Title: Cohort Profile: Quebec Longitudinal Study of Child Development (QLSCD)

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Abstract

Purpose. The Quebec Longitudinal Study of Child Development (QLSCD) was designed to examine the long-term associations of preschool physical, cognitive, social, and emotional development with biopsychosocial development across childhood, adolescence, and young adulthood.

Methods. QLSCD is an ongoing prospective cohort including 2120 singletons born in 1997/1998 in the Canadian province of Quebec. So far, data has been collected annually or every two years from child ages 5 months to 21 years. The cohort currently includes 1245 participants. Data available include a range of environmental (e.g., family characteristics, child behaviour, educational attainment, mental health), biological (e.g., hair cortisol, genetic, epigenetic), and administrative data.

Results. QLSCD has contributed to the understanding of children's psychosocial development, including the development of physical aggression and anxiety. QLSCD articles have advanced scientific knowledge on the influence of early childhood factors on childhood, adolescent, and young adult mental health, including the effect of participation in early childcare on cognitive and behavioural development, the developmental origins of adolescent and young adult mental health problems and suicide risk, and the development of interpersonal difficulties (e.g., peer victimisation) from preschool years to adolescence.

Conclusion. QLSCD has given major contributions to our understanding of the link between different aspects of child development and biopsychosocial development during the first two decades of life. Unique features include the presence of environmental, biological, and administrative data, long-term follow-up with frequent data collections, and use of data from multiple informants, including teachers, mothers, fathers, and the children themselves.

Keywords. Quebec Longitudinal Study of Child Development, cohort profile, longitudinal, developmental psychology, behavioural development

Introduction

The Quebec Longitudinal Study of Child Development (QLSCD) is a population-based representative sample of children in the Canadian Province of Quebec, born between October 1997 and July 1998. The cohort study was designed by a group of investigators who had previously led cohorts of kindergarten children to investigate the development of behaviour problems [1, 2]. Having realized the key influence of early childhood factors on later developmental outcomes, they created a birth cohort in collaboration with a research branch of the Quebec Ministry of Health: Health Quebec (Santé Quebec)[3]. 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 [4]. The study included assessments drawn from the National Longitudinal Survey of Children and Youth in Canada, initiated in 1994-95 (NLSCY: https://crdcn.org/datasets/nlscy-national-longitudinal-survey-children-and-youth). In addition, the QLSCD included more extensive assessments of early cognitive, emotional, and behaviour problems, as well as a wider range of measurements of the quality of childcare environments and children's behaviour [5, 6].

The QLSCD protocol was initially approved by the Health Quebec ethics committee. Written informed consent was obtained from all participants (parents and children's assent from age 10 years onward). The planning of the cohort was initially funded by a grant from the Social Sciences and Humanities Research Council of Canada (SSHRC) to principal investigator Dr. Richard E. Tremblay and colleagues. Additional funding was obtained from the Government of the Province of Quebec through different ministries and the Institut de la statistique du Quebec (ISQ). The Lucie and André Chagnon Foundation also made important financial contributions to support the study when the children turned 6 years of age. Over the years, the ISQ and QLSCD scientific committees have jointly led the study. Data collections

have been funded by the ISQ and by grants awarded by SSHRC to principal investigator Dr. Richard E. Tremblay, the Canadian Institutes of Health Research (CIHR) to principal investigators Drs. Sylvana Côté, Marie-Claude Geoffroy, Isabelle Ouellet-Morin, and Richard E. Tremblay, and the Canada Research Chair program to principal investigators Drs. Michel Boivin, Marie-Claude Geoffroy, Isabelle Ouellet-Morin, and Jean-Philippe Gouin (see **Supplementary Table 1**). The Quebec Research funds for health (FQRS) and for Society and Culture (FQRSC) have funded the research activities of researchers and numerous students.

Methods

Study design and participants

The cohort recruited singletons born between October 1997 and July 1998 in each administrative region of the Canadian province of Quebec (**Figure 1**), except those born in Northern Quebec, Cree Territory, Inuit Territory, and Native reserves (2.2% of all births). The 1997-98 Master birth register for the province of Quebec was used to create a stratified random sample based on living area and birth rates [3]. Children were included if the mother's pregnancy had lasted 24 to 42 weeks (i.e., 99.9% of all registered births) and mothers could speak French or English. Extremely preterm (<24 weeks of gestation) and post-term (>42 weeks of gestation) babies were excluded. From the initial 2940 selected families, 2223 families participated in the first data collection when children were 5 months old, representing 94.5% of the target population (**Figure 2**). This included an over-represented sub-sample of 103 families from one region (Monteregie) to cross-sectionally investigate the impact of a highly disruptive ice storm in January 1998. Only the remaining 2120 families participated in subsequent data collections and constituted the final longitudinal sample. At the time of study inception the Quebec population was 7 million, whereof nearly 20% was rural. French was the first language for nearly 80% of the

population. At the last data collection (child age 20 years), the cohort had retained n=1245 participants, corresponding to 60% of the initial sample (**Figure 3**). Children of families who dropped out from the study were more likely to be male, to come from socioeconomically disadvantaged and nonintact families, and to have a mother who reported greater alcohol use during pregnancy and experienced higher levels of postnatal depressive symptoms (**Table 1**; see also **Supplementary Table 2** for a summary of participants' characteristics at selected time points). Reasons for loss of participants included the death of the target child (n=5), permanent relocation outside of Quebec (n=31), and families whom we could no longer locate (i.e., due to change in contact information without notifying the study team) and those who refused or were no longer able to respond to questionnaires [7].

Data collection

Data were collected annually or every two years from ages 5 months to 21 years. Data were collected in 4 phases: (i) Phase 1 (1998-2002, ages 5 months, 1½, 2½, 3½, 4½, and 5 years) focused on early social, emotional, behavioural, and cognitive development; (ii) Phase 2 (2003-2010, ages 6, 7, 8, 10, and 12 years) focused on academic achievement, psychosocial development, and health; (iii) Phase 3 (2011-2015, ages 13, 15, and 17 years) focused on school achievement, educational aspirations, work-school-leisure balance, romantic relationships, and a variety of mental health and relational problems, including substance use, suicidal ideation, bullying-victimisation, school violence, and school dropout; (iv) Phase 4 (2016-2023, ages 19, 20, 21, 23, and 25 years) is focusing on the transition into adulthood and includes information on physical and mental health, resilience, post-secondary education, and insertion into the workforce. Information from medical birth records (e.g., birthweight, APGAR score, gestational age) was linked to the dataset. Additionally, funding was obtained to perform a linkage with health-related administrative records via the Quebec Health

Insurance Board and the Ministry of Health and Social Services. Linkage is currently being performed, and data should be available in the years to come.

Main measures

A detailed list of data collection instruments used in the QLSCD is presented in **Table 2**. During the first 17 years of the study, a parent (i.e., the Person Most Knowledgeable about the child, PMK) provided information on the family (e.g., income, composition) and rated child characteristics (e.g., temperament, behaviour). The PMK was the biological mother in most cases (95%). Several aspects, such as parenting practices and child behaviour were assessed by both parents, although mainly mothers completed the assessments. Additionally, each parent reported on their own mental health (depression, anxiety, antisocial behaviours) at different time points. Trained research assistants also reported on the home environment using the Home Observation for Measurement of the Environment [8] when the child was aged 5 and 17 months. This assessment evaluated aspects of the mother-child relationship, such as stimulation of the child and mother's verbalisation towards the child. Teachers started providing information regarding adjustment to school, physical well-being, and peer relationships at school entry (i.e., from ages 6 to 13 years). At child ages 17 months, 41 months, and 5 years, parents also filled-out questionnaires about the development of a sibling of the target child, including behaviour, nutrition, sleep, and temperament. From age 15 onwards, the adolescents completed questionnaires covering various themes, including academic aspirations and achievement, peer victimisation, suicidal ideation and attempt, mental health, substance use, and parental relations. Between 5 months and 11 years, children were also directly taking part in the assessments through age-specific tasks measuring cognitive development and school achievement, including language, attention and memory, arithmetic, school readiness, writing skills, and physical and motor development (**Table 3**).

Biological material

When the children were 10 years old, biological samples (blood and saliva) were collected on a subsample of the cohort. The children's DNA was then genotyped using the Illumina Infinium PsychArray-24 which, after appropriate quality control and imputation, yielded accurate information for several million common genetic variants among a total of 950 participants. At 17 years of age, DNA was once more collected from saliva to measure DNA methylation, a stable epigenetic mark that has the potential to inhibit DNA transcription as a result of stochastic changes or environmental influences [9]. The DNA methylation sequencing was done using the Illumina EPIC BeadChip Array (> 850 000 CpG sites), for which a total of 699 participants remained after quality control. During that same wave of data collection (i.e., 17 years), our team sent the participants a collection kit including curved scissors, hair clamps, and instructions on how to collect hair from the posterior vertex area of the scalp at home. A total of 556 participants provided enough hair for cortisol measurement, ofwhom most also provided saliva for DNA ascertainment. The hair samples were assayed in duplicate after wash and steroid extraction procedures using a luminescence immunoassay [10, 11].

Results

Data obtained from the QLSCD has led to more than 200 peer reviewed journal articles. Highlights of the main findings are summarised below.

Development of externalising and internalising behavioural problems

Several QLSCD studies have documented the development of externalising (e.g., physical aggression, opposition, hyperactivity-impulsivity) and internalising (e.g., anxiety, depression, social withdrawal) behaviours from early childhood to adolescence and their associations with later outcomes [6, 12–27, 27–45]. Early developmental trajectories of physical aggression were identified, showing that aggressive behaviours peak between ages 2 to 4

years and decrease thereafter until late adolescence. Boys were overrepresented in atypically high trajectories of physical aggression [25]. Developmental trajectories of internalising problems followed a different temporal trend, with increased levels during early childhood and the beginning of middle childhood [43]. Children following high-chronic trajectories of externalising and internalising behaviours have been shown to be at risk of negative long-term outcomes, including peer victimisation [28, 46], suicidal ideation and attempt [47, 48], and substance use [30, 43, 49].

Early-life environment and child development

QLSCD studies have documented that socioeconomic difficulties (e.g., low income, low maternal education)[12, 13, 50, 51], parenting quality (e.g., harsh parenting, maternal depression)[14–20], and maternal risky behaviour (e.g., smoking and alcohol consumption during pregnancy)[21, 22, 52–54] systematically predict higher levels of internalising and externalising behaviours, as well as poor cognitive outcomes.

Childcare attendance and cognitive and psychosocial development

The QLSCD has also documented the use of childcare – a Quebec-wide affordable service – and examined its potential benefits for children and families [6, 18, 55–62]. These studies have shown that childcare participation (especially centre-based) is associated with better school readiness and achievement [57, 59] and less infections [56] and disruptive behaviours among children from at-risk families [6, 55, 60]. These predictive associations have been found for both short-term and long-term outcomes [6, 55, 60]. For example, children of depressed mothers who attended childcare showed fewer internalising symptoms at age 5 years than those who did not attend childcare [18]. Similarly, children from disadvantaged socioeconomic backgrounds who attended childcare were less physically aggressive at 9 and 17 years than those who they did not attend childcare. However, this apparent positive effect

of childcare attendance was not detected among children from non-disadvantaged socioeconomic backgrounds [6, 60].

Peer victimization during childhood

Several studies have described the developmental trajectories, risk factors, and consequences of peer victimisation across childhood [11, 28, 31, 46, 63–69]. For instance, it was shown for the first time that a small but significant group of children start experiencing stable peer difficulties as early as age 3 years [67]. Furthermore, a recent study distinguished various peer victimisation trajectories from ages 6 to 17 years, including groups of emerging, childhood-limited, and persistent victims [46]. These studies also identified family-level (e.g., insufficient income, harsh parenting) and individual-level (e.g., physical aggression, high body mass index [BMI], internalising behaviours) risk factors of frequent exposure to peer victimisation [31, 46, 66–68]. Finally, short- and long-term negative outcomes associated with peer victimisation include increased risk of internalising symptoms and suicidal ideation/attempt [64, 65, 69], poor educational achievement [28], insomnia [63], victimisation in the workplace [66], and dysregulation of chronic cortisol secretion [11].

Parenting practices and children's behavioural development

A series of QLSCD papers have extensively documented early parenting behaviours and perceptions and described how family (e.g., mother depression) and child (e.g., difficult temperament) risk factors are uniquely associated with different dimensions of parenting [70, 71]. In turn, these aspects of early parenting (e.g., harsh parenting behaviours) have also been found to predict the development of reactive aggressive behaviour [27] and peer relation difficulties [67].

Cognitive development, school readiness, and educational achievement

Several QLSCD studies have documented the early development of several aspects of cognitive skills and school readiness and achievement [72]. This work has shown that

preschool cognitive school readiness is highly predictive of school achievement in the early grades [73], and has provided evidence for the central role of early literacy training in accounting for the link between socioeconomic status and school readiness [73]. Information from medical birth records have been used to document how gestational diabetes specifically hinders early language development [74]. A series of papers on number knowledge and achievement have shown that early and persistent delays in numeracy are linked to later difficulties in mathematics in a a small but significant group of children [75]. Achievement in mathematics has been found to predict intrinsic motivation in mathematics rather than the reverse [76]. QLSCD papers have also investigated associations between mental health, family characteristics, and participants' cognitive outcomes. Language deficits in early childhood were positively associated with physical aggression in childhood as well as in adolescence [40], whereas hyperactivity was associated with visuospatial organisation deficits [40]. Another study identified that inattention, rather than hyperactivity, was a modestly significant predictor of reading accuracy and speed during adolescence [77]. Family characteristics (e.g., maternal depression symptoms and IQ) have been found to be associated with lower levels of verbal abilities in middle childhood [78]. Furthermore, language development between 12 and 48 months has been associated with lower frequency of physical aggression [79].

Suicidal ideation and suicide attempts

Multiple studies have investigated the epidemiology and risk factors for suicidal ideation and attempt from the perinatal period to adolescence [29, 47, 48, 64, 65, 69, 80–84]. In the QLSCD, lifetime prevalence of passive suicidal ideation (13–17 years old), serious suicidal ideation, and suicide attempt (13–20 years old) are 22.2%, 9.8%, and 6.7%, respectively [82]. Children exposed to perinatal adversity such as poor foetal growth or socioeconomic adversity at the time of birth have been found to be more likely to attempt suicide by age 20

years [85]. Behavioural characteristics in childhood have also been associated with later suicidal risk. For example, the co-occurrence of high irritability and depressive/anxious mood symptoms in childhood was seen to double the risk for suicidal ideation and/or attempt in adolescence [29, 47, 86, 87]. Exposure to interpersonal violence in adolescence both face-to-face (e.g., peer victimisation) and through the media (cybervictimisation) was also associated with higher odds of suicidal ideation and attempt [64, 65, 69].

Future directions

There remain pertinent research questions concerning the impact of the early childhood environment on biopsychosocial development across childhood, adolescence, and young adulthood which can be addressed using QLSCD data. This includes understanding how parenting behaviours, parental mental health, childcare attendance, and other early childhood factors contribute to adolescent romantic relationships, dating violence, educational aspirations, and school dropout rates. Researchers can also further explore the interactions between mental health outcomes investigated so far (e.g., internalising and externalising behaviour problems, suicidal ideation and attempt) and adolescents' social environments and their transition to young adulthood by using data from the ongoing phase 4 of QLSCD. Additionally, there are opportunities to explore genetic and epigenetic mechanisms of biopsychosocial development using data from biological materials (i.e., blood, sample, hair) collected in a subsample of participants at 10 and 17 years old.

Strengths and limitations

The QLSCD cohort has made numerous important contributions to a better understanding of the biopsychosocial developmental changes occurring from infancy to early adulthood, as well as to the associated environmental factors. The main strengths of the QLSCD cohort include (1) its population representativeness, (2) the long-term follow-up (21 years so far) with extensive data collections conducted every year during early childhood and every two

years from middle childhood to young adulthood, (3) the collection of data from multiple informants, including teachers, mothers, fathers, and the children themselves, (4) and a vast and rich range of information on the child from their genes to broader environmental sources of influence, complemented by registry data across multiple domains and direct measures of the children. However, the following limitations should be acknowledged. First, the sample size is relatively small to study rare phenomena. Second, as with comparable longitudinal studies [88], attrition compromised the initial representativeness of the sample. Nevertheless, the remaining sample size still enables well-powered analyses. Finally, prospective information on child maltreatment, abuse, or neglect, which have important influences on child development and health, has not been collected; however, retrospective information will be collected in future data collections.

Data access

QLSCD data are accessible to researchers on the premises of the Centre d'accès aux données de recherche de l'Institut statistique du Quebec (CADRISQ) located in Montreal and Quebec City. To access the data, researchers affiliated with an institution in Quebec must create a profile and fill out an access request including, among other things, the purpose and aim of the research project, a summary of the analysis plan, the contact information of any researchers associated with the project, and the location where they want to use the data. Once received, the access request is analysed by the Research Data Access Point team, which makes the necessary follow-up to obtain the required authorisations and communicates the results to the researchers. Researchers receive the necessary support for the submission of their access request and the implementation of their projects. More information can be found on the Research Data Access Point website (https://www.stat.gouv.qc.ca/research/#/accueil). Numerous international collaborations have been established since the start of the study.

Declarations

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References

1. Tremblay RE, Pihl RO, Vitaro F, Dobkin PL (1994) Predicting early onset of male antisocial behavior from preschool behavior. Arch Gen Psychiatry 51:732–739. https://doi.org/10.1001/archpsyc.1994.03950090064009

2. Rouquette A, Côté SM, Pryor LE, et al (2014) Cohort profile: the Quebec Longitudinal Study of Kindergarten Children (QLSKC). Int J Epidemiol 43:23–33. https://doi.org/10.1093/ije/dys177

3. Jetté M, Des Groseilliers L (2000) Survey Description and Methodology" in Longitudinal Study of Child Development in Québec (ÉLDEQ 1998-2002). Inst Stat Qué 1:

4. Tremblay RE (2000) Introduction à l'ÉLDEQ 1998-2002. In: L'enquête: description et méthodologie. Étude longitudinale du développement des enfants du Québec (ÉLDEQ 1998-2002), Jetté, M. & Des Groseillers. Institut de la statistique du Québec, Québec, Canada

5. Baillargeon RH, Zoccolillo M, Keenan K, et al (2007) Gender differences in physical aggression: A prospective population-based survey of children before and after 2 years of age. Dev Psychol 43:13–26. https://doi.org/10.1037/0012-1649.43.1.13

6. Côté SM, Boivin M, Nagin DS, et al (2007) The role of maternal education and nonmaternal care services in the prevention of children's physical aggression problems. Arch Gen Psychiatry 64:1305–1312. https://doi.org/10.1001/archpsyc.64.11.1305

7. Belleau L, Dion K (2020) Pondération et analyse de la non-réponse des données du volet 2019

8. Bradley RH, Convyn RF, Burchinal M, et al (2001) The home environments of children in the United States part II: relations with behavioral development through age thirteen. Child Dev 72:1868–1886

9. Jones MJ, Moore SR, Kobor MS (2018) Principles and Challenges of Applying Epigenetic Epidemiology to Psychology. Annu Rev Psychol 69:459–485. https://doi.org/10.1146/annurev-psych-122414-033653

10. Ouellet-Morin I, Laurin M, Robitaille M-P, et al (2016) Validation of an adapted procedure to collect hair for cortisol determination in adolescents. Psychoneuroendocrinology 70:58–62. https://doi.org/10.1016/j.psyneuen.2016.05.002

11. Ouellet-Morin I, Cantave C, Paquin S, et al Associations between developmental trajectories of peer victimization, hair cortisol, and depressive symptoms: a longitudinal study. J Child Psychol Psychiatry n/a: https://doi.org/10.1111/jcpp.13228

12. Mazza JRSE, Boivin M, Tremblay RE, et al (2016) Poverty and behavior problems trajectories from 1.5 to 8 years of age: Is the gap widening between poor and non-poor children? Soc Psychiatry Psychiatr Epidemiol 51:1083–1092. https://doi.org/10.1007/s00127-016-1252-1

13. Mazza JRSE, Pingault J-B, Booji L, et al (2016) Poverty and behavior problems during early childhood: The mediating role of maternal depression symptoms and parenting. Int J Behav Dev 41:670–680. https://doi.org/10.1177/0165025416657615

14. Côté SM, Boivin M, Liu X, et al (2009) Depression and anxiety symptoms: onset, developmental course and risk factors during early childhood. J Child Psychol Psychiatry 50:1201–1208. https://doi.org/10.1111/j.1469-7610.2009.02099.x

15. Laurin JC, Joussemet M, Tremblay R, Boivin M (2015) Early Forms of Controlling Parenting and the Development of Childhood Anxiety. J Child Fam Stud 24:3279–3292. https://doi.org/10.1007/s10826-015-0131-9

16. Ahun MN, Consoli A, Pingault J-B, et al (2018) Maternal depression symptoms and internalising problems in the offspring: the role of maternal and family factors. Eur Child Adolesc Psychiatry 27:921–932. https://doi.org/10.1007/s00787-017-1096-6

17. La Buissonnière-Ariza V, Séguin JR, Nassim M, et al (2019) Chronic harsh parenting and anxiety associations with fear circuitry function in healthy adolescents: A preliminary study. Biol Psychol 145:198–210. https://doi.org/10.1016/j.biopsycho.2019.03.019

18. Herba CM, Tremblay RE, Boivin M, et al (2013) Maternal depressive symptoms and children's emotional problems: can early child care help children of depressed mothers? JAMA Psychiatry 70:830–838. https://doi.org/10.1001/jamapsychiatry.2013.1361

19. Côté SM, Ahun MN, Herba CM, et al (2018) Why Is Maternal Depression Related to Adolescent Internalizing Problems? A 15-Year Population-Based Study. J Am Acad Child Adolesc Psychiatry 57:916–924. https://doi.org/10.1016/j.jaac.2018.04.024

20. Battaglia M, Touchette É, Garon-Carrier G, et al (2016) Distinct trajectories of separation anxiety in the preschool years: persistence at school entry and early-life associated factors. J Child Psychol Psychiatry 57:39–46. https://doi.org/10.1111/jcpp.12424

21. Huijbregts SCJ, Séguin JR, Zoccolillo M, et al (2007) Associations of maternal prenatal smoking with early childhood physical aggression, hyperactivity-impulsivity, and their co-occurrence. J Abnorm Child Psychol 35:203–215. https://doi.org/10.1007/s10802-006-9073-4

22. Huijbregts SCJ, Séguin JR, Zoccolillo M, et al (2008) Maternal prenatal smoking, parental antisocial behavior, and early childhood physical aggression. Dev Psychopathol 20:437–453. https://doi.org/10.1017/S0954579408000217

23. Battaglia M, Garon-Carrier G, Côté SM, et al (2017) Early childhood trajectories of separation anxiety: Bearing on mental health, academic achievement, and physical health from mid-childhood to preadolescence. Depress Anxiety 34:918–927. https://doi.org/10.1002/da.22674

24. Petitclerc A, Boivin M, Dionne G, et al (2009) Disregard for rules: the early development and predictors of a specific dimension of disruptive behavior disorders. J

Child Psychol Psychiatry 50:1477–1484. https://doi.org/10.1111/j.1469-7610.2009.02118.x

25. Baillargeon RH, Morisset A, Keenan K, et al (2012) Development of Disruptive Behaviors in Young Children: A Prospective Population-Based Cohort Study. Infant Ment Health J 33:633–650. https://doi.org/10.1002/imhj.21353

26. Fontaine NMG, Brendgen M, Vitaro F, et al (2019) Longitudinal associations between delinquency, depression and anxiety symptoms in adolescence: Testing the moderating effect of sex and family socioeconomic status. J Crim Justice 62:58–65. https://doi.org/10.1016/j.jcrimjus.2018.09.007

27. Vitaro F, Barker ED, Boivin M, et al (2006) Do early difficult temperament and harsh parenting differentially predict reactive and proactive aggression? J Abnorm Child Psychol 34:685–695. https://doi.org/10.1007/s10802-006-9055-6

28. van Lier PAC, Vitaro F, Barker ED, et al (2012) Peer victimization, poor academic achievement, and the link between childhood externalizing and internalizing problems. Child Dev 83:1775–1788. https://doi.org/10.1111/j.1467-8624.2012.01802.x

29. Orri M, Galera C, Turecki G, et al (2018) Association of Childhood Irritability and Depressive/Anxious Mood Profiles With Adolescent Suicidal Ideation and Attempts. JAMA Psychiatry 75:465–473. https://doi.org/10.1001/jamapsychiatry.2018.0174

30. Lemyre A, Poliakova N, Vitaro F, et al (2018) Does shyness interact with peer group affiliation in predicting substance use in adolescence? Psychol Addict Behav J Soc Psychol Addict Behav 32:132–139. https://doi.org/10.1037/adb0000328

31. Pryor L, Brendgen M, Boivin M, et al (2016) Overweight during childhood and internalizing symptoms in early adolescence: The mediating role of peer victimization and the desire to be thinner. J Affect Disord 202:203–209. https://doi.org/10.1016/j.jad.2016.05.022

32. Baillargeon RH, Morisset A, Keenan K, et al (2011) The development of prosocial behaviors in young children: a prospective population-based cohort study. J Genet Psychol 172:221–251. https://doi.org/10.1080/00221325.2010.533719

33. Baillargeon RH, Normand CL, Séguin JR, et al (2007) The evolution of problem and social competence behaviors during toddlerhood: A prospective population-based cohort survey. Infant Ment Health J 28:12–38. https://doi.org/10.1002/imhj.20120

34. Girard L-C, Tremblay RE, Nagin D, Côté SM (2019) Development of Aggression Subtypes from Childhood to Adolescence: a Group-Based Multi-Trajectory Modelling Perspective. J Abnorm Child Psychol 47:825–838. https://doi.org/10.1007/s10802-018-0488-5

35. Tremblay RE, Vitaro F, Côté SM (2018) Developmental Origins of Chronic Physical Aggression: A Bio-Psycho-Social Model for the Next Generation of Preventive Interventions. Annu Rev Psychol 69:383–407. https://doi.org/10.1146/annurev-psych-010416-044030

36. Tremblay RE (2004) Decade of Behavior Distinguished Lecture: Development of physical aggression during infancy. Infant Ment Health J 25:399–407. https://doi.org/10.1002/imhj.20015

37. Teymoori A, Côté SM, Jones BL, et al (2018) Risk Factors Associated With Boys' and Girls' Developmental Trajectories of Physical Aggression From Early Childhood Through Early Adolescence. JAMA Netw Open 1:e186364. https://doi.org/10.1001/jamanetworkopen.2018.6364

38. Baillargeon RH, Zoccolillo M, Keenan K, et al (2007) Gender differences in physical aggression: A prospective population-based survey of children before and after 2 years of age. Dev Psychol 43:13–26. https://doi.org/10.1037/0012-1649.43.1.13

39. Baillargeon RH, Thibodeau E, Lefebvre F, Jeyaganth S (2011) [Obstetrical complications and physical aggression behaviours before the age of 2]. Can J Psychiatry Rev Can Psychiatr 56:427–435. https://doi.org/10.1177/070674371105600706

40. Séguin JR, Parent S, Tremblay RE, Zelazo PD (2009) Different neurocognitive functions regulating physical aggression and hyperactivity in early childhood. J Child Psychol Psychiatry 50:679–687. https://doi.org/10.1111/j.1469-7610.2008.02030.x

41. Girard L-C, Pingault J-B, Falissard B, et al (2014) Physical aggression and language ability from 17 to 72 months: cross-lagged effects in a population sample. PloS One 9:e112185. https://doi.org/10.1371/journal.pone.0112185

42. Galéra C, Côté SM, Bouvard MP, et al (2011) Early risk factors for hyperactivity-impulsivity and inattention trajectories from age 17 months to 8 years. Arch Gen Psychiatry 68:1267–1275. https://doi.org/10.1001/archgenpsychiatry.2011.138

43. Navarro MC, Orri M, Nagin D, et al (2020) Adolescent internalizing symptoms: The importance of multi-informant assessments in childhood. J Affect Disord 266:702–709. https://doi.org/10.1016/j.jad.2020.01.106

44. Côté SM, Orri M, Brendgen M, et al (2017) Psychometric properties of the Mental Health and Social Inadaptation Assessment for Adolescents (MIA) in a population-based sample. Int J Methods Psychiatr Res n/a-n/a. https://doi.org/10.1002/mpr.1566

45. Carbonneau R, Boivin M, Brendgen M, et al (2016) Comorbid development of disruptive behaviors from age 1½ to 5 years in a population birth-cohort and association with school adjustment in first grade. J Abnorm Child Psychol 44:677–690. https://doi.org/10.1007/s10802-015-0072-1

46. Oncioiu SI, Orri M, Boivin M, et al (2020) Early Childhood Factors Associated With Peer Victimization Trajectories From 6 to 17 Years of Age. Pediatrics. https://doi.org/10.1542/peds.2019-2654

47. Orri M, Galera C, Turecki G, et al (2019) Pathways of Association Between Childhood Irritability and Adolescent Suicidality. J Am Acad Child Adolesc Psychiatry 58:99-107.e3. https://doi.org/10.1016/j.jaac.2018.06.034

48. Forte A, Orri M, Galera C, et al (2019) Developmental trajectories of childhood symptoms of hyperactivity/inattention and suicidal behavior during adolescence. Eur Child Adolesc Psychiatry. https://doi.org/10.1007/s00787-019-01338-0

49. Zdebik MA, Boivin M, Battaglia M, et al (2019) Childhood multi-trajectories of shyness, anxiety and depression: Associations with adolescent internalizing problems. J Appl Dev Psychol 64:101050. https://doi.org/10.1016/j.appdev.2019.101050

50. Mazza JRSE, Lambert J, Zunzunegui MV, et al (2017) Early adolescence behavior problems and timing of poverty during childhood: A comparison of lifecourse models. Soc Sci Med 1982 177:35–42. https://doi.org/10.1016/j.socscimed.2017.01.039

51. Côté-Lussier C, Barnett TA, Kestens Y, et al (2015) The role of the residential neighborhood in linking youths' family poverty trajectory to decreased feelings of safety at school. J Youth Adolesc 44:1194–1207. https://doi.org/10.1007/s10964-014-0214-8

52. Huijbregts SCJ, Séguin JR, Zelazo PD, et al (2006) Interrelations Between Maternal Smoking During Pregnancy, Birth Weight and Sociodemographic Factors in the Prediction of Early Cognitive Abilities. Infant Child Dev 15:593–606. https://doi.org/10.1002/icd.480

53. Junger M, Japel C, Côté SM, et al (2013) Smoking and medication during pregnancy predict repeated unintentional injuries in early childhood but not single unintentional injuries. Prev Sci Off J Soc Prev Res 14:13–24. https://doi.org/10.1007/s11121-012-0304-3

54. Melchior M, Chastang J-F, Falissard B, et al (2012) Food insecurity and children's mental health: a prospective birth cohort study. PloS One 7:e52615. https://doi.org/10.1371/journal.pone.0052615

55. Côté SM, Pingault J-B, Boivin M, et al (2010) Pre-school education services and aggressive behaviour: a preventive role in vulnerable families. PSN Psychiatr Sci Hum Neurosci 8:77–87. https://doi.org/10.1007/s11836-010-0131-1

56. Côté SM, Petitclerc A, Raynault M-F, et al (2010) Short- and long-term risk of infections as a function of group child care attendance: an 8-year population-based study. Arch Pediatr Adolesc Med 164:1132–1137. https://doi.org/10.1001/archpediatrics.2010.216

57. Geoffroy M-C, Côté SM, Giguère C-É, et al (2010) Closing the gap in academic readiness and achievement: the role of early childcare. J Child Psychol Psychiatry 51:1359–1367. https://doi.org/10.1111/j.1469-7610.2010.02316.x

58. Geoffroy M-C, Power C, Touchette E, et al (2013) Childcare and overweight or obesity over 10 years of follow-up. J Pediatr 162:753-758.e1. https://doi.org/10.1016/j.jpeds.2012.09.026

59. Laurin JC, Geoffroy M-C, Boivin M, et al (2015) Child Care Services, Socioeconomic Inequalities, and Academic Performance. Pediatrics 136:1112–1124. https://doi.org/10.1542/peds.2015-0419

60. Orri M, Tremblay RE, Japel C, et al (2019) Early childhood child care and disruptive behavior problems during adolescence: a 17-year population-based propensity score study. J Child Psychol Psychiatry 60:1174–1182. https://doi.org/10.1111/jcpp.13065

61. Geoffroy M-C, Séguin JR, Lacourse E, et al (2012) Parental characteristics associated with childcare use during the first 4 years of life: results from a representative cohort of Québec families. Can J Public Health Rev Can Sante Publique 103:76–80

62. Pingault J-B, Tremblay RE, Vitaro F, et al (2015) Early Nonparental Care and Social Behavior in Elementary School: Support for a Social Group Adaptation Hypothesis. Child Dev 86:1469–1488. https://doi.org/10.1111/cdev.12399

63. Bilodeau F, Brendgen M, Vitaro F, et al (2018) Longitudinal Association Between Peer Victimization and Sleep Problems in Preschoolers: The Moderating Role of Parenting. J Clin Child Adolesc Psychol Off J Soc Clin Child Adolesc Psychol Am Psychol Assoc Div 53 47:S555–S568. https://doi.org/10.1080/15374416.2018.1469091

64. Geoffroy M-C, Boivin M, Arseneault L, et al (2018) Childhood trajectories of peer victimization and prediction of mental health outcomes in midadolescence: a longitudinal population-based study. CMAJ Can Med Assoc J J Assoc Medicale Can 190:E37–E43. https://doi.org/10.1503/cmaj.170219

65. Geoffroy M-C, Boivin M, Arseneault L, et al (2016) Associations Between Peer Victimization and Suicidal Ideation and Suicide Attempt During Adolescence: Results From a Prospective Population-Based Birth Cohort. J Am Acad Child Adolesc Psychiatry 55:99–105. https://doi.org/10.1016/j.jaac.2015.11.010

66. Brendgen M, Poulin F (2018) Continued Bullying Victimization from Childhood to Young Adulthood: a Longitudinal Study of Mediating and Protective Factors. J Abnorm Child Psychol 46:27–39. https://doi.org/10.1007/s10802-017-0314-5

67. Barker ED, Boivin M, Brendgen M, et al (2008) Predictive validity and early predictors of peer-victimization trajectories in preschool. Arch Gen Psychiatry 65:1185–1192. https://doi.org/10.1001/archpsyc.65.10.1185

68. Qualter P, Murphy SM, Abbott J, et al (2015) Developmental associations between victimization and body mass index from 3 to 10 years in a population sample. Aggress Behav 41:109–122. https://doi.org/10.1002/ab.21580

69. Perret LC, Orri M, Boivin M, et al (2020) Cybervictimization in adolescence and its association with subsequent suicidal ideation/attempt beyond face-to-face victimization: a longitudinal population-based study. J Child Psychol Psychiatry. https://doi.org/10.1111/jcpp.13158

70. Pierce T, Boivin M, Frenette E, et al (2010) Maternal self-efficacy and hostile-reactive parenting from infancy to toddlerhood. Infant Behav Dev 33:149–158. https://doi.org/10.1016/j.infbeh.2009.12.005

71. Boivin M, Pérusse D, Dionne G, et al (2005) The genetic-environmental etiology of parents' perceptions and self-assessed behaviours toward their 5-month-old infants in a large twin and singleton sample. J Child Psychol Psychiatry 46:612–630. https://doi.org/10.1111/j.1469-7610.2004.00375.x

72. Forget-Dubois N, Dionne G, Lemelin J-P, et al (2009) Early child language mediates the relation between home environment and school readiness. Child Dev 80:736–749. https://doi.org/10.1111/j.1467-8624.2009.01294.x

73. Forget-Dubois N, Lemelin J-P, Boivin M, et al (2007) Predicting Early School Achievement With the EDI: A Longitudinal Population-Based Study. Early Educ Dev 18:405–426. https://doi.org/10.1080/10409280701610796

74. Dionne G, Boivin M, Séguin JR, et al (2008) Gestational diabetes hinders language development in offspring. Pediatrics 122:e1073-1079. https://doi.org/10.1542/peds.2007-3028

75. Garon-Carrier G, Boivin M, Lemelin J-P, et al (2018) Early developmental trajectories of number knowledge and math achievement from 4 to 10 years: Low-persistent profile and early-life predictors. J Sch Psychol 68:84–98. https://doi.org/10.1016/j.jsp.2018.02.004

76. Garon-Carrier G, Boivin M, Guay F, et al (2016) Intrinsic Motivation and Achievement in Mathematics in Elementary School: A Longitudinal Investigation of Their Association. Child Dev 87:165–175. https://doi.org/10.1111/cdev.12458

77. Plourde V, Boivin M, Brendgen M, et al (2017) Phenotypic and genetic associations between reading and attention-deficit/hyperactivity disorder dimensions in adolescence. Dev Psychopathol 29:1215–1226. https://doi.org/10.1017/S0954579416001255

78. Ahun MN, Geoffroy M-C, Herba CM, et al (2017) Timing and Chronicity of Maternal Depression Symptoms and Children's Verbal Abilities. J Pediatr 190:251–257. https://doi.org/10.1016/j.jpeds.2017.07.007

79. Girard L-C, Pingault J-B, Falissard B, et al (2014) Physical aggression and language ability from 17 to 72 months: cross-lagged effects in a population sample. PloS One 9:e112185. https://doi.org/10.1371/journal.pone.0112185

80. Orri M, Scardera S, Perret LC, et al (2020) Mental Health Problems and Risk of Suicidal Ideation and Attempts in Adolescents. Pediatrics. https://doi.org/10.1542/peds.2019-3823

81. Galera C, Orri M, Vergunst F, et al (2020) Developmental Profiles of Childhood Attention Deficit/Hyperactivity Disorder (ADHD) and Irritability: Association with Adolescent Mental Health, Functional Impairment and Suicidal Outcomes. J Child Psychol Psychiatry. https://doi.org/10.1111/jcpp.13270

82. Orri M, Scardena S, Perret LC, et al (2020) Mental Health Problems and Risk of Suicidal Ideation and Attempts in Adolescents. Pediatrics

83. Orri M, Gunnell D, Richard-Devantoy S, et al (2019) In-utero and perinatal influences on suicide risk: a systematic review and meta-analysis. Lancet Psychiatry 6:477–492. https://doi.org/10.1016/S2215-0366(19)30077-X

84. Bolanis D, Orri M, Castellanos-Ryan N, et al (2020) Cannabis use, depression and suicidal ideation in adolescence: direction of associations in a population based cohort. J Affect Disord 274:1076–1083. https://doi.org/10.1016/j.jad.2020.05.136

85. Orri M, Russell A, Mars B, et al (2020) Perinatal adversity profiles and suicide attempt in adolescence and young adulthood: Longitudinal analyses from two 20-year birth cohorts. Psychol Med 1–13

86. Orri M, Perret LC, Turecki G, Geoffroy M-C (2018) Association between irritability and suicide-related outcomes across the life-course. Systematic review of both community and clinical studies. J Affect Disord 239:220–233. https://doi.org/10.1016/j.jad.2018.07.010

87. Orri M, Perret LC, Turecki G, Geoffroy M-C (2018) Association between irritability and suicide-related outcomes across the life-course. Systematic review of both community and clinical studies. J Affect Disord. https://doi.org/10.1016/j.jad.2018.07.010

88. Fraser A, Macdonald-Wallis C, Tilling K, et al (2013) Cohort Profile: the Avon Longitudinal Study of Parents and Children: ALSPAC mothers cohort. Int J Epidemiol 42:97–110. https://doi.org/10.1093/ije/dys066

89. Fenson L, Pethick S, Renda C, et al Short-form Versions of the MacArthur Communicative Development Inventories. Appl Psycholinguist 21:95–116

90. Alp IE (2016) Measuring the Size of Working Memory in Very Young Children: The Imitation Sorting Task: Int J Behav Dev. https://doi.org/10.1177/016502549401700108

91. Freeman S (2013) Wechsler Preschool and Primary Scale of Intelligence. In: Volkmar FR (ed) Encyclopedia of Autism Spectrum Disorders. Springer, New York, NY, pp 3351–3360

92. Zelazo PD, Jacques S, Burack JA, Frye D (2002) The relation between theory of mind and rule use: evidence from persons with autism-spectrum disorders. Infant Child Dev 11:171–195. https://doi.org/10.1002/icd.304

93. Dunn L, Thériault-Whalen C, Dunn L (1993) EVIP: échelle de vocabulaire en images Peabody. Psycan, Toronto, Canada

94. Okamoto Y, Case R (1996) Exploring the microstructure of children's central conceptual structures in the domain of number. Monogr Soc Res Child Dev 61:27–58. https://doi.org/10.1111/j.1540-5834.1996.tb00536.x

95. Busch JC, Watson JA, Brinkley V, et al (1993) Preschool embedded figures test performance of young children: age and gender differences. Percept Mot Skills 77:491–496. https://doi.org/10.2466/pms.1993.77.2.491

96. Pascual-Leone J, Baillargeon R (1994) Developmental Measurement of Mental Attention. Int J Behav Dev 17:161–200. https://doi.org/10.1177/016502549401700110

97. Chew AL, Morris JD (1984) Validation of the Lollipop Test: A Diagnostic Screening Test of School Readiness. Educ Psychol Meas 44:987–991. https://doi.org/10.1177/0013164484444022

98. Ulrich DA (1985) Test of Gross Motor Development. PRO-ED

99. Kaufman AS, Kaufman NL (2014) Kaufman Assessment Battery for Children, Second Edition. In: Encyclopedia of Special Education. American Cancer Society

100. Korkman M, Kemp S, Kirk U (1998) NEPSY: A Developmental Neuropsychological Assessment ; Manual. PsychCorp

101. Sinha (2010) The Pearson Guide to Quantitative Aptitude for CAT 2/e. Pearson Education India

Table 1. Significant differences in baseline characteristics between respondents and non-respondents at the 20-year wave of data collection

	Still in the sample at age 20 years 1245 (58.7)	Nonresponse at age 20 years 875 (41.3)	P value (Chi-squared)
Perinatal, birth, child characteristics			
Child female sex	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 (<1st distribution quartile)	255 (20.6)	268 (31.2)	<0.001
Nonintact (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

Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2018), ©Gouvernement du Quebec, Institut de la statistique du Quebec
The table reports count and % for each variable. 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.

Table 2. Summary of data collected in the different phases of the QLSCD

	Phase 1 (1998-2002)				Phase 2 (2003-2010)				Phase 3 (2011-2015)				Phase 4 (2016-2023)			
	5 m	**17 m**	**29 m**	**41 m**	**45-56 m**	**5 y**	**6 y**	**7 y**	**8 y**	**10 y**	**12 y**	**13 y**	**15 y**	**17 y**	**19 y**	**20 y**
Family characteristics																
Socioeconomic, demographic, family structure characteristics	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Perceived neighbourhood safety	x		x		x		x		x	x	x					
Family functioning	x	x					x		x	x	x	x	x	x		
Food insecurity									x	x	x	x				
Parental characteristics																
Depression	x	x		x		x		x		x		x		x		
Substance use in pregnancy	x															
Breastfeeding	x															
Child characteristics																
Child behaviour	x	x	x	x	x	x	x	x	x	x	x	x				
Temperament	x	x														
Stress													x	x	x	x
Mental health, suicidality													x	x	x	x
Physical health	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Diet and weight	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Academics and achievement								x	x	x	x		x	x	x	
Childcare attendance	x	x	x	x	x	x										
Language and literacy		x	x	x	x	x	x	x	x	x	x	x	x	x		
Smoking, substance use										x	x	x	x	x	x	x
Mental health											x	x	x	x	x	x
Motor and social development	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
Sleep	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sibling characteristics				x		x										
Sibling behaviours		x		x		x										
Parental attitudes towards sibling		x		x		x										
Relationships																
Sibling-child relationship		x		x		x										
Parenting practices	x	x	x	x	x	x	x		x	x	x	x	x	x	x	
Home environment observation	x	x	x													
Peer and teacher relations							x	x	x	x	x	x	x	x		
Peer victimization				x	x	x	x	x	x	x	x	x	x	x		

Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2018), ©Gouvernement du Quebec, Institut de la statistique du Quebec

Table 3. Summary of the main cognitive measures available in the QLSCD

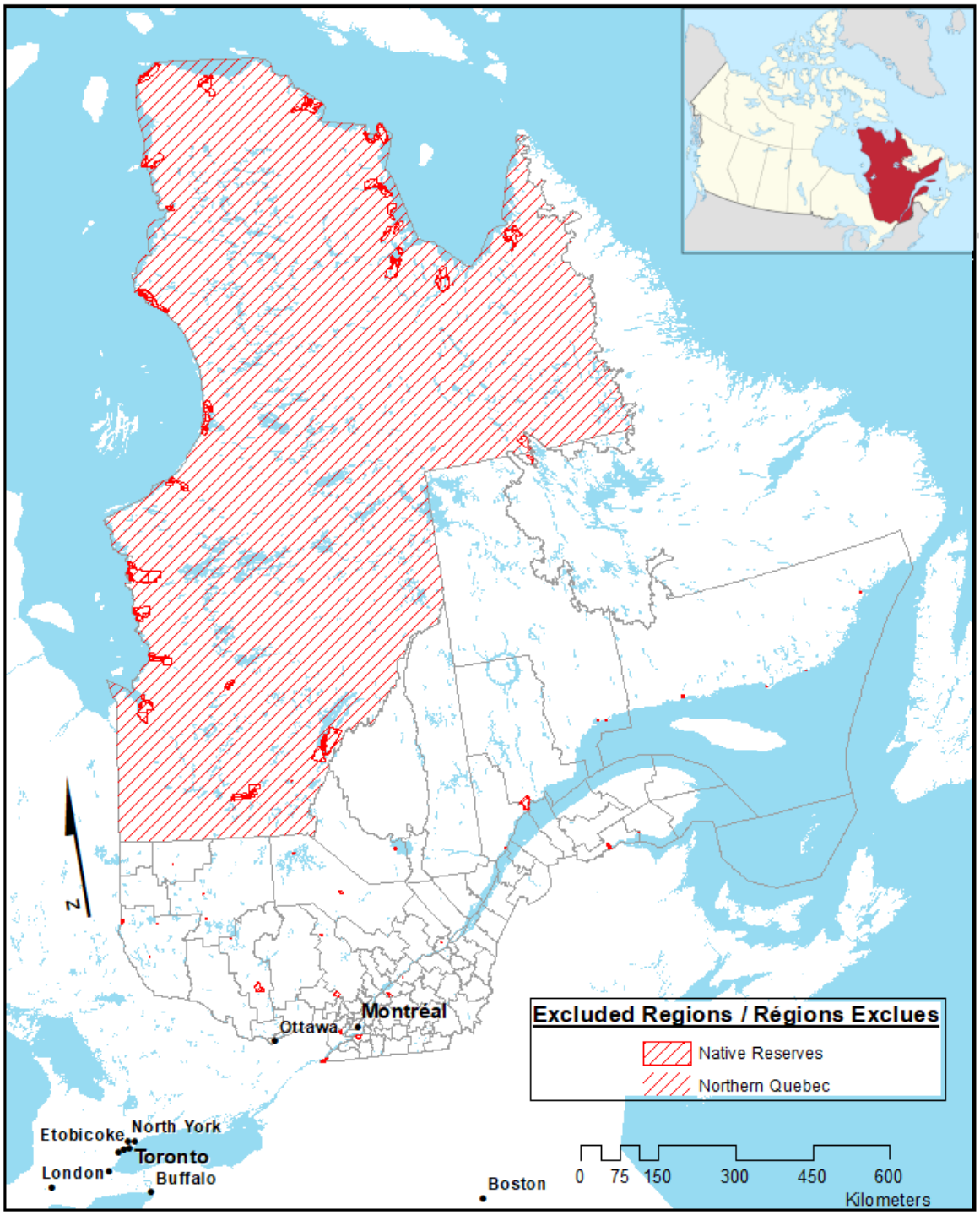
Measure	What does it measure?	Phase 1 (1998-2002)					Phase 2 (2003-2010)				
		5 m	17 m	29 m	41 m	45-56 m	5 y	6 y	7 y	8 y	10 y
McArthur Communicative Development Inventory-Short form[89]	Language development		x	x							
Imitation sorting task[90]	Working memory	x	x	x	x						
Block Test Design, from the WPPSI-R[91]	Spatial visualization ability; motor skill				x		x	x			
Visually Cued Recall[92]	Working memory				x	x	x	x			
Peabody Picture Vocabulary Test[93]	Receptive language				x		x	x			x
Number Knowledge Test[94]	Knowledge/understanding of numbers					x	x	x	x		x
Preschool Embedded Figures Test[95]	Field independence/analytical functioning					x					
Figural Intersection Task[96]	Mental attention						x	x			
The lollipop test[97]	School readiness							x			
Test of Gross Motor Development[98]	Motor skills							x		x	
K-ABC, reading comprehension and decoding subtest [99]	Reading skills								x	x	x
Non-word repetition, from the NEPSY[100]	Phonological encoding and decoding									x	
Mathematical calculation CAT/2 [101]	Numeric knowledge									x	

Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2018), ©Gouvernement du Quebec, Institut de la statistique du Quebec

WPPSI-R, Wechsler Preschool & Primary Scale of Intelligence-Revised; NEPSY, A Developmental NEuroPSYchological Assessment; K-ABC, Kaufman Assessment Battery for children

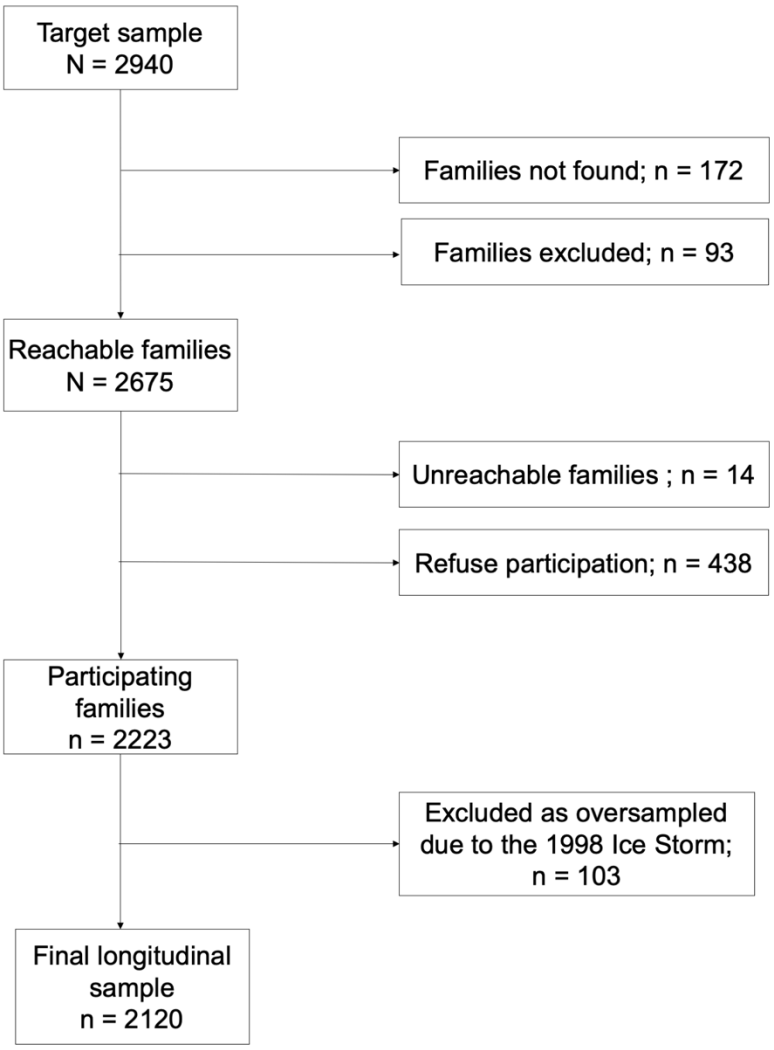
Figure title and legends

Figure 1. The province of Quebec, Canada and the territories from which children of the QLSCD have been sampled



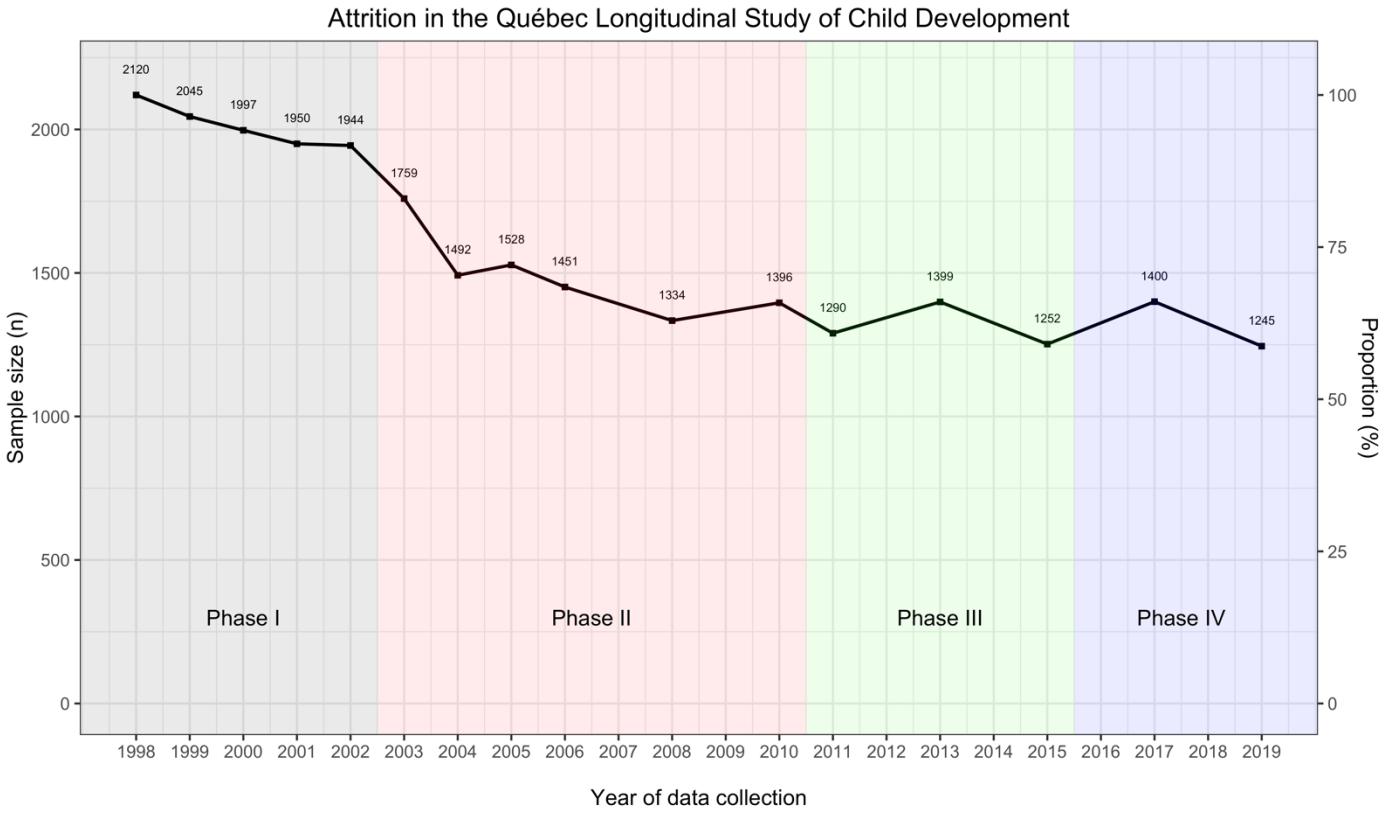
Note: The figure shows the territory of Quebec with all the administrative regions that were excluded from the initial sampling (in red).

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



Note: Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998–2018),

Figure 3. Attrition in the QLSCD



Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998–2018), ©Gouvernement du Québec, Institut de la statistique du Québec

Supplementary Table S1. Grants

Funding source	Year	Grant	Amount (CAN$)
Social Sciences and Humanities Research Council of Canada	(1995 - 2000)	Étude longitudinale et expérimentale du développement des enfants de la naissance à l'adolescence (ELEDEQ) (Co-Investigators: Barr, R. G.; Boivin, M.; Bukowski, W.; Doyle, A.-B.; Marcil-Gratton, N.; Normandeau, S.; Pérusse, D.; Piché, C.; Pihl, R. O.; Pless, B.; Robaey, P.; Tessier, O.; Tessier, R.; Zoccolillo, M.)	1,500,000.00
Fonds de la recherche en santé du Quebec	(1998 - 2000)	Validation d'outils de mesure de l'autorégulation pour l'étude longitudinale des enfans du Quebec (Co-Investigators: Séguin, Jean R.; Zelazo, P.)	70 000
Fonds pour la Formation de Chercheurs et l'Aide à la Recherche - Équipe	(1995 - 2001)	Développement et prévention des difficultés d'adaptation psychosociale chez les jeunes (Co-Investigators: Carbonneau, René; Pagani, Linda; Pihl, Robert O.; Séguin, Jean R.; Vitaro, Frank)	464 300
Ministère de la Santé et des Services sociaux - Santé Quebec	(1997 - 2001)	Enquête longitudinale sur les nouveau-nés du Quebec	343 417
Social Sciences and Humanities Research Council of Canada	(2001 - 2004)	The early determinants of socio-economic gradients in health status and the impact of quality child care (Co-Investigators: Barr, R. G.; Boivin, M.; Dubois, L.; Fortin, P.; Friendly, M.; Giasson, J.; Howe, N.; Lefebvre, P.; Merrigan, P. J; Pagani, L.; Pérusse, D.; Saint-Laurent, L.; Séguin, J. R.; Vineberg-Jacobs, E. G; Zoccolillo, M.)	675 000
Institut de la statistique du Quebec	(2003 - 2004)	Étude longitudinale du développement des enfants du Quebec (ELEDEQ)-Volet 7 (Co-Investigators: Lacourse, Éric; Lapointe, Pierre)	311 321
Social Sciences and Humanities Research Council of Canada-Major Collaborative Research Initiatives	(2001 - 2006)	Le développement des difficultés d'adaptation sociale au cours de l'enfance: études longitudinales et expérimentales concertées (ELEDEQ) (Co-Investigators: Baillargeon, R.; Barr, R. G.; Boivin, M.; Bukowski, W.; Carbonneau, R.; Doyle, A.-B.; Dubois, L.; Hébert, M.; Howe, N.; Larose, S.; Marcil-Gratton, N.; Montplaisir, J.; Pagani, L.; Pérusse, D.; Pihl, R.O.; Robaey, P.; Sabourin, S.; Saint-Laurent, L.; Séguin, J. R.; Tarabulsy, G.; Vitaro, F.; Zoccolillo, M.)	2,500 000
Canadian Institutes of Health Research - Institute of Human Development, Child and Youth Health	(2004 - 2010)	Understanding and fostering healthy developmental trajectories: A multidimensional, longitudinal, and experimental approach (Co-Investigators: Boivin, M.; Dionne, G.; Gendreau, P.; Lupien, S.; Merrigan, P.; Nagin, D.; Pansova, Z.; Paus, T.; Pérusse, D.; Robaey, P.; Schachar, R.; Séguin, J. R.; Tremblay, A.; Turecki, G.; Vitaro, F.; Zoccolillo, M.)	2 124 750

Supplementary Table 2. Summary of selected characteristics of the QLSCD participants

	n (%) or mean (SD)
Phase 1 (1998-2002)	
Child age 0-5 months	
Child female sex, n (%)	1040 (49.1)
Low (<2500 gr) birth weight, n (%)	71 (3.4)
Prematurity, n (%)	104 (4.9)
Teenage mother at childbirth, n (%)	59 (2.8)
Low maternal education (no high school diploma), n (%)	385 (18.2)
Low paternal education (no high school diploma), n (%)	339 (17.5)
Nonintact (single parent/blended) family, n (%)	406 (19.2)
Maternal smoking during pregnancy, n (%)	533 (25.3)
Maternal alcohol use during pregnancy, n (%)	752 (35.6)
Maternal use of illegal drugs during pregnancy, n (%)	30 (1.4)
Maternal depression at child age 5 months, n (%)	318 (15.0)
Paternal depression at child age 5 months, n (%)	108 (6.1)
Maternal antisocial behaviours in adolescence, n (%)	403 (19.9)
Paternal antisocial behaviours in adolescence, n (%)	405 (23.0)
Child age 1 ½ - 5 years (N=1216)	
Aggression score (mother reported)	1.85 (1.07)
Hyperactivity score (mother reported)	3.82 (1.65)
Internalizing behavior score (mother reported)	1.20 (0.93)
Pre-school peer victimization score (mother reported)	1.47 (1.22)
Phase 2 (2003-2010) and Phase 3 (2003-2010)	
Child age 6-12 years	
Peer victimization trajectories (teacher reported)	
High, n (%)	244 (14.5)
Moderate, n (%)	1000 (59.3)
Low, n (%)	441 (26.2)
Irritability trajectories (teacher reported)	
Persistent, n (%)	69 (5.0)
Declining, n (%)	103 (7.4)
Rising, n (%)	181 (13.0)
Low, n (%)	1040 (74.7)
Child age 13 years	
Cybervictimization, n (%)	112 (9.8)
Depression symptoms score (self-reported, range 0-2)	2.01 (2.15)
ADHD symptoms score (self-reported, range 0-2)	2.06 (2.04)
Physical aggression score (self-reported, range 0-2)	1.50 (1.32)
Phase 4 (2016-2023)	
Child age 15 years	
ADHD score (self-reported, range 1-10)	2.94 (1.67)
Generalized anxiety score (self-reported, range 1-10)	4.10 (2.17)
Depression score (self-reported, range 1-10)	3.48 (2.25)
Oppositional Defiant Disorder score (self-reported, range 1-10)	2.35 (1.39)
Child age 20 years	
Severe depression, n (%)	77 (6.3)
Severe anxiety, n (%)	64 (5.3)
ADHD	362 (29.8)
Several cigarettes/day	91 (7.5)
Cannabis use 3 times/week or more	121 (10.0)
Suicidal ideation/attempt, n (%)	124 (10.2)