

[CHAPTER NINE]

EDUCATION AND HEALTH

Education plays critical and wide-ranging roles in our society. In addition to imparting certain cognitive and interpersonal skills necessary for productive functioning, it also exerts a formative influence on the identities, norms and sentiments that work to integrate individuals into the larger society. Furthermore, education is widely believed to be the key to social and economic advancement, with higher educational attainment thought to bring higher status, greater rewards and more valued accomplishments. Unfortunately, our system of mass, public education does not work equally well for everyone. Those whose academic performance is compromised will sacrifice educational attainment, the promise of upward mobility, and more importantly, their health. In short, higher education yields better health and with each increase in level of education, there appears a positive difference for health status.

Yet, the interaction between education and health is both complex and cyclical. Health in childhood affects academic performance; while in adulthood, level of education has a lasting effect on health prospects. A number of studies have attempted to elucidate parts of this interaction. Here, we consider the evidence on how educational attainment affects health status in adults, but concentrate on the linkages between chronic health conditions in children and their academic performance. Children of parents with lower educational attainment tend to model the poorer health prospects of their parents. As these children become adults and have offspring of their own, a pattern or cycle develops. If we intervene in the health of children through

certain school-based programs, the negative cycle can be broken. In other words, we improve not only children's health, but also academic performance, and subsequently educational attainment. This influences a life course that positively shapes the lives of future generations.

In this chapter, we will first identify the most prevalent chronic health conditions in school-age children, and then examine the available evidence documenting the impact these conditions have on academic performance. Next, we examine assessments of interventions intended to prevent or improve these health conditions. We then turn our attention to the adult portion of the cycle, reviewing the extensive evidence relevant to the link between educational attainment and health in adulthood. Finally, we shift away from an examination of the evidence behind the various links between education and health to consider the issue of policy recommendations. In this context, we will inventory the recommendations and pay special attention to the current status of state policy in Texas. This chapter is based on a white paper submitted to the committee. The full text of the white paper is included in the report as Appendix E.

**CHILDHOOD HEALTH CONDITIONS, ACADEMIC PERFORMANCE AND SCHOOL-BASED INTERVENTIONS
PREVALENCE OF CHRONIC CONDITIONS AND THEIR LINKS
TO ACADEMIC PERFORMANCE**

Chronic conditions impact students in diverse ways. In the short term, chronic health conditions among children may affect school attendance, cognition

and behavior in the classroom, test-taking abilities, and social relationships. In the long term, chronic health conditions in childhood may affect academic achievement, grade advancement and school completion. We discuss prevalence, effect on academic performance, and the potential for academic enhancement through school-based interventions for each of these conditions. Because of our interest in non-medical, school-based interventions, much of our attention focuses on overweight, asthma and diabetes. Other conditions relevant to consider that are not discussed are depression, epilepsy, sickle cell anemia and sleep disorders.

Overweight and Obesity

Overweight and obesity in children are widely perceived to be reaching alarming prevalence in schoolchildren. The percentage of overweight students in Texas was found to be 22.4 percent in fourth grade, 19.2 percent in eighth grade, and 15.5 percent in eleventh grade (Hoelscher et al., 2004). The prevalence is even higher for Hispanic boys in Texas, who have prevalence data ranging from 14.2 percent to 32.6 percent. The drastic proportion of overweight children has clear implications for public health, given its ties to both adult obesity and diabetes. Recent studies also indicate that children who are overweight have lower reading and math scores (Datar et al., 2004). Other studies indicate that obese children consider themselves to be poor students and are more likely to be held back a grade. Given the current prevalence of overweight conditions among children and the finding that as children age, their later weight depends primarily on their earlier weight (Kelder et al., 2002), by the time they reach high school, we can expect that between a quarter and a third of them will be more likely to be held back a grade, consider themselves poor students, and expect to quit school based on

their overweight status. The evidence suggests that obesity not only poses serious health risks, but also jeopardizes academic achievement.

Asthma

The National Health Interview Survey conducted in 2002 revealed that 9 million U.S. children under the age of 18 have been diagnosed with asthma during their lifetime; that is 12 percent of U.S. children. Asthma studies in Texas indicate a prevalence of 15 percent (Arif et al., 2004), although many researchers fear that this condition is under-diagnosed and underreported. The impact of asthma on academic performance is complex; however, there is substantial evidence that children with asthma are more likely to be absent from school (Fowler et al., 1992) (Freudenberg et al., 1980; Joseph et al., 1996) (Maier et al., 1998) (O'Neil et al., 1985) (Parcel et al., 1979) (Silverstein et al., 2001) (Yeatts & Shy, 2001). This absenteeism translates into lower academic performance, principally among those from poorer households. Unfortunately, absenteeism also has implications for school funding. Each absent child costs the average school district about \$18 per day in lost state revenue. On average, children with asthma are absent about five extra days per year. The evidence for the impact of asthma on academic achievement is complex but does suggest that asthma is related to school absences and may adversely affect academic performance for children from poor households. In addition, obesity has been found to be a risk factor for asthma in children (Bibi et al., 2004).

Diabetes

The prevalence of diabetes is much lower than either obesity or asthma. About 151,000 people in the United States below the age of 20 years have diabetes. Behavioral Risk Factor Surveillance data from

2003 reports that 8.1 percent of Texas adults say that a doctor has told them that they have diabetes, an increase over the nationwide rate (7.2 percent) (CDC, 2005). Most alarming is the sudden increase in type 2 diabetes (formerly referred to as adult-onset) among children. Prior to 20 years ago, only 1 to 2 percent of diabetes cases in children were attributed to type 2. More recent estimates indicate 8 to 45 percent of all new cases of diabetes in children are due to type 2 (Aye & Levitsky, 2003). It is important to note there is a strong correlation between type 2 diabetes and obesity. Children with diabetes are more likely to have a reduction in neuropsychological functioning, to be absent from school and to perform at lower levels on academic measures over time, particularly in reading. Compared to non-diabetic children, diabetic children present significantly lower scores on school achievement scores such as arithmetic, reading and spelling (Gath et al., 1980; Ryan et al., 1985a); increased learning difficulties; lower grades in English and language arts; more grades repeated; and special instruction received (Hagen et al., 1990; Holmes et al., 1992; Yu et al., 2000). They were absent more frequently from school (Holmes et al., 1992; McCarthy et al., 2002; Ryan et al., 1985a; Yu et al., 2000), and their absence rate was associated negatively with their grade point average and academic achievement (Kovacs et al., 1992; Ryan et al., 1985a).

SCHOOL-BASED INTERVENTIONS AND THEIR LINKS TO HEALTH CONDITIONS

There is a strong body of research evaluating the effect of school health programs incorporating physical education and/or nutrition service interventions on overweight children and factors related to overweight such as physical activity, fat consumption and television-watching. Among other examples in the elementary school level, the Child and Adoles-

cent Trial for Cardiovascular Health (CATCH) was a multi-component, multi-year coordinated school health project designed to decrease fat, saturated fat and sodium in children's diets, increase physical activity and prevent tobacco use. The experimental trial of CATCH is conducted in 96 schools (56 intervention, 40 control) in four sites (California, Louisiana, Minnesota and Texas). At the completion of the trial, students exposed to the intervention consumed less fat and participated in more physical activity outside of school; school cafeterias provided meals that were lower in fat; and students were more physically active during physical education classes (Luepker et al., 1996). The CATCH cohort of students was re-measured three years after the original intervention ended (in eighth grade), and positive effects were maintained.

Still other programs are helpful to consider. The Eat Well and Keep Moving Program was effective in improving dietary intake of students and reducing television viewing (Gortmaker et al., 1999a). At the middle school level, the Planet Health program was effective in reducing television viewing hours among both girls and boys, and increasing fruit and vegetable consumption. Among girls, each hour of reduction in television viewing predicted reductions in obesity (Gortmaker et al., 1999b). The middle school MSPAN program improved moderate to vigorous physical activity in physical education classes, more for boys than for girls (McKenzie T. L. et al., 2004).

A review published in *The Journal of Pediatrics* in June of 2005 (Strong et al., 2005) of the effects of physical activity on health outcomes such as overweight and obesity, cardiovascular health, asthma, mental health, injuries, musculoskeletal health and fitness, and academic performance concludes that there is

sufficient evidence to support a recommendation of 60 minutes per day of moderate to vigorous physical activity for school-age youth.

There is also a large body of literature examining the effect of physical activity on mood-related mental health issues such as depression and anxiety and concluding that physical activity benefits both clinical and nonclinical populations (Dunn et al., 2001; Landers & Petruzzello, 1994; Morgan, 1994; Office of the Surgeon General, 1996). Furthermore, there is evidence that interventions designed to increase physical activity are effective in decreasing depressive symptoms among high-risk youth, free-living youth and clinic populations (Hawkins et al., 1999; Norris et al., 1992; Tortolero et al., 2001). Unfortunately, the results of school-based depression prevention programs have been mixed.

School-based programs for children with persistent asthma hold promise for improving disease management, reducing disease severity and decreasing school absences. Tinkelman (Tinkelman & Schwartz, 2004) reports a case study of the DSCM asthma school program incorporating a respiratory nurse care manager, web-based interactive educational tools, and an interactive asthma diary for 41 elementary and middle school public school students. The study also used a telephone-based educational disease management program for parents. At six months, students had two-thirds fewer unscheduled doctor visits, daytime frequency of symptoms dropped by 62 percent and nighttime frequency of symptoms dropped by 34 percent. Several other studies also support these findings. While the research on school-based asthma programs is limited by issues of design and sample size, the findings suggest promise for management of asthma symptoms and savings in health care utilization.

SCHOOL-BASED INTERVENTIONS AND THEIR LINKS TO ACADEMIC PERFORMANCE

School-Based Physical Activity Interventions

A rigorous evaluation of Project SPARK, an elementary school physical education program, demonstrated significant gains for reading, losses for language, and no differences for math scores on a standardized test, suggesting that, even with time taken away from the academic program for physical education, overall academic functioning was not impaired (Sallis et al., 1999). This and other studies suggest that implementation of physical education will not impair academic achievement on standardized tests, and implementation of asthma management programs may enhance academic grades for low-income asthmatic children.

The association between fitness and school performance has been examined by the California Department of Education utilizing a state-required physical fitness test reported for all fifth-, seventh-, and ninth-grade students since 2001 and the Stanford Achievement test. This cross-sectional analysis demonstrated a significant linear association between standardized test scores (Stanford Achievement Test Ninth Edition [SAT-9]) of almost 1 million students and their fitness scores on the Fitnessgram, a teacher-administered physical fitness test measuring cardiovascular endurance, body composition, abdominal strength and endurance, trunk strength and flexibility, upper body strength and endurance, and general flexibility (California Department of Education & Standards and Assessment Division, 2002; Grissom, 2005). The highest SAT-9 scores were reported by students who met three or more standard levels among the six physical fitness measures. While the Fitnessgram does not represent a school program, but rather a measurement of fitness,

these data suggest a relationship between levels of physical activity sufficient to develop and maintain fitness and academic performance as measured by a standardized achievement test.

School-Based Nutrition Interventions

Some students may not achieve academic superiority because they are undernourished, thus hindering their ability to learn. It has been suggested that even moderate undernutrition can potentially have long-lasting effects on a child's cognitive development and performance in school (Center on Hunger and Poverty and Nutrition Policy, 1998). In addition, research shows that failure to eat breakfast can have adverse effects on children's ability to problem-solve in school (Pollitt, 1995; Pollitt et al., 1981; Pollitt et al., 1982). More recent studies have documented similar results of higher test scores in nourished children compared to their undernourished counterparts (Murphy et al., 1998; Powell et al., 1998). These studies also found that the children participating in the School Breakfast Program (SBP) had fewer absences and tardies than those who did not participate in the SBP (Murphy et al., 1998; Powell et al., 1998). Other researchers focusing on a child's social and emotional well-being have found that the undernourished child tends to be less active, more anxious, and interacts less with his or her classmates and peers (Barrett et al., 1982; Rampersaud et al., 2005).

Eating patterns and other health-related habits tend to be established in early childhood, (Munoz et al., 1997). Given that schools have the potential to shape and direct the development of the students, nutrition education programs implemented and adopted by schools may play a large role in helping improve a child's chance for higher academic attainment along with improvements in

their health status related to nutritional intake. Many elementary school children depend on school meals, deriving approximately 50 to 60 percent of total daily intake of energy, protein, cholesterol, carbohydrate and sodium from school meals (Nicklas & Johnson, 2004). School nutrition programs will be very important in efforts to prevent obesity in children and are also likely to have a positive impact on academic performance.

School-Based Asthma Management Interventions

Few school-based asthma management programs have been evaluated. The most rigorous evaluation was conducted by Evans et al (Evans D. et al., 1987) using random assignment of 12 New York schools within matched pairs. Participants included 239 low-income predominantly Hispanic and African-American students from third to fifth grade who experienced at least three episodes of asthma in the last year. The asthma self-management program consisted of six 60-minute sessions on asthma management skills for the students and written information on curriculum and activities for the parents. Asthma program students performed significantly better than control students on classroom grades in mathematics, science and oral expression, but no effect of the program was evident for standardized test scores for reading or math, for teacher-rated classroom behavior or for attendance. The mixed results for the effects of the programs on school attendance is disheartening given that asthma is considered to be the leading cause of school absences (Tinkelman & Schwartz, 2004). However, the studies are limited by weaknesses in design and sample size and challenges in the accurate measurement of school absences along with the cause of the absence. More work needs to be done in both the development and implementation of school-based asthma management programs and the evaluation of those programs.

School-Based Mental Health Interventions

Gall and colleagues (Gall et al., 2000), found that among 13- to 18-year-old public high school students, two months after they received school-based mental health and counseling services, absenteeism decreased by 50 percent and tardiness decreased by 25 percent. Students referred for mental health services significantly decrease absence from school by two-thirds of a day while those not referred increased both absenteeism and tardiness. These studies are not specific to depression programs, but do suggest that the school component most likely to be responsible for depression prevention programs may have success in impacting academic factors such as absenteeism.

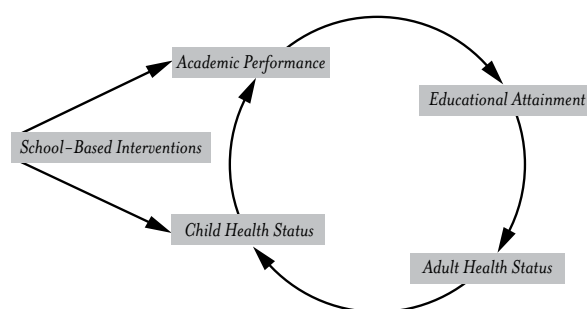
Coordinated School Health Programs

School health programs are currently considered within the context of the Coordinated School Health Program (CSHP) model. CSHP provides policies, activities and services in an organized manner to promote the health of school students and staff through: comprehensive school health education; family and community involvement; physical education; school counseling, psychological and social services; school health services; school nutrition services; and school-site health promotion for staff and faculty (McKenzie F. D. & Richmond, 1998). Programs may be designed for the general population of school children, such as those that target physical activity and nutrition, or for indicated groups of children identified with health problems such as asthma. As described earlier, chronic conditions such as obesity, asthma and diabetes negatively impact school performance. Coordinated School Health Programs improve the health of students. It logically follows these school-based health programs will result in better school performance.

EDUCATIONAL ATTAINMENT AND ADULT HEALTH STATUS

Most of the studies that considered the impact of interventions focused on health as their endpoint and not on academic achievement. Part of this may have been a function of the interests of the organizations who fund the research; those with health missions were not accountable for improvements in academic performance. This chapter also seeks to determine the reverse relationship: that of academic performance on health. Studies in school-aged children have indicated that poor school performance predicts health-compromising behaviors and physical, mental and emotional problems (Crum et al., 1998; Kessler et al., 1995; Miller D. S. & Miller, 1997; Young & Rogers, 1986). There is a body of evidence that suggests academic performance, particularly test scores, predicts level of attainment. However, focus should not merely be on the linear relationship, but also the intergenerational and cyclical nature between education and health (see Figure 1). Parents and families profoundly influence their children. Those children develop as adults and form family units of their own. The interplay of health and education is perpetuated in the family cycle. Future generations will be influenced by what is done in the present. From this point forward, the chapter will more fully focus on how education level affects health outcomes.

Figure 1: The Cyclical Nature between Education and Health



BACKGROUND ON SOCIAL STATUS AND EDUCATIONAL ATTAINMENT

Education as an indicator of socioeconomic status is an important determinant of health. Socioeconomic status refers to the individual's position or status in society's hierarchy. Income, education, occupational status and social class are all indicators of socioeconomic status and have been shown to be important determinants of health (Antonovsky, 1967; Backlund et al., 1996; Evans R. G. et al., 1994; Kunst M. & Mackenbach, 1994; Marmot M. et al., 1987; Marmot M. & Shipley, 1996; Sorlie et al., 1995).

Current research has documented a health gradient based on socioeconomic status. In other words, the more education one has, the healthier one will be. It is a dose-response relationship rather than a threshold effect. As level of education increases, so does a variety of measures of health status; the relationship is not limited to those with the worst education having the poorest health while everyone else is fine. Studies have shown that better educated people are healthier, report better health, and have lower mortality, morbidity and disability. Socioeconomic status is usually measured by income, education, occupational status, social class or a combination of these factors. Among these measures, education stands out as the most basic socioeconomic status component since it shapes future occupational opportunities and earning potential (Adler & Newman, 2002). Education is considered the primary and core status dimension that influences all other dimensions of status throughout the lifetime (Mirowsky & Ross, 2003). Education is the antecedent to all other measures of socioeconomic status as it comes early in life and influences all other measures of socioeconomic status. The association between socioeconomic status and health becomes more robust when socioeconomic status is measured

by education (Fuchs V. R., 1979; Kitagawa & Hauser, 1973; Lebowitz, 1977; Liberatos et al., 1988; Williams D. R., 1990). These results taken together have lead researchers to conclude that education is the best socioeconomic status predictor of health status (Williams D. R., 1990). It has also been shown that those who are less educated have lower health literacy (or more difficulty understanding and acting upon health information), a higher risk of infant mortality, and are more likely to develop risk factors related to poor health.

THE LINKS BETWEEN EDUCATIONAL ATTAINMENT AND ADULT HEALTH STATUS

In general, better educated people are healthier, report better health, and have lower mortality, morbidity and disability (Coburn & Pope, 1974; Ross C. E. & Van Willigen, 1997). Ross and Mirowsky (Ross C. E. & Mirowsky, 1999) have shown that the quality of the education received and of the educational environment increase the positive effects of education on health. The evidence that more education is associated with better health is strong (Deaton & Paxton, 1999; Grossman & Kaestner, 1997; Kaplan & Kiel, 1993). We will continue by examining the specific links between educational attainment and adult health.

Health Literacy and Health Knowledge

While education improves health, lack of education, and the resulting low literacy, is associated with poor health. Literacy improves health knowledge and skills in managing their disease in patients with hypertension, diabetes and asthma (Williams M. V. et al., 1998a; Williams M. V. et al., 1998b).

Mortality

A strong inverse relationship between years of education and all-cause mortality is reported by

Elo and Preston (Elo & Preston, 1996). Actuarial estimates show five to six year differences in life expectancy between the least and the most educated (Rogot et al., 1992).

Infant Mortality

Infant mortality is a key indicator of health and well-being of societies (UNICEF, 2003). One of the best predictors and contributors to fetal and infant mortality is thought to be low birth weight (Chen et al., 1998; Newland, 1981; Shapiro et al., 1980; Shoham-Yakubovich & Barell, 1988). Research has shown that mother's educational level is inversely related to both infant mortality (Arntzen & Nybo Andersen, 2004; Arntzen et al., 2004; Buor, 2003; Gisselmann, 2005; Olsen & Madsen, 1999; Pena et al., 2000) and low birth weight (Chen et al., 1998; Shapiro et al., 1980). Infant mortality risk decreases as the mother's educational level increases (Bicego & Boerma, 1993; Burne & Walker, 1991; Caldwell, 1979; Newland, 1981; Wagstaff et al., 2004).

Morbidity and Chronic Disease

There is evidence of a morbidity gradient based on education. Mirowsky and Ross (2003) report that less educated persons are more likely to suffer from common chronic conditions, with the exception of cancer.

Self-Rated Health

Evidence accumulated for more than 20 years indicates that self-rated health (SRH) is a powerful and reliable predictor of clinical outcome and mortality, even 10 years after the initial self-rating (Fayers & Sprangers, 2002; Idler & Angel, 1990). Education improves the likelihood of people feeling physically fit, having lots of energy, enjoying life, being happy and feeling hopeful about the future. Education decreases the likelihood of having trouble

sleeping, finding everything an effort, being unable to get going, having trouble keeping one's mind on things, and suffering from backaches and headaches (Mirowsky & Ross, 2003).

Risk Factors

The educated tend to have healthier lifestyles than those with less education. Researchers in diverse disciplines have noted that more educated persons are more aware of health risks and more likely to initiate actions to reduce these risks (Williams D. R., 1990). The more educated exercise more, are less likely to drink in excess, smoke less, and are less overweight than those with less education (Ross C. E. & Bird, 1994; Ross C. E. & Wu, 1995). Furthermore, health education campaigns are more effective in producing behavioral changes in better educated people.

Education and Health Care Costs

Low (2005) provides strong evidence that literacy predicts health care costs. In the 1990s, Medicaid recipients at the lowest literacy levels had annual health care costs of \$12,974 compared to \$2,969 for the overall Medicare population and were twice as likely to have been hospitalized in the previous year than patients with higher literacy (Weiss, 1999). Low literacy is responsible for about \$73 billion annually in avoidable health care costs according to an estimate by a National Academy study on Aging Society.

HOW EDUCATIONAL ATTAINMENT AFFECTS ADULT HEALTH STATUS

Education as learned effectiveness directly improves health, increases the sense of personal control, and enhances material, social and psychological resources. There are several possible explanations as to why education levels affect adult health, and we will focus on several of these explanations including

the human capital view, personal control, and occupation and social resources.

The Human Capital View

The human capital approach suggests that education improves the individual's ability to produce health. Education is a root cause of health in that it gives individuals the capacity to control and shape their own life in a way that promotes good health. The skills, knowledge and resources acquired in school build abilities (the human capital) that increase effective agency and can be used to foster health. The process can thus be described as "education as learned effectiveness" (Mirowsky & Ross, 2003). Education enables people to integrate health-producing behaviors into a lifestyle, and this lifestyle leads to control, augmenting the ability to use education as "capital" to produce health.

Personal Control

From this perspective the primary link between education and health is the sense of personal control that leads to the adoption of a healthy lifestyle (Mirowsky & Ross, 2003). As this perspective implies, education promotes a belief that the individual can alter his or her environment, which ultimately leads to adoption of a healthy lifestyle. Education also provides material resources, primarily a higher income. Several studies have indicated the positive effect of income on health. Individuals with a sense of personal control feel they can control and alter the environment they live in. It is the opposite of perceived powerlessness where individuals see no link between efforts and outcomes and feel they have no control over their life. Internal control (Rotter, 1966), mastery (Pearlin et al., 1981) and self-efficacy (Bandura, 1986) and, on the opposite end, fatalism (Wheaton, 1980), helplessness (Seligman, 1975)

and perceived powerlessness (Seeman M., 1983) are some of the names under which sense of control has been studied in psychology and the social sciences. The sense of personal control is learned through experience. Education increases the sense of personal control because school builds the skills, abilities and resources that allow better-educated people to have a rich experience of success at avoiding and solving problems, thus reinforcing their belief that their own behavior can favorably affect outcomes (Mirowsky & Ross, 1989; Ross C. E. & Mirowsky, 1992; Wheaton, 1980). Education teaches problem-solving skills and confidence.

Employment, Occupation and Work

Occupation is another possible link between education and health. Better educated people tend to work in jobs that are more rewarding financially and personally. Lower-educated individuals, particularly men, tend to be employed in more hazardous occupations. Employment, occupation and work have been posited as links between education and health. Better-educated people are more likely to be employed, to have jobs that are better paid, and that are more satisfying because they allow autonomy and reward creativity. Education brings people into the labor force and keeps them at the highest level of participation: full-time employment. Mirowsky and Ross (2003) estimate that, on average, each additional year of education increases the odds of full-time employment by 11 percent, decreases the odds of being unemployed by 10 percent, and decreases the odds of being unable to work, because of disability by 23 percent. Education also improves the stability of full-time employment by decreasing the probability of ever having been unemployed.

Health Improves Steadily with Participation in the Labor Force

Persons in full-time employment have the best health and those unable to work have the worst health (Mirowsky & Ross, 2003). Mirowsky and Ross (2003) find evidence that employment and health are in symbiotic relationship, "Just as full-time employment helps individuals to stay or become healthy, health helps them stay or become employed full-time." Selection seems to be a minor mechanism in the relationship between employment and health and to be declining over time. Better-educated workers are less likely to be in harsh or dangerous occupations (Mirowsky & Ross, 2003).

Social Resources

Better-educated people are more likely to be married and tend to have more stable and supportive relationships (Mirowsky & Ross, 2003). Social support, and in particular marriage, are protectors of health. Married people have better health than those who are not married, probably because they face less economic hardship, have more social support, especially emotional support, and lead a more orderly and regulated life. General social support improves psychological well-being that is associated with better physical health. Married people also tend to have more contact with the health care system resulting in earlier detection and treatment of disease. The effect of marriage on health behaviors is mixed. Married people are less likely to smoke or to drink heavily, and are less prone to injuries and risky sexual behavior. However, they are less likely to exercise and more likely to be overweight (Mirowsky & Ross, 2003).

INTERVENTIONS IN EARLY CHILDHOOD

The period during which brain development is the most rapid and important is in the first three to five years of life. Early life conditions affect ability

to learn and are important predictors of future academic success (Low, 2005). Several studies have reported a strong relationship between early life conditions and dropping out of high school (Jimerson et al., 2000), later performance in school, adult literacy, health status, and mortality (Keating & Hertzman, 1999). Readiness to learn when entering kindergarten has been associated with mathematical achievement in eighth grade (Fuchs V. R. & Reklis, 1997).

There is evidence that readiness to learn for at-risk children in the pre-kindergarten years can be improved through intervention. Though health effects have not been established, there is suggestive evidence that programs such as Head Start and the Perry Preschool Project may confer long-term benefits (Hertzman, 1999). Pre-school enrichment programs have been shown to improve the cognitive and social capacity of poor children at high risk. The evidence presented in this section corroborates the importance of education to health and provides justification of why investing in education and evaluating and improving policies related to education have an imperative relevance. According to Census 2000 data, 24.3 percent of adults in Texas do not have a high school diploma. That is more than the percentage of adults with a college degree (15.6 percent) or graduate or professional degree (7.6 percent). These averages reflect great variation in educational attainment by racial/ethnic status as shown in Table I. Improvement in the educational attainment of Texans would result in better health status, lower morbidity and mortality, and lower health care costs in Texas.

Table I – Educational Attainment in Texas by Racial/Ethnic Groups

	<i>Less than high school</i>	<i>High school diploma/no college degree</i>	<i>College degree or higher</i>
<i>Non-Hispanic, whites</i>	12.8%	57.2%	30.0%
<i>Hispanics</i>	50.7%	40.4%	8.9%
<i>African Americans</i>	24.2%	60.5%	15.3%
<i>Asians</i>	19.3%	32.9%	47.8%

Source: 2000 Census obtained from Texas State Data Center

SUMMARY

Through this analysis, we were able to further establish the correlation between education and health. We began by identifying the most prevalent chronic health conditions in school-age children, and then we examined the available evidence documenting the impact these conditions have on academic performance. Next, we studied assessments of interventions intended to prevent or improve these health conditions. We then considered the adult portion of the cycle, reviewing the evidence relevant to the link between educational attainment and health in adulthood.

If chronic conditions increase absenteeism, they also result in a cost burden for schools, given that student attendance rates influence school funding. If average daily attendance is increased by 1 percent, Texas school districts could receive an additional \$130 million from the state. Interventions that reduce absenteeism for less than about \$18 per student will pay for themselves, over and above the benefits brought to the children they serve. In this chapter, three approaches have stood out for consideration:

- Increase school-based nutrition interventions,
- Increase physical activities during school, and
- Implement asthma management programs for students and parents.

School-Based Nutrition Intervention

Failure to eat breakfast and undernutrition have been shown to adversely affect children’s ability to problem solve in school and potentially have long-lasting effects on a child’s cognitive development and performance in school. One recent study indicated that children in a School Breakfast Program (SBP) had increased language, math and reading scores, as well as reduced tardiness. Unlike many other areas of school health, the affects of this intervention on academic performance are consistent and significant.

The Texas Department of Agriculture established the Texas Public School Nutrition Policy, which addresses the issue of SBP, along with other nutrition and food service policies in public schools. For the fiscal year 2003-2004, 6,903 Texas schools participated in the SBP. This is impressive when one considers there are 7,009 public schools in Texas (Texas Department of Agriculture, 2004). However, according to the Texas Joint Interim Committee on Nutrition and Health in Public Schools, Interim Report to the 79th Legislature, only 26 percent of students are actually getting a school breakfast (Joint Interim Committee on Nutrition and Health in Public Schools, 2004). Based on compelling evidence of impact on academic performance, the school breakfast program should be extended to a larger number of students as a reliable means of improving academic performance while, at the same time, addressing chronic under-nourishment.

School-Based Physical Activity Interventions

The benefits of physical activity on health are well accepted; however, there is evidence that increasing its presence in school curricula does not impair academic achievement and may also improve school performance. Based on these findings, the requirement of physical activity in Texas schools should be increased. The Texas Administrative Code (TAC §74.32) requires enrolled K-6 students to participate in 60 minutes or more of moderate to vigorous physical activity based on the most current research (National Association of State Boards of Education). The U.S. Department of Human Services and U.S. Department of Agriculture recommends a minimum of 30 minutes per day or 135 minutes per week of physical activity (National Association of State Boards of Education). Given the strength of the evidence, Texas schools should increase their physical activity requirements to 60 minutes per day.

School-Based Asthma Management Interventions

The effectiveness of programs for asthma management has been well-documented in well-designed studies. Not only was absenteeism reduced, but test scores improved in a number of areas. While Texas has policies that address environmental triggers of asthmatic episodes, there is no written policy on asthma education programs for children or staff or recommendations for schools to consider them. Based on compelling evidence, Texas schools should adopt asthma management education for affected children and support staff.

In order to break the self-perpetuating cycle of health in childhood affecting academic performance; while in adulthood, level of education has a lasting effect on health prospects, intervention is necessary. Solutions should focus upon the health of children through certain school-based programs

that address the general population and certain groups suffering from chronic conditions like overweight, asthma and diabetes. If the negative cycle is broken, the potential implications are far-reaching and include improved health, academic performance and subsequent educational attainment.

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