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Nicole Etherington
Western University

Janette McDougall
Western University, jmcdoug6@uwo.ca

David DeWit
Centre for Addiction and Mental Health

Virginia Wright
Bloorview Research Institute

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RESEARCH PAPER

Maternal factors and the emotional and behavioural functioning of adolescents with chronic health conditions

Nicole Etherington¹, Janette McDougall², David DeWit³, and Virginia Wright⁴

¹Department of Sociology, Western University, London, Ontario, Canada, ²Thames Valley Children's Centre, London, Ontario, Canada, ³Social and Epidemiological Research Department, Centre for Addiction and Mental Health, London, Ontario, Canada, and ⁴Centre for Child Development, Bloorview Research Institute, Toronto, Ontario, Canada

ABSTRACT

Purpose: This study investigated the association between mothers' mental health and education and the emotional and behavioural functioning of adolescents with chronic health conditions over time. **Methods:** Data were drawn from an ongoing study. Study participants ($N = 363$) were recruited through eight children's rehabilitation centres. Logistic regression models were estimated. **Results:** There were significantly reduced odds that girls would display clinical signs of hyperactivity/inattention one year later compared to boys when a maternal mental health condition was present ($OR = 0.10$; $p < 0.01$). Where low maternal education was present, girls were more likely to display peer relationship problems one year later ($OR = 3.72$; $p < 0.01$). For both genders, having a mother with less than a high school education was also associated with conduct problems one year later ($OR = 2.89$; $p < 0.01$). **Conclusions:** Findings support a link between maternal factors and emotional and behavioural functioning in adolescents with chronic conditions. A holistic and family-centred approach to assessment and service delivery is indicated.

► IMPLICATIONS FOR REHABILITATION

- When conducting clinical assessments, service providers should consider associations between maternal education and mental health and the emotional and behavioural functioning of adolescents with chronic health conditions.
- A holistic and family-centred approach to assessment and service delivery is indicated to ensure adolescents with chronic conditions and their families receive support for interrelated needs.

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Introduction

Research has long demonstrated that children and youth with chronic health conditions (e.g. neurodevelopmental disorders, autoimmune diseases, movement disorders, injuries) face the increased risk of emotional and behavioural difficulties. [1–4]. Population-based surveys indicate that these children and youth are two to three times more likely to be reported as also having emotional problems, such as anxiety and depression, conduct problems, hyperactivity/inattention, and peer relationship difficulties compared to those with no chronic conditions [1,5–7]. The presence of these types of emotional and behavioural problems can have lasting impacts for children and youth. Combined with already existing chronic conditions, they often interfere with the accomplishment of many important outcomes, such as the creation of longstanding friendships [8] and the

completion of formal education [9]. Not surprisingly, emotional and behavioural problems have been found to persist into adulthood for children and youth with chronic conditions [4,10,11].

Empirical research has consistently demonstrated that both maternal depression and low maternal education are associated with less favourable outcomes in typically developing children, such as poor mental and physical health, impaired cognitive development, low academic achievement and social maladjustment [12–23]. Both maternal depression and lower educational attainment have been linked to unfavourable parenting behaviours, such as decreased time spent with children in structured and school-related activities and overall reduced quality of mother–child interactions [15,24–30]. Maternal characteristics appear to be most consequential for children's development, especially because

women tend to be the primary caregivers in most families [31]. Indeed, the caregiving role of mothers of children with chronic conditions may be even more pronounced given the tremendous challenges involved. Qualitative studies indicate that these mothers may experience unequal distributions of caregiving responsibilities with other family members, disruptions to family and work life, having to manage numerous daily tasks, and inadequate home care and other resources for their children [32,33]. However, scant research has investigated the association between maternal characteristics and the emotional and behavioural functioning of children and youth with chronic conditions [34,35].

Recent studies have tended to focus on the influence of parental level characteristics, such as parenting stress, parenting behaviours or family socio-demographics on children and youths' mental health [34–36]. A population-based, longitudinal study found that differences in psychosocial outcomes between children with and without neurodevelopmental disorders were largely attributable to various family socio-demographic characteristics and parenting behaviours [35]. Longitudinal studies are rare that have examined the specific influence of maternal characteristics on the emotional and behavioural adjustment of adolescents with chronic conditions. A recent population-based longitudinal study identified significant associations between increases in maternal depressive symptoms and increases in symptoms of anxiety and depression in children with chronic conditions over time [37].

The impact of maternal characteristics has also been indicated to affect the emotional and behavioural development of boys and girls differently [13,19]. Research specifically involving children and youth with chronic conditions has also found gender differences related to mental health. For example, girls with chronic conditions appear to be at higher risk for internalising difficulties, whereas boys are at higher risk for having externalising behaviours and multiple disorders [5,6,38]. The role of child gender in the relationship between maternal characteristics and adolescents' emotional behavioural outcomes in chronic conditions requires further exploration [35].

Statement of purpose

Research is lacking related to the impact of maternal mental health and education on the emotional and behavioural functioning of adolescents with chronic health conditions and the differential effects this may have for boys and girls. Therefore, the present research considers the relationship of maternal factors, specifically maternal education and mental health, to four

emotional and behavioural aspects of functioning in these youth over the course of one year. It also examines whether these associations differ by child gender. Identifying the relationships among such factors is critical to the development and implementation of effective policies, programmes, and systems of care to support adolescents with chronic conditions and their families, and to improve development and quality of life (QOL) over the life course.

Methods

Data

This research used parent report longitudinal data from an ongoing study of QOL among adolescents with chronic conditions (see McDougall and colleagues [39] for greater detail). At the time of writing this paper, only baseline data and Time 2 data collection (12 months later) had been completed and investigators were continuing to collect data for the additional time points. Youth were recruited through eight children's rehabilitation centres in Ontario, Canada. They were randomly selected, with replacement, from initial lists of potential participants compiled at each centre using a computerised randomisation method. Ethical approval for the study was obtained from the Health Sciences Research Ethics Board, Western University, London, Ontario, Canada. Adolescents aged 11 to 17 years with a chronic condition and one of their parents (most often their mothers) completed questionnaires at baseline and 12 months later regarding youths' QOL and related factors. Questions ranged from basic demographic information to youths' educational functioning, family functioning, emotional and behavioural difficulties, and life satisfaction (see McDougall and colleagues [39,40]).

Participants

The original baseline sample for the larger, ongoing study consists of 439 parents/guardians of youth with various chronic conditions. The analytic sample used in this study includes 363 biological mothers. Fathers and those caregivers who were not biological mothers were dropped ($n = 76$) as they were not relevant to the goals of the current analysis. The study employed a non-categorical approach to illness, wherein adolescents with chronic conditions were combined into a total group for the purpose of the research questions and data analysis [39]. This approach was taken because of evidence of similar psychological, psychosocial and social implications across apparently distinct chronic conditions [41–43]. Studies demonstrate that factors such as activity limitations, which cut across diagnoses,

are more indicative of problems than the presence of chronic conditions [1,6]. Participants in the study had one of the following primary conditions: cerebral palsy, autism spectrum disorder, spina bifida, acquired brain injury, cleft lip and/or palate, Down syndrome, communication disorder, developmental delay, non-progressive muscular disorders, amputation, arthritis, or any other central nervous system disorder.

Procedures

Youth and parent questionnaire completion took place in the family's home or in a private treatment centre office. Written informed assent from youth and written informed consent from parents was obtained prior to the first interview. Study interviewers provided a standardised introduction to the youth then guided him or her through completion of the questionnaire (30–60 min). While the youth interview took place, the participating parent completed the parent questionnaire in a separate room (30 to 60 min). Youth and parent responses were not shared with each other.

Measures

The primary independent variables of interest were maternal mental health status and maternal education, as reported by the mother. Specifically, the respondent reported whether she currently had a long-term mental health condition. The item was treated as a dichotomous variable, whereby "1" indicated the presence of a mental health condition. In a separate question, the respondent specified the name of the condition(s) she had. Self-reported mental health has a strong and consistent association with a variety of mental morbidity measures and is a "useful indicator for monitoring general mental health" [44]. The presence of a maternal mental health condition in the current study was associated with low socioeconomic status, a demonstrated correlate of depression and other emotional problems in past studies [45]. In addition, 77% of mothers who indicated a mental health condition at baseline still reported this condition one year later, demonstrating moderate stability of the measure.

Maternal education was reported by the mother and measured using a single item asked within the baseline parent-report questionnaire with the following categories: less than high school, high school, some post-secondary education and post-secondary education. It was then recoded as high school or less, some post-secondary, and post-secondary to ensure an adequate number of cases for analysis in each category.

The adolescent outcome variables of interest were: emotional symptoms, conduct problems, hyperactivity/inattention and peer relationship problems as reported one year after baseline data collection (Time 2). These were obtained from parents' reports on the Strengths and Difficulties Questionnaire (SDQ) [44] that was embedded within the parent questionnaire in the larger study. These four outcomes represent distinct domains within the SDQ. The SDQ has demonstrated acceptable internal consistency (mean Cronbach's alpha of 0.73) and reliability (mean correlation of 0.62 over 4 to 6 months) [47]. In the current study, the Cronbach's alpha for emotional symptoms, conduct problems, hyperactivity/inattention and peer relationship problems was 0.71, 0.60, 0.82 and 0.70 at baseline, and 0.69, 0.61, 0.83 and 0.67 at Time 2, respectively. The SDQ has been demonstrated to be better than the Child Behaviour Checklist at detecting hyperactivity/inattention and at least as good at identifying emotional and conduct problems [48,49].

Each dependent variable was comprised of five items within the SDQ, with questions such as whether the child is "generally liked by other youth" (peer relationship problems), "often seems worried" (emotional symptoms), "loses temper" (conduct problems), and is "constantly fidgeting or squirming" (hyperactivity/inattention). Each of these variables was scored and then recoded into a binary category of clinical (1) and non-clinical (0). The cut-off point in scoring the SDQ for clinical symptoms for each domain is based on the provisional banding of SDQ scores specified by Goodman [47].

Control variables included: mothers' physical health ("1" = presence of health condition), mothers' employment status (full-time, part-time, homemaker, not in workforce), family income, marital status (married, common law, divorced/separated, single/widowed), mother's age, youth age, spouse's education (high school or less, some post-secondary, completed post-secondary, not applicable), language spoken in the home ("1" = not English), youth's primary diagnosis (cerebral palsy, spina bifida, autism spectrum disorder, acquired brain injury, other conditions), and an index of youth's activity limitations. This index was generated from three items about reported home, school and community limitations. Each item uses a four-point response scale about how much daily activities are limited by health-related problems, adapted from a measure in the Participation and Activity Limitation Survey [50]. Scores for the sample ranged from 3 to 12, with a higher score representing greater limitations. To partial out variance on the outcomes at Time 2, adolescent outcomes at baseline (emotional symptoms, conduct problems, hyperactivity/inattention and peer

relationship problems) were also included as controls. Baseline outcomes were scored in the same manner as the Time 2 outcomes described above.

Statistical analysis

Binary logistic regression models were used to estimate odds ratios for the likelihood of adolescents presenting in the clinical range for emotional, peer relationship, conduct and hyperactivity/inattention problems. Logistic regression was used based on the dichotomous nature of the outcome variables [51]. Child gender and mother's education were considered first, followed by mother's mental health. Subsequent models added maternal physical health and socio-demographic controls and then youth physical health/disability and demographic controls. Multiple imputation was used to replace values for missing data on study variables. There was less than 5% missing data across all variables at baseline. At Time 2, there was approximately 13% missing data due to loss to follow up. Ten multiple imputed data sets were used for all multivariate analyses. All analyses were executed using IBM SPSS Statistics, Version 21.0 (Released 2012. IBM SPSS Statistics for Windows, IBM Corp., Armonk, NY).

Results

Descriptive analyses

Table 1 presents descriptive statistics for the sample. Boys comprised 55% of the sample. The mean age of the adolescents was 13.7 years ($SD = 2.2$). Approximately 34% of adolescents had cerebral palsy. Most mothers (59%) had a post-secondary education. Approximately 16% reported a mental health condition. Thirty-six percent of those reported having depression, 20% anxiety, 17% depression and anxiety, 14% bi-polar disorder, and 13% another condition or combination of conditions (e.g. attention deficit disorder/depression, brain injury symptoms, post-traumatic stress disorder). With regard to psychological problems, 27% of the adolescents were in the clinical range according to the SDQ for emotional symptoms, 18% for hyperactivity/inattention, 42% for peer relationship problems and 12% for conduct problems.

Multivariate analyses

Odds ratios from a series of logistic regression models predicting each of the four adolescent outcomes are presented in Tables 2 to 5. As control variables were not the focus of this research, they were not included in the tables. In addition, any tested interactions that were not significant were not included.

Table 1. Baseline youth, maternal and socio-demographic sample characteristics (study controls).

Characteristics	<i>n</i>	(%)	<i>M</i>	<i>SD</i>	Min–Max
Youth gender					
Male	201	55.4	–	–	–
Female	162	44.6	–	–	–
Youth mean age (years)	363	–	13.7	2.2	11–17
Youth primary diagnosis					
Cerebral palsy	124	34.3	–	–	–
Spina bifida	31	8.5	–	–	–
Autism	35	9.6	–	–	–
Brain injury	47	12.9	–	–	–
Other condition	126	34.7	–	–	–
Youth mean activity limitations (score)	357	–	6.9	2.1	3–12
Missing data	6	–	–	–	–
Youth emotional problems ^a					
Clinical range	96	26.5	–	–	–
Non-clinical	262	72.1	–	–	–
Missing data	5	1.4	–	–	–
Youth hyperactivity/inattention ^a					
Clinical range	65	17.8	–	–	–
Non-clinical	291	80.1	–	–	–
Missing data	7	1.9	–	–	–
Youth peer relationship problems ^a					
Clinical range	151	41.6	–	–	–
Non-clinical	208	57.3	–	–	–
Missing data	4	1.1	–	–	–
Youth conduct problems ^a					
Clinical range	42	11.6	–	–	–
Non-clinical	316	87.0	–	–	–
Missing data	5	1.4	–	–	–
Mother mental health					
Condition present	59	16.3	–	–	–
No condition	304	83.7	–	–	–
Mother physical health					
Condition present	95	26.2	–	–	–
No condition	268	73.8	–	–	–
Mother education					
Post-secondary	215	59.2	–	–	–
Some post-secondary	69	19.0	–	–	–
High school or less	76	20.9	–	–	–
Mother employment status					
Employed full-time	164	45.2	–	–	–
Employed part-time	90	24.8	–	–	–
Homemaker	56	15.4	–	–	–
Not in workforce	47	13.1	–	–	–
Missing data	6	1.5	–	–	–
Household income					
Under \$25 000	50	13.8	–	–	–
\$25 000–\$49 999	55	15.2	–	–	–
\$50 000–\$64 999	49	13.5	–	–	–
\$65 000 or higher	167	45.9	–	–	–
Missing data/chose not to answer	42	11.6	–	–	–
Mother marital status					
Married	244	67.2	–	–	–
Common-law	28	7.7	–	–	–
Divorced/separated	54	14.9	–	–	–
Single/widowed	34	9.4	–	–	–
Missing	3	0.08	–	–	–
Mother mean age (years)	354	–	44.0	5.7	29–60
Missing data	9	–	–	–	–
Spouse education					
Post-secondary	161	44.4	–	–	–
Some post-secondary	53	14.6	–	–	–
High school or less	80	22.0	–	–	–
No spouse (N/A)	69	19.0	–	–	–
Primary Language Spoken in Home					
English	333	91.7	–	–	–
Other	30	8.3	–	–	–

^aClinical range for emotional, hyperactivity/inattention, peer relationship and conduct problems is calculated based on scoring of the Strengths and Difficulties Questionnaire specified by Goodman [49].
ns are before multiple imputation for missing values.

Table 2. Estimated odds ratios from a series of logistic regression models predicting clinical levels of emotional symptoms among adolescents with chronic conditions ($N = 363$).

Variable	Model 1		Model 2		Model 3 ^a		Model 4 ^b	
	OR	CI	OR	CI	OR	CI	OR	CI
Child Gender (Male)								
Female	1.15	0.81, 1.63	1.17	0.82, 1.66	1.21	0.84, 1.75	1.36	0.91, 2.02
Mother's Education (Post-Secondary)								
Some post-secondary	0.97	0.59, 1.58	0.99	0.61, 1.64	1.16	0.66, 2.05	0.95	0.53, 1.72
High school or less	0.79	0.51, 1.23	0.42		0.70	0.42, 1.16	0.75	0.44, 1.26
Mother's Mental Health (No Condition)								
Condition present			1.90**	1.24, 2.93	1.79*	1.09, 2.94	1.54	0.93, 2.57

Clinical range for emotional, hyperactivity/inattention, peer relationship and conduct problems is calculated based on scoring of the Strengths and Difficulties Questionnaire specified by Goodman [49].

Adolescents' baseline emotional functioning is controlled in all models.

^aModel 3 controls for the following maternal health and socio-demographic characteristics: mother's physical health, mother's employment status, mother's marital status, mother's age, household income, spouse's education and primary language spoken in home.

^bModel 4 adds the following adolescent health and demographic characteristics as controls: age, primary diagnosis, activity limitations.

* $p < 0.05$.

** $p < 0.01$.

Table 3. Estimated odds ratios from a series of logistic regression models predicting clinical levels of hyperactivity/inattention among adolescents with chronic conditions ($N = 363$).

Variable	Model 1		Model 2		Model 3 ^a		Model 4 ^b		Model 5 ^c	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Child Gender (Male)										
Female	0.65	0.39, 1.06	0.61	0.37, 1.01	0.64	0.37, 1.13	0.75	0.40, 1.33	1.32	0.66, 2.61
Mother's Education (Post-Secondary)										
Some post-secondary	1.02	0.54, 1.92	1.09	0.57, 2.07	1.35	0.63, 2.89	1.20	0.59, 2.99	0.88	0.55, 2.94
High school or less	0.84	0.47, 1.49	0.92	0.51, 1.66	0.92	0.47, 1.84	0.96	0.42, 1.73	0.78	0.43, 1.90
Mother's Mental Health (No Condition)										
Condition present			1.90*	1.11, 3.24	2.25*	1.17, 4.34	1.91	0.99, 3.91	4.78**	1.90, 12.02
Mother's Mental Health X Gender										
Condition present X Female									0.10**	0.02, 0.42

Clinical range for emotional, hyperactivity/inattention, peer relationship and conduct problems is calculated based on scoring of the Strengths and Difficulties Questionnaire specified by Goodman [49].

Adolescents' baseline hyperactivity/inattention is controlled for in all models.

^aModel 3 controls for the following maternal health and socio-demographic characteristics: mother's physical health, mother's employment status, mother's marital status, mother's age, household income, spouse's education and primary language spoken in home.

^bModel 4 adds the following adolescent health and demographic characteristics as controls: age, primary diagnosis, activity limitations.

^cModel 5 includes the above mentioned maternal health and household characteristics and adolescent health and demographic characteristics.

* $p < 0.05$.

** $p < 0.01$.

Emotional symptoms

As seen in Table 2, child gender and maternal education at Time 1 were not significantly associated with emotional symptoms at Time 2. Maternal mental health at Time 1 was associated with adolescents' emotional symptoms at Time 2 in Model 2 ($OR = 1.90$; $p < 0.01$) and Model 3 ($OR = 1.79$; $p < 0.05$), but this difference was lost with the introduction of study controls in Models 3 through 4. No significant differences were found between boys and girls in the relationship between maternal education or maternal mental health at Time 1 and emotional symptoms at Time 2.

Hyperactivity/inattention

Child gender and maternal education at Time 1 were not significantly related to adolescents' hyperactivity/

inattention at Time 2 (Table 3). In Model 2, adolescents of mothers with a mental health condition at Time 1 were more likely to have clinical signs of hyperactivity/inattention ($OR = 1.90$; $p < 0.05$) at Time 2. With the introduction of maternal and socio-demographic control variables, adolescents of mothers with a mental health condition at Time 1 were still more likely to have hyperactivity/inattention issues ($OR = 2.25$; $p < 0.05$) at Time 2. The effect of maternal mental health became insignificant when adolescent health and demographic characteristics were introduced. However, a significant interaction was found between child gender and maternal mental health in Model 5. Girls were less likely than boys to demonstrate clinical signs of hyperactivity/inattention when a maternal mental health condition was present ($OR = 0.10$; $p < 0.01$). There were no significant gender differences in the

Table 4. Estimated odds ratios from a series of logistic regression models predicting clinical levels of peer relationship problems among adolescents with chronic conditions ($N = 363$).

Variable	Model 1		Model 2		Model 3 ^a		Model 4 ^b		Model 5 ^c	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Child Gender (Male)										
Female	0.59***	0.43, 0.82	0.60**	0.43, 0.82	0.61**	0.43, 0.85	0.79	0.55, 1.14	0.60**	0.56, 0.89
Mother's Education (Post-Secondary)										
Some post-secondary	0.73	0.46, 1.15	0.75	0.47, 1.18	0.76	0.46, 1.28	0.55*	0.31, 0.96	0.51*	0.29, 0.91
High school or less	0.94	0.64, 1.39	0.97	0.65, 1.44	1.05	0.67, 1.62	1.19	0.75, 1.91	0.80	0.75, 1.36
Mother's Mental Health (No Condition)										
Condition present			1.33	0.87, 2.01	1.35	0.84, 2.16	0.99	0.60, 1.63	1.08	0.65, 1.81
Mother's Education X Child Gender										
Some post-secondary X Female									1.37	0.67, 2.81
High school or less X Female									3.72**	3.72, 9.38

Clinical range for emotional, hyperactivity/inattention, peer relationship and conduct problems is calculated based on scoring of the Strengths and Difficulties Questionnaire specified by Goodman [49].

Adolescents' baseline peer problem is controlled for in all models.

^aModel 3 controls for the following maternal health and socio-demographic characteristics: mother's physical health, mother's employment status, mother's marital status, mother's age, household income, spouse's education and primary language spoken in home.

^bModel 4 adds the following adolescent health and demographic characteristics as controls: age, primary diagnosis, activity limitations.

^cModel 5 includes the above mentioned maternal health and household characteristics and adolescent health and demographic characteristics.

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$.

Table 5. Estimated odds ratios from a series of logistic regression models predicting clinical levels of conduct problems among adolescents with chronic conditions ($N = 363$).

Variable	Model 1		Model 2		Model 3 ^a		Model 4 ^b	
	OR	CI	OR	CI	OR	CI	OR	CI
Child Gender (Male)								
Female	0.99	0.60, 1.61	1.00	0.61, 1.63	0.91	0.54, 1.54	1.00	0.56, 1.77
Mother's Education (Post-Secondary)								
Some post-secondary	1.21	0.62, 2.34	1.22	0.63, 2.36	1.76	0.79, 3.93	1.71	0.71, 4.09
High school or less	1.93*	1.14, 3.29	1.98*	1.16, 3.38	1.95*	1.04, 3.64	2.89**	1.47, 5.67
Mother's Mental Health (No Condition)								
Condition present			1.35	0.72, 2.52	1.81	0.89, 3.71	1.44	0.67, 3.10

Clinical range for emotional, hyperactivity/inattention, peer relationship and conduct problems is calculated based on scoring of the Strengths and Difficulties Questionnaire specified by Goodman [49].

Adolescents' baseline conduct problem is controlled for in all models.

^aModel 3 controls for the following maternal health and socio-demographic characteristics: mother's physical health, mother's employment status, mother's marital status, mother's age, household income, spouse's education and primary language spoken in home.

^bModel 4 adds the following adolescent health and demographic characteristics as controls: age, primary diagnosis, activity limitations.

* $p < 0.05$.

** $p < 0.01$.

association between maternal education and hyperactivity/inattention.

Peer relationship problems

In Model 1, girls were less likely to demonstrate peer issues ($OR = 0.59$; $p < 0.001$) (Table 4). Child gender retained its significance until Model 4, when adolescent physical health/disability and demographic controls were introduced. Maternal education at Time 1 was not significantly associated with peer relationship problems at Time 2 in Models 1 through 4. In Model 5, however, girls whose mothers had a high school education or less were about 4 times more likely to

have peer relationship problems at Time 2 than boys of the same maternal background ($OR = 3.72$; $p < 0.01$). Maternal mental health at Time 1 was not significantly associated with adolescents' peer relationship problems at Time 2. There were also no significant differences by child gender in the association between maternal mental health and peer relationship problems.

Conduct problems

As seen in Table 5, child gender and mother's mental health at Time 1 were not significantly related to conduct problems among adolescents with chronic conditions at Time 2. In Model 1, adolescents whose

mothers had a high school education or less at Time 1 were nearly twice as likely to develop conduct problems at Time 2 (OR = 1.93; $p < 0.05$). Maternal education remained significant with the introduction of maternal health and socio-demographic characteristics as well as adolescent characteristics in Models 3 and 4. Specifically, in Model 4, children of mothers with a high school education or less were almost three times more likely to develop conduct problems at Time 2 (OR = 2.89; $p < 0.01$). The interactions between maternal education and child gender as well as maternal mental health and child gender were not found to be significant for conduct problems.

Discussion

This study investigated the associations between maternal factors and emotional, hyperactivity/inattention, peer relationship and conduct problems among adolescents with chronic health conditions over a one-year period. Whether these relationships differed by child gender was also explored. Maternal education of high school or less was significantly associated with conduct problems after one year. This is of particular interest given that this disorder was least reported in the clinical range for youth in this study. This finding of lower prevalence of conduct problems among adolescents with chronic conditions is consistent with past research [34,36]. Due to its lower prevalence in this population issues related to conduct problems may go undetected, especially among disadvantaged youth. In addition, low maternal education was associated with poorer peer relations for girls over one year, which is of particular note since overall girls were less likely to exhibit peer problems than boys. This supports other research postulating that the impact of childhood disadvantage is strongest for girls [52]. Close to half of the youth in this study were in the clinical range for peer relationship problems. This finding is reflective of other research [34,36] and underscores the significance of this issue for adolescents with chronic conditions.

Like the association between peer relationship problems and maternal education, the relationship between maternal mental health and hyperactivity/inattention in youth varied by child gender over one year. Boys were more adversely affected in this area by the presence of a maternal mental health condition than girls, reflecting the findings of general population research [13,19,53–56].

Maternal education was not significantly related to emotional symptoms or hyperactivity/inattention and maternal mental health was not significantly related to emotional, peer relationship or conduct problems in

youth, either generally or by gender. It may be that the effects of these maternal factors on such problems are not evident until later in life [57], and it should be noted that data were limited to a one-year period rather than a longer duration of time. The findings of this study, however, are useful in that they have identified specific relationships among maternal education and mental health and adolescent emotional problems over the course of one year. Such information is valuable to health and social service providers and policy makers in determining who needs support and how it can best be provided.

Implications for paediatric practice

Children with chronic conditions require ongoing care and close follow-up throughout childhood and adolescence. Models of paediatric health and rehabilitation service delivery have evolved over time from medical and biomedical models where the focus has primarily been on diagnosis and improving physical health and body function to biopsychosocial and holistic models that take into account the physical, emotional, behavioural, social and developmental aspects of children's lives [58]. Family-centred care models have emerged that emphasise child and family strengths, facilitate family empowerment and encourage family-service provider collaboration [59]. Family-centred care fosters parental psychological health that can enhance caregiving of children [59]. Major components of a holistic, family-centred approach to service delivery are coordination and continuity of care, and interprofessional and interagency collaboration. Yet, despite the emergence of this type of approach, studies indicate a lack of integrated systems of care for children with chronic conditions and their families [60].

Research suggests that many adolescents with chronic conditions and their families are not receiving the mental health and other support services that they require [36,61]. In a study of behavioural problems among adolescents with cerebral palsy, only 16.1% received psychology services, and these were youth with the most severe externalising problems [36]. Adolescents with less disruptive problems, such as hyperactivity/inattention and peer relationship problems, are likely to go untreated [36]. Moreover, the high percentages of youth in this study with each type of emotional and behavioural problem suggest that comorbidity of problems is an issue, a further indication that services are required.

King and Chiarello [59] outline how paediatric clinicians, as members of health care teams, can implement family-centred applications to support

children and families in distinctive ways. They emphasise the importance of collaborative goal setting, effective communication with families and inter-professional team work with other members of the team to ensure children and families are referred to appropriate support services. Team collaboration can help to ensure assessments of children with chronic conditions are comprehensive and consider all aspects of health, functioning and the environment. Service plans could then take into account a child's medical diagnosis as well as any neuropsychological or psychosocial concerns that may exist. A holistic and family-centred approach to assessment and service delivery would allow teams to address children's and their families' needs, including those specific to the mother as primary caregiver, support their strengths, and consider the impact of the home and community environment on children's development [62]. This type of approach would help to support youth and mothers who are experiencing the types of problems identified in this study, such as boys who have both a chronic condition and hyperactivity/inattention problems, where the mother is also experiencing mental health problems. Moreover, there would be greater likelihood that families of lower socio-economic backgrounds would be assessed for resource and support needs to ensure problems are not overlooked and to optimise children's social and behavioural development.

Study limitations and directions for future research

This study has the following limitations. First, only the parental report of the SDQ measures was examined. However, other studies including children and adolescents with cerebral palsy have also used only the parental version of the SDQ [36,63], facilitating comparisons. Moreover, research has indicated parental reports on the SDQ to be more sensitive for all problems than child self-reports [64] and reliability problems exist with child reports [18]. Still, future research might also look at child self-reports, or father and teacher reports.

Second, our measure of maternal mental health was limited to mothers' self-reports. While self-reported mental health is not a substitute for clinical measures, it has been demonstrated to be useful in monitoring general mental health [44]. Self-reported long-term mental health is used in ongoing national health surveys as well as other empirical studies [56,57]. Further, this study indicated a maternal mental health prevalence rate (16%) that is similar to prevalence rates found in other studies using clinical measures [18,45,64]. Perceived mental health also has important implications

for service use and treatment compliance [44], which may be of particular interest here.

Additionally, it should be acknowledged that the majority of mothers (59%) participating in this study had post-secondary education. Thus, relationships may be underestimated here, and may actually be larger among more disadvantaged women and their children [65]. This study was focused on the direct effect of maternal education and mental health on the emotional and behavioural functioning of adolescents with chronic conditions over a period of a year. The relationships among maternal factors and adolescents' emotional and behavioural functioning may be more complex in nature. Future longitudinal research should consider the influence of other contextual factors on the mental health of both mothers and youth, such as access to services and informal and formal supports for families, and examine the interrelated and reciprocal nature of these relationships.

Despite its limitations, this study adds to the scant body of longitudinal research that examines the relationships among maternal factors and the emotional and behavioural functioning of adolescents with chronic conditions over time. Since mothers are the primary caregiver with responsibility for children's health and development in over 95% of family situations [66,67], it is critical to understand how their mental health and education are associated with the well-being of their children as they grow. This study also considers four different emotional and behavioural problems, rather than generalising disorders as internalising or externalising, as has often been done in past research. Moreover, the differential effect of maternal factors on emotional and behavioural functioning was examined between boys and girls. These aspects of the study enhance our understanding of how particular factors are related to various problems in both similar and different ways.

Conclusion

This study supports a link between maternal factors and emotional and behavioural outcomes in adolescents with chronic health conditions. Ultimately, both mental and physical health problems have a significant impact on children, their families and the health-care system as a whole. Treatment and services costs, as well as detrimental implications for social development and educational and occupational attainment, are only some of the ways in which comorbidity can affect health services and inhibit individual lives [68]. Indeed, the combination of chronic health conditions and emotional and behavioural problems can have long-lasting effects. This has important implications for service delivery,

particularly given the exacerbation of these issues for adolescents with chronic conditions from disadvantaged backgrounds. Coordination of care and collaboration among paediatric health professionals for children and their families is essential for optimising quality of life in both early and later years. Future research must thoroughly consider the roles of child, maternal, and other contextual variables in its quest to understand and ameliorate health inequalities for adolescents with chronic conditions and their families throughout the life course.

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