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Academic Failure in Secondary School: The Inter-Related Role of Health Problems and Educational Context

Belinda L. Needham, Robert Crosnoe, and Chandra Muller
University of Texas at Austin

Abstract

This study explores whether the interplay of health problems and school environment predicts academic failure, an individual event with consequences for the life course, as well as for society at large. This exploration proceeds in three steps: 1) we examine whether physical and mental health problems are an academic risk factor during secondary school; 2) we investigate the academic mechanisms underlying this risk status; and 3) we explore whether this risk status varies by school context. A series of logistic regressions reveals that self-rated health and emotional distress are both associated with greater likelihood of failing one or more classes in the next year and that absenteeism, trouble with homework, and student-teacher bonding account for much of these associations. Associations of physical and mental health problems with academic failure vary only slightly across schools, however. We discuss the implications of these findings for both research and policy and argue that the examination of overlap among different domains of adolescent functioning can advance the sociological understanding of health, education, and social problems in general.

Academic performance, including academic failure, is often viewed in narrow terms, as an individual behavior limited to the early life course. However, academic performance has implications that play out across life stages and on multiple levels. On the individual level, academic struggles predict short-term problem behavior and dropout, and can derail educational and occupational trajectories well into adulthood (Crosnoe 2002b; Miller 1998; Rosenbaum, DeLuca, and Miller 1999). On the institutional level, academic problems among students can create disorder and undermine the general mission of schools (Steinberg, Brown, and Dornbusch 1996). On the population level, widespread academic failure influences rates of fertility, mortality, marriage, and unemployment through its relation to educational attainment and the development of human capital (Becker 1962; Mirowsky and Ross 2003b; Wilson 1978). Thus, what appears merely to be an aspect of the adolescent experience actually has far-reaching consequences across a variety of social phenomena.

Educational research has identified numerous family, peer, and economic factors that contribute to academic failure (Schneider and Coleman 1993; Steinberg et al. 1996). Often lost in this inquiry, however, is consideration of physical and mental health problems for academic performance in secondary school. The relative lack of attention to health is unfortunate given that related literatures strongly suggest the possibility that health problems disrupt academic functioning. For example, research on adult populations has shown that mental and physical health problems negatively affect work performance (Dewa and Lin 2000). This study suggests that performance in the educational system—the social institution most directly equivalent to the labor force for adolescents—is also likely affected by health problems. Moreover, small-

scale epidemiological studies have found that physical and mental health problems in childhood and adolescence impair academic functioning (Field, Diego, and Sanders 2001; Thies 1999).

This study investigates the connection between health and education in adolescence with three general research goals guided by the social epidemiological framework, which considers social problems at the intersection of risk and protective factors. First, we ask whether physical and mental health problems are risk factors for academic failure, net of other important individual and contextual correlates of both health and academic status. Second, we explore academic factors (e.g., absenteeism) that may explain the academic risk posed by health problems. Third, we identify potential protective factors that might counterbalance the academic risk status of health problems. Since we focus on education, our search for possible protective factors will target the characteristics of schools that serve youth with varying degrees of physical and mental health problems, using data from a nationally representative sample of American adolescents.

These three research goals have both conceptual and applied significance. These goals collectively will produce research demonstrating the value of holistic life course approaches that examine adolescent development at the intersection of multiple and overlapping domains of individual functioning, such as health and academics, in broader social contexts (like schools) with an eye towards the potential long-term consequences of adolescent experiences (Elder 1998). Further, this research will focus on identifiable, treatable risk factors, and potentially protective social contexts that are directly amenable to policy reforms, in order to inform programs aimed at improving adolescent well-being. Therefore, this research speaks to the potential underpinnings of the lifelong connection between education and health, as well as to the possibility of using knowledge about these underpinnings to help young people avoid problematic trajectories that have far-reaching consequences for later stages of the life course and for society as a whole.

Academic Failure in Secondary School

In the U.S. educational system, student advancement is predicated on graded performance in a series of classes. Failing to achieve passing grades has numerous additional implications during secondary school, above and beyond students' overall individual achievement level. Students with failing grades are often unable to enter more rigorous curricula (Dornbusch, Glasgow, and Lin 1996). At the same time, "no pass, no play" policies in many school districts prevent students who have failed courses from participating in extracurricular activities, many of which have positive influences on adolescent development (Crosnoe 2002a). Furthermore, implementation of high-stakes testing and school-accountability policies escalated during the period that the data for this study were collected. Implementation of these policies has broadened the consequences of academic failure beyond the student to stimulate greater interest among schools and teachers in students' academic outcomes (Schiller and Muller 2003). Finally, beyond the school level, poor academic performance can strain significant relationships, such as parent-adolescent ties (Repetti 1996).

The consequences of academic failure are not confined to adolescence or the actual period of formal schooling. Failure is an early indicator of potential dropout (Barrington and Hendricks 1989; Roderick 1993), linking this behavior to larger patterns of social inequality. In addition, one study of students in Houston found that academic failure is a major determinant of status attainment and adult well-being (Kaplan, Peck, and Kaplan 1997). Low-performing students are less likely to graduate from high school and less likely to go to college than other students; subsequently, high school dropouts, even those who obtain a General Equivalency Degree, have substantially lower adulthood wages than do high school or college graduates (American Council on Education 2001; Cameron and Heckman 1993). Moreover, both adult educational

and occupational attainment significantly predict adult mental health, longevity, relationship formation, and public service (Mirowsky and Ross 2003b; Wilson and Musick 1999). While academic failure can destabilize the individual life course, changes in the rates of academic failure could have serious ramifications for the stability of society. Academic failure, therefore, is an aspect of the individual life course that has implications for larger social problems and, as such, merits further attention. In this study, then, we draw on the classic epidemiological framework to examine the association between adolescent academic failure and both physical and mental health.

The Epidemiological Framework and the Study of Academic Failure

To study the prevalence of disease in specific populations, epidemiologists have developed a framework centered on the interplay of biological or environmental risk factors—that increase the probability of disease—and biological or environmental protective factors—that reduce the association between risk factors and disease. As a clear, parsimonious method for assessing the vulnerability of certain populations, the epidemiological framework has broad appeal outside epidemiology. In recent decades, the social and behavioral sciences have made use of the epidemiological framework for studying problematic individual or social outcomes, such as delinquency, divorce, or alcoholism (Garnezy and Masten 1986). Within these non-epidemiological applications, risk factors translate as traits, behaviors, interpersonal relations, or social conditions associated with a greater likelihood of poor developmental outcomes; protective factors translate as the individual, social, and structural characteristics and resources that promote positive developmental outcomes in the presence of risk (Garnezy and Masten 1986; Jessor et al. 1995; Masten 1994; Price and Lento 2001). The interplay of risk and protection in general human development is the basis of the *social epidemiological* framework.

In applying this social epidemiological framework to the study of academic failure, the list of potential risk or protective factors for students' academic careers is long. Important family risk factors include having low socioeconomic status, being born to a teenage mother, living in a single-parent family, and experiencing higher than average levels of stressful change, such as parental divorce or death (Alexander, Entwisle, and Kabbani 2001; Crosnoe, Mistry, and Elder 2002; Pungello et al. 1996). Important peer risk factors include associating with deviant peers and feeling rejected by other students (Kaplan et al. 1997). Acknowledging the significance of these risk factors, we argue that the study of academic failure could be expanded even further. In undertaking this expansion, our focus is on risk and protective factors that are most easily translatable into interventions aimed at combating academic problems. Many factors contributing to academic failure, whether risk factors or protective factors, are difficult to identify in any individual adolescent, and are even more difficult to change at the individual level. Identifiability and manipulability, however, are prerequisites to policy-relevant research. Thus, we focus on the school context, which is more amenable to change than other important developmental contexts, such as the family and peer group.

To apply the social epidemiological framework in a manner relevant to policy, this study focuses on health problems as a risk factor for academic failure and on school context as a source of protective factors that mitigate the academic risk posed by health problems. Physical and mental health problems are significant risk factors to target because they can be identified by school personnel, including school nurses and counselors, and because they can be treated. At the same time, schools, more than other institutions or contexts during adolescence, are amenable to reform and change. Consequently, identifying school characteristics related to student performance and physical and mental health, and to the relation between these, is a first step in prompting change in schools to promote student well-being (Good 1981; Good and Brophy 1997; Lightfoot 1983). Thus, unlike many risk and protective factors commonly studied in relation to academic failure, the linkage between health and education offers a

potentially effective intervention point for helping some struggling students. In the following sections, we elaborate on our application of the social epidemiological framework to academic failure.

Adolescent Health and Academic Failure

The first goal of this study is to determine whether physical and mental health problems are risk factors for academic failure. In other words, do health problems increase the probability of course failure during adolescence? Since research on the linkage between health and academics in adolescence is rare, our conceptualization of risk is motivated by research in related fields.

In adulthood, physical and mental health problems undermine work performance, primarily through missed work days and impaired functioning (Dewa and Lin 2000). Academic performance is the obvious corollary to work performance for the early life course, and evidence from specialized research supports our contention that the linkage between health and performance also holds in schooling. Physical health and nutrition have profound effects on school readiness, as demonstrated by the classic Perry Preschool Project that linked basic health and nutritional needs with learning (Berrueta-Clement et al. 1984). More recent research has documented the power of serious disease (e.g., HIV/AIDS, sickle cell anemia, cancer) to impair student functioning (see Thies 1999 for a review). Mental health research suggests a similar pattern for emotional problems, such as anxiety and depression. Severe emotional problems interfere with the learning process and are associated with academic underachievement in adolescence and young adulthood (Field et al. 2001; Kessler et al. 1995; Woodward and Fergusson 2001).

Of course, several demographic and ecological factors are related to both health and academic outcomes. Among the most important known predictors of physical and mental health problems are age, gender, and family socioeconomic status, with older adolescents, females, and those from low-income families reporting poorer self-rated health (Vingilis, Wade, and Seeley 2002) and more symptoms of depression (Garber and Flynn 2001). Females (Bank 1997), non-minorities (Smerdon 1999), younger adolescents (Steinberg et al. 1996), and those with higher self-esteem (Rubin 1978) tend to perform better in school. Family characteristics that influence academic achievement include family structure, parent-adolescent closeness, parental education, and family income. Academic achievement is highest among adolescents from more advantaged family backgrounds, including students living with both parents (McCartin and Meyer 1988), those who are closer to their parents (Field, Diego, and Sanders 2002), and those from families with higher socioeconomic status (Steinberg et al. 1996). These confounding factors will be taken into account in our analyses of the associations of physical and mental health problems with academic failure.

Mechanisms Underlying the Academic Risk of Health Problems

General research on adults and more specialized research on children strongly suggest that poor health is a risk factor for academic performance in secondary school. If physical and mental health problems are indeed risk factors for academic failure, then the next step is to determine why this risk occurs. Several mechanisms could explain this phenomenon, but, given our focus on education, we were most interested in the academic behaviors that might link health problems to academic failure. The second goal of this study, therefore, is to examine whether three academic behaviors—absenteeism, trouble with homework, and student-teacher bonding—account for the association between health problems and academic course failure. Again, all three academic factors are largely school-based and, consequently, can be targeted by educators.

First, students who are repeatedly absent from school do not perform as well academically as students who are rarely absent (Peterson and Colangelo 1996). Absent students often are required to make up their school work without the benefit of classroom instruction, and frequent absences may jeopardize academic progress by leading to inadequate knowledge or understanding of course material. Thus, by interfering with the ability of students to be present in school or to engage adequately in the schooling process, physical and mental health problems likely disrupt students' academic trajectories.

Second, since knowledge of course material as well as grades themselves are often based on the timely completion of assignments, students who have problems completing their assignments on time will be more likely to fail (Dornbusch et al. 1996). Therefore, time spent out of school due to physical or mental health problems can have severe consequences for academic performance. Despite the low frequency of serious health problems during adolescence, many adolescents do experience mild chronic health problems, such as headaches, stomachaches, and breathing difficulties. In fact, the estimated prevalence rate of chronic physical health conditions among people under age 18 in the United States is estimated to be as high as 31 percent (Thies 1999). While such ailments are unlikely to require lengthy absences from school, they are serious enough to disrupt concentration. Such distractions may hamper students' ability to complete school assignments, which would negatively affect their academic performance. The same process is likely true for mental health problems, which certainly also impede the ability of students to fully engage in the learning process, in or out of school (Field et al. 2001).

Third, close student-teacher relationships protect against academic failure in childhood, and some evidence suggests that this extends to adolescence (Birch and Ladd 1998; Muller 2001). For many reasons related to the factors described above, physical and mental health problems could also hamper bonding between students and teachers, which, if true, may offer an explanation for why adolescents with health problems could be at risk for academic failure.

Adolescent Health, Academic Failure, and School Context

The adoption of the social epidemiological framework has helped to reconceptualize many studies of human development and education. By identifying the factors that increase the probability of negative outcomes in terms of achievement, behavior, or adjustment, research points to the root causes of and possible solutions to many social problems. Yet, crucial to these solutions is the identification of factors that also counterbalance risks. As discussed above, since the school context provides an intersection of health and academics, it boasts valuable protective factors that may be implemented readily, especially given schools' amenability to reform.

Reflecting the potential value in identifying school characteristics as possible protective factors, the third goal of this study is to examine whether the association between health problems and academic failure varies with school environment. Essentially, we attempt to locate schools in which physically and mentally ill students do better—the school contexts that reduce the risk associated with health problems. Several recent studies have considered whether schooling factors, measured at the individual-level, moderate the association between various risk factors and developmental outcomes. For example, Robert Crosnoe, Kristan Glasgow Erickson, and Sanford M. Dornbusch (2002) found that student-teacher bonding, academic achievement, and school orientation protect adolescents against the impact of having deviant friends. Similarly, Robert W. Blum, Anne Kelly, and Marjorie Ireland (2001) found that high levels of school connectedness protect learning disabled adolescents from engaging in health risk behaviors, such as cigarette smoking.

In this study, we examine three aspects of the school environment that might protect physically or mentally ill students from academic course failure. First, the presence of health services in the school may be related to student health (Perry, Kelder, and Komro 1993). If sick students can find help at school for their problems, the risk of failure posed by these problems may decrease. Next, schools with more positive, protective climates often serve as a “safety net” that catches at-risk students (Schneider 1993) which may extend to the risks associated with physical and mental health problems. In schools characterized by positive student- teacher relationships, teachers may be more likely to help physically or mentally ill students avoid academic course failure by offering extra support or encouragement, modifying class assignments, or reviewing course material missed due to illness. Finally, previous research suggests that school size is associated with both student health (Ma 2000) and achievement (Lee and Smith 1997). In small schools, children appear to engage in more health-promoting behaviors (Ma 2000), and adolescents enjoy a better learning environment (Lee and Smith 1997). These school factors, therefore, are expected to counterbalance the academic risks associated with health problems.

Methods

Sample

This study draws on data from the National Longitudinal Study of Adolescent Health (Add Health), a large, school-based study of adolescents, their schools, and their families. The Add Health sample is representative of schools in the United States with respect to region of country, urbanicity, school type, ethnicity, and school size. In this study, we used two waves of the adolescent In-Home Interview along with three supplemental data sets. In 1994, all available seventh- through twelfth-grade students (about 90,000) in all study schools completed the In-School Survey. In 1995, a subsample (N = 20,745) of these adolescents, including a nationally-representative core sample plus four special over-samples, completed the Wave I In-Home Interview. All adolescents who participated in the first wave of data collection, except those who were in twelfth grade at Wave I, were eligible to participate in the 1996 Wave II In-Home Interview. The In-Home data can be linked to data from interviews with one parent and one school administrator, both collected at the same time as the Wave I In-Home Interview, as well as to the original In-School Survey.

For our study sample, we selected the portion of the In-Home sample that met four requirements. First, because we needed a longitudinal framework to better estimate the direction of associations, we selected only adolescents who participated in both waves of the In-Home Interview, automatically excluding all adolescents who were seniors at Wave I (new n = 14,738). Second, because our study was focused on academic performance, we included only adolescents who were enrolled in school at both waves (new n = 12,926). Third, in order to control for the oversampling of some groups in the In-Home Interviews, we included only adolescents assigned a valid sampling weight (new n = 11,969). (See Chantala and Tabor [1999] for more on design effects and sampling weights in Add Health.) Finally, given the greater likelihood of physically and mentally ill students' placement in special education classes, we included only those adolescents who did not receive any special education services in the 12 months prior to the Wave I In-Home Interview (new n = 10,988). These special education classes likely have different grading criteria that might make comparisons to students in other curricula difficult. Table 1 presents descriptive statistics for each stage of the selection process. The demographic characteristics of the study sample were only slightly different from the characteristics of other samples at each stage of filtering, suggesting that the four selection filters applied to the In-Home population introduced minimal bias.

Measures

Academic performance was measured at Waves I and II; all other items were measured at Wave I unless otherwise noted. We used the Impute procedure in Stata to estimate missing values on the independent variables (StataCorp 2003). See Table 2 for univariate statistics for all measures.

Academic Course Failure—In both waves, respondents reported the grade they received (A, B, C, or D/F) in four subjects: English, math, social studies, and science. We assigned a score of “1” to adolescents who received a D or F in at least one course; otherwise, we assigned a score of “0” (Kaplan, Peck, and Kaplan 1994).¹

Physical and Mental Health—Two measures tap adolescent health status. The first, *self-rated health*, is a widely-used, valid measure of health status (Idler and Benyamini 1997). Respondents reported on their general health, and, consistent with recent public health research (McGee et al. 1999), their responses were recoded into a binary measure (1 = fair or poor health; 0 = good, very good, or excellent health).² The second measure, *emotional distress*, was drawn from the Center for Epidemiological Studies’ Depression Scale (Radloff 1977). Adolescents reported the frequency of nineteen symptoms, such as poor appetite or talking less than usual, in the past week (0 = never or rarely; 3 = most or all of the time), and these responses were summed to create the final scale ($\alpha = .87$).

Mechanisms—We created three measures to explain the association of physical and mental health with academic performance. For *absenteeism*, we created a set of three binary measures based on adolescent-reported number and type of school absences in the past year (≥ 10 *excused absences*: 1 = missed ten or more days of school in the past year with an excuse; ≥ 10 *unexcused absences*: 1 = skipped ten or more days of school in the past year; < 10 *absences*: 1 = missed fewer than 10 days of school in the past year). Adolescents who reported 10 or more excused absences and who also reported skipping at least 10 days of school ($n = 130$) were assigned a score of “1” on the ≥ 10 unexcused absences variable and a score of 0 on the ≥ 10 excused absences variable. For *trouble with homework*, we created a continuous measure for students’ self-reported difficulty getting their homework done during the last school year (0 = never; 4 = everyday). For individual-level *teacher attachment* (see Crosnoe, Johnson, and Elder 2004), we created a continuous measure based on the mean of students’ own evaluations of how much they had trouble with teachers, felt that their teachers cared about them, and felt that teachers treated students fairly (1–5, low to high; $\alpha = .68$).

School Factors—We created three measures to test whether the associations of physical and mental health with academic performance varied across schools. Based on information from school administrators, we constructed a binary measure indicating whether the respondent’s school offered non-athletic physical *health services* on the school premises (1 = school offered health services). Next, we used information from the In-School Survey, a near census of each school to construct a school-level measure of *mean student-teacher bonding*. In the In-School Survey, respondents were asked how often they had trouble getting along with their teachers (0 = never; 4 = everyday). We reverse-coded this item so that a higher score indicates better student-teacher relations. This individual measure was then averaged across students within each school to create a school-level indicator of student-teacher bonding. Finally, we used information from school administrators to create a measure of *school size*. We assigned a score

¹ Respondents who did not receive letter grades in any of the four subjects listed or who refused to respond were coded as missing on the academic course failure variable ($n = 71$ at Wave I and $n = 115$ at Wave II).

² The binary measure is simpler to interpret, and did not produce substantially different results than those obtained when using the five-category measure to predict course failure.

of “1” to students attending schools with fewer than 900 students (i.e., small/medium schools); otherwise, we assigned a score of “0” (see Lee and Smith 1997 for a justification of this threshold of school size).

Individual-level Controls—In all analyses, we controlled for Wave I academic performance, which allowed the assessment of change in performance across waves. We also controlled for five additional individual-level factors known to be associated with health and academic performance: *gender* (1 = female), self-reported *race/ethnicity* (dummy variables for black, Latina/o, and other, with white as the reference category), *age (in years)*, and *self-esteem*. For this last measure, adolescents reported how strongly they agreed with seven statements, such as “You have a lot of good qualities” and “You like yourself just the way you are” (1 = strongly disagree; 5 = strongly agree); these responses were summed to form the final scale ($\alpha = .86$).

Family-level Controls—In addition to individual-level controls, we controlled for four family characteristics which previous research has established as important predictors of health and academic achievement: *family structure* (1 = non-intact), *parental closeness* (1 = not at all close; 5 = very close), *parent’s education* (indicating the level of education for the respondent’s most highly educated resident parent, with dummy variables for less than high school and high school, and with more than high school as the reference category), *family income* (in thousands of dollars), and *health insurance* (1 = adolescent currently covered by health insurance).

Plan of Analysis

The first objective of this study involved the examination of the associations of physical and mental health with academic performance. We used the Survey Logit procedure in Stata to regress academic failure on each of the health measures as well as the individual- and family-level control variables. This procedure produced robust standard errors by correcting for design effects and the unequal probability of selection in the Add Health data. The significance levels of the coefficients in these models were more accurate than those produced by standard logistic regression, and, therefore, gave better estimates of the association between health problems and academic failure.

Our second objective involved identifying the mechanisms that link physical and mental health to academic performance. To do this, we added absenteeism, trouble with homework, and student-teacher bonding to the baseline models described above, both individually and together.

The third and final objective of this study involved testing whether the association between health and academic performance varies by school context. We created a set of interaction terms between the two measures of health and the three school characteristics, and then added the school characteristics and the health*school interaction terms into the baseline model described above.

Results

Adolescent Health and Academic Failure

Drawing on the social epidemiological framework, our first aim was to examine the potential risk factors that increase the likelihood of academic failure, in this case physical and mental health problems. As presented in Table 3, self-rated health and emotional distress were both associated with a greater likelihood of failing a class in the next year, even controlling for other important sociodemographic characteristics.³ The odds of failing one or more courses at Wave II were 34 percent greater for adolescents who rated their own health at Wave I as fair or poor

compared to those who rated their health as good to excellent.⁴ Similarly, a one-unit increase in emotional distress was associated with a 3 percent increase in the odds of failing at least one class in the next year. Adolescents who scored one standard deviation above the mean for emotional distress at Wave I were nearly 44 percent more likely to fail one or more courses at Wave II, compared with adolescents who scored one standard deviation below the mean on emotional distress at Wave I.

Recall that these models contained, as a control variable, the Wave I measure of the academic outcome, meaning that the dependent variable effectively measured a change in academic performance over a one-year period. That these associations persisted despite this conservative framework bolstered our confidence that physical and mental health problems, in terms of self-rated general health status and emotional distress, were indeed risk factors for academic failure in secondary school.

Turning to other, non-focal factors in these models, we also found that females were significantly less likely than males to experience course failure. In addition, older adolescents and those with higher self-esteem were less likely to fail. The odds of failing one or more courses at Wave II were approximately 40 percent higher for blacks compared to whites. For adolescents in stepfamilies and single-parent families, the odds of failing one or more courses were roughly 30 percent higher than for adolescents living with both biological parents. Lower parental education and lower family income were also associated with an increased probability of poor academic performance. Finally, adolescents who failed at least one course at Wave I were nearly five times more likely to fail again at Wave II, compared to those who performed satisfactorily one year earlier. Health insurance and parental closeness were not significantly associated with course failure, once other factors were taken into account.

Mechanisms Underlying the Academic Risk of Health Problems

Now that we have established physical and mental health problems as potential risk factors for academic failure, we need to explain why this risk occurs. We attempted to do so by focusing on three potential mechanisms underlying the observed associations of physical and mental health problems with academic failure. When entered into the baseline models separately, absenteeism, trouble with homework, and individual-level teacher attachment each significantly predicted course failure, but only absenteeism, on its own, accounted for a significant proportion of the association between self-rated health and academic failure. None of these factors fully accounted for the observed association between emotional distress and course failure.

Model 4 in Panels A and B of Table 4 presents results of analyses in which the three potential mechanisms were included in the baseline models simultaneously. Taken together,

³We also ran the models presented in Table 3 with different indicators of academic failure, including failing two or more courses, grade point average, being held back between waves, and dropping out of school between Waves I and II. In these analyses, fair or poor self-rated health and emotional distress were significantly positively associated with multiple course failure at Wave II and significantly negatively associated with Wave II GPA, controlling for gender, race/ethnicity, age, health insurance, self-esteem, family structure, parental closeness, parent's education, family income, and Wave I achievement. Very few adolescents report being held back ($n = 180$) or dropping out of school between waves ($n = 407$), likely explaining why our measures of physical and mental health were not significantly associated with either of these outcomes.

⁴The odds ratio is the ratio between the probability of "success" (scoring "1" on the dependent variable) and the probability of "failure" (scoring "0" on the dependent variable). The odds ratio describes the odds of "success" associated with belonging to one group rather than another (belonging to the group of adolescents rating their health as fair or poor rather than belonging to the group of adolescents rating their health as good to excellent). In the case of a continuous predictor variable (e.g., emotional distress), the odds ratio refers to the odds of "success" associated with a one-unit change in the explanatory factor. When the probability of "success" is less than the probability of "failure", the odds ratio will be less than 1. When the probability of scoring "1" on the dependent variable is greater than the probability of scoring "0", the odds ratio will be greater than 1. When the odds ratio equals 1, the odds of "success" and "failure" are even (Powers and Xie 2000). Note that, counterintuitively, in this study "success" refers to failing at least one course while "failure" refers to passing all courses.

absenteeism, trouble with homework, and individual-level teacher attachment reduced the coefficient for self-rated health by more than 13 percent, while they accounted for approximately 66 percent of the association between emotional distress and course failure (obtained by calculating the percent change in each of the health coefficients once the mediator variables were entered into the model). Although the odds ratio for emotional distress remained significant, these analyses suggest that this set of mechanisms, encompassing multiple dimensions of academic functioning, partially explained the academic risk status of mental health problems. Students who felt bad or struggled with mental health problems were more likely to miss school, to have trouble concentrating on schoolwork, and to feel disconnected from adults in school (results not shown here); this configuration of factors disrupted their school performance.

Adolescent Health, Academic Failure, and School Context

Another important aspect of the epidemiological framework is protection—factors that moderate some risk status. Typically, studies of protection in social and psychological research have focused on interpersonal or individual factors, but this study considers a major social institution. In other words, we ask whether the risk status of physical and mental health problems is monolithic across institutional contexts or whether it varies as a function of institutional context. As explained above, we focused on the school environment as the institutional context that may moderate the association between health problems and academic failure. In particular, we considered three school characteristics, in-school health services, school-level student-teacher bonding, and school size.

Table 5 presents the results of analyses in which these three school characteristics, and their interactions with the physical and mental health variables, were included in the baseline models predicting academic failure. Overall, these analyses revealed no evidence to suggest that the association between self-rated health and course failure was conditioned by school structure or climate. Furthermore, our analyses offered very limited support for the contention that the association between mental health and academic failure was conditioned by school context. We found that adolescents with higher levels of emotional distress experienced a greater risk of failing at least one course at Wave II if they attended schools with higher, rather than lower, mean student-teacher bonding.⁵ The fitted probability of course failure is .18 for adolescents with high levels of emotional distress (defined as one standard deviation above the mean) who attend schools with low student-teacher bonding (defined as one standard deviation below the mean), while the fitted probability of course failure is .22 for adolescents with high levels of emotional distress who attend schools with high student-teacher bonding. For adolescents with low levels of emotional distress, the odds of course failure are approximately the same, regardless of the mean level of student-teacher bonding in their school (.15 in schools with low student-teacher bonding and .14 in schools with high student-teacher bonding).

Discussion

For adolescents, academic failure has many negative consequences, ranging from strained parent-adolescent relations in the short-term (Repetti 1996) to truncated educational attainment

⁵We reran these analyses using multi-level modeling, which corrects for the error structures that arise from cross-level interactions, such as those between individual- and school-level characteristics. When examining a dichotomous outcome variable, such as course failure, multi-level modeling techniques must be adjusted. In this case, it was necessary to use the Glimmix macro in SAS instead of the Mixed procedure. We chose to present the results from the survey logit models, rather than the multi-level models, because the data cannot be weighted in Glimmix. This is a serious problem for Add Health, given the inclusion of numerous over-samples (see Chantala and Tabor 1999 for more on the use of weights in Add Health). The multi-level models produced results nearly identical to those presented here, with one exception: the coefficient for the emotional distress*mean academic achievement interaction term was significant in the multi-level models but not in the survey logit models. Since this discrepancy may have been due to our inability to weight in Glimmix, we chose to focus only on those results that were found to be robust across estimation techniques.

in the long-term (Barrington and Hendricks 1989; Roderick 1993). Through these effects on collective individuals, academic failure also negatively affects society. Given what we know about long-term individual- and social-level consequences of academic failure in secondary school, an important goal of research is to understand the constellation of forces, both positive and negative, that underlie this social problem in order to identify ways in which social institutions can work together to better serve the needs of children, adolescents, and families.

In the present study, we have applied a social epidemiological framework to the study of academic failure in secondary school, one guided by a need to locate identifiable, manipulable risk factors and protective factors for this individual and social problem. In taking this approach, we have established physical and mental health problems as risk factors for academic failure and have addressed why and under what circumstances these health problems pose a risk to academic achievement.

Adolescent Health and Academic Failure

Establishing both physical and mental health problems as risk factors for academic failure is important for several reasons. First, it helps to move educational research into new areas, beyond academics. While previous research has begun to examine non-academic factors that contribute to academic problems, this is the first nationally-representative, longitudinal study to examine the role of physical and mental health problems in explaining academic failure in secondary school. Second, this basic finding suggests the need to study in tandem educational and health trajectories (or, pathways over time). Research on adult health and well-being finds that higher education predicts better health (Mirowsky and Ross 2003a). If child and adolescent health problems destabilize student trajectories through the formal schooling system, then the negative long-term association between educational attainment and adult health may be due, in part, to these early health problems. Third, establishing physical and mental health problems as risk factors for academic failure helps schools identify a population of at-risk students requiring special attention and possibly intervention, as has been done in the past for low-income students (Arroyo, Rhoad, and Drew 1999) and certain racial/ethnic groups (Gandara 2000).

Mechanisms Underlying the Academic Risk of Health Problems

Our analyses reveal that physical and mental health problems disrupt multiple aspects of students' lives in school and lead to negative consequences like excessive absenteeism, trouble completing schoolwork, and weak (individual-level) attachment to teachers. These negative consequences spill over and negatively affect their academic performance. This finding illustrates the complexity of human development in general and the complexity of schooling adolescents in particular. In order to reduce the risk associated with health problems, schools must attend to the whole student. This includes developing intervention strategies targeted at the problems that put physically and mentally ill adolescents at risk.

Adolescent Health, Academic Failure, and School Context

Risk factors are not inalterable, but instead likely vary across social contexts. These contexts offer different levels of protection and may even exacerbate the risks already present. This study focused on school context, aiming our analyses toward potentially protective schooling environments. Another important extension of the epidemiologic framework attempted by this study concerns the possibility that risk status varies with social context. We found only slight evidence to suggest that the association between health problems and course failure varies by schools, a finding that was counterintuitive.

Rather than serving as a protective factor, high levels of student-teacher bonding within a school heightened the risk of course failure among adolescents with mental health problems.

One possible explanation for this finding is that emotionally distressed students may feel especially isolated from teachers in environments with high student-teacher bonding. We tested this hypothesis, however, using the individual-level measure of teacher attachment and found no support for it. Future research should examine this finding more closely, since it implies that schools with a seemingly positive and protective climate may not effectively serve as a “safety net” for this particular group of at-risk students. This finding reveals the challenge to designing school interventions, in that selection effects mask apparent protective mechanisms, and programs designed to help may have unintended consequences.

Directions for Future Research

Cross-school, or cross-context, variability in the association between health problems and academic failure is potentially much greater than suggested by our findings. This has been the first study to consider this possibility, and much more can be done. We have examined only between-school factors and not within-school factors. Perhaps the real variation in the association between health and academic performance occurs across different subsets of the school environment—such as curricula, student activities, and peer networks. Although beyond the scope of this study, these possibilities can be addressed with the upcoming educational supplement to Add Health, which includes information from official school transcripts on course registration patterns, course content, and school environment.

At the same time, the examination of contextual variability in this and other risk-related processes can move beyond the school level, which is only one context in the larger ecology of human development. For example, family and neighborhood contexts have been found to contribute to physical and mental health in addition to academic achievement in adolescence, which could moderate the connection between health problems and academic performance (see Catsambis and Beveridge 2001 for an example of this approach). Of course, social structural subpopulations, such as racial and ethnic groups, also serve as social contexts, albeit of the more distal variety. Preliminary analyses have revealed little variation in these processes by gender. We do plan, however, racial/ethnic and class comparisons in the future. These different levels of social context are not isolated from each other. Consequently, future research should take into account how social contexts, both proximate and distal, interact to shape education and health, and the relation between the two. For example, future research might consider whether, if some school factors moderate the association between health problems and academic failure, this moderating role itself might be moderated by race/ethnicity.

Another important avenue of future research, already mentioned, concerns the need to study educational and health trajectories within and across different stages of the life course and, moreover, the degree to which such trajectories intertwine over time. For example, linking together early health status, adolescent academic failure, and later health problems is a necessary first step in linking youth and adult literatures; comparing the academic risk status across three stages of schooling (elementary, secondary, college) would also be valuable. At the same time, examining the extent to which trajectories of health problems and academic problems are interrelated across the transition to young adulthood would demonstrate the interaction among dynamic developmental trajectories in multiple domains.

Concluding Remarks

Surprisingly little research has considered the possibility that education and health, two key developmental domains of the early life course, are related to each other during adolescence. As one of the first studies to explore this possibility in a national-level quantitative framework, this preliminary study provides answers to some old questions but, simultaneously, presents new questions. Our use of the social epidemiological framework to better understand one key adolescent problem suggests that the general study of social problems can benefit from

considering how multiple domains of adjustment and functioning come together within a complex tapestry of social contexts, at both the micro- and macro-levels. This study also demonstrates how adolescent research fits into the broader area of social problems. Adolescent phenomena are important because they potentially reveal the origins of social inequalities in later stages of the life course or in society as a whole. Finally, the significance of this study is practical as well as conceptual. Identifying academic risks and the contexts in which these risks are exacerbated or assuaged helps tailor interventions for particular student groups and promote the overall functioning of the educational system.

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Table 1

Descriptive Statistics for Each Stage of the Sample Selection Process

	Full Wave I	Filter 1	Filters 1-2	Filters 1-3	Filters 1-4
Demographic Characteristics					
Female	.51	.51	.51	.51	.53
Race/Ethnicity					
White	.50	.51	.52	.52	.52
Black	.23	.22	.22	.22	.22
Latina/o	.17	.17	.16	.16	.17
Other	.10	.10	.10	.10	.10
Parent's Education					
Less than high school	.13	.12	.11	.11	.11
High school	.28	.28	.27	.27	.27
More than high school	.60	.60	.62	.62	.62
Family income (in \$1,000s)	45.73	46.06	46.90	47.24	46.66
Health Measures					
Fair or poor self-rated health	.07	.07	.07	.07	.06
Emotional distress	11.39	11.33	10.97	10.93	10.78
Academic Course Failure					
Course failure (Wave I)	.33	.33	.32	.32	.31
n	20,745	14,738	12,926	11,969	10,988

Note: All statistics are means. Filter 1 narrowed the sample to adolescents in Waves I and II, Filter 2 to adolescents in school in Waves I and II, Filter 3 to adolescents with valid sampling weights, and Filter 4 to adolescents who did not receive any special education services in the 12 months prior to Wave I.

Table 2

Descriptive Statistics for All Study Variables

	Mean (SD)	Proportion
Academic course failure		
Failed at least one course (Wave I)	—	.31
Failed at least one course (Wave II)	—	.29
Physical and mental health		
Self-rated health (1 = fair or poor)	—	.06
Emotional distress	10.78 (7.30)	—
Mediators		
Absenteeism		
≥10 Excused absences	—	.11
≥10 Unexcused absences	—	.04
<10 absences	—	.85
Trouble with homework	1.14 (1.03)	—
Teacher attachment	3.73 (.74)	—
School factors		
Health services (1 = offered)	—	.18
Mean student-teacher bonding	2.92 (.17)	—
School size (1 = <900 students)	—	.51
Characteristics of adolescents		
Female	—	.53
Race/ethnicity		
White	—	.52
Black	—	.22
Latina/o	—	.17
Other	—	.10
Age (in years)	15.99 (1.51)	—
Self-esteem	28.67 (4.07)	—
Family characteristics		
Family structure (1 = non-intact)	—	.41
Parental closeness	4.54 (.78)	—
Parent's education		
Less than high school	—	.11
High school	—	.27
More than high school	—	.62
Family income (in \$1,000s)	46.66 (45.61)	—
Health insurance	—	.88
n = 10,988		

Table 3

Odds Ratios for Logistic Regression of Course Failure at Wave II on Self-Rated Health and Emotional Distress

	Model 1	Model 2
Health		
Self-rated health (1 = fair or poor)	1.34 (.19)*	—
Emotional distress	—	1.03 (.01)***
Characteristics of adolescents		
Female	.57 (.05)***	.56 (.05)***
Race/ethnicity		
Black (vs. White)	1.47 (.16)***	1.41 (.16)**
Latina/o (vs. White)	1.10 (.13)	1.07 (.13)
Other (vs. White)	1.01 (.15)	.98 (.15)
Age (in years)	.89 (.02)***	.88 (.02)***
Self-esteem	.96 (.01)***	.97 (.01)**
Family characteristics		
Non-intact family structure	1.29 (.09)**	1.28 (.09)**
Parental closeness	.93 (.04)	.95 (.04)
Parent's education		
Less than high school (vs. more than high school)	1.62 (.24)**	1.55 (.24)**
High school (vs. more than high school)	1.50 (.13)***	1.47 (.13)***
Family income (in \$1,000s)	.99 (.00)**	.99 (.00)**
Health insurance	1.05 (.12)	1.04 (.12)
Academic course failure		
Failed at least one course (Wave I)	4.76 (.36)***	4.63 (.34)***
n	10,873	10,873

Note: Standard errors are in parentheses.

*
p < .05**
p < .01***
p < .001.

Table 4

Odds Ratios for Logistic Regression of Course Failure at Wave II on Self-Rated Health, Emotional Distress, Absenteeism, Trouble with Homework, and Teacher Attachment

	Panel A				Panel B			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Health								
Fair or poor self-rated health	1.29 (.18)	1.33* (.18)	1.33* (.19)	1.29 (.18)	—	—	—	—
Emotional distress	—	—	—	—	1.02*** (.01)	1.02** (.01)	1.02** (.01)	1.01* (.01)
Mediators								
Absenteeism								
≥10 Excused absences	1.38*** (.11)	—	—	1.29** (.11)	1.37*** (.11)	—	—	1.30** (.11)
(vs. <10 absences)								
≥10 Unexcused absences	1.26 (.22)	—	—	1.01 (.17)	1.23 (.21)	—	—	1.02 (.17)
(vs. <10 absences)								
Trouble with homework	—	1.28*** (.05)	—	1.22*** (.05)	—	1.25*** (.04)	—	1.21*** (.04)
Teacher attachment	—	—	.71*** (.03)	.76*** (.03)	—	—	.73*** (.03)	.78*** (.03)
n	10,873	10,873	10,873	10,873	10,873	10,873	10,873	10,873

Note: Standard errors are in parentheses. All models controlled for gender, race/ethnicity, age, self-esteem, family structure, parental closeness, parent's education, family income, health insurance, and prior course failure.

*
p < .05

**
p < .01

p < .001.

Table 5

Odds Ratios for Logistic Regression of Course Failure at Wave II on Self-Rated Health, Emotional Distress, and Student-School Interaction Terms

	Panel A			Panel B		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Health						
Fair or poor self-rated health	1.25 (.19)	1.80 (3.85)	1.09 (.24)	—	—	—
Emotional distress	—	—	—	1.03*** (.01)	.84* (.07)	1.03*** (.01)
School factors						
Health services	1.20 (.16)	—	—	1.42 (.46)	—	—
Mean student-teacher bonding	—	1.23 (.29)	—	—	.57 (.21)	—
School size	—	—	.99 (.12)	—	—	.99 (.16)
Student-school interaction terms						
Health × health services	1.62 (.42)	—	—	.99 (.02)	—	—
Health × mean student-teacher bonding	—	.91 (.66)	—	—	1.07* (.03)	—
Health × school size	—	—	1.36 (.38)	—	—	1.00 (.01)
n	10,873	10,873	10,873	10,873	10,873	10,873

Note: Standard errors are in parentheses. All models controlled for gender, race/ethnicity, age, self-esteem, family structure, parental closeness, parent's education, family income, health insurance, and prior course failure.

*
p < .05

**
p < .01

p < .001.