program in the first grade. Moreover, students were added to the sample over time because they repeated a grade or because their families moved to a school zone that included a participating school. Some 2,200 new students entered the project in the first grade and were randomly assigned to the three types of classes. More than 1,000 new students entered the experiment in both the second and the third grades. Newly entering students were randomly assigned to one of the three class types. This feature of the experiment enables the estimation of class-size effects for each wave of students who entered the experiment in various grades.

The students were given a battery of tests at the end of each school year. I focus on the results of the Stanford Achievement Test. Specifically, I measure student performance by the average percentile rank on the math, reading, and word recognition tests.

The Tennessee STAR experiment is the best designed large-scale educational experiment to date. Nonetheless, it had four important limitations:

- Because of parental complaints, students in the regular-size and regular-size/teacher's aide classes were randomly reassigned between these two types of classes between kindergarten and first grade, while the students in small classes continued in small classes. Note that results from the kindergarten year are uncontaminated by this deviation from the original experimental design. In addition, my analysis (see Krueger [1997]) suggests that the reassignment of students in regular-size classes in first grade did not invalidate the main results of the experiment.

- The experiment did not collect baseline test scores. These data would have been useful to assess whether the students were uniformly distributed across class types by initial achievement level. Nonetheless, the students' background characteristics (such as age, race, and probability of receiving free or reduced-price lunch) appear to be uniformly distributed across class types, which suggests that random assignment was carried out successfully.

- In grades 1 through 3, each regular class had the services of a part-time teacher's aide 25 to 33 percent of the time on average, so the variability in aide services between groups was restricted.[12] Because the present focus of my analysis is primarily on the effect of class size, this feature of the experiment is of less concern.

- Attrition from the sample was high, in part because some students repeated grades and were not tracked, and in part because some students moved to other school districts.[13]

Results of the STAR Experiment

The STAR experiment has been analyzed by Folger and Breda (1989), Word, Johnston, Bain, et al. (1990), Finn and Achilles (1990), and Krueger (1997). The main results of the experiment are summarized below. This summary draws heavily on Krueger, to which the reader is referred for further elaboration of the statistical results.

- The main results for the first four years of the experiment are summarized in Chart 3. For each entry wave of the experiment and grade level, the chart shows the average percentile ranking of students assigned to small classes, regular-size classes, and regular-size classes with a teacher's aide.[14] At the end of the initial year in which students were assigned to small classes, their average performance exceeded that of students in the regular-size and regular-size/teacher's aide classes by about five to eight percentile points. It is an interesting coincidence that this range encompasses the estimated effect of reducing class size by seven to eight students that I obtained from the regression model with the aggregate NAEP data (Table 1).

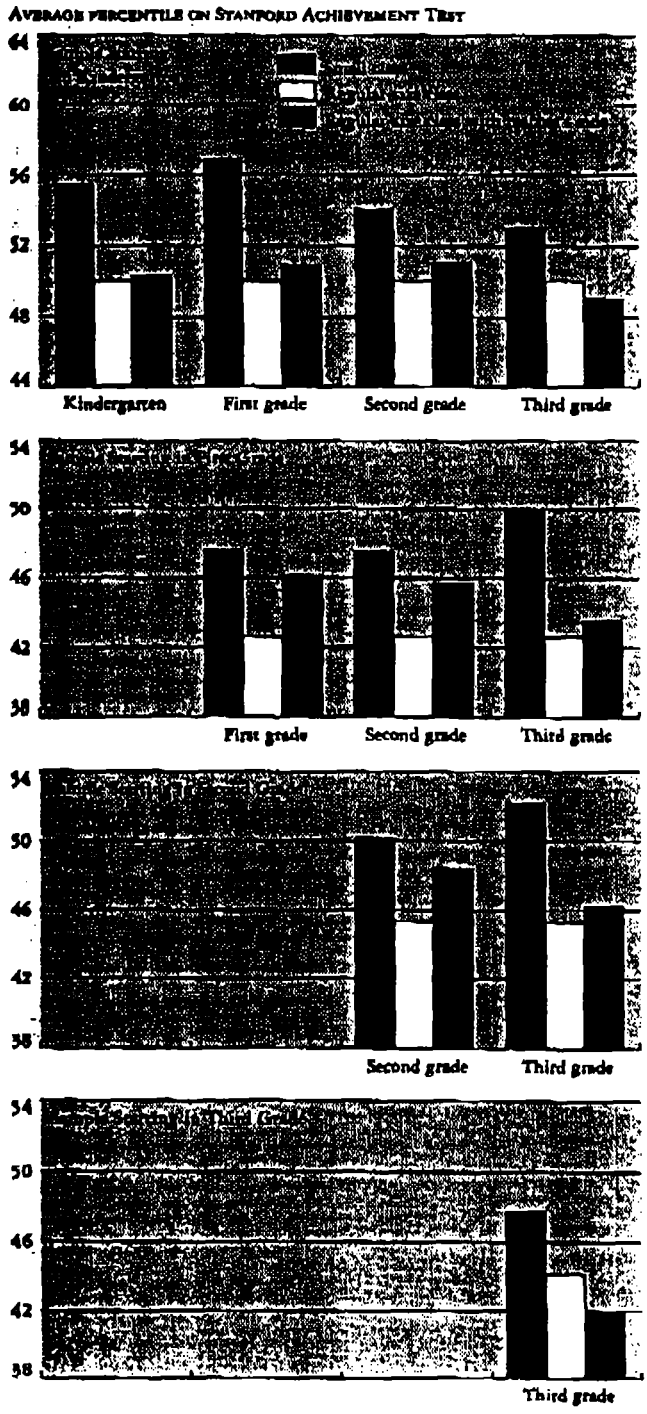
- For the largest wave, which entered the experiment in kindergarten, the relative advantage of students assigned to small classes tends to grow between kindergarten and first grade, and then is relatively stable. For students who entered in the first or second grade, the advantage of attending a small class tends to grow in subsequent grades.

- In most grades, students assigned to classes with a full-time teacher's aide perform about as well, or only slightly better, than students assigned to regular-size classes without a full-time aide.

- As in all experiments, it is possible that the "treatment" group worked in some way to prove the treatment effective (so-called Hawthorne effects), or that the "control" group worked extra hard to overcome the deficit of being assigned to a small class (so-called John Henry effects).[15] Because there was variability in size even among the classes in the control group, it is possible to explore the likely impact of such "reactive" effects to the experiment. Specifically, I divided the students assigned to regular-size classes into a relatively small class-size group (an average of twenty-one students) and a relatively large class-size group (an average of twenty-five students). I then estimated the difference in average test scores between students in the smaller and larger classes, the results of which appear in Chart 4.[16] Students in the smaller classes among the controls scored higher on the tests than students in the larger classes. Because the benefit of reducing class size is of roughly comparable magnitude in Chart 4 and Chart 3

Chart 3

Effect of Class Size on Test Scores: Tennessee Student-Teacher Achievement Ratio Experiment



Source: Krueger (1997, Figure 2).

and because students (and their teachers) in the smaller classes in Chart 4 did not know they were in a treatment group, there is little support for the view that the main experimental results described earlier are contaminated by Hawthorne effects.

- The effect of attending a smaller class tends to vary systematically across certain groups of students. For example, in the STAR experiment minority students and students on free or reduced-price lunch tended to receive a larger benefit from being assigned to a small class. This pattern is consistent with Summers and Wolfe's (1977) finding that attending a small class is more beneficial for low-achieving students than for high-achieving ones.

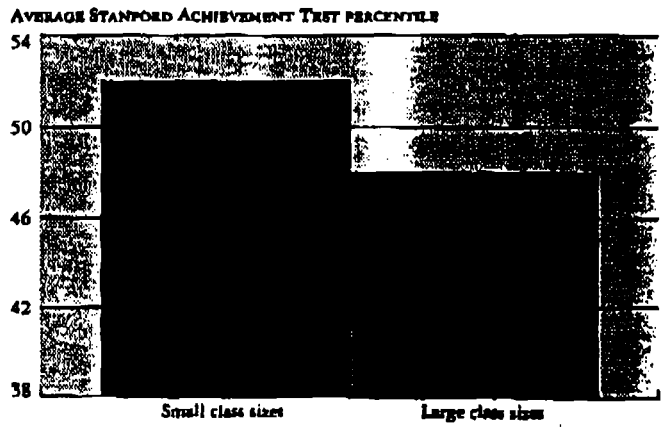
- The effect of attending a small class also tends to vary across schools. Notice that in the STAR experiment a separate class-size effect can be estimated for each school, because each school had at least one of each class type. I estimated the effect of attending a small class for each school. The standard deviation of these eighty effects (after adjusting for sampling variability) was 6.9 percentile points. At the average school, the assignment of students to a small class raised performance by 4.6 percentile points. For two-thirds of the schools, the effect of attending a small class was positive, while for one-third it was negative. Furthermore, 30 percent of the schools had t-ratios on the small-class effect exceeding 2, while 2.5 percent had t-ratios of less than -2. Smaller classes seem to help student performance at the average school and, indeed, at most schools, although there appears to be a wide distribution of the effect of class size on performance across schools.

If researchers and administrators could determine which schools manage to translate resources more effectively into student performance than others, we could target resources to those types of schools, and try to emulate their practices elsewhere. Consequently, I related the school-level class-size effects to variables such as the racial composition of the students, the urbanicity, and the percentage of students receiving free lunch. Although some of these variables were related to the effect sizes in bivariate regressions, they were all individually insignificant when they were included in a multiple regression.

- The students who participated in Project STAR were returned to regular classes after the third grade and have been tracked since then. Nye, Zaharias, Fulton, et al. (1994) find that students who were placed in small classes had lasting achievement gains through at least the seventh grade, although the later benefits are difficult to compare in magnitude with those at earlier grades because of changes in the tests that were administered. Since the STAR students are currently finishing high school, it would be desirable to learn more about their long-term academic—and just as important, nonacademic—outcomes as they enter early adulthood.

Chart 4

HAWTHORNE OR JOHN HENRY EFFECTS: A COMPARISON OF TEST SCORES WITHIN REGULAR CLASSES



Source: Author's calculations, based on Tennessee Student-Teacher Achievement Ratio data.

Notes: All grade levels have been pooled together. Small classes have an average of twenty-one students; large classes have an average of twenty-five students.

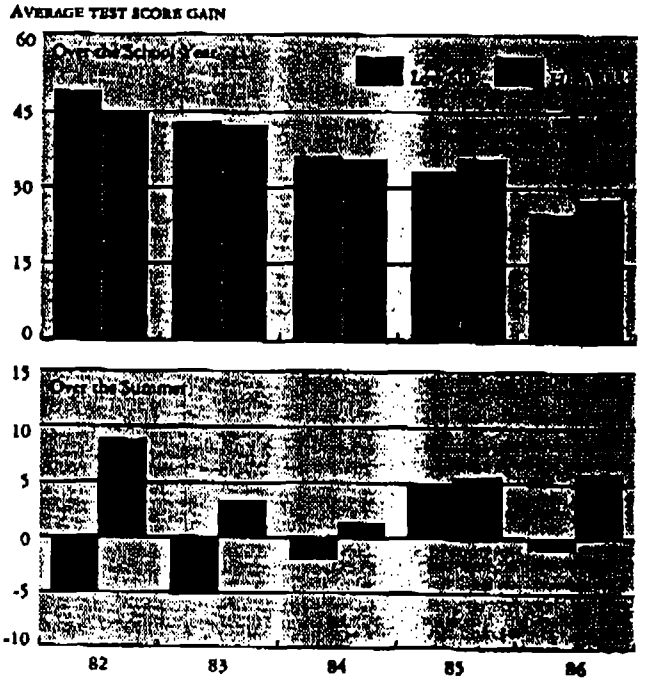
SUMMER AND SCHOOL-YEAR TEST SCORE GAINS

Another way to infer the impact of schooling on educational achievement is to compare student progress during the school year and during the summer months. Entwisle, Alexander, and Olson (1997) provide a particularly careful application of this approach. Specifically, they collected data on 790 first-time first-grade students from a stratified sample of twenty Baltimore public schools in 1982. These students were tracked for several years. They were given the California Achievement Test at the beginning and end of each school year.[17] Consequently, test score gains could be tracked during the school year and during the summer months when schools were not in session.

Entwisle, Alexander, and Olson divide students into three groups based on their families' socioeconomic status. This categorization involved weighting five standardized variables: mother's and father's occupations and education, and subsidized meal status. The top panel of Chart 5 summarizes their findings concerning seasonal gains on the math CAT for children from the lowest and highest SES groups. The test-score gains during the school year are remarkably similar for the two groups. The bottom panel of Chart 5, however, indicates that during the summer months, children from low-SES families lose ground, while children from high-SES families gain ground. Table 2 summarizes the cumulative gains on the reading and math CATs over the first five years during which the children were tracked. These results suggest that children from high- and low-SES households make roughly the same progress during the school year, although the gap between high- and low-SES children expands during the summer months because children from low-SES families fall behind when school is not in session.[18] One interpretation of these results is that the public schools overcome whatever learning deficits are associated with low socioeconomic status when schools are in session, but during the summer months the family environmental effects dominate.

Chart 5

SEASONAL GAINS ON CAT MATH EXAM, BY FAMILY SOCIOECONOMIC STATUS



Source: Entwisle, Alexander, and Olson (1997, Table 3.1).

Notes: Sample consists of 498 Baltimore public school students who entered first grade in 1982. SES = socioeconomic status.

CUMULATIVE FIVE-YEAR GAINS ON CAT EXAMS BY FAMILY SOCIOECONOMIC STATUS

Socioeconomic Status	Over the School Year	Over the Summer
	Math	
Low	185.8	-8.0
High	186.3	24.9
	Reading	
Low	193.3	0.8
High	190.9	46.6

Source: Entwisle, Alexander, and Olson (1997, Table 3.1).

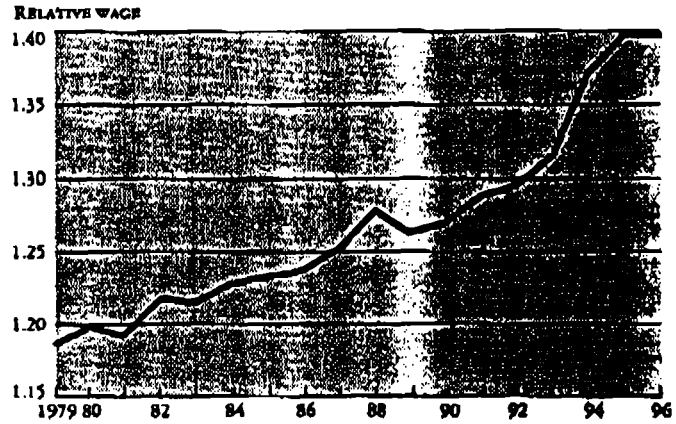
In 1967, Martin Luther King, Jr., wrote, "the job of the school is to teach so well that family background is no longer an issue." At least insofar as test-score gains are concerned, the schools may have achieved this goal. During the school year, students make roughly the same gains regardless of family background. The challenge is to overcome the relative decline in performance of low-income children that occurs when school is not in session, and before school begins.

FINISHING HIGH SCHOOL PAYS OFF

Looking across workers, researchers have found that average earnings tend to be higher for those with more years of schooling.[19] Moreover, a large literature documents that the "monetary return to education"—that is, the earnings of highly educated workers relative to those of less educated workers—rose substantially in the 1980s (see Levy and Murnane [1992] for a survey). Even when the same cohorts are tracked through time, the return to education appears to have increased, suggesting that changes in the skill composition of workers across education levels do not explain this phenomenon. The most compelling interpretation of the rise in the return to education is that the labor market now values skills more highly than it used to, probably because of the combined effects of skill-biased technological changes, globalization, and institutional changes.

Chart 6

RATIO OF MEDIAN WEEKLY WAGE OF HIGH SCHOOL GRADUATES TO THAT OF HIGH SCHOOL DROPOUTS



Source: Author's calculations, based on unpublished Bureau of Labor Statistics tables.

Note: The chart presents the ratio of median weekly wages of workers with exactly a high school education to those with less than a high school education for full-time workers aged twenty-five and older.

Although much of the literature on the return to education focuses on the college–high school wage ratio, Chart 6 documents that it is also true that the ratio of earnings of those with exactly a high school degree to those with less than a high school degree increased over time. Between 1979 and 1996, for example, the earnings advantage of high school graduates relative to that of high school dropouts roughly doubled, from 19 percent to 40 percent. Although the level of earnings of high school graduates has declined over the last two decades once we adjust for inflation, the relative earnings of high school graduates has increased substantially. This finding suggests that—compared with the alternative—completing high school is more valuable today than it used to be, which is inconsistent with the view that the secondary education system fails to produce something of value.[20]

CONCLUSION

The evidence reviewed in this paper suggests that the U.S. public school system has not deteriorated and may in fact be reasonably efficacious. It is nonetheless possible that school resources could be deployed more effectively and educational innovations could improve student outcomes. Moreover, the seemingly ever-increasing demand for skilled workers in the United States underscores the potential economic benefits of enhancing the skills of future generations of Americans by improving public schooling. But the conclusion that the current educational system is not inherently flawed leads to policy proposals of a more incremental nature. My personal view is that policymakers should be risk-averse when it comes to changing the public school system. To alter the institutional structure of U.S. schools radically without sufficient evidence that the "reforms" would be successful is to put our children at risk. With this in mind, I would propose that the following incremental reforms be given serious consideration.

- Careful experimentation and evaluation should proceed on a limited basis before wide-scale institutional changes are introduced. To the extent possible, randomized assignment to treatment and control groups should be the research design used to evaluate educational initiatives, such as vouchers, magnet schools, and charter schools. Long-term follow-up focusing on concrete outcomes, not just test scores, would also be desirable. The research base on which educational policy is formulated should be greatly expanded. More experimentation and evaluation are needed. A risk-averse strategy would require fairly convincing evidence that any new educational initiative is effective before it is implemented on a wide scale.

- Demographic projections indicate that public school enrollment will rise in the coming decade. This rise, in turn, will lead to pressure to increase class size or school spending. The research suggests to me that an increase in class size, especially in the early grades, would lower the average student's performance. Society may choose to increase class sizes rather than incur additional educational expenses, but this decision should be made with the expectation that student achievement will be affected by the level of school resources. Decision makers and the public should not bank on there being a "free lunch" when it comes to raising class size.

- In most U.S. public schools, the school year runs about 180 days. This is shorter than in many other industrialized countries. One of the strongest findings in the economics of education literature is that, on average, students who attend school longer earn higher incomes in the labor market. It is reasonable to hypothesize that more days of schooling would have a similar effect. In addition, Entwisle, Alexander, and

Olson's (1997) work suggests that disadvantaged children fall behind in the summer months when schools are closed. I would propose experimenting with an expanded school year of, say, 210 days. To facilitate evaluation of such a change, it would be desirable to phase in an extension of the school year across randomly selected communities within a state.

- The school day in the United States is a legacy of a bygone era when most women did not work for pay. Times have changed. Probably because of lax supervision in the afternoon when most parents are working, the juvenile violent crime rate peaks between 2 p.m. and 4 p.m. on school days.[21] On nonschool days, the crime rate peaks in the evening. This finding suggests possible gains from extending the school day, or from providing a richer set of after-school activities. Again, experimentation and evaluation would be desirable.

ENDNOTES

The author thanks Michele McLaughlin for very helpful research assistance and Lisa Barrow, Michele McLaughlin, and Cecilia Rouse for helpful comments.

1. For example, these arguments are expressed in National Commission on Excellence in Education (1984) and Chubb and Moe (1990).

2. The NAEP scores in the chart were first standardized by subtracting the 1996 test score (for that age group and subject) from each observation, then dividing this quantity by the 1996 cross-sectional standard deviation. The transformed scores were then regressed on two age dummies and two subject dummies. The residuals from this regression are displayed. This regression adjustment was used to remove average age and subject effects.

3. The linear trends were estimated from a bivariate regression of the NAEP exam on the year in which the test was taken. The NAEP score is scaled relative to the cross-sectional standard deviation on the exam in 1996. See also National Center for Education Statistics (1997) for a discussion of trends in NAEP scores.

4. However, these factors may be partially or fully offset by the rise in average educational attainment of parents and the decline in the number of children per family.

5. Disadvantaged urban students are defined as those who live in metropolitan statistical areas and attend schools where a high proportion of the students' parents are on welfare or are not regularly employed. Unfortunately, NAEP data are available for this group only from 1978 to 1992.

6. More precisely, if the average test score in year t is Y_t, the average score in 1996 for that subject and age group is Y_{96}, and the standard deviation of scores across students in 1996 for that subject and age group is s_{96}, then the dependent variable is $(Y_t - Y_{96})/s_{96}$. Thus, each year's test score is measured in standard deviation units from the 1996 average test score for that age group and subject.

7. Hanushek (1996) focuses on expenditures per pupil in average daily attendance instead of expenditures per enrolled pupil. Because enrollment is arguably less endogenously determined than attendance, I use expenditures per enrolled student. If the attendance measure is used, however, the coefficient in Table 1, column 2, row 1 is similar: .053 (standard error of .010).

8. A number of arguments could be made that the pupil-teacher ratio is a superior measure for these specifications. Expenditures will be heavily influenced by teacher pay, which varies over time in part because of external labor market forces that influence the pay of college-trained women. Perhaps more important, in these results the pupil-teacher ratio is more closely tailored to the grade level of the students, whereas the expenditures per student pool all grade levels. But I would not want to identify any particular estimate in Table 1 as "the" correct estimate.

9. Another question on my survey was, "Suppose that public school spending in the U.S. were to permanently increase by $2,000 per student in 1997 dollars. Give your best point estimate of the probability that student achievement would increase, on average." The median respondent thought there was a 75 percent probability that average achievement would rise in this hypothetical situation. Some of the respondents indicated that they expected any increase to be small, however.

10. Even quantitative summaries of the literature reach contrasting findings (see, for example, Hanushek [1986] and Hedges, Laine, and Greenwald [1994]).

11. Project STAR was funded by the Tennessee legislature, at a total cost of approximately $12 million. The research was designed and carried out by research teams from Tennessee State University, Memphis State University, the University of Tennessee, and Vanderbilt University. See Word, Johnston, Bain, et al. (1990) and Folger (1989) for detailed descriptions of the experiment.

12. Regular classes often had a teacher's aide because the ethic underlying the study was that students in the control group (the regular classes) would not be prevented from receiving resources that they would ordinarily receive.

13. Straightforward adjustments for attrition (for instance, assigning the last test score to students who leave the sample for each subsequent year) did not indicate that attrition distorted the results (Krueger 1997).

14. The results are based on separate OLS regression models estimated for each entry wave and grade level. The dependent variable in the regression model is the student's percentile ranking on the Stanford Achievement Test, and the independent variables are class-type assignment dummies, school dummy variables, race, sex, free-lunch status, teacher sex, teacher race, and teacher education (see Krueger [1997, Table 6, column 4]).

15. In the current case, one may be more concerned about Hawthorne effects because the treatment appears to have been effective, although John Henry effects may lead to an underestimate of the benefit of attending a small class. For an interesting study that casts doubt on the presence of Hawthorne effects in the original Hawthorne experiments, see Jones (1992).

ENDNOTES (*Continued*)

16. To increase the sample size, I pooled students across all grade levels and entry waves. The results shown in Chart 4 are from a regression of the students' percentile rank on a dummy variable for class size, student characteristics, and teacher characteristics.

17. Students were tested regardless of whether they were held back a grade. In principle, the CAT is scaled so that scores are comparable across grade levels.

18. Murnane (1975) similarly finds that test scores for inner-city children increase during the school year and either stagnate or decline during the summer months. Grossman and Sipe (1992) find that achievement levels remain constant for disadvantaged youth who are randomly selected to participate in summer school, while test scores decline for the control group over the summer. They find no long-term benefits of the summer program, however.

19. A long-standing concern has been that the observed earnings-education gradient might reflect unobserved factors such as inherent ability or family background. Most of the literature that tries to estimate the payoff to years of education, however, concludes that omitted variables do not seriously bias the OLS estimates (see, for example, Griliches [1977] and Angrist and Krueger [1991]).

20. For studies of how school resources relate to the return to education, see Card and Krueger (1992) and Heckman, Layne-Farrar, and Todd (1996).

21. See, for example, U.S. Department of Justice (1996), which is based on FBI data on violent crime in South Carolina.

References

Angrist, Joshua, and Alan Krueger. 1991. "Does Compulsory Schooling Affect Schooling and Earnings?" QUARTERLY JOURNAL OF ECONOMICS 106 (November): 979-1014.

Berliner, David C., and Bruce J. Biddle. 1995. THE MANUFACTURED CRISIS: MYTHS, FRAUD, AND THE ATTACK ON AMERICA'S PUBLIC SCHOOLS. Reading, Mass.: Addison-Wesley Publishing Company.

Card, David, and Alan B. Krueger. 1992. "Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States." JOURNAL OF POLITICAL ECONOMY 100 (February): 1-40.

Chubb, John E., and Terry M. Moe. 1990. POLITICS, MARKETS AND AMERICA'S SCHOOLS. Washington, D.C.: Brookings Institution.

College Entrance Examination Board. 1988. GUIDELINES ON THE USES OF COLLEGE BOARD TEST SCORES AND RELATED DATA. New York.

Entwisle, Doris, Karl Alexander, and Linda Olson. 1997. CHILDREN, SCHOOLS AND INEQUALITY. Boulder, Colo.: Westview Press.

Finn, Jeremy D., and Charles M. Achilles. 1990. "Answers and Questions About Class Size: A Statewide Experiment." AMERICAN EDUCATIONAL RESEARCH JOURNAL 27 (fall): 557-77.

Folger, John. 1989. "Editor's Introduction: Project STAR and Class Size Policy." PEABODY JOURNAL OF EDUCATION 67, no. 1 (fall): 1-16.

Folger, John, and Carolyn Breda. 1989. "Evidence From Project STAR About Class Size and Student Achievement." PEABODY JOURNAL OF EDUCATION 67, no. 1 (fall): 17-33.

Griliches, Zvi. 1977. "Estimating the Returns to Schooling—Some Econometric Problems." ECONOMETRICA 45 (January): 1-22.

Grissmer, David, Stephanie Williamson, Sheila Kirby, and Mark Berends. 1997. "Exploring the Rapid Rise in Black Achievement Scores in the United States (1970-1990)." Unpublished paper, RAND Institute on Education and Training, Washington, D.C.

Grossman, Jean Baldwin, and Cynthia L. Sipe. 1992. "Summer Training and Education Program (STEP): Report on Long-term Impacts." Philadelphia: Public Private Ventures, winter.

Hanushek, Eric A. 1986. "The Economics of Schooling: Production and Efficiency in Public Schools." JOURNAL OF ECONOMIC LITERATURE 24 (September): 1141-77.

———. 1996. "School Resources and Student Performance." In Gary Burtless, ed., DOES MONEY MATTER? THE EFFECT OF SCHOOL RESOURCES ON STUDENT ACHIEVEMENT AND ADULT SUCCESS, 43-73. Washington, D.C.: Brookings Institution.

Heckman, James J., Anne Layne-Farrar, and Petra Todd. 1996. "Does Measured School Quality Really Matter? An Examination of the Earnings-Quality Relationship." In Gary Burtless, ed., THE LINK BETWEEN SCHOOLS, STUDENT ACHIEVEMENT, AND ADULT SUCCESS. Washington, D.C.: Brookings Institution.

Hedges, Larry V., Richard Laine, and Rob Greenwald. 1994. "Does Money Matter? A Meta-Analysis of Studies of the Effects of Differential School Inputs on Student Outcomes." EDUCATION RESEARCHER 23, no. 3 (April): 5-14.

Jones, Stephen. 1992. "Was There a Hawthorne Effect?" AMERICAN JOURNAL OF SOCIOLOGY 98, no. 3 (November): 451-68.

Krueger, Alan B. 1997. "Experimental Estimates of Educational Production Functions." NBER Working Paper no. 6051.

Levy, Frank, and Richard Murnane. 1992. "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations." JOURNAL OF ECONOMIC LITERATURE 30, no. 3 (September): 1333-81.

Mosteller, Frederick. 1995. "The Tennessee Study of Class Size in the Early School Grades." THE FUTURE OF CHILDREN: CRITICAL ISSUES FOR CHILDREN AND YOUTHS 5 (summer/fall): 113-27.

Murnane, Richard. 1975. THE IMPACT OF SCHOOL RESOURCES ON THE LEARNING OF INNER CITY CHILDREN. Cambridge, Mass.: Ballinger Publishing Company.

National Center for Education Statistics. 1994. NAEP 1992 TRENDS IN ACADEMIC PROGRESS. Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement, July.

———. 1997. NAEP 1996 TRENDS IN ACADEMIC PROGRESS. Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement, August.

National Commission on Excellence in Education. 1984. A NATION AT RISK: THE IMPERATIVES FOR EDUCATIONAL REFORM. Washington, D.C.: U.S. Department of Education.

REFERENCES (*Continued*)

Nye, Barbara, Jayne Zaharias, B.D. Fulton, et al. 1994. THE LASTING BENEFITS STUDY: A CONTINUING ANALYSIS OF THE EFFECT OF SMALL CLASS SIZE IN KINDERGARTEN THROUGH THIRD GRADE ON STUDENT ACHIEVEMENT TEST SCORES IN SUBSEQUENT GRADE LEVELS. Seventh-grade technical report. Nashville, Tenn.: Center of Excellence for Research in Basic Skills, Tennessee State University.

Summers, Anita A., and Barbara L. Wolfe. 1977. "Do Schools Make a Difference?" AMERICAN ECONOMIC REVIEW 67, no. 4 (September): 639-52.

U.S. Department of Education. 1997. DIGEST OF EDUCATION STATISTICS 1996. Washington, D.C.

U.S. Department of Justice. 1996. JUVENILE OFFENDERS AND VICTIMS: 1996 UPDATE ON VIOLENCE. Washington, D.C.: Office of Juvenile Justice and Delinquency Prevention.

Word, Elizabeth, J. Johnston, Helen Bain, et al. 1990. "The State of Tennessee's Student/Teacher Achievement Ratio (STAR) Project: Technical Report, 1985-1990." Nashville, Tenn.: Tennessee State Department of Education.

Executive Summary, 4/9/98

The Effect of Attending a Small Class in the Early Grades on College Attendance Plans

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Background

Project STAR was an experiment in which 11,600 students and their teachers in grades k-3 were *randomly assigned* to a small class (13-17 students), regular-size class (22-25 students), or regular-size class with a teacher aide within 79 Tennessee public schools. The experiment began with kindergarten students in the 1985-86 school year. After four years, all students were returned to regular-size classes. Project STAR students who moved along on pace would have graduated from high school in the Spring of 1998. To determine the impact of having attended a smaller class in elementary school on students' long-term educational outcomes, we asked ACT, Inc. and the College Board/Educational Testing Service to link information on high school seniors in the class of 1998 who took the ACT or SAT exam to records that we provided on the 11,600 students from Project STAR, regardless of where the Project STAR students resided in 1998. The resulting database contains information on whether Project STAR students in the class of 1998 wrote either the ACT or SAT exam, their test score, and information from the background questionnaire students fill out when they take the ACT or SAT exam. This is the first database that permits a long-term examination of the behavior and post-high school aspirations of Project STAR participants. This Executive Summary describes our initial findings for a sample of more than 9,000 Project STAR students who were high school seniors in 1998.

Specific Findings

- The main results are illustrated in Figure 1. This figure reports the percent of students who took <u>either</u> the ACT or the SAT exam by the type of class they were assigned to attend their initial year in Project STAR. The figures are reported for all students combined, for white and black students separately, and for students who received free or reduced-price lunch in at least one year in grades k-3. For the entire sample, Figure 1 indicates that 43.7% of students who were assigned to a small class took either the ACT or SAT exam, whereas 40.0% of those assigned to a regular-size class took one of the exams, and 39.9% of those assigned to a regular-size class with an aide took one of the exams. The 3.6 percentage point higher test-taking rate for the students assigned to small classes relative to those assigned to regular-size classes was statistically significant at the .05 level; that is, this difference is unlikely to have occurred by chance.

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• Figure 1 also indicates that attending a small class was particularly effective in raising the proportion of black students who wrote one of the college entrance exams. Only 31.7% of black students in regular-size classes wrote the ACT or SAT exam, whereas 40.2% of black students in small classes wrote the college entrance exam. To gain some perspective on the magnitude of this effect, note that black-white gap in taking a college entrance exam was 13.3 percentage points for students in regular-size classes, and 6.1 percentage points for students in small classes. Thus, attending a small class reduced the black-white gap in the college-entrance-test-taking rate by 54 percent.

• Earlier research on Project STAR has found that minority students and students on free lunch exhibited the greatest gains in test scores as a consequence of attending a small class. The findings in Figure 1 complement a result that has been found consistently throughout Project STAR: minority students benefited most from attending a small class, and small classes were able to considerably narrow, although not eliminate, the gap in educational performance between black and white students.

• Table 1 provides further evidence on the effect of class size on the percent of students who took the college entrance exam. The first three columns of Table 1 contain the data used to construct Figure 1. To ensure that our results are not due to extraneous factors, we estimated a series of logistic regressions in which we controlled for the students' race, sex, free or reduced-price lunch status, and the specific elementary school he or she attended. Our findings were unchanged when we controlled for these variables, so we emphasize the simpler raw tabulations. Nonetheless, the fourth column of the table reports a statistical test of the null hypothesis that initial class-type assignment is unrelated to the likelihood the student writes either the ACT or SAT exam. With the exception of white students, these tests indicate that it is very unlikely that the observed differences in test-taking rates across the three types of classes would have occurred by chance.

• Tennessee is a state in which a majority of college-bound students take the ACT exam. Tables 2 and 3 provide separate tabulations of the test-taking rates for the ACT and for the SAT: some 40% of STAR students wrote the ACT exam while fewer than 6% wrote the SAT exam. The disaggregated results in Tables 2 and 3 indicate that, compared to students assigned to regular-size classes, students assigned to small classes were more likely to take the ACT exam, *and* were more likely to take the SAT exam.

• Class size may not have to shrink to 15 students for smaller classes to raise the likelihood that students take the ACT or SAT exams. We find that students who were initially assigned to a class with 21-25 students their first year in Project STAR were more likely to take the ACT or SAT exam than students who were assigned to classes with 26-30 students. And students who were assigned classes with 16-20 students were more likely to take the ACT or SAT exam than students who were assigned to classes with 21-25 students.

• We do not know how many students who took the ACT or SAT exam have actually enrolled in college, or how many years of higher education they will ultimately complete. But based on an analysis of the High School Class of 1972 Database, we found that high school seniors who took the ACT or SAT exam completed an

average of 1.63 more years of schooling than students who did not take one of the college entrance exams, after controlling for the race and gender of the students.

• Lastly, we examined the test scores students achieved on the ACT and SAT exams. For students who took the SAT but not the ACT exam, we converted their SAT score to an ACT equivalent score using a concordance developed by researchers at the College Board. For any student who wrote the ACT exam we used their ACT score, even if he or she also took the SAT exam. The average ACT test scores were virtually identical for students who were assigned to small and regular-size classes. For the full sample of 3,832 test takers, the average student in small and regular-size classes both earned a 19.3 composite ACT score. Moreover, assignment to a small class did not appear to alter the average test score for any of the subgroups that we examined (i.e., black, white and free or reduced-price lunch students). Past studies have found that average test scores tend to decline when more students take the college entrance exam, because the marginal test takers are weaker students than the average student. In the STAR experiment, however, students assigned to small classes were more likely to take the ACT or SAT exam, but the average score of those in small classes did not decline.

Conclusion

Attendance in a small class in grades k-3 appears to have raised the likelihood that students take either the ACT or SAT college-entrance exam. Since most colleges in the U.S. require students to take either the ACT or SAT exam to be admitted, these findings suggest that lowering class size in the elementary school grades raises the prospect that students will attend college. The beneficial effect of smaller classes on college aspirations appears to be particularly strong for minority students, and students on free or reduced-price lunch. Indeed, attendance in small classes appears to have cut the black-white gap in the probability of taking a college-entrance exam by more than half.

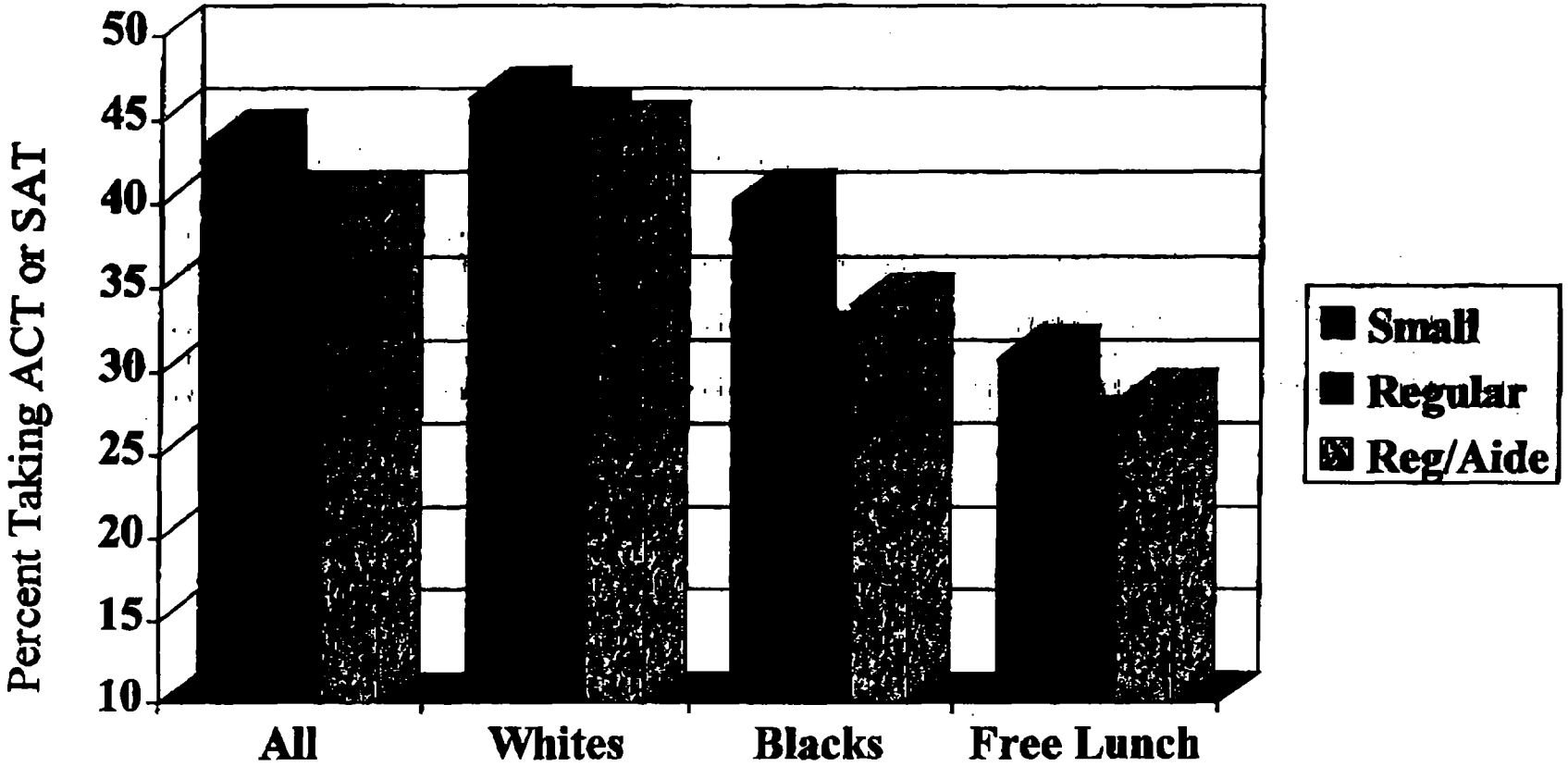
Appendix: Description of the Sample

With the assistance of HERO's, Inc., we provided the ACT and ETS organizations computer files which contained several variables from the STAR database, including demographic data, class assignment, and primary school test scores. The ACT and SAT data were merged to these records on Project STAR students on the basis of the students' names, dates of birth and Social Security numbers. If a STAR record was missing information on one of these three identifiers, the remaining identifiers were used to complete the merger. The data were merged together by searching over ACT and SAT records for the *entire* U.S., so any student who had moved away from Tennessee should still be included in the sample. About 9 percent of the STAR students who were identified by the search algorithm took the ACT or SAT exam outside of Tennessee. Once the data were merged together, the students' names, dates of birth, and Social Security numbers were concealed to preserve confidentiality.

Several checks indicated that the data were linked properly. For example, the correlation between the students' ACT score percentile rank and their 8th grade Tennessee Comprehensive Assessment Program (TCAP) Test percentile rank was .80, which is even higher than the correlation between the students 3rd grade Stanford Achievement Test Score percentile and their 7th grade TCAP percentile (.74). Additionally, the sex of the students based on their STAR records matched their sex in the ACT records in 98.7% of cases. These checks suggest that STAR students were correctly linked to their ACT and SAT records.

The ACT and SAT databases are organized by graduating high school classes. Only members of the High School Class of 1998 were included in the ACT and SAT records that formed the basis of the search. As a consequence, STAR students who repeated a grade or for some other reason were not high school seniors in 1998 could not be matched to their ACT and SAT records, even if they had taken one of the exams. Because of this feature of the data, we restrict our sample to the subset of 9,397 students who were on grade level based on information that we have on students who wrote the TCAP exam through the eighth grade. As a further check, however, we re-calculated Figure 1 for the entire sample of 11,600 students in our database (which includes students who fell behind and were not high school seniors in 1998), and find qualitatively similar results as in Figure 1. Thus, our results are robust to the inclusion of students who have fallen behind grade level.

Figure 1
Students Assigned to Small Classes were More Likely to Take the ACT or SAT College Entrance Exams



Notes: Figure shows percent of students who took either the ACT or the SAT exam, by their initial class-size assignment. Sample consists of 9,397 STAR students who were High School seniors in 1998. Free lunch group includes students who ever received free or reduced-price lunch grade k-3.

Table 1. Percent Taking Either ACT or SAT Exam

	Small	Regular	Regular/Aide	Multivariate Logit-Adjusted P-value
All Students	43.7	40.0	39.9	0.019
Free Lunch	30.8	26.5	28.2	0.025
Black	48.2	31.7	34.0	0.086
White	46.3	45.0	44.2	0.285

Notes: Sample sizes are 9,397, 5,264, 3,160, and 5,995. Multivariate logit includes initial-class assignment, race, sex, free-lunch and initial school dummy variables. The sample consists of students who never repeated a grade, and free lunch measures whether a student ever received free or reduced-price lunch in grades K-3.

Table 2. Percent Taking ACT Exam

	Small	Regular	Regular/Aide	Multivariate Logit-Adjusted P-value
All Students	41.8	39.7	38.7	0.071
Free Lunch	30.0	25.8	27.1	0.024
Black	39.3	31.4	33.1	0.015
White	44.0	43.2	42.8	0.590

Notes: Sample sizes are 9,397, 5,264, 3,160, and 5,995. Multivariate logit analysis includes initial-class assignment, race, sex, free-lunch and initial school dummy variables. The samples consist of students who never repeated a grade, and free lunch measures whether a student ever received free or reduced-price lunch in grades K-3.

Table 3. Percent Taking SAT Exam

	Small	Regular	Regular/Aide	Multivariate Logit-Adjusted P-value
All Students	6.7	5.2	5.2	0.026
Free Lunch	2.7	2.1	2.6	0.707
Black	6.5	3.2	3.9	0.123
White	7.4	6.0	5.9	0.076

Notes: Sample sizes are 9,397, 5,264, 3,180, and 5,995. Multivariate logit includes initial-class assignment, race, sex, free-lunch and initial school dummy variables. The sample consists of students who never repeated a grade, and free lunch measures whether a student ever received free or reduced-price lunch in grades K-3.

NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

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NAEPFACTS

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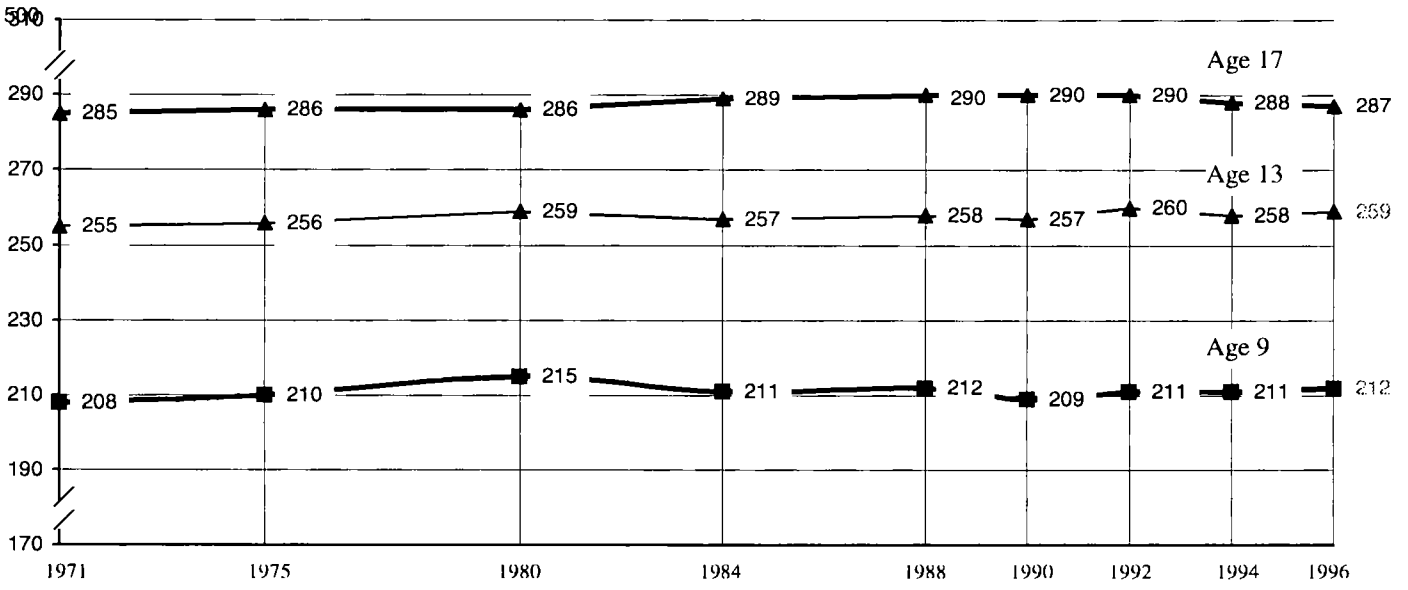
Long-Term Trends in Student Reading Performance

***Summary**: Data from the NAEP 1996 Long-Term Reading Assessment show that overall student reading performance, as tested at age levels 9, 13, and 17, has increased for both 9- and 13-year-olds since the first assessment in 1971. Scores for 9- and 13-year-olds in most racial/ethnic and gender subgroups reflected the overall increase. Black 17-year-olds were the only members of that age group to achieve an increase, and they did so while black dropout rates were declining.*

The National Assessment of Educational Progress (NAEP) continuously monitors the knowledge, skills, and performance of the nation's children and youth in a variety of academic subjects. The data collected are available in major reports. The *NAEPfacts* series takes selected data from these reports and uses them to highlight specific issues of particular interest to teachers, researchers, policymakers, and other individuals with an interest in education.

The assessments used by NAEP to evaluate long-term trends in student performance began in the early 1970s. The first assessments were given in three subject areas—science, mathematics, and reading. Students were assessed at ages 9, 13, and 17. In 1984 a fourth subject, writing, was added. Long-term trend data can be analyzed in a number of ways. Student scores for given years can be compared for statistically significant differ-

Figure 1—NAEP Reading Average Scale Scores for the Nation



▲ Positive linear trend (scores have increased) ■ No linear trend

Red lines indicate negative quadratic trend (scores rose and then fell or flattened out).

Black lines indicate no quadratic trend.

Red numbers indicate 1996 scores were significantly higher than 1971 scores, at a 5 percent combined significance level per set of comparisons.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress, 1996 Long-Term Trend Assessments

ences. Often, scores for student groups or subgroups from the first assessment are compared with the results from the most recent assessment.

It is also possible to analyze a series of scores for overall trends, rather than simple year-to-year variations. Specifically, a series of scores can be analyzed for "linear" and "quadratic" trends. Linear trends can be represented as straight lines. A positive linear trend indicates that overall the average scores for a given student group form a gradually rising line, while a negative linear trend indicates a gradually declining one. A series of scores can show a linear trend despite wide variation among individual scores, as long as the overall pattern is either up or down.[1]

Table1.—Average Scale Scores in Reading by Race/Ethnicity and Gender

	Age 9			Age 13			Age 17		
	1971†	1996	Trend	1971†	1996	Trend	1971†	1996	Trend
Nation	208*	212	q	255*	259	L	285	287	Lq
White	214*	220	L	261*	267	L	291	294	L
Black	170*	190	Lq	222*	236	Lq	239*	265	Lq
Hispanic	183*	194		233	240		252	265	Lq
Male	201*	207	Lq	250	253		279	280	q
Female	214*	218		261*	265	L	291	294	L

† NOTE: For Hispanic students, the differences are calculated between 1975 and 1996.

*Statistically significant difference from 1996, at a 5 percent combined significance level per set of comparisons.

L=Positive Linear Trend l=Negative Linear Trend

Q=Positive Quadratic Trend q=Negative Quadratic Trend

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

Quadratic trends can be represented as simple curves, and can be represented mathematically by quadratic equations.[2] A positive quadratic trend indicates that scores form a simple curve with one or both ends higher than its center—scores sagged, and then either leveled off or rose, or were flat and then rose. A negative quadratic trend indicates a simple curve whose center is higher than one or both ends—scores rose, and then either leveled off or declined, or were flat and then declined.

It is possible for scores to display both a linear and a quadratic trend. For example, if scores rose sharply and then flattened out, this would constitute a negative quadratic trend. However, if the pattern of the scores still showed an increase for the entire time period, the scores would also display a positive linear trend.

Overall Performance

Scores for 9- and 13-year-olds on the 1996 assessment are significantly higher than scores for the first assessment, given in 1971 (see figure 1). Scores for 9-year-olds showed a negative quadratic trend—rising and then falling—and no linear trend. Scores for 13-year-olds showed a positive linear trend and no quadratic trend, that is, a relatively straight-line increase. Scores for 17-year-olds showed a positive linear trend and a negative quadratic trend, because they rose and then fell, but with an overall upward trend.

Race/Ethnicity and Gender

Analysis of scores by race/ethnicity and gender shows higher scores in 1996 for most groups as compared to 1971. (Separate data for Hispanics only goes as far back as 1975.) Notably, scores for black students improved for all three age groups. (See table 1.) Whites and females recorded increases for both 9- and 13-year-olds, while Hispanics and males recorded increases for 9-year-olds only.

For the period 1971-1996 scores for white students in all three age groups showed a positive linear trend and no quadratic trend, a relatively straight-line increase. Scores for blacks in all three age groups showed both a positive linear trend and a negative quadratic trend, because scores increased overall between 1971 and 1996 but reached their high point prior to 1996 and then flattened out or declined. Scores for 17-year-old Hispanics showed the same trends. Scores for 13- and 9-year-old Hispanics showed no trends.

Scores for male 17-year-olds showed a negative quadratic trend, rising and then falling, while scores for male 9-year-olds showed a negative quadratic trend and a positive linear trend, rising and then falling, but showing an overall pattern of increase. Scores for female 17- and 13-year-olds showed a positive linear trend—a relatively straight-line increase.

The increase in reading scores for black 17-year-old students over the 1971–1996 period occurred despite the fact that dropout rates for this group fell significantly over the same period. Data from the Census Bureau's Current Population Survey indicate that in 1972 the overall dropout rate (known as the "status" dropout rate) for 16-to-24-year-olds was 14.6 percent, while the black dropout rate for this age group was 21.3 percent.[3] By

1995, the overall dropout rate had fallen to 12 percent, while the black dropout rate had fallen to 12.1 percent. (In 1995 the white dropout rate was 8.6 percent, while the Hispanic dropout rate was 30 percent.)

While the black dropout rate was dropping, the average scale scores for blacks were increasing. The reading score for black 17-year-old students was 265 in 1996, higher than the 1971 average of 239.

It is likely that a decreasing dropout rate increases the proportion of poorer-performing students in a school population.[4] Thus, it appears that the reading scores of black 17-year-old students increased even though the proportion of poorer-performing students in the overall population of black 17-year-old students was also increasing.

Performance Differences

As in the past, the 1996 Long-Term Trend Reading Assessment found significant differences in the performance of different racial/ethnic subgroups and between male and female students. Table 2 displays the differences in average reading scale scores and the trends in those differences since 1971 (in the case of Hispanics, since 1975).

White students in all three age groups outperformed their black and Hispanic peers. The difference between average scale scores for white and black students declined significantly from 1971 to 1996 for both 9- and 17-year-olds, but not for 13-year-olds. The differences in performance for all three age groups show a negative linear trend, that is, a relatively straight-line decline, due to improving scores for black students.

Differences for both the 13- and 17-year-old age groups show a positive quadratic trend as well, a decrease followed by an increase or a flattening out. In the late 1980s the differences between white and black scores for these two age groups were narrowing. For example, in 1988, scores for 17-year-old black students were 20 points lower than scores for their white peers. In 1971 the difference had been 53 points. However, the trend did not maintain itself. In 1996, the difference between scores for black and white 17-year-old students was 29 points.

Average scale score differences between white and Hispanic students did not change significantly over the years 1975–1996. Differences in scores for 17-year-old Hispanics did show a positive quadratic trend. Scores for 17-year-old Hispanics improved, narrowing the gap with whites, but then the gap widened somewhat.

Female students continued to outperform male students by a significant margin, at all three age levels. Differences in performance did not change significantly for any of the three age groups. Scores for 17- and 13-year-olds showed a negative quadratic trend, indicating that tendencies toward reduced differences in performance failed to maintain themselves. For example, in 1988, 17-year-old males scored 7 points lower than 17-year-old females, compared to 12 points lower on the first assessment in 1971. However, in 1996 the difference stood at 15 points. For the most part, minor gains in male students' performance were offset by improved scores by female students.

Table 2.—Trends in Differences in Average Reading Scale Scores by Race/Ethnicity and Gender

	1971†	1996	Trends
White vs. Black Students (white minus black)			
Age 17	53*	29	lQ
Age 13	39	31	lQ
Age 9	44*	30	l
White vs. Hispanic Students (white minus Hispanic)			
Age 17	41	30	Q
Age 13	30	27	
Age 9	34	26	
Male vs. Female Students (male minus female)			
Age 17	-12	-15	q
Age 13	-11	-13	q
Age 9	-13	-11	

† NOTE: For Hispanic students, the differences are calculated between 1975 and 1996.

*Significantly higher than 1996, at a 5 percent combined significance level per set of comparisons.

L=Positive Linear Trend l=Negative Linear Trend
Q=Positive Quadratic Trend q=Negative Quadratic Trend

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Long-Term Trend Assessment.

Conclusion

Average reading scale scores for 9- and 13-year-old students were higher in 1996 than in 1971. Scores for both 13- and 17-year-old students showed a positive linear trend, indicating a gradual rise in scores for the period 1971–1996. Scores for both 9- and 17-year-old students showed a negative quadratic trend, indicating that scores had increased, but then either declined or flattened out.

Reading scores for most but not all student subgroups were higher in 1996 than in 1971, particularly in the 13-

and 9-year-old age groups. Black students recorded increases at all three age levels. However, scores for many subgroups showed a pattern of increase in the 1980s, followed by a decline or a flattening out in the 1990s. Reading scores for 17-year-old black students have increased even as dropout rates have been falling.

Notes

[1]A series of scores may show a linear trend, either positive or negative, even though a comparison of the first and last scores does not show a statistically significant difference. The reverse is true as well.

[2]Quadratic equations, familiar from elementary algebra, involve variables with a power no greater than 2. For example, the equation $y^2=R^2- x^2$ (or $y = \sqrt{R^2 - x^2}$) is a quadratic equation, in particular, the equation used for graphing a circle. For purposes of trend analysis, this equation could be used to represent either a positive quadratic trend in which scores first fell and then rose to their original starting point, or a negative quadratic trend in which scores first rose and then fell to their original starting point.

[3]See McMillen, M. & Kaufman, P., *Dropout Rates in the United States: 1995,* Chapter 1 (National Center for Education Statistics, U.S. Department of Education, U.S. Printing Office) ***http://nces.ed.gov/pubs/dp95/index.html***.

[4]The dropout population is likely to contain a larger percentage of poorer-performing students than the student population as a whole. See Natriello, G., ed., *School Dropouts: Patterns and Policies*, 1987, Teachers College Press, New York, NY and Schwartz, W., "School Dropouts: New Information About an Old Problem," ERIC Clearinghouse on Urban Education Digest, No. 109, Aug. 1995.

For Further Information

NAEP 1996 Trends in Academic Progress, the complete report. Single copies are available free from the National Center for Education Statistics, U.S. Department of Education, Washington, DC 20208-5653. Copies may also be obtained over the World Wide Web at ***http://nces.ed.gov/NAEP/96report/97986.shtml***.

NAEPfacts briefly summarize findings from the National Assessment of Educational Progress (NAEP). The series is a product of the National Center for Education Statistics, Pascal D. Forgione, Jr., Commissioner, and Gary W. Phillips, Associate Commissioner for Education Assessment. This issue of *NAEPfacts* was written by Alan Vanneman, of the Education Statistics Services Institute, in support of the National Center for Education Statistics, and Sheida White of NCES. To order other NAEP publications, call Bob Clemons at 202-219-1690, or e-mail bob_clemons@ed.gov.

The NCES World Wide Web Home Page is ***http://nces.ed.gov/***.

Trends in the reading proficiency of 9-, 13-, and 17-year-olds

Students' ability to read is essential to their educational progress. If students fall behind in reading proficiency, they may find it difficult to benefit from other aspects of the curriculum. In the future, poor readers may also find it difficult to participate effectively in a society requiring increasingly sophisticated job skills.

- Overall, reading proficiency for 9-year-olds improved between 1971 and 1980, declined between 1980 and 1990, and was stable between 1990 and 1996. Little change occurred from 1971 to 1996 at ages 13 and 17, although scores for 17-year-olds increased slightly between 1971 and 1984.
- Females continued to outscore males in reading proficiency across all age groups.
- For all three age levels, average scores for black students rose by about 20 or more scale points between 1971 and 1988, and in 1996, the average scores were higher than those in 1971. The gap between the scores of white and black students consequently decreased at ages 9 and 17 between 1971 and 1996.
- In 1996, there was an average proficiency difference of 47 scale points between 9- and 13-year-olds, and a difference of 28 scale points between 13- and 17-year-olds. This pattern holds true for both genders and all racial/ethnic groups.

Average reading proficiency (scale scores), by sex and age: 1971–96

	Total			Male			Female		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1971	[1]208	[1]255	285	[1]201	250	279	[1]214	[1]261	291
1975	210	256	286	204	250	280	216	262	[1]291
1980	[2]215	259	286	[2]210	[2]254	282	[2]220	263	[1]289
1984	[2]211	257	[2]289	[2]208	[2]253	284	214	262	294
1988	[2]212	258	[2]290	[2]208	252	[2]286	216	263	294
1990	209	257	[2]290	204	251	284	215	263	[2]297
1992	211	[2]260	[2]290	[2]206	254	[2]284	215	[2]265	296
1994	[2]211	258	288	[2]207	251	282	215	[2]266	295
1996	[2]212	[2]259	287	[2]207	253	280	[2]218	[2]265	294

Average reading proficiency (scale scores), by race/ethnicity and age: 1971–96

	White			Black			Hispanic		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1971	[1]214	[1]261	291	[1]170	[1]222	[1]239	—	—	—
1975	217	262	293	[2]181	[1]226	[1]241	[1]183	232	252
1980	[1,2]221	[2]264	293	[2]189	[2]233	[1]243	190	237	261
1984	[2]218	263	[2]295	[2]186	[2]236	[2]264	187	240	[2]268
1988	218	261	295	[2]189	[2]243	[2]274	[2]194	240	[2]271
1990	217	262	[2]297	[2]182	[2]242	[2]267	189	238	[2]275
1992	[2]218	[2]266	[2]297	[2]185	[2]238	[2]261	192	239	[2]271
1994	[2]218	[2]265	296	[2]185	[2]234	[2]266	186	235	263
1996	[2]220	[2]267	294	[2]190	[2]236	[2]265	[2]194	240	265

— Not available.

[1] Statistically significant difference from 1996.

[2] Statistically significant difference from 1971 for whites and blacks and from 1975 for Hispanics.

NOTE: See the supplemental note to *Indicator 16* for further discussion of the NAEP assessments. The reading proficiency scale has a range from 0 to 500. (See supplemental table 16-1 for further explanations of levels.)

Level 150: Simple, discrete reading tasks

Level 200: Partial skills and understanding

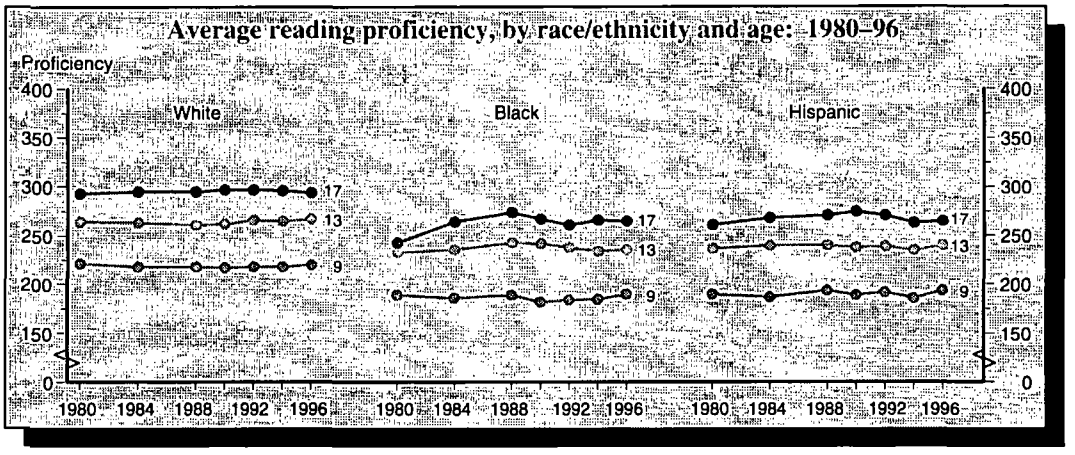
Level 250: Interrelates ideas and makes generalizations

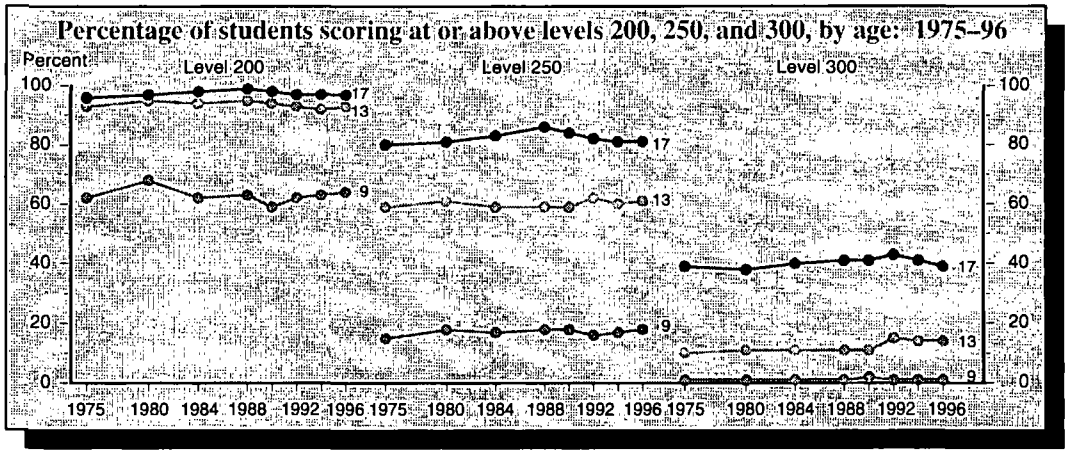
Level 300: Understands complicated information

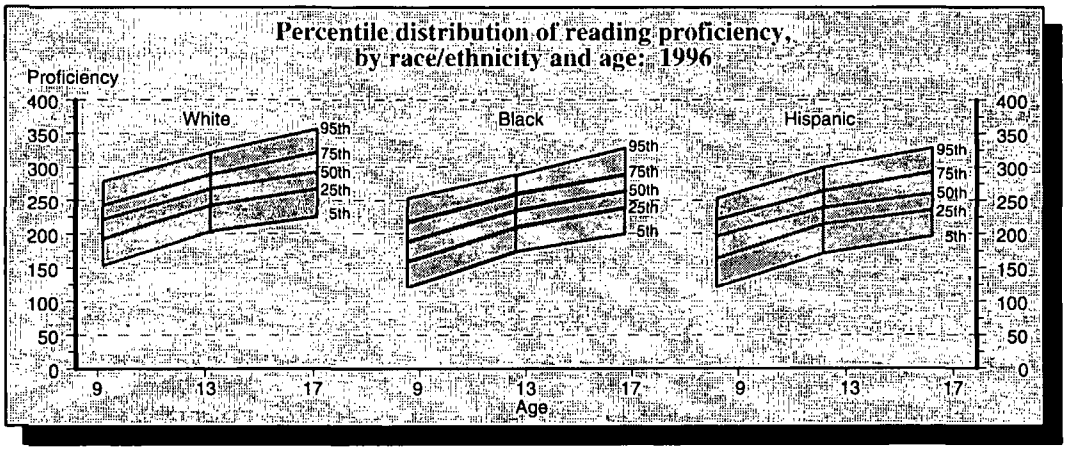
Level 350: Learns from specialized reading materials

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Average reading proficiency (scale score)







NOTE: The reading proficiency scale has a range from 0 to 500. (See supplemental table 16-1 for further explanations of levels.)

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Trends in writing proficiency in grades 4, 8, and 11

Effective writing skills are important in all stages of life from early education to future employment. In the business world, as well as in school, students often must convey complex ideas and information in a clear, succinct manner. Inadequate writing skills, therefore, could inhibit achievement across the curriculum and in future careers, while proficient writing skills help students convey ideas, deliver instructions, analyze information, and motivate others.

- Average writing proficiency remained relatively stable for 4th-grade students between 1984 and 1996. Eighth-grade writing scale scores declined between 1984 and 1990, but returned to about their original level by 1996. Eleventh-grade scores were slightly lower in 1996 than in 1984.
- Females have outscored males in writing proficiency at all grade levels since 1988.
- Scores for black and Hispanic students have remained relatively unchanged since 1984 at all grade levels. Although scores dropped slightly for white 11th-graders between 1984 and 1996, the average scores for white students were higher than those for black and Hispanic students at all grade levels.
- In 1996, 83 percent of 11th-graders could write focused, clear responses (level 250); 31 percent were generally able to write complete, sufficient responses (level 300); and 2 percent provided effective, coherent responses (level 350) (see supplemental table 17-2).
- In 1996, 4th-grade scores ranged from 142 at the 5th percentile to 268 at the 95th percentile. At the 8th-grade level, the median score (50th percentile) was 264, indicating that the top 5 percent of 4th-graders achieved approximately the same proficiency as the average 8th-graders (see supplemental table 17-3).

Average writing proficiency (scale score), by sex and grade: 1984–96

	Total			Male			Female		
Year	Grade 4	Grade 8	Grade 11	Grade 4	Grade 8	Grade 11	Grade 4	Grade 8	Grade 11
1984	204	267	[1]290	201	[1]258	[1]281	208	276	299
1988	206	264	[1]291	199	254	[1]282	213	274	299
1990	202	[1,2]257	287	195	[1,2]246	276	209	[1,2]268	298
1992	207	[1,2]274	287	198	[2]264	279	216	[1,2]285	296
1994	205	265	[2]285	196	254	[2]276	214	278	[2]293
1996	207	264	[2]283	200	[2]251	[2]275	214	276	[2]292

Average writing proficiency (scale score), by race/ethnicity and grade: 1984–96

	White			Black			Hispanic		
Year	Grade 4	Grade 8	Grade 11	Grade 4	Grade 8	Grade 11	Grade 4	Grade 8	Grade 11
1984	211	272	[1]297	182	247	270	189	247	259
1988	215	269	[1]296	173	246	275	190	250	274
1990	211	[1,2]262	293	171	239	268	184	246	[2]277
1992	217	[1,2]279	294	175	[1]258	263	189	[1,2]265	274
1994	214	272	[2]291	173	245	267	189	252	271
1996	216	271	[2]289	182	242	267	191	246	269

[1] Statistically significant difference from 1996.

[2] Statistically significant difference from 1984.

NOTE: See the supplemental note to *Indicator 16* for further discussion of the NAEP assessments. The writing proficiency scale has a range from 0 to 500. (See supplemental table 17-1 for detailed explanations of levels.)

Level 150: Disjointed, unclear writing

Level 200: Incomplete, vague writing

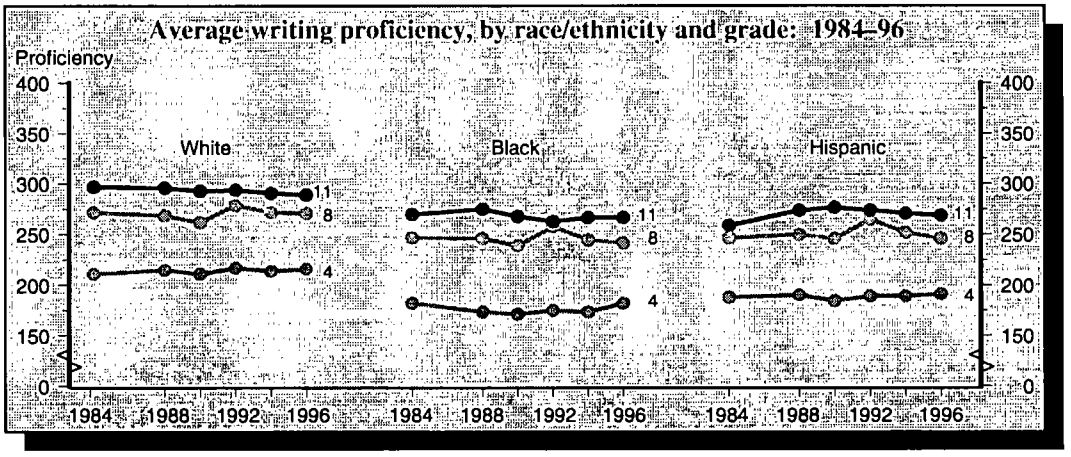
Level 250: Beginning focused, clear writing

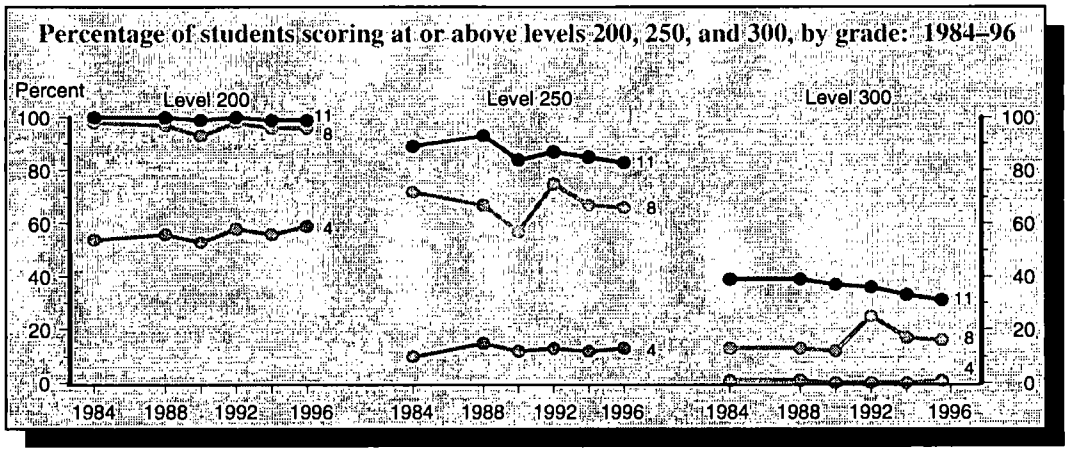
Level 300: Complete, sufficient writing

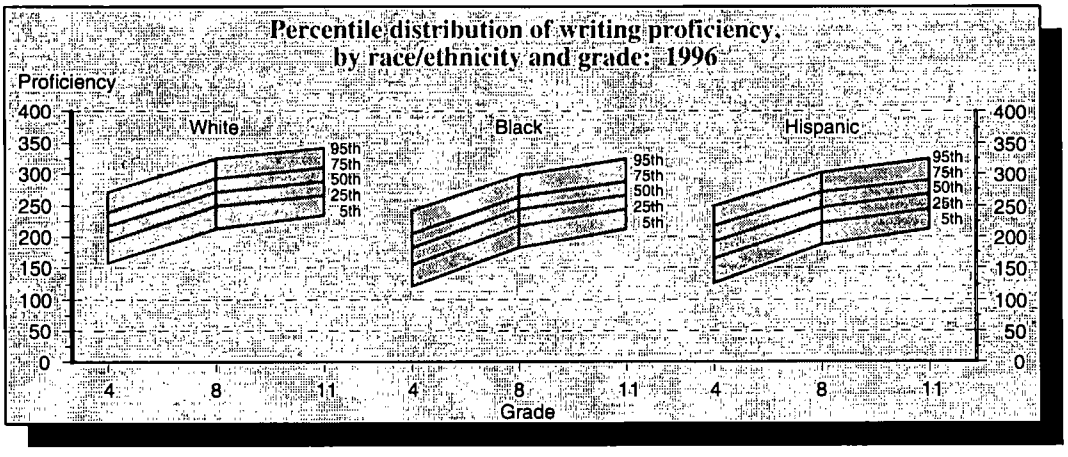
Level 350: Effective, coherent writing

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Average writing proficiency (scale score)







NOTE: The writing proficiency scale has a range from 0 to 500. (See supplemental table 17-1 for further explanations of levels.)

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Trends in the mathematics proficiency of 9-, 13-, and 17-year-olds

Proficiency in mathematics is an important outcome of education. The mathematics skills of the Nation's workers may be a crucial component of its economic competitiveness. In an increasingly technological world, knowledge of mathematics is critical for success in scientific and engineering occupations. It is also essential for those working in the growing number of diverse occupations that use computers as a foundation for their activities, such as graphic designers, librarians, and business managers.

- Average mathematics proficiency improved between 1978 and 1996 for all age groups, with 9-year-olds making the largest improvements. Another mathematics assessment, one that reflects recent curricular emphasis and mathematics standards developed by the National Council for Teachers of Mathematics, showed that scores for 4th-, 8th-, and 12th-graders increased between 1990 and 1996 (see supplemental table 18-2).
- Several states had significant increases in average mathematics scores between 1992 and 1996. Of the 38 jurisdictions in which 4th-graders participated, 15 states showed significant improvements in mathematics scores between 1992 and 1996. Of the 36 jurisdictions in which 8th-graders participated, 13 states showed significant improvements between 1992 and 1996 (see supplemental table 18-3). No state showed a significant decline at the 8th-grade level.
- Between 1978 and 1996, average scores for white students were higher than those for black and Hispanic students at all age levels. However, the scores of white 13- and 17-year-olds increased at a slower rate than the scores of their black and Hispanic peers, causing the gap in mathematics proficiency to decrease for these racial/ethnic groups over the last 20 years.

Average mathematics proficiency (scale score), by sex and age: 1973–96

	Total			Male			Female		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1973	[1]219	[1]266	304	[1]218	[1]265	309	[1]220	[1]267	301
1978	[1]219	[1]264	[1]300	[1]217	[1]264	[1,2]304	[1]220	[1]265	[1]297
1982	[1]219	[1]269	[1,2]298	[1]217	[1]269	[1,2]302	[1]221	[1]268	[1,2]296
1986	[1]222	[1]269	[1]302	[1,2]222	[1,2]270	305	[1]222	[1]268	[1]299
1990	[2]230	[1,2]270	305	[2]229	[1,2]271	306	[2]230	270	303
1992	[2]230	[2]273	307	[2]231	[2]274	309	[2]228	[2]272	[2]305
1994	[2]231	[2]274	306	[2]232	[2]276	309	[2]230	[2]273	304
1996	[2]231	[2]274	307	[2]233	[2]276	310	[2]229	[2]272	[2]305

Average mathematics proficiency (scale score), by race/ethnicity and age: 1973–96

	White			Black			Hispanic		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1973	[1]225	[1]274	310	[1]190	[1]228	[1]270	[1]202	[1]239	[1]277
1978	[1]224	[1]272	[1,2]306	[1]192	[1]230	[1]268	[1]203	[1]238	[1]276
1982	[1]224	[1]274	[1,2]304	[1]195	[1,2]240	[1]272	[1]204	[2]252	[1]277
1986	[1]227	[1]274	[1]308	[1,2]202	[2]249	[2]279	[1]205	[2]254	283
1990	[2]235	[1]276	310	[2]208	[2]249	[2]289	[2]214	[2]255	284
1992	[2]235	[2]279	312	[2]208	[2]250	[2]286	[2]212	[2]259	[2]292
1994	[2]237	[2]281	312	[2]212	[2]252	[2]286	[2]210	[2]256	[2]291
1996	[2]237	[2]281	313	[2]212	[2]252	[2]286	[2]215	[2]256	[2]292

[1] Statistically significant difference from 1996.

[2] Statistically significant difference from 1973.

NOTE: See the supplemental note to *Indicator 16* for further discussion of the NAEP assessments. The mathematics proficiency scale has a range of 0 to 500. (See supplemental table 18-1 for further explanations of levels.)

Level 150: Simple arithmetic facts

Level 200: Beginning skills and understanding

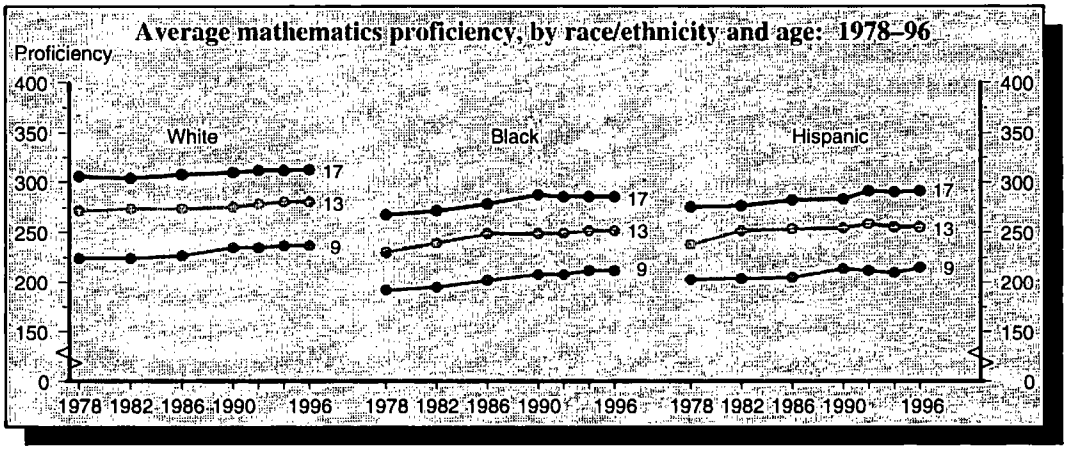
Level 250: Numerical operations and beginning problem solving

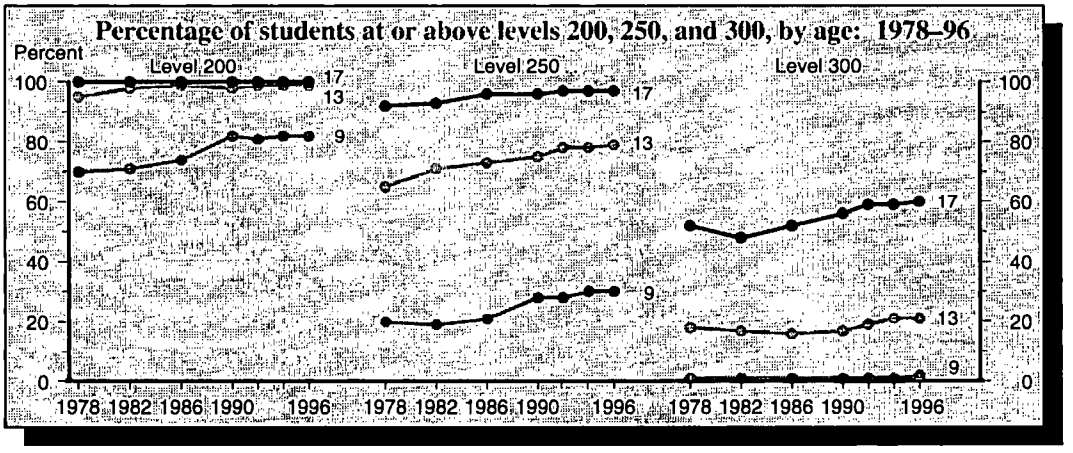
Level 300: Moderately complex procedures and reasoning

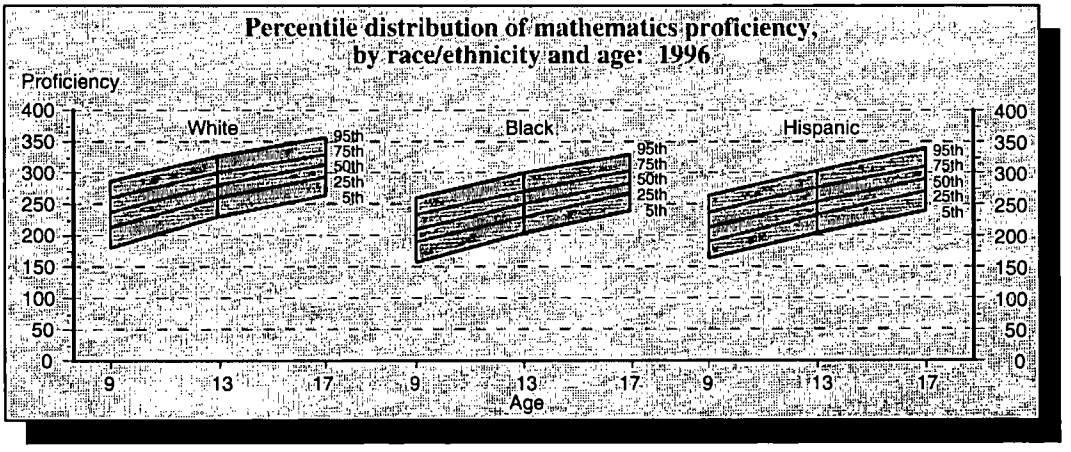
Level 350: Multi-step problem solving and algebra

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Average mathematics proficiency (scale score)







NOTE: The mathematics proficiency scale has a range from 0 to 500. (See supplemental table 18-1 for further explanations of levels.)

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1997.

Trends in the science proficiency of 9-, 13-, and 17-year-olds

Competence in science is an important outcome of education. The ability to apply scientific information, interpret data, and make inferences about scientific findings is required in a world that relies heavily on technological and scientific advances. Aside from workplace requirements, science proficiency is crucial in understanding environmental, medical, economic, and other issues that confront modern societies.

- Average science achievement scores rose for all three age levels between 1982 and 1996. However, when compared to scores from the 1970s, the 1996 average scores were higher at age 9, about the same at age 13, and lower at age 17.
- In 1996, the average science proficiency of blacks and Hispanics remained well below that of whites. However, the proficiency gap between whites and blacks at age 9 was smaller in 1996 than in 1970, and between whites and Hispanics at age 13, the gap was smaller in 1996 than in 1977.
- A higher percentage of 9- and 13-year-olds demonstrated general science skills by reaching level 250 in 1996 than in 1982. Additionally, more 17-year-olds reached levels 300 and 350 in 1996, exhibiting detailed knowledge and analytical understanding of scientific principles and the ability to integrate specialized scientific information (see supplemental table 19-2).
- There is much variation in science proficiency scores within age groups. For example, in 1996, the proficiency of white 9-year-olds varied by 131 scale points, from the 5th percentile to the 95th percentile. By comparison, the difference in the median proficiency of white 9- and 17-year-olds was 69 scale points (see supplemental table 19-3).

Average science proficiency (scale score), by sex and age: 1970–96

	Total			Male			Female		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1970	[1]225	255	[1]305	228	257	[1]314	[1]223	253	[1]297
1973	220	250	296	223	252	304	218	247	288
1977	[1,2]220	[1,2]247	[2]290	[1,2]222	[1,2]251	[2]297	[1,2]218	[1,2]244	[1,2]282
1982	[1]221	[1,2]250	[1,2]283	[1,2]221	256	[1,2]292	[1]221	[1,2]245	[1,2]275
1986	[1]224	[1]251	[1,2]289	[1]227	256	[2]295	[1]221	[1,2]247	[1,2]282
1990	229	255	[2]290	230	259	[2]296	227	252	[2]285
1992	[2]231	258	[2]294	[2]235	260	[2]299	227	256	[2]289
1994	[2]231	257	[2]294	232	259	[2]300	[2]230	254	[2]289
1996	[2]230	256	[2]296	232	261	[2]300	[2]228	252	[2]292

Average science proficiency (scale score), by race/ethnicity and age: 1970–96

	White			Black			Hispanic		
Year	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17	Age 9	Age 13	Age 17
1970	236	263	[1]312	[1]179	[1]215	258	—	—	—
1973	231	259	304	177	205	250	—	—	—
1977	[1,2]230	[1,2]256	[1,2]298	[1]175	[1]208	[1,2]240	[1]192	[1]213	262
1982	[1,2]229	[1,2]257	[1,2]293	[1]187	[1]217	[1,2]235	[1]189	[2]226	[2]249
1986	[1,2]232	[1]259	[1,2]298	[2]196	222	253	199	[2]226	259
1990	238	264	[2]301	[2]196	[2]226	253	[2]206	[2]232	262
1992	239	[2]267	[2]304	[2]200	224	256	[2]205	[2]238	270
1994	240	[2]267	[2]306	[2]201	224	257	[2]201	[2]232	261
1996	239	266	[2]307	[2]202	[2]226	260	[2]207	[2]232	269

— Not available.

[1] Statistically significant difference from 1996.

[2] Statistically significant from 1970 for whites and blacks, and from 1977 for Hispanics.

NOTE: See the supplemental note to *Indicator 16* for further discussion of the NAEP assessments. The science proficiency scale has a range from 0 to 500. (See supplemental table 19-1 for detailed explanations of levels.)

Level 150: Knows everyday science facts

Level 200: Understands simple scientific principles

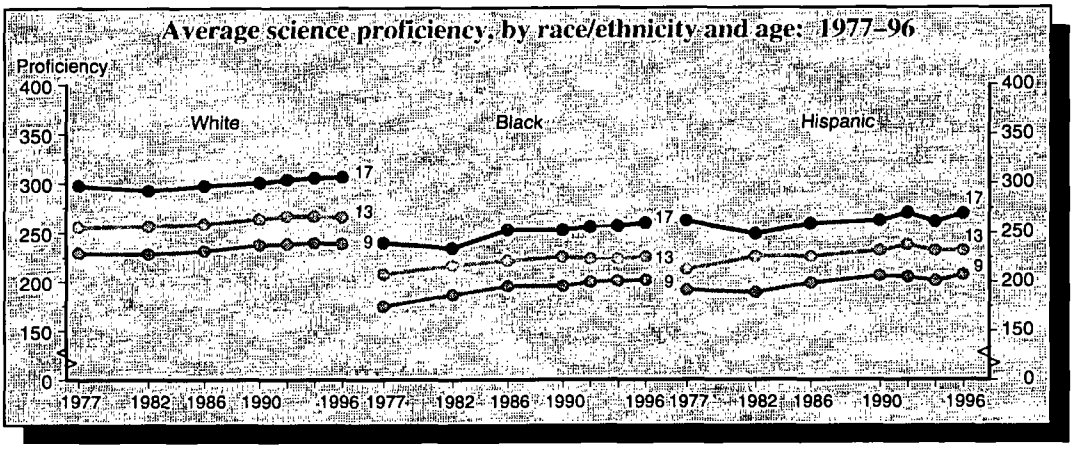
Level 250: Applies general scientific information

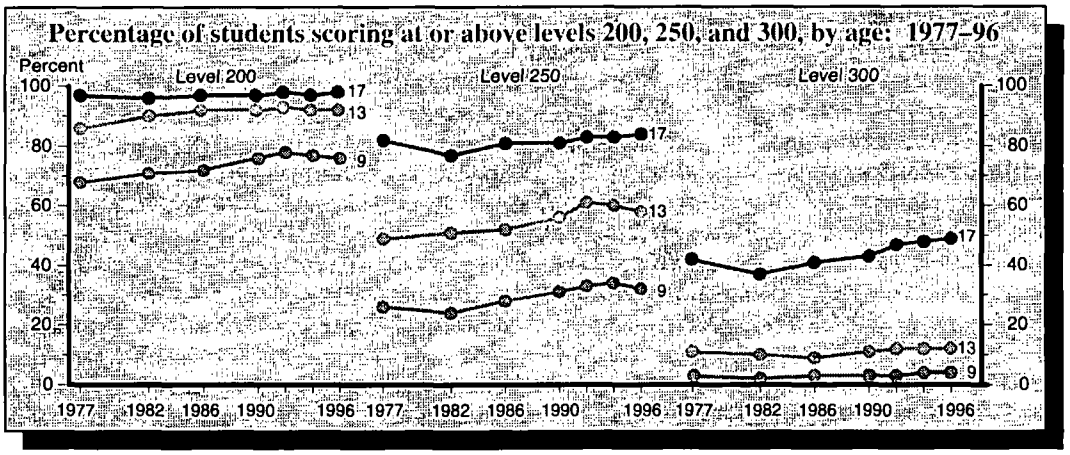
Level 300: Analyzes scientific procedures and data

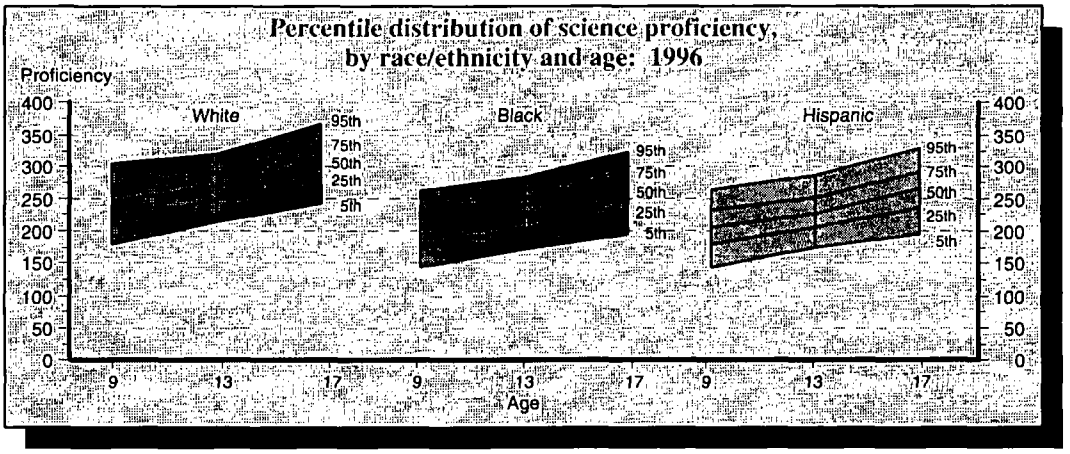
Level 350: Integrates specialized scientific information

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1998.

Average science proficiency (scale score)







NOTE: The science proficiency scale has a range from 0 to 500. (See supplemental table 19-1 for further explanation of levels.)

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress, *NAEP 1996 Trends in Academic Progress*, 1998.

International comparisons of mathematics and science performance of 4th-, 8th-, and 12th-grade students

The technical and scientific skills of a nation's workers are a crucial component of its economic competitiveness. The recently completed Third International Mathematics and Science Study (TIMSS) assessed the mathematics and science performance of students around the world. By comparing the mathematics and science proficiency of 4th-, 8th-, and 12th-graders in six wealthy industrialized countries, it is possible to monitor U.S. progress toward the National Education Goal of being first in the world in mathematics and science achievement.

- U.S. 4th-graders scored above the 26-nation average in both mathematics and science. In science, only students in Korea outperformed U.S. 4th-graders, while in mathematics, U.S. 4th-graders outperformed their peers in 12 countries and scored below their peers in 7 countries.
- U.S. 8th-graders scored above the 41-nation average in science and below the international average in mathematics. In science, U.S. 8th-graders outperformed their peers in 15 countries and scored below their peers in 9 countries. In mathematics, 8th-graders in 20 countries outperformed U.S. 8th-graders. U.S. 8th-graders had higher scores than their peers in 7 countries.
- U.S. 12th-graders scored below the 21-nation average in both mathematics and science. In science, U.S. 12th-graders scored below students in the last year of secondary school in 11 countries. U.S. 12th-graders outperformed their peers in 2 countries. In mathematics, U.S. students scored below their peers in 14 countries and outperformed their peers in 2 countries.

Average mathematics proficiency scores, by country, grade, and sex: 1995

	4th-grade			8th-grade			12th-grade		
G-7 country	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls
Canada[3]	532	534	531	[4]527	[4]526	[4]530	[4]519	[4]537	[4]504
England[1,2]	[5]513	[5]515	[5]510	506	508	504	—	—	—
France[3]	—	—	—	[4]538	[4]542	[4]536	[4]523	[4]544	[4]506
Germany[2,3]	—	—	—	509	512	509	[4]495	[4]509	480
Italy[3]	—	—	—	—	—	—	476	490	464
Japan	[4]597	[4]601	[4]593	[4]605	[4]609	[4]600	—	—	—
United States[2]	545	545	544	500	502	497	461	466	456

Average science proficiency scores, by country, grade, and sex: 1995

	4th-grade			8th-grade			12th-grade		
G-7 country	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls
Canada[3]	[5]549	[5]553	[5]545	531	537	525	[4]532	[4]550	[4]518
England[1,2]	[5]551	[5]555	548	552	562	542	—	—	—
France[3]	—	—	—	[5]498	[5]506	[5]490	487	508	468
Germany[2,3]	—	—	—	531	542	524	497	514	478
Italy[3]	—	—	—	—	—	—	475	495	458
Japan	574	580	567	[4]571	[4]579	[4]562	—	—	—
United States[3]	565	571	560	534	539	530	480	492	469

— Not available.

[1] Did not meet international sampling or other guidelines for 4th grade.

[2] Did not meet international sampling or other guidelines for 8th grade.

[3] Did not meet international sampling or other guidelines for 12th grade.

[4] Significantly higher than the United States at the .05 level.

[5] Significantly lower than the United States at the .05 level.

NOTE: Students in their last year of secondary school were assessed in whichever grade was in each country. In most countries, the 12th grade is the last year of secondary school, but in many countries (unlike the U.S.), the last year may be a lower or higher grade. See the supplemental note to this indicator for further explanation on countries that complied or did not comply with various data collection and sampling guidelines. See the glossary for the definition of G-7 countries.

SOURCE: International Association for the Evaluation of Educational Achievement, TIMSS International Study Center, *Mathematics Achievement in the Middle School Years (1996), Science Achievement in the Middle School Years (1996), Mathematics Achievement in the Primary School Years (1997), Science Achievement in the Primary School Years (1997).* U.S. Department of Education, National Center for Education Statistics, *Pursuing Excellence: A Study of U.S. Twelfth-Grade Mathematics and Science Achievement in International Context,* 1998.

NATIONAL CENTER FOR EDUCATION STATISTICS

ISSUE BRIEF

June 1998

Nonresident Fathers Can Make a Difference in Children's School Performance

Because of the high rates of non-marital childbearing, separation, and divorce in the United States, as many as half of U.S. children will spend part of their childhood living apart from at least one of their parents, usually their fathers (Zill, 1996; Furstenberg and Cherlin, 1991). Research on the salience of nonresident fathers to children's lives consistently finds that their payment of child support is important to children's well-being. Such research, however, is more mixed about the benefits of their continued contact and involvement for children (Kelly, 1993; Furstenberg and Cherlin, 1991).

This issue brief looks at the involvement of nonresident fathers in one important area of children's lives—their schools. Using data from the 1996 National Household Education Survey (NHES:96), sponsored by the National Center for Education Statistics (NCES), it examines the extent to which nonresident fathers are involved in their kindergartners' through 12th graders' schools and whether their involvement is linked to children's school performance.

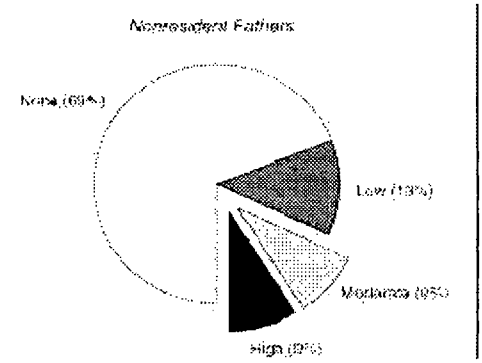
The NHES:96 asked about four types of school activities that parents could participate in during the school year: attending a general school meeting, attending a regularly scheduled parent-teacher conference, attending a school or class event, and serving as a volunteer at the school. Resident parents reported on whether nonresident parents who had had contact with their children in the past year had participated in these activities. Nonresident fathers are said to have no involvement in their children's schools if they have participated in none of the activities during the current school year. They are said to have low involvement if they have participated in only one of the four activities. They are categorized as having moderate involvement if they have done two of the activities. Those who have participated in three or four of the activities are said to be highly involved in their children's schools.[1]

[1] Not all schools offer parents the opportunity to be involved in each of these activities. Low involvement can result because parents do not take advantage of available opportunities for involvement or because schools do not offer them opportunities for involvement.

Most nonresident fathers are not very involved in their children's schools.

Sixty-nine percent of children in kindergarten through 12th grade who have seen their nonresident fathers in the past year have fathers who participated in none of the four school activities (figure 1). An additional 13 percent of children have nonresident fathers who participated in only one activity. However, eighteen percent of children have nonresident fathers who participated in at least two of the school activities and 9 percent have nonresident fathers who participated in three or four of the activities.

Figure 1.Level of involvement[1] in school of nonresident fathers who have seen their children within the last year[2]: Students in grades K–12, 1996



[1] Low involvement is participation in one activity; moderate involvement is participation in two activities; and high involvement is participation in three or four activities.

[2] Questions on nonresident parents' involvement were only asked if children had seen their nonresident fathers in the last year. According to the reports of custodial parents, 75 percent of nonresident fathers had had contact with their children in the last year.

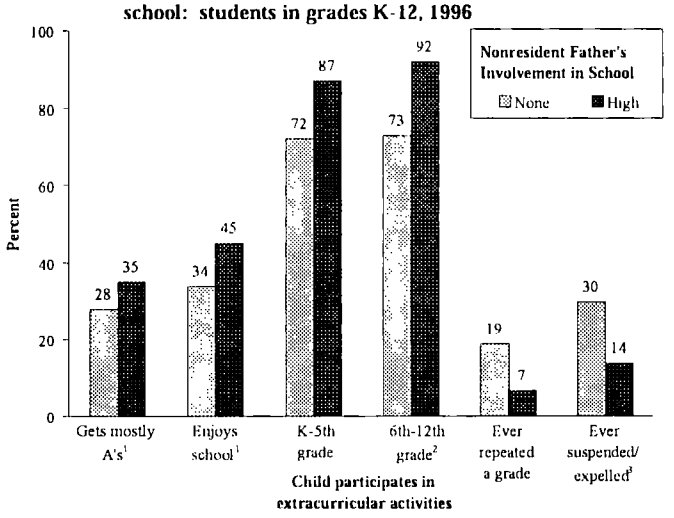
SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996 National Household Education Survey.

Children are less likely to have ever repeated a grade or been suspended or expelled if their nonresident fathers are involved in their schools.

Children in kindergarten through 12th grade are about one-third as likely to have ever repeated a grade if their nonresident fathers are highly involved in their schools (7 percent) than if their nonresident fathers are not involved in their schools (19 percent) (figure 2). Similarly, 6th through 12th graders are half as likely to have ever been suspended or expelled if their nonresident fathers are highly involved in their schools (14 percent) than if their nonresident fathers are not involved (30 percent). Even after controlling for such

factors as the child's race-ethnicity and sex, the resident mother/guardian's education, household income, family type (stepparent, mother only, or neither parent in household), and whether the nonresident father paid any child support, children are less likely to have ever repeated a grade or been suspended or expelled if their nonresident fathers are involved in their schools (U.S. Department of Education, 1997).

Figure 2.–Student outcomes, by nonresident fathers' involvement in school: students in grades K-12, 1996



[1]Children in 1st through 12th grade.

[2]Youth report.

[3]Children in 6th through 12th grade.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996 National Household Education Survey.

Children are more likely to get A's in school, to enjoy school, and to participate in extracurricular activities if their nonresident fathers are involved in their schools.

Roughly a third of students get mostly A's if their fathers are highly involved in their schools (35 percent) compared to just over one-quarter if their nonresident fathers are not involved (28 percent) (figure 2). Children also enjoy school more and are more likely to participate in extracurricular activities if their nonresident fathers are highly involved in their schools compared to if they are not involved.

Forty-five percent of children whose nonresident fathers are highly involved in their schools are said to enjoy school compared to 34 percent whose nonresident fathers are involved. Similarly, 87 percent of kindergarten through 5th graders and 92 percent of 6th through 12th graders whose nonresident fathers are involved in their schools participate in extracurricular activities compared to 72 percent of kindergarten through 5th graders and 73 percent of 6th through 12th graders whose nonresident fathers are not involved in their schools. Even after controlling for the child's race-ethnicity and sex, the resident mother/guardian's education, household income, family type, and whether the nonresident father paid any child support, children are more likely to get mostly A's, to enjoy school, and to participate in extracurricular activities if their nonresident fathers are involved in their schools than if they are not (U.S. Department of Education, 1997).

Discussion

Nonresident fathers' participation in school activities makes a difference in their children's school performance. Inconsistencies about the benefits of nonresident fathers' continued involvement with their children in extant studies may be due in large part to the fact that contact is often used to measure involvement. These results show that it is not contact, per se, that is associated with improved student outcomes, but rather active participation in children's lives through involvement in their schools that makes a difference. The majority of nonresident fathers, however, are not involved in their children's schools.

References and Related Publications

Furstenberg, F.F. and Cherlin, A. (1991). *Divided Families: What Happens to Children When Parents Part.* Cambridge, MA: Harvard University Press.

Furstenberg, F.F., Nord, C.W., Peterson, J.L., and Zill, N. (1983). The Life Course of Children of Divorce. *American Sociological Review,* 48(5): 656-668.

Kelly, J.B. (1993). Current Research on Children's Postdivorce Adjustment: No Simple Answers. *Family and Conciliation Courts Review* 31(1): 29-49.

U.S. Department of Education, National Center for Education Statistics. (1997). *Fathers' Involvement in their Children's Schools.* NCES 98-091, by Christine Winquist Nord, DeeAnn Brimhall, and Jerry West. Washington, DC.

Zill, N. (1996). Family Change and Student Achievement: What We Have Learned, What It Means for Schools. In A. Booth and J.F. Dunn, eds. *Family-School Links: How Do They Affect Educational Outcomes?* Mahwah, NJ: Lawrence Erlbaum Associates, 139-174.

Issue Briefs present information on education topics of current interest. All estimates shown are based on samples and are subject to sampling variability. All differences discussed are statistically significant at the .05 level. In the design, conduct, and data processing of NCES surveys, efforts are made to minimize the effects of nonsampling errors, such as item nonresponse, measurement error, data processing error, or other systematic error. For additional details on NHES:96 data collection methods and definitions, see U.S. Department of Education, National Center for Education Statistics. (1997.) *National Household Education Survey of 1996: Data File User's Manual,* Vol. 1, NCES 97-425, by Mary A. Collins et al. Washington, DC.

This **Issue Brief** was prepared by Christine Winquist Nord of Westat. To obtain standard errors or definitions of terms for this **Issue Brief**, or to obtain additional information about the National Household Education Survey, contact Jerry West (202) 219-1574. To order additional copies of this **Issue Brief** or other NCES publications, call 1-800-424-1616. NCES publications are available on the Internet at http://nces.ed.gov.

ISSUE BRIEF

April 1998

Factors Associated With Fathers' and Mothers' Involvement in Their Children's Schools

Parent involvement in children's education is important for children's school success (U.S. Department of Education, 1994; Henderson and Berla, 1994). Not all children, however, have parents who are involved in their schools. This issue brief examines factors that are associated with fathers' and mothers' involvement in their children's schools among children in kindergarten through 12th grade living in two-parent and in single-parent families. The data for this analysis come from the 1996 National Household Education Survey (NHES:96), sponsored by the National Center for Education Statistics (NCES).

The NHES:96 asked about four types of school activities that parents could participate in during the school year: attending a general school meeting, attending a regularly scheduled parent–teacher conference, attending a school or class event, and serving as a volunteer at the school. Parents who participated in none or only one activity are said to have low involvement. Parents who participated in two activities are described as having moderate involvement. Parents who participated in three or four activities are said to be highly involved in their children's schools.[1]

Children in elementary school are more likely than children in middle or high school to have parents who are highly involved in their schools.

Mothers and fathers in two-parent and in single-parent families tend to decrease their involvement in their children's schools as their children move from elementary to middle to high school (table 1). Among children in kindergarten through 5th grade, 69 percent of children living in two-parent families and 60 percent living in mother-only families have mothers who are highly involved in their schools. Among children in grades 9 through 12, however, only 39 percent of children living in two-parent families and 32 percent living in mother-only families have mothers who are highly involved in their schools. Similarly, the proportion of children living in two-parent families with fathers who are highly involved in their schools decreases from 30 percent in elementary school to 23 percent in high school. Part of the decrease in parental involvement is due to schools offering parents fewer opportunities for involvement as children grow older (U.S. Department of Education, 1997).

Table 1.—Percent of children whose parents are involved in their schools by level of involvement[1] and selected child and family characteristics: Students in grades K–12, 1996

	Two-parent families				Single-parent families			
	Mother		Father		Mother		Father	
	Low	High	Low	High	Low	High	Low	High
Child's grade level								
Kindergarten - 5th grade	12	69	43	30	16	60	21	53
6th - 8th grade	22	51	50	25	28	45	29	53
9th - 12th grade	36	39	54	23	43	32	40	27
Parent's education[2]								
Less than high school	43	31	72	10	40	32	35	41
High school or equivalent	24	51	55	21	28	46	34	36
VoTech or some college	18	59	45	28	21	56	25	51
Bachelor's degree	12	69	35	37	13	64	22	54
Graduate/professional school	10	70	31	41	18	62	19	67
Household income								
Less than $25,000	32	42	66	15	29	45	31	43
$25,000 - 34,999	24	52	56	21	22	53	30	38
$35,000 - 49,000	19	59	44	29	19	58	32	45
$50,000 - 74,999	16	61	38	32	16	64	19	57
$75,000 or more	13	68	35	37	19	57	18	64

[1] Low involvement is participation in none or only one activity. High involvement is participation in three or four activities. Percents are computed across rows but do not sum to 100 because the percent with moderate involvement is not shown.

[2] Education of mother for mother's involvement and education of father for father's involvement.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996 National Household Education Survey.

[1] Not all schools offer parents the opportunity to be involved in each of these activities. Low involvement can result because parents do not take advantage of available opportunities for involvement or because schools do not offer them opportunities for involvement.

Children with more family resources as measured by parents' education and household income are more likely than children with fewer resources to have parents who are highly involved in their schools.

Regardless of whether children live in two-parent or in single-parent families, the proportion of children whose mothers or fathers are highly involved in their schools increases as their parents'education level increases. Among children living in two-parent families, 31 percent have mothers who are highly involved in their schools if their mothers have less than a high school education, while 70 percent have highly involved mothers if their mothers have graduate or professional school experience. Similarly, 10 percent of children in two-parent families whose fathers have less than a high school education have highly involved fathers, while 41 percent whose fathers have graduate or professional school experience have highly involved fathers.

Children are also more likely to have mothers' and fathers' who are highly involved in their schools as household income increases. Sixty-eight percent of children living in two-parent families with household incomes over $75,000 have highly involved mothers compared to 42 percent in households earning less than $25,000 (table 1).

Children whose mothers and fathers are highly involved in their schools are more likely to have greater levels of "social capital" as measured by activities shared with parents and high parental educational expectations.

t is not only measures of socioeconomic status that are linked to mothers' and fathers' involvement in school. Children whose mothers and fathers are highly involved in their schools are more apt to have families that share activities with them such as reading stories or visiting the library with them or who expect that they will graduate from a 4-year college (table 2).

Discussion

Most children in elementary school have parents who are involved in their schools, but by the time children reach high school a much smaller proportion have parents who remain highly involved in their schools. Although part of the decrease is attributable to schools offering parents fewer opportunities for involvement, parents too are stepping back as their children grow older. Research suggests, however, that adolescents benefit when their parents are involved (U.S. Department of Education, 1997).

Children who are advantaged in terms of parental education and household income are more likely than other children to have parents who are highly involved in their schools. Furthermore, children who have highly involved parents are also generally more likely to share activities with them and to have parents who have high educational aspirations for them.

References and Related Publications

Henderson, A.T., and Berla, N. (1994). *A New Generation of Evidence: The Family is Critical to Student Achievement.* Washington, DC: National Committee for Citizens in Action.

U.S. Department of Education, National Center for Education Statistics. (1997). *Fathers' Involvement in Their Children's Schools.* NCES 98-091, by Christine Winquist Nord, DeeAnn Brimhall, and Jerry West. Washington, DC.

U.S. Department of Education. (1994). *Strong Families, Strong Schools: Building Community Partnerships for Learning.* Washington, DC.

Table 2.—Percent of children with selected sources of social capital, by level of parental involvement[1] in their schools and family type: Students in grades K–12, 1996

	Two-parent families				Single-parent families			
	Mother		Father		Mother		Father	
	Low	High	Low	High	Low	High	Low	High
In the past week, someone in the family[2]...								
told child a story	55	72	64	74	58	72	71	71
worked on a project with child	53	70	60	72	47	65	66	64
In the past month, someone visited[2]...								
the library with child	32	59	44	62	26	52	32	47
a museum or historical site with child	11	25	15	29	13	24	9	26
Parent expects youth will graduate from a 4-year college[3]	75	91	79	92	72	87	56	90

[1] Low involvement is participation in none or only one activity. High involvement is participation in three or four activities.
[2] Children in Kindergarten - 5th grade.
[3] Students in 6th - 12th grade.
SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996 National Household Education Survey.

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NATIONAL CENTER FOR EDUCATION STATISTICS

ISSUE BRIEF

April 1998

How Involved Are Fathers in Their Children's Schools?

Until recently, fathers were the hidden parent in research on children's well-being. Their importance to children's financial well-being was widely accepted, but their contribution to other aspects of children's development was often assumed to be secondary to that of mothers and was not usually examined. Reflecting this bias in research on child development, many federal agencies, and programs dealing with family issues focused almost exclusively on mothers and their children. In 1995, President Clinton issued a memorandum requesting that all executive departments and agencies make a concerted effort to include fathers in their programs, policies, and research programs where appropriate and feasible (Clinton, 1995). This new attention devoted to fathers is not intended to lessen the focus on the important role that mothers play in their children's lives, but rather to highlight the fact that fathers are important too.

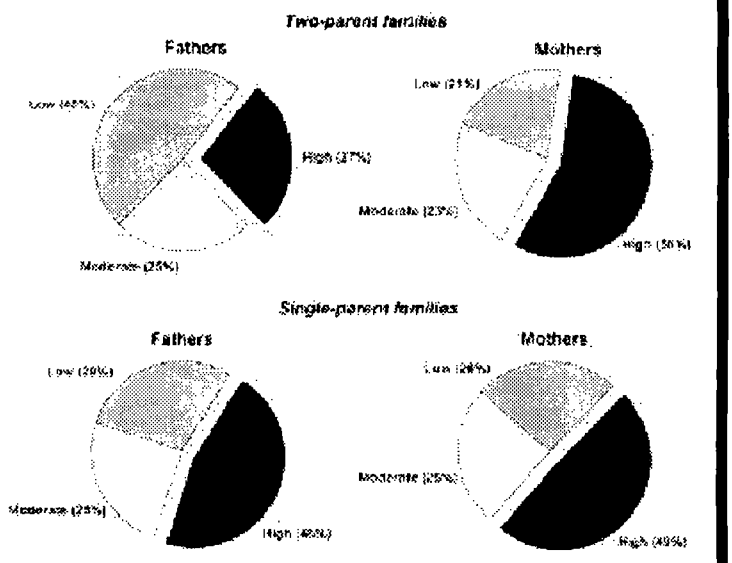
Research stimulated by the new interest in fathers suggests that fathers' involvement in their children's schools does make a difference in their children's education (U.S. Department of Education, 1997). This issue brief looks at the extent to which fathers are involved in their kindergartners' through 12th graders' schools using data from the 1996 National Household Education Survey (NHES:96), sponsored by the National Center for Education Statistics (NCES). The involvement of fathers in two-parent and in father-only families is presented and contrasted with that of mothers in two-parent and in mother-only families.[1]

The NHES:96 asked about four types of school activities that parents could participate in during the school year: attending a general school meeting, attending a regularly scheduled parent-teacher conference, attending a school or class event, and serving as a volunteer at the school. Parents are said to have low involvement in their children's schools if they have done none or only one of the four activities during the current school year. They are categorized as having moderate involvement if they have done two of the activities. Those who have participated in three or four of the activities are said to be highly involved in their children's schools.[2]

Fathers in two-parent families are less likely than mothers in two-parent families to be highly involved in their children's schools. Indeed, many fathers in two-parent families are relatively uninvolved in their children's schools.

The proportion of children living in two-parent families with highly involved fathers is about half of the proportion with highly involved mothers, 27 percent and 56 percent, respectively (figure 1). Nearly half of children in two-parent families have fathers who participated in none or only one of the four activities since the beginning of the school year. In contrast, only 21 percent of children living in two-parent families have mothers with such low participation in their schools.

Figure 1.—Level of fathers' and mothers' involvement* in school, by family type: Students in grades K-12, 1996



*Low involvement is participation in none or only one activity; moderate involvement is participation in two activities; and high involvement is participation in three or four activities.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996 National Household Education Survey.

[1] The analyses are restricted to children living with biological, step, or adoptive fathers. Children living with foster fathers are excluded.

[2] Not all schools offer parents the opportunity to be involved in each of these activities. Low involvement can result because parents do not take advantage of available opportunities for involvement or because schools do not offer them opportunities for involvement.

Fathers and mothers who head single-parent families are virtually identical in their level of involvement in their children's schools. Their level of involvement, in fact, is quite similar to mothers in two-parent families.

Children living with single fathers or with single mothers are about equally likely to have parents who are highly involved in their schools, 46 percent and 49 percent, respectively. Both fathers and mothers who head single-parent families have levels of involvement in their children's schools that are quite similar to mothers in two-parent families and are much higher than fathers in two-parent families.

Fathers in two-parent families are more likely to attend school or class events or general school meetings than they are to attend parent-teacher conferences or to volunteer at their children's schools.

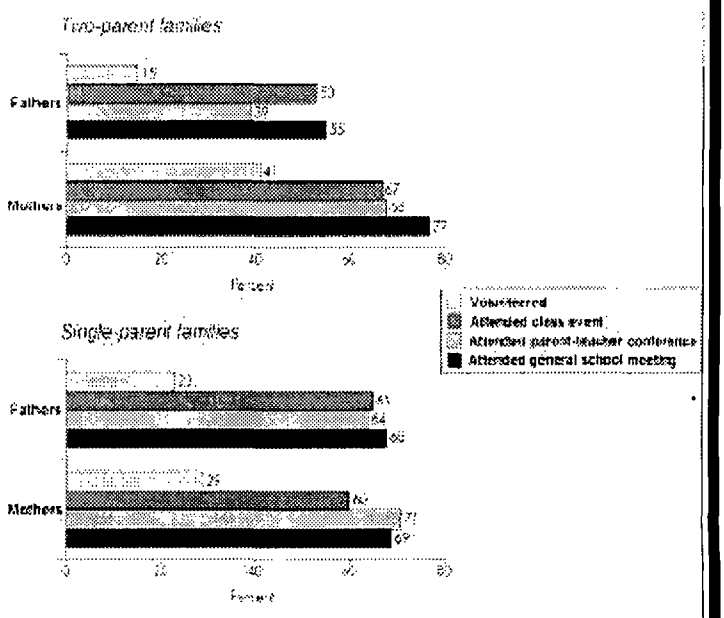
In two-parent families, there are two activities for which fathers' involvement approaches that of mothers: attendance at school or class events (such as a play, science fair, or sports event) and attendance at general school meetings (figure 2). Fathers may find it easier to attend these types of activities because they are more likely than the other two to occur during non-school and non-work hours. Fathers in father-only families are more likely than fathers in two-parent families to participate in these and other activities, so work constraints are not the sole explanation for low involvement among fathers in two-parent families.

Discussion

The observed patterns of fathers' involvement in their children's schools by family structure are consistent with existing research (Cooksey and Fondell, 1996) and with the notion that there is a division of labor in two-parent families, with mothers taking more responsibility for child-related tasks, whereas in single-parent families the lone parent assumes the responsibility. Fathers and mothers in two-parent families may be operating under the mistaken assumption that fathers do not matter as much as mothers when it comes to involvement in their children's school. The results also support research which finds that single fathers and mothers are more similar in their parenting behavior than are mothers and fathers in two-parent families (Thomson, McLanahan, and Curtin, 1992).

The low participation of fathers in two-parent families offers schools an opportunity to increase overall parental involvement. By targeting fathers, schools may be able to make greater gains in parental involvement than by targeting mothers or parents, in general. This is not to say that schools should not continue to welcome mothers' involvement. But, because mothers already exhibit relatively high levels of participation in their children's schools, there is less room to increase their involvement. Moreover, increasing fathers' involvement is likely to help children do better in school (U.S. Department of Education, 1997).

Figure 2.—Percent of children whose fathers and mothers participated in each school activity, by family type: Students in grades K-12, 1996



SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996 National Household Education Survey.

References and Related Publications

Clinton, W.J. (1995). Supporting the Role of Fathers in Families. Memorandum for the heads of executive departments and agencies, June 16.

Cooksey, E.C. and Fondell, M.M. (1996). Spending Time with His Kids: Effects of Family Structure on Fathers' and Children's Lives. *Journal of Marriage and the Family* 58(3): 693-707.

Thomson, E., McLanahan, S.S., and Curtin, R.B. (1992). Family Structure, Gender, and Parental Socialization. *Journal of Marriage and the Family* 54(2): 368-378.

U.S. Department of Education, National Center for Education Statistics. (1997). *Fathers' Involvement in Their Children's Schools.* NCES 98-091, by Christine Winquist Nord, DeeAnn Brimhall, and Jerry West. Washington, DC.

Issue Briefs present information on education topics of current interest. All estimates shown are based on samples and are subject to sampling variability. All differences discussed are statistically significant at the .05 level. In the design, conduct, and data processing of NCES surveys, efforts are made to minimize the effects of nonsampling errors, such as item nonresponse, measurement error, data processing error, or other systematic error. For additional details on NHES:96 data collection methods and definitions, see U.S. Department of Education, National Center for Education Statistics. (1997). *National Household Education Survey of 1996: Data File User's Manual*, Vol. 1, NCES 97-425. By Mary A. Collins et al., Washington, DC.

This **Issue Brief** was prepared by Christine Winquist Nord of Westat. To obtain standard errors or definitions of terms for this **Issue Brief**, or to obtain additional information about the National Household Education Survey, contact Jerry West (202) 219-1574. To order additional copies of this **Issue Brief** or other NCES publications, call 1-800-424-1616. NCES publications are available on the Internet at http://nces.ed.gov.

ISSUE BRIEF

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IB–1–97

Schools Serving Family Needs: Extended-Day Programs in Public and Private Schools

School-based extended-day programs were first introduced in the 1940s to provide care for the school-aged children of mothers who worked during the Second World War (Tuttle 1995). Today, schools are responding similarly to the need for nonparental care of children created by recent demographic trends, such as the increased labor force participation of mothers with young children (U.S. Bureau of the Census 1994) and the increased numbers of single-parent families (Center for the Study of Social Policy 1994). Schools are also responding to the growing interest in supplemental educational enrichment programs (Seppanen et al. 1993), particularly for children in high-poverty schools who often lack opportunities outside of school to extend their learning. In a previous Issue Brief, the availability of extended-day programs in public and private elementary and combined schools was found to have increased between 1987–88 and 1990–91 (Rossi et al. 1996). This brief updates and expands upon those findings by presenting data on extended-day programs drawn from the 1987–88, 1990–91, and 1993–94 Schools and Staffing Surveys (SASS), conducted by the National Center for Education Statistics (NCES).

From 1987–88 to 1993–94, both public and private schools increasingly offered extended-day programs; in each survey year, a greater percentage of private schools offered these programs than did public schools.

From 1987–88 to 1993–94, the availability of extended-day programs among public elementary and combined schools nearly doubled—from about 16 percent in 1987–88 to about 30 percent in 1993–94 (table 1). In the private sector, although about one-third of elementary and combined schools offered extended-day programs in 1987–88, nearly one-half of private schools offered extended-day programs in 1993–94. (A combined school includes grades higher than the eighth and lower than the seventh.)

Although private schools enroll fewer than one-tenth of the students enrolled in public schools, extended-day programs were more often found in private schools than in public schools in each survey year. Moreover, private schools had higher participation rates than public schools in 1993–94; about 18 percent of private school students, compared to about 11 percent of public school students, participated in their schools' extended-day programs.

Extended-day programs were least available in rural schools.

In all three survey years, the percentages of rural schools reporting available extended-day programs were much smaller than the percentages of central city and urban fringe schools in both the public and private sectors. Among public schools in 1993–94, about 18 percent of elementary and combined rural schools had these programs, compared to almost 37 percent of urban fringe schools and approximately 42 percent of central city schools. In schools that offered extended-day programs, the percentages of students participating were greater in central city than rural schools.

Table 1. Percentage of public and private elementary and combined schools offering extended-day programs, and percentages of students participating in these programs: 1987–88, 1990–91, and 1993–94

	Percent of schools with programs available			Percent of students participating*
	1987–88	1990–91	1993–94	1993–94
Public	15.5	25.2	29.7	10.5
Locale				
Central city	25.2	36.0	42.2	12.6
Urban fringe	21.4	34.4	36.9	10.0
Rural	6.7	14.7	18.3	8.1
Minority enrollment				
(<20%)	12.6	22.3	25.2	8.4
(20–49%)	17.0	25.7	34.4	9.7
(>50%)	22.6	32.2	35.3	14.1
Free/reduced-price lunch recipients				
<20%	18.7	28.8	32.0	9.4
20–49%	11.6	23.3	27.5	9.2
>50%	16.8	23.7	29.8	13.0
Private	33.2	42.5	48.4	17.8
Locale				
Central city	44.5	58.5	64.2	19.6
Urban fringe	37.2	47.4	54.0	17.0
Rural	17.4	23.1	23.8	12.6
Minority enrollment				
(<20%)	28.1	35.7	40.6	14.6
(20–49%)	47.3	59.0	61.9	24.9
(>50%)	48.3	56.5	71.2	22.5
Orientation				
Catholic	26.1	44.8	55.7	14.0
Other religious	29.8	33.9	39.8	20.9
Nonsectarian**	54.2	62.0	58.4	21.8

* Calculated including only those schools reporting extended-day program enrollments greater than zero (excluding prekindergarten students).

** Nonsectarian schools are nonreligious-oriented private schools.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1987–88, 1990–91, and 1993–94 Schools and Staffing Surveys (Public and Private School Questionnaires).

From 1987–88 to 1993–94, extended-day programs were consistently more available in high-minority schools than in low-minority schools.

In both sectors and across all three survey years, a higher proportion of high-minority schools (i.e., schools with 50 percent or more minority students) had extended-day programs than did low-minority schools (i.e., schools with fewer than 20 percent minority students). In 1993–94, approximately 71 percent of high-minority private schools compared to about 41 percent of low-minority private schools offered such programs. In addition, among both public and private schools in 1993–94, the percentages of students participating in extended-day programs were higher in high-minority schools than in low-minority schools.

In 1993–94, the participation rate in extended-day programs was higher in high-poverty schools than in low- or medium-poverty schools, although the availability of programs in these schools was similar.

In 1993–94, about 30 percent of high-poverty schools (i.e., schools in which 50 percent or more of the students receive free or reduced-price lunch) offered extended-day programs; 32 percent of low-poverty and about 28 percent of medium-poverty schools (i.e., schools in which less than 20 percent or 20–49 percent of the students receive free or reduced-price lunch) offered these programs. However, students in high-poverty schools were more likely than students in low- and medium-poverty schools to participate in the extended-day programs. In 1993–94, 13 percent of students in schools with 50 percent or more free or reduced-price lunch recipients participated, compared to about 9 percent of students in schools in the other two free-lunch categories.

The availability of extended-day programs increased more in Catholic schools than in other private schools; by 1993–94, similar percentages of Catholic and nonsectarian private schools offered extended-day programs.

In 1987–88, nonsectarian private schools were much more likely to offer extended-day programs than Catholic schools. By 1993–94, the percentages of nonsectarian and Catholic schools offering such programs were similar due to the fact that the proportion of Catholic schools offering extended-day programs more than doubled between 1987–88 and 1993–94—from about 26 percent in 1987–88 to almost 56 percent in 1993–94. In comparison, the availability of extended-day programs in nonsectarian and other religious private schools increased by about 4 percentage points and 10 percentage points, respectively, between 1987–88 and 1993–94. By 1993–94, the percentage of private school students participating in these programs was 14 percent in Catholic schools, compared to about 21 percent in both other religious and nonsectarian schools.

Discussion

These data suggest that schools are responding to the need for nonparental care of children. Between 1987–88 and 1993–94, increasing percentages of public and private elementary and combined schools offered extended-day programs. The availability of these programs, however, continued to be greater in private than public schools, in central city and urban fringe than rural schools, and in high-minority than low-minority schools. The percentage of students participating in extended-day programs in 1993–94 was lower in Catholic schools than in other religious or nonsectarian schools. In addition, although the percentages of high-, medium-, and low-poverty schools offering programs were similar, the student participation rate was higher in high-poverty than in low- or medium-poverty schools. The higher participation rate in high-poverty schools may signify the success of efforts to provide poor children with opportunities to extend their learning time beyond the regular school day.

These findings raise additional research questions that reach beyond the SASS data. For example, do the differences in program availability reflect differences in demand for extended-day services? Is the availability of extended-day programs adequate to meet the needs of single-parent and dual-working-parent families? What percentage of the students participating in extended-day programs do so because of parental interest in academic enrichment versus child care? How do these programs vary in focus, activities provided, and student populations served? How do school systems pay for and staff their extended-day programs?

References and Related Publications

Center for the Study of Social Policy (1994). *Kids Count Data Book: State Profiles of Child Well-Being*. Washington, DC: Author.

Choy, S.P., Henke, R.R., Alt, M.N., Medrich, E.A., and Bobbitt, S.A. (1993). *Schools and Staffing in the United States: A Statistical Profile, 1990–91*. Washington, DC: U.S. Department of Education, National Center for Education Statistics (NCES 93–146).

Choy, S.P., Medrich, E.A., Henke, R.R., and Bobbitt, S.A. (1992). *Schools and Staffing in the United States: A Statistical Profile, 1987–88*. Washington, DC: U.S. Department of Education, National Center for Education Statistics (NCES 92–120).

Henke, R.R., Choy, S.P., and Geis, S. (1996). *Schools and Staffing in the United States: A Statistical Profile, 1993–94*. Washington, DC: U.S. Department of Education, National Center for Education Statistics (NCES 96–124).

Rossi, R.J., Daugherty, M.S., and Vergun, P. (1996). *Extended-day Programs in Elementary and Combined Schools*. Washington, DC: U.S. Department of Education, National Center for Education Statistics (NCES 96–843).

Seppanen, P.S., Love, J.M., deVries, D.K., Bernstein, L., Seligson, M., Marx, F., and Kisker, E.E. (1993). *National Study of Before- and After-School Programs: Final Report*. Washington, DC: U.S. Department of Education, Office of Policy and Planning.

Tuttle, W.M. Jr. (1995). "Rosie the Riveter and Her Latchkey Children: What Americans Can Learn About Child Day Care From the Second World War." *Child Welfare, 74* (1), 92–114.

U.S. Bureau of the Census. (1994). *Statistical Abstracts of the United States: 1993*. (113th edition). Washington, DC: U.S. Government Printing Office.

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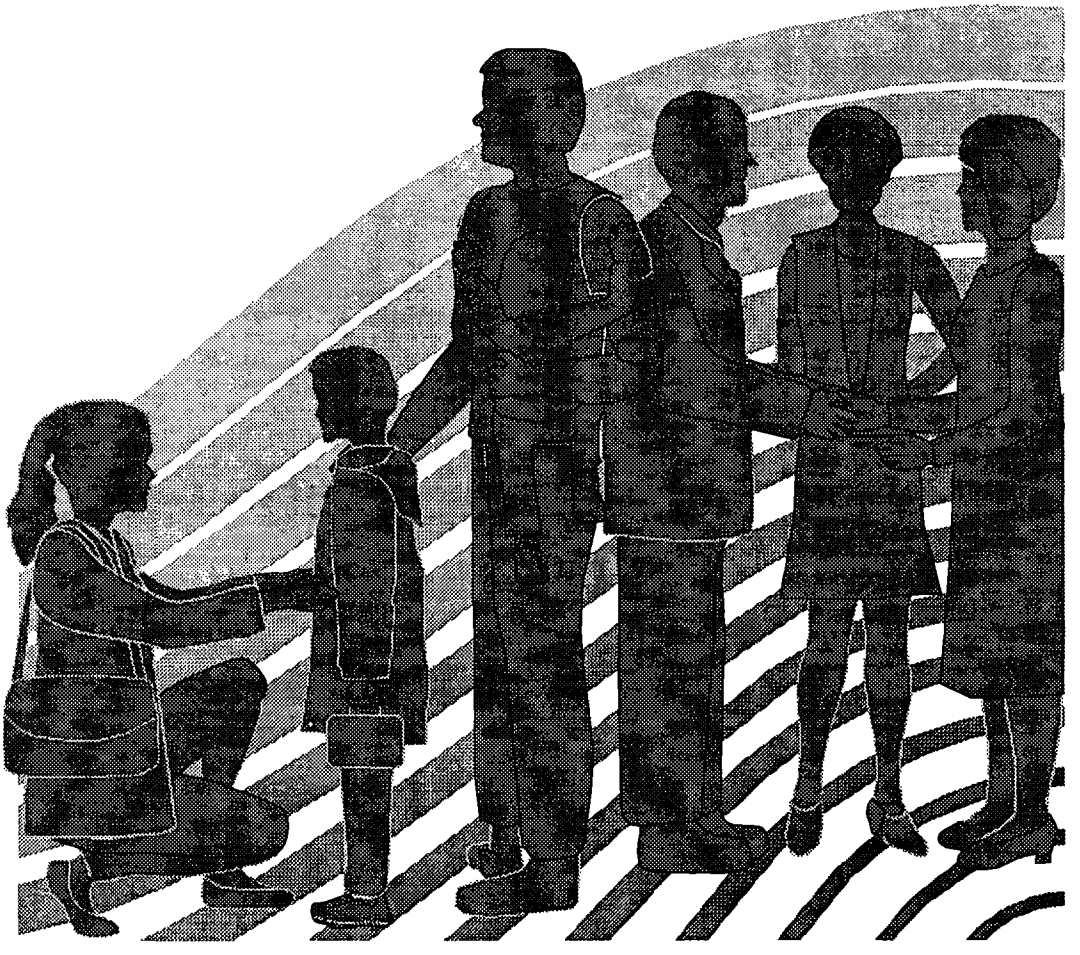

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July 1997

The text in this booklet was written by Beth Aronstamm Young, Pinkerton Computer Consultants, Inc. and Thomas M. Smith of the Data Development and Longitudinal Studies Group of NCES and appears in ***The Condition of Education, 1997.*** *Rebecca Pratt, Ginger Rittenhouse, Andrea Livingston, Karyn Madden, and Barbara Kridl edited the text, and Leslie Retallick, Don Eike, and Mary Sukkestad designed the graphics and layout.*

The Social Context of Education

Children in the United States come from a variety of family situations, income strata, and cultural backgrounds. As a result, our Nation's schools are faced with unique challenges as they strive to provide equal educational opportunities to all students.[1] Factors such as family income, family structure, and parents' education have been shown to influence a child's educational opportunities. Today, of the 4 million babies born each year, nearly one out of eight is born to a teenage mother, one out of four to a mother with less than a high school education, almost one out of three to a mother who lives in poverty, and one out of four to an unmarried mother.[2] These conditions have been shown to be associated with children experiencing problems such as repeating a grade, requiring special education services, and being suspended and dropping out of school.[3]

Students from racial/ethnic minority backgrounds and low income families are more at risk for poor school outcomes and are becoming an increasing share of the student population.[4] Since the mid-1960s, studies have linked the educational disadvantage of minority students to a combination of out-of-school factors, many of which center on family characteristics, such as poverty and parents' education.[5] The data contained in this report highlight similar findings.

Changes over time in the composition of students in terms of factors such as student English language proficiency, family income, parents' education, and family structure affect the social context of education. In the essay that follows, associations between these student-level social factors and different indicators of educational access and progress are reviewed. For each student background factor, the essay will point out how these factors have changed for families and children over time, as well as how they affect various racial/ethnic groups.

The social context of schooling is also a function of how students with various characteristics are distributed across schools. The last half of this essay examines differences in school climate and human and financial resources in high and low poverty schools. The data on these factors reflect changing conditions that schools must confront in order to be effective. In order to provide equal educational opportunity, policymakers must be aware of differences in the background of students, as well as differences in the climate and resources of schools.

Student Background

Social background factors such as race/ethnicity, limited English proficiency, family income, parental education, and family structure are associated with various levels of educational access and different educational outcomes. For example, differences in preprimary enrollment, incidence of early childhood academic and behavioral problems, level of student achievement, and the likelihood of dropping out of school or going on to college after graduation are each associated with various social background factors. Such factors are interrelated, however, and must be examined jointly when trying to understand the effect of any single factor on education. For example, a recent study showed that variation in student performance associated with family structure disappeared when other factors, such as family income, family size, and parents' education level, are taken into account.[6] Several examples of the association between social and educational access and outcomes contained in this report are summarized below.

- **Poverty is negatively associated with enrollment rates in early childhood education programs.**

Differences in enrollment rates in early childhood education across levels of poverty may indicate differential access to this

level of education. For example, in 1995, 3- and 4-year-olds from families who were classified as poor (a measure of a family's composition and income) were less likely to be enrolled in preprimary education than 3- and 4-year-olds from families who were classified as non-poor (24 and 52 percent compared to 42 and 64 percent, respectively).[7]

- **Children in single parent families are more likely to experience early school problems and are less likely to participate in early literacy activities than children in two parent families.**

Family structure is associated with children's early literacy activities and early school problems. In 1995, 3- to 5-year-olds living with two biological or adoptive parents were more likely to have been read to three or more times a week, to have been told a story once a week, or to have visited the library in the previous month than 3- to 5-year-olds living with one biological or adoptive parent.[8] Moreover, first- and second-graders aged 6–8 living with one biological or adoptive parent were more likely to experience academic problems and to have their parents report that they were academically below the middle of their class than those students living with two biological or adoptive parents.[9]

- **Parents' education level is strongly associated with student achievement.**

In general, children of parents with higher levels of education perform better, on average, on assessments of student achievement. For example, in 1994, 13- and 17-year-olds whose parents had at least some college had higher mathematics and science proficiency scores than those whose parents did not finish high school. Parents' educational attainment was positively related to reading[10] and writing[11] scores as well.

- **Difficulty speaking English is associated with dropping out of school.**

In 1995, of those 16- to 24-year-olds who spoke a language other than English at home, the dropout rate of those who had difficulty speaking English (44 percent) was substantially more than that of those who did not have difficulty speaking English (12 percent).[12]

- **High school graduates from high income families are more likely than high school graduates from low income families to go directly to college.**

High school graduates from low income families were more likely to go directly to college in 1995 than in 1972.[13] Still, in 1995, 34 percent of high school graduates from low income families went directly to college, compared to 83 percent of those from high income families.[14]

Changes in the Social Background of Children

The learning environment of schools can be enhanced by what students with a variety of backgrounds and interests bring with them; however, heterogeneity of student ability levels and preparation for school may create increased challenges for schools to meet the needs of students from different social backgrounds. This section describes changes in the social background characteristics of children in general, as well as of children from various racial/ethnic groups.

Racial/Ethnic Makeup of Students

A greater racial/ethnic diversity of students is related to more heterogeneity of language and culture in our Nation's schools. Many minority students come from poverty or non-English language backgrounds and may be at greater risk of not succeeding in school than other children.

- **Minority students are projected to make up an increasing share of the school age population during the coming decades.**

Racial and ethnic diversity has increased substantially in the United States in the last two decades, and is projected to increase even more in the decades to come. In 1995, 67 percent

Percentage change in the population of children aged 5–17, by race/ethnicity

Race/ethnicity	Percentage change	
	1993 to 2000	2000 to 2020
White		
Aged 5–13	2.9	-11.2
Aged 14–17	10.1	-10.3
Black		
Aged 5–13	12.9	15.4
Aged 14–17	11.5	20.0
Hispanic		
Aged 5–13	29.8	47.0
Aged 14–17	23.6	60.6
Other		
Aged 5–13	32.5	67.2
Aged 14–17	45.1	73.3

SOURCE: NCES, *Youth Indicators 1996*, Indicator 2.

of U.S. children aged 5–17 were white, 15 percent were black, 13 percent were Hispanic, and 5 percent were Asian/Pacific Islander, American Indian, and Alaskan Native.[15] Between 2000 and 2020, the number of minority children aged 5–17 is projected to grow much faster than the number of white children. Between 2000 and 2020, it is projected that there will be 61 percent more Hispanic children aged 14–17 and 47 percent more Hispanic children aged 5–13. The numbers of Asian/Pacific Islander, American Indian, and Alaskan Native children aged 14–17 is projected to increase by 73 percent, while the number of those children aged 5–13 is projected to grow by 67 percent. In contrast, between 2000 and 2020, the number of white children aged 5–13 is projected to decrease by 11 percent, and the number of white children aged 14–17 is projected to decrease by 10 percent.

Difficulty Speaking English

Children who speak languages other than English at home and who have difficulty speaking English face great challenges progressing through school. By law, school systems across the United States must provide services for children who have difficulty speaking English. Difficulty speaking English is most common among immigrant children and the U.S.-born children of immigrants.

- **The percentage of children having difficulty speaking English increased in recent years.**

Between 1979 and 1989, the percentage of children aged 5–17 in the United States who spoke a non-English language at home and who had difficulty speaking English increased from 3 to 5 percent and remained at 5 percent between 1989 and 1995. Hispanic children were more likely to have difficulty speaking English than their white or black peers. In 1995, 31 percent of Hispanic children spoke a non-English language at home and had difficulty speaking English, compared to 1 percent each of

black and white children. The percentage of Hispanic children who spoke a non-English language at home and who had difficulty speaking English increased slightly between 1979 and 1995.[16]

Percentage of children aged 5–17 who spoke a language other than English at home and who spoke English with difficulty,* by race/ethnicity: 1979, 1989, 1992, and 1995

Race/ethnicity	1979	1989	1992	1995
Total	**3**	**5**	**5**	**5**
White	1	1	1	1
Black	—	1	2	1
Hispanic	29	28	30	31

—Too few sample observations for a reliable estimate.

*Respondents were asked to rate the child's ability to speak English using the following scale: "not at all," "not well," "well," or "very well." All those who reported less than "very well" were categorized as having difficulty speaking English.

SOURCE: U.S. Department of Commerce, Bureau of the Census, October Current Population Surveys.

Socioeconomic Status

Many studies have found that students' socioeconomic status (SES) is associated with their likelihood of success in school. Whether measured by parents' income, occupational prestige, or level of education, students from low SES families are more likely to experience school failure than those from higher SES families.[17] Differences in the educational success of minority groups are also confounded by differences in the average SES level of minority and white families.[18] The rest of this section summarizes the changes in SES factors, which include family income, poverty rates, and parents' education level.

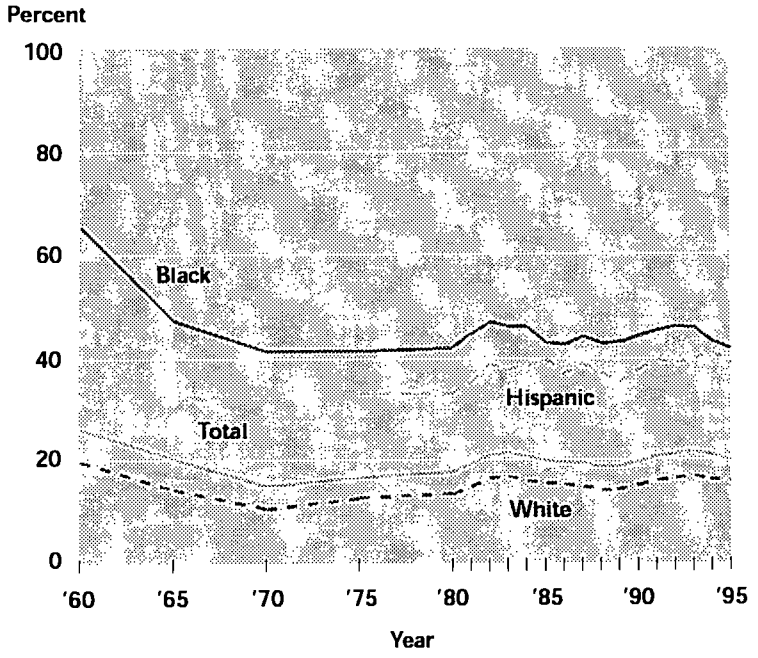
- **Although median family income has increased substantially since 1950, there has been little gain since 1970. Median family income in black and Hispanic households remains at about 60 percent of income in white households.**

Median family income, in constant dollars, increased substantially between 1950 and 1970; however, median family income showed no real gains in the 1970s, a modest increase during the 1980s, and a decline between 1989 and 1993.[19] Income in black and Hispanic households remains much less than that in white households. In 1993, the median family income for whites was $39,300, compared to $24,542 for blacks and $23,654 for Hispanics. These income differences by race/ethnicity are also evident in poverty rates.

- **In 1995, both black and Hispanic children were more than twice as likely as white children to live in poverty.**

The proportion of children under 18 who lived in families with incomes below the poverty level decreased substantially during the 1960s and then rose from 1970 to 1983. Between 1983 and 1995, the poverty rate for children fluctuated between 19 and 22 percent. Throughout the period, minority children were more likely to live in poverty than white children. In 1995, both black and Hispanic children (42 and 39 percent, respectively) were more than twice as likely as white children (16 percent) to live in poverty. Children living with two married parents were also much less likely to live below the poverty level than children living only with their mother (6 percent of children compared to 32 percent).[20]

Percentage of children less than 18 years old who lived in families with incomes below the poverty level: Selected years 1960–95



SOURCE: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-60, "Income, Poverty, and Valuation of Non-cash Benefits: 1994" (based on March Current Population Surveys); and Bureau of the Census, *Current Population Reports*, P60–194, *Poverty in the United States: 1995*, 1996.

- **Poverty rates are much higher in the United States than in many other industrialized countries.**

The percentage of children living below the poverty line, adjusted for the impact of taxes and governmental transfers on income, suggests how effective government fiscal policies are at reducing income inequalities and poverty in a society. Among countries with data available, the United States was the only wealthy industrialized country to have double-digit child poverty rates (20.4 percent in 1986) after adjusting for taxes and governmental transfers.[21] The post-transfer poverty rates for children in the United States were between two and seven times higher than

Percentage of children (aged 17 or younger) whose family income is below 40 percent of adjusted median family income, by tax and transfer status and country

G-7 Country	Year	Before transfer	After transfer
Canada	1987	15.7	9.3
France	1984	21.1	4.6
West Germany (former)	1984	8.4	2.8
United Kingdom	1986	27.9	7.4
United States	**1986**	**22.3**	**20.4**

NOTE: No data were available for Italy and Japan.

SOURCE: NCES, *Educational Indicators: An International Perspective*, 1996, Indicator 35.

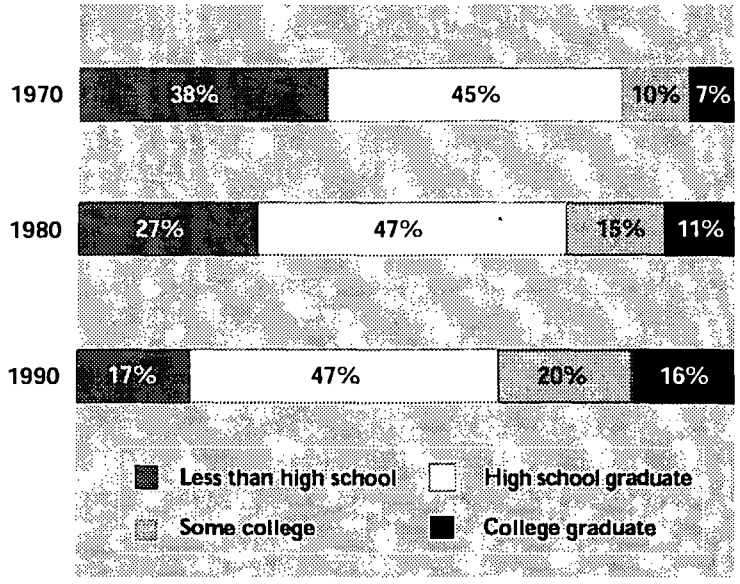
comparable rates in Canada, France, former West Germany, and the United Kingdom.

Parents' education levels are strongly associated with family income levels. Disentangling the separate effects of parents' education and family income on children's education is extremely difficult. Both are, in fact, often used as proxies for SES. Independent of income, however, parents' level of education may influence the value that parents place on education, which in turn can influence their children's educational attainment.[22] While median family income has been relatively stagnant (in constant dollars) since 1970, the average education level of parents has been increasing. Changes in parents' education levels may be an indicator of changes in families' ability to support and promote education for their children.

- **Parents' education levels have increased dramatically since 1970.**

The average education level of parents has continued to increase. For example, the percentage of fathers with less than a high school education declined from 43 percent in 1970 to 19 percent

Percentage distribution of the highest education level of mothers with children aged 15–18: 1970, 1980, and 1990



SOURCE: RAND, *Student Achievement and the Changing American Family*, 1994.

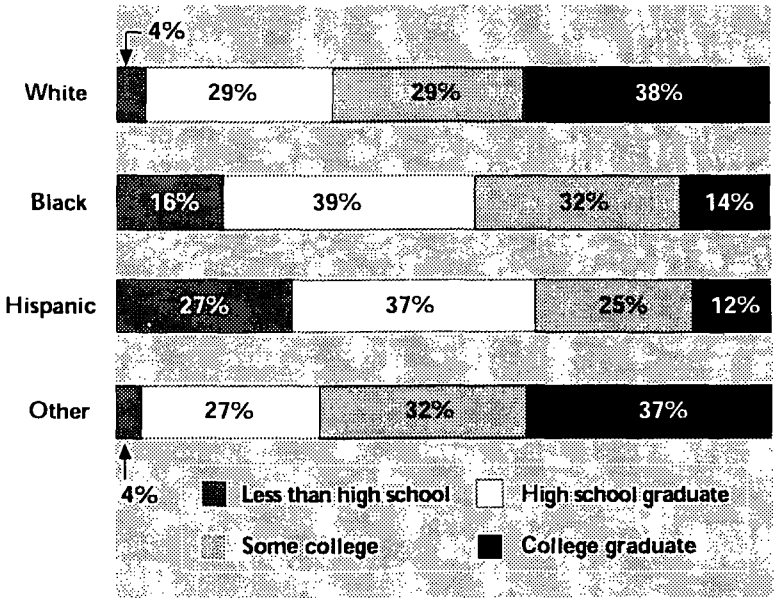
in 1990. Over the same 20-year period, the percentage of fathers with a bachelor's degree or higher increased from 13 to 23 percent. The percentage of mothers with less than a high school diploma declined from 38 to 17 percent between 1970 and 1990, while the percentage with a bachelor's degree or higher doubled.[23] There is some evidence that this increase has had an impact on student performance. A recent study on family characteristics and test scores found that parents' education was the family characteristic most strongly related to student achievement.[24]

- **Parents' level of education remains higher for white children than for black or Hispanic children.**

Although the average highest education level of parents has increased considerably, black and Hispanic children remain more likely than white children to have parents who did not graduate

from high school and are less likely than white children to have parents who graduated from college. For example, in 1995, 16 percent of black and 27 percent of Hispanic children aged 3–5 had parents who had not completed high school, compared to 4 percent of their white counterparts.

Percentage distribution of the highest education level of parents with children aged 3–5, by race/ethnicity: 1995



SOURCE: NCES, National Household Education Survey, 1995.

Family Structure

The definition of a "family" has changed greatly in the past three decades. Today children may live in a variety of family structures. For example, in 1995, 25 percent of children aged 6–8 lived with a single parent, 3 percent lived with other relatives, and 64 percent lived with two biological or adoptive parents.

Different family structures are associated with different educational outcomes, even though the effects of family structure are likely to be confounded by family income, parents' education

level, race/ethnicity, and the amount of time that parents participate in their children's education.[25] Because different family structures are associated with different educational outcomes, it is important to examine how the structure of families has changed over time.

Percentage distribution of children from birth to age 8, by family structure: 1995

Family structure	Birth to age 2	Aged 3–5	Aged 6–8
Total	**100.0**	**100.0**	**100.0**
Two biological or adoptive parents	72.4	67.0	64.0
One biological or adoptive parent	24.2	25.7	25.3
One biological and one stepparent	1.3	4.7	7.8
Other relatives	2.0	2.7	2.9

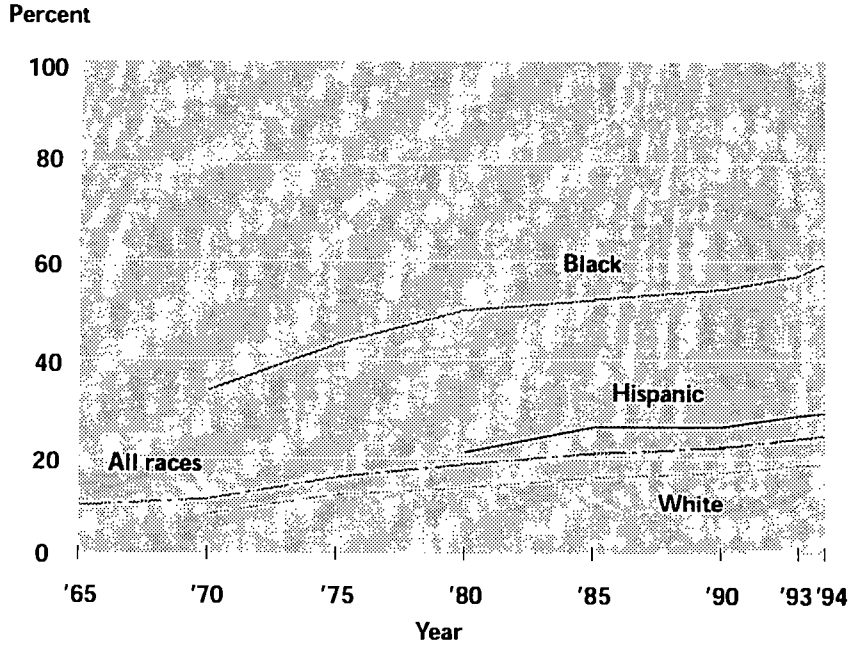
NOTE: Details may not add to totals due to rounding.

SOURCE: NCES, National Household Education Survey, 1995.

- **The proportion of children living in single parent families has more than doubled since 1970. In 1994, black children were three times more likely than white children to live in a single parent family.**

The proportion of children living in single parent families increased sharply during the 1970s and continued to rise slowly through the early 1990s. In 1994, 25 percent of children under age 18 lived in single parent families, while 11 percent did so in 1970. Between 1970 and 1994, the percentage of black children living in a single parent family nearly doubled. In 1994, 60 percent of black children lived in single parent families compared to 19 percent of white children and 29 percent of Hispanic children.[26]

Percentage of children under age 18 living in single parent families, by race/ethnicity of family householder: Selected years: 1965–94



SOURCE: NCES, *Youth Indicators 1996*, Indicator 11.

Social Context of Public Schools

An analysis of the social context of education cannot be complete unless it also examines differences in the schooling environment across low and high poverty schools.[27] Research has shown that student performance is strongly related to the educational backgrounds and aspirations of other students in the school.[28] This context or composition effect has been found to be particularly strong for low income students. For example, low income students in schools with small concentrations of such students have higher achievement and graduation rates than their counterparts in schools with high concentrations of low income students.[29]

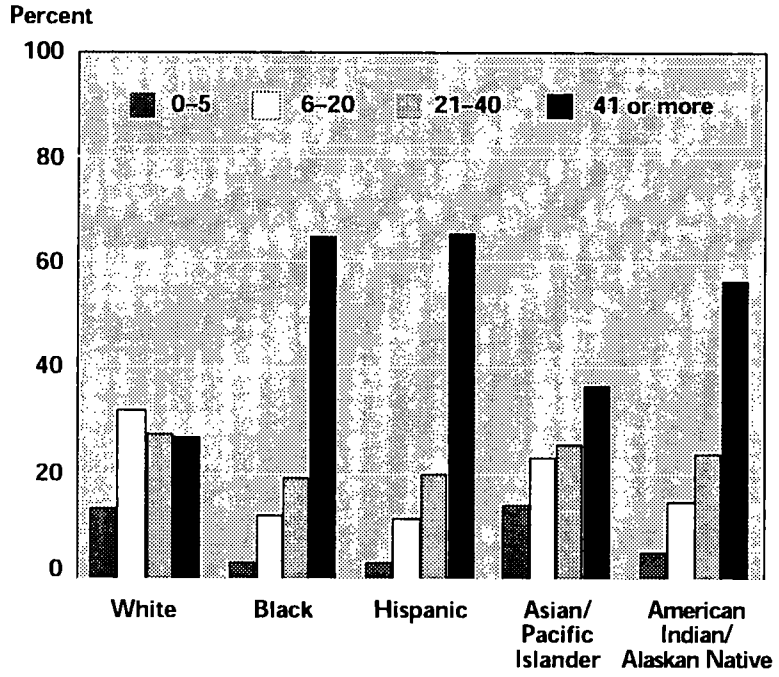
The percentage of students receiving free or reduced-price lunches in school is the most widely available and comparable mea-

sure of school poverty concentration.[30] For the purpose of this essay, "low poverty" is a term used to describe public schools in which 5 percent or fewer of the students are eligible to receive free or reduced-price lunches, and "high poverty" is used to describe public schools in which more than 40 percent of students are eligible to receive free or reduced-price lunches.

- **Minority students are more likely than white students to attend high poverty schools.**

Differences in climate or in the distribution of resources between high and low poverty schools have a disproportionate impact on minorities, as racial/ethnic minorities are far more likely to attend high poverty schools. In the 1993–94 school year, 27 per-

Percentage distribution of students, by percentage of students eligible for free or reduced-price lunch in public schools: School year 1993–94



SOURCE: NCES, Schools and Staffing Survey, 1993–94.

cent of white students were in schools with a high poverty rate compared to 65 percent of black and Hispanic students, 37 percent of Asian/Pacific Islander students, and 57 percent of American Indian/Alaskan Native students.

Systematic differences in the learning environment and the level of financial and human resources between high and low poverty schools can adversely affect the equality of educational opportunities, especially for many minority children. The remainder of this essay will examine differences in these educational opportunities between high and low poverty public schools.

Learning Environment in High and Low Poverty Schools

Differences in how teachers in high and low poverty schools perceive conditions in their schools may reflect differences in the learning environment in which education takes place in those schools.

- **Public school teachers in high poverty schools are more likely to report that student misbehavior interferes with their teaching than are teachers in low poverty schools.**

In the 1993–94 school year, public school teachers from high poverty schools were less likely to be satisfied with their school conditions than were teachers from low poverty schools.[31] For example, teachers in high poverty schools were more likely than their counterparts in low poverty schools to report that student misbehavior (e.g., noise, horseplay, or fighting in the halls, cafeteria, or student lounge) in their school interfered with their teaching (18 and 8 percent, respectively). Teachers in high and low poverty schools were about equally likely, however, to agree strongly that their principal enforced school rules for student

conduct and backed them up when they needed it and that there was a great deal of cooperative effort among the staff members in their school.

Public school teachers' perceptions and attitudes toward teaching, by percentage of students eligible for free or reduced-price lunch: School year 1993–94

	Percentage of students eligible for free or reduced-price lunch			
Perceptions and attitudes	0–5	6–20	21–40	41 or more
Percentage of teachers who strongly agree with the following:				
My principal enforces school rules for student conduct and backs me up when I need it	43.0	44.3	48.8	46.4
There is a great deal of cooperative effort among the staff members	32.7	33.5	34.8	34.3
Necessary materials are available as needed by the staff	38.8	34.4	33.6	29.6
The level of student misbehavior in this school interferes with my teaching	8.2	10.3	13.1	18.3

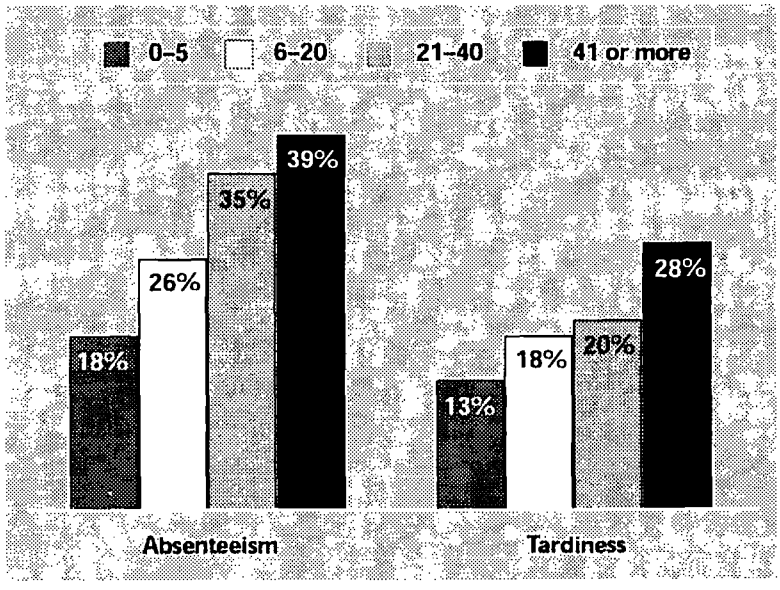
SOURCE: NCES, Schools and Staffing Survey, 1993–94.

- **Public secondary teachers in high poverty schools are more likely to report that student absenteeism and tardiness are serious problems in their schools than public secondary teachers in low poverty schools.**

An important aspect of student access to education is the amount of time students actually spend in the classroom. When students

are absent from school, arrive late, or cut class, they forgo their opportunities to learn. Furthermore, when students disrupt classes by being late or absent, they interfere with lessons in progress and with other students' opportunity to learn. In the 1990–91 school year, the reported percentage of secondary students absent on a typical day was higher in high poverty public schools (10 percent) than in low poverty public schools (7 percent). Secondary teachers in high poverty schools were more than twice as likely as secondary teachers in low poverty public schools to report that student absenteeism and tardiness were serious problems in their schools.[32]

Percentage of public high school teachers who reported that absenteeism or tardiness was a serious problem in their school, by percentage of students eligible for free or reduced-price lunch: School year 1993–94



SOURCE: NCES, Schools and Staffing Survey, 1993–94 (Teacher and School Questionnaires).

- **Teachers in high poverty public schools are more likely than their counterparts in low poverty public schools to report that lack of parental involvement is a serious problem in their school.**

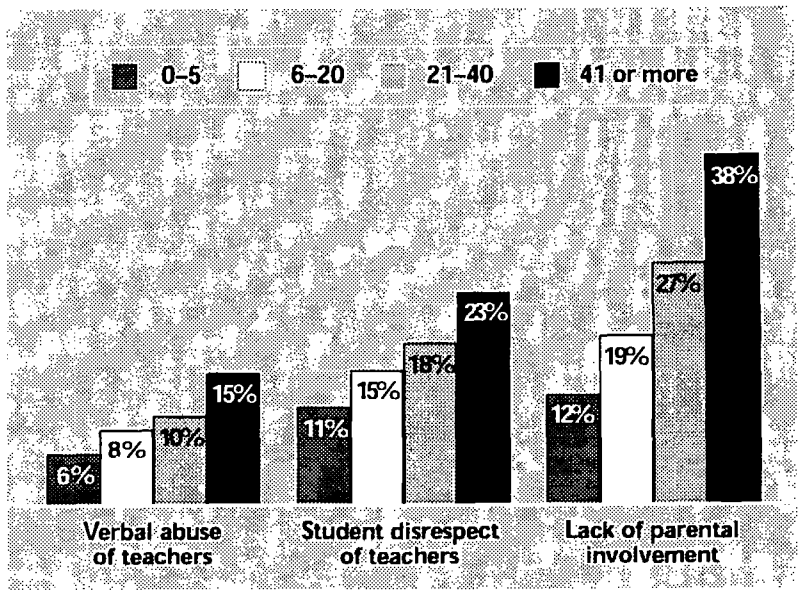
When school personnel and parents communicate, they can mutually establish a stronger learning environment for the student both at home and at school. In the 1993–94 school year, public school teachers from high poverty schools were three times more likely than their counterparts in low poverty schools to report that lack of parental involvement was a serious problem in their schools (38 compared to 12 percent).

Teachers in high poverty schools may be making less of an effort to reach out to parents, however. In 1992, parents of seniors in high poverty schools were less likely than their counterparts in low poverty schools to be contacted regarding their child's academic performance, academic program, or post-high school plans. They were also less likely to be asked to volunteer time at the school. There was no measurable difference in school-teacher contacts with parents regarding the student's attendance or behavior, however.[33]

- **Teachers in high poverty public schools are more likely than teachers in low poverty public schools to report that verbal abuse of teachers and student disrespect of teachers are serious problems in their schools.**

Frequent negative interactions between students and teachers are an indicator of a school environment that is less conducive to learning. In the 1993–94 school year, public school teachers in high poverty schools were more than twice as likely to report that verbal abuse and student disrespect for teachers were serious problems at their school than their counterparts in low poverty schools.

Percentage of public school teachers who reported selected problems were serious, by percentage of students eligible for free or reduced-price lunch: School year 1993–94



SOURCE: NCES, Schools and Staffing Survey, 1993–94.

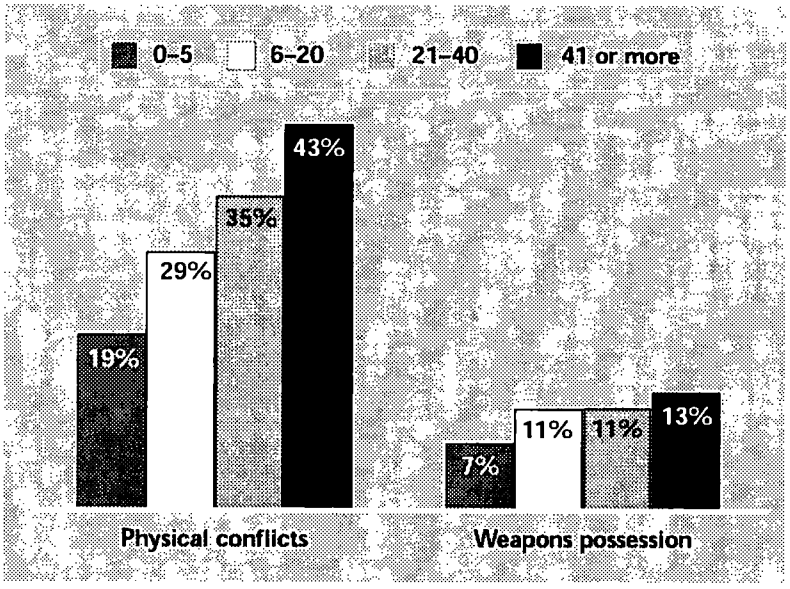
- **An increasing percentage of public school teachers report that physical conflicts and weapons possession are moderate or serious problems in their schools.**

There has been an increase in the percentage of public school teachers who, between the 1987–88 and 1993–94 school years, felt that physical conflicts and weapons possession were moderate or serious problems in their schools.[34] This concern is reflected in the views of students as well as teachers. In 1993, 50 percent of students reported using some sort of strategy to avoid harm at schools. Black and Hispanic students were more likely to have reported using such a strategy than were white students.[35]

- **Public school teachers in high poverty schools are more likely than teachers in low poverty schools to report that physical conflicts and weapons possession are moderate or serious problems in their schools.**

In the 1993–94 school year, 43 percent of public school teachers in high poverty schools reported that physical conflicts among students were a moderate or serious problem in their schools; this was more than twice the percentage of their counterparts in low poverty schools who reported that physical conflicts were a moderate or serious problem (19 percent). Thirteen percent of public

Percentage of public school teachers reporting physical conflicts among students and weapons possession as moderate or serious problems in their schools, by percentage of students eligible for free or reduced-price lunch: School year 1993–94



SOURCE: NCES, Schools and Staffing Survey, 1993–94.

school teachers in high poverty schools reported that weapons possession was a moderate or serious problem in their school, compared to 7 percent of teachers in low poverty schools.

Resource Equity Across High and Low Poverty Schools

Equity concerns typically focus on the fairness of how financial and human resources are allocated across schools. Equity can be measured across several types of resources, including differences in programs and services offered, levels of teacher qualifications and experience, teacher salaries, average class size, and expenditures per student. Equity in financial and human resources between schools with high and low poverty levels is one aspect of providing equal educational opportunities to all students.

- **Fourth-graders in high poverty public schools are less likely to be in schools with gifted and talented programs or extended day programs than fourth-graders in low poverty schools.**

The programs and services that a particular school offers are a function not only of the needs of the students, but also of the resources available to that school. Differences in offerings across school poverty levels provide information as to how educational resources are being deployed.

In the 1993–94 school year, fourth-graders enrolled in low poverty public schools were more likely to have programs for the gifted and talented, diagnostic and prescriptive services, and extended day programs in their schools than fourth-graders in high poverty public schools. Fourth-graders in high poverty public schools were more likely, however, to have bilingual education programs offered in their schools than fourth-graders in low poverty schools.

Percentage of fourth-grade students in public schools offering various programs and services, by percentage of students receiving free or reduced-price lunch: School year 1993–94

School poverty level	Bilingual education	English as a second language	Programs for the gifted and talented	Diagnostic and prescriptive services	Extended day
Total fourth-graders	**23.2**	**51.9**	**77.9**	**82.7**	**40.8**
Percentage of students receiving free or reduced-price lunch					
0–5	14.0	59.6	83.3	87.6	58.5
6–20	7.5	51.1	82.2	83.7	42.6
21–40	18.6	47.7	79.9	83.9	39.3
41 or more	36.6	53.8	74.8	80.9	38.7

SOURCE: NCES, Schools and Staffing Survey, 1993–94.

- **Students in mathematics classes in low poverty public secondary schools are more likely to be taught by teachers who majored or minored in mathematics than were students in high poverty public secondary schools.**

Concern about the quality of education in the United States has focused interest on teacher qualifications and student exposure to well-qualified teachers, especially in mathematics and science. Educational background is one measure of teacher qualifications. One indicator of teachers' substantive and academic qualifications is whether or not they majored or minored in the fields they teach.

The differences in teacher qualifications shown by school poverty levels are not uniform across subjects. For example, there is a 9 percentage point difference in the percentage of students taught mathematics by a teacher with a major or minor in mathematics between high and low poverty schools. There is no measurable

difference in the percentage of students taught science by a teacher who majored or minored in a science subject between high and low poverty schools. Differences exist, however, within specific science subjects; students in high poverty schools were less likely than students in low poverty schools to be taught chemistry by a teacher who majored or minored in chemistry (63 and 77 percent, respectively) or to be taught physics by a teacher who majored or minored in physics (29 and 43 percent, respectively).[36]

Percentage of public secondary mathematics and science students taught by teachers with a major or minor in the class subject, by percentage of students eligible for free or reduced-price lunch: School year 1993–94

	Percentage of students eligible for free or reduced-price lunch			
Subject	0–5	6–20	21–40	41 or more
Mathematics	83.3	79.7	76.1	74.1
Total science*	92.0	90.1	91.5	86.5
Biology	80.9	73.5	75.7	72.7
Chemistry	77.2	64.8	72.1	62.9
Physics	42.8	50.5	39.3	29.3

*It is easier to have majored, minored, or to have become certified in "science" than in a specific discipline, such as biology, because a teacher from any scientific field may qualify in "science," whereas qualifying in a specific discipline requires a match in class subject matter.

SOURCE: NCES, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

- **Public schools with high levels of students in poverty are less likely to be connected to the Internet than schools with lower levels of student poverty.**

Access to the Internet is one indicator of a school's connection to the "Information Superhighway." In 1996, Internet access was available in about half (53 percent) of the schools in which 71 per-

cent or more students were eligible for free or reduced-price lunch programs and in 58 percent of schools in which 31 to 70 percent of students were eligible. In comparison, 72 percent of schools with 11 to 30 percent of students eligible for the lunch program had Internet access, and 78 percent of those with less than 11 percent of students with free or reduced-price lunch eligibility were connected to the Internet.[37]

- **Teacher salaries are higher in low poverty public schools than they are in high poverty public schools.**

Teacher salaries are an important way for schools to attract and retain high quality teachers. In the 1993–94 school year, public school teachers in low poverty schools earned 28 percent more in total school earnings than did public school teachers in high poverty schools ($45,547 versus $35,496, respectively).[38] Teachers in high poverty schools were also less likely to be satisfied with their salaries than teachers in low poverty schools.[39]

- **The average class size of public school teachers is similar across all levels of school poverty.**

Class size is a measure of the average number of students a teacher sees during a class period or school day. Smaller class sizes are valued because they may allow students to receive more individual attention from their teachers and may reduce the teacher's burden of managing large numbers of students and their work. In the 1993–94 school year, the average class size was similar in high and low poverty public schools.[40]

- **Relatively low wealth public school districts spend less per pupil in general and less on capital investment than do school districts with more wealth.**

Public elementary and secondary spending can be divided into three main functional areas: instruction, support services, and capital outlay. Many factors influence how school districts spend the funds that they receive, including the overall level of funding, the organizational structure of the district; district- and state-level goals; differences in student needs (e.g., demand for special education services and programs for limited-English-proficient students); and the relative cost of educational resources (e.g., teacher salaries, building maintenance, or construction cost for new schools). The distribution of expenditures across functional areas is an indication of how different public school systems allocate funds to meet their specific needs.

In the 1992–93 school year, relatively low wealth school districts (those with a median household income of less than $20,000) spent less per student than districts with more wealth (those with a median household income of $35,000 or more). Relatively low wealth districts also spent 31 percent less per student on capital investment ($434 per student) than relatively high wealth districts ($630 per student).[41]

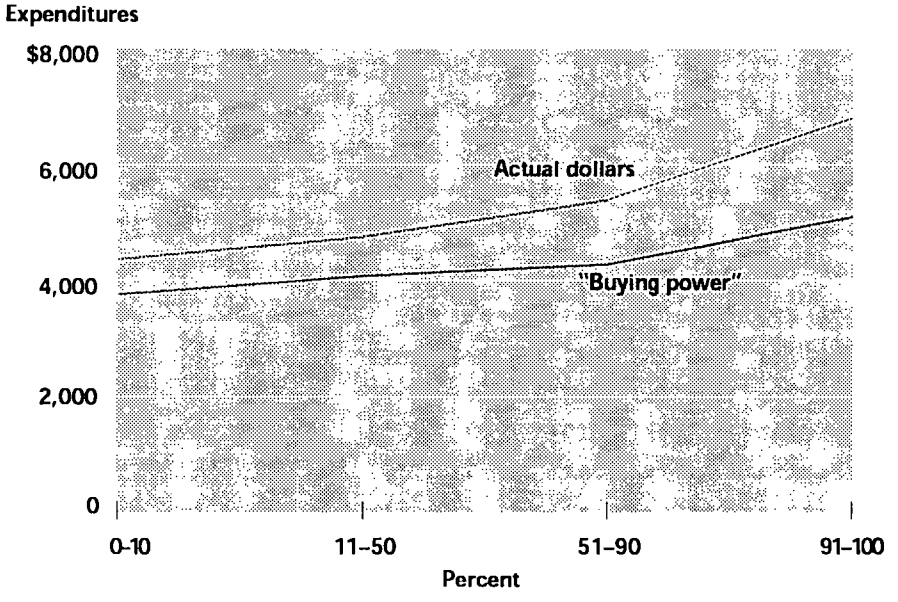
- **Adjusting education expenditures to reflect differences in the relative cost of providing education services reduces the spending gap between districts with high and low income households.**

"Buying power" is a concept used as an alternative measure of expenditures. Actual dollars spent per student can be adjusted to reflect differences in the cost of living and differences in the educational needs of students. The cost of living adjustment reflects the fact that a dollar spent in New York City buys substantially

less in actual education resources than a dollar spent in Des Moines, Iowa. The needs adjustment takes into account expenditure differences that result from the additional resources required to provide an education to students who need special education, bilingual, and compensatory education services.[42]

Disparities in public education spending are most pronounced at the extremes of district wealth (measured by median household incomes). For example, in 1989–90, the Nation's richest school districts spent 56 percent more per student than the Nation's poorest districts. These differences in expenditures per student are reduced to 36 percent, however, when "buying power" is taken into account.[43]

Public education expenditures per student, by percentage distribution of median household income of households located within district boundaries: 1989–90



SOURCE: NCES, *Do Rich and Poor Districts Spend Alike?*, 1996.

Summary

The social context of education has changed over the past few decades. The structure of families is shifting away from two biological parent families. The percentage of children from minority backgrounds is increasing, as is the percentage of children who have difficulty speaking English. Over the past 25 years, median family income has been relatively stagnant, and the poverty rate has changed very little. Black and Hispanic children remain much more likely than white children to be living in poverty, a factor associated with poor school outcomes. On the positive side, today children live in households with more educated parents than they did a few decades ago and parents' education level is a strong predictor of student achievement.

Minority students are more likely to attend schools with a high level of poverty. This is significant since in many ways the climate in high poverty schools appears to be less conducive to learning than that in low poverty schools. Similarly, high poverty schools are, on average, worse off than low poverty schools with regard to human and financial resources.

The social context in which schools operate can influence their effectiveness. Changes in social context present challenges that schools must address to enhance their effectiveness and ensure that education progress can occur.

References

[1]For a review of the research literature on education for the disadvantaged, see J. Ralph, "Improving Education for the Disadvantaged: Do We Know Whom to Help?" *Kappan* (January 1989).

[2]N. Zill, "Trends in Family Life and School Performance," paper presented at the Annual Meeting of the American Sociological Association, Pittsburgh, Pa., August 22, 1992; and N. Zill, "What We Know About the School Readiness of Young Children in the United States," presentation, National Education Goals Panel Meeting, January 17, 1992.

[3]Ibid.

[4]A. Pallas, G. Natriello, and E. McDill, "The Changing Nature of the Disadvantaged Population: Current Dimensions and Future Trends," *Educational Researcher* (June–July 1989).

[5]U.S. Department of Education, *Equality of Educational Opportunity,* by J.S. Coleman et al., Washington, D.C.: 1966; and C. Jencks et al., *Inequality: A Reassessment of the Effects of Family and Schooling in America,* New York: Basic Books, 1972.

[6]D.W. Grissmer, S.N. Kirby, M. Berends, and S. Williamson, *Student Achievement and the Changing American Family,* Santa Monica: RAND, 1994.

[7]U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1997* (NCES 97-388), Washington, D.C.: 1997, 205, based on NCES, National Household Education Survey (NHES), 1995 (Early Childhood Program Participation File).

[8]Ibid., 208, based on NCES, National Household Education Survey (NHES), 1995 (Early Childhood Program Participation File).

[9]Ibid., 209, based on NCES, National Household Education Survey (NHES), 1995 (Early Childhood Program Participation File).

[10]Ibid., 242, based on NCES, National Assessment of Educational Progress, *Trends in Academic Progress: Achievement of U.S. Students in Science, 1969 to 1994; Mathematics, 1973 to 1994; Reading, 1971 to 1994; Writing, 1984 to 1994*, 1996.

[11]Ibid., 246, based on NCES, National Assessment of Educational Progress, *Trends in Academic Progress: Achievement of U.S. Students in Science, 1969 to 1994; Mathematics, 1973 to 1994; Reading, 1971 to 1994; Writing, 1984 to 1994*, 1996.

[12]Ibid., 210, based on U.S. Department of Commerce, Bureau of the Census, October Current Population Surveys, 1995.

[13]Low income is the bottom 20 percent of all family incomes, high income is the top 20 percent of all family incomes, and middle income is the 60 percent in between.

[14]*The Condition of Education 1997*, 62, based on U.S. Department of Commerce, Bureau of the Census, October Current Population Surveys.

[15]U.S. Department of Education, National Center for Education Statistics, *Youth Indicators 1996* (NCES 96-027), Washington, D.C.: 1996, Indicator 2.

[16]For a discussion of the variable "difficulty speaking English," see the supplemental note to Indicator 4, *The Condition of Education 1997*, 211.

[17]R.B. Cairns, B.C. Cairns, and H.J. Neckerman, "Early School Dropout: Configurations and Determinants," *Child Development* 60 (1989): 1437–1452; R.B. Ekstrom, M.E. Goertz, J.M. Pollack, and D.A. Rock, "Who Drops Out of High School and Why? Findings from a National Study," in *School Dropouts: Patterns and Policies*, ed. G. Natriello, New York: Teachers College Press, 1989, 52–69; and R.W. Rumberger, "High School Dropouts: A Review of Issues and Evidence," *Review of Educational Research* 57 (1987): 101–121.

[18]For example, differences in white and Hispanic enrollment rates in center-based early childhood programs disappear once maternal education is controlled for. In addition, black children were more likely to be enrolled in center-based programs than white children once confounding variables such as family income and parents' education were held constant. See U.S. Department of Education, National Center for Education Statistics, *Access to Early Childhood Programs for Children at Risk*, by S. Hofferth, J. West, and R. Henke (NCES 93-372), Washington, D.C.: 1993.

[19]NCES, *Youth Indicators 1996*, Indicator 16.

[20]U.S. Bureau of the Census, *Current Population Reports*, Series P60-194, *Poverty in the United States: 1995*, Washington, D.C.: 1996.

[21]For this measure, poverty is calculated as the percentage of children in families with a median family income less than 40 percent of adjusted median family income. Income includes all forms of income plus food stamps and similar benefits in other countries, minus federal income and payroll taxes. See T. Smeeding, "Why the U.S. Antipoverty System Doesn't Work Very Well," *Challenge* (January–February 1992): table 3, p. 33.

[22]A recent RAND study found that parents' education was the most important family characteristic influencing student performance. See Grissmer, Kirby, Berends, and Williamson, *Student Achievement and the Changing American Family*, 1994.

[23]Ibid.

[24]Ibid.

[25]For an extensive review of the relationship between family structure and educational aptitude and achievement, see E.M. Heatherington, D.L. Featherman, and K.A. Camara, *Intellectual Functioning and Achievement of Children in One-Parent Households*, Washington D.C.: National Institute of Education, 1981.

[26]NCES, *Youth Indicators 1996*, Indicator 11.

[27]This section has benefited from previous analysis for the report from the U.S. Department of Education, National Center for Education Statistics, *Urban Schools: The Challenge of Location and Poverty*, by L. Lippman, S. Burns, and E. McArthur (NCES 96-184), Washington, D.C.: 1996, and updates some of the data in that report.

[28]Coleman et al., *Equality of Educational Opportunity*, 1996; and U.S. Department of Education, *Poverty, Achievement, and the Distribution of Compensatory Education Services*, by M.M. Kennedy, R.K. Jung, and M.E. Orland, Washington, D.C.: 1986.

[29]See J. Anderson, D. Hollinger, and J. Conaty, "Poverty and Achievement: Re-examining the Relationship Between School Poverty and Student Achievement," paper presented at the Annual Meeting of the American Educational Research Association, 1992; D.E. Myers, *The Relationship Between School Poverty Concentration and Students' Reading and Math Achievement and Learning*, Washington, D.C.: Decision Resources, Inc., 1985; and C. Jencks and S.E. Mayer, "Social Consequences of Growing Up in a Poorer Neighborhood," in *Inner City Poverty in the U.S.*, eds. L.E. Lynn, Jr. and M.G.H. McGeary, Washington, D.C.: National Academy Press, 1990.

[30]NCES, *Urban Schools: The Challenge of Location and Poverty*, 7.

[31]*The Condition of Education 1997*, 160, based on NCES, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

[32]U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1995* (NCES 95-273), Washington, D.C.: 1995, 130, based on NCES, Schools and Staffing Survey, 1990–91 (Teacher and School Questionnaires).

[33]Ibid., 128, based on NCES, National Education Longitudinal Study of 1988, Second Follow-up, Parent Survey, 1992.

[34]U.S. Department of Education, National Center for Educational Statistics, *How Safe are the Public Schools: What Do Teachers Say?* (NCES 96-842), Washington, D.C.: May 1996.

[35]U.S. Department of Education, National Center for Educational Statistics, *Student Strategies to Avoid Harm at School,* by K. Chandler, M. Nolin, and E. Davies (NCES 95-203), Washington, D.C.: October 1995.

[36]*The Condition of Education 1997,* 327, based on NCES, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

[37]U.S. Department of Education, National Center for Educational Statistics, *Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, Fall 1996,* by S. Heaviside, T. Riggins, and E. Farris (NCES 97-944), Washington D.C.: February 1997.

[38]*The Condition of Education 1997,* 326, based on NCES, Schools and Staffing Survey, 1993–94 (Teacher Questionnaire).

[39]Ibid., 303, based on NCES, Schools and Staffing Survey, 1993–94.

[40]Ibid., 136, based on NCES, Schools and Staffing Survey, 1993–94.

[41]Ibid., 170, based on NCES, Common Core of Data, "National Public Education Financial Survey," various years and "School District Fiscal Data," 1991–92; and U.S. Department of Commerce, Bureau of the Census, "1990 Census School District Special Tabulations."

[42]U.S. Department of Education, National Center for Educational Statistics, *Do Districts Enrolling High Percentages of Minority Students Spend Less?* (NCES 97-917), Washington D.C.: 1996.

[43]U.S. Department of Education, National Center for Educational Statistics, *Do Rich and Poor Districts Spend Alike?* (NCES 97-916), Washington D.C.: 1996.

Other NCES Publications

For more information, see the following NCES publications:

The Condition of Education 1997. Washington, D.C.: 1997 (NCES 97-388)

The Condition of Education 1996. Washington, D.C.: 1996 (NCES 96-304)

The Condition of Education 1995. Washington, D.C.: 1995 (NCES 95-273)

Digest of Education Statistics 1996. Washington, D.C.: 1996 (NCES 96-133)

Digest of Education Statistics 1995. Washington, D.C.: 1995 (NCES 95-029)

Other ***Findings from the Condition of Education:***

No. 1: *High School Students Ten Years After* A Nation At Risk (NCES 95-764)
No. 2: *The Educational Progress of Black Students* (NCES 95-765)
No. 3: *America's Teachers Ten Years After* A Nation At Risk (NCES 95-766)
No. 4: *The Educational Progress of Hispanic Students* (NCES 95-767)
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INDICATOR OF THE MONTH

NATIONAL CENTER FOR EDUCATION STATISTICS

Internet access in public and private schools

February 1999

The Internet, with its vast array of information, can broaden the learning resources available through schools by providing teachers and students with connections to remote libraries, schools, and government agencies. Information found on the Internet can broaden students' knowledge base, and having Internet access can prepare students for an increasingly technological workplace. Examining patterns of Internet access in schools may help determine how many students will be prepared to use this technology effectively in the future.

- Between fall 1994 and 1997, Internet access in public schools increased from 35 to 78 percent. However, in fall 1997, 27 percent of instructional rooms had Internet access.
- In fall 1995, public schools were more likely to have Internet access than private schools (50 versus 25 percent). Additionally, public schools had a higher percentage of instructional rooms with Internet access than private schools (8 versus 5 percent).
- Public schools with a high percentage of low income students (71 percent or more of students eligible for free or reduced-price lunch) were less likely than schools with a low percentage of low-income students (less than 11 percent of students eligible for free or reduced-price lunch) to have Internet access in fall 1997.
- In fall 1997, public schools with a high minority enrollment (50 percent or more) had a lower rate of Internet access than public schools with a low minority enrollment (less than 6 percent). Moreover, public schools with a high minority enrollment had a smaller percentage of instructional rooms with Internet access than public schools with a low minority enrollment.
- In both public and private schools with Internet access, teachers were more likely than students in these schools to have access to e-mail, news groups, resource location services, and the World Wide Web.

Percentage of public schools and instructional rooms with Internet access, by selected school characteristics: Fall 1994–97

School characteristics	Percentage of schools with Internet access				Percentage of instructional rooms with Internet access[1]			
	1994	1995	1996	1997	1994	1995	1996	1997
Total	**35**	**50**	**65**	**78**	**3**	**8**	**14**	**27**
Level of school[2]								
Elementary	30	46	61	75	3	8	13	24
Secondary	49	65	77	89	4	8	16	32
Percentage of students eligible for free or reduced-price lunch								
Less than 11	—	62	78	88	—	9	18	36
11–30	—	59	72	83	—	10	16	32
31–70	—	47	58	78	—	7	14	27
71 or more	—	31	53	63	—	3	7	14
Percentage of minority students enrolled								
Less than 6	—	52	65	84	—	9	18	37
6–20	—	58	72	87	—	10	18	35
21–49	—	54	65	73	—	9	12	22
50 or more	—	40	56	63	—	3	5	13

— Not available.

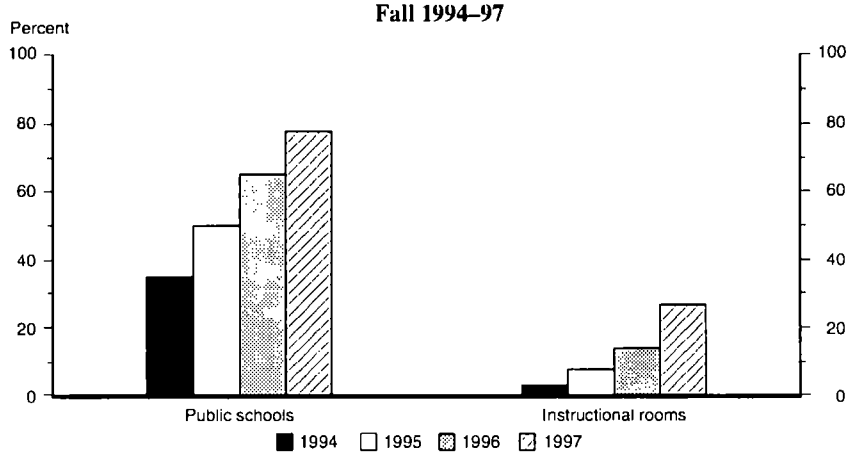
[1] Based on the total number of instructional rooms in regular public schools.

[2] Data for combined schools are not reported as a separate level of school because there are too few sample observations for reliable estimates. Data for combined schools are included in the totals.

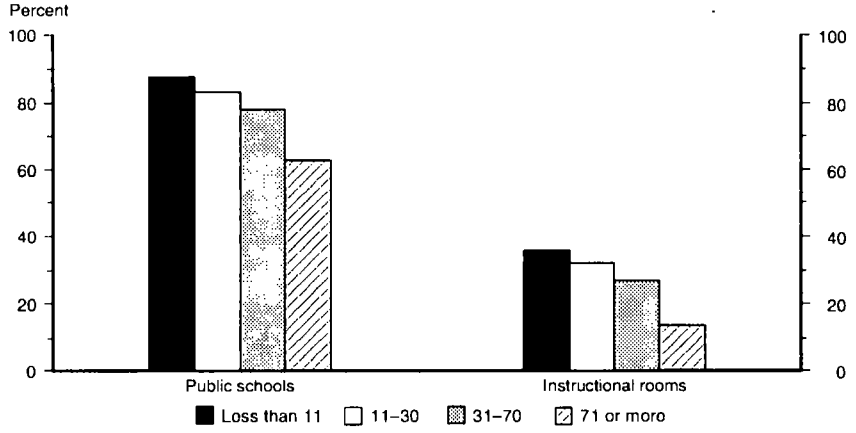
SOURCE: U.S. Department of Education, National Center for Education Statistics, "Internet Access in Public Schools," Issue Brief and Issue Brief supplemental table 1, February 1998.

Internet access in public schools

Percentage of public schools and instructional rooms* with Internet access: Fall 1994–97



Percentage of public schools and instructional rooms* with Internet access, by percentage of students eligible for free or reduced-price lunch: Fall 1997



* Based on the total number of instructional rooms in regular public schools.

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Advanced Telecommunications in U.S. Public Elementary and Secondary Schools, Fall 1996*, 1997 and "Internet Access in Public Schools," Issue Brief, February 1998.

Suggested citation: U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1998*, NCES 1999–005. Washington, DC: U.S. Government Printing Office. To obtain a copy of the full volume of *The Condition of Education*, contact ED Pubs at (877) 433-7827 (E-mail: edpubs@inet.ed.gov). The full indicator and all supplemental tables pertaining to this indicator may be viewed at http://nces.ed.gov/pubs98/condition98/c9804a01.html.

INDICATOR OF THE MONTH

NATIONAL CENTER FOR EDUCATION STATISTICS

Immediate transition from high school to college

March 1999

Since most college students enroll in college immediately after completing high school, the percentage of high school completers enrolled in college the October after finishing high school is an indicator of the total proportion of that year's high school completers who will ever enroll in college. The percentage enrolling not only reflects the accessibility of higher education to high school completers, but also shows the value completers place on attending college as compared to working, entering the military, starting families, or pursuing other interests.

- Between 1985 and 1996, the percentage of high school completers going directly to college increased from 58 to 65 percent.
- Between 1985 and 1996, high school completers from high-income families were more likely than their counterparts from low-income families to go directly to college after completing high school.
- Between 1990 and 1996, the higher the education level of a student's parents, the more likely the student was to enroll in college the year after completing high school.
- The percentage of black high school completers going directly to college increased substantially between 1973 and 1995.

Percentage of high school completers ages 16–24 who were enrolled in college the October after completing high school, by type of institution, family income, and race/ethnicity: October 1972–96

				Family income[1]				Race/ethnicity[2]				
				Low		Middle	High	White	Black		Hispanic	
		Type of institution			3-year					3-year		3-year
October	Total	2-year	4-year	Annual	average	Annual	Annual	Annual	Annual	average	Annual	average
1972	49.2	—	—	26.1	([3])	45.2	63.8	49.7	44.6	([3])	45.0	([3])
1973	46.6	14.9	31.7	20.3	([3])	40.9	64.4	47.8	32.5	41.4	54.1	48.7
1975	50.7	18.2	32 6	31.2	([3])	46.2	64.5	51.1	41.7	44.4	58.0	52.5
1977	50.6	17.5	33.1	27.7	32.8	44.2	66.3	50.8	49.5	46.8	50.8	48.5
1979	49.3	17.5	31.8	30.5	31.5	43.2	63.2	49.9	46.7	45.3	45.0	46.4
1981	53.9	20.5	33.5	33.6	33.0	49.2	67.6	54.9	42.7	40.4	52.1	49.2
1983	52.7	19.2	33.5	34.6	34.0	45.2	70.3	55.0	38.2	37.9	54.2	47.3
1985	57.7	19.6	38.1	40.2	36.2	50.6	74.6	60.1	42.2	39.6	51.0	46.5
1987	56.8	18 9	37.9	36.9	37 8	50.0	73 8	58.6	52.2	44.5	33.5	44.9
1989	59.6	20.7	38.9	48.1	45.8	55.4	70.7	60.7	53.4	48.2	55.1	51.6
1990	60.1	20.1	40.0	46.7	44 7	54.4	76.6	63.0	46.8	48.9	42.7	51.7
1991	62.5	24.9	37.7	39.5	42.3	58.4	78.2	65.4	46.4	47.2	57.2	51.6
1992	61.9	23.0	38.9	40.9	43.6	57.0	79.0	64.3	48.2	50 1	55.0	58.1
1993	61.5	22.4	39.1	50.4	44.1	56.9	79.3	62.9	55 6	51.5	62.2	55.4
1994	61.9	21.0	40.9	41.0	41.9	57.8	78.4	64.5	50.8	52.5	49.1	55.0
1995	61.9	21.5	40 4	34.2	41.3	56.1	83.4	64.3	51.2	52.6	53.7	51 2
1996	65.0	23.1	41 9	48.6	([3])	62.7	78.0	67.4	56.0	([3])	50.8	([3])

— Not available. Data for type of institution were not collected until 1973.

[1] Low income is the bottom 20 percent of all family incomes; high income is the top 20 percent of all family incomes; and middle income is the 60 percent in-between.

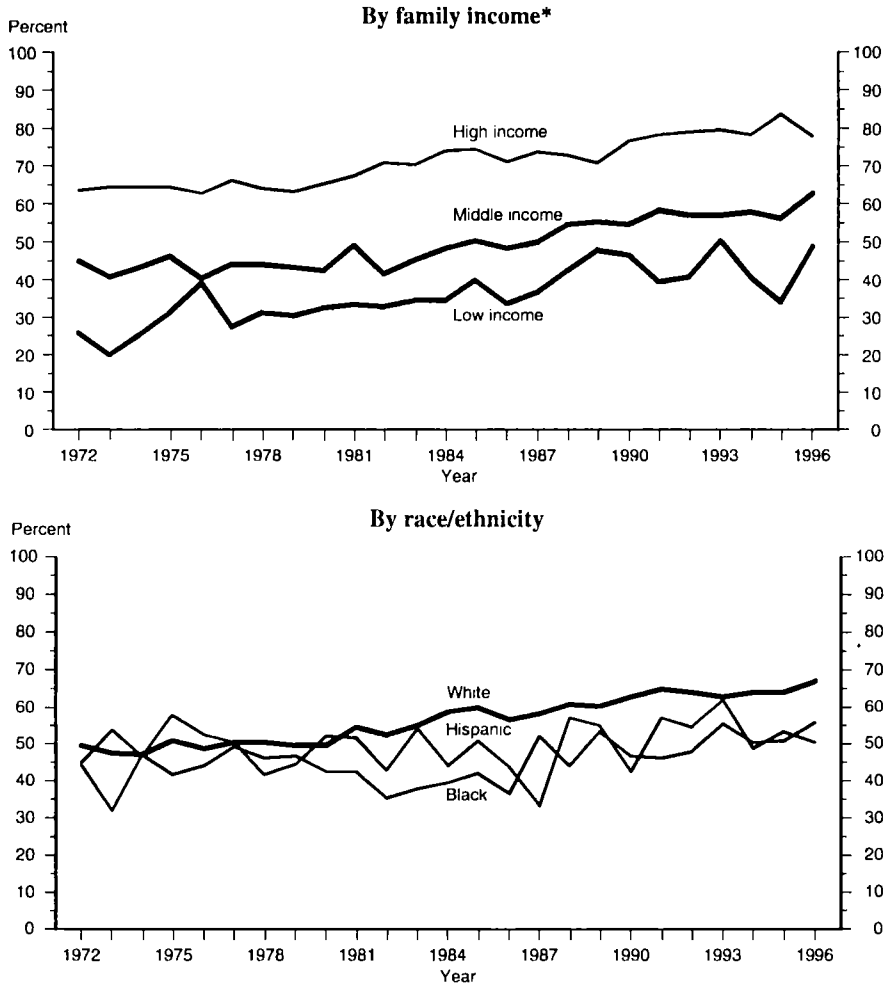
[2] Included in the total but not shown separately are high school completers from other racial/ethnic groups.

[3] Due to small sample sizes for the low income, black, and Hispanic categories, 3-year averages were also calculated for each category. For example, the 3-year average for blacks in 1973 is the average percentage of black high school completers ages 16–24 who were enrolled in college the October after completing high school in 1972, 1973, and 1974. Thus, 3-year averages cannot be calculated for 1972 and 1996, and for groups of 3 years in which some data are not available (e.g., 1973–75 for the low income category).

NOTE: Details may not add to totals due to rounding.

SOURCE: U.S. Department of Commerce, Bureau of the Census, October Current Population Surveys.

Percentage of high school completers ages 16–24 who were enrolled in college the October after completing high school: October 1972–96



* Low income is the bottom 20 percent of all family incomes; high income is the top 20 percent of all family incomes; and middle income is the 60 percent in-between. Data on family income were not available in 1974.

SOURCE: U.S. Department of Commerce, Bureau of the Census, October Current Population Surveys.

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