


## Regular Article

# The mediating role of adolescents' loneliness and social withdrawal in the association between maternal depressive symptoms and suicidality in adolescence: A 20-year population-based study

Lamprini Psychogiou<sup>1</sup> , Marilyn N. Ahun<sup>2,3</sup>, Michel Boivin<sup>4</sup>, Richard E. Tremblay<sup>5,6</sup>, Massimiliano Orri<sup>3,7,8,\*</sup> and Sylvana M. Côté<sup>2,3,8,\*</sup>

<sup>1</sup>Mood Disorders Center, University of Exeter, Exeter, UK; <sup>2</sup>Department of Social and Preventive Medicine, Université de Montréal School of Public Health, Montréal, Canada; <sup>3</sup>Centre Hospitalier Universitaire Sainte-Justine, Montréal, Canada; <sup>4</sup>School of Psychology, Université Laval, Laval, Québec, Canada; <sup>5</sup>School of Public Health, University College Dublin, Belfield, Dublin 4, Ireland; <sup>6</sup>Department of Pediatrics and School of Psychology, Université de Montréal, Montréal, Canada; <sup>7</sup>McGill Group for Suicide Studies, Douglas Mental Health University Institute, Montréal, Canada and <sup>8</sup>INSERM U1219, Université de Bordeaux, Bordeaux, France

### Abstract

We examined whether adolescents' loneliness and social withdrawal mediated the association between maternal depressive symptoms and adolescent suicidality. Secondary analyses on the Québec Longitudinal Study of Child Development data were conducted ( $n = 1,623$ ). Each mother completed the Centre for Epidemiologic Studies Depression Scale (at child ages 5 months, 1.5, 3.5, 5, and 7 years). Adolescent's social withdrawal (adolescent, father, and teacher reported at 10, 12, and 13 years) and loneliness (adolescent reported at 10, 12, and 13 years), were assessed using items from the Social Behavior Questionnaire and the Loneliness and Social Satisfaction Questionnaire, respectively. Adolescents completed self-reports to assess suicidal thoughts and attempts at 13, 15, 17, and 20 years. Children of mothers with higher levels of maternal depressive symptoms had an increased risk for suicidality ( $OR = 1.15$ , 95% CI: 1.03–1.28). Loneliness explained 16% of the total effect of maternal depressive symptoms on adolescent suicidality (indirect effect  $OR = 1.02$ , 95% CI: 1.00–1.04). There was no indirect effect of maternal depressive symptoms on adolescent suicidal outcomes via social withdrawal (indirect effect  $OR = 1.00$ , 95% CI: 0.99–1.02). Interventions that target loneliness may be beneficial for decreasing the risk for suicidality among adolescents of mothers with depressive symptoms.

**Keywords:** maternal depressive symptoms, loneliness, social withdrawal, suicidality

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Suicide is the second leading cause of death among youth and is associated with substantial social and economic costs (World Health Organization, 2015). Risk factors for suicide among youth include in-utero and perinatal adverse conditions, child abuse or neglect, family problems, stressful life events, social isolation, academic pressure, bullying, youth's psychiatric disorders, previous self-harm, and suicide in friends or family (Hawton, 2009; Orri et al., 2019; Rodway et al., 2016). Due to genetic and environmental reasons, exposure to parental psychopathology has been identified as a risk factor for youths' suicide-related thoughts (suicidal ideation) and behaviors (Goodday, Bondy, Brown, Sutradhar, & Rhodes, 2020).

Using data from the Avon Longitudinal Study of Parents and Children (ALSPAC), a prospective study of a population cohort, Hammerton, Mahedy, et al. (2015) showed that children exposed to chronic and severe levels of maternal depressive symptoms from birth to 11 years were at increased risk for suicidal ideation at age 16 years, even after accounting for children's depression and maternal attempted suicide. Importantly, children exposed to subthreshold, increasing, and mild maternal depressive symptomatology were at risk for suicidal ideation (Hammerton, Mahedy, et al., 2015) thus suggesting that even moderate levels of exposure may represent risk. Identifying environmental, child-related pathways via which exposure to maternal depression leads to suicidality (i.e., ideation and/or attempt) can inform preventive interventions targeting these putative mechanisms. Previous longitudinal studies have shown that children's mental health problems are a pathway through which exposure to maternal depression can increase the risk of youth suicidality (Goodday et al., 2020; Hammerton, Zammit, et al., 2015). However, little is known about other potential mechanisms through which the association between exposure to maternal depression and children's suicidality occurs.

**Author for Correspondence:** Lamprini Psychogiou, PhD. University of Exeter, School of Psychology, Washington Singer Laboratories, Perry Road, EX1 1RX, UK; E-mail: [lpsychogiou@exeter.ac.uk](mailto:lpsychogiou@exeter.ac.uk)

\*co-last authors.

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Impoverishment of social relationships may represent a theoretically meaningful pathway explaining increased suicidal risk in the offspring of depressed mothers (Tsypes & Gibb, 2015). The depression-inhibition hypothesis (Dix, Meunier, Lusk, & Perfect, 2012; Yan & Dix, 2014) posits that depressed mothers' relational style is unresponsive and as a result, infants are unable to have their needs met or to influence their mother's behavior. Over time, infants withdraw from interacting with their depressed mother and generalize their withdrawn behavior to other social interactions. In line with this hypothesis, previous research suggests that children of depressed mothers are more likely to experience social withdrawal, defined as children's tendency to isolate themselves from peers (Rubin, Coplan, & Bowker, 2009; Yan & Dix, 2014). Studies have found that 76% of infants whose mothers had major depressive disorder exhibited withdrawn behavior at 6 months of age (Burtchen *et al.*, 2013), and that 6-year-old children of mothers with chronic depression showed increased social disengagement (Apter-Levy, Feldman, Vakart, Ebstein, & Feldman, 2013; Feldman *et al.*, 2009). In a longitudinal study including 1,364 mother-child pairs, Yan and Dix (2014) found significant associations between mother's depressive symptoms and child's withdrawal, providing further support for the depression-inhibition hypothesis. The study also demonstrated decreased mutual responsiveness in Mother×Child interactions, a finding that reflects relational difficulties and undermined quality of Mother×Child interactions. Other studies have found that depressed mothers are unresponsive to their infant's needs, and their infants develop negative expectations of mother's availability and show low initiative for social interactions (Dix, Cheng, & Day, 2009; Dix & Meunier, 2009; Dix, Stewart, Gershoff, & Day, 2007). Reciprocal effects between mother's depressive symptoms and infant's withdrawal have also been found (Yan & Dix, 2014). Parents perceive withdrawn infants as less active, happy, and cuddly (Costa & Figueiredo, 2011), and older withdrawn children as more needy and dependent (Rubin, Root, & Bowker, 2010). In turn negative perceptions of child's behavior can exacerbate parent's depressive symptoms over time.

Social withdrawal is associated with loneliness (Boivin, Hymel, & Bukowski, 1995), an aversive experience affecting approximately 26% of adolescents, of whom 3% report feeling very lonely (Rönkä, Rautio, Koiranen, Sunnari, & Taanila, 2014). Unlike social withdrawal, loneliness refers to the negative emotions experienced as a result of discrepancies between an individual's desired and actual social relationships (Rotenberg & Hymel, 1999). Loneliness therefore reflects the perception of impoverished social relationships, whereas social withdrawal refers to the behavior of isolation from a peer group (Rubin *et al.*, 2009). A meta-analytic study reported an association between maternal emotionality dimensions and adolescents' loneliness (Mahon, Yarcheski, Yarcheski, Cannella, & Hanks, 2006). Yet we are unaware of studies specifically testing whether maternal depression is associated with loneliness in the offspring during childhood. A link between mother's depressive symptoms and child's loneliness could occur via environmental and genetic routes. At the environmental level, depressed mothers show impairments in parenting (Lovejoy, Graczyk, O'Hare, & Neuman, 2000) and their children are more likely to be insecurely attached (Cicchetti, Rogosch, & Toth, 1998; Martins & Gaffan, 2000). While no significant associations were found between maternal depressive symptoms and self-reports of loneliness in first-grade children, maternal sensitivity and children's security of attachment were associated with children's decreased loneliness

(Raikes & Thompson, 2008). It is also possible that children who are exposed to depressed mothers' maladaptive affect (e.g., flat emotional expressions), behaviors (e.g., passivity), and cognition (e.g., rumination), subsequently develop social and interpersonal vulnerabilities increasing their risk for the onset and maintenance of loneliness (Goodman, 2007; Katz, Conway, Hammen, Brennan, & Najman, 2011; Tsypes & Gibb, 2015). A sizable number of studies have found that children of depressed mothers have social-emotional, cognitive, and behavioral difficulties (Goodman, 2007; Stein *et al.*, 2014). In turn such difficulties can act as risk factors for loneliness among children and adolescents (Cacioppo & Hawkley, 2009; Qualter & Munn, 2002; Rotenberg, 1994; Spithoven, Bijttebier, & Goossens, 2017). Finally, it is possible that there is shared genetic variance between internalizing phenotypes (depressed mood in the mother, withdrawal/loneliness/suicidality in the child) (Pettersson, Larsson, D'Onofrio, Bölte, & Lichtenstein, 2020). Genes and environment may also interact in putting children at risk for experiencing loneliness. In support of this notion, a longitudinal study found that adolescents who had the short allele of the serotonin transporter linked polymorphic region (*5-HTTLPR*) polymorphism and self-reported low levels of maternal support – a composite measure of emotional and instrumental support – were at heightened risk for feeling lonely (Van Roekel, Scholte, Verhagen, Goossens, & Engels, 2010). While our study was not genetically informative, there is value in identifying phenotypes on the pathway between maternal depression and child suicidality. By identifying individual child risk factors, preventive efforts can be improved. In addition, the value resides in the capacity to offer support for children with the identified profiles of risk. This is particularly important for adolescents because as they become more independent it is more difficult to work with their parents. Both social withdrawal and loneliness are associated with a range of negative outcomes in adolescence (Cacioppo & Hawkley, 2009; Heinrich & Gullone, 2006; Jones, Schinka, van Dulmen, Bossarte, & Swahn, 2011), including suicidal ideation and attempt (Roberts, Roberts, & Chen, 1998; Rodway *et al.*, 2016; Schinka, van Dulmen, Mata, Bossarte, & Swahn, 2013; Stravynski & Boyer, 2001). However, to the best of our knowledge, no longitudinal studies have examined if adolescents' social withdrawal and loneliness are pathways through which exposure to maternal depressive symptoms is associated with adolescent suicidality.

Using data from the Québec Longitudinal Study of Child Development (QLSCD), we tested the mediating role of adolescents' loneliness and social withdrawal (10 to 13 years) in the association between early maternal depressive symptoms (5 months to 7 years) and adolescents' suicidality (13 to 20 years). Given sex differences in suicidality, for example, suicides are more frequent in males while suicide ideation and attempts are more frequent in females (Fergusson, Woodward, & Horwood, 2000; Rhodes *et al.*, 2014), and inconclusive findings of sex differences in the prevalence of loneliness (Maes, Qualter, Vanhalst, Van den Noortgate, & Goossens, 2019; Qualter *et al.*, 2015) and social withdrawal (Rubin *et al.*, 2009), we tested whether there was evidence of differential association by sex.

## Method

### Sample and procedure

The QLSCD is a large on-going study conducted by the Institut de la Statistique du Québec (Québec Statistics Institute; ISQ) which

**Table 1.** Baseline sample characteristics<sup>a</sup>

		Child's age at assessment	N
<b>Participant</b>			
Girls, %	52.1	5 months	1,623
First-born, %	44.2	5 months	1,623
Physical aggression, median (IQR)	1.33 (1.6)	6 years	1,156
Depressive and anxiety symptoms, mean (SD)	2.02 (1.1)	6 years	1,157
Irritability, median (IQR)	3.33 (1.3)	6 years	1,355
<b>Mother</b>			
Age, mean (SD)	29.39 (5.2)	5 months	1,622
Depressive symptoms, median (IQR)	1.08 (1.3)	5 months–7 years	1,623
Anxiety, median (IQR)	.88 (1.4)	4.5 years	1,535
Youth antisocial behavior, median (IQR)	1.0 (1.0)	5 months	1,571
Stimulation, mean (SD)	4.80 (2.4)	5 months	1,433
<b>Family</b>			
Socioeconomic status, mean (SD)	0.07 (1.0)	5 months	1,617
Single-parent family, %	7.2	5 months	1,617

<sup>a</sup>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.

has tracked the health and wellbeing of a representative sample of Québec infants on a range of measures since they were 5 months old (see the study website [http://www.jesuisjeserai.stat.gouv.qc.ca/default\\_an.htm](http://www.jesuisjeserai.stat.gouv.qc.ca/default_an.htm) for further details). The cohort consists of 2,120 infants born in 1997 and 1998 and followed until 20 years of age. The sample was drawn from the Québec Master Birth registry and consists of mothers who gave birth after 24 weeks' gestation and spoke French or English. Data were reported by mothers (child's age 5 months–7 years), fathers (10–13 years), teachers (10–13 years), and study participants (10–20 years). Trained research assistants collected the following information from participants during interviews held at participants' homes: maternal depressive symptoms (four assessments), social withdrawal (three assessments), and loneliness (three assessments). Teacher reports of social withdrawal were assessed three times via postal questionnaires. Adolescent suicidality was assessed four times via online questionnaires due to the sensitive nature of the questions. Further details on the measures used for each of these variables and the ages at which they were assessed are provided below. All participating families (and teachers) gave their informed written consent at each assessment. Ethics were approved by the Health Research Ethics Committees of the ISQ and the Sainte Justine Hospital Research Centre (Ethics Registration #2009-200 2762).

Analyses were based on 1,623 participants (Table 1) who had available data on suicidality for at least one measurement occasion between 13 and 20 years.

Distributions of socio-demographic characteristics at baseline were comparable for included and excluded participants, except for five characteristics: boys and participants who were more physically aggressive received less stimulation in Mother×Child interactions, and came from low socioeconomic status (SES) and single-parent families were more likely to not have suicidality data (Supplementary Table S1). Inverse probability weighting, in which weights represent the probability of being included in the

analysis sample, were therefore used in all analyses (Seaman & White, 2013).

## Measures

### *Exposure (maternal depressive symptoms from 5 months to 7 years)*

The frequency of maternal depressive symptoms during the past week were self-reported when children were 5 months, 1.5, 3.5, 5, and 7 years using a short version of the Center for Epidemiologic Studies Depression Scale (CES-D; e.g., “I felt depressed,” “What I did was an effort”) (Radloff, 1977). This validated short CES-D included 5 to 12 questions from the original CES-D at each time of assessment (Poulin, Hand, & Boudreau, 2005). Response categories ranged between 0 (none) to 3 (all the time). We used mean scores (standardized on a 0–10 scale) over the five assessment points to compute the exposure variable. Correlations among the five assessments ranged from  $r = .28$  to  $r = .45$  (all  $p < .0001$ ). Twelve percent of the mothers in our sample experienced elevated depressive symptoms across early childhood (defined as 2.67/10 – based on 16/60 cut-off from the original CES-D [Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977]).

### *Outcome (suicidality from 13 to 20 years)*

Adolescents were asked “in the past 12 months, did you ever seriously think of attempting suicide” and, if yes, “how many times did you attempt suicide” (0 vs.  $\geq 1$ ), at 13, 15, 17, and 20 years (Côté et al., 2017; Geoffroy et al., 2016). In addition, the following questions were asked at age 20, referring to the lifetime: “Did you ever go to the emergency department for a suicide attempt,” and “Have you ever been hospitalized for a suicide attempt.” The suicidality variable (i.e., reporting  $\geq 1$  serious ideation or attempt at 13, 15, 17, or 20 years) was derived from these questions.

### Mediators (social withdrawal and loneliness from 10 to 13 years)

Data on social withdrawal between 10 and 13 years were only available from adolescents (10, 12, 13 years;  $r = .31-.33$ ,  $p < .0001$ ), fathers (10 and 13 years;  $r = .51$ ,  $p < .0001$ ), and teachers (10, 12, 13 years;  $r = .30-.33$ ,  $p < .0001$ ), and assessed using four items (“does things alone,” “prefers to play alone,” “seeks the company of other children,” “little interest in activities of other children”) from the Social Behavior Questionnaire (Tremblay et al., 1991). Adolescent, father, and teacher-reported scores were moderately correlated with each other ( $r = .23-.31$ ,  $p < .0001$ ). A final social withdrawal score was the average of adolescent, father, and teacher-reported scores from 10 to 13 years. Higher scores represented increased social withdrawal. Loneliness was self-reported by adolescents at 10, 12, and 13 years using the three-item Loneliness and Social Satisfaction questionnaire (Rotenberg, MacDonald, & King, 2004). Adolescents indicated the extent (never, sometimes, always) to which, in the last two weeks, they felt “they had people they could talk to,” “left out of things,” and “alone.” The first item was reverse coded so that higher scores represented higher feelings of loneliness. Cronbach’s alpha was .68 at 10 and 12 years, and .73 at 13 years. We used a mean score of loneliness from 10 to 13 years ( $r = .28-.29$ ,  $p < .0001$ ) in analyses.

### Covariates

Based on the existing literature, we searched for variables that could confound associations between maternal depressive symptoms and adolescent suicidality pertaining to risk factors and children’s social behaviors. We selected variables if they were correlated with maternal depressive symptoms and any of the mediators or adolescent suicidality. Unless otherwise specified, all covariates were assessed at baseline (i.e., 5 months) according to epidemiological guidelines for modelling longitudinal data whereby – as much as possible – potential covariates are selected at baseline and not at subsequent timepoints (Greenland & Morgenstern, 2001; Pearce & Greenland, 2005).

The following variables were included as covariates: maternal age, self-reported generalized anxiety symptoms (assessed at 4.5 years) (APA, 1994; Shapiro, Seguin, Muckle, Monnier, & Fraser, 2017), and youth antisocial behavior (Zoccolillo, Paquette, & Tremblay, 2005), observed Mother×Child interactions (stimulation and verbalization) (Caldwell & Bradley, 1985), children’s birth order, mother, father, and teacher-reported physical aggression (Tremblay et al., 1991) and depressive and anxiety symptoms (6 years) (Achenbach & Edelbrock, 1991; Behar & Stringfield, 1974; Boyle et al., 1993), and mother-reported irritability (6 years) (Orri et al., 2018). Family status (single parent vs. bi-parental) and SES (aggregate of five items regarding parental education, parental occupation, and annual gross income; range  $-3$ [low] to  $3$ [high], 0-centered) (Willms, 1996) were also included as covariates.

### Analysis

Structural equation modelling (SEM) was used to estimate the direct and indirect (via loneliness and social withdrawal) associations between maternal depressive symptoms and adolescent suicidality while adjusting for covariates. The crude association between maternal depressive symptoms and adolescent suicidality (total association) is given by the sum of direct and indirect effects. Mediation was tested via the significance of the indirect effect from the exposure variable via the mediators to the outcome

(Holmbeck, 2002). The indirect effect is significant if the product of the coefficient of the pathway from maternal depressive symptoms to the mediator and the coefficient of the pathway from the mediator to the outcome is significant (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).

SEM was performed with Mplus version 8 (Muthén & Muthén, 2019) using the robust (Huber–White nonnormal distributions) maximum likelihood estimator with logit link. Associations were therefore expressed as odds ratios (ORs). As bootstrapped confidence intervals of the indirect effect are not available in Mplus for this analysis, the R-Mediation package was used to build unbiased confidence intervals for indirect effects (Tofghi & MacKinnon, 2011). We estimated both unadjusted models (i.e., with only the exposure, mediator, and outcome variables) as well as models adjusted for the 11 selected covariates. Given the sample size and the number of events (i.e., suicidality cases), the risk of overfitting the model with this number of included covariates is low (Pezuzzi, Concato, Kemper, Holford, & Feinstein, 1996). Missing data in mediators and covariates were handled using the full information maximum likelihood. This is the best performing technique to handle missing data in SEM, and it is based on the Missing at Random assumption; it produces unbiased estimates for the whole population even in the presence of high rates of missing data (Enders & Bandalos, 2001; Johnson & Young, 2011). In our sample, we had complete data on maternal depressive symptoms and suicidality, and 10% and 11% of missing data for social withdrawal and loneliness, respectively. Covariates presented missing data rates varying from 0% to 29% (Supplementary Table S2). Descriptive statistics, correlations, and logistic regressions were obtained using the Statistical Packages for the Social Sciences version 25 (IBM Corporation, 2017).

### Complementary analysis

We used suicidal ideation (i.e., excluding individuals who attempted suicide) and suicide attempt as separate outcomes to examine whether the patterns of association differed between these two outcomes.

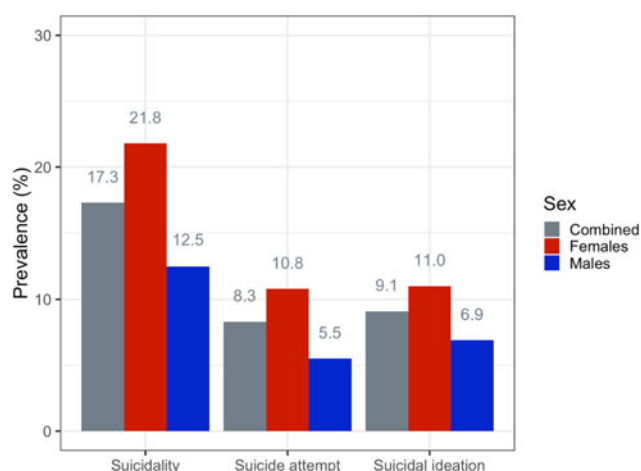
### Results

Seventeen percent of the sample reported seriously thinking about or attempting suicide (suicidality) between 13 and 20 years. Of those, 8% reported attempting suicide, while 9% reported serious ideation but no suicide attempt (Figure 1). Rates were higher for females for all suicide-related outcomes. The mean scores of loneliness and social withdrawal were 3.8 ( $SD = 0.9$ ) and 2.6 ( $SD = 1.6$ ), respectively, on a scale from 0 to 10.

We tested for differences in direct and indirect associations between boys and girls by comparing the fit of two models: the first, and most parsimonious, having paths constrained to be equal for boys and girls and the second having paths freely estimated for each sex (Kline, 2015). Because we found no evidence of superiority of the latter model ( $\chi^2_{34} = 28.2$ ,  $p = .749$ ), the final model was estimated for boys and girls combined. To examine the strength of the mediation effect of either mediator, the ratio of the mediator-specific indirect effect over the total effect was calculated (Preacher & Kelley, 2011).

Unadjusted simple regressions showed that adolescents of mothers with higher depressive symptoms during childhood had 1.15 (95% CI: 1.03–1.28) higher odds to ever report suicidality (i.e., total association). Higher levels of social withdrawal





**Figure 1<sup>a</sup>.** Prevalence of suicide-related outcomes.

<sup>a</sup>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.

( $OR = 1.20$ , 95% CI: 1.10–1.30) and loneliness ( $OR = 1.51$ , 95% CI: 1.32–1.72) were also associated with higher odds of reporting suicidality. Maternal depressive symptoms were also associated with both loneliness ( $\beta = .09$ ,  $p < .001$ ) and social withdrawal ( $\beta = .16$ ,  $p < .001$ ) in unadjusted models. Correlations between the exposure, mediator, outcome, and control variables are presented in the supplementary material (Supplementary Table S3).

Children's self-reported loneliness mediated the association between maternal depressive symptoms and adolescent suicidality even after adjusting for covariates (Figure 2).

Specifically, children of mothers with higher levels of maternal depressive symptoms had an increased risk for suicidality attributable to experiencing higher levels of loneliness ( $OR = 1.02$ , 95% CI: 1.00–1.04). Loneliness explained 16% of the total effect of maternal depressive symptoms on adolescent suicidality (Table 2). No evidence for an indirect effect of maternal depressive symptoms on adolescent suicidal outcomes via social withdrawal was found ( $OR = 1.00$ , 95% CI: 0.99–1.02).

### Complementary analyses

When suicide attempt and suicidal ideation were analyzed separately the results were consistent with those showed for the main outcome, although the indirect effect via loneliness was stronger for suicide attempt than suicidal ideation (Supplementary Figure S1).

### Discussion

Using prospective longitudinal data, we found that loneliness between 10 and 13 years mediated the association between maternal depressive symptoms (5 months to 7 years) and adolescent suicidality (13–20 years) independent of important child, mother, and family characteristics. However, we found no evidence for an indirect effect of maternal depressive symptoms on adolescent suicidal outcomes via social withdrawal. Mediation effects did not differ between boys and girls.

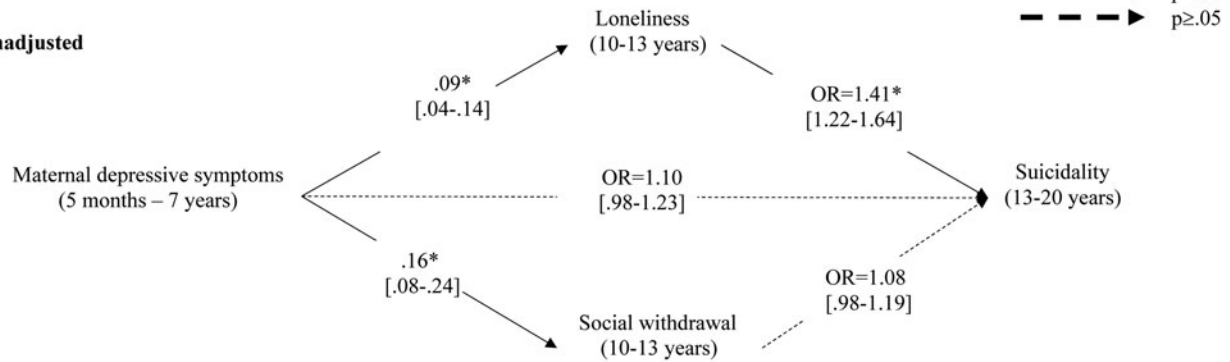
Our findings provide evidence suggesting that loneliness contributes to explaining why adolescents of mothers with higher depressive symptoms are at risk for suicidality, particularly

suicidal attempts. First, the significant association between loneliness and suicidality emphasizes the key role of perceived social and interpersonal environment in suicidality among adolescents (King & Merchant, 2008) and is consistent with previous studies that have provided evidence for this association across the life span (Garnefski, Diekstra, & Heus, 1992; Schinka, VanDulmen, Bossarte, & Swahn, 2012; Stickley & Koyanagi, 2016). Second, the findings contribute to the existing literature by showing that elevated levels of maternal depressive symptoms are associated with children's loneliness. Several explanations could account for this association. As noted earlier, it is well documented that children of depressed mothers are exposed to maladaptive affect, cognition, and behaviors and as a consequence, develop social and interpersonal vulnerabilities (Goodman, 2007; Katz et al., 2011; Tsypes & Gibb, 2015). This is reflected in research suggesting that lonely children and adolescents are more likely to not value themselves, have self-defeating thoughts, expect rejection, have low trust in others, and show heightened sensitivity to negative social stimuli compared to their less lonely counterparts (Cacioppo & Hawkley, 2009; Qualter & Munn, 2002; Rotenberg, 1994; Spithoven et al., 2017). Furthermore, insecure attachment and perceptions of low parental support and family bonding are common in children of depressed parents and have been found to predict loneliness (Goodman, 2007; Raikes & Thompson, 2008; Van Roekel et al., 2010; Wakefield, Bowe, Kellezi, Butcher, & Groeger, 2020). An additional explanation is that, given the genetic contributions to loneliness (Abdellaoui et al., 2018), genetically vulnerable adolescents who are exposed to maladaptive aspects of the family environment are at increased risk for suicidality, in line with the stress-diathesis model. Nevertheless, these speculations are tentative and future work is needed to identify the underlying mechanisms of the association between maternal depression and child loneliness.

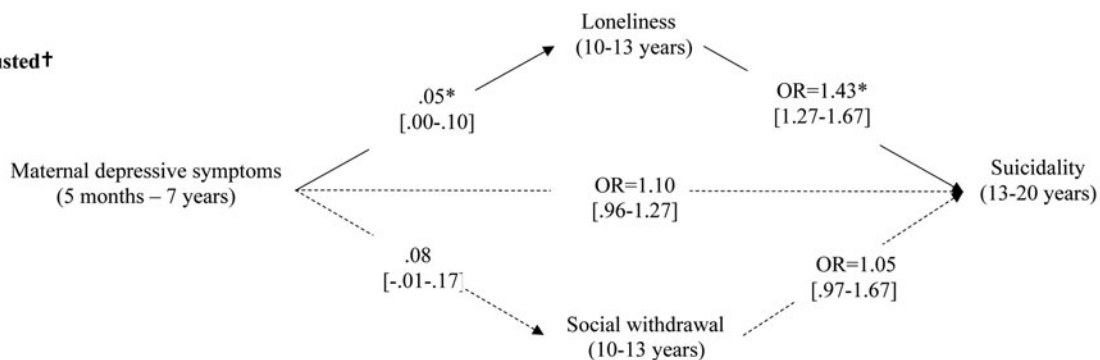
Our study did not find evidence for an indirect effect of maternal depressive symptoms on adolescent suicidal outcomes via social withdrawal. Maternal depressive symptoms were associated with higher levels of social withdrawal in unadjusted models, suggesting that this association is explained by confounding factors. However, social withdrawal was not associated with adolescent suicidality – after accounting for loneliness – in unadjusted and adjusted models. Certain methodological limitations may explain these findings. Self, father, and teacher reports were used to assess adolescents' social withdrawal, and although this multi-informant approach had the potential to reduce shared-informant bias, it may not have captured the full range of socially withdrawn behaviors. Social withdrawal is a multidimensional construct which includes different subtypes such as shyness, social disinterest, and social avoidance (Coplan & Armer, 2007). Some evidence suggests that socially disinterested children are content to spend time alone and they do not differ in social and cognitive outcomes compared to controls (Harrist, Zaia, Bates, Dodge, & Pettit, 1997; Rubin et al., 2009). In this study, we measured social withdrawal with four items; “does things alone,” “prefers to play alone,” “seeks the company of other children,” and “little interest in activities of other children.” These items tap into a preference for solitude construct but no other types of social withdrawal, and may therefore fail to distinguish between children whose social withdrawal may increase risk for suicidality versus those with similar outcomes to nonwithdrawn children. It is argued that children who exhibit different types of social withdrawal may not be at equal risk for adverse outcomes (Morneau-Vaillancourt et al., *in press*). Some evidence suggests that social avoidance is more

## Maternal depressive symptoms and adolescent suicidality

## A - Unadjusted



## B - Adjusted†



**Figure 2<sup>a</sup>.** Mediation models of the unadjusted and adjusted associations ( $\beta$  and OR [95% confidence intervals]) between exposure to maternal depressive symptoms during childhood and adolescent suicidality between 13 and 20 years.

†Adjusted for maternal age, anxiety, and youth antisocial behavior, Mother $\times$ Child interactions (stimulation and verbalization), child's birth order, physical aggression, depression and anxiety symptoms, and irritability, and family socioeconomic status and single-parent family. <sup>a</sup>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.

**Table 2.** Indirect and direct effects (OR and 95% confidence intervals) of maternal depressive symptoms on adolescent suicidality<sup>a</sup>

	Unadjusted	Adjusted <sup>b</sup>
	OR (95% confidence intervals)	OR (95% confidence intervals)
Total effect	1.15 (1.03–1.28)*	1.13 (0.98–1.29)
Direct effect	1.10 (0.98–1.23)	1.10 (0.96–1.23)
Indirect effect		
via loneliness	1.03 (1.01–1.06)*	1.02 (1.00–1.04)*
via social withdrawal	1.01 (.99–1.03)	1.00 (.99–1.02)

<sup>a</sup>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.

<sup>b</sup>Adjusted for maternal age, anxiety, and youth antisocial behavior, Mother $\times$ Child interactions (stimulation and verbalization), child's birth order, physical aggression, depression and anxiety symptoms, and irritability, and family socioeconomic status and single-parent family.

\* $p < .05$ .

problematic and puts children at particular risk for poor outcomes including maladaptive affect, symptoms of depression and social anxiety, and reduced well-being (Coplan & Armer, 2007; Coplan, Wilson, Frohlick, & Zelenski, 2006). Future work is needed to delineate if subtypes of social withdrawal, for example shyness and social avoidance, confer differential risk for

suicidality (Katz et al., 2011), as such efforts are key for identifying groups of adolescents who might be at increased risk.

The findings revealed no significant differences in mediation effects between boys and girls. These findings imply that maternal depressive symptoms may be associated with increased feelings of loneliness, in turn increasing risk for suicidality, in a similar way for boys and girls. In line with previous studies, we found no sex differences in social withdrawal (combined variable) (Rubin et al., 2009) and loneliness (Qualter et al., 2015), but higher prevalence of all suicide-related outcomes in females than in males (Fergusson et al., 2000).

This study had many strengths. It used prospective multi-informant data across childhood and adolescence in a large Canadian birth cohort. Maternal depressive symptoms were assessed at different time points spanning the first 7 years of a child's life. In addition, models were adjusted for important covariates selected on the basis of existing literature. However, the study also had some limitations. There were no available data on mothers' clinical diagnosis of depression and the findings cannot therefore be generalized to clinical populations. The study focused on environmental mechanisms, but genetic factors could explain the link between maternal depressive symptoms and adolescent's suicidality. Loneliness and suicidality were assessed with self-reports and their significant association may be due to shared method variance. In addition, while there was evidence for mediation, the effect sizes of the associations are small, calling for caution in interpreting potential impact of our findings at the population level. Furthermore, because of attrition, our analyses

were based on 77% of the initial representative sample. Although we used weights to account for attrition, this calls for caution in the generalizability of our results to the whole Québec population. Finally, we chose to use mean scores of each construct because it enabled us to capture the presentation of a given construct over a period of time (e.g., the average level of exposure to maternal depressive symptoms in early childhood). However, this limited our ability to comment on fluctuations in the constructs from one time point to another.

Despite these limitations, our findings add to the theoretical understanding of the potential mechanisms through which maternal depressive symptoms increase risk for adolescent suicidality and have potential clinical implications. First, prevention and intervention strategies should aim to prevent and/or treat maternal depression. Psychological treatments that target maternal depression have been found to be effective at improving both mother's depression and child's mental health (Cuijpers, Weitz, Karyotaki, Garber, & Andersson, 2015). Second, clinicians should aim to improve the family environment of depressed mothers (e.g., impaired parenting, maladaptive interpersonal behaviors) prior to the onset of child loneliness and be aware that some children of depressed mothers might be at increased risk for impoverished social relationships, which may put them at increased risk of subsequent suicidality. Third, prevention strategies should aim to prevent loneliness in youth by promoting for example, inclusive school environments. Finally, intervention strategies should aim to reduce loneliness. It is an encouraging finding that recent meta-analytic evidence provides support that interventions can lead to decreased loneliness in children and young people (Eccles & Qualter, 2020). To improve outcomes, Eccles and Qualter (2020) argued that such interventions should adopt a personalized approach and provide a good fit between intervention type and needs of each individual. On the basis of our findings, researchers should explore whether interventions that aim to reduce loneliness could potentially reduce suicidal risk for adolescents exposed to maternal depressive symptoms during childhood. In summary, the findings of this study make a novel contribution to the existing literature by identifying loneliness as a potential environmental pathway in the association between maternal depressive symptoms and adolescent suicidality.

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**Conflicts of Interest.** None.

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