Prospective Relations between Alexithymia, Substance Use and Depression: Findings from a Finnish Birth Cohort

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Abstract

Purpose: This study examined a developmental model that links affect-regulation difficulties in childhood with three dimensions of alexithymia in adolescence (difficulty identifying feelings, difficulty describing feelings, and externally-oriented thinking) and substance use and depression in adulthood, while accounting for cumulative contextual risk in childhood, and testing potential gender moderation.

Methods: Multiple group path analyses were conducted using data from the Northern Finland Birth Cohort 1986 (N = 6,963). Analyses used data collected during prenatal/birth, childhood, adolescence, and young adulthood periods.

Results: Our examination of early precursors for alexithymia indicated that the associations of affect-regulation problems in childhood with alexithymia were stronger for girls, potentially putting girls with affect-regulation difficulties in childhood at higher risk for developing alexithymia in adolescence. The associations of cumulative contextual risk in childhood with alexithymia, substance use disorder, and depression diagnosis in adulthood were significant for both girls and boys. Our findings in regard to substance use and depression disorders revealed that alexithymia in adolescence predicted depression diagnosis in adulthood, particularly due to a contribution from the alexithymia domain of "difficulties identifying feelings." However, none of the alexithymia domains was directly associated with substance use disorder in adulthood.

Conclusions: Our study contributes to research that links alexithymia with difficulties in affect regulation and cumulative contextual risk in childhood, yielding findings that may be relevant for preventive interventions.

Keywords: alexithymia; adolescence; substance use; depression; cumulative contextual risk.

Alexithymia is a multidimensional construct reflecting difficulties in cognitive processing and affect regulation. The term alexithymia (from the Greek “no words for emotions”) was originally coined by psychotherapist Peter Sifneos (1972) to describe a personality construct characterized by the inability to describe and recognize emotions. According to Bagby and Taylor (1997), the salient features underlying alexithymia include deficits in (i) identifying and describing feelings, (ii) differentiating between feelings and the bodily sensations of emotional arousal, and (iii) cognitive processing and affect regulation (Bagby & Taylor, 1997). Alexithymia affects an individual’s ability to recognize, manage, and express emotions and somatic states, and has been associated with a number of psychological disorders, including depression and substance use (Taylor, Bagby, & Parker, 1997). In regard to depression, the common conception is that consistent difficulties with identifying, describing, and communicating feelings exacerbate individual’s vulnerability to depressive symptoms (Taylor, 2000) and contribute to lower psychotherapeutic treatment success rates (Lumley, 2000). In regard to substance use, it has been suggested that alexithymic individuals possibly use alcohol and drugs as a coping mechanism to compensate for defects in affect regulation (Bagby & Taylor, 1997; Shishido, Gaher, & Simons, 2013; Stasiewicz et al., 2012). In fact, multiple studies indicate that individuals with higher levels of alexithymia have higher frequency and heavier intake of alcohol, and overall greater substance dependence compared to individuals with lower levels of alexithymia (See Thorberg, Young, Sullivan, & Lyvers, 2009 for a full review). However, one limitation of current alexithymia research is that the majority of studies that examined associations among alexithymia, substance use, and depression employed a cross-sectional design and approached these traits in a categorical way, for example, testing for the presence or absence of alexithymia in clinical samples of substance-dependent patients with

depression (De Rick & Vanheule, 2006; de Timary, Luts, Hers, & Luminet, 2008; Evren et al., 2008; Thorberg et al., 2009). Thus, it has not been possible to determine whether alexithymia precedes the development of depression and substance use or emerges at the same time as these disorders.

It has been suggested that the development of alexithymia may be best described as an accumulated process, which begins in childhood and further develops through adolescence into adulthood from interactions between certain personality traits and environmental factors (Taylor & Bagby, 2013). Previous research on alexithymia has linked it with adverse living conditions (e.g., cumulative contextual risk; Joukamaa et al., 2003; Kokkonen et al., 2001; Salminen, Saarijärvi, Äärelä, Toikka, & Kauhanen, 1999), and high neuroticism, represented by excess anxiety, worry, fear, frustration, and loneliness (De Gucht, Fischler, & Heiser, 2004; Zimmermann, Rossier, Meyer de Stadelhofen, & Gaillard, 2005). However, all but one study (Joukamaa et al., 2007) was conducted among adults. Thus, another limitation of current alexithymia research is a lack of studies investigating the etiology of alexithymia in adolescents and its associations with substance use and depression. Adolescence represents a critical period of development when most adolescents experience frequent periods of self-doubts and anxiety, and when alexithymia, substance use, and depression begin to emerge.

Empirical evidence has also linked depression, alexithymia, and substance use with adverse living conditions in childhood, frequently operationalized as cumulative contextual risk (CCR; Sameroff, Seifer, Baldwin, & Baldwin, 1993). It was proposed that the development of children's emotional affect is influenced by the family's environment, which in turn reflects the parent's educational level and socioeconomic status (Kauhanen, Kaplan, Julkunen, Wilson, & Salonen, 1993). Accordingly, children from lower SES families are less likely to experience

stability and routines, learn how to recognize and manage their emotions, or show empathy for others. Multiple studies documented strong links between core markers of CCR in childhood (e.g., low socioeconomic status, poverty, low mother's education) and alexithymia in adolescence and adulthood (Joukamaa et al., 2003; Joukamaa et al., 2007; Salminen et al., 1999). Likewise, CCR markers in childhood were predictive of the lifetime risk for depression (Patwardhan et al., 2017) and substance use (Mason et al., 2016). Neurotic and disruptive behaviors in childhood should be considered in regard to this etiological model because they represent risk factors for alexithymia and mental health disorders (e.g., neurotic behaviors; Parker & Taylor, 1997; Dukalski, Suslow, Egloff, Kersting & Donges, 2019) and the early onset of substance use in adolescence (e.g., disruptive behaviors Hawkins, Catalano, & Miller, 1992). Since alexithymia is a multidimensional construct, an additional question is whether different alexithymia domains are differentially associated with substance use and depression. Whereas higher scores on "difficulties in identifying feelings" and "difficulties in describing feelings" domains indicate difficulties in differentiating and communicating emotional experiences, higher scores on "externally oriented thinking" domain refers to a lack of reflection and psychological introspection (Günther, Rufer, Kersting, & Suslow, 2016). One alexithymia domain, "difficulties identifying feelings," has been more consistently identified as contributing to higher alcohol dependence and clinical depression compared to other alexithymia domains (de Timary et al., 2008; Evren et al., 2008). Despite these preliminary findings, they were based on studies that employed a cross-sectional design and used clinical samples of individuals, and therefore need to be extended and replicated in longitudinal samples.

Finally, the relevant processes may vary by gender given that the rates of alexithymia, substance use, and depression differ significantly between males and females. Numerous studies

have shown that the prevalence of alexithymia among males is almost twice as high (e.g., 9% - 17%) compared to females (5%-10%) (Joukamaa et al., 2003; Kokkonen et al., 2001; Salminen et al., 1999). There is also evidence that males are more vulnerable to certain types of substance use (Buu, Dabrowska, Heinze, Hsieh, & Zimmerman, 2015) and, particularly, substance use disorders, although these gender gaps have been closing over the past several years (Johnston et al., 2018). Conversely, depression rates are higher among females, compared to males (e.g., 21-29 % compared to 10-12 %; Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993; Van de Velde, Bracke, & Levecque, 2010). Females also maybe more severely affected by adverse living conditions and traumatic life events, and when experiencing the same stressors as males, they are more likely to develop depression in response to stress (Nolen-Hoeksema, 2001). This study addresses an additional limitation of current alexithymia research by exploring the potential moderating role of gender, which has rarely been considered but could lead to a better understanding of how associations between alexithymia, substance use, and depression may differ for males and females.

Purpose of the study

The goal of the current study is to examine the associations of alexithymia in adolescence with substance use and depression disorders in adulthood, while accounting for the potential influence of CCR and early precursors for alexithymia, depression, and substance use in childhood, and to test for potential gender moderation. As summarized in the conceptual model in Figure 1, we hypothesized that:

1) Developmental pathways to alexithymia would begin in early childhood with temperamental dispositions reflecting anxious-fearful behavior that, in combination with exposure to cumulative contextual risk, sets the stage for susceptibility to alexithymia in

adolescence. We anticipated significant contributions from anxious-fearful behavior in childhood to each of the alexithymia domains. Also of note, even though it was not the focus of the analyses, we controlled for disruptive behavior in childhood, given its associations with substance use in adolescence and adulthood.

2) Alexithymia in adolescence would be associated with substance use and depression in adulthood, and these associations would differ among the three alexithymia domains. Based on previous research, we expected stronger associations from the "difficulties identifying feelings" alexithymia domain.

We also aimed to explore how these developmental pathways would differ by gender.

Method

Participants and Procedures

Participants were from the Northern Finland Birth Cohort 1986 (NFBC1986), a population-based study of individuals born during a one-year period in the two northernmost provinces of Finland. The study was approved by the ethical committee of the Northern Ostrobothnia Hospital District. Of the 9,479 initially recruited NFBCS1986 participants, 8,755 provided a consent form to use the data for research, and 6,963 had data on cumulative contextual risk. For a case to be included in the statistical analysis, data on the earliest predictor variable (e.g., cumulative contextual risk) is required. Thus, the analysis sample consisted of 6,963 participants (73% of the original birth cohort). Forty-nine percent of the participants in the analysis sample were male, with a mean age of 16.00 at the time of adolescent data collection, ranging from 14.58 to 16.96. Additional details regarding the NFBC1986 data collection are available elsewhere (Hurtig et al., 2007; Järvelin, Hartikainen-Sorri, & Rantakallio, 1993). The

current analyses used data collected during prenatal/birth, childhood, adolescence, and young adulthood periods.

Prenatal/Birth. A prenatal background questionnaire was provided to expectant mothers at their first antenatal visit to the local prenatal clinic (on average at the 12th gestational week), with instructions to return the completed questionnaire by their 24th gestational week. Additional details on pregnancy and delivery were provided by midwives and/or medical staff at the prenatal clinics.

Childhood. In the spring of their first year of school (1993-94), when children were 8 years old, postal questionnaires were sent to parents. The age 8 parent questionnaire included questions on their child's behavior and learning difficulties (90% completion rate).

Adolescence. A postal questionnaire was mailed to the participants in 2001-2002, when they were 15 to 16 years old. This survey included questions on family, school, behavior, and health (80% completion rate). During the same period, adolescents were also invited to a clinical examination where they filled in an additional survey about substance use and mental well-being (76% participation rate).

Young Adulthood. Finnish Care Register for Health Care data through 2013 (approximately age 28) provided depression, alcohol, cannabis, and other substance use diagnoses for inpatient and outpatient care in the form of International Classification of Diseases (ICD, version 10). Other than missing due to immigration or death, these data are complete.

Measures

Childhood

Cumulative Contextual Risk. Cumulative contextual risk was created following the established approach (Sameroff, Seifer, Baldwin, & Baldwin, 1993) by summing scores from

nine dichotomous parent-reported measures representing maternal characteristics while pregnant (i.e., teenage mother, smoking while pregnant, drinking while pregnant, low birth weight), family's socioeconomic disadvantage at age 8 (i.e., unemployed mother, unemployed father, less than 9 years of comprehensive school for mother, less than 9 years of comprehensive school for father), and family structure at age 8 (i.e., single parenthood). For each indicator, presence of the risk was coded as 1 and absence of the risk was coded as 0.

Behavioral problems. Behavioral problems were rated by parents using the Rutter Children's Behavior Questionnaire (Elander & Rutter, 1996) on a 3-point Likert-type scale ranging from 0 (does not apply) to 2 (certainly applies). This psychometrically sound tool for assessing children's behavior by parents and teachers has been used extensively in prior research to study behavior problems in elementary school children (e.g.; Ekblad, 1990; McGee et al., 1985). Eight out of 30 original items of the Rutter Children's Behavior Questionnaire were present in the NFBC dataset. Given the research support for the two-dimensional structure of the Rutter Behavior Scale: hyperactive-aggressive and anxiety-fearfulness factors (Fowler & Park, 1979; Tremblay, Desmarais-Gervais, Gagnon, & Charlebois, 1987), a confirmatory factor analysis with oblimin rotation (for correlated factors) was performed for a two-factor solution. Initial eigen values indicated that the two factors explained 44% of the variance. In a search for the best solution, two items were eliminated because they did not contribute to the two-factor structure and failed to meet a minimum criteria of having a primary factor loading of .3 or above (has difficulties sleeping; lies often). After eliminating these items, a principal components factor analysis using oblimin and varimax rotations was conducted with two factors explaining 55% of the variance. Factor loadings for anxious-fearful behavior ranged from .80 to .81 and those for disruptive behavior ranged from .60 to .80, indicating that each item was substantially related to

the underlying construct. Based on this psychometric work, *Anxious-fearful behavior* was represented with the mean score of two items regarding excessive worry and fearfulness (α = .46). *Disruptive behavior* was represented as the mean of four items: difficulties in obeying, teases other children, restlessness, and unable to concentrate (α = .67). The evidence for construct validity of these subscales is presented in the results. Child gender was coded 1 for males and 0 for females.

Adolescence

Internalizing problems. Internalizing problems were measured with the Internalizing scale from the Youth Self-Report (Achenbach, 1991) on a 3-point Likert-type scale (31 items; α = .88).

Substance use. Substance use was based on three items from the adolescent self-report survey referring to the *frequency* ("How many times during the past 12 months have you had at least one drink of alcohol?") and *intensity* ("How many times in the past 12 months have you been drunk?") of alcohol use, and to *heavy episodic drinking* (past 30 days), measured on a 7-point Likert-type scale (α = .91).

Alexithymia. Alexithymia was measured with the Toronto Alexithymia Scale (TAS-20; (Bagby, Parker, & Taylor, 1994) on a 5-point scale. Domains of alexithymia were represented in the model using the three subscales: *difficulty describing feelings* (DDF; 5 items, α = .79, e.g., "It is difficult for me to find the right words for my feelings"); *difficulty identifying feelings* (DIF; 7 items, α = .65, e.g., "When I am upset, I don't know if I am sad, frightened, or angry"); and *externally-oriented thinking* (EOT; 8 items, α = .60, e.g., "I prefer talking to people about their daily activities rather than their feelings").

Adulthood

Depression Diagnosis. The rates of depression diagnoses until the end of 2013 were obtained from the Finnish Care Register for Health Care data. Participants who met criteria for any one of the International Classification of Diseases diagnoses of depression disorder (ICD-10: F32, F33, F341, F3810) were coded as 1, indicating the presence of depression disorder, whereas participants without any disorder were coded as 0.

Substance Use Disorder Diagnosis. The rates of substance use disorder diagnoses until the end of 2013 were obtained from the Finnish Care Register for Health Care data. Participants who met criteria for any one of the International Classification of Diseases diagnoses of substance use disorder - including any alcohol, cannabis, or other substance use diagnosis (ICD-10: F101, F102, F111, F112, F121, F122, F131, F132, F141, F142, F151, F152, F161, F162, F171, F172, F181, F182, F191, F192) of any substance disorder - were coded as 1, indicating the presence of substance use disorder, whereas participants without any disorder were coded as 0.

Analyses

Multivariate path analysis was conducted in Mplus 7.11 (Muthén & Muthén, 1998-2017) with the analysis sample (N = 6,963; 51% female) using the weighted least squares mean- and variance (WLSMV) adjusted estimator because of the dichotomous nature of the substance abuse and depression diagnosis outcome variables. In Mplus, pairwise deletion is used with categorical outcomes estimated with the WLSMV estimator. There were no missing data on young adult substance use and depression diagnoses, gender, and cumulative contextual risk. The missing data on childhood anxious-fearful and disruptive behaviors, alexithymia, and adolescent substance use and internalizing problems were low, ranging from 7 % to 11 %. Attrition analyses showed that the analysis sample had more females (51% v. 48%; χ^2 (1, N = 16,395) = 10.41, $p <$ .05) than the original live-born birth cohort. The analysis sample also had participants with

slightly higher CCR (M = 0.77, SD = 0.97) compared to the birth cohort (M = 0.74, SD = 0. 96), t (16,440) = 1.97, p = 0.048), even though this difference was small (Cohen's D = 0.03). The analysis sample did not differ from the birth cohort in rates of depression diagnosis (7.1% vs. 7.5%; χ^2 (1, N = 16,395) = 0.86, p = 0.35), alcohol disorders (2.4% vs. 2.8%; χ^2 (1, N = 16,395) = 2.04, p = .15), or any substance use disorders (1.1 % vs. 1.3%; χ^2 (1, N = 16,395) = 0.21, p = .65).

The data were analyzed in two stages. In the first stage, the model depicted in Figure 1 was estimated via multivariate path analysis in the total analysis sample. Although not shown in Figure 1, correlations among the exogenous variables as well as among the residuals of the adolescent variables were estimated. In the second stage, a multiple group path analysis was used to test for possible gender differences in all path coefficients. Gender moderation was tested by conducting a two-group model, treating gender as a grouping variable. In all cases, model fit was evaluated using the Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). According to recommended guidelines, model fit indices CFI and TLI ≥ .95 and RMSEA ≤ .06 represent a good model fit (Hu & Bentler, 1999).

Results

Descriptive Statistics

Table 1 presents descriptive information about the study variables (mean, range, and standard deviation) for females and males**,** and prevalence rates for the cumulative risk variables**.** It is notable that boys had significantly higher rates than girls of disruptive behavior in childhood (t (5,952) = 13.31, p < .001) and substance diagnosis in adulthood (3.6% vs. 2.5%; χ^2 (1, N = 6,963) = 7.01, p = .008), whereas girls had higher rates of internalizing problems in adolescence (t (6,169) = 31.76, p < .001) and depression diagnosis in adulthood (9.3% vs. 4.8 %; χ^2 (1, N = 6,963) = 53.11, p < .001). Adolescent girls scored higher on the alexithymia domain, "difficulties

identifying feelings" (t (6,154) = 18.10, $p < .001$), whereas adolescent boys scored higher on the domain, "externally oriented thinking" (t (6,183) = -34.44, $p < .001$). There were no gender differences in the alexithymia domain, "difficulties describing feelings" (t (6,163) = -0.59, p =.553).

Estimated correlations between study constructs are reported in Table 2. Regarding the construct validity of the Rutter's subscales, it is notable that anxious-fearful behavior at age 8 was significantly positively correlated with internalizing problems and the alexithymia domains of "difficulties identifying feelings" and "difficulties describing feelings" at age 16. It also was significantly positively associated with depression and substance use disorder diagnosis in adulthood, but was unrelated to male gender, substance use at age 16, and the alexithymia domain of "externally oriented feelings." Similarly, disruptive behavior at age 8 was significantly positively correlated with male gender, substance use, and each alexithymia domain at age 16, as well as with depression and substance use disorder diagnosis in adulthood, but was unrelated to internalizing problems at age 16. Taking into account that childhood and adolescent assessments were 8 years apart, and childhood and adulthood assessments were almost 17 years apart, and represented various reporters (i.e., parent-report, self-report, and official diagnostics data), the fact that these observed patterns of correlation were in expected directions provides evidence for their construct validity.

Full Sample Path Analyses

The path analysis model with the full sample showed an acceptable fit (χ^2 (df = 4) = 21.18, p = 0.0003; CFI = .99; TLI = .97; RMSEA = .026). All standardized estimates are presented in Table 3. Findings revealed that alexithymia in adolescence predicted depression diagnosis in adulthood, particularly due to a contribution from the alexithymia domain,

"difficulties identifying feelings" (β = .13, p <.001). None of the alexithymia domains was directly associated with substance use disorder diagnosis, but substance use and depression diagnoses were moderately correlated (r = .62, p <.001). Further, as expected, anxious-fearful behavior in childhood was predictive of the alexithymia domains, "difficulties identifying feelings" (β = .04, p <.01) and "difficulties describing feelings" (β = .04, p <.001), and internalizing behaviors in adolescence (β = .08, p <.001), but had no associations with the alexithymia domain, "externally oriented thinking" (β = -.01, p = .561). Subsequently, disruptive behavior in childhood was predictive of substance use (β = .12, p < .001) and internalizing problems (β = .06, p < .001) in adolescence, and of every alexithymia domains including, "difficulties identifying feelings" (β = .08, p < .001), "difficulties describing feelings" (β = .05, p < .001), and "external oriented thinking" (β = .05, p < .001). Coefficients for gender as a covariate in the model show that being a female increases risk for internalizing problems (β = -.37, p <.001), substance use (β = -.06, p <.001), and "difficulties identifying feelings" (β = -.23, p <.001) in adolescence, as well as lifetime risk of depression diagnosis (β = -.07, p < .05); whereas being a male increases risk for "externally oriented thinking" (β = .40, p < .001) in adolescence and lifetime substance use diagnosis (β = .13, p <.001) in young adulthood.

Multiple Group Gender Moderation Analyses

The chi-square difference test between the unconstrained and constrained multiple group models was significant (χ^2 = 23.35, df = 8, p = .003), indicating statistically significant differences between males and females in the path analysis model. While the associations between alexithymia in adolescence and substance use and depression diagnosis in adulthood were consistent with the results for the full sample and did not differ by gender, some significant gender differences emerged in the paths linking early markers of affect regulation disorder with

adolescent outcomes. Thus, results from the MODEL CONSTRAINT comparisons revealed five significant gender differences (see Table 3). First, for females, but not for males, anxious-fearful behavior in childhood was predictive of the alexithymia domains of "difficulties identifying feelings" (β = -.26, p < .05) and "difficulties describing feelings" (β = -.20, p < .05), and had stronger associations with internalizing problems in adolescence (β = -.51, p <.01). In addition, in females, but not males, disruptive behavior in childhood was associated with the alexithymia domain of "external oriented thinking" (β = -0.17, p <.05) and internalizing problems in adolescence (β = -.42, p < .01). In summary, our findings indicate that females with anxious-fearful and disruptive behaviors in childhood are more likely to develop alexithymia and internalizing problems in adolescence. The association of CCR with each of the alexithymia domains, substance use in adolescence, and depression diagnosis was significant, and did not differ by gender.

Discussion

The present study contributes to the literature by prospectively examining associations of alexithymia in adolescence with substance use and depression disorders in adulthood, while accounting for the potential influence of CCR and early precursors for alexithymia, depression, and substance use in childhood, and testing for potential gender moderation. To our knowledge, this is the first study that examined a comprehensive model of the developmental etiology of alexithymia in adolescence. Several distinct pathways were highlighted by our analyses.

First, our research highlighted the role of early affect regulation problems, represented by anxious-fearful and disruptive behaviors, in the development of alexithymia. Our findings indicated that girls with anxious-fearful and disruptive behaviors in childhood might be at higher risks for developing alexithymia and internalizing problems in adolescence, suggesting that the

origins of alexithymia in girls are at least partially related to early affect-regulation problems in childhood. These findings may reflect that girls who show early patterns of dysfunctional affect regulation in childhood in either over-controlled (e.g., anxious-fearful) or under-controlled (e.g., disruptive) ways may be more prone to experiencing difficulties in affect regulation in adolescence. The early precursors of alexithymia for boys, however, remain to be determined. We suggest that males might develop alexithymia later in life, given the evidence that alexithymia is associated with advanced age (Mattila, Salminen, Nummi, & Joukamaa, 2006; Salminen et al., 1999). These differences in progression and development of alexithymia between boys and girls could be explained by their differences in response to stress. Some studies have suggested that girls are more encouraged to internalize their distress, whereas boys are encouraged to restrict emotional expressiveness (Polce-Lynch, Myers, Kilmartin, Forssmann-Falck, & Kliewer, 1998) and act it out (Sachs-Ericsson & Ciarlo, 2000). Thus, socialization to gender-appropriate social roles may explain associations between internalizing coping strategies and higher rates of depression and anxiety in women and externalizing coping strategies and higher rates of substance use in men (Sachs-Ericsson & Ciarlo, 2000), while eventually both coying styles represent different manifestations of the same underlying distress (Nolen-Hoeksema, 2001). Further, our results also suggest that, for both men and women, the relationship between alexithymia and depression diagnosis was specific to only one alexithymia domain, “difficulties identifying feelings.” These results are consistent with previous research that reported similar associations in clinical alcoholic samples (De Gucht et al., 2004; de Timary et al., 2008; Evren et al., 2008). In light of this evidence, we suggest that “difficulties identifying feelings” may be a main mechanism linking alexithymia and depression in *clinical* and *non-clinical* samples.

Second, our study provided additional evidence of associations between cumulative contextual risk in childhood and alexithymia in adolescence for both girls and boys. These findings are aligned with previous research that linked adverse living conditions in childhood with higher prevalence of alexithymia in adulthood (Joukamaa et al., 2003; Salminen et al., 1999). One possible explanation is that adverse living conditions in childhood may interfere with the child's ability to identify, differentiate, and express emotions, and lay the foundation for the development of alexithymia later in life (Taylor, 2000).

Finally, our study indicated that adolescent alexithymia was not associated with a substance use disorder diagnosis in adulthood. These results may be due to the fact that our study applied prospective longitudinal analyses, in which alexithymia was assessed prior to onset of a substance use disorder, whereas the majority of previous research applied a cross-sectional design assessing substance use disorders and alexithymia simultaneously (Thorberg et al., 2009). Another explanation for the lack of significant associations may be due to the fact that our study is based on a non-clinical birth-cohort sample, and used a more inclusive definition of substance use disorder diagnosis (i.e., alcohol, cannabis, and any other substance use diagnosis), compared to clinical samples of alcohol-dependent patients that are commonly examined in relation to alexithymia (De Gucht et al., 2004; de Timary et al., 2008; Evren et al., 2008). To further clarify and expand upon our findings, we suggest that future studies apply longitudinal analyses to examine associations between alexithymia and substance use in the general population.

The strengths of this study include a large, nationally representative sample from Finland that allowed us to examine a comprehensive model of the developmental etiology of alexithymia, drawing data from multiple informants and developmental periods. One limitation of this study is the relatively small number of items that were available for testing our research questions, in

particular in relation to childhood affect-regulation problems, but this limitation is common for secondary data analyses of large birth cohort data sets. It is well-known that Cronbach's alpha is affected by the number of items in a scale, and can be high in subscales with a sufficient number of items. The reliability for each of the Rutter's subscales could have been strengthened if we had had access to more items from the original Rutter questionnaire. Another study limitation refers to the potential for reporting bias. For example, even though the official register data represents a strength - and provides information on diagnoses of depression, alcohol, cannabis, and other substance use disorders both for *inpatient* and *outpatient* care - the diagnosis only represents those who were seeking care. Given the fact that males are less likely to seek help with mental health disorders (Nolen-Hoeksema, 2001), these findings should be interpreted with caution. It also should be taken into account that alexithymia was assessed with self-report in adolescence, and the answers can be biased by respondents' willingness to report these problems to the researchers, particularly for males. Nevertheless, the pathways identified in our study provide a strong foundation for future research aimed at better understanding the development of alexithymia, yielding findings that may be relevant for preventive interventions addressing socio-economic disparities and social and emotional learning.

Table 1

Descriptive Statistics of Analytic Variables

				Female		Male	
Variable	Mean/%	Range	SD	Mean/%	SD	Mean/%	SD
Sex (male)	49.0%	0-1					
Cumulative Contextual Risk							
Teenage Mom (<20) (prenatal)	3.8%	0-1					
Smoking while pregnant (prenatal)	14.4%	0-1					
Drinking while pregnant (prenatal)	11.8%	0-1					
Low Birth Weight (birth)	3.0%	0-1					
Unemployed Mother (age 8)	13.3%	0-1					
Unemployed Father (age 8)	12.1%	0-1					
Mother education less than 9 yrs. (age 8)	7.0%	0-1					
Father education less than 9 yrs. (age 8)	14.1%	0-1					
Single Parent (age 8)	7.2%	0-1					
Anxious-fearful Behavior (age 8)	1.08	0-4	0.96	1.08	0.94	1.07	0.97
Disruptive Behavior (age 8)	1.17	0-8	1.37	0.95	1.21	1.40	1.49
Internalizing Problems (age 16)	40.03	23-81	7.19	42.52	7.63	37.30	5.52
Substance Use (age 16)							
At least one alcohol drink in the past 12 months	2.18	0-6	1.85	2.24	1.84	2.12	1.86
Being drunk in the past 12 months	1.67	0-6	1.71	1.73	1.71	1.61	1.72
Heavy episodic drinking past 30 days	0.74	0-5	1.08	0.74	1.07	0.73	1.09
Alexithymia (age 16)							
Difficulty Identifying Feelings (DIF)	14.98	5-34	4.78	16.03	4.89	13.88	4.41
Difficulty Describing Feelings (DDF)	11.03	3-24	3.39	11.01	3.55	11.06	3.22
Externally-Oriented Thinking (EOT)	21.89	7-38	4.12	20.27	3.84	23.57	3.70
Depression Diagnosis (Register)	7.1%	0-1		9.3%		4.8%	
Substance Use Disorder Diagnosis (Register)	3.1%	0-1		2.5%		3.6%	

Table 2

Correlations of Study Constructs

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Male											
2. Cumulative Contextual Risk	-0.01										
3. Anxious-fearful Behavior (age 8)	-0.01	0.03*									
4. Disruptive Behavior (age 8)	0.17***	0.11***	0.13***								
5. Internalizing Problems (age 16)	-0.36***	0.02	0.09***	0.00							
6. Substance Use (age 16)	-0.04**	0.14***	-0.01	0.12***	0.14***						
7. Alexithymia DIF (age 16)	-0.22***	0.04**	0.05***	0.05**	0.46***	0.21***					
8. Alexithymia DDF (age 16)	0.01	0.05***	0.04**	0.06***	0.33***	0.12***	0.64***				
9. Alexithymia EOT (age 16)	0.40***	0.05***	0.00	0.12***	-0.22***	-0.02	-0.03*	0.17***			
10. Depression Diagnosis	-0.09***	0.05***	0.04**	0.05***	0.18***	0.10***	0.13***	0.08***	-0.06***		
11. SUDD	0.03**	0.04**	0.03*	0.07***	0.04**	0.15***	0.06***	0.05***	0.00	0.27***	
Mean	0.49	0.80	1.08	1.17	40.03	-0.02	14.98	11.03	21.89	0.07	0.03
SD	0.50	0.99	0.96	1.37	7.19	0.73	4.78	3.39	4.12	0.26	0.17
N	6963	6963	6321	6320	6488	6941	6180	6186	6185	6963	6963

Note. DIF = Difficulties Identifying Feelings, DDF = Difficulties Describing Feelings, EOT = External Oriented Thinking, SUDD = Substance Use Disorder Diagnosis.

* $p < .05$; **$p < .01$; *** $p < .001$.

Table 3
Standardized Path Estimates for the Final Model

	Full sample	Females	Males	Test of gender differences
Direct Paths	β	β	β	b
Alexithymia DIF on disruptive behavior	0.08***	0.09***	0.08***	-0.10
Alexithymia DIF on anxious-fearful behavior	0.04**	0.07***	0.02	-0.26*
Alexithymia DIF on CCR	0.03*	0.04*	0.02	-0.14
Alexithymia DIF on male	-0.23***			
Alexithymia DDF on disruptive behavior	0.05***	0.07***	0.03	-0.14
Alexithymia DDF on anxious-fearful behavior	0.04**	0.06**	0.01	-0.20*
Alexithymia DDF on CCR	0.05***	0.05**	0.04*	-0.04
Alexithymia DDF on male	-0.01			
Alexithymia EOT on disruptive behavior	0.05***	0.08***	0.03	-0.17*
Alexithymia EOT on anxious-fearful behavior	-0.01	0.00	-0.02	-0.07
Alexithymia EOT on CCR	0.044**	0.05*	0.04*	-0.04
Alexithymia EOT on male	0.40***			
Substance Use (age 16) on disruptive behavior	0.12***	0.13***	0.12***	-0.02
Substance Use (age 16) on anxious-fearful behavior	-0.03*	-0.02	-0.04*	-0.01
Substance Use (age 16) on CCR	0.14***	0.13***	0.15***	0.01
Substance Use (age 16) on male	-0.06***			
Internalizing Problems (age 16) on disruptive behavior	0.06***	0.09***	0.03	-0.42**
Internalizing Problems (age 16) on anxious-fearful behavior	0.08***	0.11***	0.06**	-0.51**
Internalizing Problems (age 16) on CCR	0.01	0.02	0.00	-0.10
Internalizing Problems (age 16) on male	-0.37***			
SUDD on Alexithymia DIF	0.09	0.08	0.11	0.01
SUDD on Alexithymia DDF	0.03	0.07	-0.01	-0.02
SUDD on Alexithymia EOT	-0.05	-0.02	-0.06	-0.01
SUDD on Substance Use (age 16)	0.26***	0.26***	0.26***	0.00
SUDD on Internalizing Problems (age 16)	0.05	0.06	0.03	0.00

SUDD on CCR	0.03	-0.02	0.06	0.09
SUDD on male	0.13***			
Depression diagnosis on Alexithymia DIF	0.13***	0.14***	0.12*	0.00
Depression diagnosis on Alexithymia DDF	-0.01	0.03	-0.07	-0.03
Depression diagnosis on Alexithymia EOT	-0.06*	-0.06	-0.06	0.00
Depression diagnosis on Sub Use (age 16)	0.10***	0.07**	0.14***	0.09
Depression diagnosis on Internalizing Problems (age 16)	0.17***	0.16***	0.17***	0.01
Depression diagnosis on CCR	0.06**	0.08**	0.05	-0.03
Depression diagnosis on male	-0.07*			

Note. CCR = Cumulative Contextual Risk, DIF = Difficulties Identifying Feelings, DDF = Difficulties Describing Feelings, EOT = External Oriented Thinking; SUDD = Substance Use Disorder Diagnosis;

* p < .05; **p < .01; *** p < .001.

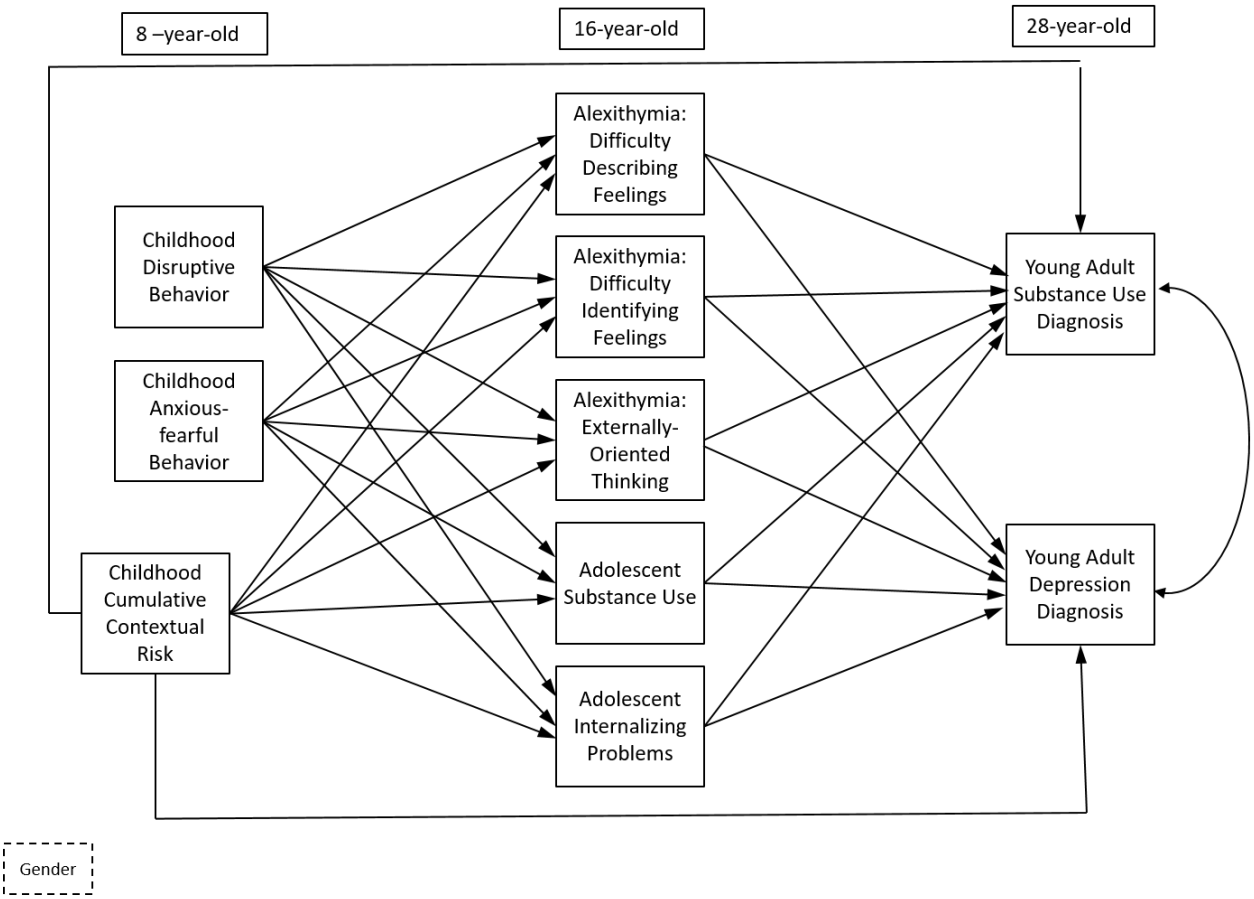

Figure 1

Conceptual Model for Alexithymia Paper (N = 6,963).

References

Achenbach, T. M. (1991). Integrative guide for the 1991 CBCL/4-18, YSR, and TRF profiles. Burlington, VT: University of Vermont.

Bagby, R. M., Parker, J. D., & Taylor, G. J. (1994). The twenty-item Toronto Alexithymia Scale—I. Item selection and cross-validation of the factor structure. Journal of Psychosomatic Research, 38(1), 23-32. doi:10.1016/0022-3999(94)90005-1

Bagby, R. M., & Taylor, G. J. (1997). Affect dysregulation and alexithymia. In G. J. Taylor, R. M. Bagby, & J. D. Parker (Eds.), Disorders of affect regulation: Alexithymia in medical and psychiatric illness (pp. 26-45). Cambridge, MA: Cambridge University Press.

Buu, A., Dabrowska, A., Heinze, J. E., Hsieh, H.-F., & Zimmerman, M. A. (2015). Gender differences in the developmental trajectories of multiple substance use and the effect of nicotine and marijuana use on heavy drinking in a high-risk sample. Addictive Behaviors, 50, 6-12. doi:10.1016/j.addbeh.2015.06.015

De Gucht, V., Fischler, B., & Heiser, W. (2004). Neuroticism, alexithymia, negative affect, and positive affect as determinants of medically unexplained symptoms. Personality and Individual Differences, 36(7), 1655-1667. doi:10.1016/j.paid.2003.06.012

De Rick, A., & Vanheule, S. (2006). The relationship between perceived parenting, adult attachment style and alexithymia in alcoholic inpatients. Addictive Behaviors, 31(7), 1265-1270. doi:10.1016/j.addbeh.2005.08.010

de Timary, P., Luts, A., Hers, D., & Luminet, O. (2008). Absolute and relative stability of alexithymia in alcoholic inpatients undergoing alcohol withdrawal: relationship to depression and anxiety. Psychiatry Research, 157(1-3), 105-113. doi:10.1016/j.psychres.2006.12.008

Dukalski, B,. Suslow, T., Egloff, B., Kersting, A., & Donges, U. (2019) Implicit and explicit self-concept of neuroticism in borderline personality disorder, Nordic Journal of Psychiatry, 73 (3), 159-168.

Ekblad, S. (1990). The children's behaviour questionnaire for completion by parents and teachers in a Chinese sample. Journal of Child Psychology and Psychiatry, 31(5), 775-791. doi:10.1111/j.1469-7610.1990.tb00817.x

Elander, J., & Rutter, M. (1996). Use and development of the Rutter parents' and teachers' scales. International Journal of Methods in Psychiatric Research. doi:10.1002/(SICI)1234-988X(199607)6:2<63::AID-MPR151>3.3.CO;2-M

Evren, C., Sar, V., Evren, B., Semiz, U., Dalbudak, E., & Cakmak, D. (2008). Dissociation and alexithymia among men with alcoholism. Psychiatry and Clinical Neurosciences, 62(1), 40-47. doi:10.1111/j.1440-1819.2007.01775.x

Fowler, P. C., & Park, R. M. (1979). Factor structure of the Preschool Behavior Questionnaire in a normal population. Psychological Reports, 45(2), 599-606. doi:10.2466/pr0.1979.45.2.599

Günther, V., Rufer, M., Kersting, A., & Suslow, T. (2016). Predicting symptoms in major depression after inpatient treatment: the role of alexithymia. Nordic journal of psychiatry, 70(5), 392-398.

Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. Psychological Bulletin, 112(1), 64-105.

Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1-55. doi:10.1080/10705519909540118

Johnston, L. D., Miech, R. A., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2018). Monitoring the Future national survey results on drug use, 1975-2017: Overview, key findings on adolescent drug use. Retrieved from Ann Arbor, MI:

Joukamaa, M., Kokkonen, P., Veijola, J., Läksy, K., Karvonen, J. T., Jokelainen, J., & Järvelin, M.-R. (2003). Social situation of expectant mothers and alexithymia 31 years later in their offspring: a prospective study. Psychosomatic Medicine, 65(2), 307-312. doi:10.1097/01.PSY.0000030389.53353.BC

Joukamaa, M., Taanila, A., Miettunen, J., Karvonen, J. T., Koskinen, M., & Veijola, J. (2007). Epidemiology of alexithymia among adolescents. Journal of Psychosomatic Research, 63(4), 373-376. doi:10.1016/j.jpsychores.2007.01.018

Kauhanen, J., Kaplan, G., Julkunen, J., Wilson, T., & Salonen, J. (1993). Social factors in alexithymia. Comprehensive Psychiatry, 34(5), 330-335.

Kessler, R. C., McGonagle, K. A., Swartz, M., Blazer, D. G., & Nelson, C. B. (1993). Sex and depression in the National Comorbidity Survey I: Lifetime prevalence, chronicity and recurrence. Journal of Affective Disorders, 29(2-3), 85-96. doi:10.1016/0165-0327(93)90026-G

Kokkonen, P., Karvonen, J. T., Veijola, J., Läksy, K., Jokelainen, J., Järvelin, M.-R., & Joukamaa, M. (2001). Prevalence and sociodemographic correlates of alexithymia in a population sample of young adults. Comprehensive Psychiatry, 42(6), 471-476. doi:10.1053/comp.2001.27892

Mason, W. A., January, S. A., Chmelka, M. B., Parra, G., Savolainen, J., Miettunen, J., . . . Moilanen, I. (2016). Cumulative contextual risk at birth in relation to adolescent substance use, conduct problems, and risky sex: General and specific predictive associations in a Finnish birth cohort. Addictive Behaviors, 58, 161-166. doi:10.1016/j.addbeh.2016.02.031

Mattila, A. K., Salminen, J. K., Nummi, T., & Joukamaa, M. (2006). Age is strongly associated with alexithymia in the general population. Journal of Psychosomatic Research, 61(5), 629-635. doi:10.1016/j.jpsychores.2006.04.013

McGee, R., Williams, S., Bradshaw, J., Chapel, J. L., Robins, A., & Silva, P. A. (1985). The Rutter scale for completion by teachers: factor structure and relationships with cognitive abilities and family adversity for a sample of New Zealand children. Journal of Child Psychology and Psychiatry, 26(5), 727-739. doi:10.1111/j.1469-7610.1985.tb00587.x

Muthén, L. K., & Muthén, B. O. (1998-2017). Mplus User's Guide (Eighth Edition ed.). Los Angeles, California: Muthén & Muthén.

Nolen-Hoeksema, S. (2001). Gender differences in depression. Current Directions in Psychological Science, 10(5), 173-176.

Patwardhan, I., Mason, W. A., Savolainen, J., Chmelka, M. B., Miettunen, J., & Järvelin, M.-R. (2017). Childhood cumulative contextual risk and depression diagnosis among young adults: The mediating roles of adolescent alcohol use and perceived social support. Journal of Adolescence, 60, 16-26. doi:10.1016/j.adolescence.2017.07.008

Polce-Lynch, M., Myers, B. J., Kilmartin, C. T., Forssmann-Falck, R., & Kliewer, W. (1998). Gender and age patterns in emotional expression, body image, and self-esteem: A qualitative analysis. Sex Roles, 38(11-12), 1025-1048. doi:10.1023/A:1018830727244

Sachs-Ericsson, N., & Ciarlo, J. A. (2000). Gender, social roles, and mental health: An epidemiological perspective. Sex Roles, 43(9-10), 605-628. doi:10.1023/A:1007148407005

Salminen, J. K., Saarijärvi, S., Äärelä, E., Toikka, T., & Kauhanen, J. (1999). Prevalence of alexithymia and its association with sociodemographic variables in the general population of Finland. Journal of Psychosomatic Research, 46(1), 75-82. doi:10.1016/S0022-3999(98)00053-1

Sameroff, A. J., Seifer, R., Baldwin, A., & Baldwin, C. (1993). Stability of intelligence from preschool to adolescence: The influence of social and family risk factors. Child Development, 64(1), 80-97. doi:10.1111/j.1467-8624.1993.tb02896.x

Shishido, H., Gaher, R. M., & Simons, J. S. (2013). I don't know how I feel, therefore I act: Alexithymia, urgency, and alcohol problems. Addictive Behaviors, 38(4), 2014-2017. doi:10.1016/j.addbeh.2012.12.014

Sifneos, P. E. (1972). Is dynamic psychotherapy contraindicated for a large number of patients with psychosomatic diseases? Psychotherapy and Psychosomatics, 21(1-6), 133-136. doi:10.1159/000287665

Stasiewicz, P. R., Bradizza, C. M., Gudleski, G. D., Coffey, S. F., Schlauch, R. C., Bailey, S. T., . . . Gulliver, S. B. (2012). The relationship of alexithymia to emotional dysregulation within an alcohol dependent treatment sample. Addictive Behaviors, 37(4), 469-476. doi:10.1016/j.addbeh.2011.12.011

Taylor, G. J. (2000). Recent developments in alexithymia theory and research. The Canadian Journal of Psychiatry, 45(2), 134-142. doi:10.1177/070674370004500203

Taylor, G. J., & Bagby, R. M. (2013). Psychoanalysis and empirical research: The example of alexithymia. Journal of the american psychoanalytic association, 61(1), 99-133. doi:10.1177/0003065112474066

Taylor, G. J., Bagby, R. M., & Parker, J. D. (1997). Disorders of Affect Regulation: Alexithymia in Medical and Psychiatric Illness. Cambridge, MA: Cambridge University Press.

Thorberg, F. A., Young, R. M., Sullivan, K. A., & Lyvers, M. (2009). Alexithymia and alcohol use disorders: A critical review. Addictive Behaviors, 34(3), 237-245. doi:10.1016/j.addbeh.2008.10.016

Tremblay, R. E., Desmarais-Gervais, L., Gagnon, C., & Charlebois, P. (1987). The Preschool Behaviour Questionnaire: Stability of its factor structure between cultures, sexes, ages and socioeconomic classes. International Journal of Behavioral Development, 10(4), 467-484.

Van de Velde, S., Bracke, P., & Levecque, K. (2010). Gender differences in depression in 23 European countries. Cross-national variation in the gender gap in depression. Social Science & Medicine, 71(2), 305-313. doi:10.1016/j.socscimed.2010.03.035

Zimmermann, G., Rossier, J., Meyer de Stadelhofen, F., & Gaillard, F. (2005). Alexithymia assessment and relations with dimensions of personality. European Journal of Psychological Assessment, 21(1), 23-33. doi:10.1027/1015-5759.21.1.23