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Par Sînziana-Ioana ONCIOIU

Le développement de l'intimidation par les pairs entre 6 et 17 ans : trajectoires, antécédents et conséquences en étude longitudinale populationnelle

The development of peer victimization from 6 to 17 years of age: trajectories, antecedents and consequences in a longitudinal population-based birth cohort

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Le développement de l'intimidation par les pairs entre 6 et 17 ans : trajectoires, antécédents et conséquences en étude longitudinale populationnelle

Résumé : Autrefois considérée comme un rite de passage pour les enfants d'âge scolaire, la victimisation par les pairs est aujourd'hui reconnue comme un véritable enjeu de santé publique. Ceci s'explique par les conséquences engendrées sur la santé mentale des jeunes ainsi que par sa prévalence élevée, en effet, 1 élève sur 3 déclare avoir été harcelé au cours de sa scolarité. La victimisation se définit par des harcèlements répétés par les pairs sur un enfant cible, ces harcèlements pouvant prendre la forme de violence verbale, physique ou psychologique. Environ 5 à 15% des jeunes sont exposés, de façon chronique, à la victimisation par les pairs et présentent un risque accru de manifester des troubles mentaux comme la dépression, l'anxiété ou les comportements suicidaires. À ce jour, les programmes de prévention du harcèlement scolaire sont largement centrés sur le milieu scolaire, et montrent des effets significatifs, mais modestes sur la réduction de la victimisation par les pairs. Cependant, ces programmes n'abordent pas les vulnérabilités préexistantes au niveau individuel ou familial qui pourraient être associées au risque d'être la cible du harcèlement scolaire. L'effet de ces vulnérabilités sur l'évolution de la victimisation serait encore plus important pendant la petite enfance, une période charnière pour l'apprentissage du vivre ensemble. Pourtant, l'évolution de la victimisation en milieu scolaire, y compris les effets de ses variations au cours du temps sur la santé mentale, n'ont pas été beaucoup étudiés. Cela limite notre compréhension sur les fenêtres temporelles les plus favorables pour mettre en place des interventions visant à réduire l'exposition à la victimisation par les pairs et ses conséquences sur la santé mentale. Les objectifs de ce projet de thèse étaient d'examiner : (1) le développement de la victimisation par les pairs de 6 à 17 ans, et ses associations avec (2) des facteurs individuels et socio-environnementaux à la petite enfance et (3) les comorbidités entre les troubles de santé mentale à l'âge adulte. Ces travaux de thèse ont été réalisés avec les données de l'Étude longitudinale du développement des enfants du Québec, un échantillon de 2120 enfants québécois qui ont été suivis annuellement ou bisannuellement de la naissance jusqu'à l'âge de 20 ans. Nous avons identifié quatre groupes d'élèves qui ont vécu des expériences différentes de victimisation par les pairs de 6 à 17 ans : (1) 33% des élèves ont été peu/pas du tout harcelés (2) 26% des élèves ont été harcelés seulement pendant l'école élémentaire, (3) 30% ont été harcelés surtout au collège et au lycée, (4) 11% des élèves ont vécu une victimisation chronique depuis leur entrée à l'école primaire jusqu'à la fin du lycée. Nous avons montré que les troubles externalisés de l'enfant avant l'âge de 6 ans et les vulnérabilités familiales (c.-à-d., avoir un père avec des antécédents de comportement antisocial ou vivre dans une famille séparée) sont associés aux trajectoires développementales de la victimisation par les pairs. Nous avons aussi trouvé que l'âge d'entrée et l'intensité de la fréquentation de services de gardes préscolaires, identifiés par certains auteurs comme facteur de risque pour les problèmes de comportements, ne sont pas associés au risque de victimisation par les pairs. En outre, nos résultats montrent que tous les jeunes qui ont vécu de la victimisation, même vécue seulement à l'école primaire, présentaient des comorbidités pour les troubles de santé mentale à 20 ans. Cependant, la sévérité de la victimisation par les pairs était associée à la sévérité de troubles mentaux. Dans leurs ensembles, ces résultats suggèrent qu'interrompre le cycle de la victimisation chronique pourrait prévenir les problèmes les plus sévères et complexes de santé mentale à l'âge adulte. Pour cela, il serait nécessaire de mettre en place des interventions pour offrir un support aux enfants vulnérables et leurs familles tôt dans l'enfance.

Mots clés : victimisation par les pairs, trajectoires développementales, petite enfance, santé mentale, services de garde préscolaire, étude longitudinale

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The development of peer victimization from 6 to 17 years of age: trajectories, antecedents and consequences in a longitudinal population-based birth cohort

Abstract: Long considered by many as a rite of passage for school-aged children, peer victimization has become an important public health issue given its prevalence and serious impact on child mental health and well-being. Peer victimization is the experience of being the target of peers' hostile behaviors intended to inflict physical harm or psychological distress. Across countries and cultures, one in three children reports victimization by peers at some point during their school years. About 5-15% of youth are exposed to chronic peer victimization and are at increased risk of mental health problems, including anxiety, depression and suicidality. To date, universal preventive interventions of peer victimization at the school level have shown significant but modest effects in reducing victimization. However, these interventions generally do not address individual or familial factors that may increase the likelihood of being a target of peers' hostile behavior. Understanding the role such preexisting vulnerabilities play for subsequent peer victimization experiences may be particularly important during early childhood, a central period for social development and the initiation of peer relationships. Furthermore, the evidence on the development of peer victimization across childhood and adolescence including the association of its timing and intensity with mental health outcomes is scarce. This limits our understanding of the periods in child development that would be most appropriate for early prevention of peer victimization. The objectives of the current thesis were to examine (1) the developmental trajectories of peer victimization from 6 to 17 years of age; and its association with (2) a wide range of early childhood behaviors and socio-environmental factors and (3) mental health comorbidities in young adulthood. We used data from the Quebec Longitudinal study of Child Development, a population-based birth cohort of 2120 children followed-up yearly or every other year from birth to 20 years old. In Study 1, we identified four developmental trajectories of peer victimization. Approximately one-third of children were in the low victimization trajectory. The remaining two-thirds of children were in either the childhood-limited trajectory (26%), in which high early childhood victimization decreased by adolescence; in the moderate adolescence-emerging trajectory (30%), in which victimization was moderate, relatively stable and above normative levels across adolescence; or the high-chronic trajectory (11%), in which victimization was persistently higher compared to peers. Furthermore, we found that early childhood externalizing behaviors and family vulnerabilities (i.e., having a father with a history of antisocial behavior or living in a separated family) were associated with the development of peer victimization. In Study 2, we showed that parents' choice regarding the age at entry into and the frequency of use of child care services does not have an effect on their offspring's experiences of peer victimization in the long-term. Finally, in Study 3 we showed that all peer victimization experiences, even those limited to childhood, were associated with mental health comorbidities in young adulthood. However, persistent victimization was associated with complex mental health comorbidity patterns. Taken together, these results suggest that continued prevention of peer victimization could help reduce the burden of severe and complex mental health problems in youth. Moreover, early support and targeted preventive interventions for vulnerable children and their families could help break the cycle of persistent peer victimization.

Keywords: peer victimization, developmental trajectories, early childhood, mental health comorbidities, child care services, longitudinal study

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LIST OF SCIENTIFIC PAPERS

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Study 1: Oncioiu SI, Orri M, Boivin M, Geoffroy MC, Arseneault L, Brendgen M, Vitaro F, Navarro MC, Galéra C, Tremblay RE, Côté SM (2020). Early Childhood Factors Associated With Peer Victimization Trajectories From 6 to 17 Years of Age. *Pediatrics*. doi.org/10.1542/peds.2019-2654

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Study 2: Oncioiu SI et al. Participation in child care services and the development of peer victimization. [in preparation]

Study 3: Oncioiu SI, Boivin M, Geoffroy MC, Arseneault L, Galéra C, Navarro MC, Brendgen M, Vitaro F, Tremblay RE, Côté SM, Orri M. Mental Health Comorbidities Following Exposure to Peer Victimization in Childhood and Adolescence: a 20-year Longitudinal Investigation. [to be submitted]

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*“Life can only be understood backwards,
but it must be lived forwards”*

Søren Kierkegaard

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Résumé détaillé

Contexte. Encore récemment, la victimisation par les pairs était perçue comme une expérience formatrice de l'enfance. Aujourd'hui, elle est reconnue comme un véritable enjeu de santé publique. La victimisation se définit par des harcèlements répétés par les pairs sur un enfant cible, ces harcèlements pouvant prendre la forme de violence verbale, physique ou psychologique.¹ A travers différents pays et cultures, environ 30% des enfants déclarent avoir été harcelés par les pairs, mais cette expérience reste transitoire pour la majorité d'entre eux.²⁻⁵ Néanmoins, une proportion non négligeable d'enfants (environ 2-24%) subissent une victimisation chronique.⁶⁻⁹

Depuis l'étude pionnière de Olweus, menée il y a maintenant 40 ans, de bonnes connaissances se sont accumulées sur l'impact de la victimisation sur la santé mentale des jeunes. Les jeunes qui sont la cible du harcèlement des pairs sont plus à risque de développer une dépression, de l'anxiété ou d'avoir des pensées suicidaires.^{6,10-20} De plus, des études récentes ont montré que les effets négatifs sur la santé mentale se retrouvent à long terme, jusqu'à l'âge adulte.^{14,21-27}

Tenant compte des conséquences néfastes de la victimisation par les pairs, des interventions préventives ont été développées et implémentées. À ce jour, ces programmes de prévention sont largement centrés sur le milieu scolaire, et montrent des effets significatifs, mais modestes sur la réduction de la victimisation par les pairs (c-à-d., une réduction d'environ 15-16%).²⁸ De plus, dans les écoles où les interventions ont réussi à créer des environnements plus sécurisants avec moins de victimisation, les troubles psychosociaux rapportés par les enfants qui restaient victimisés semblaient encore plus graves ('healthy paradox').^{25,29,30}

Une approche vie entière pour la prévention de la victimisation pourrait aider à identifier de nouvelles cibles d'intervention. Premièrement, comprendre l'hétérogénéité de l'évolution de la victimisation depuis le début de l'école primaire jusqu'à la fin du lycée pourrait aider à identifier les fenêtres temporelles les plus propices pour agir. Deuxièmement, l'identification de facteurs de risques de victimisation propres à la période de la petite enfance est une piste à privilégier afin d'offrir le support adapté aux besoins des enfants victimisés. Troisièmement, il est essentiel de comprendre si les variations de la victimisation en intensité ou en fréquence au cours du

temps ont des impacts différents sur la santé mentale au cours de la vie. A ce jour, seulement 14 études ont utilisé une approche développementale pour l'étude de la victimisation, de ses déterminants ou de ses conséquences.

Objectifs. Les objectifs de ce projet de thèse étaient d'examiner : (1) le développement de la victimisation par les pairs de 6 à 17 ans, et ses associations avec (2) des facteurs individuels et socio-environnementaux liées à la petite enfance et (3) les troubles de santé mentale (notamment leurs comorbidités) à l'âge adulte.

L'étude longitudinale du développement des enfants du Québec (ÉLDEQ). Ces travaux de thèse ont été réalisés avec les données de l'ÉLDEQ, une cohorte de naissance de 2120 enfants québécois qui ont été suivis annuellement ou bisannuellement de la naissance jusqu'à l'âge de 20 ans. Les nouveau-nés entre octobre 1997 et juillet 1998 ont été sélectionnés à partir du fichier maître des naissances du ministère de la Santé et des Services (Québec Master Birth Registry). Les critères d'inclusions étaient : être issu d'une grossesse entre 24 et 42 semaines et que la mère parle français ou anglais. L'échantillon initial de 2940 participants était représentatif de la population de nouveau-nés de Québec. Lors du premier volet, 2120 familles ont été retenues pour le suivi longitudinal. Lors du dernier volet (participants âgés de 20 ans), 1245 participants étaient encore membres de la cohorte. Les participants perdus de vue lors du suivi étaient plus souvent des garçons, provenaient de milieux plus défavorisés, avaient plus fréquemment une mère qui avait consommé de l'alcool pendant la grossesse et qui avait présenté des symptômes de dépression postpartum.

Le développement de la victimisation par les pairs de 6 à 17 ans (Étude 1). Quand les enfants avaient 6, 7, 8, 10, 12, 13, 15, 17 ans, ils ont auto-rapporté leur expérience de victimisation par les pairs par le biais de 6 questions sur la victimisation physique, verbale et relationnelle. En utilisant une méthode de modélisation pour mesures répétées utilisant l'information contenue dans les données (c.-à-d., les modèles de trajectoires fondés sur des groupes)³¹, nous avons décrit les trajectoires d'évolution de la victimisation au cours des périodes essentielles dans la formation des relations avec les pairs (le début de l'école élémentaire et les transitions vers le collège et le lycée). Nous avons identifié 4 groupes d'élèves qui ont vécu des expériences différentes de victimisation par les pairs de 6 à 17 ans: (1) 33% des élèves ont été peu/pas du tout harcelés, (2) 26% des élèves ont été harcelés seulement pendant l'école élémentaire, (3) 30% ont été harcelés surtout au collège et au lycée, (4) 11%

des élèves ont vécu une victimisation chronique depuis leur entrée à l'école élémentaire jusqu'à la fin du lycée.⁵ Nos résultats montrent que la période clé pour aider les élèves à briser le cycle de la victimisation chronique est l'école élémentaire.

Facteurs de risque précoces du développement de la victimisation (Étude 1). A travers des modèles multinomiaux multivariés nous avons étudié l'association entre les facteurs liés à la petite enfance et les 4 trajectoires précédemment mises en évidence. Nous avons montré que les troubles externalisés de l'enfant (c.-à-d., le score d'agressivité et d'hyperactivité avant 6 ans) et les vulnérabilités familiales (c.-à-d., avoir un père avec une histoire de comportement antisocial, ou vivre dans une famille séparée) étaient associés au développement de la victimisation par les pairs. Notre étude a permis de mettre en évidence des connaissances nouvelles en montrant que la santé mentale du père est liée au développement de la victimisation de son enfant, et suggérant que des actions de prévention en milieu familial pourrait avoir des effets bénéfiques sur la victimisation.⁵

Le rôle du mode de garde de l'enfant dans la prévention de la victimisation (Étude 2). Bien que la famille soit le principal agent de socialisation des jeunes enfants, les services de garde sont un milieu également important où les enfants apprennent à construire des relations avec leurs pairs. Les services de garde sont des services utilisés par les parents pour la garde de leurs enfants quand ils travaillent ou font des études, telles que les crèches, les assistantes maternelles, ou encore la garde par un membre de la famille. L'exposition au services de garde entre l'âge de 5 à 53 mois a été décrite par 3 trajectoire d'intensité de fréquentation : 1) intensité haute (36.5%) – les enfants commencent à utiliser les services de garde à partir de 5 mois puis à hauteur de 30-40 heures/semaine à partir de 17 mois, (2) intensité modérée (29.5%) - les enfants commence à utiliser les services de garde à partir de 17 mois avec une fréquentation qui augmente pour arriver à 30-40 heures /semaine à 53 mois et 3) intensité faible (34%) – les enfants sont en garde parentale la plupart du temps. Nous avons utilisé des courbes de croissance (conditional latent growth curve modeling) pour décrire l'évolution de la victimisation en fonction de ces 3 intensités de fréquentation des services de garde. Les résultats préliminaires suggèrent que l'âge d'entrée et l'intensité de la fréquentation de services de garde préscolaires, précédemment identifiés par certains auteurs comme facteur de risque pour les problèmes de comportements, ne sont pas associés au risque de victimisation par les pairs.

La santé mentale à 20 ans des élèves harcelés en milieu scolaire (Étude 3). A ce jour, la victimisation par les pairs est connue pour être associée à des problèmes de santé mentale spécifiques, comme la dépression ou l'anxiété, mais peu d'études se sont intéressées à l'association avec la comorbidité de troubles de santé mentale. Les comorbidités en santé mentale sont un indicateur de la sévérité de la psychopathologie,³²⁻³⁵ et sont liées à une mortalité élevée et une réduction de 5 à 17 années de l'espérance de vie.³⁶ La cooccurrence de problèmes de santé mentale est fréquente non seulement dans les échantillons cliniques, mais aussi dans la population générale.^{32,33,36-39} Plus de 40% des adolescents et des adultes avec au moins un diagnostic de trouble de santé mentale vont accumuler un ou plusieurs autres diagnostics au cours de la vie.^{32,40,41} Nous avons utilisé les symptômes auto-rapportés de troubles internalisés (c.-à-d., dépression, anxiété, troubles d'alimentation et pensées suicidaires) et externalisés (c.-à-d., troubles du déficit de l'attention avec / sans hyperactivité, consommation de substance et problème de conduite) pour caractériser les comorbidités à 20 ans. Nous avons utilisé deux variables principales : 1) le nombre de problèmes de santé mentale en cooccurrence dans les 12 derniers mois et 2) le type de comorbidités de santé mentale (c.-à-d., aucun problème, seulement des problèmes internalisés, seulement de problèmes externalisés et comorbidités internalisé-externalisé). Nous avons utilisé un modèle de régression binomiale négative pour étudier l'association entre les trajectoires de victimisation et le nombre de problèmes de santé mentale et un modèle de régression multinomiale pour l'association avec le type de comorbidité.

Nos résultats montrent que les jeunes ayant subi de la victimisation, même seulement à l'école primaire, présentaient plus fréquemment des comorbidités de troubles de santé mentale à 20 ans. Les jeunes touchés par les formes les plus sévères de victimisation présentaient les formes de comorbidités les plus sévères et complexes (c.-à-d., des comorbidités externalisé-internalisé). Les jeunes ayant subi de la victimisation seulement pendant l'école primaire, avaient plus de risque de présenter des troubles externalisés et des pensées suicidaires, mais ils présentaient la même probabilité que les jeunes non victimisés de présenter des troubles internalisés à la période de jeune adulte. Les associations entre les trajectoires de victimisation et la santé mentale n'étaient pas expliquées par des caractéristiques préexistantes (utilisation de la méthode du score de propension).

Conclusions. Les premières années de l'école primaire représentent une période importante pour la prévention de la victimisation par les pairs. Une part non négligeable des enfants subit

une victimisation chronique tout au long de leur cursus scolaire. Les parents, les enseignants et les pédiatres devraient porter attention à la persistance et à la sévérité de la victimisation au cours de l'enfance. Les interventions de préventions devraient tenir compte de la diversité des expériences de victimisations par les pairs. De plus, les enfants les plus susceptibles de subir des expériences chroniques de victimisation devraient bénéficier d'interventions ciblées (recommandées par les pédiatres suite au dépistage en routine, par exemple). Dans leur ensemble, ces résultats suggèrent qu'interrompre le cycle de la victimisation chronique pourrait permettre de prévenir les problèmes les plus sévères et complexes de santé mentale à l'âge adulte.

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List of Abbreviations

ADHD	Attention deficit disorder with / without hyperactivity
AveAPP	Average posterior probability
BIC	Bayesian information criterion
CAD	Canadian dollar
CFI	Comparative fit index
CI	Confidence interval
DSM-5	American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (5 th edition)
GBTM	Group-Based trajectory modeling
GMM	Growth mixture modeling
IPW	Inverse probability weighting
LGCM	Latent growth curve modeling
MAR	Missing at random
OCC	Odds of correct classification
OR	Odds ratios
PS	Propensity score
QLSCD	Quebec longitudinal study of child development
RMSEA	Root mean square error of approximation
RR	Rate ratio
SEM	Structural equation modeling
SMD	Standardized mean difference
SRMR	Standardized root mean square residual

Chapter 1 Introduction

1.1 Rationale for the current thesis

Relationships with peers are fundamental human experiences across all life stages. Unlike relationships with family members, relationships with peers are not hierarchical and offer exposure to individuals with similar age-related experiences.¹ For children and adolescents, interactions with peers offer unique opportunities for construction of the self and play a central role for behavioral and socioemotional development.^{1,2} Peer group experiences become increasingly important during early and middle childhood, with friendships being the central feature in late childhood and adolescence.^{2,3}

Unfortunately, peers do not only promote well-being, but can also be a source of distress. For children and adolescents, peer interpersonal difficulties frequently take the form of peer victimization. Peer victimization is an umbrella term used to describe the experience of being the target of intentional humiliation and attacks from peers with the goal of inflicting harm and distress⁴. Across cultures and countries, about 30% of children report being the target of peers' hostile behavior at some point during their schooling.⁵⁻⁸ Fortunately, for most children, peer victimization is a transitory experience.⁹⁻¹³ However, an important proportion of children, with estimates varying between 2-24% across developmental periods, are exposed to chronic peer victimization.^{9,11-13}

Not long ago, peer victimization was viewed as an integral part of childhood's formative experiences. Over the past 40 years, since the pioneering study of Olweus (1978)¹⁴, solid evidence has accumulated about the impact of bullying victimization on children's mental health and well-being. This evidence indicates that young victims of bullying are at increased risk of developing a wide range of mental health problems, such as depression, anxiety or suicidality.^{13,15-25} Moreover, emerging evidence suggests that the associations with poor mental health are long-lasting; extending into adulthood.^{19,26-32} Bullying is therefore a matter of concern for children, parents, teachers, health professionals and policy makers.

Given the serious consequences of peer victimization, increased effort has been put in the development and implementation of anti-bullying preventive programs and interventions, particularly in the school setting. The evidence regarding the effectiveness of these approaches

in reducing bullying and victimization has been mixed. On one hand, a recent meta-analysis of studies evaluating the effectiveness of school-bullying prevention programs reported a reduction of approximately 15-16% in the overall prevalence of bullying victimization at school.³³ On the other hand, Evans and colleagues reported that 9 out of the 27 studies reviewed showed no program effects on victimisation.³⁴ Moreover, the impact of some of these programs had limited effects in reducing peer victimization for children who experienced particularly high levels of peer rejection, internalizing problems, and lower quality of the parent-child relationships.³⁵ Additionally, in settings where interventions are successful in creating safe or healthier school environments, children who continue to be victimized may experience worse psychosocial problems than prior to the intervention (i.e., ‘healthy paradox’).^{30,36,37}

Studies investigating the limited effectiveness of the universal school-based preventive interventions and their possible undesirable effects highlight the gaps in our understanding of this phenomenon. First, universal interventions are based on a ‘one-size-fits-all’ approach. However, preexisting vulnerabilities such as individual, familial or socio-environmental factors may increase the likelihood of being a target of bullying.³⁸ To date, such factors that might render children more vulnerable to peer victimization have been seldom studied in the early childhood context. Second, these interventions have shown to be more effective among older children (i.e., aged 11–14 years) relative to those aged 10 years and younger.³⁹ Moreover, there is evidence that the vicious cycle of peer victimization and adjustment problems may already be established in the first years of school^{40–45} and possibly during the pre-school years.^{46,47}

A life course approach to the prevention of peer victimization may offer ways to strengthen current interventions. First, understanding how peer victimization unfolds for different individuals across the life span may bring forth important information about potential sensitive periods for peer victimization prevention. Accumulating evidence shows that peer victimization is characterized by substantial individual variability in its timing, duration, and intensity. Beyond chronicity, other patterns of stability and change in peer victimization across different periods from early childhood to adolescence have been documented (increasing, decreasing, transient).^{9,11–13,41,46,48–55} Transitions between school cycles may represent important periods during which changes in peer victimization may happen. To date, only two studies described the individual variations of peer victimization from the beginning of formal education throughout the high school years, capturing the critical periods in the development

of peer relationships (i.e., beginning of and subsequent transitions across the cycle of mandatory education).^{11,13}

Second, documenting early childhood factors that could increase the risk of becoming exposed to peer victimization could help involve potential victims in prevention programs. Early childhood is a period characterized by high levels of dependence on caregivers and a heightened vulnerability to adverse and stressful environmental conditions. It is a fundamental period in children's development in which they learn to navigate their social environments through their interactions with caregivers and peers. Studies showed that children exposed to parents' psychopathology,^{56,57} negative parenting^{46,58,59} or living in a separated family⁴⁹ have an increased likelihood of being peer victimized, while those who benefit from warm supportive parenting are protected against peer victimization.^{49,59} However, few of these studies have investigated these factors during early childhood or the unique role that mothers and fathers might play in children's future experiences of peer victimization. Furthermore, today, group-based childcare experiences are common for a growing number of infants, toddlers and preschoolers. They offer unique opportunities for socialization on a regular basis with a diverse array of peers. When of adequate quality, childcare should, in theory, equip children with valuable interpersonal skills such as conflict solving or understanding and navigating their emotions; which might be useful skills in dealing with interpersonal difficulties. However, some studies suggest that intense exposure to childcare services may also be linked to children's behavior problems.⁶⁰⁻⁶² To date, the role of group-based childcare experiences in the long-term development of peer victimization has been seldom studied.

Third, to develop successful intervention programs aimed at reducing the harmful outcomes of being bullied, we need to better understand if the timing and severity of peer victimization translate into the severity of mental health problems over the life course. So far, we know that peer victimization is associated with specific mental health problems in adulthood, but few studies have investigated its association with comorbid presentation of mental health problems. Comorbidity within mental health problems is an indicator of overall psychopathological severity⁶³⁻⁶⁶ and is associated with increased mortality and a reduction of 5 to 17 years in life expectancy.⁶⁷ Mental health comorbidity is the rule rather than the exception even in the general population.^{63,64,67-70} More than 40% of adolescents and adults with at least one diagnosis of mental disorder will subsequently accumulate one or more additional

diagnoses in their lifetime.^{63,71,72} Going beyond the identification of risk factors for specific mental problems, by looking more broadly at factors associated with comorbidities and psychopathology in general, may open new avenues for slowing down the mental health epidemic among youth.

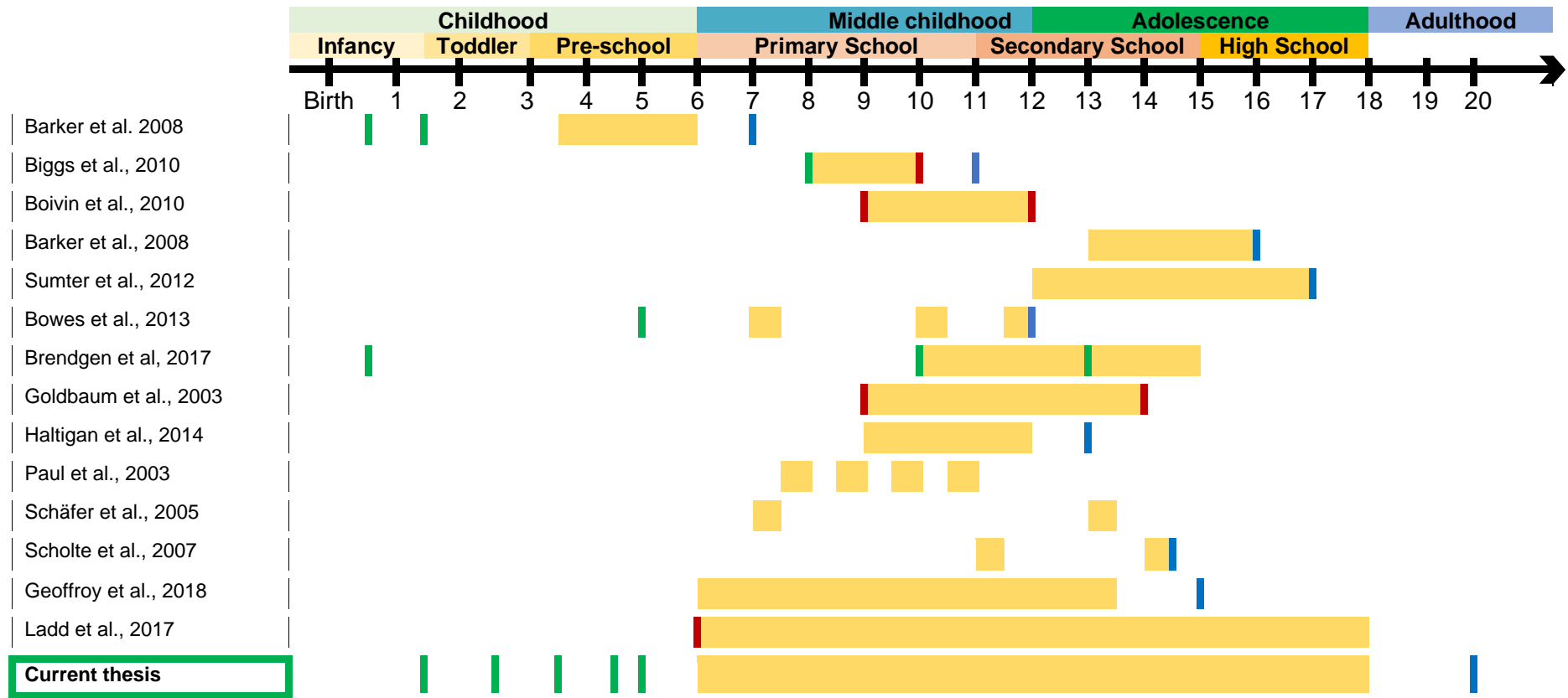
To date, few studies have taken a life course approach to the study of peer victimization evolution, its determinants, or its association with mental health problems. **Figure 1** summarizes the longitudinal studies which looked at how stability and changes in peer victimization throughout the life course were associated with either mental health problems or risk factors.






1.2 Aim and objectives

The aim of this thesis was to improve our understanding of the patterns of stability and change of peer victimization across childhood and adolescence as well as the antecedents and consequences of these patterns. The specific objectives were:

1. To describe the development of peer victimization from 6 to 17 years of age.
2. To examine the association of early childhood behavior, familial and broader socio-environmental factors with trajectories of peer victimization.
3. To study the association of the timing and severity of peer victimization with mental health comorbidities in young adulthood.

Figure 1. Summary of longitudinal studies on the development of peer victimization



 Trajectories of peer victimization
 Categorical measure of general peer victimization over time
 Measure of factors prior to/at baseline (predictors)
 Measure of factors at/after last measure of peer victimization (outcomes)
 Measure of factors concomitant with the peer victimization measures (adjustment factors)

Chapter 2 Literature review

2.1 Life course perspective

2.1.1 Definition

Life course epidemiology aims to understand the “biological, behavioral, and psychosocial processes that operate across an individual’s life course, or across generations, to influence the development of disease risk” (Kuh et al., 2003).⁷³ It is defined as the study of long-term effects on health of early life (e.g., gestation, childhood) exposure to physical or social risk factors. Central concepts in life course research relevant for the current work are the notions of trajectories and cumulative effects. Trajectories provide long-term perspective on the evolution of one dimension (e.g., psychological, behavioral, social) in an individual’s life. The concept of “cumulative effects” refers to cumulative damage to biological systems as independent or clustered exposures (e.g., behavioral, socio-economic) increase in number, duration or severity.⁷³

In this thesis we will analyze the period of life spanning from birth to age 20, which encompasses the whole period of mandatory education. This includes the developmental phases in which socialization skills are acquired, peer interactions are especially salient, and during which the basis for a healthy adult life are put.

2.1.2 Socio-emotional development and relationships with peers across the life course

Across different periods in child development, the nature of peer relationship and their role on development changes. In the next section we will briefly describe the main developmental periods covered in current thesis with a focus on peer relationship. Following QLSCD design and its’ overall objective and respecting transition periods in school setting, we defined developmental periods corresponding to four age groups: early childhood (birth to 5 years old), middle childhood (6 to 12 years old), adolescence (13 to 18 years old) and young adulthood (20 years old).

2.1.2.1 Early childhood (birth to 5 years old)

Early childhood is a period of accelerated physical growth (e.g., from head representing one-fourth of total body length in infancy to adult-like proportions in toddlerhood), dependence of a caregiver and acquisition of motor skills.⁷⁴ From three to five years old, growth in socioemotional skills includes the formation of peer relationships, gender identification, and the development of a sense of right and wrong.² Peer affiliation and play, are particularly important for learning reciprocity and other social and social-cognitive skills.¹

Limited by their difficulty in coordination, infants' and toddlers' interactions with peers involve simple rituals around objects.⁷⁵ Toddler peers can be a source of encouragement and comfort, facilitating each other's exploration of new environments and emotions (e.g., peers' emotional supportiveness in being-afraid-of-dark play determines whether the peers are trusted and whether the interactions continue).⁷⁶ First friendships appear after age two and by age four, children can reliably identify best friends, peers they like or dislike.^{2,75} Between the ages of three and five, with improved capacity of adopting the perspective of the play partner's, solving conflicts with peers challenges children to understand their peer's intentions and feelings as well as orient their own intentions and feelings accordingly if they want play to continue (e.g., learning reciprocity and other social-cognitive skills).^{75,77}

2.1.2.2 Middle childhood (6 to 12 years old)

During middle childhood, physical growth is slow and steady until the onset of puberty, when individuals begin to develop at a significantly faster pace.⁷⁴ During this period children learn the values of their societies and reason, with formal schooling beginning between ages five and seven.⁷⁸ Children have a growing peer orientation, yet they are strongly influenced by their family. During this period, peer group experiences progressively gain importance.² With increased ability to reflect on their own successes and failures and exposure to social comparison and competition in the classroom and peer groups, middle childhood is a key period for developing self-confidence (e.g., active construction of positive and negative self-cognitions).⁷⁸ Best friends are important at this stage, and the skills gained in these relationships may provide the building blocks for healthy adult relationships.²

2.1.2.3 Adolescence (13 to 18 years old)

Adolescence is a period characterized by accelerated growth and biological changes (i.e., development of primary and secondary sex characteristics, increased sexual libido, becoming fertile).^{74,79} The primary developmental task of adolescence is identity formation.⁸⁰ It is a culturally constructed period that generally begins as individuals reach sexual maturity and ends when the individual has established an identity as an adult within his or her social context.² The relationship with peers becomes the focus of the young person and social activities with peers, peer acceptance, and appearance are priorities for the majority of adolescents.⁷⁸ Many adolescents strive to gain independence from their family and peers are sought for emotional support and friendship.⁸¹

2.1.2.4 Young adulthood

Young adulthood is a period which lays the foundation for future adult milestones, such as integration into the workforce, financial independence, the formation of lasting intimate partnerships or parenthood. The main developmental task during young adulthood is to find companionship and love with another person. It is also a period during which some of the young adults can become isolated from others.⁸⁰ Nowadays, the onset of adulthood has shifted towards older ages given the delayed timing of education completion, marriage or parenthood.⁸²

2.2 Peer victimization – general overview

2.2.1 Definition

Peer victimization is an umbrella term used to describe the experience of being the target of peers' hostile or aggressive behaviors done intentionally to inflict harm (injury or discomfort) upon another.⁴ It can take different forms, such as physical (e.g., hitting, kicking, pushing, attacks on personal property), verbal (e.g., name-calling) and relational (e.g., social exclusion, spreading false rumors or lies, friendship withdrawal threat) victimization. Bullying is a specific form of peer victimization characterized by power imbalance and repetition over time.⁸³ The most important characteristic distinguishing bullying victimization from other types of peer victimization is the existence of a real or perceived power imbalance between the perpetrator and the target.⁸³ The power imbalance as perceived by the victim can be associated with objective factors such as physical strength, difference in number (i.e., alone in front of many

aggressors) or more subjective factors, i.e., self-confidence or popularity/status in the peer group. While some instances of peer victimization may be characterized by reciprocity of the aggressive acts between the victim and the aggressor, in the case of bullying victimization, the victim is less likely to retaliate.⁸⁴ In the current thesis, we did not measure the power imbalance between the victim and the aggressor, but we captured repetitiveness through annual/biennial measures of peer victimization between ages 6 and 17 years.

2.2.2 Types of victims

In the bullying scene, children take one of the following active roles: bully, pure victim or bully/victim. The perpetrator of bullying, the bully, engages in bullying to gain visibility, power or high status in the group.⁸⁵⁻⁸⁸ The pure victims, i.e., children who are submissive, unassertive and insecure about themselves represent the ideal target for the bullies' purpose to show their power and consolidate their high status within the group.^{87,89} The bully/victims are victims who engage in aggressive behavior and usually retaliate, but do not succeed in stopping the bullying.⁸⁹ Their emotional response is usually rewarding for bullies.⁸⁹ Usually, bully/victims present emotion regulation problems and high level of peer rejection (similar to the pure victims), but not higher social status (as it is the case for bullies).⁹⁰

2.2.3 Prevalence

Peer victimization is experienced by children and adolescents worldwide. Across 83 low, middle and high income countries in the six World Health Organization regions, surveillance data estimated that the past 30-day prevalence of peer victimization among youth aged 12-17 years was 30.5%, ranging from 45.1% in the Eastern Mediterranean Region and 43.5% in the African Region to 8.4% in the European Region.⁹¹ Similarly, for the same age group, in a meta-analysis of 80 prevalence studies, Modecki et al., reported a prevalence of 36% for peer victimization.⁵ Moreover, across 11 European countries, Analitis et al, found that 20% of youth (8-18 years old) reported bullying victimization.⁸ In general, the prevalence of peer victimization varies widely across countries, is higher among boys and declines with age.⁸ For instance, in the European region and North America, World Health Organization reported that among 11-year-old children, on average 14% of the boys and 11% of the girls reported bullying victimization, while the overall estimates ranged from 7% in Sweden or Armenia to over 20% in Lithuania.⁹²

2.2.4 Measurement

In population-based studies, peer victimization is usually measured through self-reports, parents', teachers' reports, peer nominations or direct observations. Typically, in studies where reports from several informants are available, the cross-informant agreement is low.^{9,93-96} However, despite low correlation, the different informant's reports on peer victimization were similarly associated to psychopathology.^{93,94,96} The most commonly used method to measure peer victimization is self-reported assessment. The use of self-reports has several advantages. First, they are easy to implement with minimal costs by researchers and teachers in the classroom. Second, they can assess the diversity of peer victimization subtypes, across multiple contexts (e.g., classroom, school yard, bus) and capture experiences that are harder to observe by teachers/parents (e.g., relational victimization). Third, they assess the perspective of the participant which is essential when studying the impacts on psychosocial functioning.⁹⁷ Regarding this last point, the subjective report on the experience of peer victimization, it also has drawbacks. For example, some victims may exaggerate their experiences, whereas others minimize them, thus it does not capture the actual exposure to peer victimization. In this way, severe cases might be missed and/or prevalence estimated inflated. Fourth, self-reports are well suited for repeated assessments over long periods of time since they ensure greater consistency across the different assessment points.¹¹ In this thesis, we assessed peer victimization via self-reports.

2.3 Factors associated with peer victimization

Being the target of peers' hostile behavior is not a random event. Individual as well as contextual factors increase children's vulnerability to peer victimization. To date, the majority of the studies on the profile of children who are victimized by peers looked at individual characteristics. A few studies analyzed familial and broader social factors in relation to peer victimization. Generally, all these studies focused on revealing the interplay between these factors during childhood and adolescence and peer victimization. The evidence about early childhood factors is sporadic, especially regarding factors unique to this developmental period, such as participation in childcare services.

2.3.1 Individual level factors

Evidence from systematic reviews showed that children's and adolescents' preexisting internalizing (e.g., depression, anxiety, social withdrawal, loneliness) and externalizing (e.g., aggression, attention problems, antisocial behavior) behaviors were prospectively associated with peer victimization.^{16,98} In their systematic review, Cook et al., present the profile of the two subtypes of victims: the typical victim and the bully/victim. The typical victim is more likely to present internalizing symptoms, negative self-related cognitions, difficulties in solving social problems, lack appropriate social skills and be rejected and isolated by peers.⁹⁹ The bully/victims had comorbid internalizing and externalizing problems, negative attitudes about one's self and the others, low social skills, poor academic performance, low social problem-solving skills and were more likely to be rejected and isolated, but also negatively influenced by peers with whom they interact.⁹⁹ However, the same review found that among these characteristics, possessing negative beliefs about one's self and being rejected and isolated by peers, differentiated victims from bullies.⁹⁹

During early childhood, externalizing behavior is the main behavioral factor associated with subsequent peer victimization.^{9,40,42,46,47} The role of internalizing behavior during this period is less understood, with studies showing either an association with subsequent chronic peer victimization⁹, a weak association with concurrent peer victimization⁴⁷ or no association.^{42,46}

2.3.2 Family-level factors

Among the family factors, the association between parenting and peer victimization is well documented. It has been argued that child-parent relationships put the basis of behaviors and expectations in future relationships.¹⁰⁰ Children exposed to negative parenting (e.g., neglect, hostility, hitting, shouting) have an increased likelihood of being the target of bullies.^{46,58,59,101} Moreover, positive parenting behavior (good communication of parents with child, warm and affectionate relationships, parental involvement and support, parental supervision) showed not only a protective effect against peer victimization, but also buffered the effect of bullying on subsequent emotional and behavioral problems.¹⁰² The review of Lereya et al, found that while the effects of positive parenting were similar for victims and bully/victims, the effect of negative parenting was stronger among bully/victims.¹⁰³ Other factors in the family

environment such as parents' psychopathology,^{56,57} siblings bullying¹⁰⁴, living in a separated family,^{49,105} with low socio-economic status^{8,9,91,106} has also shown association with peer victimization.

2.3.3 Broader socio-environmental factors

2.3.3.1 General

The role of other contextual factors beyond the family, i.e., neighborhood- or community-level factors has been rarely studied. For instance, larger school size¹⁰¹, neighborhoods characterized by residential instability¹⁰⁷, deprivation⁹⁹, higher rates of violence or crime⁹⁹, lower levels of social cohesion and trust¹⁰⁸, increased the likelihood of being a victim of bullying, while problems with neighbors increased the likelihood of being a bully-victim.¹⁰¹ Specific factors in the school environment such as the number of children receiving free school meals, larger number of pupils in the school and more children in need of special education services have also shown association with bullying behavior.¹⁰⁹

2.3.3.2 Childcare services

During early childhood, one factor potentially important for involvement in bullying is participation in childcare services (i.e., being cared for by a nanny, relatives or taking part in group-based childcare while parents are working/studying). Among the studies which looked at the association of participation in childcare services with socioemotional development, only a few of them also measured aspects related to peer relationships. Regarding the quality of childcare services, the evidence is consistent showing that the quality of childcare services translates into the quality of relationships with peers, at least on the short-term. For instance, participation in high-quality center-based childcare services resulted in less conflict with peers¹¹⁰, better social skills¹¹¹, while extensive hours from an early age in poor quality childcare was associated with more negative nomination from peers¹¹² and more peer difficulties in kindergarten.¹¹³ On long-term, studies found either no effect of childcare participation on social skills,^{111,114} or an association with higher number of friends and more physical affection during peer interactions in pre-adolescence when children spent extensive amount of time in good quality childcare.⁷⁵ Furthermore, regarding the role of different types of childcare services on long-term development of peer relationship, the evidence is still unclear. For instance, the

amount of non-relative care was associated with skillfulness with peers between 54 months and 6th grade.¹¹⁴ Similarly, attendance of center-based (relative to informal) childcare before age of three resulted in lower likelihood of having peer relationship problems during across middle childhood and pre-adolescence.¹¹⁵ However, there is also evidence suggesting that attendees of preschool center-based (relative to informal) childcare services exhibited less optimal psychosocial skills in adolescence, with the negative effects of preschool being concentrated among children who attended preschool for 20 or more hours per week.¹¹⁶

2.4 Peer victimization and mental health problems

2.4.1 Peer victimization and specific mental health problems

Systematic reviews of longitudinal and cross-sectional studies have repeatedly shown that peer victimization is associated with mental health problems.^{18,58,98,117–122} Stringent evidence indicates a detrimental effect of peer victimization on internalizing behaviors (i.e., depression, anxiety)^{17,18} and suicidality^{13,22,23,25,123} and accumulating evidence supports a small, but still important effect on externalizing behaviors (violence¹¹⁹, offending¹²⁴, and overall externalizing^{18,98}). The evidence regarding other mental health phenotypes is still conflicting. Regarding the role of peer victimization on illicit drug use, either no effect^{125,126} or small effects¹²⁷ were found, with the strongest associations observed among bully-victims,¹²⁸ when this group was distinguished. Being bullied in childhood showed an association with cigarette smoking,^{127,129} while there was no association with frequent drunkenness,^{126,127} or weak association with alcohol use.¹²⁹ Moreover, bullying victimization was associated with eating disorders, but the longitudinal evidence is still scarce.^{118 130}

2.5 Peer victimization and comorbidities within mental health

To date, the evidence about the association of peer victimization with the comorbid presentation of mental health problems is scarce. Three studies which looked only at internalizing problems, found an association between peer victimization and internalizing comorbidities,^{21,131,132} as well as unique associations with anxiety and social phobia.¹³¹ Four studies analyzed peer victimization in relation to different latent patterns of internalizing and externalizing problems in childhood¹³³ and adolescence.^{134–136} They found support for an association with patterns of mental health problems characterized by predominantly

internalizing symptoms,¹³⁶ predominantly externalizing symptoms when peer victimization was transient,¹³³ or comorbid internalizing and externalizing symptoms when peer victimization was persistent¹³³ or frequent.¹³⁴ More recently, Forbes et al. showed that the association of peer victimization with single mental health problems and the internalizing or externalizing cluster is non-specific, being accounted for by a general latent factor for psychopathology.¹³⁵ While these studies offer some indication about the association of peer victimization with mental health comorbidities, only four were longitudinal and none of them looked at externalizing and internalizing comorbidities in young adulthood.

2.6 Peer victimization across childhood and adolescence

On average, peer victimization declines with age.^{11,92,137} However, there is substantial individual variability in the timing, duration and intensity of peer victimization. A variety of patterns of stability and change have been documented across different periods from early childhood to adolescence.^{9,11–13,41,46,48–55} Below, we review the evidence regarding the heterogeneity of peer victimization experiences over time and how this heterogeneity translates into different mental health outcomes. We grouped the studies according to the method used to characterize the patterns of peer victimization into: 1) data-driven developmental trajectories and 2) *a priori* defined patterns of stability and change.

2.6.1 Developmental trajectories of peer victimization

A total of 10 studies described empirically derived groups of peer victimization evolution over time (**Table 1**). Generally, they identified between two to five groups of individuals who followed distinct patterns of peer victimization over time and about a half described three groups: chronic-, low- victims and an intermediary group. With the exception of one study⁵¹, all the others identified a group of chronic victims; the proportion of individuals in this group varying between 2-24%. The proportion of chronic victims was the highest: 14.5% and 24% in the studies with longer follow-up time covering transition periods^{11,13} and lowest in studies done in pre-school and primary school (2-4%). The intermediary groups presented different patterns of evolution: moderate- or high- increasing levels of peer victimization during pre-school and primary school while high-decreasing, decreasing or late-onset patterns of peer victimization emerged during secondary school and transition periods. Only one study covered

Table 1. Summary of studies on trajectories of peer victimization from early childhood to adolescence (n=10 studies)

First author, year of publication, Country,	Sample size	Time of follow-up (years/grades)	Number of trajectories	Groups (%)
Early Childhood				
Barker, 2008, Canada	1970	3.5 – 6 y	3	High/chronic (4%) Moderate/increasing (25%) Low/increasing (71%)
Middle Childhood				
Biggs, 2010, USA	1528	9 – 11 y, Grade 3 – 5	5	Chronic (2%) Increasing (4%) Decreasing (6%) Moderate (32.7%) Low (55.3%)
Bovin, 2010, Canada	1035	9-12 y, Grade 3-6	3	Extreme decreasing (4.5%) High-increasing (10.0%) Stable-low (85.5%)
Transition middle childhood to adolescence				
Goldbaum et al., 2003, Canada	1241	9-14 y, Grade 5-7,	4	Stable victims (1.61%) Late onset victims (4.51%) Desisters (6.12%) Non-victims (87.75%)
Haltigan et al., 2014, Canada	695	10-14 y, Grade 5-9	2	Moderate/declining (14.5%) Low/declining (85.5%)
Geoffroy, 2018, Canada	1363	6-13 y	3	Severe (14.5%) Moderate (59.3%) Low (26.2%)
Brendgen et al., 2017, Canada	1324	10 -15 y, Grade 4-9	3	High-increasing-decreasing (7%) High-decreasing (31%) Low-decreasing (62%)
Sumeter, 2011, Netherlands	1762	12-19.5 y,	3	High 6% Moderate 45% Low 48%
Adolescence				
Barker, 2008, UK	3,932	13-16 y	3	High/increasing 5% High/decreasing 10% Low 85%
Across middle childhood and adolescence				
Ladd, 2017, USA	388	6 -18 y Grade K-12	5	High-chronic (24.0%) Early victims (25.8%) Moderate-emerging (17.8%) Low victims (25.8%) Non-victims (6.5%)

the entire period from the end of pre-school until the end of high school (13 years of follow-up from 5.5 years to 17.9 years old) and identified four peer victimization trajectories: high-chronic victims (24.0%), early victims (26%), moderate-emerging victims (18%), low victims (26%), non-victims (6%).

2.6.2 Studies with *a priori* classification of stability and change in peer victimization

The four studies which described *a priori* defined peer victimization groups focused on the transition between primary to secondary school and presented four groups: chronic victims (4-13%), primary school victims (5-19%), secondary school victims (5%-10%) and non-victims (26%; 57-58%) (**Table 2**).

2.6.3 Timing and severity of peer victimization and mental health problems

Chronicity was unequivocally associated with the worse mental health problems both internalizing and externalizing,^{9,11-13,138} irrespective of the way in which the evolution of peer victimization was conceptualized (i.e., trajectories, persistence at 2 or more time points). However, the findings about children exposed only during certain developmental periods to peer victimization were less consistent. Some studies suggest that children who experience peer victimization primarily during childhood do not exhibit more mental health problems than non-victimized children.^{10,12,138} For instance, declining levels of peer victimization during school years were paralleled by reduction of negative affect¹² or sharp decrease in anxiety levels.¹³⁸ On the contrary, children in the adolescence-emerging peer victimization group showed similar level of mental health problems as those exposed to chronic peer victimization.^{10,12} For instance, Ladd et al. showed that children who were more victimized during later than during earlier school years displayed increasing levels of social anxiety, higher at the end of high school than those of non-victimized children. However, there is also evidence showing that early, but not late experiences of peer victimization are associated with poor mental health.¹³⁹ For instance, Hoffman et al., showed that children exposed to peer victimization during childhood had higher instances of arrests, depression, substance abuse, and violence compared to childhood bullying non-victims, while adolescence victims did not differ from adolescence non-victims on any of the adulthood outcomes analyzed.¹³⁹ Additionally, one study showed that even children who stopped being bullied during school age showed some lingering effects on their health, self-worth and quality of life years later compared to those never bullied.¹⁴⁰

Table 2. Summary of studies with a-priori classification of stability and change in peer victimization (n=4)

First author, year of publication, Country, Cohort/Sample Study	Sample size	Time of follow-up	Number of repeated measures
Bowes et al., 2013, UK	2146	Age 7-12 y	2 (1 in primary and 1 in secondary school)
Paul et al., 2003, USA	600	Grade 4 to 7	4 (2 in primary and 2 in secondary school)
Schäfer et al, 2005, Germany	282	Age 7-13y,	2 (1 in primary and 1 in secondary school)
Scholte et al., 2007, Netherlands	517	Age 11-14 y	2 (1 in primary and 1 in secondary school)

Chapter 3 Methodology

3.1 Presentation of Quebec Longitudinal Study of Child Development (QLSCD)

We used data from the Quebec Longitudinal Study of Child Development (QLSCD), an ongoing population-based birth cohort which follows the development of 2120 children born between October 1997 and July 1998 in the Canadian Province of Quebec. The main objective of the QLSCD was to study the long-term associations of preschool physical, cognitive, social, and emotional development with long-term academic performance and biopsychosocial (i.e., interactions between biological, psychological, and social) development.¹⁴¹ The QLSCD protocol was approved by the Health Québec, Institut de la Statistique du Québec and the Sainte-Justine Hospital Research Center ethics committee. Written informed consent was obtained from all participating families (parents and children's assent from age 10 years onward) and data were coded for confidentiality at each assessment.

The cohort recruited singletons born between October 1997 and July 1998 to mothers residing in the Canadian province of Quebec, who gave birth to singletons after 24 weeks and not later than 42 weeks' gestation, and who spoke English or French. The participants were selected from the Quebec Master Birth Registry through a stratified sampling procedure based on geographical location (remote/non-remote regions) and the birth rate (low/high) of regional municipalities. This resulted in an initial QLSCD sample of 2940 participants which was representative of 94.5% of the target population of Quebec infants. At the time of study inception, the Quebec population was 7 million, whereof nearly 20% was rural and 80% spoke French as their first language. At the first wave, the response rate was 75% (n=2223 participating families). A sub-sample of 103 families was excluded in the following waves as they were over-sampled from the Monteregion region to investigate the effects of the ice storm in January 1998. Thus, the remaining 2120 families constituted the final longitudinal sample. Details about the selection of the participants with the main reasons for exclusion are presented in **Figure 2**. Data were collected yearly during the first 8 years of the study and then biennially. At the last data collection (child age 20 years), the cohort had retained 1245 participants of those included in the longitudinal follow-up, corresponding to 59 % of the initial sample. Participants who dropped out from the study were more likely to be male, to come from

socioeconomically disadvantaged and separated families, and to have a mother who reported greater alcohol use during pregnancy and experienced higher levels of postnatal depressive symptoms (**Table 3**). The study website and previous publications contain detailed information on the QLSCD.¹⁴²

The present research draws on data collected at 19 assessment points between 1998 (i.e., participants age 5 months) and 2018 (participants age 20 years). We restricted the analyses to participants with available data on peer victimization, childcare and mental health outcomes, resulting in analytical samples sizes that varied between 1216 to 1760 participants.

We used measures of self-reported peer victimization from ages 6 to 17 years, of child behavior and family characteristics from ages 5 months to 5 years old, of childcare services use between ages 5 months and 4½ years, and of self-reported mental health at age 20 years.

3.2 Main Variables

3.2.1 Self-reported peer victimization

When the children were aged 6, 7, 8, 10, 12, 13, 15, 17 years, information on peer victimization was collected using 6 items of a modified version of the Self-report victimization scale (Annex 2).¹⁴³ Participants reported how often they experienced physical (i.e., “pushed, hit, kicked”), verbal (i.e., “called names, insulted, said mean things to you”, “teased you in a mean way/made fun of you”), relational victimization (i.e., “did not let you be part of his or her group”, “said bad things about you to other children”) and property attacks (i.e., “forced you to give something that belonged to you/made you pay them or give them something so they would leave you alone”) (responses range: 0=never, 1=once or twice, 2= more often). The wording of the items was adapted to reflect changes in the experience of victimization that could occur with age (e.g., the item “did not let me play with his or her group” used when participants were aged 6-12 years was changed to “did not let me be part of his group” when children were aged 13 years or older). At each wave, if participants answered at least 4 out of the 6 questions of the peer victimization scale, we calculated the mean of the items (range 0-2) and considered the data missing otherwise. At each wave, the mean score was rescaled (multiplied by 5) to range from 0 to 10 (with a higher score indicating a higher level of peer victimization). Cronbach α

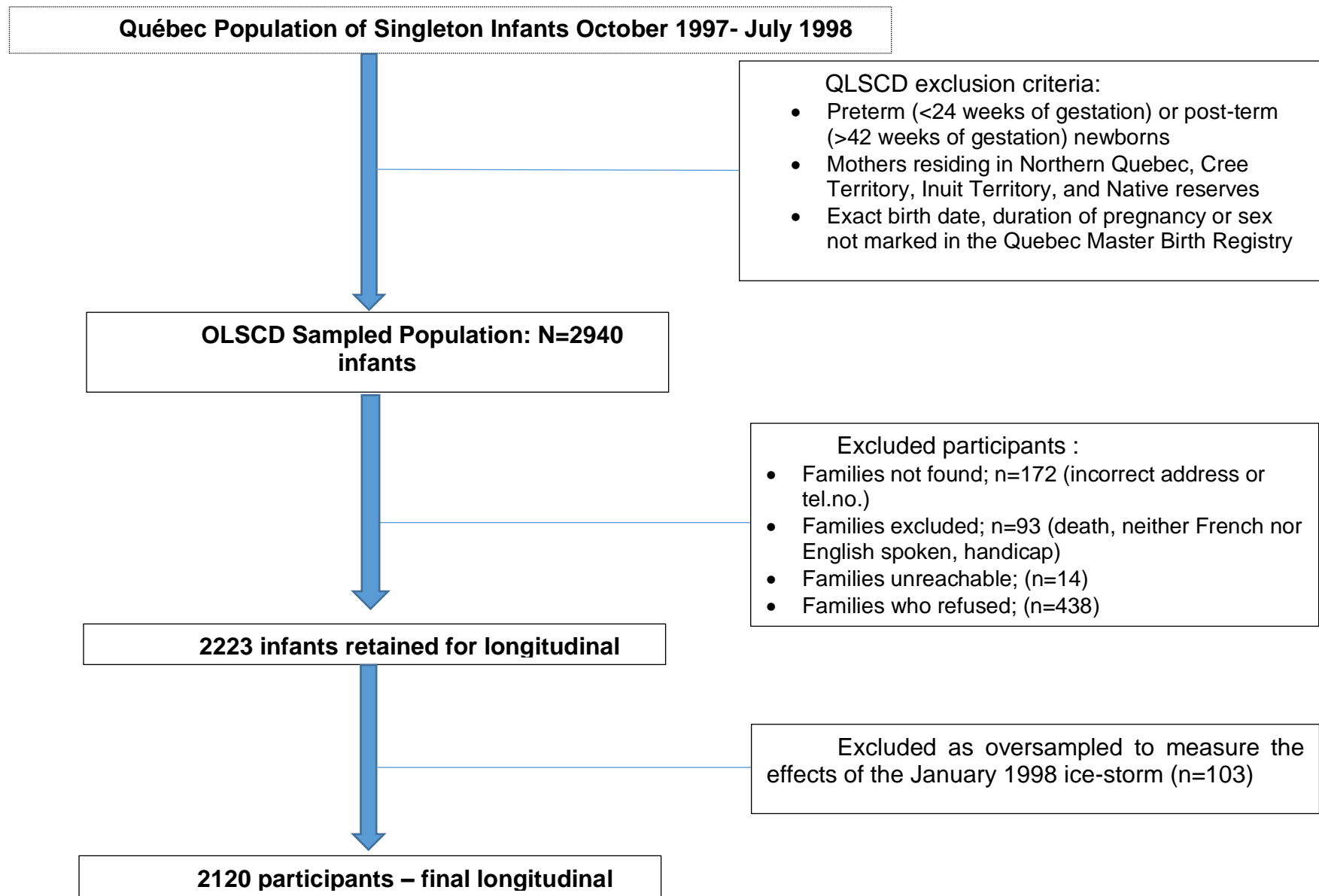


Figure 2. Flowchart of participant selection for participation in the QLSCD

Table 3. Baseline characteristics of the respondents and non-respondents in Quebec Longitudinal Study of Child Development at the 20-year data collection wave.

	Respondents n (%)	Nonrespondents n (%)	P value
	1245 (58.7)	875 (41.3)	
Perinatal, birth, child characteristics			
Female	719 (57.8)	321 (36.7)	<0.001
Low (<2500 gr) birth weight	40 (3.2)	31 (3.5)	0.772
Prematurity (< 37 weeks of gestation)	59 (4.7)	45 (5.1)	0.748
APGAR score 5 minutes < 7	17 (1.4)	10 (1.2)	0.841
Birth order > 3	197 (15.8)	146 (16.7)	0.638
Sociodemographic characteristics			
Teenage mother at childbirth	29 (2.3)	30 (3.4)	0.168
Low maternal education (no high school diploma)	190 (15.3)	195 (22.3)	<0.001
Low paternal education (no high school diploma)	185 (15.9)	154 (20.0)	0.026
Low socioeconomic status (<1 st distribution quartile)	255 (20.6)	268 (31.2)	<0.001
Separated (single parent/blended) family	208 (16.8)	198 (22.7)	0.001
Substance use in pregnancy			
Maternal smoking during pregnancy	301 (24.3)	232 (26.6)	0.253
Maternal alcohol use during pregnancy	489 (39.5)	263 (30.2)	<0.001
Maternal use of illegal drugs during pregnancy	15 (1.2)	15 (1.7)	0.433
Parental mental health			
Maternal depression at child age 5 months	153 (12.3)	165 (18.9)	<0.001
Paternal depression at child age 5 months	58 (5.3)	50 (7.4)	0.099
Maternal antisocial behaviours in adolescence	236 (19.7)	167 (20.2)	0.793
Maternal antisocial behaviours in adolescence	248 (22.8)	157 (23.3)	0.846

Note. Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2018), ©Gouvernement du Québec, Institut de la statistique du Québec. Variables were measured at child age 5 months, except for the perinatal and birth characteristics, which were extracted from the hospital birth records. Socioeconomic status was measured with an aggregate of 5 items regarding parental education, parental occupation, and annual gross income.

ranged from .74 to .81 across ages. More than half of the participants with at least one measure of peer victimization (n=1038 out of 1760, 59.0%), provided information about peer victimization on more than 6 waves (i.e., 7 or 8 out of 8 assessments) (Annex 1).

3.2.2 Early childhood behavior and family factors

The person most knowledgeable about the child (the mother in 98% of the cases) provided data about the child, the family, and the broader social context at 5 months, 1½, 2½, 3½, 4½ and 5 years after birth through home interviews. The fathers (biological fathers who had contact with the child at least once a month or mother's partner living in the household) also provided information through a self-administrated questionnaire. The following factors were measured socioeconomic status, family structure, maternal and paternal mental health (i.e., depression, anxiety, history of antisocial behavior) and parenting (i.e., positive and coercive), mother's alcohol use and cigarette smoking during pregnancy, and early childhood behavior problems (i.e., overall aggression, hyperactivity, internalizing behavior - depression and anxiety symptoms, and social withdrawal) rated by the mother and the father, and pre-school peer victimization. For variables measured repeatedly, we calculated the mean across early childhood if information was available at minimally two waves. **Table 6** in Chapter 4 provides a detailed description of these measures. A comprehensive list of the items used to derive the early childhood measures is presented in Annex 3. In **Study 1**, the early childhood behaviors and the family characteristics were included in exploratory analyses to investigate their association with peer victimization development. In **Study 2**, exposure to childcare services was analyzed in relation to peer victimization and all the other factors (i.e., the baseline measure at age 5 months) were used as covariates. In **Study 3**, all these factors were used as covariates to account for early childhood influences on the association between peer victimization and mental health.

3.2.3 Childcare services

In the current thesis, childcare services refer to services typically provided by a person chosen to care for a child when parents are working or studying, including formal and informal arrangements (e.g., nanny, grandparent, regulated childcare center, out of home family childcare).

3.2.3.1 Childcare services in the context of Québec

At the time of the recruitment of QLSCD participants in 1997, the Canadian federal government guaranteed 17 weeks of maternity leave, the last 15 of which were paid, and a further 10 weeks of paid parental leave which could be shared between the parents.¹⁴⁴ In 1997, part of an extensive family policy reform, the Québec provincial government introduced a universal childcare subsidy program under which families, regardless of their income, paid only 5 CAD/day for their children to attend regulated childcare, either in a center or in a family-based setting. Also, the Québec provincial government put the basis of a network of publicly funded regulated childcare services which promote the socio-emotional and cognitive development of children and prepare them for the demands of the school system while their parents work or study. The reduced-contribution to regulated childcare services was made available progressively, to 4-year-old children in 1997, and expanding every year to children one year younger. The participants in QLSCD benefited from this subsidy starting from 3½ years old.¹⁴⁵

3.2.3.2 Measurement of childcare services use

When children were 5, 17, 30, 42, and 53 months, mothers indicated whether their offspring received childcare since the last interview, the type of childcare used and the number of attendance hours. Using the repeated measurements of the number of hours per week in childcare services, Laurin et al., derived 3 trajectories which capture the age of entry into childcare services and their intensity of use: (1) high intensity (n = 751, 36.5%), in which children started using childcare services at 5 months and attended 30-40 hours/week from 17 to 53 months, (2) moderate intensity (n = 607, 29.5%) in which children started using childcare services at 17 months and steadily increased the number of hours they spent in childcare, until reaching 30-40 hours/ week at 53 months and (3) low intensity (n = 699, 34%), in which children were predominantly in parental care or had minimal exposure to childcare services throughout the entire period.¹⁴⁶

3.2.4 Young adulthood mental health outcomes

When they were 20 years, participants reported on their mental health during the past year (i.e., past week(s) or past month(s) for some outcomes) through confidential online questionnaires.

We assessed symptoms of internalizing problems: depression, anxiety, eating disorders, suicide attempt/ideation, and externalizing problems: attention deficit disorder with / without hyperactivity (ADHD), antisocial behavior, alcohol abuse, daily cigarette smoking, cannabis use 3 times/week or more and occasional use of hard drugs. Similar to previous studies,^{69,147,148} we used the empirically supported framework endorsed by DSM-5 for the classification of mental health problems into internalizing and externalizing categories. To identify participants with elevated symptoms, we used validated cut-offs for depression, anxiety, disordered eating behavior, ADHD and alcohol use. For the rest of the outcomes, we selected cut-offs that reflect severity while ensuring a reasonable sample size to perform the analyses (i.e., more than 5 participants in each trajectory group). A detailed description of the assessment instrument for each outcome as well as the cut-offs for severe symptomatology^{149–154} are presented in **Table 10** in Chapter 4. Our primary outcomes were (1) the number of mental health problems with elevated symptoms in the past 12 months (count variable, range 0-10) and (2) the type of mental health comorbidities in the past 12 months, with 4 possible categories: (a) no mental health problems, (b) internalizing problem(s) only, (c) externalizing problem(s) only; and (d) internalizing-externalizing comorbidity-at least one internalizing and one externalizing problem with elevated symptoms.

3.3 Statistical methods

3.3.1 Developmental trajectories

Since the 1950s, birth cohorts following individuals repeatedly over long periods of time have been established in many parts of the world. They allow the study of human development from birth to death, e.g., evolution of health, social, economic or behavioral outcomes over time. To describe such phenomena, developmental trajectories are used. They can be used to describe the average population trend over time (e.g., latent growth curve modeling - LGCM) or to identify distinct patterns of evolution of a given outcome/behavior within a population (e.g., finite mixture modeling – group-based trajectory modeling, growth mixture modeling).

3.3.1.1 Conditional latent growth curve modeling

Rationale. The pattern of change of a phenomenon over time can be described by estimating the difference between two measurements. However, with two data points we can model only linear trends. The latent growth curve modeling is used to analyze several repeated measures over time enabling the study of linear as well as curvilinear change in time. It allows to take into account the correlation between the intra-individual measures over time and to relate the parameters describing the change to different explanatory variables.¹⁵⁵ Thus, we can capitalize on the strengths of the longitudinal data and describe more precisely the variation in the rate, timing and magnitude of change. In **Study 2**, we used conditional latent growth curve modeling to investigate how much of the interindividual differences in peer victimization development from 6 to 17 years old was explained by participation in childcare services.

Estimation of model parameters. We estimated the latent growth curve model using a structural equation modeling (SEM) framework. SEM enables the testing of association between observed and latent variables.¹⁵⁶ To define the average population growth curve, two latent parameters are estimated: the intercept, describing the average baseline level of the outcome of interest (i.e., peer victimization at age 6 years), and the slope, describing the average rate of change over time of the outcome of interest (i.e., increase/decrease of peer victimization from ages 6 to 17 years). In the LGCM, each time point is treated as a separate variable. The within participant correlation is captured by correlated random intercept and random slopes. In conditional LCGM, the slope and intercept parameters are regressed onto explanatory variables (in our case, participation in childcare services). The model was estimated using maximum likelihood. We performed the analyses using the R package lavaan.

Model fit. The fit of the LGCM was evaluated using comparative fit index ($CFI > 0.90$), root mean square error of approximation ($RMSEA < 0.08$), and standardized root mean square residual ($SRMR < 0.05$).¹⁵⁷

3.3.1.2 Group-based trajectory modeling (GBTM)

Rationale. Each person has characteristics that make him/her unique. However, a collection of persons may share one trait allowing to sort them into categories. Clustering individual repeated measurements over time allows the identification of groups' trajectories. Group-based trajectory modeling (GBTM) was introduced in 1999 by Daniel Nagin and its objective is to identify (instead of assume) clusters of individuals who follow a similar developmental trajectory on an outcome of interest measured repeatedly over time.¹⁵⁸ The population is thought to be composed of literally distinct sub-populations that are not identifiable based on measured characteristics ex-ante. Therefore, the distinct sub-populations cannot be directly observed, they are latent groups – approximations of distinctive features of a continuum, but they may also reflect different etiologies.¹⁵⁹ To apply GBTM, it is essential to have (1) a hypothesis about the heterogeneity of the outcome of interest in the population; (2) at least 3 repeated measures on the same scale over time or age, and (3) sufficiently large sample. We used GBTM to derive the peer victimization trajectories from 6 to 17 years of age (**Study 1**).

Estimation of model parameters. From the statistical point of view, GBTM is a data-driven method for the analysis of longitudinal data with repeated measures. It belongs to the class of semi-parametric finite mixture models.¹⁶⁰ It assumes that the population is composed of a mixture of distinct groups defined by their developmental trajectories. It is a type of latent variable analysis with the sub-population being the latent categorical variable.

The parameters of the GBTM model are estimated by maximum likelihood. The model estimates a set of parameters to define: 1) the shape of the trajectory for each subpopulation, which is specified by a polynomial function (e.g., linear, quadratic) that models the link between time (age) and the outcome (peer victimization); and 2) the posterior probability of group membership, which gives the probability that each individual has to belong to each trajectory. Indeed, each individual has a probability to belong to each trajectory, so that for each individual in the estimation samples, a number of posterior probabilities equal to the number of trajectory groups will be estimated. The individuals are then assigned to the trajectory for which they have the highest posterior probability. This parameter is a measure of the uncertainty in the group membership. For

example, a model in which individuals have high probability to belong to one trajectory group and low probability to belong to the other groups has a greater classification accuracy than a model in which individuals have intermediate probabilities for membership in all trajectory groups.

Model selection. The purpose of the analysis is to determine the optimal number of subgroups to describe the heterogeneity of the population. Both statistical indices and expert knowledge on the topic inform model selection. To identify the model with the best statistical fit for the data, models with increasing number of latent classes are fitted and compared using the Bayesian Information Criterion (BIC). The BIC is a criterion for model selection among a finite set of models. It takes into account the increase in the likelihood function when adding parameters to the model as well as the potential for overfitting by introducing a penalty term for the number of parameters in the model. In group-based trajectory modeling, the BIC is calculated as follows:

$$\text{BIC} = \log(L) - 0.5k\log(N),$$

where L is the value of the model's maximized likelihood, N is the sample size and k is the number of parameters in the model. When two models are compared, the one with the highest BIC fits the data better than the others. For the selection of the optimal model, we also used the size of the group as an additional criterion. In order to identify groups that are relevant from a public health perspective, we used the recommended arbitrary cut-off of 5%.¹⁵⁸ If the size of any trajectory subgroup was smaller than 5%, we selected a model with fewer groups even if the BIC decreased. Finally, we selected the model that was conceptually meaningful¹⁵⁸, i.e., revealed distinct features of the data that were substantively relevant from a conceptual point of view and in line with previous evidence about the heterogeneity of peer victimization development.

Model construction. Following Nagin 2005, the construction of the model involves 2 steps.¹⁵⁸ In a first step, we select the numbers of groups to be included in the model. Several models with various number of groups are estimated given a pre-specified order of the polynomial. In the current work, we estimated models with 2 to 8 groups with all trajectories preset as quadratic. We used the BIC, the size of the group and theoretical knowledge to select the number of groups. In a second step, we determine the preferred order of the polynomial by specifying the shape of each

trajectory for the number of groups decided in the first step. The order of the polynomial was selected based on statistical significance (P-value <.05).

Model adequacy. To evaluate the model performance in classifying individuals into groups, we used two indices: 1) the Average Posterior Probability (AveAPP) and 2) the Odds of Correct Classification (OCC).

The average posterior probability indicates the extent to which the trajectory groups are well separated. Ideally, the certainty of group assignment for each individual should be 1, so that each individual is assigned with 100% probability to one trajectory group. In this ideal scenario, the AveAPP equals 1. Therefore, the more the AveAPP is closer to 1, the better the quality of the classification is. The rule-of-thumb for minimum acceptable AveAPP for each group recommended by Nagin is .70.¹⁵⁸

The odds of correct classification (OCC) indicate how well the model classifies participants better than classification by chance. It is a ratio between the odds of correct classification calculated based on the maximum posterior probability classification rule (numerator) and the odds of correct classification based on random assignment (denominator). Larger values for OCC indicate better assignment accuracy. If OCC =1, it means that the maximum posterior probability assignment rule has no predictive capacity beyond random chance. The rule-of-thumb for minimum acceptable OCC for each group recommended by Nagin is 5.¹⁵⁸

Comparison of GBTM with growth mixture modeling. Among the often discussed limitations of the GBTM is the fact that it does not take into account the correlation between each subject's repeated measures over time. Growth mixture modeling is another statistical method used to describe developmental trajectories that takes into account intraindividual correlation by using random effects. We present in **Table 4** a comparative description of the two methods which highlights the theoretical considerations that justify the use/non-use of random effects, summarizing the main ideas from the review by Nagin D. and Odgers C.L., 2010.¹⁵⁹

3.3.2 Propensity score inverse probability weighting

Rationale. One of the goals of epidemiological research is to understand the causes of diseases. In theory, the gold standard design that allows for the estimation of the true causal effect of an exposure on an outcome is the randomized controlled trial (RCT). In an RCT, the random assignment of individuals to receive the treatment of interest or the control treatment guarantees that the individuals in the control and treatment group would be similar on all the observed and unobserved background characteristics. Thus, the differences in the outcome of interest would be attributable to the (assigned) treatment. However, randomization is not suitable/ethical for all exposures, such as those that are known to be harmful, i.e., smoking, peer victimization. Therefore, researchers are left with observational data to answer causal questions. To approximate the RCT design in observational studies, we aim to compare treated and control groups that are as similar as possible regarding baseline characteristics, so that we can conclude that the effect observed is due to the actual exposure. One statistical method that serves to balance the distribution of observed covariates in the treated and control groups is weighting. In this thesis, we used propensity score as the statistical tool to estimate the similarity in observed covariates between individuals in the exposed and not exposed groups and inverse probability weighting as the method to implement the propensity score in the analyses.

Propensity score (PS). In case of an observational study with exposed and unexposed subjects to certain risk factors, the propensity score is defined as a subject's probability of being exposed to the factor conditional on its observed characteristics. It is a “closeness”/distance measure used to determine whether an individual is similar enough with another one.¹⁶¹ The propensity score summarizes all the information from measured explanatory variables into a single metric – the probability of a subject being exposed to the factor of interest given its background characteristics. One important property of propensity scores is that they are balancing scores, i.e., exposed and unexposed subjects with the same propensity score have the same distribution for all covariates defining the propensity score. Among the individuals with same or similar propensity scores, some will be exposed to the risk factor X while others will not. Thus, this approximates a randomized experiment, at least regarding the observed variables included in the propensity score.

Table 4. Comparison between group-based trajectory modeling and growth mixture modeling based on the review by Nagin D. and Odgers C.L., 2010

	Group-based trajectory modeling (GBTM)	Growth mixture modeling (GMM)
Class of statistical models	Semi-parametric	Semi-parametric
Assumptions	Unknown distribution of trajectories across population members (no assumption)	The population distribution of trajectories is composed of 2 or more subpopulations each following a conventional latent growth curve model.
Objective	Identify distinct clusters of trajectories	Describe how patterns of growth vary continuously throughout the population
Groups	Groups are approximations of distinct features of a continuum (i.e., statistical devices for approximating the unknown distribution of trajectories across population members).	Groups are subpopulations following different growth curve models (mean, covariance structure).
Random effects	No random effects are used. The use of random effects will reduce within-group variability in development and therefore, be in conflict with the objective of the method.	Random effects are used to explain interindividual variability. Their use increases within-group variability of individual-level trajectories.
Best fitting model	The fit of the model increases with the number of groups. Theoretically, the model in which the number of groups equals the number of the individuals in the sample (i.e., each individual has a distinct developmental trajectory).	Given the use of random effects, the model with fewer groups is usually more parsimonious.

Weighting. Weighting is one of the statistical methods used to include the propensity score in an analysis that estimates the effect of an exposure on an outcome. Through this method the weights given to different observations are derived from the PS as follows: for the exposed participants, weights are calculated as 1/PS; for the unexposed participants they are calculated as

1/(1-PS). The main advantages of using PS inverse probability weighting (IPW) are 1) the retention of data from all study participants; 2) easy to implement in different type of regression models;¹⁶² 3) they do not depend on the outcome. However, very large weights (i.e., if the estimated propensity scores are closer to 0 or 1) can make estimates unstable.^{161,162}

Implementation. To implement propensity score inverse probability weighting the following steps need to be followed:^{161,163}

1) Decide on the covariates to be balanced between the compared exposed and unexposed groups.

In line with the recommendations by Stuart, 2010¹⁶¹ we included in the propensity score a wide range of variables that maybe associated with the exposure/outcome to reduce the risk of confounding bias and to create a propensity score relevant for all outcomes under study.¹⁶⁴ While including variables that are actually not associated with the exposure, has virtually no influence in the propensity score model, excluding a potentially important confounder can be very costly in terms of increased bias.¹⁶¹ To decide which variables should be included in the propensity score among those preselected based on theoretical criteria, we calculated the standardized mean difference (SMD). We used the rule-of-thumb, $SMD > .100$, for inclusion of the variables in the propensity score model.¹⁶³

2) Estimate the propensity score.

We estimated the propensity score using multinomial regression models given that in both studies our exposures were categorical variables with 3 or more categories.

3) Apply the inverse probability weights to condition on the PS.

4) Assess the balance of the covariates of interest after the implementation of the PS IPW.

5) Estimate the average effect of the exposure in the conditioned sample given the PS IPW.

We performed all the five steps using the R Packages Cobalt and MatchThem.

3.3.3 Regression models

To study the association between exposures and outcomes, we used different regression models according to the type of outcome variable.

3.3.3.1 Logistic regression

It investigates the association between a dichotomous dependent variable and explanatory variables. We exponentiated the coefficients of the model and interpreted them as odds ratios (OR). We used logistic regression models in supplementary analyses to estimate associations in subgroup analyses (**Study 1**) and associations of peer victimization with specific severe mental health problems (**Study 3**).

3.3.3.2 Multinomial regression

It investigates the association between a dependent nominal variable with 3 or more categories and explanatory variables. Multinomial regression is a multi-equation model. For a nominal dependent variable with k categories, the multinomial regression model estimates $k-1$ logit equations.¹⁶⁵ We estimate the relative risk ratios (RRR) by the exponentiation of the values of the logit coefficients. The multinomial models were estimated using the R package `nnet`. We used multinomial regression model to estimate the associations between peer victimization trajectories (i.e., dependent variable with 4 categories) and early childhood factors in **Study 1** and between peer victimization and the type of mental health comorbidities in young adulthood (i.e., dependent variable with 4 categories) in **Study 3**.

3.3.3.3 Negative binomial

Negative binomial regression is a model in which the dependent variable is a count variable, usually overdispersed. The overdispersion for count data is usually present when the variance is much higher compared to the mean. It is considered a generalization of the Poisson regression as it has an extra parameter to model overdispersion. We used negative binomial regression in **Study 3** to model the association between the number of severe mental health problems in young adulthood (dependent variable) and peer victimization. Usually, the estimate

from the log expected count model is an incidence rate ratio (i.e., number of events/time). This model includes an offset which specifies the duration of follow-up for each individual (i.e., the time) when there is a difference in the follow-up time between participants. In our case, the duration of follow-up was similar for all the participants (i.e., one year from 19 to 20 years of age) and therefore the offset was not included in our model. We interpreted the effect estimates as rate ratios. The models were estimated using the R package MASS.

3.3.4 Dealing with missing data

We derived our analytical sample based on the availability of the data for the outcome and exposure variables. All participants with full missing data for the outcome and exposure variables (e.g., mental health outcomes, peer victimization, participation in childcare services) were excluded from the analyses.

We assumed that interrupted response over the follow-up for peer victimization followed a missing at random (MAR) mechanism. The GBTM and LGCM models, used to describe the peer victimization trajectories, also assume the MAR mechanism for missing data. Typically to estimate change over time allowing for other patterns that linear evolution at least 3 data points are necessary. However, GBTM is a robust method even when only one data point is used.¹⁵⁸ To derive the peer victimization trajectories, we estimated models with both 1 and 3 measurement points. As the trajectories derived were similar in terms of shape, number and size of the groups, to maximize the sample size we used the model with one 1 peer victimization measurement from age 6 to 17 years.

In the analytical samples resulting after the restriction based on the availability of the outcome and exposure, for covariates we also assumed data were missing at random. The MAR mechanism assumes that measured variables available in the data set can predict the missing data.¹⁶⁶ Missing data in our study was related to characteristics that are commonly related to attrition in the majority of longitudinal population studies (e.g., male, low education, socioeconomic disadvantage) and all the other QLSCD studies. Therefore, it is unlikely that

attrition was systemic in a specific way linked to peer victimization. Generally, MAR is realistic scenario in longitudinal studies in which several measurements for all participants are available.¹⁶⁷

Missing data proportion for covariates was below 3.5 % for the majority of the variables with the exception of father-related variables (10-20%). To avoid loss of participants due to listwise deletion, the multivariate models were estimated using multiple imputation by chained equations (R package Mice). Imputations were created on the basis of regression equations fitted to the observed data and applied to predict missing values. Through multiple imputation we created 50 complete versions of the data by replacing the missing values by plausible data values¹⁶⁸. In the imputation model we included the covariates, the outcome and exposure variables. The multivariate associations were estimated in each imputed data set. All estimates from imputed data sets were combined together into a final point estimate plus standard error.¹⁶⁸

Chapter 4 Results

4.1 Early childhood factors associated with peer victimization development from 6 to 17 years of age

4.1.1 Study 1: Early childhood factors associated with peer victimization trajectories from 6 to 17 years of age

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Abbreviations: QLSCD: Quebec Longitudinal Study of Child Development, OR: Odds Ratios, CI: Confidence Intervals, NIMH-DIS: National Institute of Mental Health Diagnostic Interview Schedule, CES-D: Center for Epidemiologic Studies Depression

Table of content summary: This study described four trajectories of peer victimization from 6 to 17 years of age and early childhood behaviors and family characteristics associated with them.

What's Known on This Subject: Peer victimization affects children worldwide. Few studies captured its evolution over critical periods in the development of peer relationships. Moreover, little is known about pre-existing vulnerabilities that may forecast the emergence of different developmental patterns of peer victimization.

What This Study Adds: The development of peer victimization was heterogeneous. For some children, peer victimization lasted throughout their school career; for others it was limited to the first years of primary school. Early childhood behaviors and family vulnerabilities were associated with these developmental patterns.

Contributors' Statements

Ms Oncioiu conceptualized and designed the study, carried out the data analysis, drafted and finalized the manuscript.

Dr Orri supervised, conceptualized and designed the study, participated in the data analyses, reviewed and revised the manuscript for important intellectual content.

Drs Côté and Boivin supervised, conceptualized and designed the study, designed the data collection instruments, obtained funding, coordinated and supervised data collection, and reviewed and revised the manuscript for important intellectual content.

Drs Geoffroy, Arseneault, Brendgen, Galéra and Ms Navarro reviewed and revised the manuscript for important intellectual content.

Drs Tremblay and Vitaro designed the data collection instruments, obtained funding, coordinated and supervised data collection, and reviewed and revised the manuscript for important intellectual content.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

ABSTRACT

Objectives: To describe (1) the developmental trajectories of peer victimization from 6 to 17 years of age; and (2) the early childhood behaviors and family characteristics associated with the trajectories.

Methods: We used data from 1760 children enrolled in the Quebec Longitudinal Study of Child Development, a population-based birth cohort. Participants self-reported peer victimization at ages 6, 7, 8, 10, 12, 13, 15 and 17 years. Participants' behavior and family characteristics were measured repeatedly between ages 5 months and 5 years.

Results: We identified four trajectories of peer victimization from 6 to 17 years of age: low (32.9%), moderate adolescence-emerging (29.8%), childhood-limited (26.2%) and high-chronic (11.1%). Compared to children in the low peer victimization trajectory, children in the other three trajectories were more likely to exhibit externalizing behaviors in early childhood and those in the high-chronic and moderate adolescence-emerging trajectories were more likely to be males. Paternal history of antisocial behavior was associated with moderate adolescence-emerging (OR=1.54, 95% CI=1.09-2.19) and high-chronic (OR=1.93, 95% CI=1.25-2.99) relative to low peer victimization. Living in a separated family in early childhood was associated with childhood-limited (OR=1.48, 95% CI=1.11-1.97) and high-chronic (OR=1.59, 95% CI=1.09-2.31) relative to low peer victimization.

Conclusion: Early childhood externalizing behaviors and family vulnerabilities were associated with the development of peer victimization. Some children entered the cascade of persistent peer victimization at the beginning of primary school. Support to these children and their families early in life should be an important component of peer victimization preventive interventions.

INTRODUCTION

Peer victimization is a public health concern worldwide.¹ It is defined as harm caused by peers acting outside of the norms of appropriate conduct.² Adolescents who have been exposed to persistent peer victimization are at increased risk of mental health problems, including anxiety, depression and suicidality.³⁻⁵ However, peer victimization is a multifaceted experience, and relatively few studies have investigated its development over the life course. The identification of early behavioral and familial factors that may forecast the emergence of different patterns of peer victimization should provide information to better tailor preventive interventions.

Peer victimization is characterized by substantial individual variability in its timing, duration and intensity. A variety of patterns of stability and change have been documented across different periods from early childhood to adolescence.^{3,6-19} The bulk of these studies showed that an important proportion of children (between 25% and 60%) experience moderate-level peer victimization with varying developmental patterns (i.e., increasing, decreasing trajectories).^{3,6,7,11,13,15,16} Most of these studies focused on the transition from primary to secondary school.^{3,11,13,15,16} However, there is evidence that the vicious cycle of peer victimization and adjustment problems may already be established in the first years of school²⁰⁻²³ and possibly during the pre-school years.^{7,24} To our knowledge, only two studies described the individual variations of peer victimization from the beginning of formal education throughout the high school years, capturing the critical periods in the development of peer relationships (i.e., beginning of and subsequent transitions across the cycle of mandatory education).^{3,16}

School-based anti-bullying interventions have shown significant, but modest effects in reducing victimization.²⁵ Universal preventive interventions generally do not address pre-existing vulnerabilities which may increase the likelihood of being target of bullying. Behavior problems before school entry (i.e., before 6 years of age) may condition subsequent peer victimization experiences. For instance, externalizing behavior problems in early childhood has been found to be one of the most important correlates of subsequent peer victimization.^{7,8,20,21,24} The role of early childhood internalizing behavior is less understood, with studies showing either an increased likelihood of^{8,26} or no association with^{7,21,24} subsequent chronic peer victimization. Moreover, studies showed that children exposed to parents' psychopathology,^{27,28} negative parenting^{7,29,30} or

living in a separated family¹³ have an increased likelihood of being peer victimized, while those who benefit from warm supportive parenting are protected against peer victimization.^{13,30} Despite the unique role that mothers and fathers play in children's psychosocial development³¹⁻³³, the evidence on their differential contribution to the experience of peer victimization³⁴ is limited.

The current investigation builds on the work of Barker et al⁷ and Geoffroy et al³ on the development of peer victimization in the Quebec Longitudinal Study of Child Development (QLSCD), by extending the follow-up period across adolescence. It complements previous work with a comprehensive analysis of the contribution of early childhood behavior, maternal and paternal mental health, parenting, family structure and socioeconomic disadvantage to distinct peer victimization developmental patterns from 6 to 17 years of age.

Thus, the aims of this paper are (1) to describe the developmental trajectories of peer victimization from 6 to 17 years of age; and (2) to identify the early childhood behavior and family characteristics associated with the identified trajectories of peer victimization.

METHOD

Participants

This study is based on the QLSCD, a population-based birth cohort which tracks the development of 2120 children born in the Canadian province of Quebec in 1997-1998 and followed up until 2015. The sample was drawn through a stratified sampling procedure based on living area and birth rate from the Quebec Master Birth Registry. All mothers giving birth after 24 weeks and not later than 42 weeks of gestation who spoke English or French were eligible. Detailed information on the QLSCD can be found elsewhere.³⁵ The QLSCD protocol was approved by the Quebec Statistics Institute and the Sainte-Justine Hospital Research Center ethics committees. Written informed consent was obtained from all participating families at each assessment. The person most knowledgeable about the child (the mother in 98% of the cases) provided data about the child, the family, and the broader social context at 5 months, 1½, 2½, 3½, 4½ and 5 years after birth through home interviews. The fathers (biological fathers who had contact with the child at least once a month or mother's partner living in the household) also provided information through a self-administrated questionnaire.

The analytical sample in the current study consists of 1760 children followed-up from 5 months to 17 years of age who reported their peer victimization experience at least once between 6 and 17 years: 862 boys (49.0 %) and 898 girls (51.0 %). More than half of the participants (n=1038, 59.0%), provided information about peer victimization on more than 6 waves (i.e., 7 or 8 out of 8 assessments) (Annex 1). **Table 5** presents the characteristics of the participants included in this study.

Self-reported peer victimization from age 6 to 17 years

When the children were aged 6, 7, 8, 10, 12, 13, 15, 17 years, information on peer victimization was collected using 6 items of a modified version of the Self-report victimization scale (Annex 2).³⁶ Participants reported how often they experienced physical (i.e., “pushed, hit or kicked”), verbal (i.e., “called names, insulted, said mean things to you”, “teased you in a mean way/made fun of you”), relational victimization (i.e., “did not let you be part of his or her group”, “said bad things about you to other children”) and property attacks (i.e., “forced you to give something that belonged to you/made you pay them or give them something so they would leave you alone”) (responses range: 0=never, 1=once or twice, 2= more often). The wording of the items was adapted to reflect changes in the experience of victimization that could occur with age (e.g., the item “did not let me play with his or her group” used when participants were aged 6-12 years was changed to “did not let me be part of his group” when children were aged 13 years or older). At each wave, if participants answered at least 4 out of the 6 questions of the peer victimization scale, we calculated the mean of the items (range 0-2) and considered the data missing otherwise. The mean score at each wave, was rescaled (multiplied by 5) to range from 0 to 10 (with a higher score indicating a higher level of peer victimization). Cronbach α ranged from .74 to .81 across ages.

Table 6 provides the description of the measures used to assess family socio-demographic characteristics, parental mental health, parent-child relationship and children’s behavior. A comprehensive list of the items used to derive the early childhood measures is available online (Annex 3).

Missing data and attrition

The excluded participants were more likely to be male, of non-Canadian origins, come from socioeconomic disadvantaged families, to have a mother with higher depressive symptoms and overprotective parents compared to participants retained in the study (Annex 4). Therefore, these variables were used to derive weights that were applied in all regression models using the inverse probability weighting procedure. Missing data rate was below 3.5 % for the majority of the variables with the exception of father psychopathology (13.4%) and father-child relationship (20%). To avoid loss of participants due to listwise deletion, the multivariate models were estimated using multiple imputation by chained equation (n=50 dataset).

Statistical analyses

Developmental trajectories of peer victimization

We used group-based trajectory modeling^{43,44} to estimate the developmental trajectories of peer-victimization from 6 to 17 years of age. Group-based trajectory modelling, a special case of finite mixture models, identifies clusters of individuals who follow similar developmental trajectories. The best fitting model was identified by estimating models with 2 to 8 latent clusters with quadratic age terms and comparing them using the Bayesian Information Criterion (BIC) as primary index. As recommended, the size of the clusters was also considered to select the best model (no solution with small group sizes, i.e., <5% of the sample, was selected). We assessed the quality of the classification identified by the model using the average posterior probability of cluster membership (good if > .70 for each trajectory).

Association between early childhood factors and peer victimization trajectories

In a first step, we used univariate multinomial logistic regression models to estimate the association between trajectory membership and each early childhood variable separately. In a second step, to estimate the unique contribution of each variable over and above the effect of the other variables, we ran multivariate multinomial logistic regression models. We entered in the multivariate model, all variables which showed a significant association at $p < .05$ with any of the trajectories relative to the reference trajectory in the univariate models. The trajectory with the lowest levels of peer victimization was used as reference category in all the multinomial logistic regression models.

Post hoc analyses

We performed two separate subgroup analyses to compare the high-chronic trajectory with the moderate adolescence-emerging and childhood-limited trajectories.

RESULTS

Trajectories of self-reported peer victimization from 6 to 17 years of age

We identified four distinct developmental trajectories of self-reported peer victimization from 6 to 17 years of age (**Figure 3**): (1) low peer victimization across the entire period (n=579, 32.9%); (2) moderate adolescence-emerging peer victimization, characterized by steady levels of victimization from age 6 to 12 years and the second highest level of victimization across adolescence (n=525, 29.8%); (3) childhood-limited peer victimization, characterized by a relatively high level of victimization at age 6, followed by a progressive sharp decline from age 6 to 17 years, and virtually no victimization at age 17 (n=461, 26.2%) and (4) high-chronic peer victimization, characterized by persistently higher levels of victimization relative to the other groups, despite a decline from age 6 to 17 years (n=195, 11.1%). The fit indices of the models with 2 to 8 trajectories that were compared to determine the optimal solution are presented in Annex 5.

Early childhood factors associated with the trajectories of self-reported peer victimization

Univariate analyses showed that early childhood behavior and family characteristics were associated with peer victimization development (**Table 5**). Similar to the univariate analyses, in multivariate analyses we showed that compared to the children following a low trajectory of peer victimization, children in the three other trajectories were more likely to exhibit higher levels of externalizing symptoms. Additionally, children following a moderate adolescence-emerging or a high-chronic trajectory of peer victimization, compared to those in the low victimization trajectory, were more likely to be boys and have a father with a history of antisocial behavior. Finally, children following a childhood-limited or high-chronic peer victimization trajectory were more likely to come from separated families (**Table 7**).

The associations for maternal and paternal depression and parenting as well as for socioeconomic disadvantage observed in the univariate models were not statistically significant

when accounting for children's behaviors and the other family characteristics in multivariate models. The level of internalizing behavior in early childhood and the maternal history of antisocial behavior were similar for children across the four peer victimization trajectories (**Table 5**).

Post hoc analyses

Children in the high-chronic relative to the moderate adolescence-emerging and childhood-limited trajectories were more likely to exhibit higher level of externalizing symptoms in early childhood, controlling for other behaviors and family factors. Additionally, children in the high-chronic trajectory were more likely to be males and have a father with a history of antisocial behavior compared to those in the childhood-limited trajectory and to come from a separated family relative to those in the moderate adolescence-emerging trajectory (Annex 6).

DISCUSSION

This was the largest study to describe the developmental trajectories of peer victimization from 6 to 17 years of age and to document their associations with early childhood behavior and family characteristics.

We identified four distinct peer victimization trajectories: low, moderate adolescence-emerging childhood-limited and high-chronic. While the majority of children reported some level of peer victimization at school entry, all groups except the moderate adolescence-emerging reported declining levels in middle childhood. The pattern of severity and stability of peer victimization, the relative size of the low and childhood-limited peer victimization groups and the higher proportion of males in the trajectories characterized by persistent peer victimization were findings similar to those described by Ladd et al¹⁶ over the same ages (i.e., 6 to 17 years). Thus, the striking similarities between these two studies done in very distinct North-American cultural settings suggest that they both captured general patterns of perceived peer victimization development throughout the cycle of mandatory education. Moreover, these two studies indicate that middle childhood is a period of substantial differentiation in the development of peer victimization. That is, more than half of children exhibited a change in the rank ordering of the peer victimization group. The childhood-limited group reported the second highest level of

victimization at 6 years of age and had, together with the low group, the lowest levels at 17 years of age. In contrast, the moderate adolescence-emerging group reported the second lowest levels of victimization at 6 years of age and the second highest level after the chronic group at 17 years of age. Our findings from 12 years of follow-up across childhood and adolescence strengthen the evidence about the existence of primary school limited and late-onset peer victimization which was theoretically described⁸ or empirically derived^{6,11} in short-term longitudinal studies.

We showed that paternal history of antisocial behavior was associated with persistent peer victimization (i.e., high-chronic and moderate adolescence-emerging trajectories) when controlling for children's sex, behavior, maternal factors, parenting, socioeconomic disadvantage and family structure. This is the first study reporting on the relationship between father's mental health and the development of peer victimization in the offspring. However, our findings are in line with evidence from studies which showed that paternal negativism³⁴ and hostility⁴⁵ are associated with peer victimization and bullying, respectively and with studies on the association between father's psychopathology and offspring's behavioral problems.^{31,46} Furthermore, in line with Brendgen et al.,¹³ we showed that living in a separated family was associated with high levels of peer victimization at school entry (i.e., high-chronic and childhood-limited trajectories). Father's antisocial behavior distinguished between children in these two trajectories. That is, children who escaped high levels of peer victimization in the first years of primary school had a father with better mental health than those who continued to be highly victimized during adolescence. These findings strengthen the importance of paternal mental health for high-chronic peer victimization.

A genetically informative study has shown that father's antisocial behavior may influence children's behavioral problems through both genetic and environmental pathways.⁴⁷ Twin studies indicated that genetic factors accounted for an important part of the variation in persistent peer difficulties.^{8,22} Moreover, a polygenic score study showed that high genetic risk for mental health problems was associated with increased exposure to bullying.⁴⁸ Therefore, future studies are needed to clarify the association between father's mental health problems and offspring's persistent peer victimization (e.g., genetic, environmental mechanisms).

Consistent with previous research^{7,8,21,24}, we found that high externalizing behavior problems during the preschool years were important factors for the development of peer victimization. Children who exhibited the highest levels of externalizing behavior during early childhood endured the highest levels of peer victimization from 6 to 17 years of age. These findings, taken together with the overrepresentation of boys and fathers with history of antisocial behavior in the trajectories characterized by persistent peer victimization, echo the literature on the profile of bully/victims.²⁷ Similar to other studies among young children^{7,21,24}, we found that children in the different trajectories of peer victimization had similar internalizing symptoms prior to school entry. These findings differ from those among older children and adolescents⁴⁹, probably because internalizing symptoms become more negatively perceived by peers and associated with peer victimization as children grow older.⁹

The findings from this study need to be interpreted in the context of its limitations. First, we did not assess the power imbalance between the bully and the victim which is part of the definition of bullying. However, students' definition of bullying tends to focus on negative actions by peers and fails to include power imbalance.^{50,51} Second, we did not differentiate between children who are only victimized and those who are simultaneously bullies and victims. Thus, the experiences of peer victimization described in this study also capture the experience of bully/victims. Third, we measured peer victimization using self-reports. Despite the advantages of this assessment method in long-term studies (see Ladd et al¹⁶), self-reported peer victimization is potentially biased by the self-system, which may be less differentiated and related to actual experiences in younger children.^{22,52} Fourth, 83% of the baseline sample was available for the 17-year follow up. To minimize attrition bias, analyses were conducted using weights accounting for the probability of being retained in the study at follow-up. To minimize loss of participants in multivariate models due to listwise deletion we used imputations. Results with and without weights and imputations were fairly similar strengthening the internal validity of the study.

These limitations notwithstanding, this is the largest and one of the longest population-based studies to have applied a longitudinal person-centered approach to repeated measure of peer victimization. The external validity of our results is reinforced by the reproduction of the peer victimization trajectories between 6 and 17 years of age described by Ladd et al¹⁶, despite the use

of a different statistical method. Moreover, this study is unique through the description of both maternal and paternal factors associated to peer victimization development.

Conclusions

In this study we identified four different developmental patterns of peer victimization across the entire cycle of mandatory education, primarily distinguished by their development during primary school. Some children experienced persistent peer victimization already in the first years in primary school. Early childhood externalizing behaviors and family vulnerabilities were associated with the development of peer victimization. To prevent persistent peer victimization, victimized children should be offered targeted interventions which address these individual and family vulnerabilities early in their school careers.

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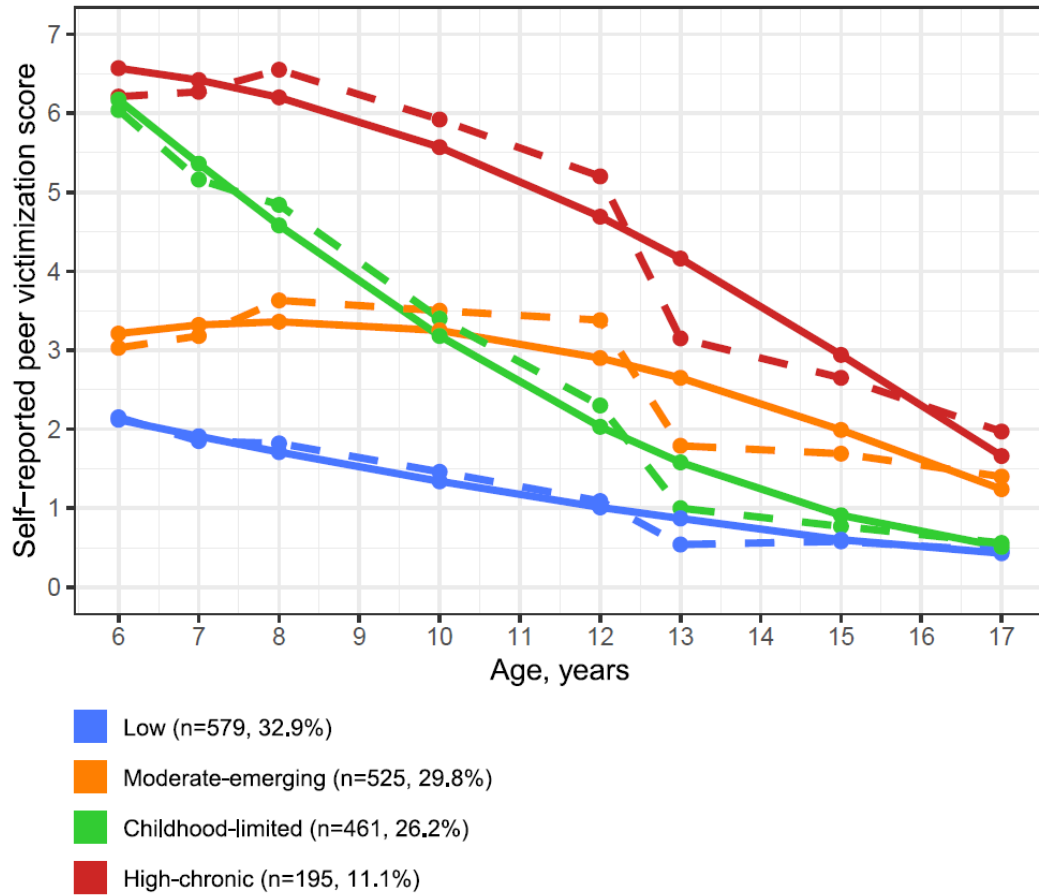
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Figure 3. Trajectories of self-reported peer victimization from 6 to 17 years of age



TABLES

Table 5. Early Life Characteristics (age 5 months – 5 years) of Participants by Trajectories of Peer Victimization from 6 to 17 Years of Age (N=1760)

Characteristics	Trajectories of peer victimization from 6 to 17 years of age											
	Overall											
	Low (n=579)		Moderate adolescence- emerging (n=525)			Childhood-limited (n=461)			High-chronic (n=195)			
	Mean (SD) or No. (%)	Mean (SD) or No. (%)	Mean (SD) or No. (%)	OR	95% CI	Mean (SD) or No. (%)	OR	95% CI	Mean (SD) or No. (%)	OR	95% CI	
Boy	862 (49.0)	243 (42.00)	275 (52.4)	1.52	1.20-1.93 ^a	228 (49.5)	1.36	1.07-1.75 ^b	116 (59.5)	2.04	1.46-2.84 ^a	
Externalizing behavior	2.91 (1.21)	2.62 (1.15)	2.98 (1.24)	1.31	1.18-1.45 ^a	3.01 (1.17)	1.33	1.19-1.48 ^a	3.37 (1.22)	1.67	1.46-1.91 ^a	
Internalizing behavior	1.22 (0.93)	1.21 (0.95)	1.25 (0.95)	1.05	0.92-1.19	1.18 (0.92)	0.97	0.85-1.11	1.24 (0.85)	1.05	0.89-1.25	
Socioeconomic status	3.99 (0.98)	3.92 (0.99)	3.97 (1.01)	1.06	0.94-1.20	4.05 (0.95)	1.15	1.01-1.30 ^b	4.14 (0.91)	1.27	1.07-1.51 ^a	
Separated family	576 (32.8)	160 (27.70)	163 (31.2)	1.17	0.90-1.52	171 (37.1)	1.56	1.20-2.03 ^a	82 (42.30)	1.93	1.38-2.71 ^a	
Maternal history of antisocial behavior	325 (19.0)	97 (17.20)	99 (19.40)	1.17	0.86-1.59	88 (19.70)	1.2	0.87-1.65	41 (21.90)	1.37	0.91-2.05	
Paternal history of antisocial behavior	272 (17.8)	68 (13.10)	93 (20.60)	1.73	1.22-2.44 ^a	64 (16.20)	1.26	0.87-1.83	47 (28.70)	2.62	1.71-4.02 ^a	

Table 5 (continued). Early Life Characteristics (age 5 months – 5 years) of Participants by Trajectories of Peer Victimization from 6 to 17 Years of Age (N=1760)

Characteristics	Overall	Trajectories of peer victimization from 6 to 17 years of age									
		Low (n=579)	Moderate adolescence- emerging (n=525)	Childhood-limited (n=461)			High-chronic (n=195)				
	Mean (SD) or No. (%)	Mean (SD) or No. (%)	Mean (SD) or No. (%)	OR	95% CI	Mean (SD) or No. (%)	OR	95% CI	Mean (SD) or No. (%)	OR	95% CI
Maternal depressive symptoms	1.39 (1.15)	1.25 (1.07)	1.49 (1.26)	1.20	1.08-1.34 ^a	1.43 (1.09)	1.15	1.03-1.29 ^b	1.49 (1.18)	1.22	1.07-1.41 ^a
Paternal depressive symptoms	1.06 (1.00)	0.99 (0.97)	1.11 (1.00)	1.14	1.00-1.30	1.01 (0.93)	1.02	0.89-1.17	1.27 (1.20)	1.3	1.11-1.53 ^a
Mother positive parenting	6.52 (0.89)	6.56 (0.87)	6.52 (0.90)	0.94	0.82-1.08	6.48 (0.91)	0.91	0.79-1.05	6.54 (0.91)	0.98	0.82-1.18
Father positive parenting	6.08 (1.18)	6.16 (1.19)	6.00 (1.18)	0.89	0.79-0.99 ^b	6.07 (1.19)	0.94	0.84-1.06	6.02 (1.15)	0.92	0.78-1.07
Mother coercive parenting	2.94 (0.99)	2.77 (0.94)	2.98 (1.05)	1.28	1.13-1.45 ^a	3.02 (0.94)	1.31	1.15-1.49 ^a	3.19 (1.00)	1.56	1.32-1.83 ^a
Father coercive parenting	2.56 (1.03)	2.43 (1.00)	2.58 (1.03)	1.18	1.03-1.34 ^b	2.62 (1.02)	1.21	1.05-1.38 ^a	2.76 (1.12)	1.38	1.16-1.66 ^a

^ap < .01, ^bp < .05

Table 6. Description of the Measurement Instruments for Early Childhood Behavior and Family Characteristics (5 months – 5 years)*

Characteristics	Child age at measurement ^a	Range ^b	Internal consistency	Example of items	Instrument and references
Familial and parental factors					
Socioeconomic disadvantage	5 m, 1½, 2½, 4½, 5 y	0-8		Standardized aggregate index of 5 items relating to annual gross income, parental education level, and occupational prestige	Index computed by Statistics Canada ³⁷
Non-intact family status	5 m, 1½, 2½, 3½, 4½, 5 y			1= the child was living in a single-parent family or blended family, i.e., living with step siblings at minimum one time point; 0 = otherwise.	
History of antisocial behavior	5 m			5 items (mother), 4 items (father), e.g., <i>trouble with the police or arrested; get into fights that you had started</i> . Derived measure:1= engaged in 2 or more behaviors during adolescence, 0= otherwise.	Modified from NIMH-DIS ³⁸
Depressive symptoms	Mother:5 m, 1½y; father: 5 m	0-10	.79-.81 (mother) .74 (father)	12 items, e.g., <i>did not feel like eating; felt lonely; had crying spells</i> (0=less 1 day/week to 3= 5-7days/week).	Short version of CES-D scale ³⁹

Table 6 (continued). Description of the Measurement Instruments for Early Childhood Behavior and Family Characteristics (5 months – 5 years)*

Characteristics	Child age at measurement ^a	Range ^b	Internal consistency	Example of Items	Instrument and references
Familial and parental factors					
Positive parenting	Mother: 2½, 3½, 4½, 5 y; father: 3½, 4½, 5 y	0-10	.61-.63 (mother) .71-.76 (father)	5-9 items, e.g., <i>calmly discuss the problem; play sports activities or games together; praise the child</i> (0=never to 5= several times/day).	Parenting Practices Scale ⁴⁰
Coercive parenting	Mother: 2½, 3½, 4½, 5 y; father: 3½, 4½, 5 y	0-10	.67-.72 (mother) .71-.73 (father)	5-8 items, e.g., <i>use physical punishment, tell the child is not as good as others</i> (0=never to 5= several times/day).	Parenting Practices Scale ⁴⁰
Child-level factors (mother-reported)					
Externalizing behavior	1½, 2½, 3½, 4½, 5 y	0-10	.77-.84	15-17 items, e.g., <i>hits, bites, kicks; encourages children to pick on a particular child, cannot sit still, is restless or hyperactive</i> (0=never to 2=often).	Preschool Behavior Questionnaire ^{41,42}
Internalizing behavior	1½, 2½, 3½, 4½, 5 y	0-10	.48-.67	5 items, e.g., <i>is nervous, is high-strung or tense; is too fearful or anxious</i> (0=never to 2=often).	Questionnaire ^{41,42}

Note: *For variables measured repeatedly, we derived a measure across early childhood if information was available at minimally two waves. For the continuous variables, we calculated the mean of the items of each scale. The mean at each wave was rescaled to range from 0 to 10, by multiplying it with a constant (except for socioeconomic disadvantage – index computed by Statistics Canada). ^a m=months, y=years; ^b the higher the score, the more severe the symptoms or the socioeconomic disadvantage; NIMH-DIS= National Institute of Mental Health Diagnostic Interview Schedule , CES-D=Center for Epidemiologic Studies Depression.

Table 7. Association Between Early Childhood Factors and Trajectories of Peer Victimization in Multivariate Multinomial Models* (N=1760)

Early Childhood Factors	Trajectories of peer victimization from 6 to 17 years of age					
	Moderate adolescence-emerging		Childhood-limited		High-chronic	
	OR	95% CI	OR	95% CI	OR	95% CI
Boy	1.41	1.10-1.80 ^a	1.24	0.96-1.59	1.73	1.23-2.44 ^a
Externalizing behavior	1.20	1.06-1.35 ^a	1.19	1.05-1.35 ^a	1.41	1.21-1.66 ^a
Socioeconomic disadvantage	0.94	0.82-1.08	1.01	0.88-1.16	1.01	0.83-1.22
Separated family	1.07	0.80-1.42	1.48	1.11-1.97 ^a	1.59	1.09-2.31 ^b
Paternal history of antisocial behavior	1.54	1.09-2.19 ^b	1.10	0.75-1.60	1.93	1.25-2.99 ^a
Maternal depressive symptoms	1.12	0.99-1.25	1.04	0.92-1.18	1.01	0.87-1.18
Paternal depressive symptoms	1.05	0.91-1.20	0.96	0.83-1.11	1.14	0.96-1.36
Father positive parenting	0.92	0.82-1.04	0.97	0.86-1.10	1.00	0.84-1.18
Mother coercive parenting	1.06	0.90-1.24	1.11	0.94-1.31	1.15	0.93-1.42
Father coercive parenting	1.05	0.90-1.22	1.10	0.95-1.29	1.09	0.89-1.33

* Reference category: Low peer victimization trajectory

^ap < .01, ^bp < .05

4.1.2 Study 2: Participation in childcare services and the development of peer victimization

The objective of this study was to investigate the association between childcare services use and the development of peer victimization from 6 to 17 years of age. Based on the number of hours/week of childcare services attendance, from 5 months to 53 months, we identified three trajectories which described the age of entry into and the intensity of use of childcare services: low intensity –mainly parental care, moderate intensity – progressively increasing number of hours/week from 17-53 months and high intensity -30-40 hours/week since 5 months. Using conditional latent growth curve modeling, we found that the mean level of peer victimization declined from ages 6 to 17 years for all the three groups characterizing the intensity of attendance of childcare services. Relative to children in the low group, children in the group of high intensity use of childcare services started with higher levels of peer victimization at age 6, and presented a more accentuated decline of the level of peer victimization over time. However, at age 17 both children in the low and high groups had the same level of peer victimization. Children in the group with moderate intensity use of childcare services had the same level of peer victimization at 6 and 17 years old and the same rate of change in peer victimization as children who were primarily in parental care (**Table 8, Figure 4**).

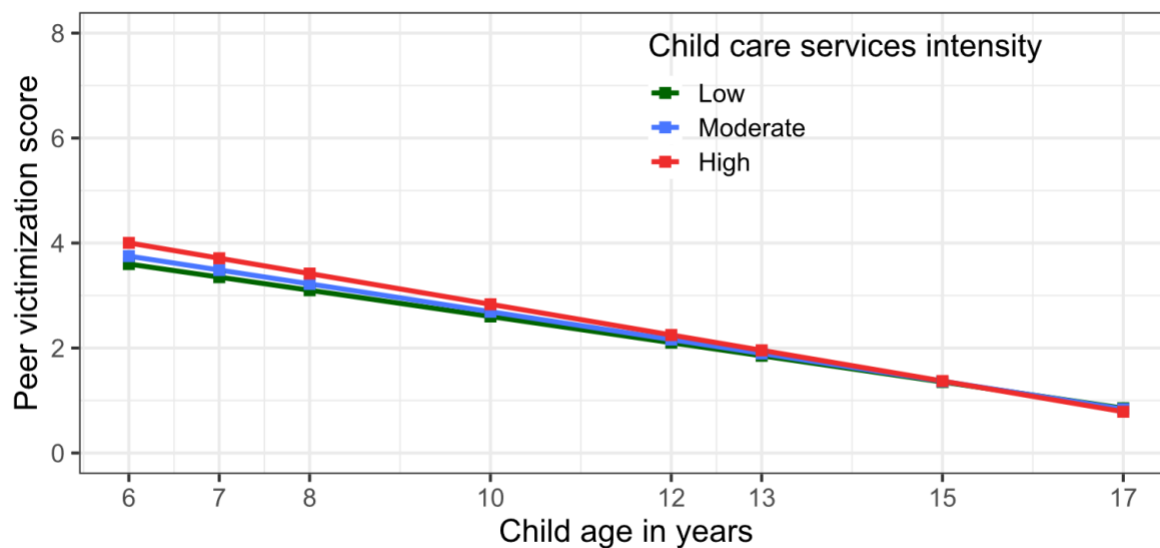
4.1.3 Complementary analyses – peer victimization trajectories

We compared the peer victimization scores at each time point between boys and girls. Boys reported higher mean scores of peer victimization at all waves according to self-reports between (6 and 17 years of age), mother's (3.5 to 6 years old) and teacher's (6 to 13 years old) ratings (Annex 7). We derived the peer victimization trajectories separately for boys and girls. As shown in Annex 8, although boys appeared to have higher levels of peer victimization than girls, the distinct patterns of peer victimization development were similar for boys and girls (i.e., the same 4 trajectories were derived both for girls and boys).

Table 8. Association between intensity of childcare participation and mean level of peer victimization evolution from 6 to 17 years of age (N=1760)

	Crude			IPW			Fully adjusted model		
	Beta	SD	p-value	Beta	SD	p-value	Beta	SD	p-value
High intensity childcare									
Intercept 6y	0.275	0.126	0.028	0.45	0.147	0.002	0.328	0.151	0.03
Intercept 17y	-0.061	0.075	0.414	-0.031	0.087	0.722	-0.008	0.091	0.932
Rate of change 6-17 y (slope)	-0.033	0.014	0.016	-0.048	0.016	0.003	-0.033	0.017	0.049
Moderate intensity childcare									
Intercept 6y	0.215	0.133	0.106	0.163	0.151	0.28	0.012	0.159	0.94
Intercept 17y	-0.031	0.08	0.698	-0.03	0.091	0.744	-0.044	0.096	0.646
Rate of change 6-17 y (slope)	-0.024	0.015	0.106	-0.019	0.016	0.235	-0.005	0.017	0.758

Figure 4. Mean level of self-reported peer victimization from 6 to 17 years of age across groups of childcare services participation intensity



4.2 Study 3: Mental health comorbidities following exposure to peer victimization in childhood and adolescence: a 20-year longitudinal investigation

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Key points

Question: Are the timing and intensity of peer victimization experiences during childhood and adolescence associated with mental health comorbidities in young adulthood?

Findings: This population-based cohort study included 1216 participants who were exposed to either no/low, childhood-limited, moderate adolescence-emerging or high-chronic peer victimization from ages 6 to 17 years. Regardless of timing or intensity, any exposure to peer victimization was associated with mental health comorbidities in young adulthood across the whole spectrum of internalizing and externalizing problems.

Meaning: Reducing peer victimization could address some of the most severe and complex presentation of mental health problems in youth.

Abstract

Importance: Peer victimization is associated with a wide range of mental health problems in youth. However, few studies described its association with mental health comorbidities, a severe form of psychopathology linked to increased mortality.

Objective: To describe the association between the timing and intensity of peer victimization experiences from 6 to 17 years of age and mental health comorbidities at 20 years of age.

Design: The Québec Longitudinal Study of Child Development (QLSCD) is an ongoing population-based longitudinal study. Participants, born in 1998/1999, and their families underwent annual or biennial assessments from 5 months to 20 years of age.

Setting: Québec, Canada

Participants: N=1216 participants who reported on their peer victimization experiences from 6 to 17 years old and mental health at 20 years old.

Exposure: Four trajectories of self-reported peer victimization: low (34.1%), childhood-limited (25.4%), moderate adolescence-emerging (29.7%) and high-chronic (10.8%).

Primary outcome: Symptoms of internalizing (depression, anxiety, eating disorders, suicidality) and externalizing (attention deficit disorder with/without hyperactivity, conduct problems and substance use) problems were self-reported at age 20 years. We derived two main outcomes: (1) number of co-occurring mental health problems with severe symptoms in the past 12 months and (2) type of severe mental health problems (i.e., no problems, internalizing only, externalizing only, internalizing-externalizing comorbidities).

Results: Compared to youth in the low victimization group, those in the childhood-limited (RR=1.36, 95% CI=1.23-1.49), moderate adolescence-emerging (RR=1.55, 95% CI=1.41-1.70), and high-chronic (RR=1.83, 95% CI=1.66-2.03) groups reported higher rates of co-occurring mental health problems in the past year. Relative to low peer victimization, moderate adolescence-emerging and high-chronic victimization increased with 96-168% the likelihood of reporting internalizing only or comorbid internalizing-externalizing problems, while childhood-limited increased with 30-60% the likelihood of any type of mental health problems. Moderate adolescence-emerging peer victimization increased with 37% the likelihood of externalizing only problems. High-chronic victims had similar levels of externalizing only problems with low victims.

Conclusion: All peer victimization experiences, even those limited to childhood were associated with mental health comorbidities in young adulthood. The persistence of peer victimization during school years was an indicator of the severity of mental health comorbidities in young adulthood.

INTRODUCTION

The co-occurrence of mental health problems (e.g., comorbidity) is the rule rather than the exception in the general population.¹⁻⁶ More than 40% of adolescents and adults with at least one mental health problem will subsequently accumulate one or more additional lifetime diagnoses.^{1,7,8} Mental health comorbidities are associated with greater psychopathological severity,^{1,2,9,10} increased mortality⁶ and a reduction of 5-17 years in life expectancy.⁶ To date, little is known about the ways to prevent the development of comorbidity within mental health disorders.

Peer victimization is a potentially modifiable factor which was found to be associated with virtually all commonly occurring mental health problems, both on the internalizing¹¹⁻²² (e.g., depression, anxiety, suicidality) and externalizing^{11,14,20,23-26} (e.g., antisocial personality, violence, criminal offending) spectra. Peer victimization is an umbrella term used to describe the experience of being the target of peers' hostile behaviors done intentionally to inflict harm and distress.²⁷ While for some children, peer victimization is a transitory experience²⁸⁻³², 2-24% of them are exposed to chronic peer victimization.^{20,28,29,31,32}

Robust evidence indicates that being chronically exposed to high levels of peer victimization is associated with serious short- and long- term mental health problems.^{11,20} However, it remains unclear whether peer victimization experiences that are limited in time (e.g., only occurring in either childhood or adolescence) and intensity (e.g., moderate, high levels) are also associated with negative mental health outcomes. Some studies suggest that children who experience peer victimization primarily during childhood do not exhibit more mental health than non-victimized children;^{30,33} On the contrary, children with adolescence-emerging peer victimization show similar level of mental health problems as those exposed to chronic peer victimization.^{30,32} However, there is also evidence showing that early, but not late experiences of peer victimization are associated with poor mental health.³⁴

Understanding how the timing and intensity of peer victimization during the school years is associated with the comorbid presentation of mental health problems may open new avenues for slowing down the mental health epidemic among today's youth.^{35,36} To date, the evidence about

the association of peer victimization with the comorbid presentation of mental health problems is scarce. Three studies which looked only at internalizing problems, found an association between peer victimization and internalizing comorbidities,^{17,37,38} as well as unique associations with anxiety and social phobia.³⁷ Four studies analyzed peer victimization in relation to different latent patterns of internalizing and externalizing problems in childhood³⁹ and adolescence.^{40–42} They found support for an association with patterns of mental health problems characterized by predominantly internalizing symptoms,⁴² predominantly externalizing symptoms when peer victimization was transient,³⁹ or comorbid internalizing and externalizing symptoms when peer victimization was persistent³⁹ or frequent⁴⁰. More recently, Forbes et al. showed that the association of peer victimization with single mental health problems and the internalizing or externalizing cluster is non-specific, being accounted for by a general latent factor for psychopathology.⁴¹ While these studies offer some indication about the association of peer victimization with mental health comorbidities, only four were longitudinal and none of them looked at externalizing and internalizing comorbidities in young adulthood. The co-occurrence of mental health problems during young adulthood could be particularly detrimental, as this period lays the foundation for adaptation to adult roles, such as integration into workforce, financial independence, the formation of lasting intimate partnerships or parenthood. If we aim to reduce the burden of mental health problems by preventing peer victimization, it is crucial to understand if the timing and intensity of peer victimization led to different mental health comorbidity profiles on the long-term.

The objective of the current study was to examine the association between the timing and intensity of peer victimization and the number and the type of comorbid mental health problems in young adulthood.

METHOD

Study Sample. We used data from the Quebec Longitudinal Study of Child Development, an ongoing population-based birth cohort established in 1997. The study follows the development of 2,120 children born between October 1997 and July 1998 to mothers residing in the Canadian province of Quebec, who gave birth to singletons after 24 weeks and not later than 42 weeks'

gestation, and who spoke English or French. The participants were selected from the Quebec Master Birth Registry through a stratified three-stage sampling design based on geographical location (remote/non-remote region) and the birth rate (low/high) of regional municipalities. The study website and previous publications contain detailed information on the QLSCD.⁴³ The QLSCD protocol was approved by the Institut de la Statistique du Québec and the Sainte-Justine Hospital Research Center ethics committees. Written informed consent was obtained from all participating families at each assessment. For the current study, data were available for 1216 participants with at least one measure of peer victimization between 6 and 17 years who answered the mental health questionnaire at 20 years old: 517 boys (42.5 %) and 699 girls (57.5%). The participants not included in the current study because they did not provide data on the outcome and exposure were more likely to be males, to come from non-intact and socioeconomically disadvantaged families, parents with low education, younger mothers with higher depressive symptoms which smoked during the entire pregnancy, higher levels of parental overprotection than the participants retained in the analytical sample. **Table 9** presents the characteristics of the participants included in this study.

Mental health outcomes at 20 years of age. When they were 20 years, participants reported on their mental health during the past year (i.e., past week(s) or past month(s) for some outcomes) through confidential online questionnaires. We assessed symptoms of internalizing problems: depression, anxiety, eating disorders, suicide attempt/ideation, and externalizing problems: attention deficit disorder with / without hyperactivity (ADHD), antisocial behavior, alcohol abuse, daily cigarette smoking, cannabis use 3 times/week or more and occasional use of hard drugs. Similar to previous studies,^{4,44,45} we used the empirically supported framework endorsed by DSM-5 for the classification of mental health problems into internalizing and externalizing categories.⁵ To identify participants with elevated symptoms, we used validated cut-offs for depression, anxiety, disordered eating behavior, ADHD and alcohol use. For the rest of the outcomes, we selected cut-offs that reflect severity while ensuring a reasonable sample size to perform the analyses (i.e., more than 5 participants in each trajectory group). A detailed description of the assessment instrument for each outcome as well as the cut-offs for severe symptomatology^{46-50, 61} are presented in **Table 10**. Our primary outcomes were (1) the number of

mental health problems with elevated symptoms in the past 12 months (count variable, range 0-10) and (2) the type of mental health comorbidities in the past 12 months, with 4 possible categories: (a) no mental health problems, (b) internalizing problem(s) only, (c) externalizing problem(s) only; and (d) internalizing-externalizing comorbidity-at least one internalizing and one externalizing problem with elevated symptoms.

Exposure to peer victimization from age 6 to 17 years. When participants were aged 6, 7, 8, 10, 12, 13, 15, 17 years, we collected information on peer victimization (verbal, relational, physical peer victimization and property attacks) using 6 items of a modified version of the Self-report victimization scale developed by Ladd and Kochenderfer-Ladd.⁵¹ Using these longitudinal data, we identified the following 4 trajectories: 1) low peer victimization across the entire period (n=579, 32.9%); (2) childhood-limited peer victimization, characterized by a relatively high level of victimization at age 6, followed by a progressive sharp decline from age 6 to 17 years, and virtually no victimization at age 17 (n=461, 26.2%); (3) moderate adolescence-emerging peer victimization, characterized by steady levels of victimization from age 6 to 12 years and the second highest level of victimization across adolescence (n=525, 29.8%); and (4) high-chronic peer victimization, characterized by persistently higher levels of victimization relative to the other groups, despite a decline from age 6 to 17 years (n=195, 11.1%) (**Figure 3**). The trajectories captured perceived peer victimization, i.e., a subjective account of the actual peer victimization. However, for the sake of simplicity throughout the text we will refer to ‘perceived peer victimization experiences’ as ‘peer victimization experiences’. Details about the estimation of these developmental trajectories of peer victimization can be found elsewhere.⁵²

Background individual, familial, and behavioral characteristics. The following factors were measured between 5 months and 5 years after birth: sex, socioeconomic status, family structure, maternal and paternal mental health and parenting, mother’s alcohol use and cigarette smoking during pregnancy, and early childhood behavior problems (i.e., overall aggression, hyperactivity, internalizing behavior - depression and anxiety symptoms, and social withdrawal) rated by the mother and the father, pre-school peer victimization and participation in childcare. For variables measured repeatedly, we calculated the mean across early childhood if information was available at minimally two waves.

Statistical analyses. We conducted two main analyses. First, we used a negative binomial regression to estimate the association between peer victimization trajectories and number of severe mental health problems at 20 years old (count variable). Second, we used a multinomial logistic regression to estimate the association between peer victimization trajectories and type of comorbidity (reference category: no mental health problems).

For each analysis, we reported both the crude and adjusted models. In adjusted models, we used propensity score (PS) inverse probability weighting (IPW)^{53 54} to account for the differences in terms of early childhood characteristics across the 4 peer victimization trajectories. We proceeded as follows. First, we calculated the standardized mean difference (SMD) for each background variable between children in the 4 trajectories of peer victimization for all 6 possible subgroups comparisons (e.g., low vs childhood-limited, moderate adolescence-emerging vs high-chronic etc.) (Annex 9). Variables showing a standardized mean difference $>.10$ in at least one of the 6 comparisons were included in the propensity score model. Second, the PS for peer victimization trajectories was estimated using multinomial regression (R package MatchThem). Third, we assessed the success of the propensity score in reducing background differences between children in the different peer victimization trajectories by comparing SMD in the weighted and non-weighted datasets. The IPW significantly reduced the differences in terms of background characteristics across the 4 peer victimization trajectories, thus increasing their comparability (Annex 9). Finally, we applied the propensity score weights to the outcome model using the IPW procedure. Covariates which were left unbalanced after the use of the IPW (socioeconomic disadvantage, maternal and paternal anxiety and hyperactivity rated by the father). Despite a reduction in the SMDs, the following variables were left unbalanced (i.e., $SMD > .10$) after the use of the PS IPW: socioeconomic disadvantage, maternal and paternal anxiety and hyperactivity rated by the father. To account for this unbalance, these variables were additionally adjusted for by inclusion as adjustment factors in the PS IPW models (fully adjusted model). To account for missing data in the background variables (below 3% for the majority and between 10-17% for father parenting and father-rated early childhood behavior), associations were estimated across 50 multiple imputed datasets (R package mice) and the results pooled.

In complementary analyses, we used binary logistic regression to estimate the association between peer victimization trajectories and each of the specific mental health problem (Annex 10).

RESULTS

Peer victimization trajectories and rate of comorbid mental health problems in young adulthood

The number of participants reporting exactly 1, 2, 3, or 4 or more severe mental health problems was: 361 (29.7%), 190 (15.6%), 120 (9.9%), and 90 (7.4%), respectively. As showed in **Figure 5**, 15 (3.6%) of the participants in the low group, 20 (6.5%) in the childhood limited, 32 (8.9%) in the moderate adolescence-emerging, and 23 (17.6%) in the high chronic group presented high levels of symptoms for 4 or more mental health problems. Over a period of 12 months in young adulthood, relative to participants in the low trajectories, those in the childhood-limited, moderate adolescence-emerging and high-chronic trajectories presented an increase of 36%, 55% and 83% in the rate of comorbid mental health problems, respectively (**Table 11**).

Perceived peer victimization trajectories and type of comorbid mental health problems in young adulthood

A total of 224 (18.4%) participants presented internalizing problem(s) only, 265 (21.8) externalizing problem(s) only and 272 (22.4%) externalizing-internalizing comorbidities. A description of the type of mental health problems in the overall sample and by peer victimization trajectory is presented in **Table 9**. The likelihood of presenting internalizing-externalizing comorbidities relative to no elevated mental health symptoms was 66%, 153% and 168% higher for children in the childhood-limited, moderate adolescence-emerging and high-chronic than for those in the low trajectory, respectively. The risk of presenting only severe internalizing problems relative to no mental health symptoms was 30%, 96% and 115% higher for children in the high-chronic, moderate adolescence-emerging and childhood-limited than for those in the low trajectory, respectively. The risk of presenting only severe externalizing problems relative to no mental health symptoms was 48% and 37% higher for children in the childhood-limited and moderate adolescence-emerging than for those in the low trajectory, respectively. Children in the

high-chronic trajectory of peer victimization had similar levels of severe externalizing problems as those in the low trajectory (**Table 11**).

Complementary analyses

The results of the association of peer victimization trajectories with each severe mental health problem separately were consistent with the main analyses. Of note, children in the childhood-limited relative to those in the low trajectory presented same likelihood of depression, anxiety and eating disorders and increased risk of reporting suicide ideation/attempt. For the externalizing outcomes, after accounting for early childhood factors, only the association with ADHD and smoking several cigarettes/day were still statistically significant (Annex 10).

DISCUSSION

This study was the first investigation of the association between different experiences of peer victimization during childhood and adolescence (varying in intensity and timing) and mental health comorbidity (distinguishing number and type) in young adulthood. Three main findings emerged.

First, we showed that participants who experienced peer victimization at moderate or high level, in childhood and/or adolescence, compared to those who did not, reported more comorbid mental health problems in young adulthood, and were more likely to present a pattern of comorbid internalizing-externalizing problems. These results are in line with studies showing that peer victimization,^{14,20} as well as other forms of interpersonal violence (e.g., domestic violence, sexual abuse)⁴⁵ are associated with general psychopathology, rather than specific mental health problems. This may indicate that peer victimization, similar to other forms of childhood maltreatment, is a transdiagnostic risk factor, with associations across the entire spectrum of psychopathology. Furthermore, we showed that persistent peer victimization was more detrimental to mental health than childhood limited peer victimization. High-chronic peer victimization showed the highest rate of co-occurring mental health problems in young adulthood similar to previous studies on the association of high-chronic victimization with the most serious symptoms for specific mental health problems.^{11,20,39} Moreover, children experiencing moderate adolescence-emerging and high-chronic peer victimization were approximately twice more likely than non-victimized

children to show internalizing problems and internalizing-externalizing comorbidities. On the other hand, even if childhood-limited peer victimization was not an anodyne experience for mental health in young adulthood, it increased only moderately (30-60%) the likelihood of presenting any type of mental health problems (i.e., internalizing, externalizing, comorbid internalizing-externalizing). These findings corroborate those pointing out that the persistence, which is one of the core features of bullying victimization,⁵⁵ has actually the most pervasive and persistent consequences in terms of wellbeing.⁵⁶

Second, we showed that exposure to childhood-limited, moderate adolescence-emerging and high-chronic peer victimization related differently with the presence of externalizing and internalizing problems. Exposure to high-chronic peer victimization was associated with comorbid externalizing-internalizing and with internalizing only problems, but not with externalizing only problems. Furthermore, we found that children who relative to the majority of their peers experienced higher levels of peer victimization only during adolescence (i.e., moderate adolescence-emerging group) exhibited internalizing and comorbid internalizing-externalizing problems similar to high-chronic victims. These findings are in line with those from previous studies which showed that children who experienced moderate adolescence-emerging peer victimization had increasing levels of anxiety over time,³³ similar to those of chronic victims.³² Furthermore, we showed that childhood-limited peer victimization was mainly associated with externalizing problems and suicide ideation/attempt, but not with depression, anxiety or eating disorders in young adulthood. These results are also in line with studies showing an association with externalizing problems (e.g., higher rates of substance abuse, violence and instances of arrests) for childhood bullying victimization^{57,34} and for transient victimization.³⁹ Furthermore, they mirror findings from studies which described desisting trajectories of peer victimization associated to lower levels of anxiety and solitary behavior compared to chronic or late-onset victimization^{33,32,57,34} This is also in line with studies showing a dissipation over time of the effect of peer victimization on mental health.^{13,14}

Third, we showed that pre-existent vulnerabilities only accounted for part of the association between the trajectories of peer victimization and later mental health comorbidities. When covariates were taken into account in our models, the larger change in the association was observed

for the high-chronic victimization group across the majority of the outcomes. Previous studies have shown that liability for psychopathology accounted for a part of the association between peer victimization and later mental health problems, but did not totally explain it.^{28,58}

Future studies are needed to understand the mechanisms through which some children escape early severe peer victimization. Moreover, it is important to clarify which factors differentiate between the experiences of high and moderate persistent peer victimization, beyond the individual and family characteristics. For instance, a genetically-informed study by Bowes et al., indicates that the experience of chronic victimization is explained by both genetic and shared-environmental factors, while late-onset victimization is explained by genetic and non-shared environmental factors.²⁸ Future studies should assess to what extent genetic factors explain the association between peer victimization timing and intensity and mental health comorbidity.

Limitations

Our findings should be considered in the context of limitations. First, both the outcomes and the exposure were self-reported by the participants. Therefore, associations might be overestimated because of the same-rater bias. Although teacher or peer's assessments may avoid this bias, subjective experience was shown to be a critical element to understand mental health consequences of interpersonal violence.⁵⁹ Second, although for the majority of the outcomes we used validated cut-offs of scales based on the symptoms described in DSM V, we had no access to formal diagnoses. Third, by accounting for children's behavior only prior to school entry, it is possible that behaviors which become apparent at older ages, such as internalizing behaviors or proximal behaviors (e.g., social isolation, friendlessness⁶⁰) which entertain bi-directional relations with peer victimization, may still play a role in the investigated associations. However, since our exposure described the evolution over time of peer victimization, we could not separate the contribution of the behaviors which are simultaneous with peer victimization from 6 to 17 years old. Fourth, because of attrition, our study was based on 57% of the original representative sample, hence generalizability to the whole Québec population must be prudent. Fifth, propensity score only account for measured confounding factors, therefore unmeasured factors (including genetic vulnerability) may still explain the observed association. This calls for cautious interpretations of the causal nature of our associations. Sixth, we did not have enough power to test sex differences.

Conclusion

Our studied showed that transient and persistent peer victimization experiences during childhood and adolescence were associated with mental health comorbidities in young adulthood, with a particularly high likelihood of presenting mental health comorbidities for children who reported persistent peer victimization. Reducing peer victimization during childhood and adolescence could address some of the most severe and complex mental health problems in young adulthood.

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Figure 5. Number of mental health problems in young adulthood according to trajectories of peer victimization from 6 to 17 years of age

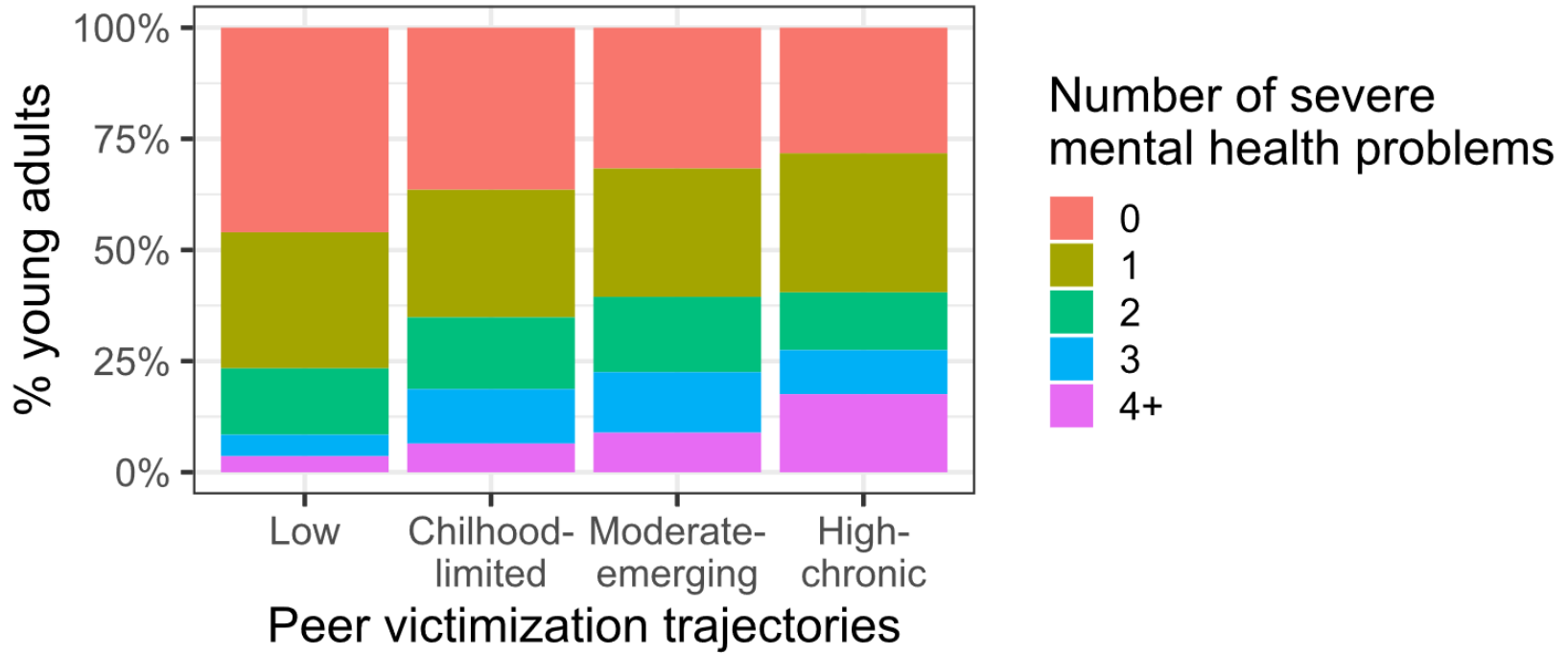


Table 9. Early childhood characteristics and mental health in young adulthood by peer victimization trajectories

	Peer victimization trajectories				
	Overall	Low	Childhood-limited	Moderate adolescence-emerging	High-chronic
n	1216	415	310	360	131
Mental health outcomes					
Type of mental health problems					
No problem	455 (37.4)	191 (46.0)	113 (36.5)	114 (31.7)	37 (28.2)
Internalizing problems only	224 (18.4)	75 (18.1)	53 (17.1)	69 (19.2)	27 (20.6)
Externalizing problems only	265 (21.8)	83 (20.0)	76 (24.5)	80 (22.2)	26 (19.8)
Internalizing-externalizing comorbidities	272 (22.4)	66 (15.9)	68 (21.9)	97 (26.9)	41 (31.3)
Internalizing					
Severe depression	77 (6.3)	14 (3.4)	14 (4.5)	31 (8.6)	18 (13.7)
Severe anxiety	64 (5.3)	17 (4.1)	11 (3.5)	21 (5.8)	15 (11.5)
Eating disorders	407 (33.5)	119 (28.7)	97 (31.3)	139 (38.6)	52 (39.7)
Suicidal ideation/Attempt	124 (10.2)	23 (5.5)	35 (11.3)	43 (11.9)	23 (17.6)
Externalizing					
ADHD	362 (29.8)	100 (24.1)	96 (31.0)	119 (33.1)	47 (35.9)
Conduct problems	57 (4.7)	9 (2.2)	16 (5.2)	23 (6.4)	9 (6.9)
High risk use of alcohol (AUDIT)	46 (3.8)	11 (2.7)	15 (4.8)	13 (3.6)	7 (5.3)
Several cigarettes/day	91 (7.5)	11 (2.7)	30 (9.7)	34 (9.4)	16 (12.2)
Cannabis use 3 times/week or more	121 (10.0)	24 (5.8)	30 (9.7)	45 (12.5)	22 (16.8)
Hard drugs occasional use	184 (15.1)	47 (11.3)	55 (17.7)	54 (15.0)	28 (21.4)

Table 9 (continued). Early childhood characteristics and mental health in young adulthood by peer victimization trajectories

	Peer victimization trajectories				
	Overall	Low	Childhood-limited	Moderate adolescence-emerging	High-chronic
N	1216	415	310	360	131
Early childhood characteristics					
Boy	517 (42.5)	143 (34.5)	127 (41.0)	169 (46.9)	78 (59.5)
First born	556 (45.7)	187 (45.1)	136 (43.9)	167 (46.4)	66 (50.4)
Socioeconomic disadvantage	3.89 (0.97)	3.82 (0.97)	3.95 (0.94)	3.86 (1.02)	4.05 (0.91)
Separated family	350 (28.8)	100 (24.2)	96 (31.0)	101 (28.1)	53 (40.5)
Childcare services participation	825 (67.8)	265 (63.9)	218 (70.3)	242 (67.2)	100 (76.3)
Parental age, mental health and parenting					
Maternal age	29.17 (5.04)	29.48 (4.92)	28.60 (4.96)	29.53 (5.10)	28.52 (5.31)
Paternal age	31.91 (5.52)	32.14 (5.29)	31.25 (5.84)	32.37 (5.35)	31.49 (5.79)
Maternal antisocial behavior	216 (18.3)	66 (16.3)	55 (18.3)	66 (18.8)	29 (23.0)
Paternal antisocial behavior	187 (17.2)	46 (12.3)	46 (16.5)	69 (21.5)	26 (22.8)
Maternal smoking (pregnancy)	230 (19.0)	61 (14.7)	59 (19.2)	79 (22.1)	31 (23.8)
Maternal alcohol use (pregnancy)	190 (15.7)	55 (13.3)	44 (14.2)	69 (19.3)	22 (16.9)
Maternal depression	1.33 (1.13)	1.22 (1.06)	1.32 (1.05)	1.42 (1.24)	1.45 (1.17)
Paternal depression	1.04 (0.99)	0.95 (0.94)	1.04 (1.00)	1.09 (1.01)	1.16 (1.09)
Maternal anxiety	1.21 (1.21)	1.17 (1.26)	1.22 (1.17)	1.20 (1.16)	1.37 (1.26)
Paternal anxiety	1.20 (1.21)	1.08 (1.12)	1.24 (1.18)	1.19 (1.21)	1.54 (1.48)
Mother positive parenting	6.55 (0.88)	6.61 (0.86)	6.54 (0.91)	6.50 (0.90)	6.57 (0.87)
Father positive parenting	6.09 (1.18)	6.20 (1.20)	6.08 (1.17)	5.98 (1.16)	5.99 (1.13)
Mother coercive parenting	2.90 (0.99)	2.73 (0.92)	2.95 (0.92)	2.93 (1.07)	3.19 (1.05)
Father coercive parenting	2.54 (1.02)	2.40 (0.98)	2.65 (1.02)	2.54 (1.03)	2.72 (1.10)

Table 9 (continued). Early childhood characteristics and mental health in young adulthood by peer victimization trajectories

	Peer victimization trajectories				
	Overall	Low	Childhood-limited	Moderate adolescence-emerging	High-chronic
n	1216	415	310	360	131
Early childhood behavior rated by the mother					
Aggression	1.85 (1.07)	1.68 (1.03)	1.88 (0.96)	1.94 (1.18)	2.09 (1.11)
Hyperactivity	3.82 (1.65)	3.45 (1.59)	3.94 (1.62)	3.90 (1.64)	4.49 (1.67)
Internalizing behavior	1.20 (0.93)	1.22 (0.95)	1.13 (0.89)	1.26 (0.95)	1.15 (0.85)
Social withdrawal	3.19 (1.77)	3.42 (1.78)	2.95 (1.65)	3.20 (1.81)	3.05 (1.83)
Pre-school peer victimization	1.47 (1.22)	1.34 (1.16)	1.45 (1.22)	1.53 (1.25)	1.73 (1.31)
Early childhood behavior rated by the father					
Aggression	1.86 (1.24)	1.68 (1.19)	1.92 (1.26)	1.94 (1.29)	2.08 (1.18)
Hyperactivity	3.58 (1.60)	3.22 (1.57)	3.73 (1.54)	3.62 (1.59)	4.27 (1.54)
Internalizing behavior	1.68 (1.26)	1.63 (1.25)	1.62 (1.28)	1.71 (1.23)	1.87 (1.37)
Social withdrawal	3.49 (1.52)	3.61 (1.51)	3.32 (1.46)	3.54 (1.56)	3.40 (1.58)
Pre-school peer victimization	1.13 (1.10)	0.99 (1.04)	1.23 (1.17)	1.20 (1.12)	1.18 (0.98)

Table 10. Description of instruments used for the assessment of mental health at 20 years old

Outcome, Scale	No items (examples)	Scale score and cut-offs for severe symptoms
Internalizing outcomes		
Depression		
CES-D short version	12 items referring to the past week, e.g., 'my appetite was poor', 'I could not shake off the blues', 'I felt depressed', 'I felt that people disliked me'	Score range 0-36; Validated cut-off for very elevated symptoms: >=21
CES-D-12-NLSCY ⁴⁶	Response options: (0-rarely/less than 1 day to 3 – most of the time/5-7 days)	
Anxiety		
Generalized Anxiety Disorder-7 ⁴⁷⁻⁴⁹ (GAD-7)	7 items referring to the past 2 weeks, e.g., 'feeling nervous, anxious or on edge', 'not being able to stop or control worrying', 'becoming easily annoyed or irritable' Response options: 0=not at all to 3=nearly every day	Score ranges from 0-21 Validates cut-off for very severe symptoms: >=15
Disordered eating behaviors		
SCOFF Questionnaire ⁶¹	4 items referring to the past 12 months, e.g., 'I made myself sick for fear of gaining weight.' I believed myself to be too fat when others said I was too thin' with response options: 0=No to 2=Often and 1 item referring to the past 3 months: 'I lost over 13 pounds (6 kilos)' (yes/no)	Response 'yes' for 2 or more items
Suicidal ideation/attempt		
	2 questions referring to the past 12 months concerning suicide attempts and suicidal ideation Response options: 0=No; 1=Yes	Response 'Yes' for either suicide attempt or ideation (126 ideation/attempt, 26 with suicide attempt)

Table 10 (continued). Description of instruments used for the assessment of mental health at 20 years old

Outcome, Scale	No items (examples)	Scale score and cut-offs for severe symptoms
Externalizing outcomes		
Attention deficit disorder with/without hyperactivity		
Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist ⁵⁰	6 items referring to the past 6 months, e.g., 'do you have trouble wrapping up the final details of a project, once the challenging parts have been done', 'when you have a task that requires a lot of thought, do you avoid or delay getting started', 'do you fidget or squirm with your hands or feet when you have to sit down for a long time' Response options: 0-never to 4-very often	1=the patient has symptoms highly consistent with ADHD in adults; 0=otherwise
Conduct problems		
Self-reported Delinquency Questionnaire (Travis Hirschi)	7 items referring to the past 12 months, e.g., 'have you gone into a place without paying when payment was required', 'have you gotten into a fist fight with someone else', 'have you spread false rumours to destroy someone's reputation', 'have you been arrested and taken to a police station because you did something illegal' Response options: 0-never to 3-very often; re-categorized in 0-'No', 1-any other option.	Response 'Yes' for 3 or more items
Alcohol abuse		
AUDIT Scale	10 items referring to the past 12 months, eg., 'How often have you been unable to remember what happened the night before because you had been drinking?'; 'How often have you found that you were not able to stop drinking once you started?' Response options: 0=Never to 4= Daily or almost daily	Score ranging from 0-20 Validated cut-off for risky use >=8

Table 10 (continued). Description of instruments used for the assessment of mental health at 20 years old

Outcome, Scale	No items (examples)	Scale score and cut-offs for severe symptoms
Cigarette smoking several times/day – past month	<p>1 question referring to the past month</p> <p>Response options: 0=Never, 1=a few times, 2=almost every day, 3=every day, 4=Every day, Several times/day</p>	Yes for the response option ‘Several times/day’
Cannabis use 3 time or more/week – past 12 months	<p>1 question referring to the past month</p> <p>Response options: 0=Never, 1=Occasionally, 2=Approximately once a month, 3=weekends or once or twice during the week, to 4=3 times or more a week, but not every day, 5= every day</p>	Yes for the response option ‘3 times or more a week, but not every day ’
Occasional use of hard drugs – past 12 months	<p>5 questions referring to past 12 months on the use of any of the following illicit drugs: cocaine, glue/solvents, hallucinogens, heroin, amphetamines/speed</p> <p>Response options: 0=Never, 1=Occasionally, 2=Approximately once a month, 3=weekends or once or twice during the week, 4=3 times or more a week, but not every day, 5= every day</p>	Yes for the response option ‘ocassionally or more often ’

Table 11. Association of peer victimization trajectories for 6 to 17 years of age with mental health comorbidities at 20 years of age

	Crude estimates			Adjusted estimates		
	Childhood-limited	Moderate adolescence-emerging	High-chronic	Childhood-limited	Moderate adolescence-emerging	High-chronic
Severe mental health problems count	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)	RR (95%CI)
	1.42 (1.20-1.68)	1.60 (1.36-1.88)	1.99 (1.63-2.46)	1.36 (1.23-1.49)	1.55 (1.41-1.70)	1.83 (1.66-2.03)
Type of mental health problems	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
No problem	ref	ref	ref	ref	ref	ref
Internalizing only	1.19 (0.78-1.82)	1.54 (1.03-2.30)	1.86 (1.06-3.26)	1.30 (1.02-1.65)	1.96 (1.56-2.47)	2.15 (1.64-2.81)
Externalizing only	1.55 (1.05-2.28)	1.61 (1.10-2.37)	1.62 (0.92-2.84)	1.48 (1.19-1.83)	1.37 (1.10-1.71)	1.19 (0.91-1.54)
Comorbid	1.74 (1.15-2.63)	2.46 (1.67-3.63)	3.21 (1.90-5.42)	1.66 (1.32-2.10)	2.53 (2.02-3.17)	2.68 (2.10-3.43)

Chapter 5 Discussion

5.1 Main findings and implications

5.1.1 Peer victimization from 6 to 17 years of age: persistent and transient experiences

We identified four distinct trajectories of peer victimization from ages 6 to 17. Thirty-three percent of children in our study experienced low levels of peer victimization from school entry to the end of high school (labelled “low peer victimization”), 26% experienced high levels of peer victimization only during the first years of schooling (labelled “childhood-limited peer victimization”), 30% experienced moderate levels of peer victimization during elementary school which persisted during the high school years (labelled “moderate adolescence-emerging” peer victimization), and 11% experienced high levels of peer victimization from school entry to the end of high school (“labelled ‘high-chronic’”). During middle childhood (ages 6-12 years), we observed substantial differentiation in the development of peer victimization, with about 40% of the children entering a pathway towards persistent peer victimization (at moderate or high level), and 26% reporting transitory peer victimization. Contrary to middle childhood, in adolescence (ages 13-17 years), the development of peer victimization did not show substantial variability. In other words, children who experienced persistent peer victimization during middle childhood continued to be victimized also during adolescence (i.e., the moderate adolescence-emerging group and the high-chronic group).

These findings indicate that middle childhood, and more precisely the first years in elementary school, is a critical window of opportunity for breaking the cycle of persistent peer victimization. While many preventive interventions focused on older children and adolescents,¹⁶⁹ our findings indicate that preventive actions for tackling peer victimization might be more effective if implemented during middle childhood. Future studies can explore this hypothesis by investigating whether the age at which interventions to prevent peer victimization are implemented have an influence on their effectiveness. Furthermore, our findings suggest that it may be useful to integrate peer victimization screening in middle childhood, for instance during well-child visits performed by pediatricians.¹⁷⁰

5.1.2 Early childhood factors associated with the development of peer victimization

5.1.2.1 Individual level factors

Consistent with previous research,^{9,42,46,47} we found that being a boy and exhibiting high externalizing behavior problems during the preschool years were important factors for the development of persistent peer victimization (i.e., moderate adolescence-emerging or high-chronic trajectories). Children who exhibited the highest levels of externalizing behavior during early childhood endured the highest levels of peer victimization from 6 to 17 years of age (i.e., high-chronic victims). These findings echo previous studies on early childhood behavioral development showing that externalizing behaviors are related to long-term maladjustment (i.e., pre-school expulsions, ADHD, low academic success).^{48,171–173} Similar to other studies among young children,^{42,46,47} we found that across the four peer victimization trajectories children had similar internalizing symptoms prior to school entry. These findings differ from those of studies looking at older children and adolescents,¹⁶ probably because internalizing symptoms are more likely to be perceived negatively by peers and associated with peer victimization as children grow older.⁴⁸ Thus, it is important for parents, health care professionals and educators to be aware that children who exhibit externalizing symptoms in early childhood are not only involved in bullying as perpetrators, but also as victims. Offering support to these children and their families with the management of externalizing behaviors^{174–176} (e.g., referral to family behavioral counselling or parent training) may have, as a spillover effect, a reduction in the severity of peer victimization reported by children during middle childhood.

5.1.2.2 Family-level factors

We showed that paternal history of antisocial behavior was associated with persistent peer victimization (i.e., high-chronic and moderate-emerging trajectories) when controlling for children's sex, behavior, maternal factors, parenting, socioeconomic disadvantage and family structure. This finding is in line with a prior study showing that paternal hostility was associated with bullying behavior.¹⁷⁷ Moreover, we showed in univariate analyses that relative to children in the low trajectory of peer victimization those in the other three trajectories were more likely to be

exposed to maternal depression and maternal and paternal coercive parenting. Moderate adolescence-emerging victims did not differ from low victims on other sociodemographic family characteristics. However, children reporting high levels of peer victimization at school entry (i.e., childhood-limited and high-chronic trajectories) were more likely to come from socioeconomically disadvantaged environments and live in a separated family (i.e., mainly single-mother families). After accounting for other family characteristics and children's behavior, only the association between high levels of peer victimization at school entry and living in a separated family remained. These findings suggest that the experience of high-chronic victimization is associated with exposure to environments characterized by the clustering of adversities (i.e., related to both paternal mental health and sociodemographic factors) during early childhood, while that of moderate adolescence-emerging and high-chronic victimization is mainly associated with exposure to father's externalizing behavior and sociodemographic disadvantage, respectively.

Awareness of such pre-existing vulnerabilities can help to further tailor peer victimization preventive interventions, for instance by addressing parents' mental health needs and offering families support to promote healthy socio-emotional development for their children.

5.1.2.3 Participation in childcare services

Serious concerns have been raised about the negative effect that participation in childcare services may have on children's social and behavioral development.⁶⁰⁻⁶² However, our findings showed that the age of entry into childcare services and the number of hours/week of attendance were not associated with peer victimization from 6 to 17 years of age. Although children who attended childcare service from an early age (i.e., 5 months) for a high number of hours (i.e., 40h/week) were more likely to experience increased levels of peer victimization compared to children cared for mainly by their parents, this increase was limited to the first years in elementary school and disappeared over time. Specifically, we found that children with early and intense exposure to non-parental childcare services had a more accentuated decline in the level of peer victimization over time compared to those in parental care. Furthermore, by age 17 years no difference in peer victimization could be detected across children with different experiences of childcare. This study provides preliminary reassuring evidence for parents that their choices

regarding the age at entry into childcare services and the intensity of attendance should not have an effect on their offspring's experiences of peer victimization in the long-term.

5.1.3 Interindividual differences in the development of peer victimization and mental health comorbidities in young adulthood

We showed that all peer victimization experiences across childhood and adolescence, even those limited to the first years in elementary school, were associated with mental health comorbidities in young adulthood. However, timing and intensity of peer victimization related differently to the severity and type of mental health comorbidities. Similar to previous studies,^{10,138} we showed that children with moderate adolescence-emerging peer victimization were similar to the high-chronic victims in terms of mental health problems in young adulthood. Specifically, moderate adolescence-emerging and high-chronic peer victimization groups showed the highest rate of co-occurring mental health problems in young adulthood and associations with internalizing and comorbid externalizing-internalizing problems. On the other hand, childhood-limited peer victimization was mainly associated with externalizing problems and suicide ideation/attempt, but not with other internalizing outcomes (i.e., depression, anxiety, or eating disorders) in young adulthood. For childhood-limited victims, an important part of the effect for externalizing problems was explained by early childhood factors. Our results indicated that beyond early childhood vulnerabilities, the persistence of peer victimization during childhood and adolescence is a marker for the severity of psychopathology in young adulthood. Moreover, our results are in line with studies showing that peer victimization,^{134,135} as well as other forms of victimization/interpersonal violence (e.g., domestic violence, sexual abuse, or cyber-victimization)¹⁴⁸ are associated with general psychopathology rather than specific mental health problems.

5.2 Emerging issues and future research

5.2.1 The origins of interindividual differences in perceived peer victimization over time

We have unraveled some of the family and individual early childhood factors that are distinctly associated with certain patterns of peer victimization evolution across childhood and

adolescence. Future studies should explore the mechanisms through which different constellations of early childhood factors relate to developmental trajectories of peer victimization. Some hypotheses could be formulated based on our results and findings from previous genetically informed studies, which suggest that genetic factors account for an important part of the variation in persistent peer difficulties.^{9,43} First, there is suggestive evidence that the persistence of peer victimization is linked to a genetic vulnerability to mental health problems. We could not test this hypothesis, but we showed that father's mental health was only associated with persistent (i.e., moderate adolescence-emerging and high-chronic trajectories) and not with transient (i.e., childhood-limited trajectory) peer victimization. This hypothesis is supported by evidence from twin studies which indicate that genetic factors account for an important part of the variation in persistent peer difficulties.^{9,43} Moreover, there is evidence that genetically influenced vulnerabilities are likely to be fairly stable over time.¹⁷⁸ Additionally, a recent polygenic score study showed that high genetic risk for mental health problems was associated with increased exposure to bullying.¹⁷⁹ In other words, the genetic risk for depression and ADHD increased the risk of depressive and ADHD symptoms, which, in turn, were associated with an increase in exposure to bullying.¹⁷⁹ Although we could not test this hypothesis with our data, our findings are consistent with these genetically informed studies. For example, we showed that father's antisocial behavior problems were associated with persistent (i.e., moderate adolescence-emerging and high-chronic trajectories), but not with transient (i.e., childhood-limited trajectory) peer victimization and that the highest level of child externalizing problems was associated with the most severe form of peer victimization (i.e., high-chronic trajectory). Taken together, these findings suggest that a genetic liability to externalizing problems plays a role in the development of peer victimization.

Second, even if the children in the two groups experiencing persistent peer victimization were exposed to paternal mental health problems, they differed regarding other indicators of childhood adversity. For instance, exposure to socioeconomic disadvantage and living in a separated family was associated with high-chronic, but not with moderate adolescence-emerging peer victimization. Therefore, it could be that environmental adversity factors in combination with family liability to mental health problems are associated with the most severe experiences of peer victimization, while family liability to mental health problems in the absence of other

environmental vulnerabilities is associated with persistent adolescence-emerging peer victimization. This hypothesis is supported by the genetically informed study by Bowes et al, which showed that shared environmental factors had no effect on late-onset victimization (i.e., early adolescence-emerging peer victimization) which was solely influenced by genetic (66.7%) and non-shared environmental factors (33.3%).⁹ On the other hand, for the variance in the chronicity of peer victimization, shared environmental factors accounted for 41%, non-shared environmental for 12% and genetic factors for 47%.⁹ Thus, chronic peer victimization was explained mainly by genetic and shared environmental factors, while late-onset peer victimization mainly by genetic and non-shared environmental factors.

Third, understanding the difference between childhood-limited and high-chronic peer victimization could inform researchers about mechanisms of resilience, at least regarding the development of internalizing problems. Indeed, exposure to high levels of peer victimization limited to childhood was still associated with externalizing problems and suicidality even many years after peer victimization ceased, but not with internalizing problems. One potential factor that could be investigated to elucidate the difference between these two distinct developmental trajectories is parenting. It has been shown in other studies that warm parenting has the potential to buffer the adverse consequences of bullying.^{59,180} Moreover, it is important to understand how the interplay between parents' mental health and parenting influences the development of peer victimization.

5.2.2 Can we prevent the accumulation of mental health comorbidities in children victimized by their peers?

We showed that peer victimization across childhood and/or adolescence is associated with internalizing-externalizing comorbidities. This suggests that peer victimization, similarly to other forms of early childhood adverse interpersonal experiences,¹⁸¹ may alter psychological and neurobiological processes that confer broad vulnerability to multiple types of psychopathology. There is evidence that peer victimization is associated with dysfunction in the hypothalamic-pituitary-adrenal axis which regulates the stress response. For example, it has been shown that bullying victimization in childhood was associated with blunted salivary cortisol response which

in turn was associated with problems with social interactions and aggressive behavior among children who were victims of bullying or physical maltreatment.^{182,183} Moreover, it has been demonstrated that transdiagnostic mechanisms (e.g., emotional reactivity and dysregulation) explain the association of early childhood adversity with psychopathology.^{181,184} Future studies are needed to understand if similar mechanisms explain the association of peer victimization with psychopathology.

Preventive interventions tackling such general mechanisms may reduce the adverse effect of peer victimization on psychopathology. Interventions focused on teaching coping skills for dealing with emotional reactivity and dysregulation, managing stress reactions or threat-related social information processing biases have been suggested as possible ways to reduce the risk of psychopathology among victims of peer victimization or interpersonal violence.^{181,184}

5.2.3 Do childcare services have the potential to attenuate the impact of early childhood adverse factors on subsequent experiences of persistent peer victimization?

We did not find evidence that attending childcare services was associated with long-lasting effects on peer victimization. Previous studies found that participation in childcare services had positive effects on cognitive and emotional development and early physical aggression, mainly among disadvantaged children.^{146,185–187} The lack of association in the overall sample could be due to an effect mainly among those exposed to adversity in early childhood. Future analyses should elucidate if the early childhood factors which have been previously associated with persistent peer victimization (i.e., parents' mental health, coming from a separated family) moderate the association between childcare participation and the development of peer victimization. Moreover, there is also abundant evidence regarding the quality of center-based childcare services and child development, often extending through adolescence and into young adulthood.^{188–190} Future studies should also explore if the quality and type of childcare influence the development of peer victimization.

5.2.4 Public health implications

Our findings suggest that, given the diversity of perceived peer victimization experiences and the specific early childhood vulnerabilities associated with these experiences, it is important to complement universal preventive interventions with targeted interventions. There are already recommendations for schools to use a three-tiered public health model for the prevention of bullying and behavioral problems.¹⁶⁹ This approach includes 1) universal preventive interventions which usually meet the needs of 80% of students within a school (implemented at school levels and addressed to all) , 2) selective interventions which are more intensive interventions addressed to those at risk of being involved in bullying (implemented in small groups – intensive social skills training or emotion-regulation approach, 10-15% may require this level of support) and 3) indicated prevention – tailored to the needs of those presenting negative effects of bullying victimization or those showing early signs of problem behaviors (it may include the family of the victim, addressed to 5% of children).¹⁶⁹

Moreover, the results of the current research show that peer victimization experiences associated with detrimental outcomes in young adulthood have their onset in the first years of elementary school. This calls for early and continued actions to prevent peer victimization and manage its long-term impact on mental health.

5.3 Methodological considerations

5.3.1 Study design

A major strength of the current thesis is its reliance on the QLSCD longitudinal birth cohort study with repeated measures collected at multiple time points over 20 years, from early childhood to young adulthood. First, in all the studies included in this thesis, the longitudinal design allowed for clear specification of the temporal sequence between exposure and outcome, since subjects are free of the outcome of interest at enrollment, even more so as this is a birth cohort. Second, since the measures are collected prospectively, the risk of recall bias is not a threat to the internal validity of the study. Third, availability of measures collected since birth allowed a comprehensive analysis of the contribution of early childhood factors (e.g., behavior, maternal and paternal mental health,

parenting, family structure and socioeconomic disadvantage) to the development of peer victimization. Fourth, the high-quality repeated measures of peer victimization over 12 years allowed us to apply a longitudinal person-centered approach to derive the peer victimization trajectories. Our study is the largest and one of the longest studies of peer victimization development to date.

5.3.2 Selection bias

Selection bias is a systematic error derived from selecting into the study subject who are more or less likely to have the outcome of interest.¹⁹¹ The QLSCD is a population-based study for which the initial sampled population was representative of 94.5% of the target population, i.e., the Quebec newborns in 1997/1998. Therefore, the selection bias that comes from an unrepresentative study population should be limited. However, the selection bias can exist in other forms. First, it can occur due to differential loss to follow up (attrition bias). In 2018, 20 years after the enrollment of the participants in the QLSCD, the response rate was 59%. Like in many longitudinal studies the probability of discontinued participation or loss to follow-up was dependent on characteristics such as being a boy, coming from a separated and socioeconomically disadvantaged family and having parents with low education. Given that the participants lost to follow-up have a profile which in general is associated with high risk for poor adjustment outcomes, it is possible that we have underestimated the magnitude of the associations of peer victimization with early childhood factors and mental health problems at age 20 years. In **Study 1**, to minimize attrition bias, analyses were conducted using weights accounting for the probability of being retained in the study at follow-up. Results with and without weights were fairly similar, strengthening the internal validity of our findings. Second, the results on the effect of childcare services on the development of peer victimization (**Study 2**) may be affected by the ‘self-selection’ bias. Attending childcare services is not a random event. In general, mainly families with certain characteristics (e.g., better-off families) succeed in having access to childcare service.¹⁹² It has been shown repeatedly that children exposed to higher levels of family or maternal risk characteristics (i.e., low education, low income) who would benefit the most in terms of healthy development from participation in childcare services are more likely to receive parental or informal childcare^{146,193,194}. Thus, we would be more likely to underestimate the effect of childcare on peer victimization. We used

propensity score weighting in an attempt to reduce the differences in the baseline factors associated with ‘self-selection’ into childcare among children who remained mainly in parental care and those who attended childcare services. However, propensity score does not account for unmeasured factors and therefore it is likely that residual selection bias remained unaccounted.

5.3.3 Misclassification

Misclassification in its strict sense of assignment of a subject to a different category than the one in which an individual should be, it is less obvious for variables which describe latent groups (e.g., the peer victimization trajectories). The peer victimization groups are derived based on the highest posterior probability of belonging to each group. Misclassification would be a problem in the case of posterior probabilities which are similar and therefore, do not discriminate very well between the groups. The average posterior probability for our group-based trajectory model was good. Another source of ‘statistical/conceptual’ misclassification could be related to the number of repeated measures used to derive the trajectories. Both the model based on three repeated measures and the one based on one measure identified the same trajectories. To maximize the sample size, we used the model based only on one measure.

We might have misclassified youth with depression and anxiety during the past 12 months as for these outcomes the questions referred to the presence of symptoms during the past weeks. However, it is very likely that this misclassification is non-differential, i.e., similar across the 4 peer victimization groups. Thus, this did not bias our estimates for the association between peer victimization and mental health comorbidities, but it might have reduced the power to detect the associations.

5.3.4 Confounding

Confounding refers to a situation where the effect of the exposure on the outcome is, at least partially, due to the effect of the third variable. Confounders are defined as factors that are related to both exposure and disease and are not an intermediate step in the causal pathway between them.¹⁹¹ In all the studies included in the current thesis, we adjusted the models, not only for confounders, but for all the variables preceding the exposure which could be theoretically

associated to either the exposure or the outcome (e.g., children's behaviors, family sociodemographic factors, parents' mental health, parenting). To account for the role of these variables in the relation between our exposure and outcome, we used propensity score weighting. For this method, it is recommended to include as many variables as possible, because the bias is higher if potentially important variables which could be associated with the exposure are omitted.¹⁶¹ However, even if we accounted for many measured factors, there are unmeasured factors which we could not take into account, such as genetic factors. Genetic factors could bias our findings on the association of peer victimization with mental health comorbidities as they are associated both with the outcome and exposure. However, the proposed mechanism through which genetic factors influence peer victimization, is mediated through the symptoms of depression which will make children more vulnerable to be victimized. Therefore, it is likely that accounting for genetic factors our estimates would be diluted. Moreover, we could not separate the contribution of factors associated with mental health problems which are simultaneous with peer victimization from 6 to 17 years old. Thus, it is possible that behaviors which become apparent during adolescence, such as internalizing behaviors or proximal behaviors (e.g., social isolation, friendlessness¹⁹⁵) which entertain bi-directional relations with peer victimization, may bias the investigated associations.

Therefore, our results cannot be interpreted in causal terms, despite respecting by design, one of the fundamental criteria for causality proposed by Bradford Hill, i.e., temporality: exposure precedes the outcome.

5.3.5 External validity

External validity, also called generalizability, refers to the extent to which findings could be applicable to other settings.¹⁹¹ The striking similarities between the trajectories of peer victimization we identified and those described by Ladd et al.¹¹ during the same time frame (age 6-17 years), using similar measures of peer victimization and a different statistical method (i.e., growth mixture modeling) indicated that both studies captured patterns of perceived peer victimization which are general across the period of formal schooling in the North American context. Moreover, chronic, childhood-limited and adolescence-emerging peer victimization

patterns have been described also in UK samples⁹ which may suggest that these four experiences of peer victimization across school years are similar at least in the Western countries. Not only the patterns of peer victimization were similar across our study and the US study, but also the internalizing mental health outcomes of the groups identified, with moderate adolescence-emerging group showing a similar profile with the high-chronic victims and the childhood-limited similar profile with the low victims. Therefore, the patterns described and their association with internalizing problems seems generalizable at least to the North American context.

5.3.6 Other methodological considerations

5.3.6.1 Self-reports

The use of self-reports for the assessment of peer victimization is widespread. Despite its advantages especially when looking at the evolution of phenomena over time, self-reports give an account about one's perception of peer victimization, not the objective reality of peer victimization. Negative perceptions of the world or the self which are usually associated with internalizing problems¹⁹⁶ may determine self-reports of peer victimization that are not concordant with the external observations of other raters, such as teachers or peers. Indeed, the agreement between parents/teacher reports of peer victimization and self-reports is generally low.^{93,94} However, in the case of peer victimization the subjective perspective is an important information especially because of its potential association with internalizing problems. Furthermore, recent evidence shows that the subjective perspective of childhood maltreatment, even in its absence shows stronger association with mental health problems than its objective measure.¹⁹⁷ A potential limitation of self-reported victimization is that it reflects a perception potentially biased by the self-system and mental health status.¹⁹⁸ The use of self-report for both victimization and other self-reported risk factors may also have induced shared method variance and inflated effect sizes.

5.3.6.2 Peer victimization and bullying victimization

We did not assess the power imbalance between the bully and the victim which is part of the definition of bullying. However, students' definition of bullying tends to focus on negative acts by peers regardless of whether or not the relationship is unequal.^{199,200} The repetition of these

harmful acts (captured in this thesis by the persistent trajectories) is recognized by students as a condition for bullying victimization rather than the power imbalance.¹⁹⁹ Moreover, the importance of looking more broadly at peer difficulties has been emphasized previously in the literature.⁴

Chapter 6 Conclusions

1. Middle childhood is an important period for prevention of peer victimization. Some children report persistent peer victimization already in the first years in primary school. Parents, educators and health professionals should monitor the persistence and severity of peer victimization from school entry.
2. Universal prevention should be complemented by selective and indicated prevention that take into account the diversity of the perceived peer victimization experiences and their risk factors.
3. Reducing peer victimization through early and continued actions across childhood and adolescence could address some of the most severe and complex mental health problems in young adulthood.

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Annexes

Annex 1. Total Number of Participants According to the Number of Waves Peer Victimization was Reported

Number of waves	Number of participants who reported peer victimization
	n (%)
1	102 (5.8)
2	107 (6.1)
3	110 (6.2)
4	106 (6.0)
5	133 (7.6)
6	164 (9.3)
7	368 (20.9)
8	670 (38.1)
Total	1760 (100.0)

Annex 2. Self-reported peer victimization items from age 6 to 17 years

The 6 items were used consistently across all 8 waves.

The wording of these items was adapted to reflect changes in the experience of victimization that could occur with age e.g., the item “did not let me play with his or her group” used when participants were 6-12 years old was changed to “did not let me be part of his group” when children were 13 years or older.

The question stated:

Since the beginning of this school year (approximately 6 months), how many times did it happen that some children at school ...

- (1) *pushed, hit or kicked you?* (physical peer victimization)
- (2) *called you names, insulted, said mean things to you?* (verbal peer victimization)
- (3) *teased you in a mean way/made fun of you, laughed at you?* (verbal peer victimization)
- (4) *said bad things about you to other children?* (relational victimization)
- (5) *did not let you play with/be part of his/her group?* (relational victimization)
- (6) *forced you to give something that belonged to you/made you pay them or give them something so they would leave you alone?* (property attacks)
 - a) *Never*
 - b) *Once or twice*
 - c) *More often*

Annex 3. Description of the Items Used to Derive the Early Childhood Behavior and Family Characteristics

Measure	Items of the scale
Mother's and father's history of antisocial behavior	<p>(1) Did you more than once swipe things from stores or from other children, or steal from your parents or from anyone else?</p> <p>(2) Did you more than once get into fights that you had started? (Father: Did you often get into fights that you had started?)</p> <p>(3) Were you ever involved with Social Services (Department of Youth Protection), in trouble with the police or arrested because of your misbehavior?</p> <p>(4) Did you ever skip school at least twice in one year? (Father: Were you ever expelled or suspended from school?)</p> <p>(5) Did you ever run away from home overnight?</p> <p>Possible response options: Yes –coded 1 and No - coded 0</p>
Mother's and father's depressive symptoms*	<p>(1) I did not feel like eating, my appetite was poor</p> <p>(2) I feel that I could not shake off the blues even with help from my family or friends</p> <p>(3) I had trouble keeping my mind on what I was doing</p> <p>(4) I felt depressed</p> <p>(5) I felt that everything I did was an effort</p> <p>(6) I felt hopeful about the future*</p> <p>(7) My sleep was restless</p> <p>(8) I was happy. *</p> <p>(9) I felt lonely</p> <p>(10) I enjoyed life*</p> <p>(11) I had crying spells</p> <p>(12) I felt that people disliked me.</p> <p>*reversed items</p> <p>Possible response options: 0=less 1 day/week to 3= 5-7days/week</p>
Mother's and father's positive parenting*	<p>Common questions asked when the child was 2½, 3½, 4½ and 5 years:</p> <p>(1) How often did you and the child talk or play with each other, focusing attention on each other for five minutes or more, just for fun?</p> <p>(2) How often did you do something special with him that he enjoys?</p> <p>(3) How often did you play sports activities, hobbies or play games with him?</p> <p>(4) When the child broke the rules or did things that he was not supposed to, how often did you calmly discuss the problem?</p> <p>(5) When the child broke the rules or did things that he was not supposed to, how often did you describe alternative ways of behaving that are acceptable?</p> <p>(6) <i>Of all the times that you've talked to the child about his behavior, what proportion is praise? (question asked only at 2½ years)</i></p> <p>Additional questions asked when the child was 5 years old:</p> <p>(1) How often did you play fight with the child just for fun?</p>

Annex 3 (continued). Description of the Items Used to Derive the Early Childhood Behavior and Family Characteristics

Measure	Items of the scale
	<p>(2) How often did you say to your child that you were proud of him? (3) How often did you help your child doing tasks that were difficult for him? (4) How often did you comfort your child when he was sad? Possible response options: 0=never to 5= several times/day</p> <p><i>Father's measures were available when the child was 3½, 4½ and 5 years old.</i></p>
<p>Mother's and father's coercive parenting*</p>	<p>Questions asked when the child was 2½ years:</p> <p>(1) How often do you tell him that he is bad or not as good as other? (2) Of all the times that you talk to him about his behavior, what proportion is disapproval? (3) How often do you get angry when you punish the child? (4) How often did you think that the kind of punishment you gave him depends on your mood? (5) How often do you feel you are having problems managing him in general? (6) How often did you have to discipline him repeatedly for the same thing? (7) When the child broke the rules or did things that he was not supposed to, how often did you raise your voice, scold or yell at him? (8) When the child broke the rules or did things that he was not supposed to, how often did you use physical punishment?</p> <p>Questions asked when the child was 3½, 4½, 5 years:</p> <p>(1) How often did you get angry with the child for saying or doing something he was not supposed to? (2) How often did you hit the child when he was difficult? (3) How often do you get angry when you punish the child? (4) When the child broke the rules or did things that he was not supposed to, how often did you raise your voice, scold or yell at him? (5) When the child broke the rules or did things that he was not supposed to, how often did you use physical punishment? (6) How often did you grab firmly or shake your child when he was difficult? (asked only at 5 years) (7) How often did you have to discipline him for the same thing? (asked only at 5 years)</p> <p>Possible response options: 0=never to 5= several times/day <i>Father's measures were available when the child was 3½, 4½ and 5 years old.</i></p>

Annex 3 (continued). Description of the Items Used to Derive the Early Childhood Behavior and Family Characteristics

Measure	Items of the scale
Externalizing behavior*	<p>At 1½, 2½, 3½, 4½, 5 years old, mothers rated the following items:</p> <ol style="list-style-type: none"> (1) Physically attacks others (2) Fights often with others (3) Hits, bites, kicks (4) Intimidates others to get what he/she wants (5) Tries to dominate other children (6) Encourages children to pick on a particular child (7) Reacts in an aggressive manner when something is taken away from him/her (8) Reacts in an aggressive manner when contradicted (9) Reacts in an aggressive manner when teased (10) When hurt by another child, gets angry and reacts by fighting (11) Cannot sit still, is restless or hyperactive (12) Is fidgety (13) Is impulsive or acts without thinking (14) Has difficulty waiting for his/her turn in games (15) Cannot settle down to do anything for more than a few moments <p>Possible response options: 0=never to 2=often</p>
Internalizing behavior*	<p>At 1½, 2½, 3½, 4½, 5 years old, mothers rated the following items:</p> <ol style="list-style-type: none"> (1) Is nervous, is high-strung or tense? (2) Is too fearful or anxious? (3) Is worried? (4) Is not as happy as other children? (5) Has trouble enjoying him/herself? <p>Possible response options: 0=never to 2=often</p>

*For these variables, we followed the standard procedure used by the Quebec Institute of Statistics (managing the data) to consider data valid (not missing). That is, if at least two thirds of the items of a scale have been answered, we calculated the mean of the items; the mean was rescaled to range from 0 to 10, by multiplying it with a constant.

Annex 4. Baseline Characteristics (5-17months) of Participants and Non-participants in Study 1

	Overall	Participants	Non- participants	p-value
N	2120	1760	360	
Boy, No. (%)	1080 (50.9)	862 (49.0)	218 (60.6)	<0.001
Birth weight, mean (SD), kg	3.40 (0.50)	3.40 (0.50)	3.41 (0.48)	0.721
Difficult temperament	2.72 (1.62)	2.71 (1.61)	2.73 (1.67)	0.835
Non-Canadian origins	765 (36.3)	594 (34.0)	171 (47.9)	<0.001
Separated family, No. (%)	406 (19.2)	329 (18.7)	77 (21.6)	0.246
Number of siblings				0.324
0	887 (41.8)	730 (41.5)	157 (43.6)	
1	850 (40.1)	718 (40.8)	132 (36.7)	
2 or more	383 (18.1)	312 (17.7)	71 (19.7)	
Socioeconomic disadvantage	4.01 (1.00)	3.96 (1.00)	4.23 (0.97)	<0.001
Paternal age at birth of target child, mean (SD), yr	31.84 (5.64)	31.82 (5.51)	31.96 (6.24)	0.666
Maternal age at birth of target child, mean (SD), yr	28.88 (5.23)	28.88 (5.22)	28.90 (5.28)	0.947
Maternal depressive symptoms	1.47 (1.39)	1.43 (1.37)	1.62 (1.50)	0.022
Paternal depressive symptoms, mean (SD)	1.07 (1.02)	1.06 (1.00)	1.15 (1.16)	0.188
Maternal history of antisocial behavior, No. (%)	378 (18.6)	325 (19.0)	53 (16.1)	0.242
Paternal history of antisocial behavior, No. (%)	316 (17.5)	272 (17.8)	44 (16.0)	0.536
Coercive mothering	1.07 (1.46)	1.08 (1.46)	1.01 (1.47)	0.426
Coercive fathering	1.31 (1.63)	1.32 (1.63)	1.21 (1.64)	0.304
Maternal overprotection	5.39 (2.41)	5.32 (2.42)	5.79 (2.31)	0.001
Paternal overprotection	4.14 (2.37)	4.04 (2.34)	4.69 (2.44)	<0.001

Annex 5. Indices Used to Determine the Best Fitting Model Between Estimated Models with 2 to 8 Latent Clusters and Quadratic Age Term

Number of latent clusters	Bayesian Information Criterion (BIC)*	Size of the smallest cluster	Average posterior probability (APP)	Odds of correct classification (OCC)
		n (%)	Median (range)	Median (range)
2	-21348.4	869 (49.4)	0.88 (0.88, 0.89)	7.6 (7.2, 8)
3	-21255.5	227 (12.9)	0.81 (0.79, 0.84)	11.9 (2.9,29.4)
4	-21171.8	203 (11.5)	0.75 (0.67, 0.80)	7.8 (4.3, 30.8)
5	-21138.1	118 (6.7)	0.74 (0.67, 0.79)	14.6 (2.9; 44.3)
6	-21120.5	91 (5.2)	0.70 (0.64, 0.77)	13.1 (3.6; 62.7)
7	-21103.3	49 (2.8)	0.67 (0.59, 0.77)	18.6 (4.0, 117.9)
8	-21103.2	57 (3.2)	0.69 (0.60, 0.76)	31.7 (2.6; 93.3)

*In group-based trajectory modeling, the BIC is always negative and the model with the value of BIC closer to 0 fits better the data (i.e., being on the negative scale, this means the higher BIC, the better the model fit).

Note: All models are based on the maximum available sample n=1760. The BIC increased sharply from the 3- to the 4-group solution and then slightly from the 5- through the 7-group solution. The 4-group solution was selected as it was conceptually meaningful (revealed distinct features of the data that were substantively relevant from a conceptual point of view) and provided the best balance between the fit indices evaluated (increased BIC, size of the smaller cluster >5% of the sample, quality of the classification, APP >.70 and odds of correct classification, classifying participants better than classification by chance, OCC>5).

Annex 6. The Association Between Early Childhood Factors and Self-Reported Peer Victimization Trajectories in Multivariate Multinomial Weighted Models – Subgroup Comparisons

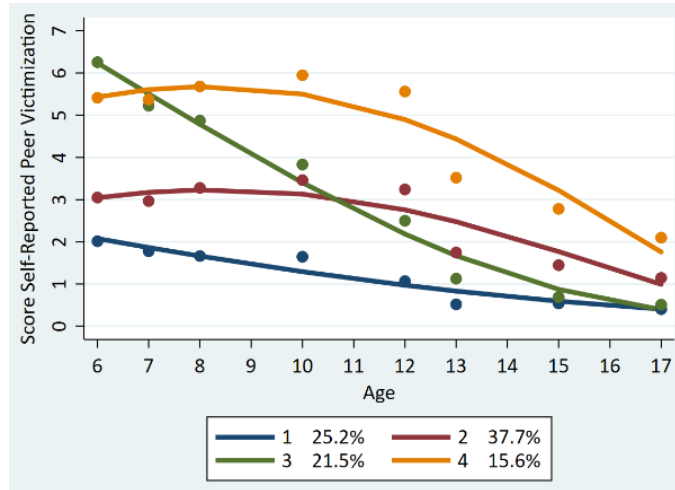
	High-chronic vs Childhood-limited victims (N=656)			High-chronic versus Moderate-emerging victims (N=720)		
	OR	95% CI	p-value	OR	95% CI	p-value
Boy	1.44	1.01-2.06	0.046	1.23	0.86-1.74	0.253
Externalizing behavior	1.21	1.03-1.43	0.023	1.18	1.01-1.38	0.041
Socioeconomic disadvantage	1.00	0.81-1.23	0.972	1.07	0.88-1.29	0.520
Separated family	1.04	0.71-1.53	0.828	1.47	1.01-2.13	0.044
Paternal history of antisocial behavior	1.82	1.16-2.87	0.01	1.25	0.82-1.92	0.302
Maternal depressive symptoms	0.97	0.82-1.15	0.728	0.92	0.79-1.06	0.240
Paternal depressive symptoms	1.17	0.98-1.41	0.088	1.09	0.91-1.29	0.355
Father positive parenting	1.02	0.86-1.21	0.841	1.08	0.90-1.29	0.401
Mother coercive parenting	1.06	0.85-1.31	0.618	1.08	0.88-1.32	0.481
Father coercive parenting	0.98	0.80-1.21	0.854	1.04	0.85-1.27	0.737

Annex 7. Mother-, Self- and Teacher-Reported Peer Victimization by Age and Sex of Child

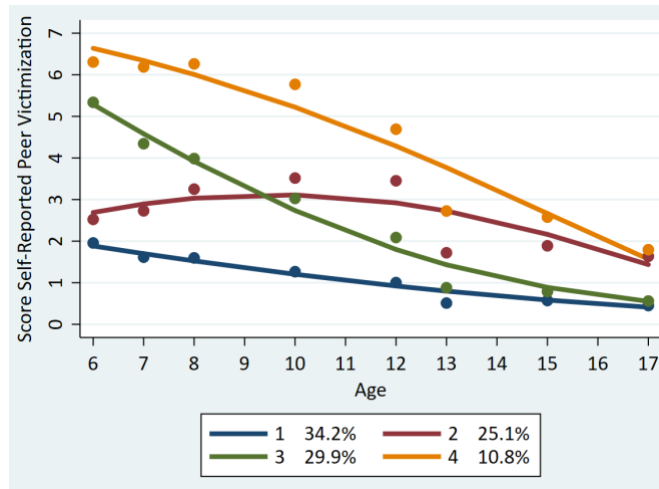
Age	Total	Girls	Boys	p-value
		mean (SD) n=898	mean (SD) n=862	
Mother-reported peer victimization				
3.5 years	1710	1.21 (1.34)	1.39 (1.43)	0.006
4.5 years	1709	1.35 (1.56)	1.46 (1.66)	0.162
5 years	1612	1.66 (1.80)	1.86 (1.85)	0.026
6 years	1433	1.86 (1.90)	2.33 (2.02)	< 0.001
Self-reported peer victimization				
6 years	1169	3.52 (2.58)	3.79 (2.69)	0.08
7 years	1474	3.18 (2.36)	3.51 (2.40)	0.008
8 years	1467	3.22 (2.32)	3.58 (2.44)	0.004
10 years	1310	2.81 (2.20)	3.48 (2.29)	< 0.001
12 years	1343	2.31 (2.01)	2.93 (2.27)	< 0.001
13 years	1229	1.16 (1.35)	1.57 (1.66)	< 0.001
15 years	1436	1.18 (1.38)	1.27 (1.54)	0.239
17 years	1227	0.92 (1.26)	0.99 (1.28)	0.308
Teacher-reported peer victimization				
6 years	942	0.69 (1.35)	1.03 (1.45)	< 0.001
7 years	1263	0.95 (1.58)	1.45 (1.80)	< 0.001
8 years	1226	0.87 (1.65)	1.24 (1.76)	< 0.001
10 years	933	0.85 (1.63)	1.66 (2.29)	< 0.001
12 years	971	0.81 (1.63)	1.50 (2.19)	< 0.001
13 years	786	0.58 (1.42)	1.52 (2.42)	< 0.001

Annex 8. Trajectories of peer victimization derived separately for boys and girls

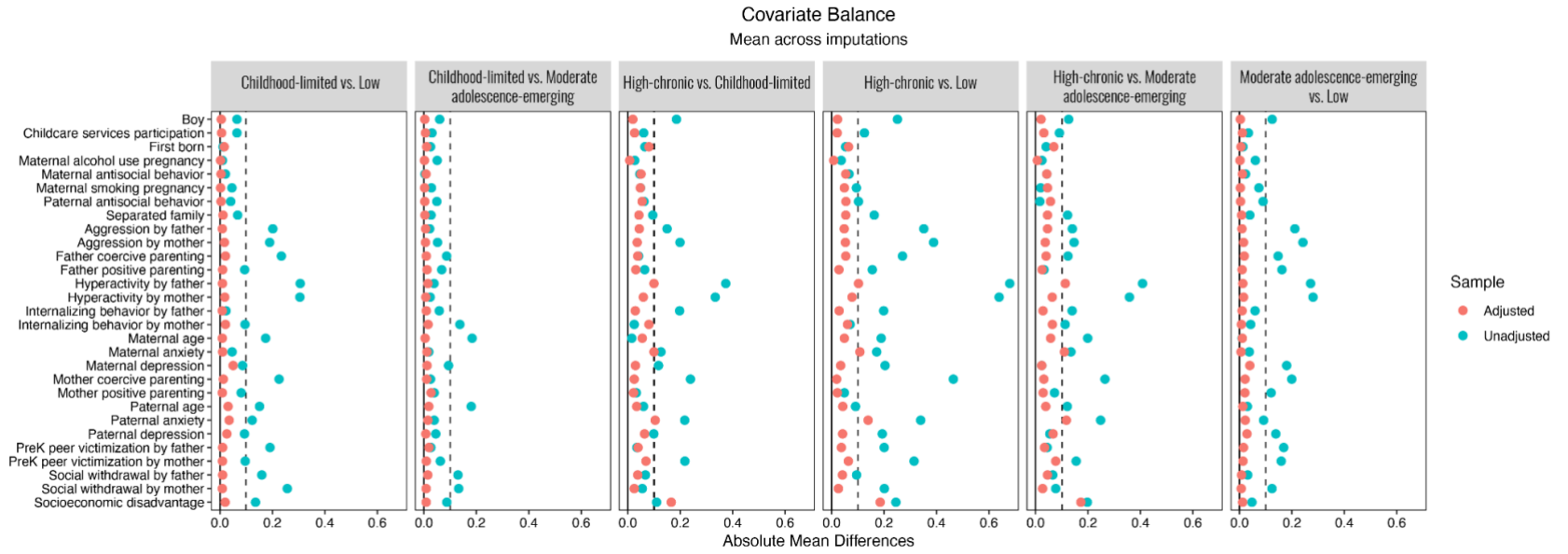
Boys



Girls



Annex 9. Covariance balance by peer victimization groups before and after the application of the propensity score via inverse probability weights



Annex 10. Association of peer victimization trajectories from age 6 to 17 years with mental health problems at 20 years of age

	Crude Estimates									IPW Adjusted Estimates								
	Childhood-limited			Moderate adolescence-emerging			High-chronic			Childhood-limited			Moderate adolescence-emerging			High-chronic		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Internalizing																		
Severe depression (CESD-12)	1.35	0.63	2.91	2.7	1.44	5.31	4.56	2.21	9.61	1.09	0.49	2.45	2.43	1.21	4.84	3.73	1.58	8.83
Severe anxiety (GAD-7)	0.86	0.39	1.85	1.45	0.75	2.83	3.03	1.45	6.26	0.8	0.34	1.86	1.44	0.7	2.96	3.37	1.4	8.09
Eating disorder (SCOFF)	1.13	0.82	1.56	1.56	1.16	2.11	1.64	1.08	2.46	1.14	0.81	1.62	1.89	1.37	2.62	2.02	1.21	3.37
Suicidal ideation/attempt	2.17	1.26	3.8	2.31	1.38	3.98	3.63	1.95	6.75	2.17	1.21	3.9	2.36	1.34	4.15	3.17	1.53	6.58
Externalizing																		
ADHD	1.41	1.02	1.97	1.56	1.14	2.13	1.76	1.15	2.68	1.48	1.03	2.11	1.49	1.06	2.1	1.28	0.77	2.14
Conduct problems	2.46	1.09	5.87	3.08	1.45	7.11	3.33	1.27	8.7	1.8	0.73	4.4	2.5	1.07	5.87	2.15	0.75	6.15
Risky use of alcohol (AUDIT)	1.87	0.85	4.23	1.38	0.61	3.17	2.07	0.75	5.38	1.47	0.61	3.54	0.94	0.39	2.32	1.09	0.38	3.14
Cigarette	3.94	2	8.33	3.83	1.97	8.03	5.11	2.33	11.62	2.88	1.33	6.22	2.77	1.29	5.93	2.2	0.86	5.64
Cannabis	1.75	1	3.07	2.33	1.4	3.96	3.29	1.77	6.1	1.34	0.74	2.43	1.76	1.01	3.06	3	1.43	6.27
Hard drugs	1.69	1.11	2.58	1.38	0.91	2.11	2.13	1.26	3.55	1.55	0.99	2.44	1.25	0.8	1.96	2.45	1.31	4.6