

# **Trajectories of Psychopathology and Mental Health Service Use Among Youth with A Physical Illness**

by

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This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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## **Statement of Contributions**

This thesis consists of three manuscripts that have been submitted for publication. Exceptions to sole authorship:

Chapter 5: Dol, M., Browne, D., Perlman, C., Ferro, M.A. (2024). Trajectories of psychopathology among youth with physical illness. Submitted to *Child Psychiatry & Human Development* (Manuscript ID: 54f0962a-5d30-420d-bd06-435e4362d1f4).

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As lead author of these three manuscripts, I was responsible for developing the objectives and research questions, conducting background research, leading the design of each study, conducting statistical analyses, interpreting the results, and writing the initial drafts. My co-authors provided guidance during each step of the research and provided feedback on manuscript drafts. Under the supervision of Dr. Mark Ferro, I also prepared the remaining chapters in this thesis, which were not written for publication.

## **Abstract**

Youth with chronic physical illness (CPI) are at an increased risk of developing co-occurring mental disorders (i.e., multimorbidity). About 40% of youth with CPI receive a mental disorder diagnosis. The relatively high multimorbidity prevalence suggests this is a pressing public health issue—youth with multimorbidity experience greater symptom severity and functional impairment. In addition, multimorbidity negatively impacts psychosocial outcomes, including health-related quality of life, self-esteem, and academic functioning. Although these children experience poorer outcomes and use a greater amount of mental health services, there is limited understanding of how specific trajectories of mental disorder symptoms (i.e., psychopathology) influence service use over time. By examining the course of psychopathology and its association with mental health service use (MHSU), we can identify critical intervention points aiming to improve the effectiveness of care and allocation of resources.

In Canada, the financial burden of mental illness is approximately \$51 billion annually, including costs arising from healthcare services, lost productivity, and poor quality of life. Compounding on these burdens, there is an acute shortage of youth-specific mental health services in Canada, where up to 70% of youth with mental health concerns do not receive the specialized services they need. Understanding MHSU in youth with CPI may help efficiently use resources, identify unmet needs, improve the timing of interventions, support families in predicting care needs, and inform policies for targeted and integrated services.

This dissertation addresses critical gaps in research on youth psychopathology among youth with CPI. While previous studies have explored youth MHSU, few have examined the unique trajectories of psychopathology in this population or how these trajectories affect mental health service use over time. Additionally, limited research has investigated the interplay between parent psychological distress, youth psychopathology, and healthcare use, particularly using longitudinal models. Focusing on these areas, this dissertation provides insights into the complex needs of youth with CPI. It highlights opportunities for improving integrated mental health and healthcare support for this at-risk group.

To address these gaps, this dissertation examined youth psychopathology trajectories and transitions and whether psychopathology trajectories impact the association between family factors and MHSU. Specifically, the objectives were to: 1) identify distinct trajectories of psychopathology among youth with a CPI; 2) validate these trajectories by comparing with categorical classifications produced by a diagnostic interview tool; 3) examine predictors of the trajectory groups; 4) identify distinct subgroups of youth psychopathology; 5) examine transitions across these subgroups of psychopathology; 6) identify predictors of such transitions; 7) explore if youth psychopathology trajectories mediate the association between family factors and MHSU.

The first study developed a trajectory model using latent class growth analysis (LCGA) to examine the optimal number of trajectories of youth psychopathology and predictors of the different trajectories. Results indicated a three-trajectory model characterized as low-stable, moderate-decreasing, and high-decreasing trajectories. Older

age, higher disability, greater parent psychological distress, and higher household income were associated with less favourable trajectories. Results demonstrate that youth with CPI exhibit different courses of psychopathology, and that different individual and family characteristics are associated with trajectory group membership.

The second study used latent profile analysis to identify four profiles of youth psychopathology: low psychopathology, primarily internalizing, primarily externalizing, and high psychopathology. Additionally, latent transition analysis was used to track transitions between these profiles over time. Many youths in the primarily internalizing subgroup transitioned to the low psychopathology subgroup over time. Further, youth classified in the high psychopathology subgroup from six to 24 months were more likely to have persistent psychopathology. These findings suggest that youth with CPI exhibit distinct profiles of psychopathology, with unique symptom combinations and patterns of change over time, emphasizing the potential for different mental health needs and trajectories within this population. Youth with CPI do not all experience psychopathology in the same way, and they may shift between profiles, suggesting dynamic changes in symptom patterns.

The third study conducted a path analysis to determine if youth psychopathology trajectories mediate the association between family factors (parent psychological distress and family functioning) and MHSU (i.e., contact with a healthcare professional). Results demonstrated that youth psychopathology trajectories (subclinical vs. low) mediate the association between parent psychological distress and contact with a healthcare professional.

These findings support using a family-centred care approach to youth healthcare to minimize the burden on families and promote well-being and positive health outcomes.

This dissertation fills a critical gap in terms of knowledge of psychopathology and MHSU among youth with CPI. Taken together, these findings can be distilled into four themes: (1) call for integrated physical and mental healthcare; (2) early identification of psychopathology among youth with CPI; (3) adaptive treatment approaches to care; and (4) the need for family-centred care in youth mental health settings. Future longitudinal research should investigate transitions across psychopathology profiles over longer periods and investigate other potential mediators that facilitate or impede the use of mental health services for youth with CPI.

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## List of Abbreviations

ADHD	Attention deficit hyperactivity disorder
AIC	Akaike information criterion
BIC	Bayesian information criterion
BLRT	Bootstrap likelihood ratio test
CCHS-MH	Canadian Community Health Survey- Mental Health
CD	Conduct disorder
CES-D	Center for Epidemiologic Studies Depression Scale
CI	Confidence interval
CPI	Chronic physical illness
DSM	Diagnostic and Statistical Manual of Mental Disorders
EBS	Emotional Behavioural Scales
FAD	McMaster Family Assessment Device
GAD	Generalized anxiety disorder
GAD-7	General Anxiety Disorder – 7 scale
GMM	Growth Mixture Models
ICD	International Classification of Disease
LCGA	Latent class growth analysis
LMR	Lo-Mendell-Rubin likelihood ratio test
LPA	Latent profile analysis
LTA	Latent transition analysis
MAR	Missing at random
MCMC	Markov chain Monte Carlo
MDD	Major depressive disorder
MHSU	Mental health service use
MINI-KID	Mini International Neuropsychiatric Interview for Children and Adolescents
MLR	Maximum likelihood estimation with robust standard errors

ODD	Oppositional defiant disorder
ON-MARG	Ontario Marginalization Index
OR	Odds ratio
SABIC	Sample adjusted Bayesian information criterion
SAD	Separation anxiety disorder
SEM	Structural equation modelling
SES	Socio-economic status
SP	Social phobia
WHODAS 2.0	World Health Organization Disability Assessment Schedule 2.0

# Chapter 1

## Introduction

Mental disorders impart a substantial burden on youth with chronic physical illness (CPI) due to their impact on overall well-being (1). The co-occurrence of CPI and mental disorder is common among youth and often persists over time (2,3). The term *multimorbidity* will be used to refer to the co-occurrence of CPI and mental disorder throughout this dissertation. Youth with multimorbidity experience greater symptom severity and functional impairment in both their physical and mental health (4). Furthermore, multimorbidity negatively impacts psychosocial outcomes, including health-related quality of life (5–8), self-esteem (9,10), and academic functioning (11,12). These adverse outcomes affect not only the youth themselves but also the mental health and functioning of parents and families (13–17). The impact on parents and families is relevant for youth with multimorbidity as families must navigate through a complex system that often delivers fragmented care between physical and mental healthcare settings (18,19).

Research examining physical-mental multimorbidity in youth is lacking, limiting our understanding of the mental health of youth diagnosed with CPI and how their psychopathology may change over time. Having a CPI can exacerbate the risk of developing mental disorder due to additional stressors such as managing the illness and associated functional limitations (20,21). Early identification is crucial to prevent long-term adverse outcomes, making it essential to study psychopathology in youth with CPI. This intersection of physical and mental health highlights the importance of studying these youth to

understand better how psychopathology develops and changes over time. Understanding psychopathology in this context can provide insights into targeted interventions for improving mental and physical health outcomes in this vulnerable population.

Youth psychopathology can evolve (22), with some children improving while others experience worsening symptoms. Tracking symptom trajectories over time helps identify youth at risk for chronically elevated symptoms versus those with mild transient symptoms, enabling more targeted interventions beyond cross-sectional assessments. By understanding the trajectories of psychopathology in this population of youth with CPI, clinicians and researchers can identify which youth are most at risk of poor outcomes and may benefit from more integrated physical and mental healthcare. Modelling trajectories can also identify key transition points for youth, as well as critical periods for intervention.

Youth with CPI may require additional health services to manage both their physical and mental health needs; thus, understanding the patterns of their mental health service use (MHSU) is an important area for study. Despite the increase in perceived need for and use of mental health services, barriers such as stigma, lack of access, or unrecognized symptoms often prevent youth from receiving the mental healthcare they require. By examining the relationship between psychopathology trajectories and MHSU in youth with CPI, this dissertation will contribute evidence to help identify youth who are less likely to access services. This knowledge can inform healthcare policies and practices for at-risk populations to improve service access and utilization.

This dissertation examines the complex relationships between youth psychopathology trajectories, family factors, and MHSU. It focuses on identifying patterns of psychopathology, transitions between psychopathology profiles, and the mediating role of these trajectories between parent psychological distress, family functioning, and contact with healthcare professionals. Chapter 2 provides an overview and review of relevant scientific literature pertaining to the scope of the dissertation. Chapter 3 outlines the rationale of the dissertation and the specific objectives for each research question. Chapter 4 outlines the general methods, which describe the Multimorbidity in Youth across the Life-course (MY LIFE) study, details relevant measures, and describes the statistical analyses conducted and the rationale for choosing such analyses. Chapters 5, 6, and 7 discuss the relevant work and answers for each research question in the form of three manuscripts. Lastly, Chapter 8 provides an integrated discussion of the overall dissertation, including findings, implications for policy and clinical practice, and opportunities for future research.

## **Chapter 2**

### **Background**

This chapter will begin by defining youth psychopathology and describing the connection between CPI and increased risk for psychopathology, including trajectories and transitions of psychopathology over time. CPI is the presence of a long-term condition that persists for 12 months or longer and requires ongoing medical care. Then, this chapter will review the impact of parent psychological distress and family functioning and their role in youth mental health. This will be followed by an overview of MHSU among youth, focusing on youth with CPI. The underlying theoretical approach will then be introduced, the Anderson Model of Health Service Use. The chapter will conclude by identifying gaps in the literature that this dissertation will address.

#### **2.1 Youth psychopathology**

In Canada, mental disorders are prevalent among youth, with approximately one in five children and youth (herein youth) affected (23). Youth mental disorders are the leading contributor to the burden of disease (24). Most of this burden is due to common mental disorders and subclinical mental disorder symptoms (25–28). These mental disorder symptoms, often referred to as *psychopathology*, have implications for youth emotional, social, and academic development (29–33). Most mental disorders (~75%) occur before the age of 25, and the peak onset age for mental disorders is 14.5 years (34). Youth are at a critical period in developing their mental health (35,36). They must navigate numerous

challenges, including transitioning into different social roles and developing distinct identities, which can impose a strain on mental health (37).

Mental disorders can have long-lasting impacts throughout the life course as they are often chronic (37,38), leading to poorer outcomes regarding functioning, health-related quality of life, educational/employment attainment, relationships with others, frequency of accidents and injuries, and criminal behaviour (37,39–41). The burden of mental disorders is not only carried by children and their families but also by the healthcare system and broader society (37). Evidence has shown that the perceived need for and use of mental health services among youth is increasing in Canada, which includes healthcare professional consultations, emergency department visits, and hospitalizations (36,42). In Canada, mental disorders cost the economy approximately \$51 billion per year in healthcare costs, lost productivity, and lower quality of life (43).

Mental disorders are commonly categorized into two distinct groups of symptoms—internalizing and externalizing (3). However, emerging frameworks, such as the Hierarchical Taxonomy of Psychopathology (HiTOP) and research on the general psychopathology factor (p-factor) suggest additional dimensions, including thought disorders, which do not fit into these traditional categories (44,45). For this thesis, I focus on the traditional categorizations of internalizing and externalizing symptoms, as these are the dimensions measured by the tool utilized in this research. While thought disorders and other dimensions proposed by broader frameworks such as HiTOP are important, they are beyond the scope of this dissertation. The internalizing dimension is further divided into secondary dimensions of fear

and distress. It is characterized by high levels of negative affectivity, including mood disorders such as major depressive disorder (MDD) and dysthymia, and anxiety disorders such as generalized anxiety disorder (GAD), separation anxiety, phobias, and eating pathology (44–46). The externalizing dimension is characterized by maladaptive behaviours directed outward into the environment, including attention-deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), conduct disorder (CD), and substance use disorders (46).

## **2.2 Measures of youth psychopathology**

The assessment of emotional and behavioural problems is commonly evaluated using either dimensional or categorical measurements (47). Dimensional approaches consider problems as varying along a spectrum of severity or frequency. In contrast, categorical approaches use diagnostic frameworks such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) (48) or the International Classification of Diseases (ICD) (49) to dichotomize problems, identifying a disorder as present or absent (50).

Many studies define youth psychopathology using diagnostic criteria from the DSM-5. Only studying youth who meet the full criteria for mental disorders may underestimate the burden as those with symptoms who do not meet full diagnostic criteria might still suffer from an impairment, risk of chronic problems, and future disorders as an outcome of those symptoms (51,52). Thus, a more comprehensive understanding of youth psychopathology should not be limited to DSM disorders but requires the full spectrum of mental health, including subclinical symptoms.

Structured diagnostic interviews are a common categorical approach designed to categorize emotional and behavioural problems based on diagnostic criteria for mental disorders. However, they have disadvantages, including being costly and time-consuming, and their reliability is low. Additionally, while these interviews classify problems categorically, they do not measure them dimensionally (50).

Youth can report their symptoms using checklists to provide a dimensional measurement of psychopathology. Since the early 2000s, these checklists have been used in psychological epidemiological research to assess emotional and behavioural problems as dimensional traits (50). The benefits of checklists include conciseness, low respondent burden, and ease of administration (53). In terms of psychometric properties, they also offer increased validity and reliability compared to categorical measures (54). The Emotional Behavioural Scales (EBS) is used in this dissertation as a checklist for symptoms of youth psychopathology.

### **2.3 CPI and youth multimorbidity**

Approximately 25% of children and youth under 18 years of age have a CPI (55), exposing them to stressors related to symptom management, family stress, and lifestyle limitations (56). CPI is defined as those conditions anticipated to persist for 12 months or longer, leading to one or more sequelae, such as functional limitations, reliance on support to manage these limitations, or the need for extra healthcare (57). Chronic physical illnesses include asthma, juvenile arthritis, diabetes, epilepsy, and cerebral palsy.

Youth with CPI are at an increased risk of subsequently developing mental disorders (5,58–60). This co-occurrence of CPI and mental disorder – defined as *physical-mental multimorbidity* – is common among youth, as about 40% of children with CPI also receive a diagnosis for a mental disorder (61,62). In population samples, the estimate is lower, with approximately 20-30% of children with multimorbidity (4). This prevalence suggests that multimorbidity is a pressing public health concern. Several factors are associated with multimorbidity, including older youth, males, higher levels of disability, parent depression, higher household income, and increased cortisol levels (63,64). Intervening early is crucial to prevent the onset of mental disorders among youth with CPI, as youth with CPI experience worse psychosocial health (65) and use a larger amount of mental health services (65,66).

Youth with multimorbidity are a priority population that utilizes many healthcare resources (67). Approximately 5% of children account for about 60% of healthcare costs, primarily due to treating chronic illnesses and multimorbidity (68). Multimorbidity is also linked to various adverse outcomes, including reduced health-related quality of life, more severe mental health symptoms, and a negative impact on physical health (5,58–60,66). Integrated care approaches are needed for youth with multimorbidity and can help address outcomes of worse disability, reduced social interaction, and poor treatment adherence (66,69,70). Integrated care is a strategy to address the fragmentation of the healthcare system across different domains of healthcare (physical health, mental health, substance use) and through different levels and sites within the healthcare system (e.g., from universal services and primary care, through specialized mental health care centers) (71). The delivery of care

should be tailored to the needs of individual children and their families across developmental periods (72). The goal of integrated care is to improve access to care and quality of care for families with a focus on efficiency and cost-effectiveness (71).

The chronicity of multimorbidity poses a significant public health and clinical challenge, as these youth frequently require complex care management that spans both physical and mental health services, along with coordination of education and social services (62,73). This chronicity poses such challenges as it can lead to delayed treatment due to fragmented care, increased hospitalizations and emergency room visits, as well as interfering with school attendance and social engagement.

#### **2.4 Psychopathology trajectories and transitions**

Understanding the course of psychopathology in youth requires examining both the trajectories of mental disorder symptoms over time and the transitions between different mental disorder profiles. By studying these patterns, researchers can gain insights into how psychopathology evolves, the factors that influence these changes, and the potential for understanding crucial transition points for intervention. Numerous studies have examined trajectories of psychopathology across internalizing and externalizing domains using trajectory-based analyses. Oerlemans et al. (2020) identified distinct trajectories of youth psychopathology, including classes with decreasing, continuous, and moderate symptom patterns. Nivard et al. (2017) found five trajectories ranging from very low to increasing trajectories. Similarly, Veldman et al. (2015) identified four trajectories for internalizing and

externalizing problems: high-stable, decreasing, moderate-high, moderate-low, and low-stable.

On the other hand, transitions between psychopathology profiles offer essential insights into how youth move between different mental health statuses over time. By examining these transitions, researchers can better understand patterns of stability, persistence, improvement, or worsening of symptoms, which can inform targeted interventions for youth at risk of persistent or escalating psychopathology. Research on transitions within specific domains, such as internalizing and externalizing symptoms, has shown that as the time between initial and follow-up assessments increases, the overall stability of psychopathology tends to decrease (74,75). Additionally, findings indicate that externalizing behaviours tend to exhibit greater stability over time than internalizing symptoms, which may be more likely to fluctuate across developmental stages (76–78).

Much of the literature in this area utilizes large population-based youth samples, leaving gaps in our understanding of trajectories and transitions of psychopathology in clinical samples of youth who are at higher risk of poor health and social and functional outcomes. Likewise, multimorbidity research using growth curve modelling has typically focused on single physical and mental disorders (79–83). Examining both the trajectories and transitions of psychopathology provides a comprehensive understanding of how psychopathology changes in youth. While trajectories offer insight into the long-term patterns and predictors of symptom development, studying transitions highlights the dynamic nature of psychopathology, revealing when and how individuals shift between

psychopathology states. Together, these approaches underscore the importance of identifying stable and transient phases of psychopathology, which can inform interventions tailored to prevent the persistence of more severe, chronic symptoms and support recovery.

## **2.5 Predictors of psychopathology trajectories**

Identifying and examining the factors that contribute to psychopathology trajectories among all youth is important to identify those who are at risk of worsening psychopathology. Numerous individual, familial, and environmental predictors aid in shaping the development and progression of internalizing and externalizing symptoms in youth. By examining these predictors, researchers can gain valuable insights into why some youth experience worsening symptoms and some show improvement while others exhibit stable symptoms over time. Risk factors for psychopathology in youth are typically categorized into youth characteristics and parent/family characteristics. Child characteristics include age, sex, ethnicity, physical health, cognitive/psychological function, pre- and perinatal exposures to illness, stress, self-esteem, low self-efficacy, high trait perfectionism, poor peer relationships, alcohol, drugs, nutrition, and infections/environmental agents. Parent/family characteristics include parent age, education, socioeconomic status, employment, psychiatric and medical history, and family functioning (25,29,84–87). Additionally, the diagnosis of a CPI, a potentially chronic lifelong health problem, could be considered an adverse or traumatic experience early in life (88,89).

This section will explore key predictors of youth psychopathology that are relevant to this dissertation, including child age, sex, disability, household income, and parent mental

health, providing a foundation for developing targeted interventions and prevention strategies.

Evidence suggests sex differences in youth mental health whereby males show more aggression and noncompliance behaviours and females have more anxiety and depression symptoms (90). The prevalence of mental disorders, including attention deficit hyperactivity disorder (ADHD; M:7.5% vs. F:2.7%), oppositional defiant disorder (ODD; M:9.5% vs. F:6.1%), and conduct disorder (CD; M:1.7% vs. F:1.3%), are much higher among male youth compared to female youth. On the other hand, there is a higher prevalence of major depressive disorder (MDD; M:4.7% vs. F:5.7%) and generalized anxiety disorder (GAD; M:4.8% vs. F:6.2%) in female youth compared to male youth (23).

Age is an important predictor of psychopathology trajectories because changes throughout development can impact the onset and progression of psychopathology symptoms. Research shows that younger youth may experience more transient symptoms, while older youth are more likely to exhibit stable psychopathology over time (78,91–93). Regarding mental disorders, a previous report showed increases in mood disorders from early to late adolescence and from late adolescence to young adulthood (94). In contrast, anxiety disorders showed steep increases from childhood to early adolescence but remained stable from late adolescence to young adulthood (95). Anxiety disorders were most common in children ages 5 to 9, while depressive disorders were most prevalent in teens and young adults aged 15-24 (96). Externalizing disorders tend to arise in childhood and peak in severity during late childhood or early adolescence and decrease in late adolescence (97).

However, they can persist into adulthood, such as ADHD and CD, both of which are critical targets in treatment and prevention because they often increase the risk of addiction and substance use problems as well as personality disorders (98–101).

Youth with higher levels of disability face a greater risk of developing more persistent psychopathology (61), partly due to the added challenges of managing their disability and self-esteem (102). The term disability captures functional limitations resulting from health conditions. Research has shown that individuals experiencing disability are more prone to anxiety and depression (102), and they often engage in more passive, solitary activities (103–107). This limited engagement in meaningful social and leisure activities can negatively impact their self-esteem, self-concept, and sense of belonging (107,108), further contributing to feelings of isolation and deepening psychological distress. Moreover, the interplay between disability and mental health often creates a vicious cycle; as mental disorder symptoms worsen, they further impair daily functioning and quality of life, compounding the challenges faced by those with disability and functional impairment. This underscores the need for integrated interventions that address both physical and mental health challenges in youth with higher levels of disability.

Studies show that youth from lower socioeconomic status (SES) families have a higher prevalence of mental disorders compared to those from high SES families, regardless of the SES indicator used (e.g., parent education, household income, neighbourhood deprivation) (109). Parental education, particularly maternal education, plays a crucial role in shaping youth psychopathology, with higher education levels linked to better mental health

outcomes (110). Lower parental education is associated with an increased risk of mental disorders and worse psychosocial health outcomes in children (109). Parent education is especially influential in early childhood as it may enhance parental awareness of the psychological well-being of the family (111). Evidence suggests that this relationship is mediated by emotional well-being, parenting practices, and health literacy (110). Furthermore, different developmental phases may alter the importance of contextual influences, with the family context being more critical in childhood and the school and peer environment being more relevant in adolescence (110).

Similarly, household income impacts youth psychopathology trajectories, as children from families with low household incomes have a higher risk of mental disorders (112,113). A prospective study found that increasing household income has a dose-response relationship with youth mental disorders as income was associated with continuous decreases in child mental disorders, with the strongest effects observed for ADHD, depression, and anxiety (112). Lower household income can lead to increased stress and reduced access to care, increasing the likelihood of more severe or persistent psychopathology in children (114,115).

## **2.6 Parent psychological distress and family functioning**

Most studies examining the relationship between parent psychological distress and youth psychopathology focus on maternal distress, reflecting the prominent caregiving role mothers often play in the family environment (116). Studies show that parents with mental disorder often exhibit behaviours such as reduced engagement and monitoring, which contribute to a stressful family environment (13,26,117–119). These conditions can heighten

negative emotions in children (e.g., anger, fear, sadness) and increase their vulnerability to both internalizing and externalizing problems through complex, interconnected processes involving emotional dysregulation, caregiving dynamics, and environmental stressors (120). This relationship between parent and child mental health is also bi-directional, with child behavioural disorders often exacerbating parental psychological distress, creating a feedback loop of distress within the family (121). Shared genetic factors are processes that can explain this association between parent psychopathology and child susceptibility to emotional and behavioural problems (122). Addressing both child and parent mental health is crucial for reducing the impact of parental distress on children, thereby improving child mental health outcomes.

Family functioning is important in shaping youth psychopathology, with poor family dynamics linked to more negative mental health outcomes for youth. Dysfunctional environments can undermine emotional support and hinder coping strategies, contributing to the persistence or worsening of psychopathology in youth (123,124). Marital conflict, parent-child discord, and poor family cohesion are predictors of youth depression and behavioural problems (125–127). Specific domains of family functioning, including problem-solving and communication, are particularly influential in youth mental health, with deficits in these areas associated with an increase in the likelihood of youth mental disorder (123). Additionally, the presence of a mental disorder in children can negatively impact overall family functioning, suggesting another bi-directional relationship within family environments. Youth psychopathology can increase family conflict, reduce cohesion, and make it difficult for

families to balance the needs of all members (126,128–130). This strained dynamic can further exacerbate child symptomatology, leading to poorer clinical outcomes, including heightened symptoms, higher levels of disability, and worse response to treatment (131–134). Addressing family functioning is essential, as family dysfunction can not only contribute to the onset of psychopathology but also hinder recovery and long-term well-being for youth with psychopathology.

## **2.7 Mental health service use**

Mental health services in Canada operate under the Canada Health Act, adopted in 1984, which ensures that healthcare, including mental health services, is publicly funded and accessible to all Canadians (135). The Act emphasizes five principles: public administration, comprehensiveness, universality, portability, and accessibility (136). While mental health services are included under the Act, it only requires public funding of “medically necessary” treatments, often delivered in hospitals or primary care settings (137). Treatments at the community level, such as psychotherapy, counselling, and peer support, are not included (137). This results in a mental healthcare system with varying access, coverage, and quality (137). This is particularly relevant, as it can result in disparities in service availability and access, especially for youth.

In Ontario, various mental health services are offered through different types of providers in the community, primary care, and hospitals, including inpatient and outpatient services (138). Community Health Centers and Family Health Teams deliver primary care across the province (139,140). While family doctors are the first point of contact for most

publicly funded mental health services, many have reported that they lack the resources or specialized mental health training to meet the growing demand for services (141–143). This has led to a fragmented mental healthcare system for youth in Ontario, where services are siloed, and youth and their families are unable to access the specialized care they need in a timely manner (144–146).

The perceived need for and use of mental health services has been increasing among children and youth in Canada (36,42). Despite the need for timely and appropriate treatment within these services, evidence suggests that the limited access to and use of mental health services for youth is an important clinical and public health problem in Canada (147).

Most Canadian youth experience delays in mental health services related to help-seeking, long wait times (148), and long pathways to care (149,150). Youth with a CPI also experience difficulty transitioning from child and adolescent to adult services and treatment non-adherence (19). In addition to difficulty accessing mental healthcare, there are issues of coordination between community and primary care services in Canada (151–154). This lack of coordination can impact individual quality of life, and access to care. Specifically in Canada, care fragmentation is prevalent—the lack of flow of information and resources between different care sectors, results in poor efficiency and effectiveness of care provision (155). Because mental disorders are common in youth with a CPI, access to comprehensive services and multidisciplinary care is important (19). Furthermore, parents and caregivers are key factors in helping youth seek mental health treatment (156). Yet, limited availability and

unclear paths to youth-specific mental healthcare led to stress and confusion for parents and worse mental health for youth (157,158).

In light of these issues, less than one-third of youth have contact with a mental health provider (23), resulting in reliance on acute care and emergency services (36,159–161). Barriers to mental health services include poor integration of community care with healthcare services (162), long wait times (137,163), not knowing where to go for help (Government of Ontario, 2020; Stats Can, 2019), shortage of mental healthcare providers (137), language/cultural barriers (137), stigma (164), geographic and demographic barriers (e.g., rural areas, lack of cultural sensitivity, discrimination) (137,165), and costs for services that are not covered or partially covered by private insurance (137,166). Poor integration of community care with healthcare services is an especially important barrier for the population included in the current study sample of youth with a CPI. The unique challenges faced by youth in this population, such as the added burden of managing both CPI and mental health symptoms, can complicate their access to coordinated care, further prioritizing the removal of this barrier. This siloed care can result in delays in receiving appropriate mental health support (167). When youth are not provided or are waiting for mental healthcare services, it becomes a missed window of opportunity for early intervention. This early intervention for youth with CPI is essential to prevent worsening mental health symptoms, improve coping skills, and ensure better coordination across mental and physical healthcare.

Despite evidence that the perceived need for and use of mental health services is increasing in Canada (65), how and to what extent youth with a CPI utilize mental health

services is understudied. Although children and youth with multimorbidity account for approximately 60% of healthcare costs (68), the current organization and delivery of services are not adequate to support youth mental health concerns (37). Clinical research has demonstrated that youth with multimorbidity are less likely to receive inpatient care and have reduced hospital stays for their mental health concerns (168). Additionally, physical illness is often disregarded as an individual-level determinant of mental disorder in youth (1,29,59,169). Often, the management of their physical health may be prioritized, unintentionally disregarding mental health needs (170).

The Canadian healthcare system is fragmented and would benefit from a more integrated and collaborative approach to care designed to meet the needs of these youth (137,139,171). Multimorbidity poses significant challenges to healthcare systems due to its association with increased disease severity, increased demand for treatment, lengthier treatment duration, and reduced treatment response (172,173). Effective mental healthcare delivery must be a priority in this population of high-risk youth. Thus, integrating physical and mental healthcare has received much attention for early intervention and improved treatment outcomes. The Canadian Mental Health Association has highlighted service integration as one of its five strategies to ensure mental healthcare receives equitable and proportional recognition within the healthcare system (137). Further, the Canadian Paediatric Society suggests that “integrating mental healthcare into pediatric primary care is critical to optimize the health of Canadian children and youth” (174).

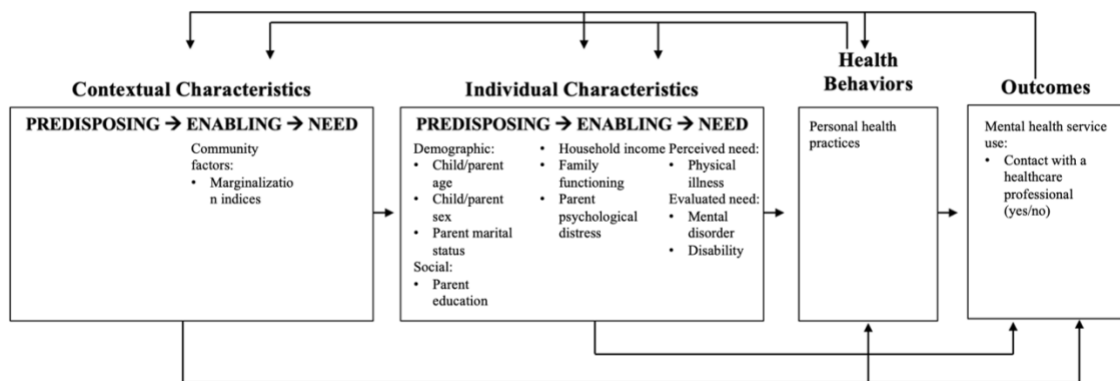
## **2.8 The Anderson Model of Health Service Use**

A factor unique to youth is their reliance on parents or caregivers to seek mental healthcare. Understanding the current challenges to mental health service access in Canada is crucial to advocating for integrating health services to enhance treatment outcomes. Promoting uptake in service use among youth with mental disorder is improved when efforts depend on established and robust frameworks.

The Andersen Model of Health Service Use is one of several theories and one of the more widely acknowledged and cited frameworks related to the utilization of health services (175–178). Initially developed by Ronald Anderson in 1968, the model is applied to explain associations between the factors that impact health service use (179,180) and reflects a comprehensive framework for understanding access to healthcare services. This model contextualizes service use as potential and realized access, influenced by individual and contextual characteristics. It includes three main components: predisposing, enabling, and need factors. Recent model versions differentiate between individual and contextual determinants of service use (180). Contextual characteristics are measured at the aggregate level and include community characteristics (180).

The model informed this study by guiding the selection of variables across predisposing, enabling, and need factors, which are important to understanding MHSU. Predisposing factors, such as age and sex, were included based on their potential to influence healthcare utilization. Enabling factors like family income, family functioning, and parent psychological distress were selected to capture contextual elements that facilitate or hinder

service use. Need factors, particularly youth psychopathology, disability, and CPI diagnosis were identified as key drivers of healthcare needs. The model also informed the directionality of associations, positing that youth psychopathology (a need factor) may potentially mediate the relationship between family factors (enabling factors) and MHSU. Additionally, the analytic approach, including mediation and trajectory analyses, was structured to align with the conceptual framework of the model, ensuring consistency between theory and methodology.



**Figure 1.** A theoretical model based on the Andersen model of health service use.

\*Personal health practices include characteristics such as diet and exercise, but they are not included in this thesis.

### 2.8.1 Predisposing Factors

For youth with multimorbidity, predisposing factors include demographics such as age, sex, and parent education. Research suggests that older youth are more likely to report MHSU (23,181,182), and females generally report greater MHSU than their male

counterparts (22,183,184). Parent education may also be associated with child MHSU on account of increased mental health literacy among these parents (185,186).

### **2.8.2 Enabling Factors**

Enabling factors cover the availability and accessibility of mental health services, family-centered care, and support systems. Multiple family and youth characteristics are associated with accessing services, such as family insurance benefits, the severity of child symptoms, SES, geographical location, and stigma (187). In the context of this dissertation, household income and family functioning are individual level enabling factors. Research is inconsistent on household income. One study has shown that lower-income youth in general are more likely to use outpatient mental health services (188), whereas another study has found that youth living in poverty are less likely to connect with mental health services (114). Evidence suggests that better family functioning is associated with a lower likelihood of MHSU (168). Furthermore, contextual level enabling factors, such as neighbourhood marginalization, play a significant role. Prior research has found that children living in more deprived areas, specifically neighbourhoods with higher concentrations of poverty, are more likely to have mental health problems (189). However, the association between marginalization and MHSU requires more research.

### **2.8.3 Need Factors**

Need factors in the model include perceived and evaluated needs. Need factors are associated with the severity and type of physical and mental health conditions experienced by

youth. Need factors, such as perceived health status, are significant predictors of help-seeking for mental health concerns (190). In this dissertation, psychopathology was considered a perceived need. Those who report higher levels of psychopathology may report more MHSU compared to those who report lower levels.

## **2.9 Gaps in the literature**

Despite the growing research on youth psychopathology and MHSU, several gaps in the literature remain, especially in the context of youth with CPI. Specifically, there is a need for research that explores the dynamic nature of psychopathology trajectories and transitions over time among youth with CPI. Additionally, understanding how these trajectories influence MHSU, especially among youth with CPI, is crucial to guide the allocation of healthcare resources towards those with greater need.

In general, most clinical studies on multimorbidity have been small, cross-sectional, and focused on a single mental or physical illness (191). In child psychiatry, comorbidity among mental disorders is the rule rather than the exception (192). The fact that comorbidity is common and symptoms between internalizing and externalizing domains overlap supports the approach to modelling both. This dissertation utilizes a sample of youth with various physical illnesses and a range of mental disorder symptoms, whose families are followed longitudinally. Longitudinal modelling for internalizing and externalizing psychopathology patterns in high-risk clinical samples of youth with CPI is lacking. Further, factors that impact access to mental health services are largely unknown among youth with a CPI. Therefore, this dissertation aims to characterize the trajectories of internalizing and

externalizing psychopathology among youth with a CPI and to evaluate the influence of these trajectories on healthcare professional contacts. It is important to address these gaps in knowledge to inform integrated healthcare and ensure timely and appropriate access to treatment for this high-risk group of youth.

While longitudinal evidence exists that identifies trajectories of youth psychopathology, most studies use large epidemiological samples or focus on one mental or physical illness (32,80–83,93,193–198). Additionally, studies examining internalizing and externalizing symptoms have not explored a population of youth with physical illness, focused on adolescence to early adulthood, or evaluated different subscales of internalizing and externalizing problems compared to the measure used in this dissertation (EBS). Previous research has modelled separate and fewer illnesses under the internalizing and externalizing sphere (193,194,197,199), whereas this dissertation models a broader coverage of internalizing and externalizing symptoms and aligns better with DSM diagnostic criteria. Studying dimensional psychopathology is critical, as it allows for a more nuanced understanding of symptom severity, co-occurrence, and developmental trajectories, which may be particularly relevant for youth with CPI and their unique mental health needs.

To the best of our knowledge, this was the first study to identify psychopathology trajectories in a clinical sample of youth with various CPIs and to examine a wide range of mental disorder symptoms across the internalizing and externalizing domains. Furthermore, although predictors such as age, sex, family factors, and socioeconomic status have been examined, there is limited understanding of how these factors collectively influence the

development and progression of youth psychopathology trajectories (32,194,199). This knowledge is important for clinical practice to identify those at greater risk of worsening or persistent psychopathology early in life and guide timely and targeted interventions. Additionally, understanding these risk factors can improve public health strategies, efficient resource allocation, and long-term mental health outcomes for youth.

Previous studies have identified distinct youth psychopathology profiles spanning the internalizing and externalizing domains using latent class or latent profile analysis; however, much of the research utilizes cross-sectional study designs (200,201), large population-based samples of school-age children (202–204), and samples characterized by high poverty levels (205,206). Furthermore, some studies have utilized latent transition analysis (LTA) to examine individual-level changes across profiles over time (207–209). However, there is a lack of understanding of the stability and change of psychopathology profiles, specifically in youth with CPI. This thesis will identify psychopathology profiles in this high-risk population and explore factors that drive transitions between these profiles over time among youth with CPI. This can have implications for identifying optimal targets for future intervention studies and youth more likely to benefit from early treatment.

Existing research has explored individual associations between family factors and youth MHSU. However, there is a notable gap in understanding whether youth psychopathology trajectories mediate this relationship. Research specifically examining the impact of family functioning on MHSU is particularly scarce despite evidence that family dynamics can impact youth mental health outcomes. Similarly, while parent psychological

distress is known to impact youth psychopathology, few studies have investigated whether this distress indirectly influences service engagement through its impact on psychopathology trajectories. Furthermore, longitudinal evidence on the evolving relationship between family factors and MHSU, especially how these factors affect youth psychopathology and service engagement, is limited. Addressing these gaps is essential to better understanding how family dynamics contribute to MHSU in youth with CPI.

## **Chapter 3**

### **Study Objectives and Research Questions**

#### **3.1 Purpose of Dissertation**

This dissertation identified psychopathology trajectories among youth with CPI and investigated whether these trajectories mediate the association between family factors (i.e., parent psychological distress and family functioning) and MHSU (i.e., contact with a healthcare professional). Furthermore, this dissertation evaluated latent profiles of youth psychopathology and transitions between these profiles over time, including predictors associated with transitioning. The following section describes the three research studies conducted to meet these objectives.

#### **3.2 Study 1: Psychopathology trajectories among youth with multimorbidity: A latent class growth analysis**

##### **3.2.1 Research Questions**

The objectives of Study 1 were to determine the latent class trajectories of internalizing and externalizing psychopathology over time, the validity of these trajectory groups, and the predictors of trajectory class membership among a clinical sample of youth with CPI. This paper answered the following research questions:

1. What is the optimal number of psychopathology trajectory classes among youth over time (i.e., baseline, six months, 12 months, and 24 months)?

2. Are the identified trajectories valid when compared to diagnosed mental disorders using a structured diagnostic interview?
3. What factors are associated with latent class membership?

### **3.2.2 Hypotheses**

1. I hypothesized that the optimal number of trajectories would be three.
2. I hypothesized that the trajectories would be valid when compared to the structural diagnostic interview.
3. Based on previous research, I hypothesized that older child age, female sex, and higher levels of disability would be associated with worse trajectories of psychopathology, while greater parent education and household income would be associated with more stable and lower levels of psychopathology.

## **3.3 Study 2: Latent transition analysis (LTA) of youth psychopathology classes**

### **3.3.1 Research Questions**

The objectives of Study 2 were to examine if youth transition to different psychopathology statuses and the predictors of these transitions. Study 2 built on Study 1 to strengthen the longitudinal literature investigating youth psychopathology. This paper answered the following research questions:

1. What are the latent profiles of psychopathology among youth in this sample of youth with CPI?

2. How do individuals in the study transition across the identified psychopathology profiles over time?
3. What factors are associated with these individual-level transitions?

### **3.3.2 Hypotheses**

1. Based on the literature, I hypothesized that the latent profile analysis would reveal a four-profile model that will be characterized as low psychopathology, internalizing, externalizing, and high psychopathology.
2. I hypothesized that most youth in the low psychopathology profile would remain in that profile over time. Additionally, I hypothesized that youth within the high psychopathology group will have the most movement, transitioning to either internalizing or externalizing subgroups. Research demonstrates that youth with low psychopathology have minimal symptoms and may have effective coping mechanisms, better emotional regulation, and less risk factors for developing higher levels of psychopathology (210). These youth may be less likely to experience fluctuations in psychopathology symptoms because they are not at high risk for worsening symptoms or developing new symptoms. Youth with high psychopathology are more likely to transition due to symptoms being more complex and initial symptoms being risk factors for developing additional symptoms (211).
3. I hypothesized that child age, disability, parent education, parent psychological distress, and household income would be associated with transitions. Specifically, I predicted that older youth and those with greater levels of disability would be less

likely to transition from high psychopathology to lower psychopathology profiles.

Conversely, I predicted that higher parental education, lower parent psychological distress, and higher household income would increase the likelihood that youth will transition from high psychopathology to less severe psychopathology profiles.

### **3.4 Study 3: The association between trajectories of youth psychopathology and mental health service use**

#### **3.4.1 Research Questions**

The objectives of Study 3 were to examine if psychopathology trajectories from Study 1 mediate associations between family factors (i.e., parent psychological distress and family functioning) and MHSU.

1. Does contact with a healthcare professional differ between subclinical and low psychopathology trajectories across the four time points?
2. Do mean psychopathology scores differ for youth who had contact with a healthcare professional compared to those who did not?
3. Do psychopathology trajectories (low vs. subclinical symptoms) mediate the association between family factors and contact with a healthcare professional?

### **3.4.2 Hypotheses**

1. I hypothesized that, at each time point, there would be a significant difference between low and subclinical psychopathology trajectories for youth who reported healthcare professional contact.
2. I hypothesized that the mean psychopathology score would be higher among those who did have contact with a healthcare professional across all time points.
3. I hypothesized that psychopathology trajectories will mediate the association between family factors and healthcare professional contact.

## **Chapter 4**

### **General Methods**

#### **4.1 Data Source: MY LIFE Study**

The Multimorbidity in Children and Youth Across the Life-course (MY LIFE) prospective study investigates multimorbidity among children and youth aged 2 to 16 years. It explores determinants of multimorbidity and how they impact mental health service use. The study combines measures of youth multimorbidity, child/parent health and functioning, physical activity, psychosocial and biological factors, and MSHU. This study recruited participants from outpatient clinics at an academic pediatric hospital in Ontario, Canada. The study enrolled 263 youth and their primary caregiving parent/guardian. These participants were followed for 24 months, with assessments at four different time points: baseline, six, 12, and 24 months (67). The study is ongoing.

##### **4.1.1 Participants**

Youth were eligible to participate in the study if they: (i) were between the ages of 2 and 16 years at the time of diagnosis, (ii) were diagnosed as having one CPI by a physician (a condition expected to last  $\geq 12$  months and lead to impaired functioning, dependencies, and need for additional healthcare) (57), and (iii) receiving outpatient care. Youth were excluded from the study at recruitment if they had multiple physical conditions (i.e., medically complex) or their current mental state limited their ability to complete the interview and questionnaires (e.g., currently experiencing a psychotic episode). Youth and their

parent/guardian must have had sufficient English language skills to complete the selected questionnaires, as most of the measures used in the study have not been validated in other languages (67).

#### **4.1.2 Sampling Method**

MY LIFE received the necessary ethical approvals from the University of Waterloo Human Research Ethics Board (ORE-22183) and the Hamilton Integrated Research Ethics Board (2797). Participants were recruited from outpatient clinics from the following specialties: allergy and dermatology, endocrinology, gastroenterology, hemophilia, immunology, neurology, respirology, and rheumatology. Health professionals and research assistants worked together to identify eligible families. After the youth received a diagnosis or consulted with a physician, clinic nurses introduced the study to families and were invited to speak with a research assistant before or after their appointment. The research assistant verified their eligibility and described the study. If interested, written consent was obtained from eligible participants, and parents were informed that they would be contacted within the next several days (67). The study coordinator contacted the parent to answer queries, obtain verbal consent to participate and complete the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID) over the phone.

#### **4.1.3 Study Procedures**

The research staff scheduled times for participants to complete the interviews and questionnaires and provide biological samples at the hospital. If requested, research assistants

also met with participants at their homes to accommodate their travel and childcare schedules. If families could not meet in person, questionnaires were mailed to the families, followed by phone calls from research staff as reminders for completion. Data collection was conducted in a private research office during the hospital study visits. In March 2020, all data collection shifted to mail (except the structured interviews via telephone) due to the COVID-19 pandemic. At the beginning of the first study visit, informed written consent (parent and youth aged 16 years) and assent (children and youth aged 7 to 15 years) was obtained (67). Parents and youth  $\geq 10$  years of age independently completed computer-assisted self-report questionnaires on laptop computers (MediaLab software), and research assistants collected biological samples. Due to COVID-19, biological samples were collected by parents. Baseline study appointments were scheduled between August 2017 and November 2019, with follow-ups at six, 12, and 24 months.

## **4.2 Measures**

### **4.2.1 Multimorbidity**

#### *4.2.1.1 Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID)*

The MINI-KID is a clinical diagnostic interview for assessing mental disorders in youth over the past six months, according to the Diagnostic and Statistical Manual of Mental Disorders-5 and International Classification of Diseases 10 (67,212). The MINI-KID is validated for youth ages six to 17 years old, however, the measure was also used for those

ages two to five for consistency. The in-person interview was administered to youth by a single interviewer who underwent training that included monitored practice. There are two versions, one for youth and one for the parent (proxy report). The MINI-KID is organized into diagnostic modules containing screening questions for each disorder. The common mental disorders identified in this study include internalizing disorders (MDD, SAD, SP, and GAD) and externalizing disorders (ADHD, ODD, and CD) (213). The MINI-KID has demonstrated strong psychometric properties relative to other measurement tools (53,214). Participants who met the diagnostic criteria for any of the above mental disorders were classified as multimorbid.

## **4.2.2 Psychopathology**

### *4.2.2.1 Emotional Behavioural Scales (EBS)*

The EBS is a 52-item checklist that measures parent- and youth-reported symptoms of youth psychopathology in the past six months. The checklist measures internalizing disorders (MDD, SAD, SP, and GAD) and externalizing disorders (ADHD, ODD, and CD) that is based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR) criteria (215). The checklist is completed by parents (67), where the parent will respond to the measure with the child in mind. Each item on the EBS is rated as 0 = ‘never or not true,’ 1 = ‘sometimes or somewhat true,’ and 2 = often or very true, where higher scores indicate greater symptomatology of their psychiatric disorder (216). The EBS is scored using the subscale scores for each mental disorder and is calculated by summing all items that correspond with each disorder (216). It has demonstrated robust psychometric properties in

clinical and general population samples (215,216). Internal consistency was high in this sample for the internalizing ( $\alpha = 0.84$ ) and externalizing ( $\alpha = 0.73$ ) psychopathology variables. The survey items for the 52-item EBS are provided in Supplementary Table 1.

### **4.2.3 Youth Disability**

The proxy-administered 12-item version of the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) derived from the original 36-item version was used for this study. The WHODAS 2.0 is a generic assessment instrument that can measure health and disability among youth (217,218). The scale assessed functioning across cognition, mobility, self-care, getting along, life activities, and participation. Disability represents the second order factor whose score is a function of the six first-order factors (i.e., domains). Parents reflected on the difficulty their child has had within the past 30 days for the 12 items using a five-point scale ranging from 1 (none) to 5 (extreme/cannot do). The WHODAS 2.0 was a composite score that summed all the items, ranging from 12 to 60), whereby higher scores represent a greater level of disability (219). Because the WHODAS 2.0 was originally intended for use in adults, the MY LIFE study made two revisions to the instrument. Item two was revised to "...household responsibilities/chores," and item 12 was revised to "...work/school." These revisions were made to support comprehension and relevance to youth. Disability was used as a clinical variable rather than chronic physical illness type as disability is a stronger predictor of psychopathology. Internal consistency for the WHODAS 2.0 was high ( $\alpha=0.93$ ). Additionally, the 12-item proxy-administered

WHODAS 2.0 was found to be valid and reliable in young children with physical illness, and both parents and youth interpret the construct of disability similarly (220,221).

#### **4.2.4 Mental Health Service Use**

The items used to assess MHSU in the MY LIFE study were adapted from the Canadian Community Health Survey- Mental Health (CCHS-MH). Items asked various closed- and open-ended questions to parents regarding the past 12 months of their child's MHSU, specifically, if they/their child had talked with various healthcare providers about the emotional or mental health of their child and, if so, the number of times. Healthcare providers included general practitioners, family doctors, nurses, psychologists, psychiatrists, social workers, counsellors, caseworkers, psychotherapists, or any other provider. This dissertation assessed the outcome of healthcare professional contacts only due to limited reporting for other outcomes, such as total hospitalizations (yes/no), the number of hospitalizations, and length of hospital stay (Supplementary Table 2-5). Additionally, due to small cell counts, healthcare professional contacts were modelled as a binary indicator (yes/no).

#### **4.2.5 Family Functioning**

##### *4.2.5.1 McMaster Family Assessment Device*

The General Functioning subscale of the McMaster Family Assessment Device (FAD) was used to measure problem-solving, communication, roles, affective responsiveness, affective involvement, and behavioural control (222). This 12-item assessment was completed by parents. Each item in the scale was rated on a four-point scale

from 0 = strongly agree to 3 = strongly disagree. Six positive items in the scale are reverse scored so that the total possible scores on the scale range from 0 to 36. The measure was scored by summing items on the FAD to compute a total score, where higher scores indicate better family functioning (73,168). Internal consistency was high in this sample ( $\alpha=0.86$ ).

#### **4.2.6 Parent Psychological Distress**

Parental psychological distress was characterized based on measures of depression and anxiety.

##### *4.2.6.1 Center for Epidemiological Studies Depression Scale*

Levels of depressive symptoms were measured using the Center for Epidemiological Studies Depression (CES-D) Scale. This 20-item scale assessed negative and positive affect, somatic activity, and interpersonal relations the previous week (223). Parents were asked to rate their frequency of experiencing symptoms over the past week on a four-point Likert scale (0= rarely or none of the time – less than one day per week to 3= most or almost all of the time – 5-7 days per week). The total possible score ranged from 0 to 60, with higher scores indicating greater depressive symptomatology or impairment (220). The CES-D had strong psychometric properties (224) and it showed high internal consistency in this sample ( $\alpha=0.92$ ).

##### *4.2.6.2 Generalized Anxiety Disorder-7 Scale*

The Generalized Anxiety Disorder-7 (GAD-7) scale is a brief scale used to assess parent symptoms of generalized anxiety disorder (225). Participants were asked, within the

past two weeks, indicate the number of days they felt the following symptoms: 1) feeling nervous, anxious, or on edge, 2) not being able to stop or control worrying, 3) worrying too much about different things, 4) trouble relaxing, 5) being so restless that it's hard to sit still, 6) becoming easily annoyed or irritable, and 7) feeling afraid as if something awful might happen (225). The GAD-7 was scored on a four-point scale from 0 (not at all) to 3 (nearly every day) and was summed for a total score ranging from 0 to 21, where higher scores indicate a greater level of anxiety (225). The GAD-7 also demonstrated high internal consistency in this sample ( $\alpha=0.88$ ).

## **4.2.7 Demographic and Covariates**

### *4.2.7.1 Sociodemographic Characteristics*

Parents of youth were asked to report information about age, sex, and immigration status (for both them and their child), as well as their relationship status (partnered relationship or not), education level (completed college/university degree or not), and household income ( $< \$90,000$  or  $\geq \$90,000$ ). The cutoff of \$90,000 was used as the cutoff point for household income as Statistics Canada reported this as being the median income of a >1 person household (226).

### *4.2.7.2 Ontario Marginalization Index- Residential Instability*

To assess the role of neighbourhood-level marginalization, data from this study were linked via parent-reported postal codes to the Ontario Marginalization Index (ON-MARG). The ON-MARG indices were based on dissemination areas, the smallest standard geographic

area available in Canada. Dissemination areas have a population between 400 and 700 individuals (195). The ON-MARG aimed to measure differences in marginalization and understand inequalities in health and social well-being between geographic areas as measured by four dimensions: residential instability, material deprivation, ethnic concentration, and dependency (227).

ON-MARG factor scores represent a standardized scale with a mean of zero and a standard deviation of one (i.e., z scores). Lower scores on each dimension represent the least marginalized areas (227). For this study, we focused on residential instability as a proxy for social disadvantage, calculated based on the following indicators: proportion of the population living alone; proportion of the population >16; average number of persons per dwelling; proportion of dwellings that are apartments; proportion of the population not married; proportion of dwellings that are not owned; and proportion of the population recently moved (past 5 years). This variable was included as a covariate in the multivariable logistic regression analysis in Chapter 5.

### **4.3 Missing Data**

Data from the MY LIFE study were available as fully reported data (raw scores) and imputed scores. Missing data within the study is minimal, with only 30 subjects missing at 24 months, and 85% of the sample is still being contacted at the 6-year follow-up. For Chapters 6 and 7, missing data were imputed under the assumption that data were missing at random (MAR). This assumption was made because while missingness was associated with parent age, stress, education, and psychological distress, these were not the cause of missingness.

This was concluded based on using missing data pattern analysis (Supplementary Table 6). The distribution of missing data across groups does not indicate a systemic mechanism by which missingness directly depends on these factors. This dissertation used multiple imputation procedures in MPlus v8.5 (228), whereby missing data is imputed through the Markov Chain Monte Carlo (MCMC) method. This method used all available data to estimate the model and adjust standard errors and is robust when data are MAR or missing completely at random and when sample sizes are small (229). MPlus was instructed to run ten iterations to generate missing data values and store the values once converged (230).

#### **4.4 Statistical Analysis**

The statistical analyses conducted for each paper are described in their respective chapters (Chapters 5-7). Descriptive statistics were conducted for each paper for youth, parent, and geographical-level variables. This sub-section outlines the rationale for the choice of modelling methods for each of the following three papers:

##### **4.4.1 Paper 1: Latent Class Growth Analysis (LCGA)**

###### *4.4.1.1 Rationale for Model Selection*

Numerous statistical methods exist for analyzing longitudinal data, depending on the research questions and variables being investigated. Many studies analyze the evolution of health outcomes across entire study samples or pre-specified observed subgroups (231). Trajectory modelling methods have been developed to allow researchers to address the complexities of intra- and inter-individual variability. They do this by identifying

homogenous subgroups of individuals who share similar symptoms, behaviours, or patterns rather than relying on oversimplified average estimates (231).

Methods for analyzing longitudinal data can be thought of in two broad categories: variable-centred and person-centred analyses (232). Variable-centred approaches focus on the relationships among variables and use techniques such as regression analysis, factor analysis, and structural equation modelling (233). The goal is to predict outcomes and identify the associations between dependent and independent variables (232,233). Alternatively, person-centred approaches aim to classify individuals into subgroups based on individual response patterns using cluster analysis, latent class analysis, and finite mixture methods (233). The application of this approach to the area of youth psychopathology is useful as it captures the heterogeneous nature of youth mental health, revealing patterns that may support tailored prevention strategies.

For longitudinal data, trajectories describe the evolution of one or more repeated measures such as a quantity, behaviour, biomarker, or symptom over time (234). Group-based trajectory modelling is useful for classifying individuals following similar trajectories based on individual response patterns into subgroups (234). Individuals within the same subgroup share more similarities compared to individuals in different subgroups (232,233). Group-based trajectory modelling is relevant to this thesis because researchers can examine subgroups to inform prevention and clinical practice. For this project, youth participants were grouped according to various trajectories of mental disorder symptom severity (i.e., psychopathology). Trajectory analyses estimate the likelihood that an individual belongs to a

certain class (i.e., estimated latent groups) rather than directly assigning them to classes (235).

Several modelling techniques focus on identifying latent variable trajectories, two popular ones being growth mixture models (GMM) and latent class growth analysis (LCGA) (236). These two methods are specific types of latent growth curve models that are closely related. They mainly differ in which values are allowed to vary within and across latent classes (236). Unlike GMMs, LCGA assumes that there is no individual-level random variation within each trajectory class. Thus, individuals assigned to the same class share the same trajectory (236). LCGA is beneficial when using smaller sample sizes (236). The model for a LCGA has fixed effects regression coefficients specific to each class and is expressed as (237):

$$Z_{ij|s} = \beta^s_0 + \beta^s_1 t_j + e^s_{ij}, \quad s = 1, \dots, S$$

$Z$  represents a continuous variable and  $e^s_{ij}$  are independently distributed error terms. The error terms identify the random perturbations of each observed data point from their class-specific trajectory. This means that they capture the distance between the observed data for the  $i$ -th individual and the true individual-specific trajectory.  $\beta^s_0$  and  $\beta^s_1$  are individual-specific fixed coefficients that are the same for every member of class  $s$ . Additionally,  $t_j$  indicates the actual observation over time so that the relationship with time is properly captured (237).

LCGA is a more parsimonious model and less computationally intensive than GMM (238,239), which is important for this thesis, as the sample size is a relatively small clinical sample. Latent class growth analysis also emphasizes the identification of interpretable classes rather than statistical complexity (233,240), aligning with the goal of Chapter 5, which is to understand distinct trajectories of psychopathology. This results in more straightforward communication of findings and their policy and clinical practice implications. Instead, GMM is more suitable when the research question involves individual differences within trajectories rather than identifying distinct groups (236,241,242).

#### **4.4.2 Paper 2- Latent Transition Analysis**

##### *4.4.2.1 Rationale for Model Selection*

Latent transition analysis (LTA) is an extension of latent class analysis (LCA) or latent profile analysis (LPA). It identifies changes in latent class membership over time and quantifies the probabilistic changes in a matrix of trajectories between two time points (243). Three sets of parameters are assessed in LTA: latent status prevalence at each time, item-response probabilities conditional on latent status membership and time, and transition probabilities between latent statuses over time (244,245). Item-response probabilities provide the basis for assigning labels to latent statuses, and within LTA, they correspond with time. In this study, there were three sets of item-response probabilities, one at time 1 (baseline), one at time 3 (12 months) and one at time 4 (24 months) (245). Transition probabilities – the result of interest – represent the change between latent statuses over time conditional on previous latent status membership (245).

Latent transition analysis was a logical next step after identifying group-based trajectories in Study 1 to move from group-level to individual-level patterns. Latent class growth analysis identifies distinct trajectories of psychopathology at a group level, providing valuable insights into general patterns and the heterogeneity of psychopathology within my sample (232). By transitioning to LTA, this thesis shifts from understanding these broader trajectories to examining individual-level dynamics of change and stability. Latent transition analysis allows for capturing how individuals transition between latent profiles over time, offering a more detailed understanding of the stability and fluidity of these profiles (78,221,245). This assists in understanding how youth might move between different psychopathology states, providing insights that the group-level analysis fails to detect. Therefore, the combined approach using LCGA and LTA can demonstrate how broader trajectories can be more dynamic at the individual level.

For this dissertation, LTA complements LCGA findings by providing a more comprehensive picture of youth psychopathology, combining general trends over time with individual-level transitions. From a practical perspective, insights from LTA may inform targeted interventions that might not be apparent from using LCGA alone. For example, suppose that LTA shows that individuals within certain profiles of psychopathology are more likely to transition to more severe statuses over time. In this case, interventions can be targeted to help prevent these transitions, whereas LCGA does not produce this information. Furthermore, understanding transitions and predictors of such transitions may aid in strategically allocating resources. For example, if specific profiles are found to be relatively

stable, resources might be better allocated to individuals who are more likely to transition in ways that increase their risk of adverse outcomes.

### **4.4.3 Path Analysis- Mediation**

#### *4.4.3.1 Rationale for Model Selection*

The main analysis for Study 3 is mediation using a path analysis approach, a form of structural equation modelling (SEM) that examines associations between multiple variables, including direct ( $c'$ ), indirect ( $ab$ ) and total effects ( $ab + c'$ ). A direct effect is the effect of the independent variable ( $X$ ) on the dependent variable ( $Y$ ), controlling for the mediator ( $M$ ). An indirect effect is the effect of the independent variable ( $X$ ) on the dependent variable ( $Y$ ) through the mediator ( $M$ ). The total effect is the sum of the direct and indirect effects (246–248). Path analysis provides more statistical power and accuracy in estimating effects and can handle latent variables (248,249) compared to the more traditional Baron and Kenny method. The simplest mediation model indicates the relationship in which the independent variable ( $X$ ) is associated with the mediator ( $M$ ), and the resulting mediator variable ( $M$ ) is associated with the dependent variable ( $Y$ ) (Figure 1).

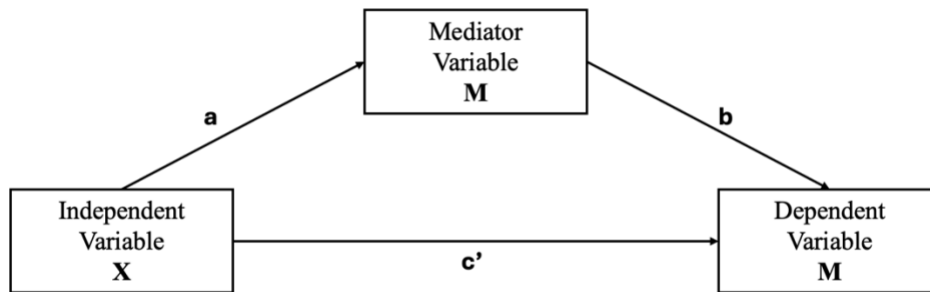


Figure 1. Simple mediation model

Path analysis was selected for this dissertation to examine mediation effects over other methods, such as causal mediation and the Baron and Kenny approach, due to its advantages in dealing with more complex models and multiple time points (250). Unlike the Baron and Kenny method, which relies on a stepwise testing procedure and often lacks statistical power to detect mediation effects (249), path analysis can directly estimate indirect effects and adjust for normality using maximum likelihood estimation with robust standard errors (MLR) to enhance robustness and reliability of results (250–253). Additionally, a causal mediation approach offers rigorous controls for confounding and is useful in randomized settings but is less suited to observational data. In contrast, path analysis allows for flexible modelling of relationships between variables without assuming strict causality (254). As this study is longitudinal, path analysis provides insight into the temporal relationship between variables by modelling mediation effects over time (255). These advantages make path analysis more appropriate for testing mediation in the context of this dissertation.

Study 3 is a critical component of this dissertation that brings together the findings from Study 1 to assess whether the psychopathology trajectories identified mediate the association between parent factors and MHSU. This study completes the narrative of my thesis and provides valuable insights into the pathways that influence MHSU, with important implications for research and clinical practice. Understanding the mechanisms that link parent psychological distress and family functioning to healthcare outcomes is key to identifying potential points of intervention. By incorporating this analysis into my dissertation, the key role of the family environment in shaping youth mental health is acknowledged and empirically tested. This contextual component adds to my research, highlighting how psychopathology trajectories are embedded within and influenced by broader family factors.

The first two studies focus primarily on understanding the patterns and dynamics of youth psychopathology. This final study goes further by linking psychological patterns to real-world outcomes. I address a critical question: How do psychopathology trajectories impact MHSU? A better understanding of this is important for informing health policy and interventions that can support families and reduce barriers to care.

#### **4.5 Power Analyses**

For Study 1, a sample size of 263 is within the recommended range for LCGA studies involving up to four trajectory classes and four time points (256,257). A power analysis for the LCGA was conducted using G\*Power version 3.1.9.7 to estimate the required sample size for adequate power to detect differences across the trajectories. With a medium effect

size, three trajectory classes, and an alpha of 0.05, the analysis confirmed that the available sample size of 263 provides a statistical power of at least 0.80.

For study 2, a sample size of 263 is considered adequate for LTA with up to four latent classes (258). A power analysis calculation in G\*Power version 3.1.9.7 was calculated using a chi-squared goodness of fit test based on logistic regression approximations for the transition probabilities between latent statuses. With a medium effect size and an alpha error probability of 0.05, the analysis demonstrated that a sample size of 263 provides a statistical power of at least 0.80. The full power calculations for Studies 1 and 2 are provided in Appendix 4.

For Study 3, a power analysis was conducted in MPlus to ensure that the sample size had enough power to detect mediation effects with a medium effect size and an alpha of 0.05. The power analysis revealed that the study is well-powered at 88.3%, which is strong evidence for the detectability of direct and indirect effects in the mediation model and that the sample size is sufficient.

## **Chapter 5**

### **Manuscript 1**

#### **Psychopathology trajectories among youth with physical illness: A latent class growth analysis**

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## 5.1 Overview

The objectives of this study were to characterize 24-month trajectories of psychopathology, validate psychopathology groups, and identify youth, parent, family, and neighbourhood characteristics associated with each identified trajectory in a sample of youth with chronic physical illness (CPI). Data come from a longitudinal study of 263 youth aged 2-16 years diagnosed with CPI and their parents. Participants were recruited from outpatient clinics at a pediatric hospital in Canada and assessed at recruitment (baseline), 6, 12, and 24 months. Parents reported on youth psychopathology using the Emotional Behavioural Scales. Latent class growth analysis was used to identify trajectories of psychopathology. Baseline predictors of trajectory group membership were investigated using multinomial logistic regression. Three distinct psychopathology trajectories best fit the data; the model had a BIC of -3579.70 and average posterior probabilities of 0.97. The trajectories were classified as, low-stable (LS: n=156, 58%), moderate-decreasing (MD: n=85, 34%), and high-decreasing (HD: n=21, 8%). Youth who were older [HD: OR=1.33 (1.05, 1.69)], had higher disability scores [HD: OR=1.31 (1.19, 1.45) and MD: OR=1.14 (1.08, 1.21)], had parents with greater psychological distress scores [HD: OR=1.11 (1.05, 1.18) and MD: OR=1.04 (1.01, 1.07)], and came from households with higher incomes [HD: OR=4.67 (1.06, 20.67)] were associated with higher psychopathology trajectories compared to LS. Parent-reported youth psychopathology was generally low over 24 months, though over one-third had symptoms that reflected borderline clinical psychopathology. Predictors for group membership could help identify at-risk youth with CPI early for psychopathology.

**Keywords:** mental disorders, child, adolescent, latent class growth analysis, longitudinal studies

## 5.2 Introduction

The prevalence of chronic physical illness (CPI) in youth is approximately 25% (1). These youth often experience burdens in daily life associated with functional limitations and dependencies, symptom management, and the need for increased levels of care compared to their healthy peers (2). As a result, they face substantial impacts on their physical, psychosocial, and emotional well-being (3). Physical and mental health are strongly related; having a CPI increases the risk of developing a concurrent mental disorder (i.e., multimorbidity) (4). Multiple biological and psychosocial mechanisms may explain the onset of multimorbidity (5–8). Mental disorders affect approximately 20-30% of youth in epidemiologic samples and  $\geq 50\%$  in clinical samples of youth with CPI (4,9,10). Multimorbidity is persistent in children with newly diagnosed CPI and is associated with worse quality of life and increased service use (11–13). Multimorbidity poses challenges for not only the youth themselves but also their families and health professionals caring for these youth (14).

Understanding risk factors and symptoms of mental disorder (i.e., psychopathology) among youth with CPI is key to informing targeted strategies to prevent the incidence of multimorbidity. Several studies have examined trajectories of both internalizing and externalizing symptoms (15–17). Much of this literature utilizes large population-based samples of youth, leaving gaps in our understanding of trajectories of psychopathology in clinical samples of youth who are at higher risk for poor health, social, and functional outcomes. Further, longitudinal studies of youth multimorbidity have typically focused on

single physical illnesses and mental disorders (18,19). One study assessing trajectories of depressive symptoms during the transition to early adulthood found that having a CPI was associated with less favourable trajectories and higher depression scores (19).

This study addresses gaps in the literature on assessing psychopathology longitudinally in a clinical sample of youth with various CPIs. We investigated psychopathology trajectories over 24 months, the validity of trajectory groups using a structured diagnostic interview, and individual, family, and community-level predictors of trajectory group membership.

## **5.3 Methods**

### **5.3.1 Design and Sample**

Data come from the Multimorbidity in Children and Youth Across the Life Course (MY LIFE) study (20). MY LIFE is an ongoing prospective study of 263 youth aged 2-16 years and their parents who attended outpatient clinics at an academic pediatric hospital in Ontario, Canada. Eligibility criteria required youth to have one physician-diagnosed CPI (defined as having a condition expected to be present for  $\geq 12$  months and result in  $\geq 1$  of the following: functional impairment, dependencies to compensate for impairment, need for additional health services) (21). Youth and parents must have had sufficient English language skills to participate in MY LIFE. For these analyses, follow-up data over 24 months were modelled (assessments at baseline, six, 12, and 24 months).

### *5.3.1.1 Sample Size Calculation*

For the MY LIFE study, sample size calculations determined that a study with 250 youth and four follow-up occasions would be adequately powered ( $1-\beta \geq 0.80$ ) at  $\alpha = 0.05$  to estimate non-linear changes in psychopathology trajectories.

### **5.3.2 Study Procedures**

Parents consented on behalf of children aged 2-6 years, youth aged 7-15 years provided written informed assent, and all parents and youth  $\geq 16$  provided written informed consent. Data were collected using structured interviews and self-report questionnaires. Parent-reported data were collected for all youth and youth  $\geq 10$  years of age provided self-reports. MY LIFE received ethical approval from the Hamilton Integration Research Ethics Board (2797) and the University of Waterloo Research Ethics Board (ORE-22183).

### **5.3.3 Measures**

#### *5.3.3.1 Youth Psychopathology*

Past six-month youth psychopathology was measured using the parent-reported 52-item Emotional Behavioural Scales (EBS) (22). The EBS measures symptoms of internalizing (generalized anxiety, separation anxiety, social phobia, major depressive disorder) and externalizing disorders (attention-deficit hyperactivity, oppositional defiant, conduct disorder) based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR). Items on the EBS are rated as 0='never or not true,' 1='sometimes or somewhat true,' and 2='often or very true,' where higher scores indicate greater psychopathology. The total

score is calculated as the sum of all items. The EBS has demonstrated robust psychometric properties in clinical and general population samples of youth (22,23). Internal consistency was high in this sample ( $\alpha=0.86$ ).

The parent-reported Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID) was used to measure youth mental disorders during the past six months (24). The following disorder modules were assessed: major depressive episode, generalized anxiety, separation anxiety, social phobia, specific phobia, attention-deficit hyperactivity (ADHD), oppositional defiant disorder, and conduct disorder. The MINI-KID has demonstrated strong psychometric properties (25). It was used to validate trajectory groups derived from the MY LIFE cohort.

### *5.3.3.2 Youth Disability*

The proxy-administered 12-item World Health Organization Disability Assessment Schedule (WHODAS) 2.0 was used to measure youth disability (26). The WHODAS 2.0 assesses functioning across the domains of cognition, mobility, self-care, getting along, life activities, and participation. Parents reflected on the amount of difficulty their child had within the past 30 days on each item using a five-point scale ranging from 1 (none) to 5 (extreme/cannot do). A composite score that summed all items, ranging from 12-60, was computed; higher scores represent more disability. The WHODAS 2.0 has demonstrated robust psychometric properties in this sample (27) and internal consistency was high ( $\alpha=0.93$ ).

#### *5.3.3.3 Parent Stress*

The 18-item Parent Stress Scale (PSS) was used to measure parent stress in four domains: rewards, stressors, loss of control, and satisfaction (28). Items are scored from 1 (strongly disagree) to 5 (strongly agree). The total score ranges from 18 to 90, with higher scores indicating more parent stress. The scale has demonstrated reliability and validity in parents of children with CPI (29). Internal consistency was high in this sample ( $\alpha=0.86$ ).

#### *5.3.3.4 Parent Psychological Distress*

Parent level of depressive symptoms was measured using the 20-item Center for Epidemiological Studies Depression (CES-D) Scale (30). This scale assesses negative and positive affect, somatic activity, and interpersonal relations during the previous week. Parents rated their frequency of experiencing symptoms using a four-point Likert scale (0='rarely or none of the time' [less than one day per week] to 3='most or almost all of the time' [5-7 days per week]). Total scores range from 0 to 60, with higher scores indicating greater depressive symptomatology. The CES-D has strong psychometric properties in parents of youth with mental disorder (31). Internal consistency was high in this sample ( $\alpha=0.92$ ).

Parent symptoms of generalized anxiety were measured using the seven-item Generalized Anxiety Disorder scale (GAD-7) (32). Within the past two weeks, parents were asked to indicate the number of days they experienced symptoms. The GAD-7 was scored on a four-point scale from 0 (not at all) to 3 (nearly every day) and summed for a total score ranging from 0 to 21, where higher scores indicate greater levels of anxiety. Internal consistency was high in this sample ( $\alpha=0.88$ ).

#### *5.3.3.5 Family Functioning*

The McMaster Family Assessment Device (FAD) general functioning subscale was used to measure family functioning in terms of communication, problem-solving, behavioural control, affective responsiveness and involvement, and roles in the family (33). Items on the scale are scored from 0 (agree) to 3 (strongly disagree). Raw scores are summed for a total score, where higher scores indicate better family functioning. The scale has shown robust psychometric properties (34). Internal consistency was high in this sample ( $\alpha=0.86$ ).

#### *5.3.3.6 Residential Instability*

To assess the role of community-level marginalization, data were linked to dissemination areas from the 2016 Canadian Census using participant postal codes, and subsequently to the residential instability dimension in the 2016 Ontario Marginalization Index (ON-Marg) (35). Residential instability refers to concentrations of individuals who experience a higher degree of family or housing instability. While quintiles are commonly used, sparse data necessitated the use of factor scores which were standardized with a mean of zero and a standard deviation of one. Lower scores on the instability dimension represent less residentially unstable areas.

#### *5.3.3.7 Sociodemographic Characteristics*

Parents were asked to report on youth and parent age, sex, and immigration status. Additionally, they were asked about their marital status (partnered or not), highest level of

education (college/university degree or not), and annual household income (<\$90,000 or  $\geq$ \$90,000).

#### **5.3.4 Statistical Analyses**

Trajectories of youth psychopathology (EBS scores) were modelled using latent class growth analysis (LCGA). Latent class growth analysis is a statistical technique developed by Nagin (2005) to identify homogenous subpopulations with similar growth trajectories using longitudinal data collected from a larger heterogeneous population (36). Individuals are classified based on their individual-level response patterns. Latent class growth analysis is a simplified growth mixture model in which the variance and covariance estimates within classes are fixed, assuming within-class homogeneity.

The optimal number of classes for LCGA was determined by fitting multiple models with different numbers of classes (in this case, one to six classes) and comparing their goodness of fit statistics (37). We tested the nonlinearity of trajectories by starting with cubic, quadratic, and linear terms for time for each modelled class. Non-significant ( $p > 0.05$ ) higher-order terms were removed sequentially, and the model was re-specified. This iterative process continued until all terms were significant for each model. Model fit for each of the six models was evaluated using two fit indices, the Akaike Information Criteria (AIC) and Bayesian Information Criterion (BIC), as well as using average posterior probabilities of class membership, which measures the precision individuals are assigned to their respective classes. Successive comparisons were made of the AIC and BIC values across specified models, with the maximum (i.e., least negative) value suggesting a better model fit. Posterior

probabilities of class membership values closer to 1.0 are best and guidelines suggest that the proportion of the sample in each trajectory should be  $\geq 5\%$ . Additionally, models were inspected with a preference for parsimony.

Nagin (2005) suggested that LCGA requires a sample size of  $\geq 100$  individuals and  $\geq 3$  time points of measurement to derive valid and reliable model estimates (37). With 263 participants and four time points, the study was assumed to be adequately powered to model trajectories with nonlinear time.

To examine individual-, family-, and community-level factors associated with trajectory class membership, we conducted multinomial logistic regression with class membership as the outcome. Odds ratios (ORs) with their 95% confidence intervals (CIs) were computed. The model included the following explanatory variables to predict group membership: youth age, sex, and level of disability, parent age, education, level of psychological distress, and parenting stress, household income, family functioning, and residential instability. Because the CES-D and GAD-7 were highly correlated ( $r=0.77$ ) their scores were summed to create an overall measure of parent psychological distress.

Attrition in the sample was minimal with 30 subjects missing at the 24-month follow-up. SAS 9.4 was used to conduct the LCGA using the PROC TRAJ procedure. Missing data were handled by maximum likelihood estimation within PROC TRAJ (38). The multinomial logistic regression analysis was performed using SAS Studio Enterprise 3.81.

## 5.4 Results

### 5.4.1 Sample Characteristics (Table 1)

Youth had a mean age of 9.5 years (SD=4.2) and 52% were male. The most common diagnoses were rheumatological (27.8%), respiratory (20.5%) and endocrine (14.5%). Over one-quarter (26.6%) of youth represented new-onset cases of CPI (duration <1 year).

The mean age of parents was 40.5 (6.5) years, majority were female (90.1%), and 15.1% immigrated to Canada. Eighty-seven percent of parents were in partnered relationships (married or common-law), and most had postsecondary education (76.1%). Further, 59.8% reported annual household incomes of  $\geq$ \$90,000. Mean parent psychological distress score was 15.3 (SD=13.2). Families typically resided in areas with low residential instability.

**Table 1.**

Sample Characteristics

Characteristic	Value
<b>Individual</b>	
Age (years), mean (SD)	9.5 (4.2)
Age, n (%)	
2-4	51 (19.4%)
5-7	55 (20.9%)
8-10	61 (23.2%)
11-13	45 (17.1%)
14-16	51 (19.4%)
Male, n (%)	138 (52.5)
Born in Canada, n (%)	248 (94.3)

Diagnosis, n (%)	
Dermatological	23 (8.8)
Endocrine	38 (14.5)
Gastroenterological	34 (12.9)
Hematological	29 (11.0)
Neurological	12 (4.6)
Respiratory	54 (20.5)
Rheumatological	73 (27.8)
Years since diagnosis, n (%)	
<1.0	70 (26.6)
1.0 to <2.5	39 (14.8)
2.5 to <5.0	62 (23.6)
5.0 to <7.5	40 (15.2)
≥7.5	52 (19.8)
Mental Disorders (MINI-KID), n (%)	
Major depressive	21 (8.02)
Generalized anxiety	28 (10.69)
Separation anxiety	22 (8.40)
Social phobia	23 (8.78)
Specific phobia	24 (9.16)
ADHD	41 (15.65)
Oppositional defiant	16 (6.11)
Conduct	4 (1.53)
<b>Family</b>	
Age (years), mean (SD)	40.52 (6.5)
Female, n (%)	237 (90.1)
Born in Canada, n (%)	223 (84.8)
Partnered relationship, n (%)	228 (86.7)
College/university degree, n (%)	200 (76.1)

Household income $\geq$ \$90,000, n (%)	156 (59.3)
Psychological distress, mean (SD)	15.3 (13.2)
<b>Community</b>	
Residential instability, n (%)	-0.4 (0.8)

#### 5.4.2 Latent Classes of Psychopathology Trajectories

Models with one to six classes were estimated to identify the optimal number of trajectories for youth psychopathology. Table 2 shows that the AIC and BIC decreased with an increasing number of classes; however, models with five and six classes had group sizes  $<5\%$ . The average posterior probability was higher (0.97) in the three-class compared to the four-class model (0.91). Additionally, upon visual inspection, the addition of the fourth trajectory group in the four-class model did not seem to be a useful or clearly delineated category. As such, the three-class model was selected as the optimal model.

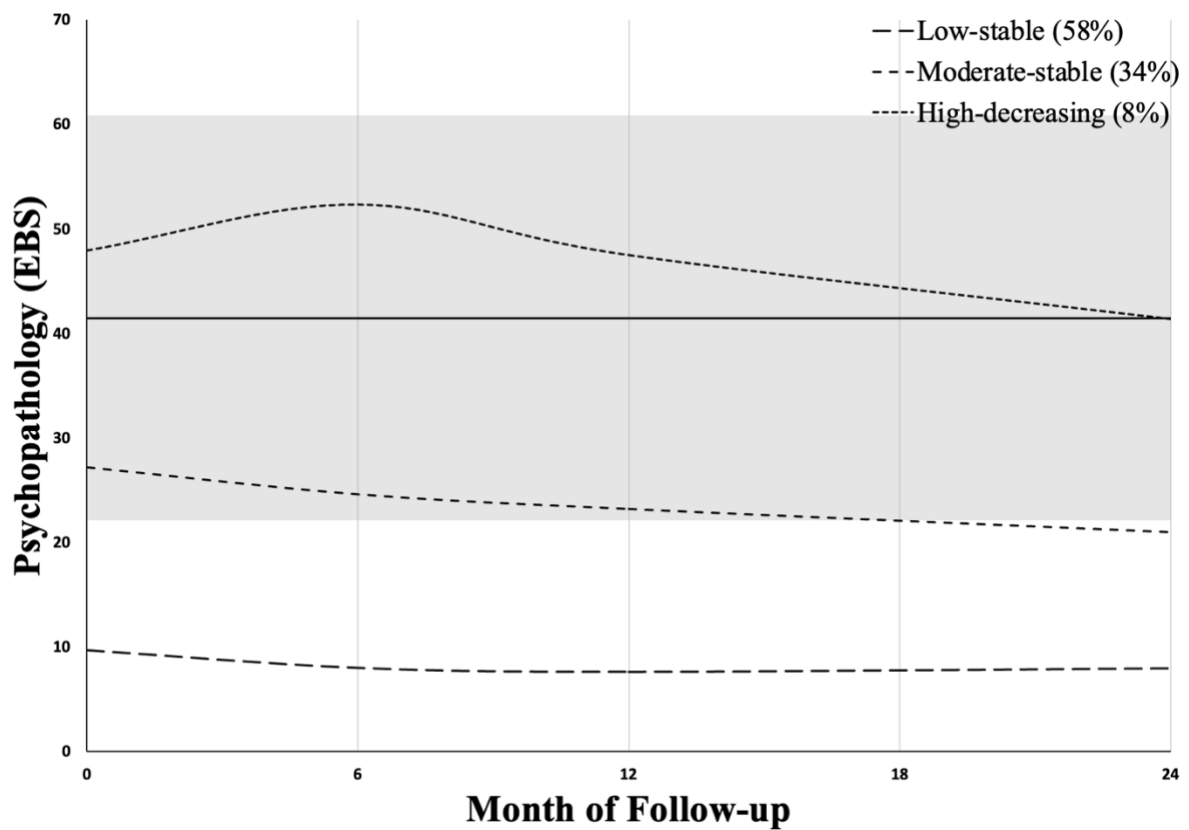
Figure 1 displays the three-class model, and Table 3 shows the model parameter estimates for each of the three groups in the LCGA model. Youth in the low-stable group (Group 1) representing most of the sample (58%,  $n=153$ ), had consistently low psychopathology over the 24-month follow-up. Youth in the moderate-decreasing group (Group 2; 34%,  $n=89$ ) had moderate levels of psychopathology that decreased significantly over time. The smallest groups had high-decreasing psychopathology (Group 3; 8%,  $n=21$ ); high levels of psychopathology that decreased significantly over time.

**Table 2.**

LCGA model fit by number of latent classes

# of Classes	AIC	BIC	Average PP	Proportion of the sample in each class					
				1	2	3	4	5	6
1	-3950.84	-3956.20	100%	100.0	-	-	-	-	-
2	-3717.31	-3728.03	0.95	73.9	26.1	-	-	-	-
3	-3561.84	-3579.70	0.97	58.0	34.0	8.0	-	-	-
4	-3537.65	-3562.66	0.91	44.4	28.5	20.2	6.9	-	-
5	-3508.93	-3541.08	0.91	35.4	28.2	26.4	7.4	2.5	-
6	-3493.73	-3534.81	0.93	35.6	28.2	25.9	6.9	0.8	2.6

*LCGA: Latent Class Growth Analysis; AIC: Akaike's Information Criterion; BIC: Bayesian Information Criterion; PP: Poster probability of group membership.*



**Figure 1: Psychopathology trajectory groups**

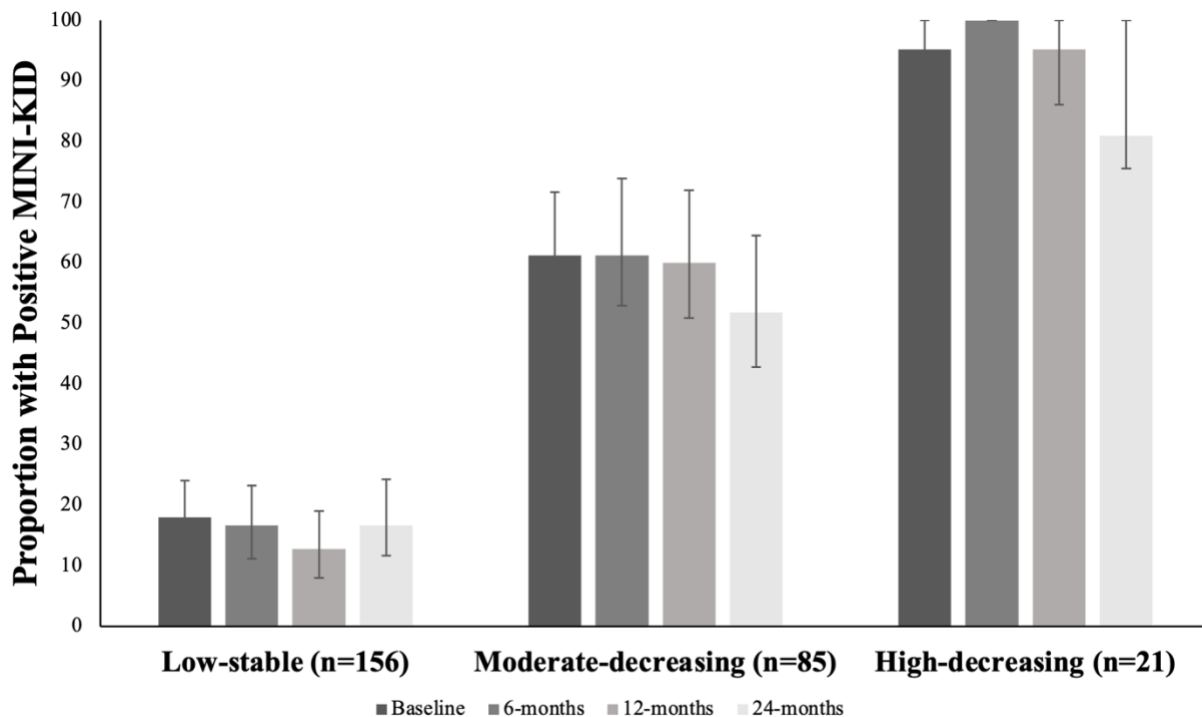
The solid line at EBS=41.5 represents the mean psychopathology score for youth with a mental disorder. The shading represents one standard deviation on either side of the mean (SD=19.3).

**Table 3.**  
Parameter estimates for the three-trajectory model of youth psychopathology

Trajectory group	Intercept	Linear slope	Quadratic slope
Low stable	0.05 (0.53)**	-0.87 (0.44)*	-
Moderate decreasing	26.60 (0.85)**	-2.99 (0.60)**	-
High decreasing	48.74 (1.75)**	4.83 (4.23)	-4.36 (1.96)*

\* p ≤ .05. \*\* p ≤ .01

To examine the validity of the trajectory classes, we examined the proportion of youth who screened positive for a mental disorder on the MINI-KID. The high-decreasing group had the largest proportion of youth who screened positive on the MINI-KID and the low stable group had the lowest proportion.



**Figure 2.** Proportion of youth who screened positive for any MINI-KID disorder in each trajectory group.

### 5.4.3 Predictors of Trajectories of Psychopathology

Table 4 presents the multinomial logistic regression examining predictors of trajectory group membership using the low-stable group as the reference. Older youth had greater odds of being in the high-decreasing group [OR=1.33 (1.05, 1.69)]. Youth with more disability had greater odds of being in both the high-decreasing [OR=1.31 (1.19, 1.45)] and moderate-decreasing group [OR=1.14 (1.08, 1.21)]. Higher level of parent psychological distress was associated with being in the high-decreasing [OR=1.11 (1.05, 1.18)] and moderate-decreasing group [OR=1.04 (1.01, 1.07)]. Moreover, youth in families with higher

household incomes ( $\geq$ \$90,000) were more likely to be in the high-decreasing group [OR=4.67 (1.06, 20.67)].

**Table 4.**

Multinomial logistic regression of factors associated psychopathology trajectory [OR (95% CI)]

	High-decreasing vs. low-stable	Moderate-decreasing vs. low-stable
Child age	<b>1.33 (1.05, 1.69)</b>	1.08 (0.98, 1.20)
Child sex	0.27 (0.06, 1.11)	0.93 (0.50, 1.72)
Time since diagnosis	1.05 (0.87, 1.26)	1.01 (0.93, 1.10)
Child disability	<b>1.31 (1.19, 1.45)</b>	<b>1.14 (1.08, 1.21)</b>
Parent age	0.89 (0.77, 1.04)	0.97 (0.90, 1.03)
Parent education	0.46 (0.11, 1.94)	1.27 (0.57, 1.82)
Parent psychological distress	<b>1.11 (1.05, 1.81)</b>	<b>1.04 (1.01, 1.07)</b>
Parent stress	1.06 (0.98, 1.16)	1.02 (0.97, 1.06)
Household income	<b>4.67 (1.06, 20.67)</b>	1.77 (0.87, 3.56)
Family functioning	1.02 (0.90, 1.16)	0.98 (0.92, 1.04)
Residential instability	1.71 (0.79, 3.71)	0.91 (0.61, 1.37)
Results are OR (95% CI).		

## 5.5 Discussion

Consistent with previous research, we did not identify an increasing trajectory group for overall psychopathology (joint internalizing and externalizing symptoms) among youth with CPI (16,17,39). Parent-reported youth psychopathology was generally low and stable over 24 months in this study. This finding is aligned with results from Rosic et al. (2019)

who found that trajectories of youth- and parent-reported depression symptoms in youth with epilepsy were low and stable over 28 months (18). Ferro et al. (2015) examined trajectories of depressive symptoms and similarly found that the largest trajectory group comprised of youth with low symptom levels and relatively stable trajectories (39). Moreover, a study found that for internalizing and externalizing trajectories, there was a large proportion of children in the low and very low trajectory groups based on maternal reports of psychopathology (Nivard et al., 2017). Maternal-reported psychopathology in another study also found that most children exhibited low levels of internalizing problems (Fanti and Henrich, 2010).

In contrast, previous research has found stable-high and/or increasing trajectories of externalizing symptoms (16,17). Further, internalizing symptoms have been found to be in a transient, more fluid state in early childhood compared to adolescence (40). Person-centred analyses using latent transition analysis have suggested that children with internalizing disorders at baseline were more likely to transition to a normative class (40). The absence of an increasing trajectory group in our study may be due to the relatively low prevalence of diagnosed externalizing disorders compared to internalizing disorders. Rejected models with four, five, and six, classes also did not have an increasing trajectory group.

Differences in the number of trajectories between our analysis and previous studies are likely attributable to differences in study samples and methodologies. Ours was a clinical sample of youth aged 2-16 years with four measurement occasions; trajectories into young adulthood were not examined. Future research should examine these trajectories in larger

clinical samples over longer periods to capture potential changes from adolescence to early adulthood. This is relevant given the importance of childhood and adolescence in the development of mental health problems, the impairments of which often persist into adulthood (41). Studies examining trajectories of youth psychopathology demonstrated adverse long-term health, social, and economic outcomes, especially among individuals with continuously high levels of psychopathology (15–17). Given the burdens of dealing with health challenges and functional impairments among youth with CPI (42), future research should assess the differential impact of trajectories on psychosocial, educational, and health service use outcomes. Further, our sample included a large proportion of relatively affluent families and underrepresented minority groups and immigrants, which might contribute to the absence of an upward trajectory. Such trajectories are typically associated with sociodemographic disadvantage (43).

Several predictors were found to be associated with less favourable psychopathology trajectories—older age, elevated disability, more parent psychological distress, and higher household income. Research indicates that older youth are more vulnerable to developing mental disorders compared to younger youth (44), both among those with and without CPI. Our finding aligns with studies that show most mental disorders peak in adolescence and early adulthood (45). This suggests the importance of early promotion of positive mental health and early intervention to prevent worsening psychopathology into adulthood.

Elevated levels of disability were found to be associated with being in the high-decreasing or moderate-decreasing group. Youth with chronic illnesses—physical or

mental—experience more disability compared to their healthy peers, and this occurs in a dose-response manner, whereby youth with multimorbidity report the highest levels of disability (46). Applying the non-categorical approach to youth CPI is important in the context of youth disability as it shifts focus from specific diagnoses to individual abilities and needs. The non-categorical approach proposes that the risk of mental disorders in youth with CPI is consistent regardless of the type of physical illness (42). This finding is important to inform integrated care services, which are often fragmented, siloed, and tailored to either physical or mental health.

Findings also reinforced that parent psychological distress is associated with the progression and treatment of youth psychopathology (47). This is relevant for youth with CPI as they require more caregiving demands and involvement in illness management. Parents can also experience a lack of control over their child's condition, insecurity, loss of self-esteem, and mental health problems, often depression (48,49). Increased levels of depression in mothers often lead to negative emotions toward children, potentially resulting in lower child self-esteem and psychological well-being (14). These variables are potentially modifiable targets for integrated approaches to family-centred care. Family-centred care is best practice in the care of youth mental health and results in greater patient satisfaction and better health outcomes (50). Intervening on these variables can help to improve mental and psychosocial health. Interventions for parents of children with CPI improve parent psychological well-being and include acceptance and commitment therapy (49), as well as group-based cognitive behavioural therapy and mindfulness programs (51).

Contrary to previous research (52), youth from higher household incomes were more likely to be in the high-decreasing group. Because psychopathology was parent-reported, high income may be a proxy for high socioeconomic status and, thus, better mental health literacy. Additionally, the decreasing trajectory may be explained by higher income facilitating the use of private health services, which in turn results in better outcomes over time. These explanations are speculative, and ultimately, more research is needed to understand the association between household income and youth multimorbidity.

Future research can expand on this study to assess these and other predictors of psychopathology and the mechanisms linking predictors and multimorbidity. Additionally, the biological and psychosocial mechanisms linking CPI and mental disorders need to be understood.

### **5.5.1 Limitations**

Some limitations warrant consideration. First, we used parent-reported youth psychopathology due to the limited number of age-eligible youth to provide self-reports. Parent reports are often negatively biased and have low agreement with youth self-reports (53). Second, our sample was relatively homogeneous regarding family composition, socioeconomic status, and ethnicity which may impact the generalizability of our findings to the broader population of youth with CPI. Third, our study included a wide age range that spans multiple developmental periods and could not ascertain how trajectories differ across these periods. Fourth, we lacked a comparison group of youth without CPI. Nevertheless, this

was a secondary analysis of a study whose primary purpose was to delineate the natural course of mental health in youth with CPI.

## **5.6 Conclusion**

Psychopathology was generally low in youth with CPI over 24 months, though over one-third had symptoms that reflected borderline clinical psychopathology. Health professionals can use the risk profiles found in this study to identify at-risk youth more readily for poor mental health and develop an integrated care plan that adopts family-centred care strategies to best support youth health and prevent the onset of multimorbidity early in life.

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## **Chapter 6**

### **Manuscript 2**

#### **Latent transition analysis (LTA) of youth psychopathology classes**

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## 6.1 Overview

**Objectives:** This study aimed to examine if youth transition to different psychopathology statuses over two years and the predictors of these transitions. Examining the stability and change of youth psychopathology aids in discerning whether certain behaviours are transient developmental fluctuations or signs of persistent psychopathological problems.

**Methods:** Data for this study come from a clinical longitudinal study which included 263 youth aged 2-16 years diagnosed with a chronic physical illness and their parents who were assessed at baseline (T1), six months (T2), 12 months (T3), and 24 months (T4). Parents reported on youth psychopathology using the Emotional Behavioural Scales (EBS). Latent profile analysis identified psychopathology profiles and latent transition analysis quantified the probability that youth remained within or transitioned across psychopathology subgroups.

**Results:** Four psychopathology subgroups were identified: low psychopathology (LP-T1: 67.3%, T2: 62.4%, T3: 71.1%, T4: 67.3%) primarily internalizing (PI- T1: 20.2%, T2: 27.0%, T3: 16.7%, T4: 16.3%), primarily externalizing (PE- T1: 10.6%, T2: 8.0%, T3: 10.3%, T4: 13.3%), and high psychopathology (HP- T1: 1.9%, T2: 2.7%, T3: 1.9%, T4: 3.4%). As expected, homotypic continuity was lower for the PI, PE, and HP subgroups compared to the LP subgroup. From T1 to T2, 85.7% of youth remained in the HP subgroup. Between T2 and T3, 70.6% of youth remained in the HP subgroup. Between T3 and T4, 59.2% of youth remained in the HP subgroup. Many children classified in the PI subgroup transitioned to the LP subgroup over time. Children classified in the HP subgroup from T2 to T4 were more likely to have persistent psychopathology, with all such children remaining in

either the PI, PE, or HP subgroup. Child age and sex, parent psychopathology, and family socioeconomic status were significant predictors of transitioning across latent classes.

**Conclusions:** Findings indicate that for most youth, psychopathology tends to be transient, as they may shift between various mental health challenges over time. However, a small proportion of youth with HP (<5%) had persistent problems, demonstrating an at-risk state for these individuals. These results demonstrate the clinical importance of focusing resources on early identification of persistent psychopathology in youth to enhance their care.

**Keywords:** mental disorders, child, adolescent, latent profile analysis, latent transition analysis

## 6.2 Introduction

Psychopathology is common among young people, with approximately one in five youth <18 years of age having one or more mental disorders involving symptoms of impairment (1). Risk factors such as family dysfunction/instability, parental psychopathology, and low socioeconomic status are associated with youth psychopathology (2,3). The critical development stage from early childhood to late adolescence involves numerous biological changes (e.g., puberty), cognitive developments (e.g., identity formation), and socio-environmental transitions (e.g., moving to a new school). Struggles in adapting to these challenges increase the risk of developing mental health problems (4,5). Indeed, most mental disorders have their onset during adolescence (6) and affect outcomes over the life course (6–10). Early onset of mental illness can result in a downward spiral of disadvantage and suffering among youth and their families, eventually leading to psychosocial, academic, and economic adversity (11–14).

Likewise, chronic physical illnesses and health problems requiring long-term management affect approximately 25% of youth, and their prevalence is increasing (15). These children often experience mental health problems due to their physical illness or its treatment, leading to more severe symptoms and impairment in both physical and mental health (16,17). This dual burden, or multimorbidity, negatively impacts daily functioning, increases health service use, and increases the risk of suicide and substance abuse (18–23). About 40% of youth with CPI screen positive for a mental disorder diagnosis, and this

multimorbidity is persistent over time (24,25). Despite its prevalence and chronicity, research on physical-mental multimorbidity among youth is limited.

Given the burden of poor mental health, particularly among youth with chronic physical illness, examining the course of youth psychopathology can shed light on which aspects represent transient phases of development, and which indicate persistent problems (26). Symptoms of psychopathology are typically categorized into two distinct groups: internalizing symptoms (e.g., depression) and externalizing symptoms (e.g., conduct disorder) (27). Additionally, youth can have co-occurring and sequential comorbidities of internalizing and externalizing problems, and individuals can move between diagnoses over the lifespan (28). Multiple symptoms are linked to greater severity, persistence into adulthood, and more negative outcomes (2,29).

In early life, the risk of comorbidity increases due to the constantly shifting symptoms of psychopathology as children develop (30,31). These symptoms are often transient, typically decreasing with age due to the rapid developmental changes during childhood (4,26). Some studies have tracked the fluidity of psychopathology throughout early development using approaches focused on symptoms and group-based trajectory modelling (2,32,33). Yet, using a person-centred approach allows data to reflect that individuals may experience different symptoms at various times, enabling tracking of these symptom changes over time (28). This aligns with the observed patterns of simultaneous and sequential comorbidity (10,34,35) and the dynamic and unpredictable nature of psychopathology in youth (30). Person-centred approaches assume that while there are groups of

psychopathology symptoms within the population, individuals can shift between these groups over time (28).

Many studies have used latent profile/class analysis to identify subgroups of youth with similar mental health symptoms, but few have examined a broad range of symptoms covering both the internalizing and externalizing spectrum (26,28,36,37). These studies typically find that the largest group comprises individuals with low symptom levels. Latent transition analysis tracks transitions between profiles, aligning with the dynamic nature of youth psychopathology. However, it has not been used in a sample of youth with CPI (4,26,28,30,37–39). Person-centred studies on youth can provide valuable insights into the early composition of psychiatric comorbidity and subsequent developmental trajectories (40).

The present study aims to build on previous research by examining transitions in youth with a chronic physical illness—a subset of youth that has thus far not been the focus of the study. The interplay between chronic physical and mental illness underscores the need for a comprehensive approach to healthcare that addresses both the physical and mental health needs of youth. Understanding the stability and change in psychopathology in youth with chronic physical illness is crucial for developing targeted interventions that can mitigate these risks and improve overall health outcomes.

This study has three objectives; (i) to examine the latent structure of psychopathology in a sample of youth with a chronic physical illness, (ii) to examine person-level stability and change of these profiles over time, and (iii) to identify predictors of transitions over time. By

examining individual-level transitions between internalizing, externalizing, and comorbid profiles over time, we may better understand how these profiles develop over time.

## **6.3 Methods**

### **6.3.1 Design and Sample**

Data come from the Multimorbidity in Children and Youth Across the Life-course (MY LIFE) study (41). This ongoing prospective study investigates the mental health of children with a CPI (e.g., asthma, diabetes, epilepsy). It includes 263 youth aged 2-16 years and their parents who attended outpatient clinics at McMaster Children's Hospital (Hamilton, Ontario, Canada). The inclusion criteria required that youth have one physician-diagnosed CPI (defined as a condition expected to be existent for  $\geq 12$  months). Additionally, youth and parents were excluded if they either could not understand English or if the child had  $>1$  physical illness (i.e., medically complex) at the time of recruitment. For these analyses, follow-up data over 24 months were modelled with assessments at baseline (T1), six (T2), 12 (T3), and 24 (T4) months.

### **6.3.2 Study Procedures**

Parents consented on behalf of children 2-6 years old, youth aged 7-15 years provided written informed assent, and all parents and youth  $\geq 16$  provided written informed consent. Data were collected using structured interviews and computer-assisted self-report questionnaires. Parent-reported data were collected for all participating youth and youth  $\geq 10$  years old provided self-reports. MY LIFE received ethical approval from the Hamilton

Integration Research Ethics Board (2797) and the University of Waterloo Research Ethics Board (ORE-22183).

### **6.3.3 Measures**

#### *6.3.3.1 Youth Psychopathology*

Past six-month youth psychopathology was measured using the parent-reported 52-item Emotional Behavioural Scales (EBS) (42). The EBS measures symptoms of internalizing [generalized anxiety (GAD), separation anxiety disorder (SAD), social phobia (SP), major depressive disorder (MDD)] and externalizing disorders [attention-deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD)] based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR). Items on the EBS are rated as 0='never or not true,' 1='sometimes or somewhat true,' and 2='often or very true,' where higher scores indicate greater psychopathology. The total score is calculated as the sum of all items. The EBS has demonstrated robust psychometric properties in clinical and general population samples of youth (42–44). Internal consistency was high in this sample ( $\alpha=0.86$ ).

#### *6.3.3.2 Youth Disability*

The proxy-administered 12-item World Health Organization Disability Assessment Schedule (WHODAS) 2.0 was used to measure youth disability (45). The WHODAS 2.0 assesses functioning across cognition, mobility, self-care, getting along, life activities, and participation. Parents reflected on the difficulty their child had with each item within the past

30 days using a five-point scale ranging from 1 (none) to 5 (extreme/cannot do). A composite score that summed all items, ranging from 12 to 60, was calculated with higher scores representing greater disability. The WHODAS 2.0 has demonstrated robust psychometric properties in this sample (46) and the internal consistency was high ( $\alpha=0.93$ ).

#### *6.3.3.3 Parent Stress*

The 18-item Parent Stress Scale (PSS) measures parent stress in four domains: rewards, stressors, loss of control, and satisfaction (47). Items are scored from 1 (strongly disagree) to 5 (strongly agree). The total score ranges from 18 to 90, with higher scores representing more parent stress. The scale has demonstrated reliability and validity in parents of children with CPI (48). Internal consistency was high in this sample ( $\alpha=0.86$ ).

#### *6.3.3.4 Parent Psychological Distress*

The 20-item Center for Epidemiological Studies Depression (CES-D) Scale assessed parent level of depressive symptoms (49). This scale evaluates negative and positive affect, somatic activity, and interpersonal relations over the past week. Parents reported how often they reported symptoms on a four-point Likert scale (0='rarely or none of the time' [less than one day per week] to 3= 'most or almost all of the time' [5-7 days per week]). Total scores range from 0 to 60, with higher scores indicating greater depressive symptomatology. The CES-D has strong psychometric properties in parents of youth with mental disorder (50) and it showed high internal consistency in this sample ( $\alpha=0.92$ ).

The seven-item Generalized Anxiety Disorder scale (GAD-7) measures parents' generalized anxiety symptoms (51). They indicated how many days in the past two weeks they experienced symptoms on a scale from 0 (not at all) to 3 (nearly every day). The score, ranging from 0 to 21, reflects the level of anxiety, with higher scores indicating greater anxiety. The GAD-7 also demonstrated high internal consistency in this sample ( $\alpha=0.88$ ).

### 6.3.4 Demographic Characteristics

Parents reported information about the youth and parents' age, sex, and immigration status. Additionally, they were asked about their marital status (partnered relationship or not), the highest level of education (completed a college/university degree or not), and household income ( $< \$90,000$  or  $\geq \$90,000$ ). Demographic information is provided in Table 1 at each time point (T1-T4).

**Table 1.** Demographic Characteristics

	Baseline (T1)	6 months (T2)	12 months (T3)	24 months (T4)
<b>Child</b>				
Age (years), mean (SD)	9.5 (4.2)	10.0 (4.2)	10.5 (4.2)	11.5 (4.2)
Male, n (%)	138 (52.5)	-	-	-
Born in Canada, n (%)	248 (94.3)	-	-	-
<b>Parent</b>				
Age (years), mean (SD)	40.52 (6.5)	41.0 (6.5)	41.5 (6.5)	42.5 (6.5)
Female, n (%)	237 (90.1)	-	-	-

Born in Canada, n (%)	223 (84.8)	-	-	-
Partnered relationship, n (%)	228 (86.7)	222 (84.4)	213 (81.0)	202 (76.8)
College/university degree, n (%)	200 (76.1)	190 (72.2)	190 (72.2)	192 (73.0)
Household income ≥\$90,000, n (%)	156 (59.3)	153 (58.2)	147 (55.9)	153 (58.2)

### 6.3.5 Statistical Analyses

#### 6.3.5.1 Latent Profile Analysis

Latent profile analysis (LPA) was applied to define psychopathology subgroups at T1, T2, T3 and T4, using scores from the EBS subscales as indicators (i.e., CD, ODD, ADHD, MDD, GAD, SA, SP). The log-likelihood, (AIC), Bayesian Information Criterion (BIC), and the sample-adjusted Bayesian Information Criterion (SABIC) were used to assess the fit of each model (52–54). Lower estimates of AIC, BIC, AND SABIC indicate better model fit (37). The entropy of the models was evaluated with values closer to 1, indicating better classification, and all profiles obtained should have a minimum of 1% of the participants (26). Lastly, all profiles were inspected visually to ensure each additional profile had a distinct severity. Because imputed data were used, we could not ascertain the bootstrapped likelihood ratio test (BLRT) or Lo-Mendell-Rubin (LMR) test for each model.

Profiles were defined by comparing mean scores in each of the profiles. Missing data were imputed under the assumption that data were missing at random (MAR) (55).

#### *6.3.5.2 Latent Transition Analysis*

Latent transition analysis (LTA) was used to calculate transition probabilities between psychopathology profiles. First, longitudinal measurement invariance using LTA was tested by computing two LTAs, one with and one without invariance constraints. Because this analysis used imputed data, we could not ascertain the information needed for the likelihood ratio difference test. Instead, the measurement invariant solution was used to facilitate the interpretation of profiles and corresponding transitions (56).

Next, we used the number of profiles based on the optimal model at each time point from the LPA to estimate the status prevalence and transition probabilities using LTA (56). Transition probabilities of profiles were estimated from T1 to T2, T2 to T3, and T3 to T4. Lastly, we tested predictors of transitions for each model in which demographic characteristics (i.e., child age, child sex, child disability, parent education, parent psychological distress, and household income) were included as covariates using multinomial logistic regression. Both LPA and LTA were conducted using MPlus v8.5 (55).

## **6.4 Results**

### **6.4.1 Latent Profile Analysis**

If two or more models fitted the data equally well, the optimal fit was based on visual inspection of the output. We could not discriminate between models at T1-T4 based on the

loglikelihood, AIC, BIC, or SABIC because the estimates decreased with each increasing number of profiles added to the model. At T1, entropy determined that four or five profiles fit the data equally well. Visual inspection showed that a five-profile model would not have differed in severity from the profiles already identified in the four-profile fit. At T2, a four-profile was determined to be the best-fitting model as it had the highest entropy value. At T3, the three-profile fit had a higher entropy but decided to retain the four-profile fit because it had lower values for loglikelihood, AIC, BIC, and SABIC and was consistent with the previous two-time points. Lastly, at T4, a four-profile fit was determined to be the best-fitting model as it had the same entropy value as the three-profile fit, and the five-profile fit had <1% of participants in the smallest profile. Therefore, a four-profile model was determined to be the optimal model to use across all four-time points for subsequent analyses. Model fit indices are provided in Table 2.

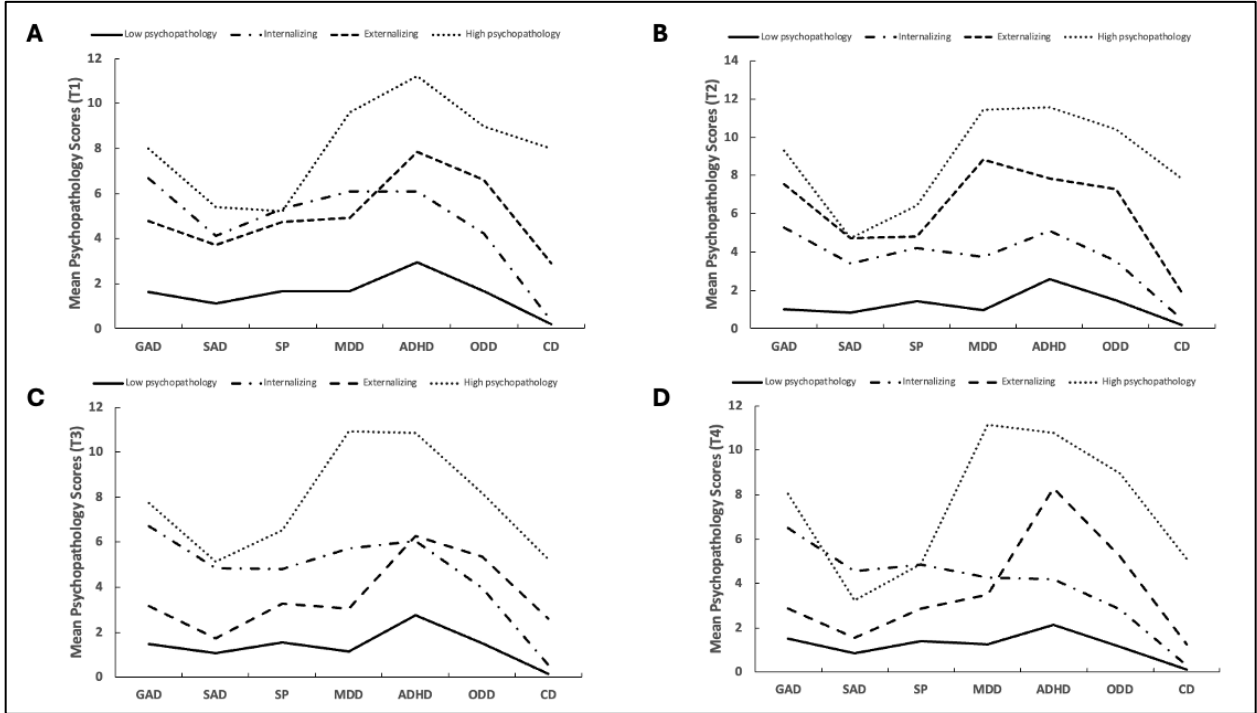
**Table 2.** Model Fit Statistics for latent profile models at T1, T2, T3, and T4

	<b>Number of Profiles</b>	<b>LL</b>	<b>AIC</b>	<b>BIC</b>	<b>SABIC</b>	<b>Entropy</b>	<b>Smallest Profile</b>
T1	2	-4085.79	8215.59	8294.17	8224.42	0.91	25.48%
	3	-3978.30	8016.59	8123.76	8028.64	0.92	3.42%
	4	-3891.24	7858.47	7994.21	7873.73	<b>0.95</b>	1.90%
	5	-3834.35	7760.70	7925.02	7779.18	<b>0.96</b>	1.90%
T2	2	-4081.66	8207.32	8285.91	8216.16	0.96	14.83%
	3	-3991.06	7882.12	7989.28	7894.17	0.94	4.18%
	4	-3880.51	7737.02	7872.76	7752.28	<b>0.94</b>	2.66%
	5	-3777.47	7646.95	7811.27	7665.42	<b>0.95</b>	2.28%

T3	2	-3989.71	8023.41	8102/00	8032.25	0.94	20.15%
	3	-3882.71	7825.42	7932.59	7837.47	0.94	3.42%
	4	-3823.18	7722.35	7858.10	7737.62	<b>0.96</b>	3.04%
	5	-3768.84	7629.67	7793.99	7648.15	0.93	2.66%
T4	2	-3972.13	7988.26	8066.85	7997.10	0.92	20.15%
	3	-3830.18	7720.37	7827.53	7732.42	0.93	3.42%
	4	-3761.56	7599.11	7734.85	7614.37	<b>0.93</b>	3.42%
	5	-3686.28	7464.56	7628.88	7483.04	<b>0.95</b>	0.004%

AIC= Akaike information criterion, BIC= Bayesian information criterion, LL= loglikelihood, SABIC= Sample-Adjusted Bayesian information criterion

The four profiles are described as 1) low psychopathology (T1: 67.3%, T2: 62.7%, T3: 72.6%, T4: 68.1%) with low scores on all disorder subscales, 2) primarily internalizing (T1: 20.2%, T2: 27.0%, T3: 17.4%, T4: 15.2%), with higher scores on GAD, SA, SP, and MDD subscales 3) primarily externalizing (T1: 10.6%, T2: 8.0%, T3: 6.5%, T4: 12.9%) with higher scores on ADHD, ODD, and CD subscales, and 4) high psychopathology (T1: 1.9%, T2: 2.7%, T3: 3.0%, T4: 3.4%) with higher scores on all disorder subscales, see Figure 1.



**Figure 1.** Psychopathology profiles, measured using the EBS, derived with latent profile analysis **A** at T1, **B** at T2, **C** at T3, and **D** at T4

### 6.4.2 Latent Transition Analysis

Based on fit statistics, all three models for the LTA fitted the data equally well (T1 to T2: BIC= 15650.549, entropy= 0.93; T2 to T3: BIC= 15454.09, entropy= 0.94; T3 to T4: BIC= 15142.45, entropy= 0.95). Transition probabilities between T1-T4, based on invariant models, are shown in Table 3.

Homotypic continuity, which indicates children classified in the same psychopathology subgroup at two consecutive time points, was 97.0% between T1 and T2 for the low psychopathology profile, 96.3% between T2 and T3, and 96.6% between T3 and T4. Homotypic continuity for primarily internalizing symptoms was 73.2% between T1 and

T2, 76.7% for T2 to T3, and 75.9% for T3 to T4. For primarily externalizing symptoms, homotypic continuity was 59.6% for T1 to T2, 55.2% for T2 to T3, and 82.8% for T3 to T4. Lastly, homotypic continuity for the high psychopathology profile was 85.8% for T1 to T2, 70.5% for T2 to T3, and 61.0% for T3 to T4.

Regarding heterotypic continuity, few children transitioned from the low psychopathology profile to the primarily internalizing (T1-T2: 3.0%; T2-T3: 3.7%; T3-T4: 1.3%) and primarily externalizing (T3-T4: 2.1%) profiles, but no children transitioned from low psychopathology into the high psychopathology profile. Few children transitioned out of the primarily internalizing profile into the primarily externalizing profile (T1-T2: 3.0%; T2-T3: 8.2%), whereas a greater number of children transitioned to the low psychopathology profile (T1-T2: 23.7%; T2-T3: 15.1%; T3-T4: 24.1%). No children transitioned from the internalizing profile to the high psychopathology profile. For the primarily externalizing profile, a larger number of children transitioned into the primarily internalizing profile (T1-T2: 33.9%; T2-T3: 44.8%; T3-T4: 1.3%), very few transitioned into the low psychopathology profile (T3-T4: 8.9%), and very few transitioned into the high psychopathology profile (T1-T2: 6.5%; T3-T4: 7.0%). Lastly, for the high psychopathology profile, some children transitioned into the low psychopathology (T1-T2: 14.2%) and primarily internalizing (T2-T3: 9.7%; T3-T4: 11.4%) profiles; however, more children transitioned into the primarily externalizing profile (T2-T3: 19.8%; T3-T4: 27.6%). No youth transitioned from the high psychopathology profile to the low psychopathology group

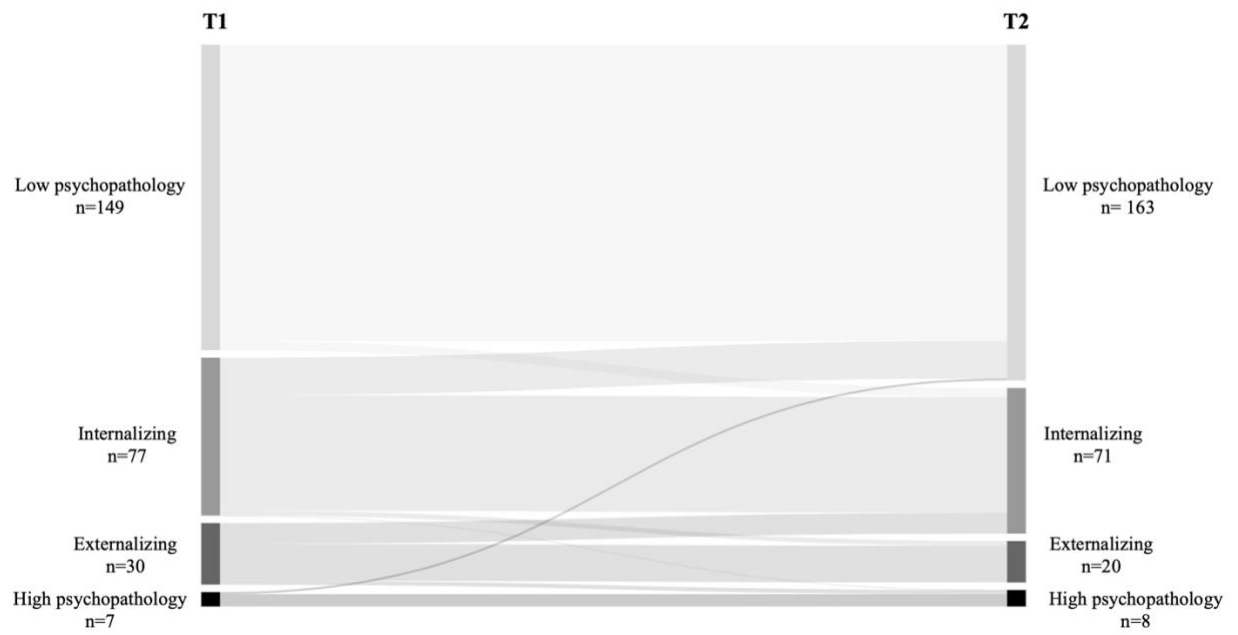
between T2 to T3 and T3 to T4. Sankey diagrams that illustrate the transitions can be seen in Figure 2.

**Table 3.** Latent probability transition matrices of four-time points (unconditional models)

Latent category	Low psychopathology group	Primarily internalizing group	Primarily externalizing group	High psychopathology group
<b>T1-T2</b>				
Low psychopathology group	<b>0.970 (145; 55.0%)</b>	0.030 (5; 1.7%)	0.000	0.000
Primarily internalizing group	0.237 (18; 7.0%)	<b>0.732 (56; 21.4%)</b>	0.030 (2; 0.9%)	0.001 (0; 0.0%)
Primarily externalizing group	0.000	0.339 (10; 3.9%)	<b>0.596 (18; 6.8%)</b>	0.065 (2; 0.8%)
High psychopathology group	0.142 (1; 0.4%)	0.000	0.000	<b>0.858 (6; 2.3%)</b>
<b>T2-T3</b>				
Low psychopathology group	<b>0.963 (148; 56.4%)</b>	0.037 (6; 2.2%)	0.000	0.000
Primarily internalizing group	0.151 (12; 4.5%)	<b>0.767 (60; 23.0%)</b>	0.082 (7; 2.5%)	0.000
Primarily externalizing group	0.000	0.448 (9; 3.2%)	<b>0.552 (10; 4.0%)</b>	0.000

High psychopathology group	0.000	0.097 (1; 0.4%)	0.198 (2; 0.8%)	<b>0.705 (8; 3.0%)</b>
<b>T3-T4</b>				
Low psychopathology group	<b>0.966 (159; 60.6%)</b>	0.013 (2; 0.8%)	0.021 (3; 1.3%)	0.000
Primarily internalizing group	0.241 (11; 4.1%)	<b>0.759 (34; 13.0%)</b>	0.000	0.000
Primarily externalizing group	0.089 (4; 1.5%)	0.013 (1; 0.2%)	<b>0.828 (36; 13.5%)</b>	0.070 (3; 1.1%)
High psychopathology group	0.000	0.114 (1; 0.4%)	0.276 (3; 1.1%)	<b>0.610 (6; 2.3%)</b>
<ol style="list-style-type: none"> <li>1. Profiles on the x-axis represent T1, T2, and T3, respectively and profiles on the y-axis represent T2, T3, and T4, respectively.</li> <li>2. Numbers represent transition probabilities (row sum = 100%).</li> <li>3. n and % of each transition (out of 16) are shown in parenthesis.</li> <li>4. Bold numbers indicate homotypic continuity.</li> </ol>				

**A**



**B**



C



**Figure 2:** Sankey Diagram displaying transitions from **A:** T1-T2, **B:** T2-T3, and **C:** T3-T4 of the study

### 6.4.3 Predictors of Latent Transition Probabilities

Table 6 displays the results of the conditional latent transition models. For T1-T2, compared to those who remained in the high psychopathology profile, youth with higher levels of disability had significantly lower odds of transitioning from the high

psychopathology to low psychopathology profile at T2 [OR=0.86(0.78,0.95)]. Youth with higher levels of disability and those whose parents had lower levels of psychological distress had significantly lower odds of transitioning from the high psychopathology to the internalizing profile at T2 [OR=0.76(0.65,0.89); OR=0.91(0.86,0.97), respectively].

For T2-T3, compared to those who remained in the high psychopathology profile, youth with higher levels of disability and those whose parents had lower levels of psychological distress had significantly lower odds of transitioning from the high psychopathology profile to the low psychopathology profile at T3 [OR=0.89(0.82,0.96); OR=0.91(0.88,0.95), respectively]. In contrast, those whose parents have a college/university degree had significantly higher odds of this transition [OR=4.66(1.09,19.89)]. Older youth, those with higher levels of disability, and those whose parents had lower levels of psychological distress had significantly lower odds of transitioning from the high psychopathology to the internalizing profile at T3 [OR=0.72(0.59,0.87); OR=0.83(0.75,0.91); 0.91(0.88,0.95), respectively]. Older youth, those with higher levels of disability, and those whose parents had lower levels of psychological distress had significantly lower odds of transitioning from the high psychopathology to the externalizing profile at T3 [OR=0.74(0.60,0.92); OR=0.64(0.50,0.83); OR=0.88(0.83,0.93), respectively].

For T3-T4, compared to those who remained in the high psychopathology profile, youth with higher levels of disability and those who had parents with lower levels of psychological distress scores had significantly lower odds of transitioning from the high

psychopathology to the externalizing profile at T4 [OR=0.76(0.65,0.89);

OR=0.95(0.91,0.99), respectively].

**Table 6.** Estimates for covariates predicting transition probabilities (N=263)

<b>Covariate</b>	<b><math>\beta</math> (SE)</b>	<b><i>p</i></b>	<b>OR (95% CI)</b>
<b>T1-T2</b>			
<b>High psychopathology profile to low psychopathology profile vs. remaining in the high psychopathology profile</b>			
Child age	-0.12 (0.13)	0.329	0.89 (0.69,1.14)
Child disability	<b>-0.15 (0.05)</b>	<b>0.002</b>	<b>0.86 (0.78,0.95)</b>
Parent education	0.74 (0.77)	0.330	2.10 (0.46,9.48)
Parent psychological distress	-0.03 (0.02)	0.238	0.97 (0.93,1.01)
Household income	0.28 (1.00)	0.781	1.32 (0.19,9.39)
<b>High psychopathology profile to primarily internalizing profile vs. remaining in the high psychopathology profile</b>			
Child age	-0.15 (0.13)	0.224	0.86 (0.67,1.11)
<b>Child disability</b>	<b>-0.27 (0.08)</b>	<b>0.001</b>	<b>0.76 (0.65,0.89)</b>
Parent education	0.50 (0.83)	0.545	1.65 (0.32,8.39)
<b>Parent psychological distress</b>	<b>-0.09 (0.03)</b>	<b>0.004</b>	<b>0.91 (0.86,0.97)</b>
Household income	0.13 (1.02)	0.903	1.14 (0.15,8.41)

**High psychopathology profile to primarily externalizing profile vs. remaining in the high psychopathology profile**

Child age	0.03 (0.12)	0.825	1.03 (0.81,1.30)
Child disability	-0.05 (0.04)	0.266	0.95 (0.88,1.03)
Parent education	0.42 (0.76)	0.579	1.52 (0.34,6.75)
Parent psychological distress	0.02 (0.02)	0.394	1.02 (0.98,1.06)
Household income	1.35 (1.05)	0.199	3.86 (0.49,30.20)

**T2-T3**

**High psychopathology profile to low psychopathology profile vs. remaining in the high psychopathology profile**

Child age	-0.19 (0.10)	0.044	0.83 (0.68,1.01)
Child disability	<b>-0.12 (0.04)</b>	<b>0.001</b>	<b>0.89 (0.82,0.96)</b>
Parent education	<b>1.54 (0.74)</b>	<b>0.037</b>	<b>4.66 (1.09,19.89)</b>
Parent psychological distress	<b>-0.09 (0.02)</b>	<b>0.000</b>	<b>0.91 (0.88,0.95)</b>
Household income	-0.76 (0.82)	0.351	0.47 (0.09,2.33)

**High psychopathology profile to primarily internalizing profile vs. remaining in the high psychopathology profile**

Child age	<b>-0.33 (0.10)</b>	<b>0.001</b>	<b>0.72 (0.59,0.87)</b>
Child disability	<b>-0.19 (0.05)</b>	<b>0.000</b>	<b>0.83 (0.75,0.91)</b>
Parent education	1.63 (0.85)	0.056	5.10 (0.96,27.00)

Parent psychological distress	<b>-0.09 (0.02)</b>	<b>0.000</b>	<b>0.91 (0.88,0.95)</b>
Household income	-1.33 (0.89)	0.133	0.26 (0.05,1.51)
<b>High psychopathology profile to primarily externalizing profile vs. remaining in the high psychopathology profile</b>			
Child age	<b>-0.30 (0.11)</b>	<b>0.005</b>	<b>0.74 (0.60,0.92)</b>
Child disability	<b>-0.44 (0.13)</b>	<b>0.001</b>	<b>0.64 (0.50,0.83)</b>
Parent education	1.24 (0.79)	0.116	3.46 (0.73,16.25)
Parent psychological distress	<b>-0.13 (0.03)</b>	<b>0.000</b>	<b>0.88 (0.83,0.93)</b>
Household income	-2.07 (1.10)	0.061	0.13 (0.01,1.09)
<b>T3-T4</b>			
<b>High psychopathology profile to low psychopathology profile vs. remaining in the high psychopathology profile</b>			
Child age	-0.20 (0.10)	0.046	0.82 (0.67,1.00)
Child disability	-0.09 (0.06)	0.108	0.91 (0.81,1.03)
Parent education	-0.31 (0.80)	0.703	0.73 (0.15,3.52)
Parent psychological distress	-0.02 (0.02)	0.477	0.98 (0.94,1.02)
Household income	-0.12 (0.94)	0.895	0.89 (0.14,5.60)
<b>High psychopathology profile to primarily internalizing profile vs. remaining in the high psychopathology profile</b>			

Child age	-0.17 (0.10)	0.086	0.84 (0.69,1.03)
Child disability	-0.01 (0.05)	0.928	0.99 (0.90,1.09)
Parent education	0.84 (0.78)	0.284	2.32 (0.50,10.68)
Parent psychological distress	0.02 (0.02)	0.459	1.02 (0.98,1.06)
Household income	0.46 (0.95)	0.630	1.58 (0.25,10.20)
<b>High psychopathology profile to primarily externalizing profile vs. remaining in the high psychopathology profile</b>			
Child age	-0.19 (0.10)	0.048	0.83 (0.68,1.01)
Child disability	<b>-0.27 (0.08)</b>	<b>0.001</b>	<b>0.76 (0.65,0.89)</b>
Parent education	-0.05 (0.80)	0.950	0.95 (0.20,4.56)
Parent psychological distress	<b>-0.05 (0.02)</b>	<b>0.019</b>	<b>0.95 (0.91,0.99)</b>
Household income	-0.15 (0.89)	0.867	0.86 (0.15,4.93)
CI= confidence interval; OR= odds ratio; SE= standard error			

## 6.5 Discussion

This study aimed to identify transitions in psychopathology profiles in youth with chronic physical illness and the factors that are associated with transitions. Similar to previous studies using LCA to investigate multiple psychopathology symptoms (26,28,29,37,57), subgroups of psychopathology included four profiles: low psychopathology, primarily internalizing, primarily externalizing, and high psychopathology.

It was observed that the stability of youth remaining within the high psychopathology profile decreases with age. Notably, while there is a change in symptoms for youth classified in the high psychopathology profile, all youth from this high-risk group from six to 12 months and 12 to 24 months remain in either the primarily internalizing, primarily externalizing, or high psychopathology subgroups over time.

The transition probability towards the low psychopathology profile decreased over time, whereas the probability of transitioning towards the internalizing profile remained stable, and transitioning to the primarily externalizing profile increased over time. Early interventions are, therefore, important to maximize the likelihood of positive outcomes. Like findings by Healey et al. (2022) in a population sample of youth between 12 to 24 months, most youth with CPI who moved into the high psychopathology subgroup had transitioned from the primarily externalizing profile. Thus, a small subset of these youth with primarily externalizing behaviours were at risk for worsening issues and might need ongoing monitoring (28). Continuous monitoring and early intervention could help prevent the escalation of psychopathology symptoms and reduce cross-domain comorbidity.

In line with McElroy et al. (2017), youth with primarily internalizing symptoms were more likely to transition to the low psychopathology profile over time compared to those with primarily externalizing problems, indicating that internalizing symptoms specifically are a transient phase of development for many youths. Additionally, few youths transitioned from primarily externalizing to the low psychopathology profile, suggesting that externalizing psychopathology may confer a higher risk of developing cross-domain

comorbidity compared to internalizing psychopathology (37). Consequently, identifying risk factors in youth with externalizing problems, worsening trends, and intervening early may help to lower the risk of comorbidities, societal health burdens, and social costs (28).

As expected, the largest number of youths were classified in the low psychopathology profile. Homotypic continuity was high for all three transition groups. This suggests that most youth who exhibit low levels of psychopathology early on will continue to have low symptom levels as they age. Only 2-4% of those with initially low symptoms shifted to the primarily internalizing profile over time, and 1% moved to the primarily externalizing profile. Compared to previous work (26,26), this study found higher homotypic continuity for all subgroups. The homotypic continuity might be high because the follow-up period is only two years, which may not be long enough for symptoms to change significantly across subgroups. Future studies should examine transitions in youth with CPI over longer follow-ups to better understand how psychopathology symptoms evolve, which may inform the timing and nature of interventions. This supports the implementation of early screening to identify youth at low risk and provide ongoing support for more severe symptoms, ensuring appropriate allocation of resources for long-term mental health outcomes.

Findings from Figure 2 show that between baseline and six months and six to 12 months, the proportion of children with primarily internalizing symptoms remains stable, whereas there is a notable decrease in the proportion of children classified in the primarily internalizing group at 12 to 24 months. The stable prevalence observed from baseline to 12 months indicates a certain stability in the prevalence of internalizing symptoms, with more

youth reporting mainly internalizing symptoms during this period. This is contrary to previous research, which suggests that the risk of internalizing problems increases with age (58). Potential reasons for this inconsistency could include differences in the age range of the study participants, variations in the assessment tools used to measure internalizing symptoms or unique characteristics of the study populations that influence the trajectory of internalizing problems over time. Kessler et al. (2005) also describe that anxiety disorders can emerge at any age, whereas mood disorders are more likely to appear during adolescence. While internalizing symptoms may be stable initially, they may decrease over time, indicating a possible window for early intervention. Future research should explore factors influencing internalizing symptoms over time, including age-specific risks and measurement methods.

On the other hand, results showed a decline in children classified in the primarily externalizing profile between baseline and six months and six to 12 months, followed by a notable increase in children classified in the primarily externalizing group at 12 to 24 months. This aligns with earlier studies using LPA (26,37) and the understanding that externalizing disorders can develop into late childhood (6,59,60). However, other longitudinal research has shown that the prevalence of externalizing disorders decreases from childhood to adolescence (61). These findings imply that youth transitioning to the primarily externalizing profile were mainly those in the high psychopathology group at earlier time points (26,37). Moreover, those youth who transitioned out of the primarily externalizing profile transitioned mainly to the primarily internalizing profile between baseline and six months and six to 12 months and to the low psychopathology group from 12 to 24 months.

There is a need to explore the pathways of externalizing behaviours and their interactions with other psychopathology profiles. Additionally, programming should focus on early risk factors for externalizing disorders to prevent long-term behavioural problems in youth with CPI.

The prevalence of high psychopathology was relatively stable across time in this study. In contrast, previous studies found that the prevalence of the high psychopathology profile is highest in late childhood, after which there is a decline into adolescence (26,62). This could be due to a relatively small sample size compared to other studies that used large population-based samples. However, our results support the evidence that the high psychopathology subgroup is an at-risk state for persistent psychopathology (26,28). Where between baseline and six months, only 14% of youth in the high psychopathology profile transitioned to the low psychopathology profile, and no youth transitioned to the low psychopathology profile between six to 12 months and 12 to 24 months. Studies need to explore different factors that contribute to the persistence of high psychopathology.

Regarding predictors of transitions, the analysis suggests that youth with more severe disabilities were consistently less likely to transition out of the high psychopathology group into less severe psychopathology profiles over time. Specifically, youth with worse disability and those whose parents had lower psychological distress scores were less likely to move into the low psychopathology or externalizing groups at different intervals, including from baseline to six months and six to 24 months. While lower psychological distress is generally beneficial, it may also have unintended consequences of reducing awareness or intervention.

Additionally, older youth and those with greater disability were less likely to transition into the internalizing group between six and 12 months. Given the influence of youth disability and parent psychopathology on youth transitions over time, efforts are needed to support youth with higher levels of disability as they are less likely to transition out of high-risk psychopathology over time. For practice, this highlights the importance of early, comprehensive care that includes tailored interventions for youth with disability. Future research should identify specific factors that can facilitate positive transitions in this population.

This study should be considered in the context of its limitations. First, youth psychopathology was parent-reported due to the limited number of age-eligible youth available to provide self-reports. Parent informants frequently exhibit a negative bias and tend to have low agreement with youth informants (63). Second, our clinical sample was relatively small and homogenous regarding family composition, socioeconomic status, and ethnicity which may impact the generalizability of our findings. Third, our study included a wide age range that spanned multiple developmental periods; thus, we could not ascertain how youth transitioned across subgroups across these developmental periods. Fourth, we did not have access to medical records or information on services received between time points; we could not account for the impact of access to mental health services.

## **6.6 Conclusion**

This study examined the prevalence and characteristics of various psychopathology subgroups and changes in symptoms over two years. Four behavioural profiles were

identified: low psychopathology, primarily internalizing, primarily externalizing, and high psychopathology. While many youths showed transitions between these profiles, those in the high psychopathology profile were more likely to have persistent symptoms. All youth in the high psychopathology profile between six and 24 months remained in a high-risk state. These findings suggest that internalizing and externalizing symptoms may be transient, whereas high psychopathology indicates a greater risk for long-term mental health issues. There is a need for more integrated services that address both mental health and disability to improve long-term outcomes for youth with CPI.

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## **Chapter 7**

### **Manuscript 3**

#### **Associations between psychopathology latent classes and mental health service use among youth with physical illness**

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## 7.1 Overview

This study investigated whether child psychopathology trajectories mediate the association between parent psychological distress/family functioning and mental health service use (MHSU) among children with a chronic physical illness (CPI). Data come from a longitudinal study of 263 children and youth aged 2-16 years diagnosed with a CPI and their parents assessed at baseline, six, 12, and 24 months. Parent psychological distress was measured by creating a composite score from the Centre for Epidemiological Studies Depression scale and Generalized Anxiety Disorder-7 scale, and family functioning was measured using the McMaster Family Assessment Device. Previous work identified three trajectories of psychopathology among children: low-stable, moderate-stable, and high-decreasing. Path analysis was used to estimate potential mediating effects. A significant indirect effect of parent psychological distress on healthcare professional contact through child psychopathology was found ( $\beta = 0.003(0.001)$ ,  $p=0.036$ ). The indirect effect of family functioning was not significant ( $\beta = -0.002(0.002)$ ,  $p=0.200$ ). Addressing parent mental health may reduce child psychopathology and potentially decrease MHSU in children with CPI. Understanding these pathways is needed to develop family-centred interventions that support mental health in children with CPI and their parents.

**Keywords:** Child mental health disorder, Family dynamics, Family-centred care, Mental health service access, Path analysis

## 7.2 Introduction

Approximately 25% of children globally are affected by a chronic physical illness (CPI) (1). This experience poses significant challenges due to functional limitations, impacting both the affected children and their families as they work to manage these difficulties (2). The effects of CPI frequently extend into adulthood (3), affecting quality of life throughout the life course (4). Early-life CPI increases the likelihood of developing concurrent mental disorders (2,5,6). Research indicates that about 40% of children with CPI also receive a diagnosis for a mental disorder which often persists over time (7,8). This dual burden, or multimorbidity, adversely impacts daily functioning, leads to greater use of health services, and increases the risk of suicide and substance abuse (9–14).

Longitudinal research has identified that parent psychopathology is a key predictor of adverse social, emotional, and behavioural outcomes in children (15). Several studies have identified that increased levels of parent psychopathology, especially maternal depression, are associated with internalizing and externalizing psychopathology symptoms, poor social skills, and worse cognitive functioning in children (16–19). Children with CPI often experience unique stressors and complex healthcare needs, which can intensify parent mental health challenges and reduce quality of life (18–25). Parents with poor psychological flexibility may struggle to adjust to the demands of caring for their child with a CPI and may experience symptoms such as anxiety, depression, and stress (26–28).

The diathesis-stress model indicates that the development of mental disorder is influenced by the interplay between individual vulnerability (diathesis) and stressful life

events (29,30). The added stress of managing a CPI may increase the likelihood of children developing mental disorders, particularly when they are exposed to maternal depression (31). Factors such as a history of child mental disorder, poor maternal health, unstable family dynamics, and lower socioeconomic status, can increase depressive symptoms in mothers of children with CPI and affect child psychological health (31).

Specific aspects of family functioning are strongly related to mental disorders among children including problem-solving, communication, and behaviour control (32). The caregiving stress of parents can impact the family, leading to communication breakdowns, dissatisfaction with the family, and long-term dysfunction, which are exacerbated by the chronicity of childhood CPI and its ongoing demands (33,34). Using a family system perspective, all members of the family mutually affect one another (35). Poor family functioning can lead to worse clinical outcomes for children including more severe symptoms, higher levels of disability, and worse treatment responses (36–39). There is limited research on how the family environment influences access to mental health services for children. One study in a clinical sample of children found that specific domains of family functioning, including problem-solving and communication, were associated with internalizing mental disorders and mental health service use (MHSU) (32). Another study determined that children in a vulnerable family environment (poor family functioning, low social support, and caregiver psychological distress) resulted in less MHSU (40). In contrast, other research has found that parental support was associated with a lower likelihood of MHSU (41).

Children with multimorbidity are a vulnerable population who often require complex care management across physical and mental health services due to their increased need for mental health support and frequent healthcare contact (8,42). While an increase in MHSU has been observed in Canadian children over the past two decades, the extent of MHSU among those with multimorbidity presents mixed findings (43). Clinical studies report less use of acute services, whereas population-based studies show higher overall and acute MHSU (11,44). Epidemiological research indicates that children with multimorbidity report significantly higher MHSU compared to those with only mental disorders (11). Regarding the perceived need for MHSU, children with multimorbidity were less likely to report unmet needs compared to those with only mental disorders (11).

This relationship between parent and child mental health, as well as family functioning, is often bi-directional with implications for managing both physical and psychological health in families who have children with a CPI. The rationale for focusing on the pathway from parent psychological distress and family functioning to child psychopathology trajectories, leading to contact with a healthcare professional, stems from the understanding that parental mental health and broader family dynamics are often more distal to service use. Parents play a key role in recognizing and seeking help for the mental health needs of their children (45–48), particularly when they are experiencing psychological distress (49). This parental distress can heighten their awareness of child psychopathology, leading to more frequent engagement with healthcare services (49). By structuring the

analysis in this order, the study reflects the interconnected role of parental mental health and family functioning in shaping both child mental health and the decision to seek care.

The cross-sectional design of previous studies limits our understanding of how MHSU for children with a CPI change over time. This present study aims to examine if child psychopathology mediates the association between family factors (i.e., parent psychological distress and family functioning) and child MHSU, specifically any contact with a healthcare professional. For clinicians, this knowledge can lead to targeted interventions to address family dynamics and mental disorder risks early, improving outcomes for children. For policymakers, these insights can guide the development of targeted mental health services and resources that focus on both family support and the early detection of mental disorders, leading to more effective and efficient healthcare strategies.

## **7.3 Methods**

### **7.3.1 Design and Sample**

Data come from the Multimorbidity in Children and Youth Across the Life Course (MY LIFE) study (50). MY LIFE is an ongoing prospective study of 263 children and youth aged 2-16 years and their parents who attended outpatient clinics at an academic pediatric hospital in Ontario, Canada. Eligibility criteria required children to have one physician-diagnosed CPI (defined as having a condition expected to be present for  $\geq 12$  months and result in  $\geq 1$  of the following: functional impairment, dependencies to compensate for impairment, need for additional health services) (51). Children and parents must have had

sufficient English language skills to participate in MY LIFE. For these analyses, follow-up data over 24 months were modelled (assessments at baseline, six, 12, and 24 months).

### **7.3.2 Study Procedures**

Parents consented on behalf of children aged 2-6 years, children aged 7-15 years provided written informed assent, and all parents and children  $\geq 16$  provided written informed consent. Data were collected using parent-reported measures. MY LIFE received ethical approval from the Hamilton Integration Research Ethics Board (2797) and the University of Waterloo Research Ethics Board (ORE-22183).

### **7.3.3 Measures**

#### *7.3.3.1 Parent Psychological Distress*

Parent depressive symptoms were measured using the 20-item Center for Epidemiological Studies Depression (CES-D) Scale (52). This scale assesses negative and positive affect, somatic activity, and interpersonal relations during the previous week. Parents rated their frequency of experiencing symptoms using a four-point Likert scale (0='rarely or none of the time' [less than one day per week] to 3='most or almost all of the time' [5-7 days per week]). Total scores range from 0 to 60, with higher scores indicating greater depressive symptomatology. The CES-D has strong psychometric properties in parents of children with mental disorder (53). Internal consistency was high in this sample ( $\alpha=0.92$ ).

Parent symptoms of generalized anxiety were measured using the seven-item Generalized Anxiety Disorder scale (GAD-7) (54). Parents were asked, within the past two

weeks, to indicate the number of days they experienced symptoms. The GAD-7 was scored on a four-point scale from 0 (not at all) to 3 (nearly every day) and was summed for a total score ranging from 0 to 21, where higher scores indicate greater levels of anxiety. Internal consistency was high in this sample ( $\alpha=0.88$ ).

Given the strong positive correlation between the two measures ( $r=0.77$ ) and the fact that symptoms of depression and anxiety often co-occur, a composite measure of psychological distress was used.

#### *7.3.3.2 Family Functioning*

The McMaster Family Assessment Device (FAD) general functioning subscale was used to measure parent-reported family functioning in terms of communication, problem-solving, behavioural control, affective responsiveness and involvement, and roles in the family (55). Items on the scale are scored from 0 (agree) to 3 (strongly disagree) (50). Raw scores are summed for a total score, where higher scores indicate better family functioning. The scale has shown robust psychometric properties (50,56). Internal consistency was high in this sample ( $\alpha=0.86$ ).

#### *7.3.3.3 Child Psychopathology*

Past six-month child psychopathology was measured using the parent-reported 52-item Emotional Behavioural Scales (EBS) (57). The EBS measures symptoms of internalizing (generalized anxiety, separation anxiety, social phobia, major depressive disorder) and externalizing disorders (attention-deficit hyperactivity, oppositional defiant,

conduct disorder) based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR). Items on the EBS are rated as 0='never or not true,' 1='sometimes or somewhat true,' and 2='often or very true,' where higher scores indicate greater psychopathology. The total score is calculated as the sum of all items. The EBS has demonstrated robust psychometric properties in clinical and general population samples of children (57,58). Internal consistency was high in this sample ( $\alpha=0.86$ ).

#### *7.3.3.4 Mental Health Service Use*

Parents reported on their child's MHSU in the past 12 months using questions adapted from the Canadian Community Health Survey-Mental Health (59). These questions included both closed and open-ended formats assessing whether the child had contact with various healthcare professionals regarding their mental health, and the frequency of these events in the past year. Healthcare professionals included psychiatrists, family doctors, general practitioners, psychologists, nurses, social workers, counsellors, case workers, psychotherapists, and any other consulted professionals.

#### *7.3.3.5 Child Disability*

The proxy-administered 12-item World Health Organization Disability Assessment Schedule (WHODAS) 2.0 was used to measure child disability (60). The WHODAS 2.0 assesses functioning across the domains of cognition, mobility, self-care, getting along, life activities, and participation. Parents reflected on the amount of difficulty their child had within the past 30 days on each item using a five-point scale ranging from 1 (none) to 5

(extreme/cannot do). A composite score that summed all items, ranging from 12 to 60, was computed; higher scores represent more disability. The WHODAS 2.0 has demonstrated robust psychometric properties in this sample (61) and internal consistency was high ( $\alpha=0.93$ ). WHODAS 2.0 score was used as a control variable in the statistical models.

#### *7.3.3.6 Sociodemographic Characteristics*

Parents were asked to report on their child and parent's age, sex, and immigration status. Additionally, they were asked about their marital status (partnered or not), the highest level of education (college/university degree or not), and annual household income (<\$90,000 or  $\geq$ \$90,000). These sociodemographic characteristics were used as control variables in the statistical models.

#### **7.3.4 Statistical Analyses**

Descriptive statistics (frequency and percent) were calculated for the number of contacts with a healthcare professional. This paper is an extension of two previous studies utilizing the MY LIFE data. The first study identified trajectories of psychopathology among children with CPI using latent class growth analysis (LGCA) and identified a three-class trajectory, which was classified as low-stable, moderate-decreasing, and high-decreasing. The MINI-KID was used to validate trajectory groups derived from the MY LIFE cohort (Dol et al., n.d.). For this study, the psychopathology trajectory variable was collapsed into a binary variable to represent moderate-stable/high-decreasing psychopathology (subclinical

levels) and low-stable psychopathology. Approximately 41% of children with CPI had subclinical levels of psychopathology.

Additional descriptive statistics were computed to understand if there were significant differences between the psychopathology trajectory groups of children who did vs. did not have contact with a healthcare professional. Chi-square tests compared healthcare professional contacts between the low vs. subclinical psychopathology groups. Wilcoxon rank-sum tests were used to compare total psychopathology scores between children who had vs. those who did not have contact with a healthcare professional.

Path analysis was utilized to examine if child psychopathology trajectory groups (subclinical vs. low levels) mediated the association between parent psychopathology and family functioning with healthcare professional contacts at 24 months. The outcome was any contact with a healthcare professional (yes vs. no). Path analysis enables the examination of specific direct effects of each variable and the degree of indirect effects of parent psychological distress to healthcare professional contacts through child psychopathology trajectory (62). Since the psychopathology trajectory group was the mediator variable, probit regression was used to model the relationship between the exposure and the mediator. The path model was specified in MPlus 8.5 using the weighted least squares mean and variance (WLSMV) adjusted estimator, which is suitable for models that involve categorical mediators. This estimator adjusts for the non-normality and provides accurate standard errors and chi-squared tests for categorical data. In addition, bootstrapping with 5000 resamples provided p-values for the indirect effects, offering a non-parametric method for assessing

statistical significance. The significance level was set at  $\alpha = 0.05$ . To assess the adequacy of the sample size, we conducted a Monte Carlo simulation in MPlus to evaluate the statistical power for detecting the effects of interest, which revealed that our study is well-powered at 88.3%.

## Results

### 7.3.5 Sample Characteristics (Table 1)

Children had a mean age of 9.5 years (SD=4.2), and 52% were male. The most common diagnoses were rheumatological (27.8%), respiratory (20.5%) and endocrine (14.5%). Over one-quarter (26.6%) of children represented new-onset cases of CPI (duration <1 year).

The mean age of parents was 40.5 (6.5) years. The majority were female (90.1%), and 15.1% immigrated to Canada. Eighty-seven percent of parents were in partnered relationships (married or common-law), and most had postsecondary education (76.1%). Further, 59.8% reported annual household incomes of  $\geq$ \$90,000. The mean parent psychological distress score was 15.3 (SD=13.2).

**Table 1.**

Sample Characteristics

Characteristic	Value
<b>Individual</b>	
Age (years), mean (SD)	9.5 (4.2)

Male, n (%)	138 (52.5)
Born in Canada, n (%)	248 (94.3)
Diagnosis, n (%)	
Dermatological	23 (8.8)
Endocrine	38 (14.5)
Gastroenterological	34 (12.9)
Hematological	29 (11.0)
Neurological	12 (4.6)
Respiratory	54 (20.5)
Rheumatological	73 (27.8)
Years since diagnosis, n (%)	
<1.0	70 (26.6)
1.0 to <2.5	39 (14.8)
2.5 to <5.0	62 (23.6)
5.0 to <7.5	40 (15.2)
≥7.5	52 (19.8)
<b>Family</b>	
Age (years), mean (SD)	40.52 (6.5)
Female, n (%)	237 (90.1)
Born in Canada, n (%)	223 (84.8)
Partnered relationship, n (%)	228 (86.7)
College/university degree, n (%)	200 (76.1)
Household income ≥\$90,000, n (%)	156 (59.3)
Family functioning, mean (SD)	28.1 (5.4)
Psychological distress, mean (SD)	15.3 (13.2)

Table 2 shows that for each time point in the study, there was a statistically significant difference between children in the subclinical and low psychopathology trajectories who reported contact with a healthcare professional. Table 3 shows that at all four-time points, mean total psychopathology scores are significantly higher for children who had contact with a healthcare professional compared to those who did not.

**Table 2.** Comparison of contact with a healthcare professional between subclinical and low psychopathology trajectories across four time points

<b>Contact with a healthcare professional</b>	<b>Subclinical psychopathology, frequency, (%)</b>	<b>Low psychopathology, frequency, (%)</b>	<b>p-value</b>
Time 1	20 (7.6%)	10 (3.8%)	<b>0.0022</b>
Time 2	22 (8.4%)	11 (4.2%)	<b>0.0011</b>
Time 3	25 (9.5%)	12 (4.6%)	<b>0.0003</b>
Time 4	29 (11.5%)	14 (5.3%)	<b>&lt;0.0001</b>
Percentage of total sample			

**Table 3.** Total psychopathology scores by contact with a healthcare professional across the four time points

<b>Time</b>	<b>Contact with a healthcare professional</b>	<b>Total psychopathology score, mean (SD)</b>	<b>Wilcoxon U-statistic</b>	<b>p-value</b>
Time 1	Yes	26.87 (13.44)	5831.00	<b>0.0002</b>
	No	17.66 (14.06)		
Time 2	Yes	29.00 (18.40)	5915.00	<b>&lt;0.0001</b>
	No	15.48 (13.10)		
Time 3	Yes	23.57 (17.12)	5893.00	<b>0.0018</b>
	No	14.79 (12.57)		
Time 4	Yes	23.27 (14.73)	6883.00	<b>&lt;0.0001</b>
	No	12.81 (10.73)		
Wilcoxon rank-sum test				

### 7.3.6 Characteristics of Healthcare Professional Contacts

Across all time points, 24.7% of children with CPI had some form of contact with any healthcare professional for their mental health. Additionally, the type of healthcare professionals most contacted were social workers, which included counsellors, case workers, and psychotherapists (46.5%-64.9%). The least reported healthcare professionals contacted were nurses (5.4%-11.6%). Of children who had subclinical levels of psychopathology, 66% had contact with any healthcare professional across all time points. Healthcare professional contacts at 24 months is presented in Table 4.

**Table 4.** Parent-reported healthcare professional contact for children’s emotions or mental health at 24 months.

<b>Type of healthcare professional</b>	<b>Total (n=233)</b>	<b>Low psychopathology (n=140)</b>	<b>Subclinical psychopathology (n=93)</b>	<b>p</b>
Any	43 (17.4%)	14 (10.0%)	29 (31.2%)	<b>&lt;0.001</b>
Psychiatrist	8 (3.4%)	0	8 (8.6%)	<b>0.001*</b>
Family doctor	17 (7.3%)	6 (4.3%)	11 (11.8%)	<b>0.030</b>
Psychologist	16 (6.9%)	4 (2.9%)	12 (12.9%)	<b>0.003</b>
Nurse	5 (2.1%)	1 (0.7%)	4 (4.3%)	<b>0.084*</b>
Social worker	20 (8.6%)	7 (5.0%)	13 (14.0%)	<b>0.017</b>
Other	8 (3.4%)	4 (2.9%)	4 (4.3%)	0.716*

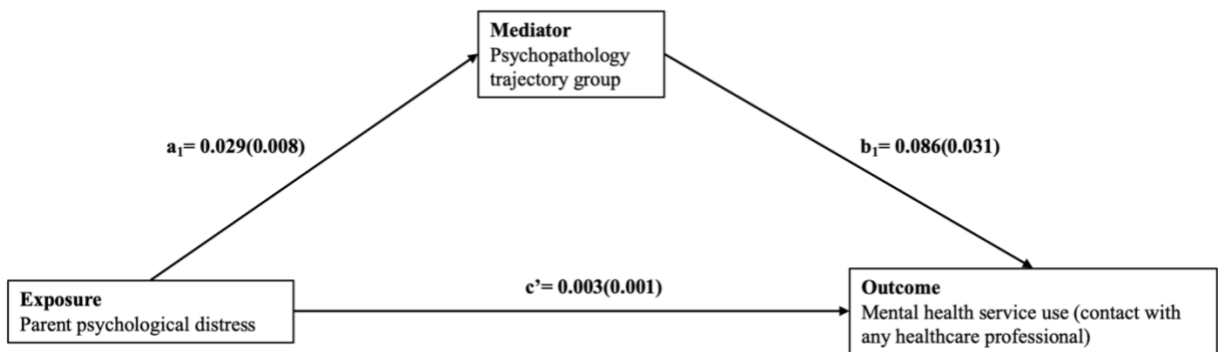
\*Fisher’s exact test  
Missing= 30 subjects

### 7.3.7 Mediation Analyses

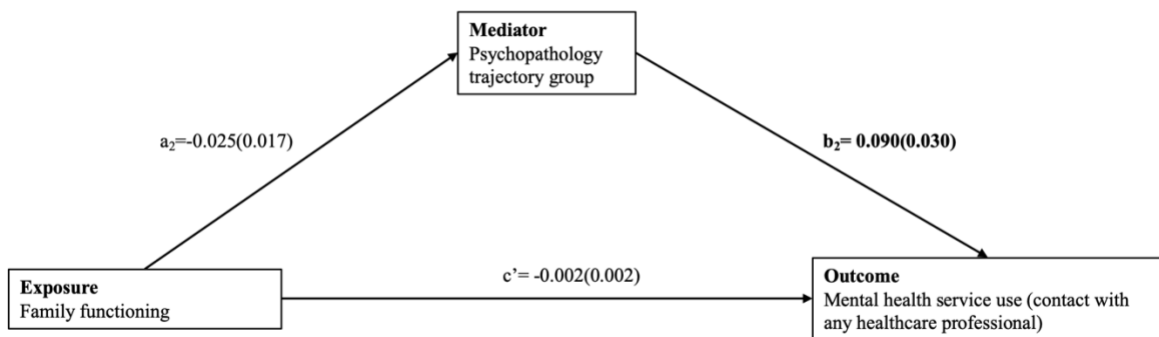
As shown in Figure 1, direct paths between parent psychological distress to the mediator, child psychopathology trajectory group (X to M) indicated that worse parent psychological distress was associated with subclinical levels of child psychopathology when adjusting for relevant confounders. Additionally, for both models, there was a significant direct association between the child psychopathology trajectory group and MHSU, where subclinical symptoms of psychopathology were associated with more healthcare professional contacts. Additionally, there was a significant positive relationship between family functioning and MHSU, where worse family functioning was associated with more service

use. Regarding indirect effects, child psychopathology had a significant mediating effect on the association between parent psychological distress and healthcare professional contacts (Table 5).

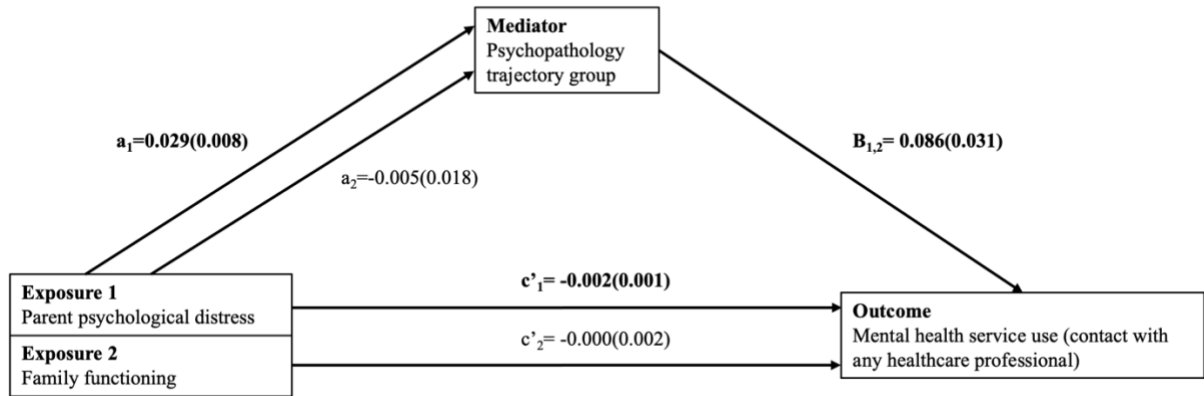
**A:**



**B:**



C:



**Figure 1.** Mediation paths with estimates from the single-group path models with parent psychological distress (A) and family functioning (B) as exposures as well as a model with both exposure variables modelled simultaneously (C). Adjusted for child age, child disability, parent age, parent education, and household income.

**Table 5** Single-group path models adjusted for child age, child disability, parent age, parent education, household income

Label	Model parameter	Est	SE	p	std
<b>Separate Models</b>					
Indirect effects from Parent Psychological Distress to Healthcare Professional Contact through:					
IndM	Trajectory Group	0.003	0.001	<b>0.036</b>	0.092
Indirect effects from Family Functioning to Healthcare Professional Contact through:					
IndM	Trajectory Group	-0.002	0.002	0.200	-0.033

<b>Simultaneous Model</b>					
Indirect effects from Parent Psychological Distress to Healthcare Professional Contact through:					
IndM	Trajectory Group	0.002	0.001	<b>0.041</b>	0.089
Indirect effects from Family Functioning to Healthcare Professional Contact through:					
IndM	Trajectory Group	0.000	0.002	0.782	-0.007

## 7.4 Discussion

This study examined whether child psychopathology trajectory groups mediated the association between parent psychological distress and family functioning with healthcare professional contacts among children with CPI. Findings indicated that child psychopathology trajectories mediated the association between parent psychological distress and healthcare professional contacts.

Children with subclinical levels of psychopathology were significantly more likely to engage with healthcare professionals compared to those with low psychopathology across all time points. Additionally, higher total psychopathology scores were consistently associated with increased healthcare contact. Findings suggest that children with greater symptom levels are more likely to seek or receive professional care, highlighting the importance of addressing subclinical symptoms to prevent further escalation.

We found that the association between parent psychological distress and healthcare professional contact in children with CPI is influenced by child psychopathology trajectories. This emphasizes the indirect pathways through which parent distress can impact health

service use as the mental health of parents not only impacts the immediate mental health of children but also indirectly impacts if children contact a healthcare professional. Addressing parent psychological distress may indirectly reduce healthcare use by improving child psychopathology outcomes. Family-centred care models that include support for parent mental health may be important in managing the overall well-being of children with CPI (35). Furthermore, findings suggest that not only clinically significant psychopathology but also subclinical symptoms, warrant attention in clinical practice. Future research should explore how factors such as family functioning, coping strategies, and social support may interact with parent and child mental health.

On the other hand, child psychopathology did not mediate the association between family functioning and healthcare professional contact in children with CPI. This contrasts with previous research that has highlighted the importance of the family environment in shaping child mental health outcomes (64–69). Indeed, family functioning was positively associated with healthcare professional contact. Families that experience greater levels of dysfunction may struggle to provide the emotional support needed to buffer against child mental disorder (70).

Several factors may explain why child psychopathology did not mediate the association between family functioning and healthcare professional contact. First, the specific challenges associated with childhood CPI might overshadow the influence of family functioning, with healthcare contact driven more by physical health needs (12). As a result, the mediating role of psychopathology may be reduced. Third, it is possible that the care

team for the CPI is integrating mental health services within routine check-ups and was not reported by parents. Lastly, family functioning may directly influence contact. Better functioning might facilitate family access to mental health services.

Findings suggest that family-centred care is important for children with CPI. Family-centred care recognizes the essential role of families in supporting the overall well-being of children (71) and has been associated with less severe symptoms and improved functional outcomes (72). Integrated care models that include psychological support for children and their parents may be more effective in reducing psychopathology and the need for mental health services compared to child-only-focused interventions.

These findings have important implications for clinical interventions and policies aimed at supporting children with CPI. Mental health professionals should consider factors that might influence service use for this population, such as fragmented and siloed services, and work to address these barriers to ensure more comprehensive and accessible care (73). However, incorporating family-centred care into these interventions remains essential for providing holistic care (74). Healthcare professionals should consider the broader benefits of family strengths in family-centred care approaches, such as improving family resilience, coping strategies, competence and skill in care delivery, and motivation (75). Future research should investigate other potential mediators or moderators that could explain the relationship between parent psychological distress and healthcare professional contacts for children with CPI.

There are some models that have applied family-centred approaches to care. Browne et al. (2013) utilized a family-based integrated care model among children with complex disabilities and found that families who received care from highly integrated teams reported the lowest levels of family dysfunction (76). Additionally, Foroughe et al. (2023) demonstrated the benefits of emotion-focused family therapy for caregivers of children with mental health problems. The study showed that caregivers who reported greater self-efficacy also reported greater reductions in their child's mental health symptoms (77).

#### **7.4.1 Limitations**

This study should be considered within the context of several limitations. First, the self-reported nature of the measures used to assess family functioning, parent psychological distress, child psychopathology, and healthcare professional contacts may be subject to bias. Social desirability and recall biases may have led to underreporting of unfavourable behaviours or symptoms and parent-reported healthcare professional contact may be biased if parents are unaware of all services their child uses. Third, while this information was collected, the number of hospitalizations and length of hospital stay were not included as outcomes in the analysis due to low-frequency counts. Future research should consider using data from linked administrative health records to better inform a family-centred model of care that integrates physical and mental health services. Lastly, the single-site recruitment may limit the generalizability of findings, as the sample may not reflect the broader population of children with CPI. Future longitudinal research with more diverse and representative samples are needed to validate findings and explore other potential mediators.

## **7.5 Conclusion**

Our study found evidence that child psychopathology mediated the association between parent psychological distress and healthcare professional contacts. Early identification and support of parents with psychological distress and children with CPI showing subclinical symptoms could help prevent the escalation of more severe levels of psychopathology and limit the need for healthcare contact. Future research should examine interventions designed to alleviate parent psychological distress and assess their impact on child psychopathology and healthcare use. Longitudinal studies that examine the bi-directional nature of parent-child mental health dynamics could provide a better understanding of how changes in parent distress influence child trajectories over time and enhance the quality of life for children with CPI and their families.

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## **Chapter 8**

### **General Discussion**

#### **8.1 Overview**

Research on youth multimorbidity is limited but growing to understand and improve mental health for youth with CPIs. It is known that youth with a CPI are at an increased risk of developing a mental disorder (i.e., multimorbidity) due to factors such as managing physical illness, low self-esteem, impaired family functioning, and reduced physical functioning (56). Multimorbidity creates challenges for youth that may lead to further impairments in their health, including reduced quality of life, worsening mental health symptoms (i.e., psychopathology), and increased service use (4,58,66,259,260). It is important to have high-quality research on youth with a CPI who are at risk of poor mental health outcomes because they transition through life stages where considerable disruptions to their mental health can occur. In doing so, negative mental health experiences can be understood and mitigated through integrated mental and physical healthcare services. Furthermore, as this group of youth utilizes a large proportion of healthcare services (65,66), research in this area can aid in ensuring that resources are used more efficiently, and care is coordinated appropriately. Early prevention and identification of psychopathology are essential to improving individual and population-level mental health. The findings from this dissertation will inform preventive interventions and practices to address these critical issues.

Given the relatively high prevalence of multimorbidity and the critical nature of mental disorders in youth transitioning into adulthood, this dissertation addressed important

knowledge gaps by investigating trajectories of psychopathology, determining transitions across distinct profiles of youth psychopathology, and identifying if trajectories mediate the association between family factors and mental health service use. The establishment of trajectories of psychopathology in youth provides novel information on these patterns among youth, specifically with a CPI, as these youth are at a higher risk of worse psychopathology. Examining subgroups of psychopathology among youth with CPI and transitions across these subgroups over time, this dissertation developed new knowledge on specific patterns that suggest tailored/coordinated interventions that can prevent the development of psychopathology or reduce severity.

The following sections of this chapter will describe key findings for each manuscript in this dissertation (section 8.2), integrated findings from this project (section 8.3), implications for public health policy and practice, clinical practice, and future research (section 8.4), strengths and limitations (section 8.5), and overall conclusions (section 8.6).

## **8.2 Summary of Key Findings**

Study 1 (Chapter 5) examined trajectories of psychopathology among youth with CPI, validated these trajectories using a diagnostic interview of mental disorders, and identified predictors of the trajectory groups. Study findings identified that a three-trajectory model was optimal. Trajectories were labelled low-stable, moderate-stable, and high-decreasing. Older age, higher disability, greater parent psychological distress, and higher household income were associated with higher psychopathology trajectories compared to the low-stable trajectory. These findings are consistent with previous research that did not identify an

increasing trajectory group for externalizing and internalizing psychopathology (80,193,197). Additionally, studies have also found that there is a large proportion of children in low or very-low-trajectory groups based on parent-reported psychopathology (32,93).

This study is novel in its use of LCGA to determine specific, interpretable patterns of psychopathology within a diverse sample. It suggests that earlier identification of youth with higher levels of psychopathology relative to current practice can allow for intervention that may prevent worsening mental health. Findings emphasize the value of a non-categorical approach, which looks beyond specific diagnoses of CPI to consider broader patterns of need and functioning in youth. This study proposes moving away from diagnosis-centred models of care toward an integrated approach that utilizes proactive mental health interventions coordinated with physical health providers, addressing both physical and mental health needs in the same system.

Study 2 (chapter 6) used LPA to determine distinct patterns of psychopathology among youth and LTA to identify individual-level transitions over time across profiles. Findings indicated four profiles of psychopathology that were classified as low psychopathology, primarily internalizing, primarily externalizing, and high psychopathology. In line with previous studies examining transitions, homotypic continuity was high across all profiles, indicating the predictive validity of youth remaining in the same subgroup at each subsequent follow-up (78,207,261). Regarding heterotypic continuity, many youths in the primarily internalizing subgroup initially transitioned to low psychopathology over time. Youth in the high psychopathology subgroup were more likely to have persistent

psychopathology from six to 24 months, with all such youth remaining in the primarily internalizing, primarily externalizing, or high psychopathology subgroup.

Moreover, child age and sex, parent psychopathology, and family socioeconomic status were significant predictors of transitioning across latent profiles. Overall, this study confirmed that for many, internalizing and externalizing psychopathology tends to be transient, as youth may shift between various states over time. However, a small proportion of youth with high psychopathology had persistent psychopathology, representing a high-risk state (78,261).

These findings addressed knowledge gaps by revealing the dynamic nature of psychopathology among youth with various CPIs and going beyond static categorizations of youth psychopathology. Findings from this study advocate for early identification of persistent psychopathology in youth with CPI, especially among those with high levels of psychopathology. It highlights certain risk factors such as parent psychological distress, parent education, and household income that may influence transitions that clinicians should consider when treating youth for physical and mental health concerns. Further, there is a need for flexibility and adaptability of interventions to respond to shifts in psychopathology profiles.

Study 3 (Chapter 7) used path analysis to show that youth psychopathology trajectories mediated the association between parent psychological distress and healthcare professional contact, controlling for covariates. This is because parents who experience higher psychological distress are more likely to have children with higher levels of

psychopathology, which, in turn, increases the likelihood that these children will use mental health services. This finding highlights the importance of addressing parent psychological well-being as part of mental health interventions for youth with CPI. Supporting parents in managing their distress may reduce youth psychopathology symptoms, ultimately reducing the need for service use. It also demonstrates the interconnectedness of family mental health dynamics and the potential benefits of integrated healthcare approaches that consider the mental health of both parents and youth. Understanding these pathways is important to develop holistic family-centred interventions that support the mental health of children and their parents.

### **8.3 Integrated findings**

The findings in this dissertation were consistent across all three studies. First, psychopathology among youth with CPI is an important healthcare issue. Youth with CPI are at a higher risk for mental health challenges due to the complex interplay between their physical health conditions and psychosocial stressors. Addressing their mental health needs is crucial, as untreated psychopathology can exacerbate physical health outcomes, impair quality of life, and increase healthcare use and costs. Each study emphasized the complexity and persistence of mental health challenges in this group of youth with CPI, highlighting not only the unique trajectories and transitions in psychopathology over time but also the influence of family dynamics on MHSU. Together, these findings indicate an urgent need for integrated approaches that address physical and mental health needs in youth with CPI, highlighting comprehensive care as essential to improving long-term outcomes.

This brings us to the second common finding: the importance of implementing integrated care or coordinated care approaches at the community level. Canada needs an improved mental healthcare system that integrates evidence-based mental health services into primary care (137). An Ontario-based study found that parents seeking mental healthcare for their child reported contacting five different agencies and receiving two different treatments for their mental disorder, on average. This suggests that parents must navigate a complex system of services that lacks coordination (262). A study reviewing mental health clinical pathways for youth with long-term health conditions identified that most pathways followed an integrated care model. They found that integrated care models may lead to positive mental health outcomes among youth, suggesting that prioritization of integrated care may be appropriate in this population (263). Achieving parity and widespread improvement of youth mental health requires better coordination services and access to a comprehensive continuum of care.

Third, the findings of this dissertation communicate the need for interventions to include family-centred care for youth with CPI. Each study helped demonstrate how important family factors are in impacting youth psychopathology. Family-centred care is defined as “mutually beneficial partnerships between healthcare providers, patients, and families in healthcare planning, delivery, and evaluation” (264). Research shows that family-centred care increases patient satisfaction with healthcare services, reduces parent stress, and improves child outcomes (265). Family-centred care should be a priority within the Canadian

healthcare system, especially for primary care providers who are often the first contact for children with CPI (123).

Traditional delivery models for mental healthcare often rely on gaining access to a limited pool of specialty mental health services that may not address the diverse and complex needs of youth and their families today (266). Both parents and children report challenges such as long wait times and difficulty accessing specialized care (163,267). The demand for mental healthcare exceeds available Canadian mental health services and resources, and this gap will likely worsen (268). A study found that although there was a 17% increase in the number of practicing psychiatrists between 2003 and 2013 and increases in the number of patients seen, demand for services continues to outpace supply (269). Because many parents and their children are realizing that traditional approaches to mental healthcare delivery models are not meeting their needs, a paradigm shift may be necessary (270). Some may argue that societal expectations of healthcare systems need to change or that traditional models of care remain appropriate while emphasizing the importance of resilience-building for individuals. Nevertheless, evidence suggests that structural limitations in mental healthcare currently warrant a rethinking of how care is delivered to better align with demands.

Fourth, results indicate a need to tailor interventions to youth with CPI who have higher initial levels of psychopathology to prevent worsening symptoms and persistent psychopathology. This could be achieved by integrating physical and mental healthcare, promoting resilience and coping skills, and monitoring symptomatology over time. This

narrative underscores the reality that a subset of these youth experiences significant psychopathology and increased healthcare utilization, emphasizing the critical need for early intervention to prevent the onset of mental disorders among youth with CPI. This aligns with previous studies recommending screening to ensure at-risk youth receive the care and resources needed to improve mental health outcomes and positively alter trajectories (61,79,271). The Canadian Mental Health Association also recommends investing in the promotion, prevention, and early intervention as part of their appeal for a Mental Health Parity Act (123).

An example of an intervention is the Stepping Stones Triple P parenting program for parents of children with a disability (272). The multilevel program is designed to prevent serious behavioural, emotional, and developmental problems in children by enhancing parents' knowledge, skills, and confidence (273). A Korean study found efficacy for the program seminars as parents reported significantly less severe child behaviour and emotional problems and less dysfunctional parenting practices compared to the control group (272). Similar results were found from a randomized controlled trial in an Irish sample for the Group Stepping Stones Triple P- Positive Parenting Program for parents of children with developmental disabilities and internalizing/externalizing behavioural problems. Findings showed improved child behaviour and parenting outcomes (274).

Another example is a more recent pilot program in Ontario for children and youth with complex special needs. The program aims to help youth with complex special needs, including developmental and intellectual disabilities, mental health problems, chronic

physical illness, and physical disabilities, access personalized and specialized care. Families will work with a team of professionals, including doctors, social workers, and behavioural consultants, to provide personalized support (275).

Lastly, findings from this dissertation suggest utilizing a noncategorical (i.e., non-condition specific) approach to identifying and caring for youth with CPI (276). This framework suggests that youth can be grouped by similar consequences of various conditions rather than individual diagnoses (277). It can also be useful for program planning, service delivery, and policymaking (55,278,279). Condition-specific approaches to integrated care are unnecessary, which is efficient from a healthcare systems/administrative perspective. This approach avoids fragmentation of care and ensures that services are accessible across diverse CPIs.

#### **8.4 Implications for policy, clinical practice, and future research**

The knowledge created by this dissertation has implications for public health policy, clinical practice, and research as they pertain to psychopathology among youth with a CPI and their MHSU. First, the findings highlight potential opportunities to improve public health policies and practices to address youth psychopathology. Integrating mental healthcare into physical healthcare settings and, conversely, physical healthcare into mental healthcare settings can be an efficient and effective way to provide more comprehensive care so that mental health concerns are not overlooked when treating physical health conditions. It is important that mental and physical health concerns are adequately addressed irrespective of the healthcare setting in which youth access services. Policies encouraging partnerships

between healthcare providers and schools should be implemented to deliver mental health education and support. This could help youth with CPI access services in a familiar and convenient environment and provide social support to reduce isolation (280).

In care settings for parent psychological distress, treatments should also address the mental health of their children, as parental distress can exacerbate emotional and behavioural challenges in children. This is particularly important for high-risk children with a CPI. Research shows that ensuring parents receive appropriate and adequate treatment for their mental health and distress has benefits for the functioning and mental health of their children (281–283). Conversely, interventions for child mental health should also attend to the mental health of parents, ensuring parents are addressing their mental health and receiving support in accessing appropriate services (284). Research suggests that untreated parent mental health is linked to poorer treatment progress and outcomes among youth receiving mental health services (284–287). However, future research should examine the extent to which addressing parent mental health during child treatment improves outcomes for both parents and children.

Consistent with recommendations from Healy et al. (2022), it is essential for interventions to focus on factors that distinguish youth with persistent psychopathology, such as worse youth disability and parent psychological distress so that resources can be tailored appropriately. This approach may improve the likelihood of positive mental and/or physical health outcomes by addressing the risk factors of these high-risk youth. Another strategy for clinical practice is training programs for healthcare providers to recognize signs of psychopathology in youth with CPI. Training should include understanding unique stressors

and risks associated with CPI, such as poor family functioning and parental distress, and knowing when and how to refer patients to mental health services. This could help improve early identification in primary care and specialty settings to prevent psychopathology in youth with a CPI (288,289).

This dissertation highlights opportunities for future research to provide further evidence to inform the course of mental health among youth with a CPI and strategies to improve mental health and well-being. It was not possible to control for or predict outcomes using all possible risk and protective factors. Future research should examine other family factors (e.g., sibling relationships, family history), social factors (e.g., peer relationships, school environment), and environmental factors (e.g., environmental stressors, traumatic experiences, neighbourhood factors) that may influence psychopathology trajectories and transitions in youth with CPI to provide greater insight into factors which adversely impact youth mental health. Additionally, due to low mental health service use among youth in this dissertation, it was not possible to examine other key mental health service use outcomes, including the number of hospitalizations and length of hospital stay. This is an important area for future research to provide more comprehensive findings across different MHSU outcome indicators. Furthermore, this dissertation is based on a 24-month follow-up with four measurement occasions; future research should investigate trajectories and the stability and change of psychopathology profiles over a longer period to understand the evolution of psychopathology beyond the timeframe of this study.

## **8.5 Strengths and Limitations**

This dissertation has numerous strengths in its examination of longitudinal patterns of youth psychopathology and their association with MHSU, including the study design of the MY LIFE study and the analytical approaches used. First, the use of longitudinal data collected at four time points over a 24-month period allowed for the evaluation of psychopathology trajectories in youth with a CPI. While this two-year follow-up provides valuable insights, future research with longer-term follow-up is needed to capture more extended developmental changes. Additionally, the sample size of the MY LIFE study had sufficient power to examine changes in mental health symptoms over time and test potential mediating effects. The MY LIFE study also captured various CPIs across different specialty clinics. Evidence suggests that differences in risk factors for mental illness may be negligible across different physical conditions (non-categorical approach), and this allowed for a broader analysis that may apply to a wider population of children (5,9,59).

A strength of using LCGA in this study was that it required at least three time points for the analysis, ensuring robust estimation of growth trajectories. At the time of study completion, the MY LIFE study had four time points, which was preferable for estimating more complex models, including trajectories (290). Ultimately, this dissertation includes one more follow-up point than the minimum required, enhancing the accuracy and reliability of trajectory estimates. Further, LPA and LTA provided a more comprehensive assessment of psychopathology by identifying patterns and transitions across multiple symptoms rather than

analyzing individual traits, such as anxiety or depression, which have symptoms that often overlap.

This dissertation is not without limitations. First, the MY LIFE study only recruited youth and their parents from a single research site, as well as individuals with sufficient command of the English language. This may limit the generalizability of the findings of this dissertation, which may reduce the ability to make inferences to inform mental health interventions aimed at reducing child multimorbidity. Second, it was not possible to examine sex and gender-specific effects as the variable gender was not collected during the first four time points of the MY LIFE study. Third, this project is limited to parent-proxy-reported mental health service use only, and it was not possible to link data with services provided by the Ministry of Children, Community and Social Services (67). Parents may be unaware of some services their children access, especially within the school system. Additionally, services that parents consider beneficial for youth mental health may vary across parents. Fourth, follow-up assessments beyond the adolescent period are needed to identify the developmental trajectories of psychopathology into adulthood. This is important because the impacts of mental disorders extend well into adulthood.

Lastly, the use of LCGA and LTA also has limitations. Missing data on the latent class indicators is assumed to be missing at random (MAR) or missing completely at random (MCAR) (224). If data are missing not at random (MNAR), the model does not adjust for it, which might generate biased results (290,291). This limitation could potentially result in the misclassification of individuals into different classes. However, using full information maximum likelihood (FIML) to estimate the models can be considered a strength of this

dissertation because it accommodates missing data in MPlus for observational research designs.

## **8.6 Conclusions**

This dissertation emphasizes the importance of understanding the evolution of psychopathology in youth with CPI and its impact on MSHU. Findings identified three trajectories of youth psychopathology, highlighting various patterns of symptom development over time. Key trajectories included low-stable, moderate-stable, and high-decreasing symptom patterns, illustrating the diversity in how symptoms progress among youth with CPI. Understanding the different patterns will aid in identifying youth who may need support earlier or require different interventions. This dissertation also identified four distinct subgroups of psychopathology and transitions across these subgroups over time. Results highlight that youth mental health is stable for some youth and fluid for others, suggesting that support should be flexible to accommodate these changes, which could improve long-term outcomes. Further, the findings found that youth with subclinical levels of psychopathology are at an increased likelihood of healthcare professional engagement, suggesting parent distress indirectly influences service use through its impact on youth psychopathology levels. Thus, addressing parents' psychological distress could reduce youth psychopathology and reduce healthcare use, indicating a family-centred approach may be essential for effective intervention.

These studies collectively advance understanding of youth psychopathology, linking trajectories, transitions, and mediation effects to create a cohesive picture of youth mental

health over time. Findings inform service provision, especially in tailoring mental health interventions and supporting youth and their families. The broader public health relevance is highlighted in terms of improving mental health outcomes for youth and reducing the burden on the healthcare system through targeted, evidence-based approaches.

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## Appendix A

**Supplemental Table 1**

Survey Items Used for 52-item EBS separated by externalizing and internalizing disorders

<b>Symptom</b>	<b>Disorder</b>	<b>Survey Item</b>
Externalizing	Conduct Disorder (11 items)	Destroys things belonging to his/her family or other children
		Gets in many fights
		Has been physically cruel to others
		Has broken into someone else's house, building, or car
		Runs away from home
		Sets fires
		Stays out at night despite being told not to
		Steals outside the home
		Truancy, skips school
		Uses weapons when fighting
		Opposition Defiant Disorder (6 items)
	Argues a lot with adults	
	Blames others for own mistakes	
	Easily annoyed by others	
	Gets back at people	
	Loses temper	
	Attention Deficit Hyperactivity Disorder (8 items)	Can't concentrate, can't pay attention for long
Can't stay seated when required to do so		
Distractible, has troubles ticking to any activity		
Fails to finish things he/she starts		
Fidgets		
Has difficulty awaiting turn in games or groups		
Impulsive or acts without thinking		
Makes careless mistakes		
Internalizing	Major Depressive Disorder (9 items)	Changes in appetite
		Deliberately harms self or attempts suicide
		Feels worthless or inferior
		Gets no pleasure from usual activities
		Has trouble enjoying self

	Overtired or lacks energy
	Talks about killing self
	Trouble sleeping
	Unhappy, sad, or depressed
Generalized Anxiety Disorder (6 items)	Anxious or on edge
	Finds it hard to stop worrying
	Nervous, high-strung or tense
	Too fearful or anxious
	When anxious, his/her mind goes blank
	Worries about doing better at things
Separation Anxiety Disorder (7 items)	Avoids school because of fear of separation from loved ones
	Complains of feeling sick before separating from loved ones
	Has nightmares about being separated from loved ones
	Overly upset when leaving loved ones
	Scared to go to sleep without parents being near
	Worries that bad things will happen to loved ones
	Worries that something bad will cause separation from loved ones
Social Phobia (5 items)	Afraid of doing things in front of others
	Avoids social situations
	Doesn't like to be with people he/she doesn't know
	Gets anxious about meeting new people
	Is nervous with people he/she doesn't know

## Supplemental Table 2

Frequency of contact with different HCPs

<b>Variable</b>	<b>Baseline Freq (%)</b>	<b>6 months Freq (%)</b>	<b>12 months Freq (%)</b>	<b>24 months Freq (%)</b>
Any HCP				
0	232	221	210	190
1	30 (11.4)	33 (12.8)	37 (14.6)	43 (17.4)
Psychiatrist				
0	258	244	235	225
1	4 (1.5)	10 (3.9)	12 (4.7)	8 (3.2)
Family doc/GP				
0	249	238	235	216
1	13 (4.9)	16 (6.2)	12 (4.7)	17 (6.9)
Psychologist				
0	249	139	230	217
1	13 (4.9)	15 (5.8)	17 (6.7)	16 (6.5)
Nurse				
0	259	251	245	228
1	3 (1.1)	3 (1.2)	2 (0.8)	5 (2.0)
Social worker				
0	246	236	223	213
1	16 (6.1)	18 (7.0)	24 (9.5)	20 (8.1)
Other				
0	257	250	242	225
1	5 (1.9)	4 (1.6)	5 (2.0)	8 (3.2)

All variables are missing 1 participant at baseline

All variables are missing 6 participants at 6 months

All variables are missing 10 participants at 12 months

All variables are missing 16 participants at 24 months

### Supplemental Table 3

Parent-reported healthcare professional contact for children's emotions or mental health over 24 months

<b>Timepoint</b>	<b>N</b>	<b>Psychiatrist</b>	<b>Family doctor</b>	<b>Psychologist</b>	<b>Nurse</b>	<b>Social worker</b>	<b>Other</b>
<b>Baseline</b>	30 (11.4%)	4 (13.3%)	13 (43.4%)	13 (43.4%)	3 (10.0%)	16 (53.3%)	5 (16.7%)
<b>6 months</b>	33 (12.8%)	10 (30.3%)	16 (48.9%)	15 (45.5%)	3 (9.1%)	18 (54.6%)	4 (12.1%)
<b>12 months</b>	37 (14.6%)	12 (32.4%)	12 (32.4%)	17 (46.0%)	2 (5.4%)	24 (64.9%)	5 (13.5%)
<b>24 months</b>	43 (17.4%)	8 (18.6%)	17 (39.6%)	16 (37.2%)	5 (11.6%)	20 (46.5%)	8 (18.6%)
<b># of individuals</b>	65 (24.7%)*	22 (8.4%)*	31 (11.8%)*	32 (12.2%)*	9 (3.4%)*	45 (17.1%)*	13 (4.9%)*

Due to missing data, cells may not sum to total sample size.

\*Percentage of total sample.

**Supplemental Table 4**

Hospitalizations (Binary)

<b>Timepoint</b>	<b>Hospitalizations (yes/no)</b>
Baseline	4 (1.5%)
6 months	5 (2.0%)
12 months	2 (0.8%)
24 months	1 (0.4%)

**Supplemental Table 5**

## Number of Hospitalizations

<b>Timepoint</b>	<b>Number of Hospitalizations</b>	<b>Frequency (%)</b>
Baseline	0	258 (98.0%)
	1	4 (1.5%)
	2	0 (0.0%)
6 months	0	249 (98.0%)
	1	2 (0.8%)
	2	3 (1.2%)
12 months	0	245 (99.2%)
	1	1 (0.4%)
	2	1 (0.4%)
24 months	0	231 (99.6%)
	1	1 (0.4%)
	2	0 (0.0%)

**Supplemental Table 6**

Missing Data Patterns for Multiple Imputation Sample

	<b>Group</b>									
<b>Variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<i>Baseline</i>										
ADHD	X	X	X	X	X	X	X	X	X	.
ODD	X	X	X	X	X	X	X	X	X	.
CD	X	X	X	X	X	X	X	X	X	.
GAD	X	X	X	X	X	X	X	X	X	.
MDD	X	X	X	X	X	X	X	X	X	.
SAD	X	X	X	X	X	X	X	X	X	.
SP	X	X	X	X	X	X	X	X	X	.
Child sex	X	X	X	X	X	X	X	X	X	X
Child age	X	X	X	X	X	X	X	X	X	X
Parent sex	X	X	X	X	X	X	X	X	X	X
Parent age	X	X	X	X	X	X	X	X	X	X
Parent education	X	X	X	X	X	X	X	X	X	X
Parent marital status	X	X	X	X	X	X	X	X	X	X
Parent depression	X	.	X	X	X	X	X	X	X	X
Parent anxiety	X	.	X	X	X	X	X	X	X	X
<i>6 months</i>										
ADHD	X	X	X	X	X	X	X	.	.	X
ODD	X	X	X	X	X	X	X	.	.	X
CD	X	X	X	X	X	X	X	.	.	X
GAD	X	X	X	X	X	X	X	.	.	X

MDD	X	X	X	X	X	X	X	.	.	X
SAD	X	X	X	X	X	X	X	.	.	X
SP	X	X	X	X	X	X	X	.	.	X
Child sex	X	X	X	X	X	X	X	X	X	X
Child age	X	X	X	X	X	X	X	X	X	X
Parent sex	X	X	X	X	X	X	X	X	X	X
Parent age	X	X	X	X	X	X	X	X	X	X
Parent education	X	X	X	X	X	X	X	.	.	X
Parent marital status	X	X	X	X	X	X	X	.	.	X
Parent depression	X	X	X	X	X	X	X	.	.	X
Parent anxiety	X	X	X	X	X	X	X	.	.	X
<i>12 months</i>										
ADHD	X	X	X	X	X	.	.	X	.	X
ODD	X	X	X	X	X	.	.	X	.	X
CD	X	X	X	X	X	.	.	X	.	X
GAD	X	X	X	X	X	.	.	X	.	X
MDD	X	X	X	X	X	.	.	X	.	X
SAD	X	X	X	X	X	.	.	X	.	X
SP	X	X	X	X	X	.	.	X	.	X
Child sex	X	X	X	X	X	X	X	X	X	X
Child age	X	X	X	X	X	X	X	X	X	X
Parent sex	X	X	X	X	X	X	X	X	X	X
Parent age	X	X	X	X	X	X	X	X	X	X
Parent education	X	X	X	X	X	.	.	X	.	X

Parent marital status	X	X	X	X	X	.	.	X	.	X
Parent depression	X	X	X	X	X	.	.	X	.	X
Parent anxiety	X	X	X	X	X	.	.	X	.	X
<i>24 months</i>										
ADHD	X	X	X	X	.	X	.	X	.	X
ODD	X	X	X	X	.	X	.	X	.	X
CD	X	X	X	X	.	X	.	X	.	X
GAD	X	X	X	X	.	X	.	X	.	X
MDD	X	X	X	X	.	X	.	X	.	X
SAD	X	X	X	X	.	X	.	X	.	X
SP	X	X	X	X	.	X	.	X	.	X
Child sex	X	X	X	X	X	X	X	X	X	X
Child age	X	X	X	X	X	X	X	X	X	X
Parent sex	X	X	X	X	X	X	X	X	X	X
Parent age	X	X	X	X	X	X	X	X	X	X
Parent education	X	X	X	X	.	X	.	X	.	X
Parent marital status	X	X	.	X	.	X	.	X	.	X
Parent depression	X	X	X	X	.	X	.	X	.	X
Parent anxiety	X	X	X	X	.	X	.	X	.	X
Total	225	1	2	1	15	1	8	2	7	1
X: complete data for selected variable										

**Supplemental Table 7**

Expanded tables for the Latent Profile Analysis (LPA)

Baseline

<b>No. of Profiles</b>	<b>LL</b>	<b>FP</b>	<b>AIC</b>	<b>BIC</b>	<b>SABIC</b>	<b>Entropy</b>	<b>Profile 1</b>	<b>Profile 2</b>	<b>Profile 3</b>	<b>Profile 4</b>	<b>Profile 5</b>
2	-4085.8	22	8215.6	8294.2	8224.4	0.909	196	67	-	-	-
3	-3978.3	30	8016.6	8123.8	8028.6	0.924	73	181	9	-	-
4	-3891.2	38	7858.5	7994.2	7873.7	0.945	177	53	28	5	-
5	-3834.4	46	7760.7	7925.0	7779.2	0.956	24	173	55	5	6

6 months

<b>No. of Profiles</b>	<b>LL</b>	<b>FP</b>	<b>AIC</b>	<b>BIC</b>	<b>SABIC</b>	<b>Entropy</b>	<b>Profile 1</b>	<b>Profile 2</b>	<b>Profile 3</b>	<b>Profile 4</b>	<b>Profile 5</b>
2	-4081.7	22	8207.3	8285.9	8216.2	0.961	224	39	-	-	-
3	-3911.1	30	7882.1	7989.3	7894.2	0.937	175	77	11	-	-
4	-3830.5	38	7737.0	7872.8	7752.3	0.941	71	7	165	21	-
5	-3777.5	46	7646.9	7811.3	7665.4	0.951	13	165	67	6	12

12 months

<b>No. of Profiles</b>	<b>LL</b>	<b>FP</b>	<b>AIC</b>	<b>BIC</b>	<b>SABIC</b>	<b>Entropy</b>	<b>Profile 1</b>	<b>Profile 2</b>	<b>Profile 3</b>	<b>Profile 4</b>	<b>Profile 5</b>
2	-3989.7	22	8023.4	8102.0	8032.3	0.935	210	53	-	-	-
3	-3882.7	30	7825.4	7932.6	7837.5	0.936	194	9	60	-	-
4	-3823.2	38	7722.4	7858.1	7737.6	0.955	17	191	46	8	-
5	-3768.8	46	7629.7	7794.0	7648.1	0.934	60	165	16	16	7

24 months

<b>No. of Profiles</b>	<b>LL</b>	<b>FP</b>	<b>AIC</b>	<b>BIC</b>	<b>SABIC</b>	<b>Entropy</b>	<b>Profile 1</b>	<b>Profile 2</b>	<b>Profile 3</b>	<b>Profile 4</b>	<b>Profile 5</b>
2	-3972.1	22	7988.3	8066.9	7997.1	0.923	210	53	-	-	-
3	-3830.2	30	7720.4	7827.5	7732.4	0.928	194	60	9	-	-
4	-3761.6	38	7599.1	7734.9	7614.4	0.934	179	9	40	34	-
5	-3686.3	46	7464.6	7628.9	7483.0	0.947	52	179	23	1	8

## Appendix B

### Supplemental Figure 1

I chose the three-trajectory model over the four-trajectory model for several reasons. First, two of the trajectories in the four-trajectory model were very similar (moderate-stable), and the fourth trajectory did not offer substantial new insights or significant improvement in the model fit. Additionally, following the principle of parsimony, the simpler three-trajectory model reduces the risk of overfitting with a relatively small sample and is easier to interpret.

