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Patterns of anxiety symptoms during adolescence: Gender differences and sociomotivational factors☆

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ABSTRACT

Although many adolescents experience anxiety, few studies have examined anxiety trajectories separately for boys and girls or have attempted to understand the role of associated sociomotivational factors (SF). Based on self-determination theory, the present study aimed to identify trajectories of anxiety symptoms for boys and girls aged from 11 to 16 years and to explore whether these trajectories are predicted by academic competence, concerns about relatedness, and introjected regulation. A longitudinal sample of 493 adolescents (224 boys, 269 girls) took part in this study. Group-based trajectory analyses revealed three comparable trajectories for boys and girls (low, moderate, and high trajectory groups), as well as one trajectory unique to girls (moderate-increasing trajectory group). Concerns about relatedness were associated with the trajectory characterized by higher anxiety symptomatology in both boys and girls. Academic competence and introjected regulation, on the other hand, were related to the moderate-increasing trajectory for girls.

1. Introduction

Anxiety is among the most common forms of psychological distress in children and adolescents (Costello, Egger, Copeland, Erkanli, & Angold, 2011; Higa-McMillan, Francis, & Chorpita, 2014; Rapee, Schniering, & Hudson, 2009). Descriptive epidemiological studies have shown that the median age for the appearance of clinical anxiety symptoms is 11 years (Jones, 2013; Kessler et al., 2005), and the lifetime prevalence is slightly more than 30% (Merikangas et al., 2010). The current state of empirical evidence also suggests that anxiety symptoms can severely alter functioning in youth who experience it regularly (Higa-McMillan et al., 2014). This condition also co-occurs with other psychological disorders such as depression (Chu, Merson, Zandberg, & Margaret, 2012) and can significantly undermine adaptation in various areas of life, including academic functioning (Duchesne, Vitaro, Larose, & Tremblay, 2008) and social interaction (Kingery, Erdley, Marshall, Whitaker, & Reuter, 2010).

Research indicates that self-reported anxiety symptoms appear to be moderately stable when measured toward the end of childhood or during adolescence (Bosquet & Egeland, 2006; Duchesne, Ratelle, & Roy, 2012; Gullone, King, & Ollendick, 2001). However, this apparent stability does not apply to all adolescents, as recently revealed in findings that manifestations of anxiety followed different developmental trajectories (e.g., Crocetti, Klimstra, Keijsers, Hale, & Meeus, 2009; Miers, Blöte, de Rooij, Bokhorst, & Westenberg, 2013). Because these studies are still at the initial stage, further research is needed to replicate these trajectories for boys and girls. In the present study, anxiety symptoms refer to normative emotional experiences of worries, nervousness, and oversensitivity.

Moreover, very little is known about sociomotivational factors associated with anxiety trajectories in adolescence. Considering that educational settings are supposed to be hubs for frontline service delivery to prevent mental health problems in youth (Atkins, Hoagwood, Kutash, & Seidman, 2010; Fox, Herzig, Colognori, Stewart, & Warner, 2014), it is critical to identify the malleable personal factors that parents and school staff could intervene in to reduce the risks associated with anxiety. According to self-determination theory (SDT; Deci & Ryan, 2000, 2012), a macro-theory of motivation, personality, and well-being, anxiety may result from poor satisfaction of basic psychological needs as well as controlled motivations (Ng et al., 2012; Ryan, Patrick, Deci, & Williams, 2008; Vansteenkiste & Ryan, 2013). However, these personal factors have not been related to developmental trajectories of anxiety in adolescents. By adopting a sociomotivational perspective drawn largely from SDT, this longitudinal study aimed to identify trajectories of anxiety symptoms for boys and girls from age 11 to 16 years and to explore

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whether these developmental trajectories could be explained by sociomotivational factors. These factors include academic competence (perceiving oneself as being effective as a student), concerns about relatedness (social concerns about peers and teachers), and introjected regulation (behaving out of internal pressures such as guilt and obligation). SDT suggests that people who feel competent, respected by others, and free to act without being pressured are more likely to experience positive emotions (e.g., low anxiety) in new and possibly stressful situations (Ng et al., 2012; Ryan et al., 2008).

2. Trajectories of anxiety symptoms in adolescents and gender differences: background

Studies on developmental changes in anxiety symptoms are scant in the literature, particularly for mixed-gender community samples of adolescents. We found only five published studies in peer-reviewed journals that investigated developmental trajectories of anxiety symptoms in this population (Crocetti et al., 2009; Miers et al., 2013; Legerstee et al., 2013; Letcher, Sanson, Smart, & Toumbourou, 2012; Morin et al., 2011), of which only two considered boys and girls separately (Legerstee et al., 2013; Letcher et al., 2012). All five studies used a longitudinal method based on individual developmental trajectories to identify discrete subpopulations of adolescents who differed qualitatively in terms of the occurrence and persistence of anxiety symptoms over time (for details of this technique see Asparouhov & Muthén, 2007; Muthén & Muthén, 2007; Jones & Nagin, 2007, and Nagin, 2005). A group-based trajectory analysis would be a useful alternative to statistical methods, like variance or growth curve analyses, which assume that developmental patterns evolve in a similar manner for all individuals within a given population (Dupéré, Lacourse, Vitaro, & Tremblay, 2007; von Eye & Bergman, 2003).

In the first study that considered gender differentiation, Letcher et al. (2012) administered age-appropriate questionnaires to assess anxiety symptoms longitudinally at ages 11–12, 13, 15, and 17 years. Trajectory analyses revealed three distinct patterns for boys (low, moderate-decreasing, and high-increasing) and for girls (low, moderate, and high-increasing). In the second study, Legerstee et al. (2013) assessed anxiety symptoms in youth at three times over a six-year period (age 11–17 years). Their analyses also revealed three distinct developmental trajectories for boys (low, mid-adolescence-limited, and mid-adolescence-decreasing) and for girls (low, mid-adolescence-limited, and mid-adolescence-increasing). The three studies that did not estimate trajectories as a function of gender (Crocetti et al., 2009; Miers et al., 2013; Morin et al., 2011) found trajectories that were consistent with those obtained by Legerstee et al. and Letcher et al. These studies identified two (Crocetti et al., 2009), three (Miers et al., 2013), and five (Morin et al., 2011) trajectories with low, moderate, high, and changing symptoms. In addition, significantly more girls than boys were in the trajectories characterized by higher anxiety symptoms (Crocetti et al., 2009; Morin et al., 2011).

In sum, these studies highlight the diversity of developmental patterns of anxiety symptoms across non-clinical adolescent samples. In the two studies that considered gender differences, three sex-specific trajectories were identified. In most boys and girls, these symptoms were slightly or moderately severe and stable over time, or in some cases declined slightly from the end of childhood to the end of adolescence. Some youth also showed high anxiety symptoms at ages 11–12, which increased steadily up to the end of adolescence, while for a subgroup of girls, these symptoms appeared progressively at about age 12 (Legerstee et al., 2013). Methodological differences such as participants' age at initial assessment, type and reliability of measures used, and assessment frequency can partly explain the variability observed in the number and shape of the trajectories. Further studies are therefore needed to replicate the three distinct developmental patterns in terms of gender in adolescence.

Building on the two above-mentioned studies, we believed that we could obtain a more comprehensive description of adolescents' anxiety trajectories by measuring anxiety at more than three time points to determine in more detail the shape of developmental trajectories. This would allow a finer assessment of how symptoms fluctuate over time (e.g., a cubic trajectory form), and would enable including in the trajectory analysis factors that provide more insight into individual differences (Jones & Nagin, 2007; Jones, Nagin, & Roeder, 2001; Nagin, 1999, 2005). The latter is critical for gaining an in-depth understanding of anxiety symptoms and for structuring the education service delivery, in accordance with its mandate to provide universal and targeted interventions (e.g., Duchesne, Larose, Vitaro, & Tremblay, 2010; Stoiber & DeSmet, 2010). In the present study, we focused on the contribution of perceived academic competence, concerns about relatedness, and introjected controlled regulation, in line with the literature on the transition to adolescence, which generally acknowledges their importance in understanding the psychological well-being of young adolescents (e.g., Grills-Taquechel, Norton, & Ollendick, 2010; Roeser, Eccles, & Sameroff, 2000). The theoretical framework underlying this study is that of SDT, a motivation theory that has been applied in health and education fields (Ryan et al., 2008; Vansteenkiste, Lens, & Deci, 2006). To the best of our knowledge, developmental trajectories of anxiety during adolescence have not yet been explored with sociomotivational factors based on SDT.

3. A sociomotivational perspective on anxiety

SDT (Deci & Ryan, 2000, 2012) proposes that competence and relatedness are essential psychological needs for human functioning. They are considered innate and universal needs, which, when satisfied, foster autonomous, self-regulated behavior and psychological health (Deci & Ryan, 2000; Ryan et al., 2008; Schultz & Ryan, 2015). The need for competence refers to the desire to interact effectively with the environment, to engage optimal challenges, and to experience mastery or effectance in accomplishing tasks of varying difficulty (Deci, 1975; Reeve, 2012). In education, this need is satisfied when youth are actively engaged in tasks that are appropriate for their ability levels, and when they aim to exceed themselves and improve their mastery. The need for relatedness refers to the desire to be emotionally connected to others, to be involved in interpersonal relationships that are warm, caring, and sensitive, and to belong to a social group (Baumeister & Leary, 1995; Ryan, La Guardia, Butzel, Kim, & Chirkov, 2003). This need is satisfied when youth have meaningful relationships with significant persons in their lives, such as peers and teachers.

Some studies have examined the contribution of competence and relatedness, in educational settings, to anxiety symptoms and/or emotional stress during the transition from elementary to high school (Duchesne et al., 2012; Grills-Taquechel et al., 2010; Harter, Whitesell, & Kowalski, 1992; Letcher et al., 2012; Roeser et al., 2000). Of these studies, the only one that estimated the trajectory of anxiety symptoms found that girls in a high-anxiety group had lower academic competence and more difficult relationships with peers, which can be approximated as poor relatedness (Letcher et al., 2012). A similar relatedness pattern was found for boys in the high-anxiety group. These results concur with other studies, which have suggested that students who are academically competent, socially connected, and less concerned about relatedness with peers and teachers prior to the high school transition are at lower risk for anxiety and emotional distress post-transition. From an SDT perspective, it is reasonable to believe that students' competence and relatedness needs were satisfied and that they have resources and options enabling them to feel confident about adapting to the demands and constraints of high school and to experience positive feelings there (Ratelle & Duchesne, 2014).

Another unique concept of SDT is the multidimensional conceptualization of motivation, which can be defined as reasons underlying a behavior. SDT distinguishes between *autonomous* (engaging willingly in

an activity for the pleasure that it provides or out of personal values) and *controlled* (engaging in an activity for reasons other than the activity itself such as internal or external pressures) forms of motivation. Whereas autonomous motivation is associated with lasting and significant benefits on psychological well-being, controlled motivation has been found to undermine psychological well-being (Ng et al., 2012; Ratelle, Simard, & Guay, 2013; Ryan et al., 2008). A type of controlled motivation that appears particularly salient for investigating anxiety symptoms is introjected regulation (Ng et al., 2012; Schultz & Ryan, 2015). It refers to motivation to act according to self-imposed constraints such as anxiety, guilt, shame, fear of criticism, and fear of disapproval by significant others (Deci & Ryan, 2012). The reasons underlying behaviors become internal to the self – i.e., they do not require environmental prompts – but they are not coherent with one's true self. In such cases, individuals are not autonomous in regulating their behaviors, which are motivated primarily by the ego, or the desire to look good and appear competent (Deci & Ryan, 2000).

SDT-based studies have found positive and significant associations between introjected regulation and anxiety symptoms, in both the health and education sectors. For example, in a study in children attending grades 3 to 6, Ryan and Connell (1989) found that introjected regulation was positively correlated to school anxiety measures. Stoeber, Feast, and Hayward (2009) also demonstrated that introjected reasons for studying predicted higher levels of worry about exams in undergraduate students. Furthermore, in a recent meta-analysis of independent studies in the health sector, introjected regulation was significantly and positively related to anxiety symptoms (Ng et al., 2012). Altogether, these findings suggest that introjected regulation behaviors contribute to psychological ill-being, as characterized by an increased risk for anxiety symptoms.

A review of the empirical literature appears to support links between SDT-based variables and anxiety, and researchers have suggested the mechanisms involved in this association. One of them involves appraisals of stressful situations (Ntoumanis, Edmunds, & Duda, 2009; Skinner & Edge, 2002; Tong et al., 2009). Underlying this mechanism is the notion that individuals who feel competent, connected to others, and autonomous (as opposed to introjected) would be less vulnerable to anxiety, such that stressful events would be viewed as more controllable. These individuals would be more likely to consider these events as challenges to take up and opportunities for personal growth. This positive assessment would, in turn, increase their confidence in having control over the event, which would reduce the risk of activating negative emotions, such as anxiety.

Besides the role of cognitive appraisals, the internalization of self-critical standards has also been proposed as a potential mechanism of action (Vansteenkiste & Ryan, 2013). This occurs when basic psychological needs are constantly frustrated by the social context. Need frustration leads some individuals to develop rigid thought patterns (e.g., self-critical perfectionism) whose purpose is to restore their sense of well-being (e.g., proving their self-worth). The difficulty of achieving and maintaining such standards, however, induces feelings of guilt and inferiority, thus predisposing the person to ill-being and anxiety.

In the present study, participants were followed at a time when they were preparing to undertake the important transition from elementary to high school. This event is generally considered to be stressful and destabilizing for young adolescents due to a number of changes in terms of curriculum characteristics, academic expectations, and peer interactions (Duchesne et al., 2012). Research shows that this transition can be anxiety-provoking, with findings of increased anxiety symptoms throughout this period (e.g., Grills-Taquechel et al., 2010; Harter et al., 1992). With this knowledge, combined with findings from SDT-based research, it is possible to consider that youths whose needs are frustrated and who attend school out of obligation at the end of elementary school will be more at risk in terms of the development, maintenance, and worsening of anxiety symptoms once they arrive in high school. These youths could assess the transition to their new environment as stressful and uncontrollable, or impose difficult demands on themselves to satisfy pressure from others or to project a positive self-image.

4. Research aims and hypotheses

Studies focusing on both the identification, description, and understanding of anxiety trajectories in adolescence are extremely rare. To the best of our knowledge, this study is the first to explore anxiety trajectories using six-year longitudinal data, and to examine these trajectories with SDT-based factors, while considering an important potentially confounding variable. Thus, the first aim was to identify distinct developmental trajectories of anxiety symptoms from age 11 to 16 years in boys and girls separately. Following our literature review on anxiety symptom trajectories in adolescence, four hypotheses were formulated: 1) at least three developmental trajectories will be identified for both boys and girls; 2) most adolescents will follow a stable trajectory, with the degree of anxiety varying from low to high; 3) some adolescents will belong to a trajectory characterized by increasing anxiety symptoms over time; and 4) a greater proportion of girls than boys will belong to a high and/or high-increasing anxiety trajectory.

The second aim was to investigate the contribution of perceived academic competence, concerns about relatedness with peers and teachers, and introjected motivation to developmental trajectories of anxiety. Depressive symptoms were included as a covariate, given their close association with anxiety (e.g., Costello, Foley, & Angold, 2006; Duchesne, Ratelle, Poitras, & Drouin, 2009; Higa-McMillan et al., 2014; Rudolph, Hammen, & Daley, 2006). By considering depressive symptoms, we could better discern the contribution of the SDT variables to explain the anxiety trajectories. Two hypotheses were proposed: 1) perceived academic competence will be associated with a lower risk of belonging to a higher anxiety trajectory group; and 2) concerns about relatedness and introjected motivation will be associated with a higher risk of belonging to a higher anxiety trajectory group. However, the magnitude of these associations could be expected to differ according to gender, because differences have been reported between boys and girls on the sociomotivational variables retained. Thus, compared to boys, girls would have higher perceived academic competence (Duchesne & Ratelle, 2014), be more concerned about relatedness with peers and teachers (Duchesne et al., 2012), report higher levels of introjection (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007), and feel more guilt and shame, especially at the beginning of adolescence (Else-Quest, Higgins, Allison, & Morton, 2012).

5. Method

5.1. Participants

Data were collected from a sample of 493 adolescents (224 boys, 269 girls) who took part in a larger project on school transitions, adaptation, and perseverance in high school. The study was conducted across the province of Quebec, Canada, over a six-year period, from school year 2005–2006 (Grade 6/Time 1 – end of elementary school) to 2010–2011 (Grade 11/Time 6 – end of high school). At Time 1 (T1), participants' average age was 11.82 years ($SD = 0.49$). Most of them were born in Quebec (92%), spoke French at home (98%), and lived with both biological parents (74%). The average annual family income, as reported by the responding parent, varied from $50,000 to $59,000, which is comparable to the median income for a middle-class Quebec household at the time of the first data collection ($59,734 CAN; Statistics Canada, 2006).

5.2. Procedure

The sample came from a randomly generated list of names and telephone numbers provided by the Quebec Ministry of Education, Leisure and Sport. This list was stratified according to three dimensions:

adolescent gender, family socioeconomic status, and family geographical location (rural vs. urban). The purpose was to construct a representative sample of young French-speaking students in Quebec attending Grade 6 elementary school in the 2005–2006 academic year. To participate in the study, both the students and one of their parents had to provide consent. In March and April 2006 (Grade 6; age 11; T1), 2007 (Grade 7; age 12; T2), 2008 (Grade 8; age 13; T3), 2009 (Grade 9; age 14; T4), 2010 (Grade 10; age 15; T5), and 2011 (Grade 11; age 16; T6), participants were invited to complete either a paper-and-pencil or an electronic questionnaire on a secure Web platform. The questionnaire included measures of participants' psychological health (anxiety, depression) and school experience (competence, relatedness, and motivation). Participants were compensated for their time with either a free movie ticket or a gift certificate for an online book and music store.

5.3. Attrition

Complete data were available for all the variables measured at age 11 (T1). From age 12 (T2) to age 16 (T6), the proportion of adolescents for whom data on the measure of anxious symptomatology were available varied from 57% to 77%. Chi-square tests were performed on demographic variables to compare adolescents with complete data to those without complete data. There were no statistically significant differences between the two groups with regard to age, $\chi^2 = 1.87$, $df = 2$, $p = 0.39$, gender, $\chi^2 = 0.61$, $df = 1$, $p = 0.44$, family structure, $\chi^2 = 1.16$, $df = 1$, $p = 0.28$, language spoken at home, $\chi^2 = 0.10$, $df = 1$, $p = 0.75$, and family income, $\chi^2 = 5.45$, $df = 7$, $p = 0.61$.

5.4. Measures

5.4.1. Anxiety – age 11(T1) to 16 (T6)

5.4.1.1. Anxiety symptoms. Adolescents' anxiety symptoms were assessed each year with the worry/oversensitivity subscale of the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1997). The RCMAS is a widely used instrument that assesses anxiety in community samples of children and adolescents from 6 to 19 years of age (Gullone et al., 2001). This self-report questionnaire contains three anxiety subscales measuring worry/oversensitivity, physiological anxiety, and concentration. In the present study, only the worry/oversensitivity subscale (12 items in the French-Canadian version; Turgeon & Chartrand, 2003) was administered to participants. This decision was intended to reduce the length of the questionnaire (the participants took part in an extensive longitudinal survey designed to better understand school trajectories throughout high school). This subscale was preferred to the other two because it covers a broader range of anxiety symptoms (obsessive concerns, nervousness, and oversensitivity), in addition to having better reliability and validity indices (see Turgeon & Chartrand, 2003). Some examples of items are, "I worry a lot of the time," "I get nervous when things do not go the right way for me," and "My feelings get hurt easily." Participants were asked to respond to each item with either 1 (no) or 2 (yes). Items were then summed and scores varied from 12 (no symptoms) to 24 (presence of many symptoms). The French-Canadian version of this subscale (Turgeon & Chartrand, 2003) has shown adequate validity, supported by test-retest reliability ($r = 0.61$ after 6 months) and internal consistency (Cronbach's alpha = 0.81). In the current study, the internal consistency coefficients (Cronbach's alpha) at each assessment time are as follows: 0.74 (age 11), 0.80 (age 12), 0.80 (age 13), 0.84 (age 14), 0.83 (age 15), and 0.86 (age 16).

5.4.2. Sociomotivational factors – age 11 (T1)

5.4.2.1. Academic competence. Three items from the Academic subscale of the Perceived Competence in Life Areas Scale (Losier, Vallerand, & Blais, 1993) were used to assess *perceived academic competence* at the end of elementary school. The items on this subscale were rated from 1 (*completely disagree*) to 7 (*completely agree*). A sample item is, "As a student, I have developed very good competencies." Internal consistency of 0.81 and test-retest reliability of 0.84 (one-month interval) have been reported for this subscale (Losier et al., 1993). In the present study, Cronbach's alpha was 0.67.

5.4.2.2. Concerns about relatedness. Concerns about relatedness at the beginning of high school were assessed with five self-reported items from a scale that measures specific representations related to academic performance and relationships with peers and teachers surrounding the transition to high school (Duchesne et al., 2012). Participants responded on a 5-point Likert scale ranging from 1 (*does not correspond to what I think at all*) to 5 (*corresponds exactly to what I think*). Sample items are, "I am concerned that the teachers will not be interested enough in me," and "I am concerned that I won't be able to make new friends." The higher the score, the greater the expressed concerns about relatedness in high school. In the present study, Cronbach's alpha was 0.78.

5.4.2.3. Introjected regulation. The Introjection subscale of the Academic Motivation Scale (Vallerand, Blais, Briere, & Pelletier, 1989) was used to measure *introjected regulation*. It contains three items that represent reasons for attending school (e.g., "To prove to myself that I'm an intelligent person"). Items were rated on a 5-point Likert scale ranging from 1 (*completely disagree*) to 5 (*completely agree*). Previous studies have supported the scale's internal consistency (Vallerand, Fortier, & Guay, 1997; Vallerand et al., 1989). In the present study, Cronbach's alpha was 0.85.

5.4.3. Control variable – age 11 (T1)

5.4.3.1. Depression symptoms. Symptoms of depression at the end of elementary school were measured using five items from the Short Form of the Children's Depression Inventory (CDI-S; Kovacs, 1992). These items assessed symptoms typically found in depressed children and adolescents (e.g., loneliness, self-deprecation, rumination). For each item, participants were asked to choose the statement that best corresponded to their feelings in the last two weeks (e.g., 1 = "I don't feel lonely," 2 = "I often feel lonely," 3 = "I always feel lonely"). The CDI-S has been used with clinical and non-clinical populations, and its psychometric properties (reliability and validity) have been well established (Kovacs, 1992). The internal consistency coefficient (Cronbach's alpha) for the depression scale in this study was 0.72.

5.5. Analytic strategy

A group-based trajectory modeling (Nagin, 1999, 2005) was used to estimate developmental trajectories of adolescents' anxiety symptoms over six years (using the PROC TRAJ macro in SAS; Jones & Nagin, 2007; Jones et al., 2001). Models with one to five groups were estimated separately for boys and girls. The best-fitting models were selected according to the Bayesian Information Criterion (BIC). The most parsimonious model is selected based on the maximum BIC value, which is always negative. The model with the BIC closest to zero is considered as providing the best fit to the data. The PROC TRAJ module also allows including variables liable to affect the probability of belonging to a given trajectory group (Jones & Nagin, 2007). The defining parameters for the trajectory shapes and for the effect of the factors on the trajectory probabilities are therefore estimated jointly. The sociomotivational factors and the depressive symptom scores were included in all the models to determine their contribution to the estimated anxiety trajectories.

5.6. Missing data

Missing data can be an important issue in longitudinal research because it may influence the accuracy of estimates and bias the

interpretation of results (Little & Rubin, 2002). The PROC TRAJ procedure allows estimating missing values under maximum likelihood when participants completed at least two data points on the criterion variable, and when the pattern of missing data does not depend on the data distribution (Broadbent, Thomson, & Poulton, 2008; Dodge, Shen, & Ganguli, 2008; Jones et al., 2001). Procedures using the maximum likelihood estimator to handle missing data are considered far preferable to ad hoc methods (e.g., listwise deletion, mean imputation) since they allow correcting for the loss of statistical power and provide unbiased estimates (Peugh & Enders, 2004; Wilkinson & Task Force on Statistical Inference, 1999). Before handling missing data, however, it is recommended to determine whether the data are missing completely at random (MCAR). The MCAR data can be ignored because missing values for a given variable do not depend on its values nor the values of the other measured variables (Graham, 2009). For all variables in this study, Little's MCAR test was not statistically significant for both boys, χ^2 (220) = 247.61, $p = 0.10$, and girls χ^2 (218) = 238.53, $p = 0.16$, confirming that there were no systematic patterns of missing data.

6. Results

6.1. Preliminary analyses

The descriptive data analysis for each studied variable revealed that they satisfied the criteria for a normal distribution (skewness and kurtosis coefficients < |3|). These variables were then submitted to correlation analysis. Table 1 presents the results for all variables along with the means and standard deviations. Correlations between anxiety and predictors are in the expected direction, with correlation coefficients ranging from −0.20 to 0.53. In addition, the correlation patterns across assessment times showed temporal stability for the anxiety symptoms. The magnitude of these relationships was relatively high over a 12-month period, with coefficients varying from 0.54 to 0.72.

6.2. Developmental trajectories of anxiety symptoms

Anxiety trajectories were modeled with the inclusion of conditional factors (i.e., sociomotivational variables) measured at baseline. Depression was also used as a covariate. These factors were standardized before being entered as predictors of trajectories. Trajectories were analyzed using a funneling procedure (see Nagin, 2005). In the first step, one- to five-group models were estimated for each gender. These models included cubic trajectories only. In the second step, once the model with the optimal number of trajectories was selected, we determined the shape of each trajectory using backward removal of statistically nonsignificant parameters (cubic parameters were eliminated first, followed by quadratic and then linear parameters). This yielded more parsimonious models, which were compared to the initial models with cubic parameters on the basis of their BIC values.

6.2.1. Boys' trajectories

The BIC values for the cubic models indicated that the optimal initial model for boys had a 3-group solution (1-group solution = −2427.81; 2-group solution = −2199.37; 3-group solution = −2187.13; 4-group solution = −2194.32; and 5-group solution = −2206.40). However, the most parsimonious 3-group model provided a better fit to the data than the initial model (BIC = −2175.12). The average class probability for each group in this model was >0.70 (scores range from 0.85 to 0.90), which would be adequate (see Nagin, 1999, 2005). As shown in Fig. 1, the low group (N = 45; 20% of the boys' sample) comprises adolescents who reported very few anxiety symptoms at age 11, which declined gradually to almost disappear from age 14 to 16. The linear parameter for the trajectory was statistically significant at $p < 0.001$. The moderate group (N = 117; 52% of the sample) included boys who reported moderately severe anxiety symptoms, which diminished slightly and steadily in intensity up to age 16 (linear parameter statistically significant at $p < 0.001$). The high group (N = 63; 28% of the sample) included boys who showed higher anxiety symptoms at age 11, compared to the two other groups. Symptoms reached a peak at age 15 and declined slightly thereafter (quadratic parameter statistically significant at $p < 0.001$).

6.2.2. Girls' trajectories

A 4-group solution provided the best fit to the data from girls (BIC for 1-group solution = −3189.39; 2-group solution = −2898.08; 3-group solution = −2855.46; 4-group solution = −2852.97; and 5-group solution = −2858.33). Nevertheless, the parsimony analysis identified a 4-group model that provided a better fit to the data than the initial model (BIC = −2836.84). In the final model, the probability of belonging to each trajectory group varied from 0.79 to 0.92. Fig. 2 illustrates the trajectories described in this model. The low group (N = 50; 19% of the girls' sample) comprises girls who reported very few or no anxiety symptoms throughout the entire length of the study (constant parameter statistically significant at $p < 0.001$). The moderate group (N = 106; 39% of the sample) includes girls who reported moderate and stable anxiety symptoms across all assessment times (constant parameter statistically significant at $p < 0.001$). The moderate-increasing group (N = 40; 15% of the sample) includes girls who presented moderate anxiety symptoms at age 11, whose severity increased until age 14 and stabilized thereafter until age 16 (quadratic parameter statistically significant at $p < 0.01$). The high group (N = 73; 27% of the sample) included girls who reported high anxiety symptoms from age 11 to 16. The polynomial parameter for the trajectory indicated that symptom

Table 1
Means, standard deviations, and zero-order correlations for all variables.

	1	2	3	4	5	6	7	8	9	10	Mean (SD)
1. Gender	–										1.55 (0.50)
2. Depression symptoms[a]	0.05	–									6.60 (1.77)
3. Academic competence[b]	0.11	−0.33	–								5.73 (1.09)
4. Concerns with relatedness[c]	0.12	0.38	−0.22	–							2.50 (0.96)
5. Introjected regulation[d]	−0.12	0.09	−0.05	0.18	–						3.43 (1.23)
6. Anxiety (age 11)[e]	0.14	0.46	−0.20	0.53	0.16	–					16.51 (2.82)
7. Anxiety (age 12)[e]	0.14	0.36	−0.19	0.37	0.10	0.54	–				16.70 (3.13)
8. Anxiety (age 13)[e]	0.19	0.28	−0.16	0.31	0.08	0.52	0.65	–			16.69 (3.29)
9. Anxiety (age 14)[e]	0.28	0.28	−0.10	0.17	0.13	0.41	0.57	0.67	–		16.95 (3.42)
10. Anxiety (age 15)[e]	0.26	0.26	−0.08	0.19	0.11	0.38	0.51	0.66	0.72	–	16.87 (3.35)
11. Anxiety (age 16)[e]	0.29	0.23	−0.04	0.21	0.08	0.37	0.41	0.61	0.69	0.72	16.68 (3.61)

Note. Girls serve as the reference group. Correlations greater than or equal to 0.11 are significant at $p < 0.05$ and correlations greater than or equal to 0.16 are significant at $p < 0.01$.
[a] Score ranged from 5 to 15.
[b] Scored on a 7-point scale.
[c] Scored on a 5-point scale.
[d] Scored on a 5-point scale.
[e] Score ranged from 12 to 24.

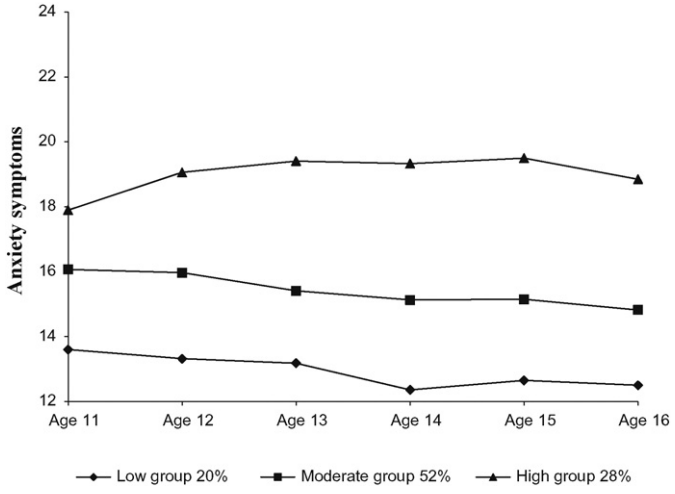

Fig. 1. Trajectories of anxiety symptoms for boys (N = 224).

severity increased slightly from age 11 to 16 (linear parameter statistically significant at $p < 0.01$).

6.3. Sociomotivational factors as predictors of developmental trajectories of anxiety

Tables 2 and 3 present the results of conditional trajectories of anxiety where sociomotivational factors were used as predictors of membership in anxiety trajectories for boys and girls. The trajectory with the lowest anxiety scores (i.e., low group) was used as the reference for both genders.

6.3.1. Boys' trajectories

The results showed that concerns about relatedness with peers and teachers during the transition to high school increased the odds of belonging to a high (coefficient = 1.06, SE = 0.35, $p < 0.001$) or moderate anxiety trajectory (coefficient = 0.96, SE = 0.35, $p < 0.01$) compared to a low anxiety trajectory. The results also indicated that boys with depressive symptoms at age 11 were more likely to belong to the high anxiety trajectory compared to the low trajectory (coefficient = 1.47, SE = 0.53, $p < 0.01$). However, neither perceived academic competence nor introjected regulation predicted trajectory membership.

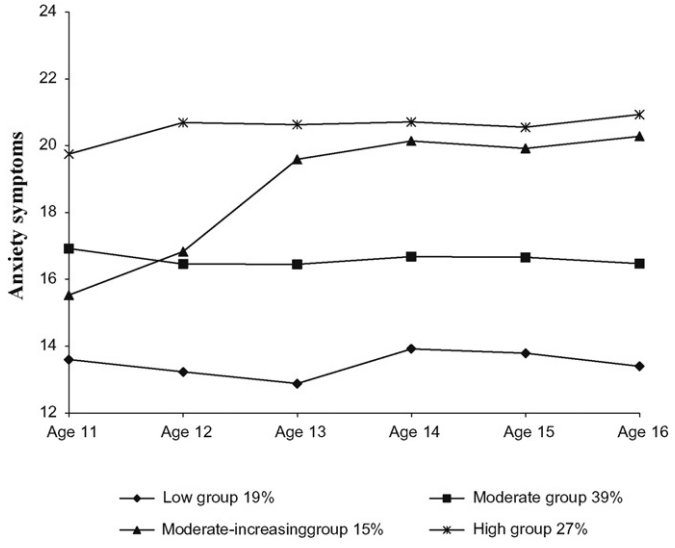

Fig. 2. Trajectories of anxiety symptoms for girls (N = 269).

6.3.2. Girls' trajectories

Girls' concerns about relatedness predicted higher odds of belonging to a high anxiety trajectory (coefficient = 1.65, SE = 0.40, $p < 0.001$) or a moderate anxiety trajectory (coefficient = 1.15, SE = 0.35, $p < 0.001$) rather than the low trajectory group. The probability of belonging to the high anxiety trajectory also increased as a function of depressive symptoms (coefficient = 1.63, SE = 0.54, $p < 0.01$). Furthermore, academic competence predicted higher odds of being in the moderate-increasing trajectory (coefficient = −0.92, SE = 0.39, $p < 0.05$), whereas introjected regulation increased it (coefficient = 0.52, SE = 0.26, $p < 0.05$).

7. Discussion

Few studies have examined development trajectories of anxiety symptoms separately for adolescent boys and girls. Moreover, the scant evidence available does not permit a thorough understanding of the role of sociomotivational factors that potentially contribute to these trajectories. The present study attempted to fill these gaps by investigating a community-based sample of adolescents followed annually from age 11 to 16 years. The results revealed three developmental trajectories characteristic of both boys and girls (low, moderate, and high) as well as a fourth trajectory specific to girls only (moderate-increasing). Furthermore, sociomotivational factors were related to the increasing trajectory for girls only, whereas concerns about relatedness and depressive symptoms at age 11 predicted membership in the high anxiety trajectory for both boys and girls. The implications of these findings are discussed below.

7.1. Developmental trajectories of anxiety symptoms for boys and girls

The first trajectory group that was common to both genders included youth who reported very few or no anxiety symptoms from age 11 to 16. The same proportion of boys (20%) and girls (19%) was found in this trajectory. The second trajectory group included youth who reported higher anxiety symptoms throughout the entire study period. The proportion of boys and girls belonging to this trajectory was similar (28 and 27% of the sample, respectively). However, girls' anxiety symptoms tended to increase slightly over time whereas they remained relatively stable for boys. The third trajectory, characterized by moderate anxiety symptoms, differed for boys and girls on two accounts. First, there were more boys than girls in the moderate trajectory. Second, anxiety symptoms decreased over time for boys but not girls. These gender disparities can be explained by the presence of a fourth trajectory for girls, where a subgroup of them initially reported moderate anxiety symptoms that progressively increased over time. In mid-adolescence, these girls reported about 8 of the 12 anxiety symptoms under study.

The number and shape of the anxiety trajectories identified in this study are similar to those reported in previous studies that analyzed adolescent development trajectories separately for boys and girls (Legerstee et al., 2013; Letcher et al., 2012). These studies also identified three trajectories common to boys and girls, characterized by low, moderate, and high anxiety symptoms. In addition, and in line with the findings by Legerstee and colleagues, our findings revealed the presence of an increasing trajectory specific to girls. Taken together, these results have two main implications. First, there were as many boys as girls who felt anxiety before, during, and several years after the transition to high school. Second, among youth reporting moderate anxiety symptoms toward the end of childhood, a subgroup of girls emerged as particularly at risk for an increase in these symptoms, which almost reached the levels of the most anxious group around age 14. Previous studies have reported a higher prevalence of anxiety symptoms in girls compared to boys, and this gap generally appears from age 12 to 15 years (see, for example, Kendall, Hedtke, Aschenbrand, 2006). In light of our results, we suggest that this difference might partly be

Table 2
Predictors of trajectory group membership for boys (N = 224).

	High group[a]			Moderate group[a]		
Sociomotivational characteristics at age 11	Coefficient	Error	*t*	Coefficient	Error	*t*
Academic competence	0.09	0.27	0.34	0.09	0.27	0.34
Concerns with relatedness	1.06	0.35	3.05**	0.96	0.35	2.72**
Introjected regulation	0.37	0.29	1.27	−0.07	0.24	−0.30
Covariate						
Depression symptoms[a]	1.47	0.53	2.76**	1.00	0.54	1.87

[a] The low trajectory group was used as the reference.
** $p < 0.01$.

attributable to the presence of moderate anxiety symptoms in girls who are about to enter puberty.

7.2. Predictive contribution of sociomotivational factors to anxiety trajectories

Perceived academic competence was found to be a predictor of the moderate-increasing anxiety trajectory for girls, although high academic competence at the end of elementary school decreased the odds of belonging to this trajectory. SDT posits that psychological health and well-being result notably from the satisfaction of the need for competence (Ryan et al., 2008), a need that is satisfied when individuals feel that they have an impact on their environment and that they can attain valued outcomes within it (Reeve, 2012). In education, the important role of academic competence in preventing anxiety symptoms and facilitating social adjustment has been stressed during the transition to high school (e.g., Duchesne et al., 2012; Harter et al., 1992; Letcher et al., 2012). It has been established that the stressful nature of this transition gives rise to anxieties about one's ability to cope with academic demands, especially in girls (Duchesne et al., 2009). Knowing this, we may hypothesize that children whose need for academic competence was satisfied in elementary school would probably feel less concerned about being able to satisfy the new demands of high school, and more confident in their ability to cope with them. This confidence would help them interpret the transition in terms of a challenge rather than a stressor (Ntoumanis et al., 2009), and thereby leading to fewer anxieties during and after this transition. On the other hand, students whose need for academic competence is unmet in elementary school might worry more about their ability to cope with high school demands, giving rise to symptoms of anxiety (Harter et al., 1992). These symptoms could then increase (in number and/or severity) at the moment where the social comparison is a particularly salient issue in adolescence (see Wigfield & Wagner, 2005).

The results also showed that concerns about relatedness with peers and teachers in high school increased the odds of belonging to more stable trajectories, namely the moderate and high trajectory groups. Moreover, these predictions applied to boys and girls alike. These findings are in line with those of studies showing how social concerns regarding the transition to high school were associated with anxiety symptoms or emotional problems (e.g., Duchesne et al., 2009, 2012). According to SDT, the development of meaningful and satisfying social relationships is a basic psychological need whose satisfaction is necessary for optimal mental well-being (Deci & Ryan, 2000; Ryan et al., 2008). It is therefore not surprising that elementary school children who report difficulties in developing and maintaining secure and constructive social relationships would be more inclined to express anxieties about their relatedness with peers and teachers in high school. The fear that their need for relatedness will not be completely met could feed their anxieties in terms of obsessive concerns, nervousness, and oversensitivity (Duchesne et al., 2009). This anxiety could be maintained for several years, such that it would prevent some adolescents from seizing opportunities to develop meaningful, high-quality social relationships that would provide them with support and comfort to help them deal with these problematic situations (Ntoumanis et al., 2009).

A noteworthy finding in this study was that introjected regulation increased the odds that girls would be in the moderate-increasing vs. the low trajectory group. In other words, young girls whose academic motivation springs from a need to prove themselves and reduce negative feelings toward the self are at greater risk for reporting more anxiety symptoms starting around age 12, as well as for these symptoms to continue and/or increase up to age 16. This finding concurs with studies that associated introjected regulation with anxiety (e.g., Ng et al., 2012; Stoeber et al., 2009) and studies that found that girls report higher levels of this regulation type (Ratelle et al., 2007) and emotions such as guilt and shame (Else-Quest et al., 2012). Nevertheless, the present study is the first to demonstrate that introjection predicts the anxiety trajectory that is unique to girls. In line with hypotheses stemming from SDT (Bartholomew, Ntoumanis, Ryan, Bosch, Thøgersen-Ntoumani, 2011; Vansteenkiste & Ryan, 2013), this association might translate into a propensity for young girls to impose high personal standards on themselves. This would lead them to frequently upbraid themselves, and to live in perpetual fear of criticism from significant others and eventual disapproval when their work is deemed below standard. They would also experience higher levels of negative emotions such as guilt and shame, which can damage one's ego as well as one's projected social image. In the long term, school behaviors that are regulated by introjection are accompanied by the kinds of emotions that can engender dissatisfaction and anxiety symptoms (Ng et al., 2012).

Finally, this study also controlled for the contribution of depressive symptoms, which were found to predict membership to the high trajectory group, for both boys and girls. This suggests that depressive

Table 3
Predictors of trajectory group membership for girls (N = 269).

	High group[a]			Moderate-increasing group[a]			Moderate group[a]		
Sociomotivational Characteristics at age 11	Coefficient	Error	*t*	Coefficient	Error	*t*	Coefficient	Error	*t*
Academic competence	−0.21	0.35	−0.60	−0.92	0.39	−2.34*	−0.26	0.31	−0.84
Concerns with relatedness	1.65	0.40	4.10**	−0.24	0.51	−0.47	1.15	0.35	3.25**
Introjected regulation	0.27	0.28	0.94	0.52	0.26	1.96*	0.34	0.23	1.46
Covariate									
Depression symptoms[a]	1.63	0.54	3.00**	−1.22	0.79	−1.54	0.60	0.53	1.13

[a] The low trajectory group was used as the reference.
* $p < 0.05$.
** $p < 0.01$.

symptoms at age 11 can potentially distinguish youth who will report moderate or high anxiety symptoms throughout most of their adolescence, independently of social concerns about entering high school. Research has shown that depression and anxiety are frequent psychopathological comorbidities (e.g., Costello et al., 2006), and that their symptoms have been strongly correlated (e.g., Duchesne et al., 2009). Although the co-occurrence of these two emotional disorders may stem from common etiological characteristics (see Austin & Chorpita, 2004; Buist, Dekovic, Meeus, & van Aken, 2004), it is possible that youth who feel unloved have little self-esteem and feel abandoned or rejected, and thus would be more resistant to change and less confident in their ability to respond to change effectively. This perceptual and emotional fragility would put them at greater risk for anxiety symptoms as they transition through developmental stages.

7.3. Applied implications

The results of this study contribute to the existing literature by illustrating how a significant proportion of youth leaving elementary school report a higher frequency of anxiety symptoms that persist until the end of high school. The findings also show that, for many moderately anxious girls in elementary school, these symptoms gradually increased over time. Given these findings, it appears crucial to implement interventions before the transition to high school. These activities would be most efficient if they occurred within the school context, thereby reaching a large number of students and facilitating the development of skills in real-life conditions (McLoone, Hudson, & Rapee, 2006; Neil & Christensen, 2009).

In terms of the content of these school-based interventions, two meta-analyses (Fisak, Richard, & Mann, 2011; Zalta, 2011) have shown that interventions in the school context that are aligned with the cognitive-behavioral approach have been particularly effective in preventing or reducing anxiety. These interventions focus mainly on affective education (explain what anxiety is), cognitive restructuring (identify and question erroneous thoughts), role playing (practice a skill), in vivo exposure (gradually approach an anxiety-producing situation), contingent reinforcement (reward desired behaviors), and relaxation (see Fox et al., 2014; James, James, Cowdrey, Soler, & Choke, 2013; Weissman, Antinoro, & Chu, 2009). Our results suggest that these interventions could be applied, first and foremost, to students who already have these symptoms (i.e., high groups for both boys and girls, and moderate groups for girls). Depending on the school's available resources, these interventions could be delivered as individual or group sessions (see Silverman, Pina, & Viswesvaran, 2008 for reviews). Finally, in the context of universal prevention, some of these interventions could also be applied in the classroom by a trained teacher (McLoone et al., 2006; Neil & Christensen, 2009) and adequately supervised by a mental health professional (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Easton & Erchul, 2011; Franklin, Kim, Ryan, Kelly, & Montgomery, 2012).

The results of this study also suggest that perceived academic competence, concerns about relatedness, and introjected academic motivation prior to the high school transition are factors that should not be overlooked in understanding changes in anxiety symptoms throughout adolescence. According to SDT (Deci & Ryan, 2000), individuals have basic psychological needs, and the satisfaction of these needs depends on the presence of three environmental "nutrients": autonomy support (understanding and acknowledging the person's perspective and providing opportunities for choice), structure (creating a predictable environment by clearly communicating expectations and the consequences for not meeting them), and interpersonal involvement (allocating material and emotional resources such as showing interest in the person, spending time together, and providing encouragement). It was demonstrated that a need-satisfying environment, whether at school, at home, or in a therapeutic intervention, fosters autonomous regulation and well-being in individuals (see Guay, Ratelle, & Chanal, 2008; Raftery, Grolnick, & Flamm, 2012; Ryan et al., 2008). Elementary school principals could take a leadership role by planning and coordinating, with the professional resources available within the school (e.g., psychologist) and in the community (e.g., academic expert), knowledge dissemination activities on the characteristics of this environment. These activities could aim teachers and parents. For one, before the school year begins, teachers might benefit from a workshop that would show them how to adopt practices that support the satisfaction of their students' psychological needs and promote autonomous academic motivations. In addition, students' parents could be sensitized to the importance of supporting the satisfaction of their child's psychological needs and given tools to better understand how to contribute to the satisfaction of these needs through means such as a lecture given by an expert or through the school website or newspaper.

7.4. Limitations and future directions

Although this study uncovered some significant results on developmental trajectories of anxiety symptoms across adolescence, including gender differences and sociomotivational predictors, some limitations should be taken into account when interpreting these findings. First, a community sample of adolescents was examined, which does not allow generalizing the results to populations that are considered disadvantaged or at greater risk. Moreover, participants were almost all Caucasians living in middle-class households. Future studies would benefit from using samples with a wider diversity in terms of ethnic origin and sociodemographic factors. Second, the use of self-reported measures can result in common method bias. Replication studies are therefore needed to consider other information sources, such as peers (to assess social relationships) and teachers (to assess academic competence). Third, the sociomotivational factors retained were measured at the onset of the trajectories. Although these factors may have played a role in determining anxiety trajectories, it is also probable that young adolescents' anxiety symptoms could have influenced their perceptions of their psychological need satisfaction and academic motivation. For instance, studies have found that higher levels of anxiety symptoms are negatively associated with academic competence beliefs (Muris, Schouten, Meesters, & Gijsbers, 2003) and peer acceptance (for a review, see Kingery et al., 2010), and positively associated with a learning-avoidance goal orientation (Duchesne, Ratelle, & Feng, 2014; Maltais, Duchesne, Ratelle, & Feng, 2015). Anxiety could thus undermine one's perceptions of being able to meet the school's academic and social demands, while fostering the development of a controlled motivation toward school. Further studies are needed to more accurately determine the direction of the relationship between SDT-based variables and anxiety. One research avenue could be to assess these variables before measuring anxiety symptoms. Another way would be to verify the reciprocal and longitudinal associations between these variables using a cross-lagged panel design (see Cecil, Barker, Jaffee, & Viding, 2012). Finally, this study focused on two of the three basic psychological needs according to SDT: competence and relatedness. Future studies should examine the additional contribution of the third basic psychological need, autonomy (acting according to one's own volition, through personal choice).

8. Conclusion

This study identified distinct developmental trajectories of anxiety symptoms during adolescence. More specifically, comparable trajectory patterns were found for boys and girls, with the notable exception of one subgroup of moderately anxious girls who showed an escalation of anxiety symptoms around ages 12 to 13. Perceived academic competence and introjection regulated academic motivation were associated with an increasing trajectory for girls, whereas concerns with relatedness during the transition to high school predicted being in a high anxiety trajectory for both genders. These links remained statistically significant even after

controlling for depressive symptoms. The findings of this study shed new light on how anxiety symptoms change throughout adolescence for boys and girls. In addition, specific sociomotivational factors emerged as potential determinants for these developmental patterns, pointing to new avenues for the design of preventive interventions during the transition to high school.

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