Effect of an Intensive Multi-Modal Intervention for Attention-Deficit Hyperactivity Disorder (ADHD) on Equity in Children's Health and Educational Outcomes

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BACKGROUND

Attention-Deficit Hyperactivity Disorder (ADHD), characterized by pervasive and age-inappropriate behavioural inattention, impulsivity, and hyperactivity, is the most common neurobehavioural disorder among children and youth. ADHD diagnoses also correlate with serious **behavioural, academic, and social difficulties**, which often persist from childhood and adolescence into adulthood.

Limited evidence exists for the long-term benefits of combining medication and behavioural modification into **multi-modal ADHD treatment approach**. These strategies have a number of complementary effects and may improve outcomes across a range of measures.

OBJECTIVES

To determine whether an intensive, multi-modal ADHD intervention for children and youth resulted in

a) improved long-term health, social, and educational outcomes

b) reduced inequity in these outcomes across the socioeconomic gradient

APPROACH

Data: **Administrative data** from the health, education, and social services sectors were extracted from the the Population Health Data Repository at the **Manitoba Centre for Health Policy.**

Intervention: The ADHD intervention is a multi-disciplinary program targeting children and youth aged 5-17. It offers a range of supports, including medication management, and ongoing consultations with mental health professionals and family intervention specialists. A physician must refer patients to the program for diagnostic assessment and/or medication review.

Population: The intervention group comprised **children and youth** (n=485) who had 3+ visits to the ADHD intervention program between 2007 and 2012. A **matched control group** (n=1,884) was constructed; controls had been diagnosed with ADHD but did not participate in the intervention program. Possible confounders were controlled using inverse probability of treatment weights.

RESULTS

Study Population

Table 1. Descriptive Characteristics of the Study Cohort

		Intervention Group (n, %)		Control Group (n, %)	
Total n		485	100	1,884	100
Sex	Male	401	83	1,604	85
	Female	84	17	280	15
Age at first visit (yrs)					
≤6		76	16	313	17
7		79	16	346	18
8		71	15	297	16
9		70	14	266	14
10		49	10	190	10
11		38	8	136	7
12		38	8	148	8
≥13		64	13	188	10
Income Quintile					
Q1 (lowest)		93	19	399	21
Q2		94	19	353	19
Q3		92	19	333	18
Q4		88	18	338	18
Q5 (highest)		109	22	429	23
Not found		9	2	32	2

Health, Social and Education Outcomes

Table 2. Health, Social, and Education Outcomes for Children and Youth with ADHD

		Rate Ratio (95% CI)	p-value
Health Outcomes			
Hospital Episodes		1.29 (0.68, 2.46)	0.43
Visits to Emergency Department			
All	Pre-treatment	1.09 (0.89, 1.35)	0.39
	Post-treatment	1.03 (0.75, 1.41)	0.87
Injury-Related	Pre-treatment	0.95 (0.67, 1.34)	0.77
	Post-treatment	1.00 (0.68, 1.46)	1.00
Medication Use		**1.21 (1.08, 1.36)**	**<0.01**
Medication Adherence		**1.42 (1.03, 1.96)**	**<0.05**
Social and Education Outcomes			
Contact with Child and Family Services		1.34 (0.54, 3.35)	0.53
Age Appropriate Grade		**1.33 (1.09, 1.63)**	**<0.01**

Significant values ($p < 0.05$) are in bold text. CI: confidence interval.

Concentration Curves and Concentration Indices

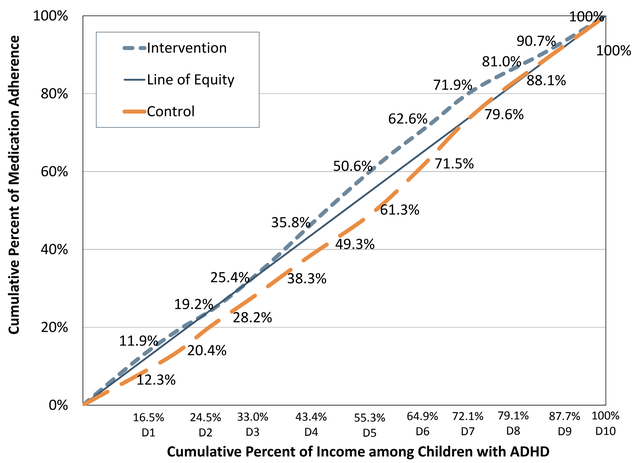

Figure 1. Concentration Curves for the Distribution of Medication Adherence across Income Deciles following the Intervention

Table 3. Distribution of Outcomes across the Socioeconomic Gradient following the ADHD Intervention

Outcome	Concentration Index (95% CI)		
	Intervention Group	Control Group	Absolute Difference
Medication Use	-0.045 (-0.096, 0.007)	0.025 (-0.003, 0.054)	**0.070 (0.013, 0.127)**
Medication Adherence	-0.052 (-0.107, 0.003)	**0.060 (0.031, 0.090)**	**0.112 (0.052, 0.173)**
Age Appropriate Grade	-0.023 (-0.082, 0.036)	**0.062 (0.032, 0.091)**	**0.084 (0.017, 0.152)**

Significant values ($p < 0.05$) are in bold text. CI: confidence interval.

Interpreting Concentration Curves

If curve **above** the line of equality, the outcome occurs more in **lower income deciles.**
If curve **below** the line of equality, the outcome occurs more in **higher income deciles.**

Interpreting Concentration Indices

Concentration indices represent the **area** between the curve and the line of equity.
Thus, the **absolute difference** between control and intervention groups' concentration indices represents the **change in equity associated with the intervention**.

KEY FINDINGS

Children and youth in the ADHD intervention group were more likely than ADHD controls to have **increased medication use, increased adherence to medication,** and were more likely to be in their **age-appropriate school grade.** Participation in the intervention was also associated with reduced inequity across income deciles in **adherence to medication** and **age-appropriate school grade.**

CONCLUSIONS

The ADHD intervention was associated with improvements to children and youths' long-term health and educational outcomes. The program also contributed to closing the gap between high- and low-income families.

POLICY IMPLICATIONS

This study demonstrates that intensive programming to manage ADHD can have a real impact on children and youth, setting them up with the potential to build stronger family relationships and achieve academic success despite the challenges they face in living with ADHD. Given that children in low-income households are at higher risk for ADHD, the finding that the program was associated with increased equity is particularly encouraging, as it suggests that access to treatment through the multi-modal intervention program is not a significant barrier for low-income Manitobans.

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