Academic Performance among Children with Inflammatory Bowel Disease: A Population-Based Study

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Objectives To determine grade 12 academic performance for children with inflammatory bowel disease (IBD).

Study design Children diagnosed with IBD at age <17 years identified from the population-based University of Manitoba IBD Epidemiology Database were matched by age-, sex-, and area of residence to 10 randomly selected controls. Grade 12 educational outcomes (scores on the provincial grade 12 language arts and mathematics standards tests, and enrollment-in-grade-12-by- age-17) were determined by linkage to the province wide Manitoba Education Database. Linear and logistic regression analysis were used to compare the educational outcomes, adjusting for socioeconomic status and comorbidities and evaluate predictors of educational outcomes among children with IBD.

Results Grade 12 educational outcomes among 337 children with IBD were compared with 3093 without IBD. There were no significant differences among the 2 groups in the standardized scores (language arts: $P = .31$; mathematics: $P = .48$) or enrollment-in-grade-12-by- age-17 ($P = .25$). Lower socioeconomic status and diagnosis with mental health problems 6 months prior to and 6 months post-IBD diagnosis were independent predictors of worse educational outcomes. There was no significant effect of age of diagnosis of IBD, type of IBD (ulcerative colitis vs Crohn's disease), use of corticosteroids or immunomodulator agents, hospitalizations, or surgery for IBD.

Conclusions Children with IBD on average achieve similar levels of academic achievement in grade 12 as those without IBD. This study underscores the educational impact of mental health conditions at IBD diagnosis among children. *(J Pediatr 2015;166:1128-33)*.

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The peak incidence of inflammatory bowel disease (IBD) occurs between the ages of 15 and 25 years, with up to 12% of Canadians with IBD presenting before the age of 20.[1] Several reports suggest that the incidence of IBD in children and adolescents may be increasing.[2,3] Children with IBD may be more likely than adults to have aggressive disease, more extensive intestinal involvement, and rapid clinical progression.[4,5] Children are more likely to be treated with corticosteroids than adults, with reports of 80% of children with IBD treated with corticosteroids over a median duration of follow-up of 8 years.[6]

There are currently very limited data on school performance among children with IBD. Certain chronic physical illnesses in children such as cystic fibrosis and chronic renal failure have been reported to be associated with lower academic achievement, though differences have not been found with other chronic diseases such as type 1 diabetes and juvenile rheumatoid arthritis.[7] As children with IBD often have a high burden of illness and may suffer from significant absenteeism from school, they may be at risk for adverse effects on their educational performance. Although it may seem intuitive that children with IBD will have impaired school performance, persons with IBD are typically of higher socioeconomic background, which often correlates with higher educational achievement.[8]

CD	Crohn's disease
DPIN	Drug Program Information Network
IBD	Inflammatory bowel disease
LAI	Language arts achievement index
MAI	Mathematics achievement index
SEFI	Socioeconomic factor index
SES	Socioeconomic status
TNF	Tumor necrosis factor
UC	Ulcerative colitis
UMIBDED	University of Manitoba IBD Epidemiology Database

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Moreover, individuals diagnosed with IBD as adults have comparable educational levels as the controls even when adjusted for the socioeconomic status (SES).[9] Furthermore, once children achieve remission it is possible that they can catch up on their schooling.

We aimed to determine the grade 12 educational outcomes in a population-based cohort of children with IBD, in comparison with those without IBD and assess potential predictors of educational achievement among children with IBD.

Methods

Manitoba is a central Canadian province with a relatively stable population (1.27 million in 2012). Manitoba Health is the publicly funded health insurance agency providing comprehensive universal health insurance to all residents of Manitoba. There is minimal nonparticipation as residents do not pay premiums to register for insured benefits. Manitoba Health maintains several electronic administrative databases to monitor the services provided and to provide reimbursement to the health care providers for the services rendered. These databases include the Medical Claims database, which includes all inpatient and outpatient physician billings; Hospital Discharge Abstract database of all hospital admissions; and the Drug Program Information Network (DPIN) database, which records all prescription drugs dispensed by all outpatient pharmacies to all Manitoba residents. The accuracy and comprehensiveness of these databases have been previously established in multiple studies.[10,11] The DPIN data are available from 1995 onwards, whereas the other health databases are available from the mid-1970s. The Manitoba Health Population Registry includes demographic, vital status, and migration status data of all permanent residents in the province. This study was approved by the University of Manitoba Health Research Ethics Board, the Health Information Privacy Committee of Manitoba Health, and Manitoba Education.

The University of Manitoba IBD Epidemiology Database (UMIBDED) was created using Manitoba Health Administrative Databases and, therefore, contains all of the information listed above for Manitoba Health Administrative databases.[12] The case definition of IBD in the UMIBDED has been previously validated.[12] Each IBD case in the UMIBDED is matched to 10 randomly selected controls based on age (year of birth), sex, and postal area of residence on the date of IBD diagnosis (index date). The index date is assigned by the date of IBD diagnosis, defined as the date for the first claim for IBD. For controls, the index date is the date of diagnosis of their matching cases. This study included incident cases of IBD, defined in UMIBDED as those with the first physician claim or hospitalization with an IBD diagnosis code in or after 1987 and registration with Manitoba Health for at least 3 years preceding the initial IBD-related health care contact.

Manitoba Education is the provincial agency responsible for setting priorities and allocating funding for the province's public and independent school system. Manitoba Education maintains a database of assessment, evaluation, and enrollment information for all students in the province of Manitoba. For grade 12 students, Manitoba has had a provincial standards testing system in place since 1993, with the test scores counting for 30% of students' final course mark. The 'Standards Tests' are curriculum-based and mandatory for all students, with adaptations available for many special needs students and exemptions for individual students as required. There are separate tests for language arts and mathematics. Students pass the language arts test by scoring 50% or more on any of the following examinations: English, French as a secondary language (for students in the French immersion program), or French as a primary language. Individuals pass the mathematics test by scoring 50% or better on the precalculus exam, the consumer math exam, or the applied math exam. Researchers in Manitoba have previously developed and validated a language arts achievement index (LAI) based on the provincial language arts test and mathematics achievement index (MAI) created using the scores on the provincial grade 12 mathematics tests and enrollment in different mathematics courses, which are described in detail elsewhere.[13-15] Briefly, using the methods discussed by Mosteller and Tukey[16] and Willms,[17] a standardized score is calculated for each individual by assuming an underlying logit distribution, which is divided into pieces according to the percentage of the cohort members in each category. Scores are calculated separately for each birth cohort to account for changes in marking each year. The logit transformation produces an index with overall mean of 0 and SD of 1. The highest test scorers get a score of 2.96, and those withdrawn from school are assigned a score of −1.84. These indices include children who wrote the standard test as well as those who were absent from school, did not complete the test, were in grade 11 or lower (ie, retained at least 1 year), or who had withdrawn from school altogether. The different databases can be linked together most reliably from 1984 onwards, when every resident of Manitoba was assigned a personal health identification number.

The Johns Hopkins aggregated diagnosis groups method was used to categorize study subjects into low/moderate vs high morbidity categories[18] and into those with or without major or minor psychosocial comorbidities (aggregated diagnosis group 23, 24, and 25, which includes depression, panic disorder, and substance abuse) around the time of index/IBD diagnosis date (6 months prior to 6 months after the index date). The IBD diagnosis codes were excluded in assessment of comorbidities.

Among the children with IBD, the exposure to immunomodulators (azathioprine, 6-mercaptopurine, and methotrexate), biologicals (anti-tumor necrosis factor [anti-TNF] agents), and corticosteroids was determined using the DPIN database, in or after 1995. Association with IBD-related intestinal surgeries (colectomy among those with ulcerative colitis [UC]; colectomy or small bowel resection among those with Crohn's disease [CD]) was assessed.

SES was assigned based on the neighborhood of residence on the index date using socioeconomic factor index (SEFI), a

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