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Childhood Disability and Educational Outcomes: A Systematic Review

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ABSTRACT

Problem: Graduation from high school is an important milestone for all adolescents and affects future health in adulthood. Children with chronic illnesses have additional challenges that affect school attendance, grade retention and graduation. If children with chronic conditions are not able to participate fully in education, this may limit their opportunities for future health. The aim of this study was to integrate the evidence in the past 28 years about educational outcomes of children and adolescents with chronic conditions causing disability.
Eligibility criteria: Quantitative studies reporting on a chronic condition and attendance, grade retention, or high school graduation, from a peer-reviewed journal in the English language, data collection since 1990, and research conducted with a population in the United States were eligible for review.
Sample: Forty-three studies from a literature search of CINAHL, MEDLINE, ERIC, Teacher Reference Center, Psychology & Behavioral Science Collection, and Academic Search Elite databases, followed by ancestry searches, were included in this review.
Results: In general, chronic conditions are significantly associated with increased absenteeism, grade repetition and not completing high school within four years, although hemophilia does not follow this pattern. Additionally, increased severity of the condition is associated with poorer educational outcomes.
Conclusions: Nurses and other healthcare providers should include an educational assessment as part of psychosocial assessment of children and adolescents to identify risk, intervene early and limit risk.

Introduction

Disability is a long-term limitation in an individual's ability to fulfill their social role, such as being a student (Newacheck & Halfon, 1998). Students with disabilities are eligible for special education services and accommodation through an Individual Education Plan or a 504 Plan, respectively (Office of the Assistant Secretary for Administration and Management, 1973; United States, 2004). During the 2014–15 school year, 13% of all public school children in the United States, 6.6 million, received special education services due to a disability (McFarland et al., 2017). This number only includes students who have a disability requiring special education services. Often children and adolescents with chronic conditions do not need special education, but do need services that are not special education such as access to medication, flexibility to use bathrooms and other accommodations which are available through a 504 Plan. Students with chronic conditions have a high risk of poor school performance compared to those without chronic conditions (Crump et al., 2013; Maslow, Haydon, McRee, Ford, & Halpern, 2011).

Findings from previous research studies (Maslow et al., 2011; Smith, Patterson, Szabo, Tarazi, & Barakat, 2013; Wesley, Zhao, Carroll, & Porter, 2016) have proposed that for children with a chronic illness, the causal mechanisms for poor educational outcomes are likely school absenteeism (due to pain, fatigue, crisis) affecting a child's development and educational success, low parental educational attainment, cognitive effects of the disease due to chronic anemia and limited access to education and other resources. This discussion is particularly salient as widening gaps in the health outcomes of children lead, through reduced access to education, to adult socioeconomic disparities in health (Fitzpatrick et al., 2015; Freudenberg & Ruglis, 2007; Hertzman & Boyce, 2010).

Adult socioeconomic disparities related to high school graduation

People who do not obtain a high school diploma are more than two times as likely to report poor health as those who hold that credential or a higher one (Lansford, Dodge, Pettit, & Bates, 2016). Not completing high school is associated with increased risk, in adulthood, of diabetes, cardiovascular disease, asthma, substance use, and federally-qualified disability (Kubota, Heiss, MacLehose, Roetker, & Folsom, 2017; Maynard, Salas-Wright, & Vaughn, 2015; McFarland et al., 2017; Vaughn, Salas-Wright, & Maynard, 2014). These conditions affect the quality of life, job

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prospects, available resources to manage health, and family lives of individuals as well as their communities (Lansford et al., 2016).

In combination with significant health risks to individuals of not graduating from high school, there are economic costs for them. Economic costs to individuals who do not graduate from high school include a lower annual income (i.e. less than $20,000 per year) and less job stability (Lansford et al., 2016; Semega, Fontenot, & Kollar, 2017; Vaughn et al., 2014). Lower income and job instability affect the resources that are available for health care and access to healthy foods, lifestyles and housing.

The significant sequelae of not graduating from high school make this a priority area for health promotion and illness prevention. An understanding of the outcomes of high school graduation, and precursors of attendance and grade retention, for children and adolescents with chronic conditions is necessary to conduct an adequate assessment of risk in this population. And based on nursing assessment, plan interventions to promote educational success. The purpose of this review is to integrate the evidence collected since 1990 of educational outcomes of attendance, grade repetition and high school graduation in U.S. children in primary and secondary school with chronic conditions creating disability.

Method

Data sources and selection criteria

The following databases were searched from January 1, 1990 until June 25, 2018: Cumulative Index of Nursing and Allied Health Literature (CINAHL), MEDLINE, Educational Resources Information Center (ERIC), Teacher Reference Center, Psychology & Behavioral Science Collection, and Academic Search Elite. Titles and abstracts were searched with a combination of keywords: (absent* OR attendance OR "grade promotion" OR "grade retention" OR "grade repetition" OR graduation OR dropout) AND disability OR chronic condition OR chronic illness OR "sickle cell disease" OR seizure* OR "traumatic brain injury" OR "brain injury" OR heart OR cardiac OR lung OR pulmonary OR epilepsy OR genetic OR muscul* OR endocrin*. In addition to database searches, a reference librarian was consulted, backward searches of included article references, and forward searches of articles citing those identified by databases were used extensively due to the limited number of articles identified through the database search.

Inclusion and exclusion criteria

Studies were included if they reported on a chronic condition or disability and one or more of the following outcomes: absenteeism, attendance, grade repetition, grade promotion, high school graduation, or dropout. Other inclusion criteria were quantitative or mixed methods research design, limited to school-age children (5–21 years for the majority of U.S. States (National Center for Education Statistics, 2017)), from a peer-reviewed journal, in the English language, data collection since 1990, and research conducted with a population in the United States. The search was limited to data collected in the past 28 years and in the United States due to the changing outcomes of failure to graduate from high school and the social and educational contextual differences during the 1980's and earlier within the United States (Heckman & LaFontaine, 2010). Excluded studies were conducted in countries outside the United States where the opportunities, educational and social contexts are not necessarily transferable to the United States. Reviews, doctoral theses, case-studies, conference papers and abstract-only papers were also excluded. Finally, studies that measured chronic illness as self- or caregiver-reported poor health were excluded due to the lack of specificity of this measure. Fig. 1 is a PRISMA diagram of the selection process.

Quality appraisal

The first step in quality appraisal of the included articles was assessment for adherence to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) recommendations using the combined STROBE checklist (von Elm et al., 2014). Studies were considered to have strong adherence to the recommendations if all but two

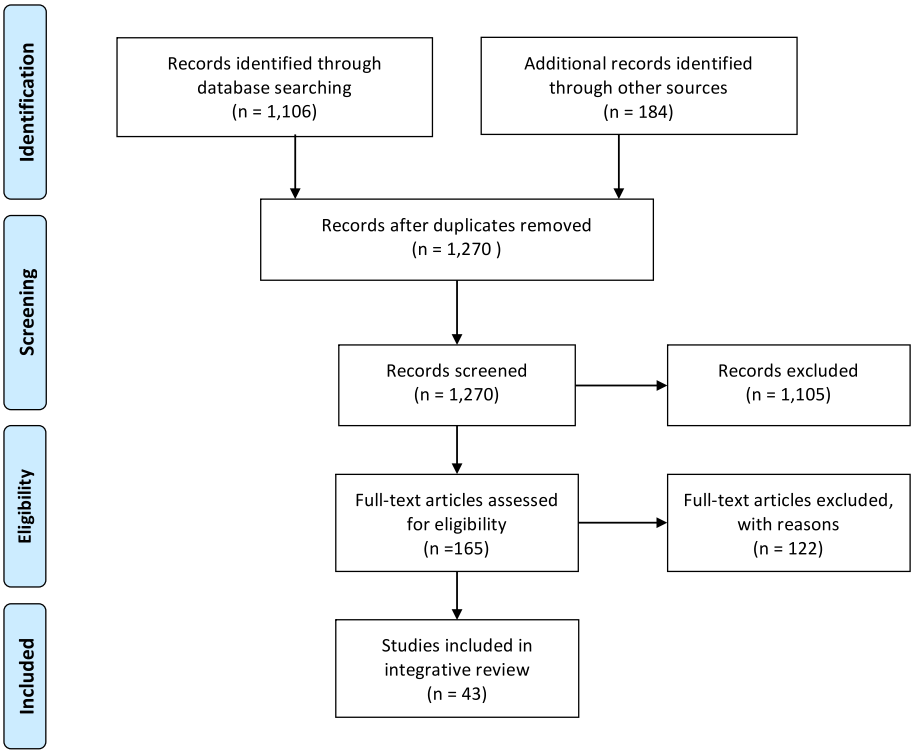

Fig. 1. PRISMA 2009 flow diagram.

guidelines were addressed, and if four or fewer were partially adhered to. Studies were considered to have weak adherence to the recommendations if three or more guidelines were not addressed and more than four guidelines were not fully addressed. To assess for risk of bias of individual studies, the Newcastle-Ottawa Scales (Wells et al., n.d.) were used for cohort and case-control studies, and the Newcastle-Ottawa Scale adapted for cross-sectional studies (Herzog et al., 2013) was used for that study design. These scales have nine points possible and studies that met five or more of the items were considered to have a low risk of bias, and those with fewer than five points or those with no points in the outcomes section, were considered to have a high risk of bias.

Results

Forty-three articles using data from 42 different studies met inclusion criteria. Of these forty-three reports, there were 17 cross-sectional studies, 15 cohort studies and 11 case-control studies (see Tables 1–3). Strong adherence to the STROBE recommendations was evident in 33 study reports, and weak adherence to the recommendations was identified in ten study reports (See Table 4). Use of the Newcastle-Ottawa Scale revealed a low risk of bias in all but 5 studies (see Table 5). Sample sizes varied between 36 (Hansen, Weiss, & Last, 1999) and 99,513 (Newacheck & Halfon, 1998) and generally smaller samples were set in illness-specific specialty centers and the largest samples used data from national longitudinal surveys such as National Longitudinal Survey of Youth 1997 (NLSY-97) and the National Longitudinal Study of Adolescent to Adult Health (Add Health). Newacheck and Halfon (1998) estimated the population prevalence of disability, defined as "long-term reduction in ability to conduct social role activities", as 6.5% of all children under the age of 18 (p. 610). Using a similar definition of disability, Shandra and Hogan (2009) estimated prevalence at 13%. Population samples that calculated prevalence of chronic conditions varied between 12.7% (Crump et al., 2013) and 22% (Champaloux & Young, 2015). The fact that not all chronic conditions cause disability, addresses some of the discrepancy between the prevalence of disability and the prevalence of chronic conditions. In addition, Crump et al.' (2013) study used a sample from one large, urban school district in California, while Champaloux and Young used national data.

The majority of studies in this review were conducted since the year 2000. Twenty-four studies had a measure of absenteeism or attendance, 10 had a measure of grade repetition, and 16 studies had a measure of high school completion (see Tables 1–3). Within this group of studies, educational outcomes were measured differently. For example, studies of certain conditions, such as behavioral and emotional disorders, used the measure of graduation or dropout of high school predominantly with few measures of absenteeism or grade repetition. Most studies of physical chronic conditions used measures of absenteeism, but fewer measured grade repetition or graduation. The remainder of this section will discuss findings from individual studies. First, studies that evaluated absenteeism or attendance will be discussed, followed by studies evaluating grade repetition. Then studies of completion of high school will be discussed. The studies in this review primarily evaluated one educational outcome only, and where multiple educational outcomes were evaluated, the results are discussed in the relevant sections. Finally, the results will be summarized and limitations identified.

Absenteeism

Absenteeism was a commonly reported educational outcome in this pool of studies. Children with chronic conditions causing disability were found to miss an average of six school days per year in Newacheck and Halfon's (1998) study, and 23% of the sample between five and 17 years of age had a disability which limited school attendance. Other studies measured the percentage of children missing school to estimate differences between groups: Reuben and Pastor (2013) identified 18% of children with complex health care needs missed school days, compared to 6.5% of children with health care needs requiring a prescription only, and 3.6% of control subjects. Crump et al. (2013) found that children with chronic conditions had more absenteeism than those without (Adjusted Incidence Rate Ratio 1.3, CI [1.26–1.35], $p < .001$) and that students with mental disorders had the highest absence rates. In adolescents with chronic pain (n = 217), levels of depressive symptoms were found to predict school absences (Logan, Simons, & Kaczynski, 2009). Studies of chronic illnesses such as asthma, diabetes and liver transplant among others, often measured the outcome of absenteeism.

Asthma

Asthma is one of the most common chronic illnesses of childhood and a leading cause of school absenteeism (Centers for Disease Control and Prevention, 2017). In a sample of students with symptomatic asthma (n = 905), over half missed one or more days due to asthma, and almost 90% were absent at least one day compared to just 71% of children without asthma (n = 13, 830) (Akinbami, Parker, & Merkle, 2010). Meng, Babey, and Wolstein (2012) reported that almost 23% of students with asthma (n = 1276) had at least one absence due to asthma, a percentage less than half of Akinbami et al. (2010). Regional differences may account for this since Meng et al. used a sample from the California Health Interview Survey, which is geographically limited, while Akinbami et al., used the National Health Interview Survey data.

In a study of over 9000 students in St. Louis, Missouri, in which <10% had asthma (n = 770), students with asthma missed 1.5 more days of school per year than those without ($p = .006$) (Moonie, Sterling, Figgs, & Castro, 2006). In a second study, Moonie, Sterling, Figgs, and Castro (2008) reported that as the severity of asthma increased, the average number of days missed also increased, such that students with persistent asthma missed more days than those with mild intermittent asthma. Although the difference in absences between students with and without asthma was <2 days per year in these studies, the increased absences in those with persistent asthma may cause significant time away from school and thus, falling behind in coursework increasing their risk of not graduating. All of the studies in this section controlled for race and two controlled for socioeconomic status (Akinbami et al., 2010; Meng et al., 2012).

Diabetes

Diabetes in children and adolescents requires management in school settings to maintain blood sugar levels within a normal range (National Diabetes Education Program, 2016). When students experience hypoglycemia or hyperglycemia, the symptoms affect their ability to pay attention in class, think, and learn, in addition to serious risks to health (McCarthy, Lindgren, Mengeling, Tsalikian, & Engvall, 2002). In two reports of students with Type 1 diabetes (n = 244), McCarthy et al. (2002); McCarthy, Lindgren, Mengeling, Tsalikian, and Engvall (2003) evaluated associations between diabetes and school absences. When compared to healthy siblings (n = 110), students with diabetes (n = 244) missed an average of 2 more school days per year (McCarthy et al., 2002). There were no differences in grade repetition between the groups. In a second study evaluating only the students with diabetes, school absences were not correlated with glycemic control (McCarthy et al., 2003). Parent, Wodrich, and Hasan (2009) found similar results in their study of children with diabetes (n = 95) and healthy sibling controls (n = 95): children with diabetes missed 18 days of school per year compared to seven and a half days per year in healthy siblings ($p < .001$). When comparing the sample of children treated with conventional diabetes therapy to those receiving intensive therapy, no relationship between absenteeism and glycemic control was observed. Champaloux and Young (2015) evaluated diabetes as part of a group including cancer and epilepsy and found that 20% of subjects with these conditions did not graduate or earn their general educational development certificate (GED) by 21 years of age and that school absences, grade repetition and depressive symptoms were mediators of

Table 1
Studies of disability and education outcomes.

Authors	Disability	Study design	Education variables evaluated	Sample characteristics	Academic outcome/primary/secondary
Champaloux and Young (2015)	Chronic Health Conditions (CHC) asthma, cancer, diabetes, epilepsy, heart condition, other conditions	Cohort	Absences, grade repetition, graduation or GED attainment by 21 years of age	National Longitudinal Study of Youth-cohort 1997 (NLSY-97) N = 6795	Did not graduate or earn a GED by 21 years of age: 12% of subjects without a CHC 15% of subjects with a CHC (OR 1.47, CI [1.22–1.76]) 17% of children with asthma (OR 1.63, CI [1.31–2.02]) 20% of subjects with cancer, diabetes and epilepsy (OR = 1.96, CI [1.13–3.37]) For cancer, diabetes, and epilepsy: school absences, grade repetition and depressive symptoms were mediators of low educational attainment
Crump et al. (2013)	Chronic Health Conditions asthma, ADHD, epilepsy, heart problems, diabetes mellitus	Cohort	Absenteeism	San Jose Unified School District 2007–2010 school years (52 schools) N = 22,730 students	Those with CHC had higher absenteeism than those without CHC Students with mental disorders had highest absenteeism rates
Maslow et al. (2011)	Chronic illness (cancer, diabetes mellitus, heart disease, epilepsy)	Cohort	Educational attainment	The National Longitudinal Study of Adolescent to Adult Health (Add Health) data set of 13,965 in Wave I and IV, 2.2% respondents had child-onset chronic illness (n = 295) and 13,136 without child onset chronic illness	8.1% of students without CHC and 12.9% of students with CHC achieved less than a high school degree; 20.1% of students without CHC, 29.5% of students with CHC achieved a high school degree or GED 92% of students without CHC, 87.1% with CHC attained a high school degree/GED or more education ($p < .001$)
Newacheck and Halfon (1998)	Children with chronic conditions causing disability	Cross-sectional	Absenteeism	National Health Interview Survey 1992–1994 Total: n = 99,513 children <18 years old	23% of children 5–17 years old had a limitation in school attendance due to disability. For all activity limiting conditions, children in the sample missed an average of 6.2 days per year.
Reuben and Pastor (2013)	Children with special health care needs	Case-control	Absenteeism, grade repetition	National Survey of Children's Health - 2007 Total: n = 59,440 Complex-CSHCN N = 7935 (13% of total) Prescription only CSHCN n = 5811 (9% of total) Control N = 45,694	Missed school days: 18.1% of complex CSHCN, 6.5% of CSHCN requiring prescription only, versus 3.6% of control subjects. Complex CSHCN were more likely to have missed school days compared to controls, adjusted Risk Ratio = 4.4 ($p < .001$) Grade Repetition: More complex CSHCN were more likely to have repeated grade compared to controls, adjusted Risk Ratio = 2.5 ($p < .001$)
Shandra and Hogan (2009)	Disability	Cohort	Absenteeism, grade repetition, high school graduation by 22 years of age	NLSY1997 and 2003 N = 2239	10%(SD = 29.7) had mild disability, 3.2% (SD = 17.6) had serious disability. Students with serious disability, when other variables controlled for, are 50% less likely to graduate than those without disability
Wisk and Weitzman (2017)	Chronic medical condition	Cohort	High school graduation or earned GED	Panel Study of Income Dynamics N = 2555	Educational attainment by CHC: Sample total: 5% didn't graduate high school 14.9% graduated high school 80.1% had more education than high school CHC diagnosed before or at 14 years old: 6.5% didn't graduate, 17.2% graduated high school, 76.3% had more education than high school CHC diagnosed after 14 years old: 2.7% didn't graduate, 10.7% graduated high school, 86.6% had more education than high school Sample without CHC: 3.6% didn't graduate, 13.2% graduated high school, 83.2% had more education than high school (all above $p < .001$) When confounders were entered into the longitudinal model, the educational attainment of subjects with CHC was not significantly different than subjects without CHC Developmental/learning disability (n = 596) (OR = 0.30, CI [0.13–0.7])

CHC: Chronic Health Condition; CSHCN: Children with Special Health Care Needs; OR: Odds Ratio; CI: 95% Confidence Interval;

Table 2
Studies of learning, mental or emotional disorders and educational outcomes.

Authors	Disability	Study design	Education variables evaluated	Sample characteristics	Academic outcome/primary/secondary
Breslau et al. (2008)	Mental disorders	Cross-sectional	Graduation from high school	National Comorbidity Survey Replication (NCS-R) data set that is nationally representative, multi-stage, clustered area probability sample of adults 18 and over N = 5691 case	Of those completing primary school, 14.3% did not complete high school. Compared to having no mental disorder, having one did not increase odds of not graduating high school, but having two or more mental disorders increased odds of not graduating
Breslau et al. (2011)	Mental disorders	Cross-sectional	Graduation from high school in 4 years	National Epidemiologic Survey on Alcohol and Related Conditions Waves 1 & 2 (n = 29,662 for this sample)	16.9% sample didn't complete high school on time, of the 73.2% without mental disorder, 15.2% didn't graduate on time. Percentage of students not graduating on time: 18.1–26.6% internalizing disorders, 26.6–32.3% externalizing disorders, 19.5–24% Substance use, 20.5–29.1% Substance use disorders
Fletcher (2008)	Depression	Cohort	High school dropout	Add Health data set (n = 13,000) with education and mental health outcomes	Depression at Wave 1 was associated with high school dropout at Wave 3 ($p = .022$)
Hansen et al. (1999)	ADHD	Cohort	High school graduation	ADHD identified in childhood (n = 18), No psychiatric illness (n = 18)	No significant differences between ADHD group and no psychiatric illness group for graduation from high school or earning GED
McLeod and Kaiser (2004)	Mental health and behavior problems	Cohort	Grade repetition, high school graduation	NLSY – 5 waves of data that were 6–8 years old in 1986, 20–22 years old in 2000 N = 424	Both internalizing and externalizing behaviors in childhood have a significant negative relationship with high school graduation, even when multiple confounders were controlled for. Both internalizing and externalizing behaviors in childhood predicted grade repetition and grade repetition in grades 5–7 or grades 9–11 had a significant negative relationship with high school graduation. Socioeconomic disadvantage didn't explain the association and continuing emotional or behavioral problems didn't explain much of the association. Grade repetition in middle and early high school were strong mediators of graduation
McLeod et al. (2012)	Mental health and behavior problems	Case-control	Educational attainment	7–12th grade students (n = 6315) from Add Health data set approximately 29% had one mental health problems, approximately 20% had more than one mental health problem	Predictors of lower educational attainment were depression, attention problems, delinquency, and substance use. Youth who experienced more than one mental health problem generally achieved a lower degree
Murphy et al. (2002)	ADHD	Case- control	High school graduation	ADHD-Inattentive (n = 36), ADHD-Combined (n = 60) Control (n = 64) in the Northeastern U.S.	No significant difference in graduation from high school between ADHD-Inattentive or ADHD-Combined or controls.
Redmond and Hosp (2008)	Communication disorder, learning disability, emotional disturbance	Case-control	Absenteeism	Kindergarten-4th grade sample n = 133(63 students with communication disorders, 70 control subjects) 5th -9th grade sample n = 107 (Communication disorder = 28, learning disability = 28, emotional disturbance = 26, control subjects = 25) in Intermountain West region	In children Kindergarten-4th grade, there were increased absences in Kindergarten which decreased in 1st-3rd grades. In grades 1–4, children with communication disorders were absent more than other groups. ($F(12, 392) = 1.790$, $p = .048$, $\eta^2 = 0.052$)
Rojewski (1999)	Learning disability (LD)	Cohort	Graduation rate	National Educational Longitudinal Study 1988–1994, national probability sample. Sample was 19–21 years old at final data collection stage. N = 11,178 (included 441 young adults with LD)	In this sample, men with LD graduated high school at a lower rate than men without (81.2% vs. 90%), while women with LD had a 68% graduation rate and women without had a 91.9% graduation rate.
Schifter (2011)	Disability	Cohort	Years to graduation or dropout	NLTS2, 2010 - Followed from 2001 to 2010 N = 11,500 13–16 yo receiving Special education, 1250 in each Disability category except 1012 with autism, 559 with traumatic brain injury, and 122 with Deaf-Blindness	Median time to grad: Sensory impairment (4.7 years) orthopedic impairment (4.85 years), traumatic brain injury (5.19 years), Deaf-Blindness (5.33 years), learning disability had the lowest estimated time to graduation (mean 4.57 years), deaf-blindness had the highest estimated time to graduation (mean 5.33 years) Within 8 years after entry into high school, 14.5% of students with sensory impairment hadn't graduated, 26.8% of students with deaf-blindness, over 40% of students with emotional disturbance, autism and multiple disabilities hadn't graduated after 8 years.

(continued on next page)

Table 2 (*continued*)

Authors	Disability	Study design	Education variables evaluated	Sample characteristics	Academic outcome/primary/secondary
Schifter (2016)	Disabilities identified in Individuals with Disabilities Education Act	Cohort	High school graduation within 7 years of starting high school	Statewide Massachusetts Data between 2005 and 2012 n = 36,507	High prevalence disabilities (learning disability or speech/language impairment) had an 81.1% graduation rate. Emotional disturbance 52.3%, intellectual disability 36.6%, other health impairment or neurological disability 69.5% Sensory (hearing, vision or physical) Low prevalence disabilities (Autism, multiple disabilities, Deaf-blindness 33.7%)
Zablocki and Krezmien (2013)	Disabilities identified in Individuals with Disabilities Education Act	Cohort	High school dropout, grade repetition	NLTS2, first 3 waves of data N = 5928, 13–17 year old with disabilities	A 12.5% dropout rate across the sample, 11.3% of students with learning disability, 9.6% of students with mental retardation, 26.7% of those with emotional disturbance, 14.2% of those with other health impairment and 8.5% of those with speech impairment. Students who had been retained in a grade had over twice the risk of dropping out (OR = 2.34, $p < .001$)

OR: Odds Ratio; CI: 95% Confidence Interval.

this lower graduation rate. The studies about diabetes and educational outcomes are consistent in their findings that students with diabetes miss more school which is a mediator of failure to complete high school.

Liver transplant

Sorensen et al. (2011) evaluated children who had received a liver transplant prior to 5 years of age and found that 55% of the children had been absent more than five days in the preceding year (25% missed 11 or more days). Gilmour, Sorensen, Anand, Yin, and Alonso (2010) also found that almost a third (32.8%) of their sample with liver transplants missed >10 days of schools and 11% missed over 30 days. Children who were older or had a shorter duration since transplant were more likely to have missed over 10 days (Gilmour et al., 2010). Missing school days limits the student's opportunities to engage in social and educational development with their peers.

Other chronic conditions

The effect or association of many other health conditions and educational outcomes has been studied, but less commonly. In a study of communication disorders, learning disabilities and emotional disturbance in kindergarten to fourth grade students, children with communication disorders were absent more than children with either learning disabilities or emotional disturbance (Redmond & Hosp, 2008). In children (n = 83) with bowel or bladder incontinence, 28% of children missed 6–10 days of school, and another 28% missed 11 or more days compared to just 17% missing >6 days in the National Health Interview Survey (Filce & LaVergne). Mackner, Bickmeier, and Crandall (2012) reported that the population of adolescents with inflammatory bowel disease (n = 50) had significantly more absences than healthy adolescents (n = 42). The same pattern of more missed school days was found in children with cancer (Noll et al., 1999), chronic kidney disease (Duquette, Hooper, Wetherington, Icard, & Gipson, 2007), chronic pain (Agoston, Gray, & Logan, 2016), cystic fibrosis (Grieve et al., 2011), and dental disease (Seirawan, Faust, & Mulligan, 2012) than in healthy controls. Bleeding episodes were correlated with school absenteeism in boys with hemophilia (n = 126) (Shapiro et al., 2001) reinforcing previous research demonstrating severity of condition is positively correlated with absenteeism.

Sickle cell disease did not follow the same pattern of poorer educational outcomes for those with the condition compared to those without. Richard and Burlew (1997) found no differences in grade repetition or absenteeism between children with sickle cell disease (n = 42) and control subjects (n = 26) matched by race and socioeconomic status which points to the importance of race and socioeconomic status on absenteeism. In a cross-sectional study of students with sickle cell disease (n = 40), students missed an average of 12% of the school year, and over a third (37.5%) missed 20 or more days of school (Schwartz, Radcliffe, & Barakat, 2009).

Summary

In this section most chronic conditions are associated with increased absenteeism compared to healthy control subjects. Absenteeism was a common outcome of most chronic conditions, and the severity of illness was linked to more days of school missed (Moonie et al., 2006; Reuben & Pastor, 2013; Shapiro et al., 2001).

Grade repetition

Two studies discussed in the previous section (McCarthy et al., 2002; Richard & Burlew, 1997) evaluating both absenteeism and grade repetition found no relationship between chronic illness and grade repetition. Grade repetition was reported in only one study of aggregate chronic conditions: In a nationally representative sample of children with disabilities using data from the NSLY97, 21% of the sample had repeated a grade (Shandra & Hogan, 2009). Grade repetition is associated with specific chronic illnesses: Epilepsy, liver and kidney disease (Bailet & Turk, 2000; Duquette et al., 2007; Huberty, Austin, Risinger, & McNelis, 1992; Kennard et al., 1999) which are discussed below.

Epilepsy

Epilepsy can cause brain cell death through hypoxia which can alter a student's ability to engage in learning through attention problems and lowered intelligence, in addition to the effects of medications limiting engagement with learning (Bailet & Turk, 2000). In a sample of children with epilepsy (n = 74), their siblings without epilepsy (n = 23) and children with migraine (n = 13), children with epilepsy had a higher rate of grade repetition (34%) compared to the sibling control group (13%), but not compared to children with migraine (38%), although no significance data was provided (Bailet & Turk, 2000). The authors excluded children from the sample who had increased risks for educational problems such as abnormal brain scans or coexisting medical conditions. Huberty et al. (1992) found that almost 40% of children had repeated at least one grade in their study of children with epilepsy (n = 136). This research demonstrates that this population of students is at risk for grade repetition which may affect graduation rates such as those found by Champaloux and Young (2015).

Liver and kidney conditions

Children who had received a liver transplant also had high rates of grade repetition and absenteeism. Kennard et al. (1999) conducted a study of long-term (3–9 years) survivors of pediatric liver transplant

Table 3
Studies of physical chronic conditions.

Authors	Disability	Study design	Educational variables evaluated	Sample	Academic outcome/primary/secondary
Asthma					
Akinbami et al. (2010)	Asthma	Cross-sectional	Asthma-related absenteeism	2002–2003 National Health Interview Survey (n = 905 5–17 year olds with asthma diagnosis and greater than or equal to one asthma attack per year) and (n = 13,830 children without asthma)	58.6% of subjects with symptomatic asthma had ≥1 day of absence per year due to asthma and 88.9% had missed ≥1 total absence days compared to 71.4% of children without asthma ($p < .001$)
Champaloux and Young (2015)	Chronic Health Conditions (CHC) asthma	Cohort	Absenteeism, grade repetition	National Longitudinal Study of Youth-cohort 1997 (NLSY-97) N = 6795	17% of students with asthma did not graduate or earn a GED by 21 years of age (OR = 1.63, CI [1.31–2.02])
Meng et al. (2012)	Asthma	Cross-sectional	Asthma-related absenteeism	2007 California Health Interview Survey (n = 1276 with asthma)	22.8% of students with asthma had at least one absence due to asthma.
Moonie et al. (2006)	Asthma	Cross-sectional	Absenteeism	N = 9014 registered students in St. Louis, MO in 2002–03, n = 770 have asthma	Asthma status, race and grade are significant predictors of absenteeism ($p < .05$) Those with asthma missed 1.5 days more school per year than those without ($p = .006$) As asthma severity increased, so did mean days absent from school ($p = .007$)
Moonie et al. (2008)	Asthma	Cross-sectional	Absenteeism	N = 3812 students in St. Louis, MO, 397 (10%) had asthma	Those with asthma were absent 1.5 more days than those without ($p = .007$) Persistent asthma had higher mean days absent compared to mild intermittent asthma ($p = .001$)
Bowel or bladder					
Filce and LaVergne (2015)	Incontinence – bowel or bladder	Cross-sectional	Absenteeism	N = 83, self-selected (51.2% participation rate) drawn from medical clinics and parent support groups	13.25% had no absences, 24.1% missed 1–5 days, 27.71% missed 6–10 days, 27.71% missed 11 or more days (no significance data provided)
Mackner et al. (2012)	Inflammatory Bowel Disease (IBD)	Case-control	Absenteeism, grade repetition	N = 50 IBD, n = 42 healthy comparisons. All students were 11–17 years old, no location specified	Adolescents with IBD had significantly more absences (t (60) = 2.28, $p < .05$) 20% of subjects with IBD missed >3 weeks of school, compared to 4% of healthy adolescents In IBD, absences were significantly correlated with GPA, income, single or divorced parents and internalizing scores- absences were significantly correlated with income and parent marriage in non-IBD subjects also
Cancers					
Champaloux and Young (2015)	Chronic Health Conditions (CHC) including cancer	Cohort	Absences, grade repetition, graduation or GED attainment by 21 years of age	National Longitudinal Study of Youth-cohort 1997 (NLSY-97) N = 6795	20% of subjects with cancer, diabetes and epilepsy did not graduate or earn a GED by 21 years of age (OR = 1.96 CI [1.13–3.37]) For cancer, diabetes, and epilepsy: school absences, grade repetition and depressive symptoms were mediators of low educational attainment
Noll et al. (1999)	Cancer	Case-control	Absenteeism	8–15 year old cancer patients from a local tumor registry receiving chemotherapy (n = 70) and classroom peers (n = 70)	Group with cancer missed an average of 31.29 days (SD = 23.68), while the control group missed an average of 6.17 (SD = 6.37) (no significance data provided)
Diabetes					
Champaloux and Young (2015)	Chronic Health Conditions (CHC) including DM	Cohort	Absences, grade repetition, and high school graduation or GED prior to 21 years of age	National Longitudinal Study of Youth-cohort 1997 (NLSY-97) N = 6795	20% of subjects with cancer, diabetes and epilepsy did not graduate or earn a GED by 21 years of age (OR 1.96, CI [1.13–3.37]) For cancer, diabetes, and epilepsy: school absences, grade repetition and depressive symptoms were mediators of low educational attainment
McCarthy et al. (2002)	Diabetes Mellitus (DM)	Case-control	Absenteeism, grade repetition	Rural Midwestern specialty clinic patients with Type 1 DM n = 244 Healthy siblings n = 110 Control n = 209	Significantly more school absences in DM group (M = 7.3 days per year) than their siblings (M = 5.3 days per year) and more behavioral problems ($p < .02$) No relationship between grade repetition and DM was found
McCarthy et al. (2003)	DM	Cross-sectional	School absences	Rural Midwestern specialty clinic patients with Type 1 DM n = 244	Same study as above, separated out DM group by glycemic control School absences were not correlated glycemic control
Parent et al. (2009)	DM	Case-control	Absenteeism	N = 95 children with DM N = 95 healthy sibling controls. 5–18 year-old sample from Arizona	Absenteeism DM 17.94 days (SD = 17.45) and healthy siblings 7.64 days (SD = 6.01) (n = 69, $p < .001$) Absenteeism in conventional therapy DM group: 24.81 days (SD = 28.18)

(continued on next page)

Table 3 (*continued*)

Authors	Disability	Study design	Educational variables evaluated	Sample	Academic outcome/primary/secondary
					Intensive therapy DM group 16.13 days (10.94) (n = 77, $t = 1.94$, $p < .03$, $\eta^2 = 0.048$) No relationship between absenteeism and HbA1C levels.
Epilepsy					
Bailet and Turk (2000)	Epilepsy migraine	Case-control	Grade repetition	8–13 year-old sample from Florida N = 74 children with epilepsy, no other medical problems N = 23 healthy siblings N = 13 disease control of children with migraine Control group older All with IQ >80	34% of cases repeated a grade, three control subjects 3 repeated a grade. 38% of migraine group had repeated a grade Sample excluded children with increased risks for educational problems (abnormal brain scans, symptoms of seizure disorder, coexisting medical conditions)
Champaloux and Young (2015)	Chronic Health Conditions (CHC) including epilepsy	Cohort	Absences, grade repetition, high school graduation or GED by 21 years of age	NLSY-cohort 1997 N = 6795	20% of subjects with cancer, diabetes and epilepsy did not graduate or earn a GED by 21 years of age (OR 1.96, CI [1.13–3.37]) For cancer, diabetes, and epilepsy: school absences, grade repetition and depressive symptoms were mediators of low educational attainment
Huberty et al. (1992)	Epilepsy	Cross-sectional	Grade repetition	Sample from a Midwestern state, N = 136 (66 female, 70 male, 8–12 years old, all children low-average to above-average intelligence, average age of onset is 5 years old)	39.7% of sample had repeated at least one grade, the majority in first or second grade (51.2% and 19% respect). Children with secondary generalized seizures are more likely to be retained in grade (chi square (4, n = 131) = 16.15; $p < .001$), no relationship between being retained and seizure type
Liver transplant					
Kennard et al. (1999)	Post liver transplant	Cohort	Grade repetition	N = 50 between 6 and 23 year-old sample in Dallas, TX 58% of total group who survived 3 + yrs	48% had a history of repeating a grade across all groups, similar numbers repeated grades
Gilmour et al. (2010)	Post liver transplant	Cohort	Attendance, grade repetition	N = 823 participants (72.6% participation from 39 SPLIT centers nationwide) 6–18 years old, >9mos since liver transplant	32.8% of the cohort missed >10 days school, 11.4% missed >30 days. Older participants and children with shorter intervals since transplant were more likely to miss >10d in past year. 19.9% repeated a grade (more common in 15–18 years old, $p = .001$)
Sorensen et al. (2011)	Liver transplant recipient	Cross-sectional	Absenteeism, grade repetition	Post-liver transplant patients who were patients at SPLIT centers nationwide, ages 5–7 years old (n = 144)	8% of sample repeated a grade, 46% missed 0-4d, 30% missed 5-10d, 25% missed ≥11 days
Other Conditions					
Agoston et al. (2016)	Pain – primary chronic pain, JIA	Multiple case-control	Attendance	129 subjects 12–19 years old with primary chronic pain, 61 with Juvenile Idiopathic Arthritis (JIA), and 70 healthy controls in Boston, MA. Pain at least weekly or 5 times per month, excluded if had medical condition or separate chronic pain syndrome.	Missed school days Primary chronic pain group missed significantly more days (M = 8.95, SD = 12.22) than JIA (M = 1.69, SD = 3.76, $p < .001$) or healthy group (M = 0.33, SD = 0.93, $p < .001$). Significantly higher number of days missed in primary chronic pain group compared to JIA/Healthy group ($F(2,245) = 26.21$, $p < .001$) Primary chronic pain group visited school nurse significantly more often (M = 5.71, SD = 7.81) than JIA (M = 1.07, SD = 1.67) ($p < .001$)
Logan et al. (2009)	Chronic pain	Cross-sectional	Absenteeism	Adolescents with chronic pain (n = 217) aged 12–17 years old at a large, urban children's hospital	In students with chronic pain, levels of depressive symptoms predicted school absences ($p < .001$)
Duquette et al. (2007)	Chronic kidney disease (CKD)	Case-control	Absenteeism in previous 30 days, grade repetition	Children with CKD from one academic medical center 6–18 years old with kidney dysfunction x 3 months or more (n = 30 half on dialysis, half other therapies) and controls (n = 41)	Children with CKD were at higher risk for grade repetition ($p < .001$), absenteeism ($p < .01$)
Grieve et al. (2011)	Cystic Fibrosis (CF)	Cross-sectional	Absenteeism	Sample from 2 Midwestern CF centers, aged 16–21 years old (n = 40)	Sample was absent an average of 23.6 days/year (attendance rate 86.9% of 180-day school year compared to state average of 92.7–93.3% attendance during study period) Increased absences are associated with lower grade point average
Drake et al. (2010)	Hemophilia A or B	Cross-sectional	≥12 years schooling or education beyond high school ≥1 year college was considered high school graduation	7842 men ≥18 years old Nationally-representative Part of public health surveillance program at 130 hemophilia treatment centers in US. Collected 1998, 2008	Overall: Hemophilia A graduation rate was higher, 85.2% (CI [84.3–86.1]) compared to all US men (83.9%) Severity: Hemophilia A with mild symptoms is significantly higher percentage of graduates 86.8%, than the national average for men (CI [85.2–88.5])

Table 3 (*continued*)

Authors	Disability	Study design	Educational variables evaluated	Sample	Academic outcome/primary/secondary
Shapiro et al. (2001)	Hemophilia	Cross-sectional	Absenteeism	N = 126 participants between 6 and 12 years old currently under care in U.S. Hemophilia centers	Bleeding episodes and school absenteeism were correlated (Spearman correlation = 0.23, p = .01).
Richard and Burlew (1997)	Sickle Cell Disease (SCD)	Case control	Absenteeism, grade repetition	N = 42 African-American children with SCD and N = 26 control from an urban, Midwestern city	No differences in grade repetition or absenteeism between groups
Schwartz et al. (2009)	Sickle Cell Disease	Cross-sectional	Absenteeism	N = 40 adolescents ages 12–18 years old in a large, East Coast children's hospital	Subjects missed an average of 11.67% (SD = 1.09) of the school year and 37.5% (n = 15) of subjects missed 20 or more school days.
Seirawan et al. (2012)	Dental disease	Cross-sectional	Attendance	Los Angeles, CA public schools. N = 1495 disadvantaged elementary and high school students	40% of children had cavities and children in the sample missed an average of 2.2 days per year due to dental problems. 16% of students with toothaches in past 6 months compared to 3% of students without missed school ($p < .001$). Students with urgent dental needs missed significantly more school than those without ($p = .048$)

SD: Standard Deviation; CI: 95%Confidence Interval.

(n = 50) and found that 48% of the sample had repeated a grade and 26% were identified as having a learning disability. Gilmour et al. (2010) studied children and adolescents at least 9 months after transplant (n = 823) from 39 specialty liver transplant centers across the United States. Almost one in five (19.9%) of the sample had repeated a grade and this was more likely in 15–18 year-old subjects. Grade repetition was also found to be higher in children with chronic kidney disease ($p < .001$) (Duquette et al., 2007).

Summary

In this section, the outcome of grade repetition has been associated with epilepsy, liver and kidney conditions, as well as one study of

Table 4
STROBE checklist.

Author	Adherence
Agoston et al. (2016)	Strong
Akinbami et al. (2010)	Strong
Bailet and Turk (2000)	Weak
Breslau et al. (2008)	Strong
Breslau et al. (2011)	Strong
Champaloux and Young (2015)	Strong
Crump et al. (2013)	Strong
Drake et al. (2010)	Strong
Duquette et al. (2007)	Weak
Filce and LaVergne (2015)	Weak
Fletcher (2008)	Weak
Gilmour et al. (2010)	Strong
Grieve et al. (2011)	Weak
Hansen et al. (1999)	Strong
Huberty et al. (1992)	Weak
Kennard et al. (1999)	Strong
Logan et al. (2009)	Strong
Mackner et al. (2012)	Strong
Maslow et al. (2011)	Strong
McCarthy et al. (2002)	Strong
McCarthy et al. (2003)	Strong
McLeod and Kaiser (2004)	Strong
McLeod et al. (2012)	Strong
Meng et al. (2012)	Strong
Moonie et al. (2006)	Strong
Moonie et al. (2008)	Strong
Murphy et al. (2002)	Strong
Newacheck and Halfon (1998)	Strong
Noll et al. (1999)	Strong
Parent et al. (2009)	Strong
Redmond and Hosp (2008)	Strong
Reuben and Pastor (2013)	Strong
Richard and Burlew (1997)	Strong
Rojewski (1999)	Weak
Schifter (2011)	Strong
Schifter (2016)	Weak
Schwartz et al. (2009)	Weak
Seirawan et al. (2012)	Strong
Shandra and Hogan (2009)	Strong
Shapiro et al. (2001)	Strong
Sorensen et al. (2011)	Strong
Wisk and Weitzman (2017)	Strong
Zablocki and Krezmien (2013)	Strong

Table 5
Newcastle-Ottawa Scale.

Author	Selection	Comparability	Outcome	Total
Agoston et al. (2016)	3	2	1	6
Akinbami et al. (2010)	5	1	3	9
Bailet and Turk (2000)	3	2	1	6
Breslau et al. (2008)	4	2	3	9
Breslau et al. (2011)	5	2	2	9
Champaloux and Young (2015)	5	2	3	9
Crump et al. (2013)	4	2	2	8
Drake et al. (2010)	4	2	2	8
Duquette et al. (2007)	3	0	1	4
Filce and LaVergne (2015)	2	0	2	4
Fletcher (2007)	3	2	2	7
Gilmour et al. (2010)	4	2	2	7
Grieve et al. (2011)	0	0	3	3
Hansen et al. (1999)	2	2	2	6
Huberty et al. (1992)	2	1	2	5
Kennard et al. (1999)	4	0	2	6
Logan et al. (2009)	4	2	3	9
Mackner et al. (2012)	4	1	3	8
Maslow et al. (2011)	4	2	3	9
McCarthy et al. (2002)	4	2	3	9
McCarthy et al. (2003)	4	2	3	9
McLeod and Kaiser (2004)	4	2	2	8
McLeod et al. (2012)	3	2	2	7
Meng et al. (2012)	4	2	2	8
Moonie et al. (2006)	4	2	2	8
Moonie et al. (2008)	3	2	2	7
Murphy et al. (2002)	4	2	1	7
Newacheck and Halfon (1998)	5	2	2	9
Noll et al. (1999)	4	2	1	7
Parent et al. (2009)	4	2	3	9
Redmond and Hosp (2008)	4	2	2	8
Reuben and Pastor (2013)	4	2	2	8
Richard and Burlew (1997)	3	2	2	7
Rojewski (1999)	3	2	2	7
Schifter (2011)	4	2	2	8
Schifter (2016)	4	2	3	9
Schwartz et al. (2009)	2	2	3	7
Seirawan et al. (2012)	4	2	3	9
Shandra and Hogan (2009)	4	2	3	9
Shapiro et al. (2001)	5	2	0	7
Sorensen et al. (2011)	5	2	0	7
Wisk and Weitzman (2017)	3	2	2	7
Zablocki and Krezmien (2013)	4	2	2	8

children with disabilities. In the educational literature, grade repetition is associated with a lower likelihood of graduation from high school (Christle, Jolivette, & Nelson, 2007; Jimerson, 2001; Randolph, Fraser, & Orthner, 2006; Shandra & Hogan, 2009). Students who have these conditions and repeat a grade may be at higher risk for not completing their high school education, limiting their work opportunities in adulthood.

High school completion

The majority of studies using national data used some measure of graduation from high school whether graduation or earned GED by 21 years old (Champaloux & Young, 2015), graduation from high school by 22 years old (Shandra & Hogan, 2009), or graduation from high school or earned GED (Maslow et al., 2011; Wisk & Weitzman, 2017). The time to graduation among different disabilities will be discussed in a later section. Measurement beyond the cohort-graduation rate of 4 years after entering high school provides valuable information about eventual graduation that would not be captured otherwise (Schifter, 2011).

Chronic conditions as a group

Champaloux and Young (2015) found that children with chronic health conditions had a 47% higher odds of not graduating or earning a GED by 21 years of age (OR = 1.47, CI [1.22,1.76]) than the sample without chronic health conditions. Maslow et al. (2011) had similar findings with 12.9% of students with chronic conditions not graduating and just 8% of students without chronic conditions ($p < .001$). In students with chronic health conditions diagnosed at or before 14 years of age, 6.5% did not graduate, in students diagnosed after 14 years of age, 2.7% did not graduate and in the sample without chronic conditions 3.6% of students did not graduate high school (all comparisons $p < .001$) (Wisk & Weitzman, 2017). This study concludes that the earlier a child experiences effects of chronic illness, the poorer their educational outcomes. In the same study, students with a major medical condition had half the chance of graduation (OR = 0.54, CI [0.29, 0.999]) compared to those without, and those with a major medical condition limiting activity had one-third the chance of graduating (OR = 0.33, CI [0.16, 0.68]) (Wisk & Weitzman, 2017). Shandra and Hogan (2009) also found that, within their sample, those with a serious disability (based on parent report of significant limitation) were 50% less likely to graduate from high school. These results demonstrate that chronic illness is a risk factor for not graduating, however the duration and severity of chronic illness worsen chances of graduation.

Behavioral and mental conditions

Behavioral and mental conditions were consistently linked with lower graduation rates. For example, Wisk and Weitzman (2017) reported that students with psychological or emotional problems (n = 490) had one-third the odds of graduation (OR = 0.32, CI [0.15, 0.68]) as compared to students without these problems. Breslau, Lane, Sampson, and Kessler (2008) identified that having one mental disorder did not change the odds of graduation compared to students without a mental disorder, but having two or more mental disorders increased the risk of not graduating by 40% (OR = 1.4, CI [1.0, 2.0], $p = .027$). In this same study, students with three or more mental disorders had more than double the risk of not graduating (OR = 2.5, CI [1.9, 3.3], $p < .001$). Breslau, Miller, Chung, and Schweitzer (2011) categorized emotional and behavioral disorders as internalizing (depression, mania, panic, phobia and generalized anxiety disorders) or externalizing (conduct disorder or ADHD types) and those with externalizing disorders were much less likely to graduate on time (within 4 years of entering 9th grade). When multiple confounders (sex, income, race, etc.) were controlled for, conduct disorder (OR = 1.89, CI [1.57, 2.26]) and ADHD-combined type (OR = 2.06, CI [1.66, 2.56]) had the highest risk of not graduating on time, while the internalizing group did not differ from the control sample. McLeod and Kaiser (2004) had similar findings, after controlling for sociodemographic variables, for significant effects of externalizing behaviors earlier in school on risk of not graduating with a high school degree. One difference, though, was that internalizing problems were also significantly related to not graduating from high school ($p < .05$), contrary to Breslau et al.'s (2011) findings.

Depression in middle and high school was associated with high school dropout (n = 13,0000; $p = .022$) in a study conducted by Fletcher (2008). McLeod, Uemura, and Rohrman (2012) found that depression, delinquency, substance use and attention problems each predicted not graduating from high school in 7th to 12th grade students (n = 6315). Attention-deficit hyperactivity disorder (ADHD) has been associated with not graduating in studies mentioned earlier (Breslau et al., 2011; McLeod et al., 2012) although, one study (Murphy, Barkley, & Bush, 2002) demonstrated conflicting results. Murphy et al. (2002) found no statistically significant difference in graduation from high school in young adults (n = 160) between a group with sub-types of ADHD (ADHD Combined Type and Predominantly Inattentive Type) and a control group without ADHD, although confounders were not controlled for. This study could have been strengthened by conducting an analysis of covariance, and allowed more comparison with other studies, since many other variables were also tested for in the study.

Substance use worsens outcomes for students with mental disorders (McLeod et al., 2012). The combination of substance use and mental illness was associated with a lower rate of graduation in young adults (n = 424) (McLeod et al., 2012). Substance use and abuse is predictive of dropping out of high school in two studies (Breslau et al., 2008, 2011; McLeod et al., 2012). Students using any substance are at almost three times (OR = 2.9, CI [2.1, 4.0]) the risk of high school dropout (Breslau et al., 2008). When controlling for prior psychiatric illness in a different data set, Breslau et al. (2011) reported the risk for dropping out was increased for tobacco dependence by 50% and illegal drug abuse or dependence by a third. Studies examining mental illness and behavioral disorders demonstrate that mental illness, and especially having more than one mental illness increases the risk of not graduating from high school.

Individuals with disabilities educational act categories

High school completion was the outcome studied in students with a disability under the Individuals with Disabilities Educational Act. The IDEA categories outlined in United States law are:

> intellectual disabilities, hearing impairments (including deafness), speech or language impairments, visual impairments (including blindness), serious emotional disturbance…, orthopedic impairments, autism, traumatic brain injury, other health impairments, or specific learning disabilities.
> [(Individuals with Disabilities Education Act of 2010, 2010, sec. 3A).]

Three articles compared rates of graduation across disability categories (Schifter, 2011, 2016; Zablocki & Krezmien, 2013) and two articles had narrower foci for their studies (Redmond & Hosp, 2008; Rojewski, 1999). A national study of children with disabilities reported an overall high school dropout rate across the sample (n = 5928) of 12.5%, and ranged from a low of 8.5% in participants with speech impairment, to a high of 26.7% for participants with emotional disturbance (Zablocki & Krezmien, 2013). In addition, a history of grade repetition was found to double the risk of dropping out (OR = 2.34, $p < .001$). Using statewide educational data from Massachusetts between 2005 and 2012, Schifter (2016) reported different results with 81.1% of those with learning disability or speech impairment graduating within 7 years of starting high school, while just 52% of those with emotional disturbance and 34% of those with autism, multiple disabilities or deaf-blindness graduating. Schifter (2011) evaluated the time to graduation for different disabilities using national data and found that over 40% of students with emotional disturbance had not graduated wthin eight years of beginning high school. The low graduation rate for those

with emotional disturbance aligns with the findings in the earlier two studies of lower high school completion in students with emotional disturbance.

Although learning disability (LD) was found by Zablocki and Krezmien (2013) to have a relatively high completion rate (89%), Rojewski (1999) reported different results when examining gender in people with learning disabilities: Men with LD had an 81% graduation rate, compared to women with a 68% graduation rate, while the control groups had similar graduation rates (men 90% and women 92%). Wisk and Weitzman (2017), in their sample of students with developmental delay and learning disabilities (n = 596), identified the odds of graduating high school was one third that of children without disabilities. Developmental delay was not a category studied in other reports in this section, but intellectual disability did have a much higher risk of dropout (33%) than learning disabilities (19%) (Schifter, 2011). Students with speech and language impairments have a lower risk of not graduating (14%) than the other two groups (19% learning disabilities and 41% emotional disturbance) (Schifter, 2011). This is interesting when comparing to the findings in earlier grades that children with communication disorders miss more school (Redmond & Hosp, 2008) but may indicate differential effects of these disabilities on ability to engage in learning despite absences (Schifter, 2011).

Chronic health conditions

Few studies evaluated graduation outcomes for specific chronic health conditions. Champaloux and Young (2015) reported that the odds of not graduating or earning a GED by 21 years of age were increased in children with asthma compared to those without. And in one nationally-representative study of men with hemophilia, the graduation rate was actually higher for 18–24 year old men with hemophilia A than men in the United States across all ethnicities ($p < .001$) (Drake et al., 2010). The authors suggest this higher graduation rate may be due to receiving care in "federally supported comprehensive HTCs [hemophilia treatment centers]" (p. S492) where multidisciplinary care focused on psychosocial development in addition to health needs.

Summary

Studies of populations of students with behavioral, mental and physical chronic health conditions demonstrated that this population has higher rates of absenteeism and risks of grade repetition and were less likely to graduate from high school than students without these conditions. In addition, many studies reported that increased severity of illness worsened outcomes (Breslau et al., 2011; McLeod et al., 2012; Moonie et al., 2006, 2008; Reuben & Pastor, 2013; Seirawan et al., 2012; Shandra & Hogan, 2009; Shapiro et al., 2001) while in diabetes, the relationship was more nuanced (McCarthy et al., 2003). In general, the studies in this review controlled for socioeconomic status and race, variables influencing educational outcomes (Canfield, Nolan, Harley, Hardy, & Elliott, 2016; Gottfried, 2014; Morrissey, Hutchison, & Winsler, 2014) and reported disability due to chronic conditions was significantly associated with educational outcomes. One study reported that the difference in educational outcomes was due to socioeconomic status, rather than to sickle cell disease (Richard & Burlew, 1997). Studies that measured incidence in specific health conditions demonstrated more variability among conditions related to educational outcomes. For example, while most studies in this review found increased absenteeism, increased grade repetition and decreased graduation rates, men with hemophilia were more likely to graduate than the U.S. population of men (Drake et al., 2010).

Discussion

This integrative review examined the relationship between chronic conditions and educational outcomes in school-aged individuals. After evaluating the past 28 years of literature in this area, a strength of this body of literature is that researchers controlled for common confounders in all but four of the 43 reports (Duquette et al., 2007; Filce & LaVergne, 2015; Grieve et al., 2011; Kennard et al., 1999). This review of the literature has identified that, in general, chronic conditions are significantly associated with poorer educational outcomes, although hemophilia does not follow this pattern. Additionally, increased severity of the condition is associated with worse educational outcomes.

Quality assessment

The quality assessment of studies in this review included use of the STROBE statement recommendations (von Elm et al., 2014) for reporting of studies (See Tables 4 and 5). Eighteen reports of 43 reports addressed bias incompletely (Agoston et al., 2016; Bailet & Turk, 2000; Breslau et al., 2008, 2011; Duquette et al., 2007; Filce & LaVergne, 2015; Gilmour et al., 2010; Huberty et al., 1992; Logan et al., 2009; McCarthy et al., 2003, 2002; Meng et al., 2012; Noll et al., 1999; Redmond & Hosp, 2008; Reuben & Pastor, 2013; Schwartz et al., 2009; Seirawan et al., 2012; Wisk & Weitzman, 2017), 14 reports did not address missing data (Agoston et al., 2016; Bailet & Turk, 2000; Huberty et al., 1992; Logan et al., 2009; Mackner et al., 2012; McCarthy et al., 2003, 2002; Meng et al., 2012; Moonie et al., 2006, 2008; Richard & Burlew, 1997; Sorensen et al., 2011; Wisk & Weitzman, 2017; Zablocki & Krezmien, 2013) and 19 reports did not address the funding of studies (Bailet & Turk, 2000; Champaloux & Young, 2015; Duquette et al., 2007; Filce & LaVergne, 2015; Gilmour et al., 2010; Grieve et al., 2011; Hansen et al., 1999; Kennard et al., 1999; Mackner et al., 2012; McLeod & Kaiser, 2004; Moonie et al., 2006, 2008; Murphy et al., 2002; Parent et al., 2009; Redmond & Hosp, 2008; Richard & Burlew, 1997; Rojewski, 1999; Schifter, 2011, 2016) which could introduce bias. In most studies, effect sizes were not provided, and in two reports a *p*-value was not provided (Bailet & Turk, 2000; Noll et al., 1999). Incomplete reporting of study information limits the reader's ability to assess study methodology, strengths, and weaknesses. Most studies in this review strongly adhered to the reporting recommendations generally.

A second quality assessment step was use of the Newcastle-Ottawa Scale (Wells et al., n.d.) to assess study quality by design category (see Table 5). Four of the 11 case-control studies had at a risk of selection bias identified (Agoston et al., 2016; Duquette et al., 2007; McLeod et al., 2012; Richard & Burlew, 1997), one demonstrated a problem with comparability (Duquette et al., 2007) and four had a risk in the outcomes section (Agoston et al., 2016; Duquette et al., 2007; Murphy et al., 2002; Noll et al., 1999). Of the 15 cohort studies, five had selection bias risk (Bailet & Turk, 2000; Fletcher, 2008; Hansen et al., 1999; Rojewski, 1999; Wisk & Weitzman, 2017), one a risk in the comparability category (Kennard et al., 1999), and nine with concerns about outcomes (Bailet & Turk, 2000; Gilmour et al., 2010; Hansen et al., 1999; Kennard et al., 1999; McLeod & Kaiser, 2004; Rojewski, 1999; Schifter, 2011; Wisk & Weitzman, 2017; Zablocki & Krezmien, 2013), generally these were due to self-report of outcome measures. Finally, in 10 of 17 cross-sectional studies (Breslau et al., 2008; Drake et al., 2010; Filce & LaVergne, 2015; Grieve et al., 2011; Huberty et al., 1992; Logan et al., 2009; McCarthy et al., 2002; Moonie et al., 2008; Schwartz et al., 2009; Seirawan et al., 2012) there was some selection bias risk, two studies did not control adequately for confounders (Filce & LaVergne, 2015; Grieve et al., 2011) and two studies had poor outcome measures (Shapiro et al., 2001; Sorensen et al., 2011).

Limitations

The limitations that affect this review are three-fold: The quality of the studies according to the STROBE guidelines, the method of this review, and the limitations of the individual studies in this review. The majority of studies in this review strongly adhered to the STROBE recommendations (von Elm et al., 2014). Selection bias risk was evident in almost half of the studies in this review, especially for cross-sectional studies, where convenience samples were more common. Incomplete

reporting using the STROBE recommendations may have contributed to this finding if selection bias information was incomplete in the report. Although there were many studies using large national data sets for students with emotional, developmental or other disabilities requiring special education, the studies of other conditions such as physical health conditions were limited by small sample sizes.

Several limitations affect this systematic review including difficulty identifying published studies, lack of generalizability outside the United States, and a single reviewer conducting this study. Although many databases were used and a variety of search terms, studies may have been missed because not all possible search terms for childhood chronic illnesses were used. In addition, all of the databases drew from published literature sources, so studies conducted but not published were not included. This may have biased the review towards studies with significant outcomes. Another limitation is that this review only evaluated studies conducted within the United States, so it is not generalizable to other countries. Although this was planned due to the variation internationally in funding for education and health and the structure of educational systems, it nevertheless limits this review's generalizability. Another limitation is that this review was conducted by a single researcher.

Although the majority of the studies had a low risk of bias, there was significant variability in the types of chronic conditions and outcomes studied, which limited generalizability. Use of the Newcastle-Ottawa Scale resulted in a risk of selection bias identified in less than half of the studies, and less than half of studies had a risk identified in outcome measures, generally related to self- or parent-report of absenteeism, grade repetition or graduation. Selection bias occurs when the comparison groups have differences at baseline that could provide alternate explanations for the study findings other than the variable being studied (Brink & Wood, 1998). The other risk of bias found frequently in articles in this review is the risk of reporting bias in which the student or parent reports a socially desirable answer instead of what actually occurred resulting in inaccurate outcome findings (Brink & Wood, 1998). The majority of articles in this review did not have these risks of bias present, but they were more likely in smaller studies of individual conditions. In summary, the reports in this review had a relatively low risk of bias and thus implications drawn from the findings are discussed below.

Implications for clinical nursing practice

The results of this review highlight the risk that children with chronic conditions resulting in disability face in accessing education and graduating from high school. Identification of children experiencing a disability related to their chronic condition may not occur if nurses do not assess a child or adolescent's function in school. A holistic nursing assessment of children with chronic conditions includes an assessment of psychosocial well-being including collecting an age-appropriate school history (American Nurses Association, 2015). When the nurse identifies an increased risk for educational problems, the nurse's next action is to support families in accessing community resources, such as special education (an IEP) or an accommodation (504 Plan) so the child is able to participate as fully as possible in education. In some regions of the United States, such as the Northeast, a school nurse is present in over 90% of schools who may be able to address those needs, while in the Western U.S. over 30% of schools have no paid school nursing available (Willgerodt, Brock, & Maughan, 2018). All nurses working with children and adolescents should be aware of educational supports for children and help families in accessing those resources. Therefore, it is incumbent upon nurses in all settings working with families of children with chronic conditions to understand the increased risks of poor educational outcomes for these children and to advocate for additional educational support as needed.

Tallon, Kendall, Priddis, Newall, and Young (2017), in their integrative review of barriers to addressing social determinants of health, suggest changing the focus from the disease and directing it towards the impact of the disease on daily life and function. Nurses in the acute, specialty, school and primary care settings can and should ask children and families about school as part of the psychosocial assessment of the child and family. Nurses have the ability then to assist them to access resources at critical periods such as new diagnosis, exacerbation of chronic condition or identification of educational difficulty. Tallon et al. identified, through their integrative review, that nurses are not truly caring for the patient and family holistically when they avoid psychological and social issues. Nurses support families and children to manage their chronic condition at home and also facilitate the child's management in school, where there may not be a nurse or parents to assist them. This type of advocacy may include crossing the usual boundaries of workplace to assure consistency of care and support for the developing child.

Implications for nursing research

The majority of studies in this review have demonstrated that primary and secondary students with chronic conditions have poorer educational outcomes. Nursing research examining the effect of chronic conditions on educational outcomes in children not requiring special education is needed, since the bulk of large sample research concerns the population of students with a disability needing special education services. In addition, research evaluating the effect of physical chronic conditions on educational outcomes with larger, national samples are needed to strengthen the evidence and improve generalizability. Drake et al. (2010) suggested the finding that males with hemophilia had higher graduation rates than the normal population may have been due to the emphasis of multidisciplinary hemophilia centers on psychosocial adaptation of patients. Further research about multidisciplinary centers that emphasize psychosocial adaptation and educational outcomes of children with chronic conditions would provide evidence to guide interdisciplinary decisions for this group of students. In addition, statistical significance information should be provided in reports that measure educational outcomes as a primary or secondary outcome. Finally, research is needed into the long term educational outcomes of children with chronic physical conditions and interventions that promote graduation for this group of students at higher risk for high school dropout.

When examining the educational outcomes of students with disabilities, multiple aspects of marginalization should be assessed in data collection. Clark (2014) states that “people with disabilities experience additive disparities” in which the disability compounds disparities due to membership in low-income, ethnicity, or other marginalized groups (p. 123). Persons who are members of multiple marginalized groups are at greatest risk of poor health, therefore identifying the risks for these already marginalized groups is important to address disparities. Nursing research evaluating the effects of chronic conditions on educational attainment need to include multiple measures of marginalization to identify if the effects are due to the chronic condition or to socioeconomic factors, such as race and socioeconomic status, as in the case of sickle cell disease (Richard & Burlew, 1997). A final recommendation for future research is consistency in use of keywords such as the term “chronic illness” as a keyword in studies evaluating specific chronic conditions could enhance the ability to find these studies.

Implications for nursing education

Implications for practice and research require that nursing education programs respond by preparing nurses with information about risk factors related to education. Pre-licensure education programs should include preparation to conduct holistic nursing assessments which include a child's educational history, interventions to address challenges with education, and prevention strategies to limit educational difficulties in high-risk groups such as those discussed in this article. Post-licensure education for practicing nurses working with students with

chronic conditions is also important to improve the care for this population.

Advocacy and policy

The lifelong outcomes of students who do not complete high school, such as job instability, poor health and disproportionate use of the social safety net, highlight the importance to society of students successfully graduating from high school (Lansford et al., 2016; Semega et al., 2017; Vaughn et al., 2014). Therefore, advocacy and policy decisions are pertinent to this discussion. Expansion of federally supported comprehensive treatment centers, to conditions other than hemophilia, may be warranted if research demonstrates similar educational outcomes. Additionally, multi-disciplinary teams caring for students with chronic conditions ought to focus attention on psychosocial aspects that increase risk of not graduating from high school. Finally, multidisciplinary teams must include professionals with knowledge of both the educational and health systems, such as school nurses, to holistically support students with chronic conditions to achieve their full potential.

Conclusion

This systematic review of the literature synthesized the findings of 43 studies that examined the relationship between chronic conditions and educational outcomes. Overall, chronic conditions were consistently associated with absenteeism, grade repetition or failure to graduate on time. For students with disabilities necessitating special education, graduation was the predominant outcome measured and a disability increased risk of not graduating. Students with mental, emotional, and cognitive delays had the highest risk of not graduating.

For students with physical health conditions such as asthma, cancer, diabetes and epilepsy, increased absenteeism was a common finding. Students with liver transplant, chronic kidney disease and epilepsy had a high incidence of grade repetition in addition to missing school days. Chronic physical conditions were also associated with nearly two times the risk of not graduating from high school.

This review demonstrates that chronic conditions are consistently associated with poorer educational outcomes in primary and secondary school students. Due to the consistent findings of poorer educational outcomes for students with chronic conditions, an assessment of educational function should be part of a holistic nursing assessment of any school-age child with a chronic condition. Educational attainment is a determinant of future health. Therefore, the risks to students with chronic conditions of poor educational attainment increase their risks for poor health in adulthood. Nurses and other healthcare providers should include an educational assessment as part of psychosocial assessment of children and adolescents to identify risk, intervene early and limit risk.

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