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Rêves dysphoriques, adversité précoce et adaptation psychosociale : Étude longitudinale chez les enfants et les adolescents

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Rêves dysphoriques, adversité précoce et adaptation psychosociale : Étude longitudinale chez les enfants et les adolescents

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Résumé

Cette thèse a pour but d'examiner 1) les associations longitudinales entre les rêves dysphoriques et les problèmes d'adaptation psychosociale à travers l'adolescence, 2) les effets principaux de l'environnement et du tempérament précoce dans le développement des rêves dysphoriques plus tard à l'adolescence et 3) le rôle modérateur du tempérament précoce dans l'association entre l'environnement précoce et les rêves dysphoriques à l'adolescence. Elle se compose de deux articles empiriques rédigés par la candidate, ainsi que de deux articles en annexe rédigés par la candidate en tant que co-auteure qui forment la base fondamentale de cette thèse.

Le premier article en annexe présente des résultats transversaux sur les associations entre les rêves dysphoriques et les idéations suicidaires chez les adolescents de 12 et 13 ans. Le premier article de cette thèse enrichit ces résultats en ajoutant une perspective développementale et en considérant également les associations entre les rêves dysphoriques et les symptômes intériorisés tout au long de l'adolescence. Ce premier article principal de la thèse clarifie les associations bidirectionnelles et longitudinales entre la fréquence des rêves dysphoriques, les idéations suicidaires, les symptômes dépressifs et les symptômes anxieux chez les adolescents entre 13 et 18 ans. Les données soutiennent les résultats antérieurs en montrant qu'il existe des associations importantes entre l'expérience onirique, le risque suicidaire et les symptômes intériorisés à travers l'adolescence, permettant de donner une piste de plus dans la prévention du risque suicidaire.

Le deuxième article en annexe se concentre sur le rôle modérateur développemental de l'émotivité négative précoce dans les associations entre les rêves dysphoriques et les problèmes d'adaptation psychosociale à 11 ans. Dans un esprit de continuité, le deuxième article principal

de cette thèse répond à de nouvelles questions en explorant (1) les effets principaux de l'environnement social précoce et de l'émotivité négative précoce dans le développement des rêves dysphoriques, mais à travers toute l'adolescence, et (2) le rôle modérateur de l'émotivité négative précoce dans l'association entre l'environnement social précoce et la fréquence des rêves dysphoriques à l'adolescence. Les résultats montrent qu'un vécu d'adversité précoce est associé à une plus grande fréquence de rêves dysphoriques à l'adolescence, mais seulement chez les adolescents ayant des niveaux élevés d'émotivité négative précoce. En effet, nos résultats démontrent que l'émotivité négative précoce modère l'association entre l'environnement social précoce et la fréquence des rêves dysphoriques plus tard à l'adolescence. Plus précisément, lorsque l'émotivité négative précoce était élevée, la fréquence des rêves dysphoriques était plus élevée dans un environnement précoce adverse et plus faible dans un environnement positif. Chez les enfants ayant des niveaux d'émotivité négative précoce plus faibles, ils ne se trouvaient pas sensibles à la qualité de leur environnement dans la présentation des rêves dysphoriques à l'adolescence. Ces résultats soutiennent l'idée que c'est la combinaison des caractéristiques individuelles et environnementales qui explique le mieux le développement des rêves dysphoriques.

Finalement, les résultats sont discutés en mettant en lumière les apports à la littérature, tout en les intégrant à diverses théories et hypothèses sur les rêves. Les forces et les limites, les contributions nouvelles et les implications théoriques et cliniques de la thèse, ainsi que des avenues futures de recherche sont présentées. En somme, cette thèse ajoute à notre compréhension du développement des rêves dysphoriques et à leurs associations et a des implications dans la prévention des rêves dysphoriques et de la santé mentale.

Mots clés : Rêves dysphoriques, environnement social précoce, adaptation psychosociale, symptômes intériorisés, émotivité négative précoce, idéations suicidaires.

Abstract

The purpose of this thesis is to examine: 1) the longitudinal associations between disturbing dreams and psychosocial adjustment problems throughout adolescence; 2) the main effects of early environment and early temperament on the development of disturbing dreams later in adolescence; and 3) the moderating role of early temperament in the association between early environment and the frequency of disturbing dreams later in adolescence. The thesis contains two empirical articles written by the candidate, as well as two articles in the appendix written by the candidate as a co-author and on which this thesis is based.

Article 1 of the appendix presents cross-sectional findings on the associations between disturbing dreams and suicidal ideation in 12- and 13-year-old adolescents. The first article in this thesis expands upon these findings by adding a developmental perspective to this research question and by considering the associations between disturbing dreams and internalizing symptoms throughout adolescence. This first article clarifies the bidirectional and longitudinal associations between disturbing dream frequency, suicidal ideation, depression and anxiety symptoms in adolescents between the ages of 13 and 18. The study's results support previous findings by showing significant associations between disturbing dreams, suicide risk, and internalizing symptoms throughout adolescence, thereby providing an additional avenue for the prevention of suicide risk.

Article 2 of the appendix focuses on the developmental moderating role of early negative emotionality in the associations between disturbing dreams and psychosocial adjustment problems in 11-year-old children. The second article in this thesis adds to these findings by investigating new questions exploring: 1) the main effects of the early social environment and early negative emotionality in the development of disturbing dreams throughout adolescence; and

2) the moderating role of early negative emotionality in the association between the early social environment and the frequency of disturbing dreams in adolescence. Results show that early adversity is associated with a greater disturbing dream frequency in adolescence, but only in adolescents with high levels of early negative emotionality, suggesting that early negative emotionality moderates the association between early social environment and disturbing dream frequency later in adolescence. Specifically, when early negative emotionality was high, later disturbing dream frequency was greater with an early adverse environment, and lower in a positive environment. Children with low levels of early negative emotionality were not as sensitive to their environment and did not show a difference in their disturbing dream frequency in adolescence. These results support the idea that it is the combination of individual and environmental characteristics that is most strongly associated with the development of disturbing dreams.

Finally, these findings are discussed by highlighting their contributions to the literature and by integrating them into current theories and hypotheses about dreaming. The strengths and limitations, novel contributions, and theoretical and clinical implications of the thesis as well as future research directions are then presented. In sum, this thesis contributes to our understanding of disturbing dream development and its associations with mental health in adolescents and carries implications for the prevention of disturbing dreams and mental health difficulties.

Keywords: Dysphoric dreams, early social environment, early negative emotionality, internalizing symptoms, psychosocial adjustment, suicidal ideation.

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Liste des sigles et des abréviations

AIC = Akaike's information criterion

ANX = Level of anxiety

BIC = Bayesian Information Criteria

BLRT = Bootstrap Likelihood Ratio Test

CFI = Comparative fit index

CI = Confidence interval

DD = Disturbing dreams

DEP = Level of depression

df = Degrees of freedom

FIML = Full information maximum likelihood

LL = Log-likelihood

LMR-LRT = Lo-Mendell-Rubin Likelihood Ratio Test

MLR = Maximum likelihood estimation with robust standard errors

NE = Negative emotionality

RD = Recurrent dreams

RMSEA = Root mean square error of approximation

SABIC = Schwarz's sample-size adjusted BIC

SD = Standard deviation

SI = Suicidal ideation

SRMR = Standardized root-mean-square residual

TDAH = Trouble du déficit de l'attention avec ou sans hyperactivité

TLI = Tucker Lewis index

TSPT = Trouble de stress post-traumatique

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Avant de vous jeter dans la lecture de ma thèse, j'aimerais prendre le temps de remercier des personnes qui m'ont été significatives lors de mon parcours doctoral.

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1. Introduction générale

1.1 Position du problème

Les troubles oniriques, incluant les rêves dysphoriques (p. ex. mauvais rêves et cauchemars), représentent un des troubles du sommeil les plus communs dans la population générale (Levin & Nielsen, 2007; Siclari et al., 2020). Malgré une prévalence plus élevée de rêves dysphoriques à l'enfance qu'à l'âge adulte, les études portant sur les cauchemars et les mauvais rêves se sont davantage penchées sur des populations adultes cliniques et non-cliniques. Celles-ci démontrent que la fréquence de rêves dysphoriques est associée à un moindre bien-être psychologique et un taux plus élevé de troubles psychopathologiques (Levin & Nielsen, 2007).

Chez les enfants de la population générale, jusqu'à 20% d'entre eux vont rapporter des difficultés d'adaptation psychosociale (Fechete et al., 2018) et la majorité ne vont pas chercher de l'aide auprès des services de santé mentale (Russell et al., 2018). De plus, les jeunes ont souvent de la difficulté à reconnaître ou ont une certaine méconnaissance de leur vie affective, rendant plus difficile la communication de leurs états internes (Bernert et al., 2015; Russell et al., 2018). Ceci vient ajouter à la nécessité d'examiner les problèmes d'adaptation psychosociale durant cette période développementale. Des études récentes démontrent que les rêves dysphoriques sont reliés à une diversité de comportements intériorisés et extériorisés à l'enfance et l'adolescence (Floress et al., 2016; Gauchat et al., 2014; Lemyre et al., 2019; Secrist et al., 2019) mais il existe plusieurs divergences dans les méthodes (c'est-à-dire le devis utilisé, les variables contrôles, etc.) affectant la convergence des résultats des études. De plus, certaines utilisent un construit général pour représenter une diversité de troubles du sommeil, ne permettant pas de faire ressortir la spécificité du rôle des rêves dysphoriques (Quach et al., 2018; Wang et al., 2019; Zhang et al., 2018).

Les liens entre les rêves dysphoriques et les troubles d'adaptation plus sévères, tels que les idéations suicidaires, ont davantage été documentés auprès de la population adulte qu'auprès des enfants et des adolescents (Pigeon et al., 2012). Les rares études auprès des jeunes suggèrent un lien positif entre la présence de rêves dysphoriques et le risque suicidaire. Toutefois, ces études sont de nature transversale (Russell et al., 2018; Stanley et al., 2017) ou utilisent un facteur commun regroupant plusieurs troubles du sommeil, ne permettant pas de départager la variance unique des rêves dysphoriques de celle des autres troubles du sommeil dans leurs associations avec le risque suicidaire. (Wong et al., 2011).

Bien que les rêves dysphoriques représentent un des troubles du sommeil les plus communs dans la population générale, qu'il existe une prévalence plus élevée des rêves dysphoriques chez les jeunes que chez les adultes et qu'ils sont reliés à une diversité de problèmes d'adaptation psychosociale, la genèse des rêves dysphoriques et leur développement en bas âge demeurent peu connus, tant au plan clinique qu'expérimental. Par exemple, pour certains individus, les rêves dysphoriques sont présents dès l'enfance et persistent jusqu'à l'âge adulte; pour d'autres, ils disparaissent à l'enfance pour ressurgir à l'adolescence ou à l'âge adulte, suite à un événement marquant (Hartmann, 1998a; Nielsen, 2017a). Ainsi, le développement des rêves dysphoriques à travers les âges reste méconnu. En ce qui a trait à la genèse des rêves dysphoriques, récemment, une attention particulière est portée à l'hypothèse de l'accélération du stress (*Stress Acceleration Hypothesis*) des problèmes de santé mentale (Callaghan & Tottenham, 2016) qui stipule que le vécu d'un ou de plusieurs événements adverses durant la petite enfance augmenterait la probabilité qu'un individu développe un problème de santé mentale. Nielsen (2017) a adapté cette théorie à la genèse des rêves dysphoriques, en proposant que le fait de vivre de l'adversité précoce à l'enfance influencerait la nature des rêves vécus par les individus plus tard dans leur développement. Ces rêves seraient caractérisés par des contenus dysphoriques.

De plus, selon Hartmann (1984a, 1984b, 1984c) et Carr et Nielsen (Carr et al., 2021; 2017), la prédisposition des individus à être plus vulnérables et sensibles aux événements stressants ou émotionnels de vie, ajoutée au vécu d'événements adverses, peuvent jouer un rôle dans l'apparition de rêves dysphoriques. Cette sensibilité peut s'apparier à la détresse affective (c.à.d., une tendance à réagir avec une grande détresse face à des stresseurs émotionnels), tel que proposée dans le modèle de production de cauchemars de Levin et Nielsen (2007) et également au concept de sensibilité au traitement sensoriel (Aron & Aron, 1997), récemment adapté par Carr et Nielsen (2017) dans le contexte des cauchemars. Ces différents concepts font référence à une sensibilité individuelle qui s'apparente à un trait de tempérament, soit l'émotivité négative, c'est-à-dire la tendance à vivre une détresse psychologique lorsque confronté à de nouvelles situations ambigües (Rothbart et al., 2001). Or, le rôle de l'émotivité négative dans le développement de rêves dysphoriques n'a jamais été examiné empiriquement dans la population générale, ni chez les individus ayant vécu de l'adversité lors de leur enfance.

En somme, cette thèse vise à examiner (1a) le développement des rêves dysphoriques à travers l'adolescence, ainsi que (1b) leurs corrélats en lien avec les problèmes d'adaptation psychosociale (idéations suicidaires et symptômes intériorisés), et (2) les facteurs environnementaux précoces et individuels spécifiques au tempérament précoce associés à l'apparition des rêves dysphoriques plus tard à l'adolescence.

1.2 Rêves dysphoriques

Les rêves dysphoriques se caractérisent par des thématiques hautes en émotions négatives, incluant la peur, la confusion, la colère et la tristesse (Levin & Nielsen, 2007; Robert & Zadra, 2014; Siclari et al., 2020). Les rêves dysphoriques représentent différentes formes de rêves, dont principalement les cauchemars et les mauvais rêves. Ces deux catégories se distinguent par le fait

que les cauchemars entraînent un réveil chez l'individu (Zadra & Donderi, 2000). Les cauchemars sont trois à quatre fois plus prévalents chez les enfants et les adolescents que chez les adultes (Levin & Nielsen, 2007) et 75% des enfants rapportent au moins un cauchemar dans leur vie (American Sleep Disorders Association, 2005).

Depuis longtemps, on cherche à comprendre non seulement pourquoi certaines personnes sont plus aptes que d'autres à faire des cauchemars, mais aussi si les cauchemars ont une fonction ou représentent un bris dans la fonction des rêves. Nous nous centrerons ici sur le modèle neurocognitif proposé par Levin et Nielsen (2009; 2007), qui représente la théorie la plus intégrative dans le domaine d'étude des rêves dysphoriques. En effet, il s'agit d'un modèle à la fois étiologique et fonctionnel, qui assimile la majorité des autres modèles explicatifs des rêves dysphoriques le précédant, en plus d'inclure une large gamme de rêves dysphoriques (mauvais rêves, cauchemars idiopathiques et cauchemars post-traumatiques).

Le modèle de Levin et Nielsen (2009; 2007) s'inscrit dans un paradigme plus large accordant aux rêves une fonction de régulation émotionnelle (Cartwright, 1991; Hartmann, 1998b; Scarpelli et al., 2019). Pour Levin et Nielsen, cette régulation émotionnelle est accomplie par un processus d'extinction des émotions négatives de peur reliées à des souvenirs (*fear-extinction memories*), suivant les principes d'apprentissage et d'extinction du conditionnement classique. De plus, ils proposent deux facteurs à considérer dans ce processus, soient la charge affective (*affect load*) et la détresse affective (*affect distress*). La charge affective se définit par un état situationnel reflétant l'impact des événements émotionnellement négatifs ou stressants sur la capacité de l'individu à réguler ses émotions. La détresse affective représente une prédisposition stable de l'individu à éprouver des niveaux plus élevés de détresse et d'affects négatifs et à exprimer cette détresse plus fréquemment et avec plus d'intensité en réaction à des situations négatives. Ainsi, ces auteurs postulent que la détresse affective pourrait représenter un

sous-type du tempérament en lien avec les affects négatifs. La détresse affective fait donc référence à la dimension de l'émotivité négative introduite et définie plus haut. Par conséquent, un pont conceptuel peut se créer entre la détresse affective et l'émotivité négative.

Plus récemment, le concept de sensibilité au traitement sensoriel (*sensory processing sensitivity*), tel que défini par Aron et Aron (1996; 1997), a été adapté par Carr et Nielsen (2017) au développement des cauchemars. Entre autres, Carr et Nielsen (2017) proposent que la sensibilité au traitement sensoriel est un concept plus englobant que celui de la détresse affective et pourrait caractériser les individus qui seraient plus vulnérables à faire des cauchemars.

Selon Aron et ses collègues (1997; 2012), les individus qui ont des niveaux élevés de sensibilité au traitement sensoriel démontreraient une plus grande réactivité émotionnelle tant aux stimuli positifs que négatifs, un traitement cognitif (c'est-à-dire une profondeur et une différenciation sémantique) plus profond des stimuli émotionnels et une conscience environnementale des stimuli perceptifs et sociaux plus élevée. La sensibilité au traitement sensoriel est décrite comme un trait « pour le meilleur et pour le pire », puisqu'elle serait associée à des conséquences négatives dans un environnement adverse et stressant, mais serait également associée à des bienfaits dans un environnement favorable. Ainsi, le concept de sensibilité au traitement sensoriel englobe un éventail plus large d'expériences humaines que celui de la détresse affective, puisqu'il tient compte du rôle positif que les environnements favorables pourraient jouer dans le développement psychologique des individus. La sensibilité au traitement sensoriel serait alors considérée comme un facteur de sensibilité alors que la détresse affective serait considérée comme un facteur de vulnérabilité.

En tenant compte des hypothèses de Carr et Nielsen, il est possible de postuler que l'émotivité négative pourrait également suivre les principes du modèle de sensibilité au traitement sensoriel, étant donné la littérature récente qui souligne également que l'émotivité

négative agirait comme un facteur de sensibilité différentielle à l'environnement. Dans le cadre de cette thèse, l'étude du rôle modérateur de l'émotivité négative et la description du patron de l'interaction permettront de fournir une première piste sur la nature de cette dimension de tempérament, si elle s'apparente à un facteur de vulnérabilité (selon le modèle de diathèse-stress) ou plutôt à un facteur de sensibilité (selon le modèle de sensibilité différentielle) dans le développement des rêves dysphoriques.

Selon Levin et Nielsen (2007), les cauchemars et les mauvais rêves impliqueraient la même étiologie, mais se distingueraient quant à leur capacité à réguler la charge affective du rêveur au cours du sommeil. Il n'est donc pas clair s'ils représentent deux phénomènes qualitatifs distincts ou simplement un phénomène variant en intensité. Il est toutefois convenable de postuler que ces deux construits sont reliés, mais diffèrent dans leur fonction de régulation des fluctuations de la charge affective. En fait, lors du cauchemar, la fonction d'extinction des émotions négatives du rêve serait interrompue par le réveil, contrairement aux mauvais rêves. Cependant, dans le cadre de cette thèse, les cauchemars n'ont pu être différenciés des mauvais rêves étant donné que les participants peuvent éprouver de la difficulté à distinguer les deux concepts et qu'il est plus facile pour les enfants de comprendre le terme « mauvais rêves ».

1.2.1 Rêves dysphoriques et problèmes d'adaptation psychosociale

Malgré le fait qu'on retrouve la plus grande fréquence de cauchemars chez les enfants (Levin & Nielsen, 2007; Li et al., 2011; Simard et al., 2008), les études examinant leurs corrélats se sont beaucoup concentrées sur les populations adultes. Les rêves dysphoriques ont été associés de façon répétée à un moindre bien-être psychologique et à une augmentation de troubles de santé mentale chez les populations adultes cliniques et non-cliniques (Hasler & Germain, 2009; Levin & Nielsen, 2007; Nadorff, Porter, et al., 2014; Sandman et al., 2016). Parmi les grandes

catégories diagnostiques, les rêves dysphoriques sont associés aux troubles de la personnalité, au trouble de stress post-traumatique (TSPT), aux troubles dépressifs et bipolaires, aux troubles anxieux et obsessionnels-compulsifs, au trouble du déficit de l'attention avec ou sans hyperactivité (TDAH), aux troubles du spectre de la schizophrénie, aux troubles de l'usage de substances, ainsi qu'aux troubles alimentaires (Lemyre et al., 2019).

En fait, plusieurs études chez les adultes ont démontré que le contenu des rêves reflète les perceptions du rêveur de soi-même, des autres, de leur vision subjective du monde et de leurs préoccupations émotionnelles (Bulkeley, 2018; Domhoff, 2011; Pesant & Zadra, 2006; Schredl & Hofmann, 2003). Ceci concorde avec l'hypothèse de la continuité des rêves (Domhoff, 1996; Hall & Nordby, 1972) qui postule l'existence d'une correspondance entre le contenu onirique et la pensée d'éveil, y compris les expériences diurnes émotionnellement saillantes, et représente ainsi une façon d'expliquer certains corrélats psychologiques des cauchemars. Cette hypothèse pourrait s'appliquer aux populations plus jeunes; l'expérience répétée de cauchemars à tonalité négative durant l'enfance et l'adolescence pourrait être reliée à la détresse émotionnelle vécue durant l'éveil et aux problèmes d'adaptation psychosociale.

Chez les enfants et les adolescents, les rêves dysphoriques sont effectivement reliés à plusieurs difficultés sur le plan de l'adaptation psychosociale. Tout d'abord, la fréquence des rêves dysphoriques est associée à d'autres troubles du sommeil, tels que l'insomnie, le somnambulisme, le bruxisme, le fait de parler dans son sommeil, le fait de se réveiller durant la nuit et la réticence à vouloir dormir (Hawkins & Williams, 1992; Lebowitz et al., 2019; Salzarulo & Chevalier, 1983; Schredl et al., 2000; Schredl et al., 2009b; Shang et al., 2006; Simonds & Parraga, 1982; Stein et al., 2001). De plus, la fréquence des rêves dysphoriques a été liée à des problèmes académiques (Schredl et al., 2000), ainsi que divers symptômes de troubles de santé mentale, tels que de faibles comportements prosociaux (Schredl et al., 2009b; Smedje et al.,

2001), des symptômes émotionnels (Lereya et al., 2017; Schredl et al., 2009b), des expériences psychotiques (Fisher et al., 2014; Koopman-Verhoeff et al., 2019), ainsi qu'au trouble de la personnalité limite (Lereya et al., 2017). De façon prospective, la fréquence de rêves dysphoriques à l'âge de 12 ans était reliée aux symptômes psychotiques plus tard à l'âge adulte (Thompson et al., 2015).

Ensuite, les études chez les enfants et les adolescents démontrent que les rêves dysphoriques sont liés aux deux grandes catégories de psychopathologie, soient les problèmes intériorisés (c'est-à-dire les symptômes anxieux, dépressifs, somatiques, obsessionnels et compulsifs) et les problèmes extériorisés (c'est-à-dire les symptômes reliés au déficit d'attention, à l'agressivité et à la délinquance) (Achenbach & Edelbrock, 1984; Castellanos-Ryan et al., 2016; Liu et al., 2022). Par exemple, la fréquence des rêves dysphoriques a été associée maintes fois aux symptômes d'anxiété pédiatrique (Alfano & Gamble, 2009; Floress et al., 2016; Gregory & Eley, 2005; Mindell & Barrett, 2002; Nielsen et al., 2000; Reynolds & Alfano, 2016; Schredl et al., 1996; Simard et al., 2008). L'étude prospective de Gregory et ses collègues (2008) a aussi démontré des liens significatifs entre les rêves dysphoriques rapportés par les parents d'un groupe d'enfants et d'adolescents âgés entre 6 et 19 ans et la présence de symptômes d'anxiété et de dépression auto-rapportés plus tard chez ces mêmes personnes lorsqu'elles étaient âgées entre 18 et 32 ans.

Pour ce qui est des troubles extériorisés, les études montrent que les rêves dysphoriques sont associés chez les enfants et les adolescents âgés entre 5 et 17 ans aux troubles de conduite (Schredl et al., 2009a), aux comportements ne respectant pas les règles, aux comportements agressifs, à l'impulsivité (Wong et al., 2018) et à l'hyperactivité (Li et al., 2011; Muratori et al., 2019; Schredl et al., 2009b). De plus, une étude (Grünwald & Schlarb, 2017) a trouvé des liens significatifs entre la fréquence de rêves dysphoriques et le TDAH, alors que d'autres ont trouvé

des liens plus spécifiques significatifs avec les différents sous-types du TDAH, soient le sous-type inattentif, hyperactif-impulsif ou mixte (inattentif et hyperactif-impulsif; Chiang et al., 2010; Mayes et al., 2009). Mayes et ses collègues (2009) ont trouvé que les enfants ayant un TDAH de sous-type inattentif et hyperactif-impulsif avaient plus de rêves dysphoriques que ceux ayant un TDAH de sous-type inattentif. Ces résultats ont été répliqués par Chiang et ses collègues (2010), qui ont en plus trouvé que les enfants ayant un TDAH de sous-type hyperactif-impulsif avaient également plus de rêves dysphoriques que ceux n'étant pas atteints d'un TDAH. De plus, , l'étude prospective de Gregory et ses collègues (2008) a trouvé que les rêves dysphoriques rapportés par les parents de jeunes âgés entre 6 et 19 ans prédisaient des symptômes auto-rapportés d'inattention et d'agressivité directe et indirecte chez ces mêmes personnes lorsqu'elles étaient âgés entre 18 et 32 ans. Dans le cadre de cette thèse, les symptômes intériorisés et extériorisés seront explorés en lien avec les rêves dysphoriques chez les adolescents entre 11 et 18 ans.

1.2.2 Rêves dysphoriques et idéations suicidaires

Les études chez les adultes, dont une méta-analyse (Pigeon et al., 2012), suggèrent aussi que la fréquence des rêves dysphoriques est associée aux comportements et idéations suicidaires. D'ailleurs, les rêves dysphoriques représentent un des troubles du sommeil les plus fortement associés au risque suicidaire chez des patients qui avaient fait une tentative de suicide (Sjöström et al., 2009). Des résultats similaires ont été trouvés chez les populations adultes non-cliniques (Bernert et al., 2017; Cukrowicz et al., 2006; Nadorff, Anestis, et al., 2014; Sandman et al., 2013; Sandman et al., 2015).

En contrepartie, les études qui ont examiné ces relations chez les enfants et les adolescents sont beaucoup plus rares. Or, ce manque dans la littérature développementale

représente un problème majeur étant donné que le risque suicidaire augmente le plus durant la période de l'adolescence (Avenevoli et al., 2013; Brezo et al., 2008; Gould et al., 2003; Nock et al., 2013; Patton et al., 2009). De plus, jusqu'à un tiers des adolescents présentant des idéations suicidaires développent un plan, et de ceux-ci, environ 60% commettent une tentative de suicide (Nock et al., 2013). Non seulement la prévalence d'idéations suicidaires croît de façon rapide chez les adolescents de 12 à 17 ans, mais on retrouve chez la majorité de ceux-ci (63%) une transition entre la présence d'idéations suicidaires et le développement d'un plan (63%) ou une tentative de suicide (86%) dès la première année où les idéations suicidaires ont été rapportées. Il est davantage important d'identifier les corrélats du risque suicidaire, puisque les adolescents sont inconfortables à rapporter leurs idéations suicidaires (Bernert et al., 2015; Lothen-Kline et al., 2003; Russell et al., 2018).

Les études examinant les associations entre les rêves dysphoriques et les idéations suicidaires chez les jeunes sont non seulement rares, mais elles ne convergent pas toutes. D'une part, un premier groupe d'études suggère que les rêves dysphoriques seraient reliés significativement aux idéations suicidaires. Parmi ces études, une étude a trouvé une association significative entre les rêves dysphoriques et les idéations suicidaires chez les adolescents européens, âgés entre 13 et 16 ans (Choquet & Menke, 1990). Une autre étude examinant des adolescents asiatiques âgés entre 12 et 18 ans a trouvé que ceux qui rapportaient avoir des rêves dysphoriques quelquefois ou souvent avaient une probabilité deux à trois fois plus grande de rapporter des idéations suicidaires que ceux qui rapportaient une fréquence rare de rêves dysphoriques (Liu, 2004). Cette association est demeurée significative même après avoir contrôlé pour la dépression. D'autre part, d'autres études ne semblent pas trouver de liens significatifs entre les rêves dysphoriques et les idéations suicidaires. Parmi ces dernières, une étude examinant des adolescents australiens âgés entre 12 et 18 ans n'a pas trouvé d'association significative entre

la fréquence de rêves dysphoriques et les idéations suicidaires (Roberts & Lennings, 2006). Une étude prospective auprès d'enfants américains a seulement trouvé qu'avoir de la difficulté à dormir entre les âges de 12 et 14 ans prédisait la présence d'idéations suicidaires entre les âges de 15 et 17 ans (Wong et al., 2011). Dans cette étude, les rêves dysphoriques ne jouaient pas de rôle prédicteur de la présence d'idéations suicidaires. Le modèle utilisé contrôlait pour des facteurs de risque communs et des problèmes de sommeil, tels que l'alcoolisme chez les parents, un historique de pensées ou de tentatives suicidaires chez les parents, le sexe et l'âge du participant, les idéations suicidaires présentes au premier temps (12-14 ans), les symptômes dépressifs, les comportements agressifs, les problèmes reliés aux substances, une fatigue excessive, les cauchemars et avoir de la difficulté à dormir. Enfin, les divergences retrouvées dans ces études peuvent être dues aux différences méthodologiques et aux différents échantillons utilisés.

En contrepartie, plusieurs études récentes convergent entre elles et trouvent des liens significatifs entre la présence et la fréquence de rêves dysphoriques et les idéations suicidaires chez les jeunes. Plus précisément, une étude examinant des jeunes âgés entre 6 et 15 ans, atteints d'un trouble bipolaire, a trouvé que le risque suicidaire était deux fois plus grand chez ceux qui avaient un « trouble des cauchemars » répondant aux critères du DSM-IV depuis leur enfance (Stanley et al., 2017). Une étude transversale, examinant des adolescents âgés entre 15 et 17 ans, a trouvé que la présence d'idéations suicidaires était trois fois plus grande chez ceux qui rapportaient des cauchemars à un niveau clinique sur l'échelle du *Disturbing Dreams and Nightmare Severity Index* (Russell et al., 2018). Les auteurs rapportent qu'un niveau clinique sur cette échelle pourrait représenter un trouble des cauchemars tel que décrit dans le DSM. Finalement, une récente étude longitudinale suivant des adolescents pendant un an a démontré qu'une fréquence élevée de cauchemars était associée de manière significative à un risque élevé de comportements suicidaire ultérieurs, dont plus de pensées suicidaires (Liu et al., 2020).

Ces résultats convergent également avec une étude clé effectuée sur le même échantillon longitudinal que cette thèse et à laquelle j'ai contribué en tant que co-auteure en mettant à jour la revue de littérature (Gauchat et al., 2021). Cette étude avait pour objectif d'examiner les associations entre les rêves dysphoriques, les rêves récurrents et les idéations suicidaires chez des jeunes adolescents à 12 et 13 ans. Nous avons trouvé que les jeunes adolescents qui ont déclaré avoir eu des idéations suicidaires au cours de la dernière année avaient une fréquence de rêves dysphoriques et de rêves récurrents significativement plus élevée que les adolescents qui n'ont présenté aucune idéation suicidaire. Cette étude présente des résultats préliminaires au premier article de cette thèse. Étant donné que les résultats pointent vers l'existence d'associations positives significatives entre les rêves dysphoriques et les idéations suicidaires, nous avons décidé dans le cadre de cette thèse d'explorer ces associations de manière longitudinale à travers toute l'adolescence. Les associations avec les symptômes intériorisés seront également considérées, afin d'évaluer la contribution indépendante des rêves dysphoriques au risque suicidaire. Ainsi, la convergence des études récentes chez les adolescents motive à examiner de manière longitudinale les corrélats des idéations suicidaires, dont les rêves dysphoriques, afin d'améliorer la prévention du risque suicidaire dans cette population.

1.3 Adversité à l'enfance

Alors que les études pointent vers des associations positives significatives entre les rêves dysphoriques et les problèmes d'adaptation psychosociale à l'adolescence, dont ceux plus sévères tels que les idéations suicidaires, un intérêt majeur devrait être également porté sur la genèse des rêves dysphoriques. Un vécu d'adversité précoce pourrait effectivement contribuer au développement des rêves dysphoriques. Un événement est dit adverse lorsqu'il est susceptible d'entraîner des effets délétères sur la santé physique et mentale de l'individu qui en fait

l'expérience (Teicher & Samson, 2016). À titre d'exemple, l'adversité à l'enfance augmente le risque de développer du diabète, de l'obésité, de l'asthme, un cancer des poumons, des conditions auto-immunes, de la migraine, des maladies cardiovasculaires et des comportements de santé à risque (Anda et al., 2008; Brown et al., 2010; Kalmakis & Chandler, 2015; Nusslock & Miller, 2016; Su et al., 2015). De plus, l'adversité à l'enfance est aussi associée à plusieurs troubles de santé mentale, tels que la psychose, le TSPT, le trouble de personnalité limite, l'anxiété, la dépression et le suicide (Beards et al., 2013; Bentall et al., 2014; Green et al., 2010; Nusslock & Miller, 2016). Une étude montre que dans 45% des cas, l'adversité précoce est associée à des troubles à l'enfance et dans 26 à 32% des cas à des troubles apparaissant plus tard dans le développement, justifiant l'importance d'examiner les corrélats des événements adverses tôt à l'enfance dans le but de prévenir le développement de problèmes d'adaptation (Green et al., 2010).

Les enfants sont fréquemment exposés à diverses formes d'adversité, que ce soit de vivre des expériences de négligence, de séparation, d'abus sexuel, d'abus émotionnel ou d'abus physique, d'être exposé à un membre de la famille ayant un trouble lié à l'usage de substances (alcool ou drogue), ou être témoin d'adversité (Nielsen, 2017a; Van der Kolk & Smyth, 2010). De plus, des expériences d'intensité moins sévère peuvent aussi être interprétées par l'individu comme adverses. En fait, les travaux de Hartmann (1984a, 1984b, 1984c) se sont concentrés sur les expériences à l'enfance de manière rétrospective auprès d'adultes afin d'observer des indices d'événements traumatiques, ou de dynamiques relationnelles familiales inhabituelles, qui auraient pu avoir un impact sur l'apparition des cauchemars. Plus précisément, des études basées sur des questionnaires suggèrent qu'un événement relativement ordinaire, tel que la naissance d'un deuxième enfant, peut jouer le rôle d'un événement traumatique pour le premier enfant, et prédire l'apparition de cauchemars (McCann et al., 1990). En fait, ces résultats s'expliqueraient par le

fait qu'un enfant ayant une prédisposition à être plus vulnérable et sensible et exprimant une plus grande émotivité face à des événements serait plus à risque de vivre des événements comme étant adverses. Bref, Hartmann conclut que c'est un mélange de sensibilité et d'événements considérés par plusieurs comme bénins qui pourraient susciter l'apparition de cauchemars chez certains individus.

De ce fait, l'adversité à l'enfance serait reliée à la présence de troubles du sommeil à l'âge adulte (Baiden et al., 2015; Kajeepeta et al., 2015) tels qu'une qualité moindre de sommeil, un sentiment de fatigue (Chapman et al., 2013), la narcolepsie, l'apnée du sommeil (Agargun et al., 2003), la difficulté à s'endormir ou à rester endormi (Baiden et al., 2015; Tomasdottir et al., 2015) et les terreurs nocturnes (Fisher et al., 2014). Les études soutiennent aussi que l'adversité à l'enfance est associée à un plus grand risque de rapporter des cauchemars (Agargun et al., 2003; Chambers & Belicki, 1998; Csóka et al., 2011; Cuddy & Belicki, 1992; Duval et al., 2013; Kales et al., 1980; Lereya et al., 2017; Punamäki et al., 2005; Simard et al., 2008). Cette association entre l'adversité à l'enfance et les rêves dysphoriques pourrait s'expliquer dans le cadre d'une théorie expliquée ci-dessous.

1.3.1 L'hypothèse de l'accélération du stress des problèmes de santé mentale et l'adversité à l'enfance

L'hypothèse de l'accélération du stress des problèmes de santé mentale (Callaghan & Tottenham, 2016) postule qu'un individu serait plus vulnérable à développer un problème de santé mentale si celui-ci a vécu un ou plusieurs événements adverses durant la période sensible et précoce de la petite enfance. Plus précisément, cette période, communément appelée la période amnésique infantile, se situerait entre la naissance et l'âge de 3,5 ans (Alberini & Travaglia, 2017; Rubin, 2000). En fait, cette période est décrite comme amnésique étant donné que

l'individu n'aurait aucun souvenir lors de ses premières années de vie (Alberini & Travaglia, 2017; Henri & Henri, 1895). Un vécu précoce d'événements adverses pourrait écourter cette période amnésique et entraîner plusieurs changements au niveau du développement normal de l'humain, soit une maturation précoce des processus de régulation émotionnelle. Par conséquent, l'enfant pourrait en retirer des bénéfices à court terme lorsqu'il y a absence de soins, tels qu'une meilleure régulation émotionnelle, mais souffrirait de conséquences plutôt négatives à plus long terme, telles que de développer des problèmes de santé mentale (anxiété, dépression). L'enfant utiliserait donc des processus de régulation émotionnelle normalement utilisés à l'âge adulte, et ceux-ci seraient alors mésadaptés pour son âge. Ces processus seraient notamment en lien avec l'expression, l'apprentissage et l'extinction de la peur.

Cette hypothèse pourrait aussi expliquer l'apparition des rêves dysphoriques chez certains enfants (Nielsen, 2017a). Plus précisément, étant donné que la période amnésique serait plus courte chez les enfants ayant vécu des événements adverses que chez les enfants de la population générale, et que l'individu serait plus vulnérable aux émotions et aux effets des souvenirs habituellement oubliés, les états d'éveil et de sommeil de l'individu seraient tous deux affectés. En fait, une période amnésique écourtée influencera certains processus neurologiques qui prennent place autant durant l'éveil que le sommeil, et qui sont impliqués dans l'apparition de rêves dysphoriques, tels que la consolidation en mémoire émotionnelle (Nielsen, 2017a). L'information serait encodée au niveau émotionnel et serait également accessible durant les rêves, puisque le vécu d'expériences adverses aurait pour effet d'augmenter l'accès aux émotions primaires de grande intensité. Par conséquent, l'expérience onirique des individus ayant vécu des événements adverses durant la période amnésique infantile sera influencée par ces derniers, puisque l'expérience onirique pourra présenter des éléments de vie négatifs habituellement oubliés.

1.3.2 Adversité à l'enfance et rêves dysphoriques

Plusieurs études suggèrent que les expériences adverses pourraient en effet entraîner davantage de cauchemars plus tard dans le développement. En fait, une étude a trouvé qu'un « événement de vie majeur » non spécifié pouvait être identifié chez 60% des patients adultes souffrant de cauchemars dès leur enfance (Kales et al., 1980). Une enquête réalisée chez les femmes canadiennes montre qu'avoir un historique d'abus sexuel ou physique prédisait une présence fréquente de cauchemars (Cuddy & Belicki, 1992). Cependant, l'âge ou la période auquel s'est passé l'événement adverse n'était pas spécifié pour ces études.

Lorsque les études examinent l'impact des événements adverses survenus durant les périodes de l'enfance ou de l'adolescence, elles retrouvent les mêmes résultats. Plus précisément, une étude montre que des femmes de 19-24 ans qui rapportaient des abus dans leur enfance ou adolescence rapportaient davantage de cauchemars actuels (Duval et al., 2013). De plus, le vécu d'événements adverses avant l'âge de 14 ans entraînait un rappel plus élevé de cauchemars, plus de détresse reliée aux cauchemars et de plus grands impacts reliés aux cauchemars sur l'éveil, comparativement aux participants qui ne rapportaient pas d'expériences adverses (Chambers & Belicki, 1998). Une autre étude a montré que la probabilité de rapporter un événement traumatique survenu durant leur enfance était plus élevée chez ceux qui rapportaient une présence fréquente de cauchemars que ceux qui rapportaient une fréquence plus basse ou ne rapportaient aucun cauchemar (Agargun et al., 2003). Dans le même sens, comparativement à des enfants de 7 à 19 ans avec de bas niveaux de traumas, ceux avec des hauts niveaux de traumas rapportaient davantage de réveils reliés aux cauchemars, de cauchemars avec des thématiques à caractère négatif reliées à la mort, à la destruction, à la peur, à la colère, à l'hostilité, à l'anxiété, ainsi que moins de rêves bizarres ou symboliques, narratifs et avec une atmosphère plus positive (Punamäki et al., 2005). Or, ces études de nature transversale et rétrospective n'ont pas tenu

compte de l'âge auquel l'expérience adverse serait survenue, ne distinguant pas les effets de l'adversité à l'enfance de celle vécue plus tard dans le développement. D'autant plus, ces études rétrospectives permettent seulement d'évaluer les souvenirs subjectifs d'adversité, ce qui ne prendrait pas en compte certains individus qui pourraient avoir vécu de l'adversité sans pour autant en garder une trace.

Les études qui ont précisé l'intervalle de l'âge auquel est survenue l'expérience adverse ont aussi trouvé des associations entre l'adversité à la petite enfance et l'apparition de cauchemars plus tard dans le développement. D'ailleurs, une étude nationale rétrospective portant sur des adultes a démontré une association entre la séparation maternelle d'une durée minimale d'un mois survenue dans la première année de vie et le rappel actuel fréquent de cauchemars (Csóka et al., 2011). De plus, une étude prospective examinant des enfants a trouvé des liens significatifs entre l'adversité dans la famille de 0 à 4 ans et la présence de cauchemars à l'âge de 2,5-9,5 ans (Lereya et al., 2017). En somme, ces résultats suggèrent un lien important entre la présence d'adversité à l'enfance et l'apparition subséquente de cauchemars à l'enfance, à l'adolescence ou même à l'âge adulte.

1.3.3 Rôle de l'émotivité négative

Parallèlement, certaines études ont également examiné l'émotivité négative précoce en tant que prédicteur ou modérateur dans les associations avec les rêves dysphoriques (Gauchat et al., 2020; Lereya et al., 2017; Simard et al., 2008), mais la nature de son rôle reste peu documentée. Plus précisément, l'émotivité négative est une dimension du tempérament qui réfère à la tendance à vivre une grande détresse psychologique et plusieurs émotions négatives telles que la peur, la colère, la tristesse, l'inconfort, ainsi qu'à des difficultés de régulation de l'humeur lorsque confronté à de nouvelles situations ambigües perçues comme émotionnellement intenses

(Rothbart et al., 2001). Par exemple, les nouvelles situations ambiguës pourraient susciter un niveau élevé de peur chez les individus ayant un niveau élevé d'émotivité négative. L'émotivité négative est une dimension du tempérament qui apparaît tôt dans la vie et qui tend à rester présente jusqu'à l'adolescence et aussi jusqu'à l'âge adulte (Kopala-Sibley et al., 2018; Pesonen et al., 2003).

L'émotivité négative a été associée de façon répétée à des problèmes d'adaptation psychosociale à l'enfance et à l'adolescence, et est considérée comme un prédicteur robuste de ceux-ci (Carneiro et al., 2016; Lawson & Ruff, 2004; Lengua, 2002; Northerner et al., 2016; Rhee et al., 2015; Uhl et al., 2019). L'émotivité négative serait associée aux comportements intériorisés en général (Hankin et al., 2017), incluant des augmentations du niveau de dépression et d'anxiété durant l'enfance (Anthony et al., 2002; De Boo & Spiering, 2010; Phillips et al., 2002; Uhl et al., 2019). Une étude chez les enfants montre des liens entre l'émotivité négative et les comportements intériorisés, tels que la phobie sociale, l'anxiété de séparation, le trouble panique, l'anxiété généralisée, le trouble obsessionnel compulsif, la dépression, ainsi que les comportements extériorisés, tels que le trouble de conduite, le trouble oppositionnel avec provocation et les difficultés d'inattention et d'hyperactivité (Mikolajewski et al., 2013). Des études prospectives ont aussi démontré que l'émotivité négative joue un rôle prédicteur significatif dans le développement précoce de problèmes intériorisés et extériorisés (Côté et al., 2009; Lahey et al., 2008; Shaw et al., 1997).

Ces études ont utilisé divers instruments pour mesurer l'émotivité négative, y compris *the Mood subscale of the Toddler Temperament Scale* (Fullard, McDevitt et Carey, 1984), the *Emotionality subscale of the Colorado Childhood Temperament Inventory* (Rowe and Plomin, 1977), *the fearfulness and irritability subscales of the Early Adolescent Temperament Questionnaire* (Capaldi et Rothbart, 1992), *the short form of the Early Childhood Behavior*

Questionnaire (Putnam, Gartstein et Rothbart, 2006); *the Childhood Behavior Questionnaire* (Rothbart et al., 2001), *the Early Adolescent Temperament Questionnaire-Revised* (Ellis 2002; Putnam, Ellis et Rothbart, 2001), *the Positive and Negative affect schedule-Expanded form* (Watson and Clark, 1991), *the Positive and Negative Affect Scale for Children* (Laurent et al., 1999), *the Child and Adolescent Dispositions Scale* (Lahey et al., 2008), *the difficult temperament scale of the Infant Characteristics Questionnaire* (Bates, Freeland, & Lounsbury, 1979) et *the Infant Behavior Questionnaire* (Rothbart 1981), mais rapportent toutes des résultats convergents.

Certaines recherches se sont concentrées sur le rôle du tempérament comme prédicteur de la fréquence des rêves dysphoriques (Lereya et al., 2017; Simard et al., 2008). Lereya et ses collègues (2017) ont trouvé un lien significatif entre l'émotivité négative mesurée à 2 ans et la persistance des cauchemars de 2,5 à 9,5 ans. Les résultats de l'étude de Lereya et ses collègues (2017) corroborent ceux trouvés dans l'étude prospective de 987 enfants québécois, où l'émotivité négative à 5 mois et la présence d'anxiété à 17 mois prédisaient la fréquence des mauvais rêves à 29 mois (Simard et al., 2008). De plus, les résultats de cette dernière étude (Simard et al., 2008) démontraient que les mauvais rêves persistaient jusqu'à l'âge de 6 ans.

En complément aux modèles qui se concentrent sur les effets principaux de l'émotivité négative dans l'association avec les rêves dysphoriques, d'autres chercheurs proposent plutôt que ce serait l'interaction entre l'environnement social précoce et l'émotivité négative précoce qui serait davantage importante dans la prédiction des rêves dysphoriques (Carr & Nielsen, 2017; Hartmann, 1984b; Levin & Nielsen, 2007). D'ailleurs, une autre étude importante pour cette thèse et à laquelle j'ai également contribué en tant que co-auteure en mettant à jour la revue de littérature, et utilisant le même échantillon longitudinal que les articles de cette thèse, s'est penchée sur les associations entre la fréquence des rêves dysphoriques et les symptômes

intériorisés et extériorisés, ainsi que sur l'effet modérateur possible de l'émotivité négative précoce dans ces associations (Gauchat et al., 2020). Nous avons trouvé que l'émotivité négative jouait un rôle modérateur entre la fréquence des rêves dysphoriques et les symptômes extériorisés chez les jeunes de 11 ans. Plus précisément, l'association entre la fréquence des rêves dysphoriques et les symptômes extériorisés était significative chez les jeunes présentant une émotivité négative modérée à 17 mois, mais était particulièrement plus forte chez les jeunes présentant une émotivité négative précoce élevée. Étant donné que l'émotivité négative précoce semble jouer un rôle plus spécifique en tant que modérateur développemental dans les associations avec les rêves dysphoriques, le rôle modérateur de l'émotivité négative précoce, également mesurée à 17 mois, a alors été exploré dans l'association entre l'environnement social précoce et les rêves dysphoriques plus tard à l'adolescence dans le cadre de cette thèse.

L'émotivité négative peut s'apparenter au concept de détresse affective proposé par Levin et Nielsen (2007) dans l'apparition des rêves dysphoriques comme un facteur de vulnérabilité, qui répondrait aux principes du modèle de diathèse-stress. Cependant, les études sur les modèles récents de Carr et Nielsen (2017), basés sur les travaux de Aron et Aron (1997) sur la sensibilité au traitement sensoriel, suggèrent que l'émotivité négative pourrait plutôt être un facteur de sensibilité à l'environnement, c.-à-d. que non seulement ce trait de tempérament mènerait à des conséquences négatives dans un environnement social adverse, mais également à des conséquences positives dans un environnement social soutenant.

Tout d'abord, le modèle neurocognitif de production des cauchemars de Levin et Nielsen (2007) aborde le concept de détresse affective, qui serait une prédisposition stable de l'individu à faire l'expérience de niveaux plus élevés de détresse et d'affects négatifs et à exprimer cette détresse plus fréquemment et avec plus d'intensité en réaction à des situations négatives. La définition de la détresse affective partage des similarités avec la définition de l'émotivité

négative, où les deux incluent une réactivité négative et une détresse ressentie face à des situations. La détresse affective influencerait alors les variations et l'intensité des rêves dysphoriques. Un parallèle peut être effectué avec la littérature touchant les modèles d'interaction entre le tempérament et l'environnement social, où le rôle de la détresse affective suivrait les assises d'un modèle diathèse-stress (Monroe & Simons, 1991; Zuckerman & Riskind, 2000). Celui-ci voudrait que le tempérament interagisse seulement lorsque l'environnement est adverse, et serait vu uniquement comme un facteur de vulnérabilité menant à plus de problèmes d'adaptation psychosociale.

En appui au modèle de diathèse-stress, une étude a démontré que l'émotivité négative accentuait l'association entre un contexte à risque (risque cumulatif; index incluant cinq facteurs, soient une faible éducation maternelle, vivre dans un quartier dangereux, un faible soutien social, une taille de ménage excessive et provenir d'une famille monoparentale) et les problèmes intériorisés et de sommeil chez des enfants âgés de deux ans (Northerner et al., 2016). Plus précisément, les enfants ayant des niveaux élevés d'émotivité négative précoce se montraient sensibles à un contexte à risque et présentaient des niveaux élevés de problèmes intériorisés et de problèmes de sommeil, alors que les enfants ayant des niveaux faibles d'émotivité négative précoce ne se montraient pas sensibles à leur environnement. Ces derniers présentaient le même niveau de problèmes intériorisés et de problèmes de sommeil, quel que soit l'environnement auquel ils étaient exposés. Ces résultats soutiennent le modèle d'interaction diathèse-stress, selon lequel les individus avec une émotivité négative élevée seraient plus affectés négativement que leurs pairs ayant des niveaux plus faibles d'émotivité négative lorsqu'exposés à des environnements négatifs (Belsky & Pluess, 2009).

Tel que mentionné précédemment, Carr et Nielsen (2017) adaptent la sensibilité au traitement sensoriel (Aron et Aron, 1997) comme un trait pour caractériser les individus qui sont

plus vulnérables à faire des rêves dysphoriques. Le modèle de la sensibilité au traitement sensoriel est plus global que le modèle de diathèse-stress, puisqu'il prend également en compte l'adaptation aux environnements soutenants. L'émotivité négative en tant que trait pourrait agir selon les principes du modèle de la sensibilité au traitement sensoriel, étant donné que les études récentes soutiennent que lorsque l'émotivité négative est élevée, un environnement adverse serait associé à des conséquences négatives chez l'individu, et un environnement positif et soutenant serait associé à des conséquences positives chez l'individu (Rioux et al., 2016). Les hypothèses de Carr et Nielsen ont été soutenues par une étude préliminaire récente (Carr et al., 2021). Ces auteurs ont trouvé des corrélations significatives entre les cauchemars, un faible bien-être mental et des problèmes psychiatriques mineurs principalement chez des adultes dont les niveaux de sensibilité au traitement sensoriel étaient élevés. Ils recommandent que les recherches futures examinent les associations développementales longitudinales en considérant le rôle de la sensibilité dans des environnements positifs pour déterminer la séquence développementale de ces associations.

Le modèle de Carr et Nielsen (2017) est en accord avec deux modèles d'interaction entre le tempérament et l'environnement, qui se veulent être plus intégratifs que le modèle de diathèse-stress, soient celui de la sensibilité différentielle (Belsky & Pluess, 2009) et de la sensibilité biologique au contexte (Boyce & Ellis, 2005; Ellis & Boyce, 2008). Ces modèles ajoutent au modèle de diathèse-stress en spécifiant sous quelles conditions ils s'appliquent, mais également en stipulant que les individus ayant des niveaux élevés de sensibilité seraient également avantagés comparativement à leurs pairs ayant des niveaux plus faibles de sensibilité lorsqu'exposés à des environnements positifs. Des études ont démontré que l'émotivité négative à l'enfance agirait comme un facteur de sensibilité dans la prédiction des symptômes intériorisés et extériorisés, appuyant alors ces trois modèles, la sensibilité au traitement sensoriel (Aron et Aron,

1997), la sensibilité différentielle (Belsky & Pluess, 2009) et la sensibilité biologique au contexte (Boyce & Ellis, 2005; Ellis & Boyce, 2008; Kim & Kochanska, 2012; Morgan et al., 2012; Ramchandani et al., 2010; Rioux et al., 2016; van Zeijl et al., 2007). Ces trois modèles (sensibilité au traitement sensoriel, sensibilité différentielle et sensibilité biologique au contexte) partagent tous l'idée que les individus sensibles peuvent différer non seulement dans leur réaction à des contextes adverses, mais aussi lorsqu'exposé à des environnements positifs et soutenants.

Toutefois, le rôle de l'émotivité négative précoce combiné à l'environnement social précoce reste méconnu dans l'apparition de rêves dysphoriques plus tard dans le développement. Cette thèse permettra alors de clarifier la nature du rôle de l'émotivité négative précoce dans le développement des rêves dysphoriques, en fournissant un premier test de l'interaction entre l'environnement précoce et l'émotivité négative précoce dans la prédiction de la fréquence des rêves dysphoriques à l'adolescence, dans le but de déterminer si l'émotivité négative précoce devrait être conceptualisée comme un facteur de vulnérabilité (selon le modèle de diathèse-stress) ou plutôt comme un facteur de sensibilité (selon les trois modèles de sensibilité différentielle) dans le développement des rêves dysphoriques.

1.4 Conclusion

En somme, les études démontrent que, tout comme à l'âge adulte, il existe des liens significatifs entre la présence ou la fréquence des rêves dysphoriques et les problèmes d'adaptation psychosociale à l'enfance et l'adolescence. Ces études comportent malgré tout quelques limites méthodologiques qui seront adressées dans cette thèse. D'abord, certaines études combinent les différents problèmes et troubles de sommeil en un seul construit, ce qui ne permet pas d'examiner spécifiquement le rôle des rêves dysphoriques dans les associations avec les problèmes d'adaptation psychosociale (Quach et al., 2018; Wang et al., 2019; Zhang et al., 2018).

De plus, certaines études utilisent les estimations rapportées par des parents pour mesurer la fréquence des rêves dysphoriques chez les jeunes. Toutefois, il est démontré que cette méthode sous-estime la fréquence comparativement à celle rapportée par le jeune lui-même (Floress et al., 2016; Mindell & Barrett, 2002; Schredl et al., 2009a). Ainsi, les études de cette thèse utiliseront des mesures de rêves dysphoriques et de problèmes d'adaptation psychosociale (idéations suicidaires et problèmes intériorisés) auto-rapportées par le jeune. Finalement, les modèles proposés prendront en considération les facteurs de risque communs aux rêves dysphoriques et au risque suicidaire (c'est-à-dire les problèmes intériorisés) pour examiner la contribution indépendante des rêves dysphoriques dans la prédiction du risque suicidaire.

1.5 Hypothèses ou buts de la recherche

L'introduction présentée amène à se poser certaines questions sur les associations entre les rêves dysphoriques et la santé psychologique des adolescents, ainsi que sur l'apparition des rêves dysphoriques. Tel que présentés dans les sections précédentes, les deux articles principaux de cette thèse représentent une continuité de deux études clés citées dans la thèse (Gauchat et al., 2021; Gauchat et al., 2020). Ces deux études ont utilisé le même échantillon et se sont penchées sur des concepts similaires, soient les rêves dysphoriques, le risque suicidaire et l'émotivité négative précoce mais n'avaient pas été publiées à l'origine (Gauchat, 2015). Mes contributions apportées à ces deux études en tant que co-auteure ont permis de mettre à jour la recension des écrits et la section « discussion » de ces deux articles, menant à leur publication dans deux revues scientifiques, soient *Frontiers in Neurology* et *Dreaming*. Ces articles se trouvent en annexe à cette thèse.

Ainsi, trois questions de recherche s'appuyant en partie sur ces deux publications antérieures seront explorées dans le cadre de cette thèse. Tout d'abord, le premier article de cette

thèse permettra d'enrichir les résultats trouvés en lien avec les rêves dysphoriques et les idéations suicidaires chez les adolescents de 12 à 13 ans (Gauchat et al., 2021) en s'étendant à travers l'adolescence et en considérant leurs associations avec les symptômes dépressifs et les symptômes anxieux. Le premier article vise à explorer les associations bidirectionnelles et longitudinales au cours de l'adolescence (13 à 18 ans) entre les quatre variables suivantes : la fréquence des rêves dysphoriques, les idéations suicidaires, les symptômes dépressifs et les symptômes anxieux. Nous émettons l'hypothèse que des associations significatives existent entre la fréquence des rêves dysphoriques, les idéations suicidaires, les symptômes dépressifs et les symptômes anxieux au cours de l'adolescence (c.a.d., de 13 à 18 ans).

Ensuite, le deuxième article de cette thèse représentera une continuité des résultats trouvés sur le rôle modérateur développemental de l'émotivité négative précoce dans les associations entre les rêves dysphoriques et les symptômes extériorisés chez des enfants de 11 ans (Gauchat et al., 2020). Les travaux qui seront présentés dans cette thèse viendront amener une perspective nouvelle, étant donné que le deuxième article visera l'exploration de (1) l'environnement social précoce et l'émotivité négative précoce en tant que prédicteurs du développement des rêves dysphoriques tout au long de l'adolescence (13 à 18 ans), et (2) le rôle modérateur de l'émotivité négative précoce dans l'association entre l'environnement social précoce et la fréquence des rêves dysphoriques plus tard à l'adolescence. Nos deux hypothèses sont (1) qu'un environnement social précoce adverse et une émotivité négative précoce élevée prédisent une plus grande fréquence de rêves dysphoriques à l'adolescence, et (2) que l'interaction entre l'environnement social précoce et l'émotivité négative précoce prédit de façon significative la fréquence des rêves dysphoriques à l'adolescence. Aucune hypothèse n'est émise sur la direction de cette interaction, étant donné le manque d'études ayant examiné ces associations.

2. Articles de thèse

Articles de recherche

2.1 Premier article

Longitudinal associations throughout adolescence: suicidal ideation, disturbing dreams, and internalizing symptoms

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Objectifs spécifiques de cet article : Clarifier les associations bidirectionnelles et longitudinales entre la fréquence des rêves dysphoriques, les idéations suicidaires, les symptômes dépressifs et les symptômes anxieux chez les adolescents entre 13 et 18 ans.

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Contribution des auteurs

Mira El-Hourani : Conceptualisation de l'article, méthodologie, analyses statistiques, interprétation des résultats, rédaction révision et publication de l'article

Antonio Zadra : Soutien à la conceptualisation de l'article, méthodologie, soutien à la rédaction, révision et soutien à la publication de l'article, financement de la recherche

Natalie Castellanos-Ryan : Soutien à la conceptualisation de l'article, méthodologie, soutien aux analyses statistiques et à l'interprétation des résultats, soutien à la rédaction, révision et soutien à la publication de l'article

Sophie Parent : Soutien à la conceptualisation de l'article, méthodologie, révision de l'article et financement de la recherche

Johanne Renaud : Soutien à la conceptualisation, méthodologie et révision de l'article

Jean R. Séguin : Soutien à la conceptualisation de l'article, méthodologie, soutien aux analyses statistiques et à l'interprétation des résultats, soutien à la rédaction, révision et soutien à la publication de l'article, administration et financement de la recherche

Abstract

Objective/Background: Many studies have reported associations between disturbing dream occurrence and internalizing symptoms in adults, but the extent to which such associations also characterize adolescents remains unknown. The main goal of the present longitudinal study was to evaluate the strength and stability of the associations between disturbing dream frequency, suicidal ideation, and internalizing symptoms from ages 13 to 18.

Methods: Participants (n = 434) drawn from two longitudinal birth cohort studies on child development in the province of Quebec, Canada, completed annual self-reports of disturbing dream frequency, suicidal ideation, and levels of depression and anxiety.

Results: Two separate cross-lagged panel models for symptoms of depression and anxiety were conducted with both models showing similar results. In early adolescence, high levels of and higher change in disturbing dream frequency were associated with increased odds of reporting later suicidal ideation, whereas in mid to late adolescence, increased odds of reporting suicidal ideation at age 17 was associated with increased disturbing dream frequency at age 18. Across adolescence, increased levels of depression and anxiety were associated with increased odds of reporting later suicidal ideation and increased disturbing dream frequency.

Conclusions: These findings support previous literature suggesting that disturbing dream frequency, depression, and anxiety, are risk factors for suicidal ideation throughout adolescence. The present longitudinal study allows for a refinement of our conceptualization of disturbing dream and their relation to suicide and internalizing symptoms throughout adolescence and suggests that the collection of information on disturbing dream and internalizing symptoms during early adolescence may help screen adolescents for suicide risk.

Keywords: Dreaming, Nightmare, Disturbing dream, Suicidal ideation, Internalizing symptoms, Adolescents.

Résumé

Objectif/Contexte : Plusieurs études ont rapporté des associations entre la fréquence des rêves dysphoriques et les symptômes intériorisés chez les adultes, mais rares sont celles qui ont exploré ces associations chez les adolescents. L'objectif principal de cette étude longitudinale était d'évaluer la force et la stabilité des associations entre la fréquence des rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés entre 13 et 18 ans.

Méthode : Les participants (N = 434) tirés de deux cohortes de naissance qui ont été suivis de manière longitudinale sur le développement de l'enfant dans la province de Québec, Canada, ont rempli des questionnaires à chaque année sur la fréquence des rêves dysphoriques, les idéations suicidaires et les niveaux de dépression et d'anxiété.

Résultats : Deux modèles autorégressifs à décalage croisé pour les symptômes de dépression et d'anxiété ont été effectués, où les deux modèles montrent des résultats similaires. Au début de l'adolescence, des niveaux élevés et des changements positifs et significatifs dans la fréquence des rêves dysphoriques étaient associés à une augmentation de la probabilité à rapporter des idéations suicidaires un an plus tard, tandis qu'au milieu et à la fin de l'adolescence, une plus grande probabilité à rapporter des idéations suicidaires à l'âge de 17 ans était associée à une fréquence accrue de rêves dysphoriques à l'âge de 18 ans. Au cours de l'adolescence, des niveaux accrus de dépression et d'anxiété ont été associés à une plus grande probabilité à rapporter des idéations suicidaires ultérieures et une fréquence accrue de rêves dysphoriques.

Conclusions : Ces résultats appuient la littérature antérieure qui suggère que la fréquence des rêves dysphoriques, la dépression et l'anxiété sont des facteurs de risque communs aux idéations suicidaires à l'adolescence. La présente étude longitudinale permet de raffiner notre conceptualisation des rêves dysphoriques et de leurs associations avec le risque suicidaire et les symptômes intériorisés tout au long de l'adolescence et suggère que la collecte d'informations sur

les rêves dysphoriques et les symptômes intériorisés au début de l'adolescence peut aider à dépister le risque suicidaire chez les adolescents.

Mots-clés : Rêves, cauchemars, rêves dysphoriques, idéations suicidaires, symptômes intériorisés, adolescents

1. Introduction

Suicide is a major worldwide public health problem with a heterogeneous etiology (Hawton et al., 2012; Hedström et al., 2021; Underwood et al., 2020; Wang et al., 2019). Overall, approximately 703,000 people die annually by suicide (World Health Organization, 2021). Several biological, clinical and psychosocial risk factors play a role in the presentation of suicide risk, some of which are non-modifiable, such as age, and others that are potentially modifiable (Wang et al., 2019). Because adolescents are not always comfortable reporting the presence of suicidal ideation (Bernert et al., 2015; Britto et al., 2010; Lothen-Kline et al., 2003; Russell et al., 2018), clinicians face the complex challenge of predicting suicide risk in this particularly vulnerable population (Andrews & Hanna, 2020). Early identification of at-risk individuals is advocated, as epidemiological studies indicate that approximately one third of individuals with suicidal ideation will develop a suicide plan and 56% will attempt suicide (Nock et al., 2008; Nock et al., 2013). It is thus important to identify modifiable risk factors for suicide and better understand underlying mechanisms to inform prevention programs aimed at this population (Harris et al., 2019a, 2019b; Hawton et al., 2012).

Sleep disturbances are one class of modifiable risk factors related to suicide risk (Pigeon et al., 2012). Studies have repeatedly demonstrated a significant and positive association between various sleep-related problems and suicidal ideation or suicidal behaviors across multiple populations (Pigeon et al., 2016; Russell et al., 2019). Specifically, disturbing dreams (DD), including nightmares and bad dreams, have been associated with a greater risk of suicidal ideation, suicide attempts and suicide deaths (Ağargün et al., 1998; Bernert et al., 2005; Cukrowicz et al., 2006; Don Richardson et al., 2014; Don Richardson et al., 2018; Gauchat et al., 2021; Li, 2010; Liu et al., 2017; Liu, Liu, et al., 2019; Liu et al., 2000; Nadorff et al., 2011; Russell et al., 2018; Sandman et al., 2017; Sjostrom et al., 2007; Tanskanen et al., 2001). One

longitudinal study has also showed prospective associations between nightmare frequency and suicide risk in adolescents (Liu et al., 2021). DD are typically defined as vivid dreams marked by intense negative emotions such as fear, sadness, and anger (Gauchat et al., 2020; Nielsen & Levin, 2007; Robert & Zadra, 2014). Two to 10% of the general population report one or more DD per week (Nielsen & Levin, 2007), and DD frequency may be even higher in pediatric populations (Levin & Nielsen, 2007; Liu, Liu, et al., 2019; Liu et al., 2000; Nielsen & Levin, 2007). Thus, DD represent an important factor contributing to suicide risk, but its specific etiological role remains to be clarified (Titus et al., 2018).

While systematic reviews and meta-analyses report a significant and positive association between DD and suicide risk (Andrews & Hanna, 2020; Liu, 2004; Pigeon et al., 2012; Russell et al., 2019), these results are largely based on cross-sectional or retrospective investigations, studies with small sample sizes, or research examining broad relationships between sleep and suicide. This last point limits our understanding of the association between DD and suicide, despite evidence pointing toward a greater contribution of DD in explaining suicide risk compared to insomnia (Bernert et al., 2005; Cukrowicz et al., 2006; Sjöström et al., 2009; Sjostrom et al., 2007).

In addition to investigating the associations between suicide and DD, it is important to focus on the developmental mechanisms underlying these associations and their correlates to broaden our understanding of this phenomenon in order to help effectively decrease suicide risk (Andrews & Hanna, 2020). In fact, depression has been shown to correlate with DD frequency, and both are common risk factors for suicidal ideation (Don Richardson et al., 2018; Hawton et al., 2012; Hom et al., 2016). Specifically, DD are related to a range of psychological difficulties, including anxiety, depression, and behavioral problems, thereby suggesting failures in processes underlying emotional regulation that are believed to occur during sleep and possibly in dreams

(Ennis et al., 2017; Gauchat et al., 2014; Gauchat et al., 2020; Gruber & Cassoff, 2014; Levin & Nielsen, 2007; Nielsen, 2017; Nielsen & Levin, 2007; Palmer & Alfano, 2017; Scarpelli et al., 2019; Simard et al., 2008). In addition, although depression is considered one of the strongest risk factors for suicide, the longitudinal associations between depression and suicide remain inadequately investigated (Yu et al., 2021). Several studies have shown that depression and sleep-related problems are independent risk factors for suicidal behaviors and that DD and insomnia, in particular, increase the risk of suicidal behaviors in patients with depression. These studies highlight the importance of examining the specific role of DD as well as depressive symptoms in suicide risk (Wang et al., 2019).

Moreover, not only has the frequency of DD been repeatedly associated with depressive symptoms during childhood and adolescence, but it is also associated with anxiety symptoms (Alfano & Gamble, 2009; Floress et al., 2016; Gregory & Eley, 2005; Mindell & Barrett, 2002; Nielsen et al., 2000; Reynolds & Alfano, 2016; Schredl et al., 1996; Simard et al., 2008). For example, prospective studies of adolescents revealed predictive associations between parent-reported DD in youth aged 10-19 years and subsequent anxiety and depressive symptoms at ages 18-32 (Gregory et al., 2008). A study in adults revealed that frequencies of anxiety and depressive symptoms were higher in individuals who reported lifetime exposure to suicide (i.e., knowing someone who died by suicide) (Cerel et al., 2016). To date, no study has examined the longitudinal relationships in adolescents between DD, suicidal ideation, and internalizing symptoms, including depressive and anxiety symptoms. Furthermore, studies have focused primarily on adult populations (Pigeon et al., 2012), whereas suicide risk increases most during adolescence (Gould et al., 2003; Nock et al., 2013).

In sum, there is a need to clarify the temporal sequence and consistency of these associations across adolescence and to investigate if they are comparable across internalizing

symptoms. The main aim of the present study was thus to use transactional analyses to investigate the longitudinal associations between DD frequency, suicidal ideation, and internalizing symptoms (i.e., levels of depression and anxiety) across adolescence.

2. Method

2.1. Participants

Participants were drawn from two cohorts of the Quebec Longitudinal Study of Child Development (QLSCD): a first cohort born in 1996 in which 1000 Quebec families were randomly selected from urban areas from a Quebec birth registry and a second cohort born in 1997 in which 2120 Quebec families were also randomly selected from the Quebec birth registry. In the first cohort, 572 families agreed to participate in the first wave when their child was 5 months old. In order for a participant to be included in the present study, the participant had to have at least one valid data response on the variables of interest at any time point between the ages of 13 and 18, which resulted in a total of 266 participants from the first cohort. A sample of 168 adolescents from the second cohort matched to the urban catchment areas was added to the first cohort sample to increase the statistical power of the analyses, which resulted in a sample of 434 participants in total. The sample in the present study ($n = 434$) did not differ significantly from the rest of the original sample on household income, family type (i.e., single parent or not), the mother's or the father's age, the father's highest level of education, but did differ in terms of the mother's highest level of education ($p < .001$), with a greater proportion of mothers having reached higher levels of education than in the original sample. Table 1 (p. 50) presents the sociodemographic characteristics for the study sample.

Table 1

Sociodemographic characteristics of the present sample (n = 434)

Sociodemographic characteristic	Percentage of sample
Sex	
Girls	55.8
Boys	44.2
First language learned	
French	86.5
English	6.3
Race/Ethnicity	
White	96.0
Black	2.3
Other	1.7
Mother's last completed degree	
Less than high school	8.6
High school	23.9
CEGEP, college, technique graduate	29.0
University graduate or more	38.5
Family annual income	
<30,000$	26.8
30,000$-59,999$	34.3
≥60,000$	39.0
Family composition	
Intact or recomposed	96.5
Single	3.5
Mother's age in years (SD)	30.1 (4.9)

Prior to adolescence, data were collected annually throughout participants' childhood. Consent was provided yearly by the parents and by the child when the child was sufficiently mature to provide consent in addition to that obtained from the parents. Data were reported by parents until the child reached 11 years of age, after which data were self-reported annually by the child. To increase the validity of the responses, confidentiality was assured to the adolescents. This research project was approved by the Institut de la statistique du Québec, the Sainte-Justine Hospital Research Center, and the Louis-Hippolyte Lafontaine Hospital Research ethics committees.

2.2. Measures

2.2.1. Disturbing dreams (DD). Participants self-reported their DD frequency annually beginning at age 11. Adolescents were first asked, "On average, how frequently do you have bad dreams?" using the measurement scale of "Never," "Sometimes," "Often," "Always," or "Don't know." Because "dysphoric dreams" is a less familiar term for many youths, the term "bad dreams," defined as “very disturbing dreams,” was used instead. Participants who reported experiencing bad dreams were also asked to "Estimate the number of bad dreams you have had in the past month." The number of bad dreams was coded as 0 for children who reported never having bad dreams in the first question. Because the variance was primarily between 0 and 5 bad dreams per month, frequency categories were formed as follows: "0 DD," "1 DD," "2 DD," "3 or 4 DD," and "5 or more DD" per month. A one-month retrospective unit of measure was used rather than a one-year retrospective measure as the one-month retrospective measure is more consistent with prospectively collected log-based frequency measures of dysphoric dreams (Robert & Zadra, 2008; Zadra & Donderi, 2000).

2.2.2. Suicidal ideation. Participants were asked the following question, "Have you ever thought about suicide in the past 12 months?" with the following measurement scale "Never," "Rarely," "Quite often," "Very often," "Don't know," or "Does not apply." This question has been extensively validated in other studies (Bolanis et al., 2020; Geoffroy et al., 2016; Marschall-Lévesque et al., 2017; Orri et al., 2020). Given the non-normality of responses to this item, it was dichotomized with 0 indicating "Absence of suicidal ideation" and 1 indicating "Presence of suicidal ideation."

2.2.3. Depression and anxiety symptoms. The Children's Depression Inventory (Kovacs, 1981) was used to assess level of depression from age 13 to 18. At age 13 and 17, participants were asked to answer to 14 items, while for the other ages, they were asked to answer to 12

items. The measurement scale includes a three-point scale (1-3), which represents the absence, presence, and frequency of occurrence of the symptom. For each item, the child selected the answer that most closely corresponded to his or her state at the time of testing. Internal consistency for the scale was considered acceptable to moderate from 13 to 18 years of age (.75 $\leq \alpha \geq$ .87). For level of anxiety, participants were asked each year to complete four items from the Youth-Self Report (Achenbach, 1999). The measurement scale includes a three-point scale (1-3): "Never," "A few times," or "Often." Internal consistency for the scale was considered moderate from 13 to 18 years of age (.81 $\leq \alpha \geq$ .88).

2.2.4. Control variable. Sex was included as a control variable in the analyses as it has been shown to be associated with DD (Levin & Nielsen, 2007), suicidal ideation (Beautrais, 2002) and internalizing symptoms (Bijl et al., 2002; Cyranowski et al., 2000; Kessler, 2003; Leach et al., 2008).

2.3. Statistical analyses

To examine directional effects between DD frequency, presence of suicidal ideation, levels of depression and of anxiety, cross-lagged panel models (CLPM) were conducted in Mplus 7.4 (Muthén & Muthén, 2012). This analysis allows for the examination of bi-directional (cross-lagged) effects between the different variables at each age, while controlling for stability across time (autoregressive effects). Full information maximum likelihood under the missing at random assumption (FIML) was used to handle missing data and maximum likelihood estimation with robust standard errors (MLR) was used to handle severe normality deviations (Muthén & Asparouhov, 2002; Yuan & Bentler, 2000). Model fit was assessed by considering the following parameters and their criteria: the model chi-square (should be < 3 times the degrees of freedom), the root mean square error of approximation (RMSEA; acceptable fit < .08), the comparative fit

index (CFI; acceptable fit ≥ .90), the Tucker Lewis index (TLI; acceptable fit ≥ .90), and the standardized root-mean-square residual (SRMR; acceptable fit < .08).

Two models were conducted. The first model focused on the associations between DD frequency, presence of suicidal ideation, and level of depression from ages 13 to 18. The second model focused on the associations between DD frequency, presence of suicidal ideation, and level of anxiety from ages 13 to 18. Thus, the models were compared to examine whether the same patterns exist regardless of the internalizing symptom considered.

3. Results

3.1. Descriptive statistics

Tables 2 and 3 (p. 54) present the descriptive statistics for the key variables included in the models from ages 13 to 18. Scores on the depression and anxiety scales generally increased with age. At age 13, 57.7% of participants reported at least one DD in the last month, 62.5% at age 14, 44.8% at age 15, 56.9% at age 16, 46.4% at age 17 and 60.6% at age 18. These prevalences are consistent with the literature where rates in children aged 9 to 18 ranged between 30 and 60% (Abdel-Khalek, 2006; Schredl et al., 2008; Schredl et al., 2009a, 2009b). Presence of suicidal ideation increased from age 13, peaked at age of 15 at 14.7%, and then decreased until age 18 (see Figure 1 at p. 54). Tables S1, S2 and S3 (p. 221-222) in the supplemental materials in appendix 3 present the correlation matrices for the key sets of variables included in the models (DD frequency, suicidal ideation, levels of depression and anxiety) from ages 13 to 18.

Table 2
Descriptive statistics on continuous key variables

Study variable	M	SD	Skew	Kurtosis
Depression				
Age 13	1.31	0.29	1.16	0.66
Age 14	1.33	0.29	1.39	2.46
Age 15	1.35	0.32	1.51	2.98
Age 16	1.38	0.36	1.44	1.93
Age 17	1.38	0.32	1.08	0.95
Age 18	1.45	0.35	1.00	0.62
Anxiety				
Age 13	1.53	0.47	0.64	-0.44
Age 14	1.54	0.50	0.71	-0.26
Age 15	1.56	0.52	0.73	-0.17
Age 16	1.62	0.57	0.62	-0.59
Age 17	1.65	0.58	0.53	-0.71
Age 18	1.78	0.59	0.38	-0.79

Table 3
Percentages of participants by response options for DD frequency at each year

	0 DD	1 DD	2 DD	3 - 4 DD	5+ DD
Age 13	42.3	17.7	16.9	11.5	11.5
Age 14	37.5	20.2	18.6	10.9	12.8
Age 15	55.2	17.2	13.5	8.3	5.8
Age 16	43.1	19.1	16.7	11.8	9.4
Age 17	53.6	15.0	13.1	11.7	6.6
Age 18	39.4	17.7	18.8	15.2	8.9

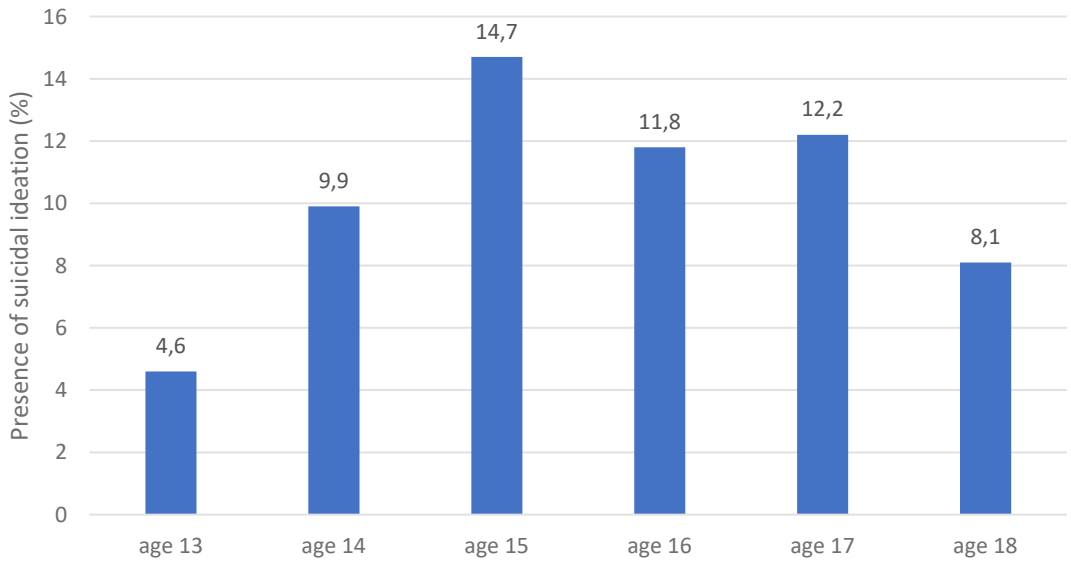

Figure 1. Percentages of presence of suicidal ideation at each year

3.2. Cross-lagged panel models

3.2.1. Model 1: DD frequency, presence of suicidal ideation and level of depression

In Model 1, shown in Figure 2 (p. 56), longitudinal associations between DD frequency, presence of suicidal ideation, and level of depression were examined from ages 13 to 18. A first model (including only lag-1 paths) did not fit the data well (see Table S4 at p. 223). With the addition of higher order paths (see Table S5 at p. 224), the model fit the data well: $\chi^2(116) = 153.0$, RMSEA = .03, 90% CI [.01 - .04], CFI = .97, TLI = .96, SRMR = .06. All three variables were stable across time, with the stationarity assumption respected (i.e., which refers to the unchanging causal structure among the measured constructs; see Table S4 at p. 223). Thus, the autoregressive paths reach a state in which they are the same magnitude from wave to wave (Little, 2013). Standardized betas for the stability of DD frequency ranged from 0.29 to 0.36, and for level of depression from 0.32 to 0.46. For presence of suicidal ideation, the odd ratios (OR) were 5.47 from age 13 to 18. The predictive equilibrium assumption was also respected for the concurrent correlations between constructs (i.e., they are the same magnitude from wave to wave; see Table S1 at p. 221; Newsom, 2015). The correlations between DD frequency and presence of suicidal ideation at each age were small (r = 0.04 - 0.06, $p < .10$). Those between DD frequency and level of depression were also small but significant (r = 0.08 - 0.14, $p < .001$). Finally, the correlations between level of depression and presence of suicidal ideation were moderate and significant (r = 0.26 - 0.39, $p < .001$).

Several cross-lagged paths were found. Note that in Figures 2 and 3 (p. 56 and 59) variables after 13 years represent residual scores controlling for previous scores and cross-lagged associations. High levels of DD frequency at age 13 and increases in DD frequency from ages 13 to 14 significantly predicted increased odds of reporting suicidal ideation one year later (at 14 and 15 years; OR = 2.07 and 1.35, respectively). High levels of depression at age 13 and increases in

subsequent levels of depression significantly and independently predicted increased odds of reporting suicidal ideation one year later, consistently across adolescence (ORs = 1.12 - 1.26). High levels of depression at age 13 and increases in levels of depression at ages 14 and 15 predicted increased DD frequency one year later (from 14 to 16 years with β = 0.11 - 0.19). Unexpectedly, the model showed that increased odds of reporting suicidal ideation between ages of 13 and 14 predicted decreases in DD frequency from ages 14 to 15 (β = -0.19). However, the opposite was found at subsequent ages, where increased odds of reporting suicidal ideation (from previous year) at 15 and 17 significantly predicted increases in DD frequency one year later, at 16 and 18, respectively (both β = 0.13). Even when considering the autoregressive and cross-lagged paths, high odds of reporting suicidal ideation at 13 significantly predicted increases in DD frequency 5 years later at age 18 (β = 0.18). The same patterns were observed when accounting for sex. We also conducted supplemental analyses to take into account the comorbidity between both internalizing symptoms (levels of depression and anxiety) and the results were essentially the same except for minor changes; the role of depression remained the same with suicidal ideation, however increases in levels of depression predicted increases in DD frequency one year later only from ages 13 to 14 (see Supplemental Model 1).

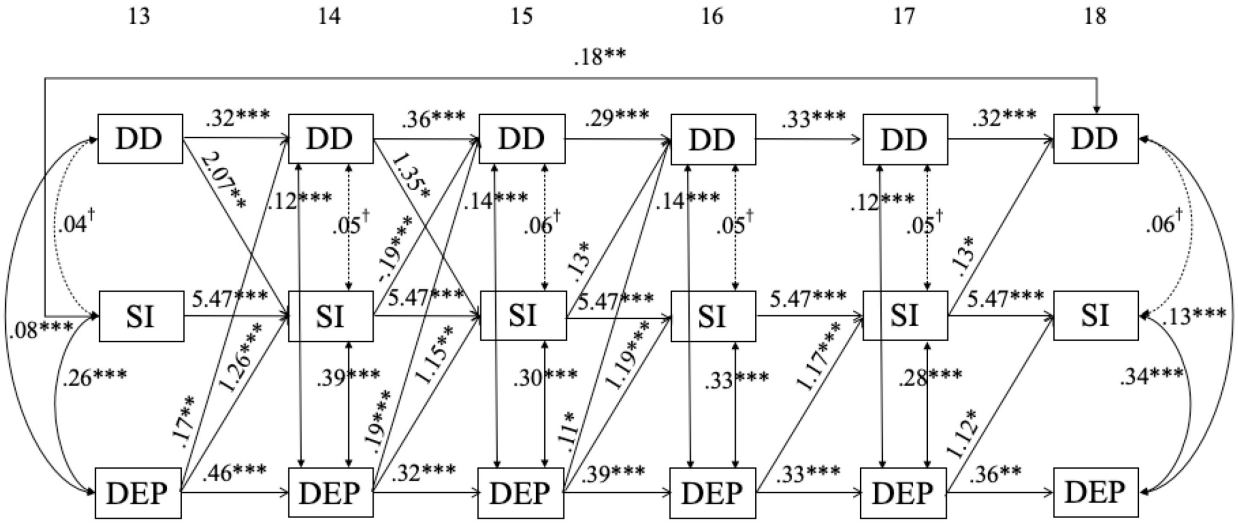

Figure 2. Standardized results for the cross-lagged model including level of depression. n = 434. Model fit: χ^2 = 153.0, df = 116, p = .01; RMSEA = .027; CFI = .97; TLI = .96; SRMR = .062. † = p < .10; * = p < .05; ** = p < .01; *** = p < .001. DD = Disturbing dream frequency; SI = Presence of suicidal ideation; DEP = Level of depression. All coefficients are standardized betas, except for associations predicting presence of suicidal ideation, which are odd ratios. All model coefficients and p values are provided in Table S8 in the supplemental materials (p. 227). A test of the same associations but controlling for levels of anxiety from 13 to 18 years old is presented in Supplemental Model 1.

3.2.2. Model 2: DD frequency, presence of suicidal ideation and level of anxiety

In Model 2, shown in Figure 3 (p. 59), longitudinal associations between DD frequency, presence of suicidal ideation and level of anxiety were examined from ages 13 to 18. A first model (including only lag-1 paths) did not fit the data well (see Table S6 at p. 225). With the addition of higher order paths (see table S7 at p. 226), the model fit the data well: $\chi^2(92)$ = 109.5, RMSEA = .02, 90% CI [.00 - .04], CFI = .99, TLI = .98, SRMR = .06. Standardized betas for the stability of DD frequency ranged from 0.18 to 0.46, and for level of anxiety from 0.31 to 0.55. For presence of suicidal ideation, the odd ratios ranged from 4.15 to 11.11. The correlations between DD frequency and presence of suicidal ideation at each age were small (r = 0.05 - 0.06, p < .10). Those between DD frequency and level of anxiety were also small but significant (r = 0.09 - 0.16, p < .001). Finally, the correlations between level of anxiety and presence of suicidal ideation were also small and significant (r = 0.17 - 0.20, p < .001).

Several cross-lagged paths were found. High levels of DD frequency at age 13 and increases in DD frequency from ages 13 to 14 significantly predicted increased odds of reporting suicidal ideation one year later (at 14 and 15 years; OR = 1.60 and 1.30, respectively). High levels of anxiety at age 13 and increases in levels of anxiety in early and mid adolescence

significantly and independently predicted increased odds of reporting suicidal ideation one year later (ORs = 1.25 – 1.34). High levels of anxiety at age 13 and increases in levels of anxiety across early to mid adolescence (from 14 to 17 years old) also predicted increases in DD frequency one year later (with β = 0.17 - 0.20). In turn, increased DD frequency from ages 14 to 15 predicted increases in levels of anxiety two years later (from 15 to 17 years old with β = 0.14). Unexpectedly, the model showed that increased odds of reporting suicidal ideation between ages 13 and 14 predicted decreases in DD frequency at age 15 (β = -0.15). However, the opposite was found at subsequent ages, where increased odds of reporting suicidal ideation (from previous year) at ages 15 and 17 marginally predicted increases in DD frequency one year later, at ages 16 and 18 (β = 0.12 and 0.11, $p < .10$, respectively). Even when considering the autoregressive and cross-lagged paths, high odds of reporting suicidal ideation at 13 significantly predicted increases in DD frequency 5 years later at age 18 (β = 0.14). The same patterns were observed when accounting for sex. Supplemental analyses that took into account both internalizing symptoms in the same model (levels of depression and anxiety) showed essentially the same results except for minor changes. The role of anxiety remained the same with DD frequency, however levels of anxiety did not predict suicidal ideation across adolescence independently when depression was taken into account (see Supplemental Model 1).

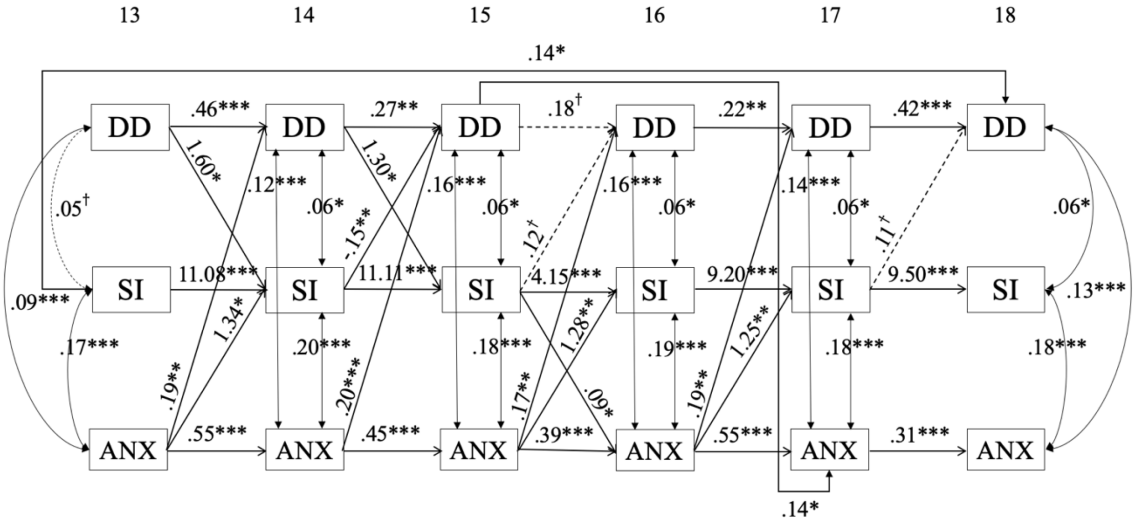

Figure 3. Standardized results for the cross-lagged model including level of anxiety. n = 434. Model fit: χ^2 = 109.47, df = 92, p = .10; RMSEA = .021; CFI = .99; TLI = .98; SRMR = .062. † = p < .10; * = p < .05; ** = p < .01; *** = p < .001. DD = Disturbing dream frequency; SI = Presence of suicidal ideation; ANX = Level of anxiety. All coefficients are standardized betas, except for associations predicting presence of suicidal ideation, which are odd ratios. All model coefficients and p values are provided in Table S8 in the supplemental materials (p. 227). A test of the same associations but controlling for levels of depression from 13 to 18 years old is presented in Supplemental Model 1.

4. Discussion

This study's main objective was to examine the potential bidirectional relationships between DD frequency, suicidal ideation, and symptoms of depression and anxiety across adolescence using six time points to parse out the developmental sequence between these variables. To test this, we used a cross-lagged approach which allowed to simultaneously test for predictive relationships between key variables.

Results from the two cross-lagged autoregressive models revealed the possibility of common developmental patterns for symptoms of depression and anxiety. Our main findings, in

both models, showed that high levels of DD frequency at age 13 and increases in DD frequency between ages 13 and 14 predicted subsequent increased odds of reporting suicidal ideation, regardless of the presence of depression or anxiety symptoms. This result is consistent with findings in adult populations, where the association between DD frequency and suicidal ideation remained significant even after controlling for depression (Pigeon et al., 2012). This finding is also in line with the results of Liu et al (2021) who found that adolescents' self-reported frequent nightmares at baseline were significantly associated with increased risk of subsequent suicidal behavior. This result adds to the understanding of the developmental sequence of DD frequency, suicidal ideation, and internalizing symptoms throughout adolescence.

Cukrowicz et al. (2006) suggested that a decrease in sleep quality associated with the presence of nightmares affects sleep-related emotional regulation, thereby exacerbating the presence of suicidal ideation. Our models, however, revealed that the direction of the relationship between changes in DD frequency and suicidal ideation from one year to the next varied across adolescence, with increased suicidal ideation being associated with later increases in DD frequency in late adolescence. Unexpectedly, the models revealed one negative relationship between change in suicidal ideation at age 14 and subsequent changes in DD frequency at age 15. In other words, increased odds of reporting suicidal ideation from ages 13 to 14 predicted decreases in DD frequency from ages 14 to 15. More research is needed to clarify the possible developmental mechanisms at play in these associations. What is clear, however, is that our findings point to a bidirectional association between DD and suicide risk across adolescence.

Moreover, our findings are consistent with the idea that DD during adolescence can be related to negative daytime emotional states; these dysphoric states may, in turn, impact nightly dream experiences (Bulkeley, 2018; Domhoff, 2011; 2018; Pesant & Zadra, 2006; Schredl & Hofmann, 2003). Just as daytime stressors can impact sleep quality, the results from our models

indicate that high levels of or increases in depression and anxiety symptoms are associated with increased DD frequency during early adolescence. These results support the evidence on the interplay between sleep and psychological difficulties and clarify the direction of the association between changes in DD frequency and internalizing symptoms across adolescence. What's more, once suicidal ideation is taken into account, our models highlight developmental psychological mechanisms throughout adolescence in which the presence of internalizing symptoms (levels of depression and anxiety) in early adolescence predicts subsequent increases in DD frequency which, in turn, predict increased odds of reporting suicidal ideation which subsequently predict increased DD frequency. Thus, these results support the view of complex developmental cascades between DD, suicidal ideation, and internalizing symptoms across adolescence.

Our findings are also consistent with findings in adults (Cerel et al., 2016) in showing that high levels of or increases across adolescence in depression and anxiety symptoms predict increased odds of reporting suicidal ideation. Although the third model, presented in supplemental materials, suggests that the associations between internalizing symptoms and suicidal ideation may be more specific to symptoms of depression, this finding needs to be interpreted with caution given the lack of statistical power. Nonetheless, our findings from models 1 and 2 extend previous findings by showing that associations between internalizing symptoms and suicidal ideation are reciprocal, or bidirectional, across early and middle adolescence, and, more importantly, by identifying certain developmental cascades between our factors of interest. A number of developmental cascades from early internalizing symptoms to later DD frequency via suicidal ideation were found across adolescence. The most important, however, for the prevention of suicidal ideation are the developmental cascades identified in early adolescence going from internalizing symptoms (13 years) to suicidal ideation (15 years) via DD frequency (14 years). A major implication of our results is the identification of DD

frequency as a potential intermediary variable between waking levels of distress and suicidal ideation and thus as a target for suicide risk prevention.

Findings in adults have shown that the experience of frequent nightmares can generate a level of distress that is above and beyond that associated with internalizing symptoms, highlighting the independent contribution of nightmare frequency to suicide risk (Wang et al., 2019). In fact, waking distress and the unpredictable and uncontrollable aspect of nightmares could be linked to feelings of hopelessness, which can account for increased suicide risk (Nadorff et al., 2011). Some authors have hypothesized that sleep can act as an escape strategy from everyday problems, thus offering an alternative to suicide (Littlewood et al., 2016). Our study is consistent with findings in adult populations (Wang et al., 2019), where DD frequency predict suicidal ideation. Moreover, the bidirectionality of the associations found in our study also highlights that waking psychological distress would in turn exacerbate DD frequency.

To our knowledge, this is the first study to examine the bidirectional effects between DD frequency, suicide risk and internalizing symptoms throughout adolescence while accounting for the stability of these effects across time. Collecting information on DD in clinical contexts may be valuable since studies show that adolescents are generally not comfortable reporting their suicidal thoughts, especially when confidentiality is not assured (Bernert et al., 2015; Britto et al., 2010; Lothen-Kline et al., 2003). Thus, focusing on DD as well as developmental mechanisms associated with suicide risk could be socially and clinically meaningful in assessing suicide risk in adolescents.

4.1. Strengths and limitations

The present study has several notable strengths. First, it sheds light on the developmental sequence of DD frequency, suicidal ideation, and levels of depression and anxiety across adolescence. Second, it provides a better understanding of the mechanisms associated with

suicide risk during adolescence. Third, it addresses several limitations of cross-sectional studies in the field, including previous studies' inability to assess the developmental sequence and directionality of the associations between DD frequency and suicidal ideation throughout adolescence (Andrews & Hanna, 2020).

The following limitations of the present study must be acknowledged. First, although the vast majority of our results are consistent with the literature, the effect sizes of the associations found were generally small which may limit their clinical relevance. However, small effect sizes are expected given the complexity of the models at work and the number of variables involved. Second, while cross-lagged models adequately address the objective of examining bidirectional effects longitudinally, they do not separate intra-individual from inter-individual variance (Hamaker et al., 2015; Lüdtke & Robitzsch, 2021). Third, the use of self-reported retrospective measures for DD frequency is another limitation, although the use of a single item to measure DD frequency yields comparable and equally valid results as those obtained with multiple items (Kelly & Mathe, 2020). That said, since correlates of retrospective measures of dream recall frequency may differ from those obtained with prospective, log-based measures of dream recall, including for DD, prospective measures are usually favored (Bernstein & Belicki, 1996; Wood & Bootzin, 1990; Zadra & Donderi, 2000). Fourth, we did not assess participants' level of distress associated with their DD. Given that DD-related distress is not always strongly correlated with DD frequency (between $r = .26$ and $r = .44$) and that it may show stronger relations to measures of psychopathology (Belicki, 1992a, 1992b; Böckermann et al., 2014; Lee & Suh, 2016; Roberts & Lennings, 2006; Schredl et al., 2014), its inclusion in future studies is warranted (Hedström et al., 2021; Titus et al., 2018). Fifth, instead of adopting a clinical definition of nightmares in our questionnaire (e.g., repeated awakenings with recollection of intensely disturbing dream mentation), we opted for the more common and easily understood (for adolescents) term "bad

dreams" which was defined as "very disturbing dreams." That said, this term avoids having young participants determine whether their awakening was caused by the dream itself, which can lead to confusion, and the use of this term resulted in the investigation of a more common and broader dimension of disturbed dreaming (e.g., Levin & Nielsen, 2007; Robert & Zadra, 2014)) that can be better captured in a normative sample such as this one. Sixth, although we examined key variables across adolescence, other problems, such as sleep disturbances (Liu, Tu, et al., 2019) and substance use (Berny & Tanner-Smith, 2022), may be developmentally important in the associations found in our models. Given that our study focused on describing the associations between changes from one time to another, future studies with a larger sample size should focus on explaining these associations by including other relevant variables. Seventh and finally, cross-lagged models were only estimated with one internalizing symptom at a time because of concerns related to statistical power in already complex models. For example, a more complex model integrating both depression and anxiety in the same model, would result in a low ratio between the number of participants and parameters tested (or high number of parameters for the number of participants). Although our supplementary results support the hypothesis of independent contribution of depression and anxiety symptoms to the association between DD frequency and suicidal ideation, future studies with larger and better powered sample sizes should focus on delineating more reliably the unique and common variance between depression and anxiety symptoms to test for the presence of a latent internalizing factor (Castellanos-Ryan et al., 2016).

4.2. Conclusions

In conclusion, our results point to a significant developmental sequence of predictive and independent associations between DD and suicidal ideation. These longitudinal associations have both theoretical and clinical implications for understanding the mechanisms underlying suicidal ideation and for identifying adolescents at risk for suicide.

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2.1.2 Transition entre les articles 1 et 2

Le premier article de cette thèse a permis de clarifier les associations longitudinales et bidirectionnelles entre la fréquence des rêves dysphoriques et la présence d'idéations suicidaires à travers l'adolescence, tout en considérant les associations avec les symptômes intériorisés (symptômes dépressifs et anxieux). Étant donné les résultats trouvés dans ce premier article qui montrent des interactions importantes entre le sommeil et l'éveil tout au long de l'adolescence, nous avons décidé de nous concentrer sur ce qui pouvait expliquer le développement des rêves dysphoriques plus tard à l'adolescence. Ainsi, pour répondre à cet objectif, le deuxième article de cette thèse s'est penché sur certains mécanismes qui peuvent contribuer à la genèse des rêves dysphoriques. Dans la littérature, on retrouve des écrits qui suggèrent qu'une combinaison de sensibilité individuelle et d'un vécu d'événements adverses à un jeune âge pourrait être associée aux rêves dysphoriques. Plus précisément, le deuxième article explorera les associations entre les expériences adverses à l'enfance (avant l'âge de 3 ans et demi) et la fréquence des rêves dysphoriques plus tard à l'adolescence, tout en examinant le rôle modérateur du tempérament, soit de l'émotivité négative, dans cette association.

2.2 Deuxième article

Longitudinal study of early adversity and disturbing dream frequency: Moderating role of early negative emotionality

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Objectifs spécifiques de cet article : Explorer (1) l'effet principal de l'environnement social précoce dans le développement des rêves dysphoriques à travers toute l'adolescence, et (2) le rôle modérateur de l'émotivité négative précoce dans cette association.

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Contribution des auteurs

Mira El-Hourani : Conceptualisation de l'article, méthodologie, analyses statistiques, interprétation des résultats, rédaction révision et publication de l'article

Antonio Zadra : Soutien à la conceptualisation de l'article, méthodologie, soutien à la rédaction, révision et soutien à la publication de l'article, financement de la recherche

Natalie Castellanos-Ryan : Soutien à la conceptualisation de l'article, méthodologie, soutien aux analyses statistiques et à l'interprétation des résultats, soutien à la rédaction, révision et soutien à la publication de l'article

Charlie Rioux : Soutien à la conceptualisation de l'article, soutien aux analyses statistiques et à l'interprétation des résultats, soutien à la rédaction, révision et soutien à la publication de l'article

Richard E. Tremblay : Soutien à la conceptualisation de l'article, méthodologie, révision de l'article et financement de la recherche

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Jean R. Séguin : Soutien à la conceptualisation de l'article, méthodologie, soutien aux analyses statistiques et à l'interprétation des résultats, soutien à la rédaction, révision et soutien à la publication de l'article, administration et financement de la recherche

Abstract

Although disturbing dreams are prevalent in youth and are associated with psychopathology, little is known about their developmental course and risk factors. We aimed to examine the association between early social environment and subsequent disturbing dream frequency across adolescence as moderated by early negative emotionality. Measures of children's early social environment and negative emotionality were collected from the mothers of 410 children (5-42 months old) and measures of disturbing dream frequency directly from the children (13-18 years old). Preliminary steps identified subgroups of families with distinct profiles of social environment using latent variable mixture modeling, and captured changes in disturbing dream frequency using latent growth modeling. Regression and moderation analyses were conducted to test the study objectives. Results showed that the diverse family patterns were best captured by two profiles reflecting adverse and positive social environments, and that overall disturbing dream frequency decreased during adolescence. Moderation analyses showed that when early negative emotionality was higher, DD frequency was not only more elevated in an adverse environment, but lower in a positive environment. These results indicate that the development of disturbing dreams is most strongly associated with a combination of individual and environment factors. Our study adds to the literature by refining our conception of individual traits and disturbing dream development and has implications for the prevention of bad dreams, nightmares, and associated psychopathologies.

Keywords: Dreaming, disturbing dream, early social environment, early negative emotionality, early adversity, children, adolescents.

Résumé

Malgré que les rêves dysphoriques soient prévalents chez les jeunes et qu'ils soient associés à des psychopathologies, on en connaît peu sur leur évolution au cours du développement et sur leurs facteurs de risque. Les objectifs de l'étude étaient d'examiner l'association entre l'environnement social précoce et la fréquence des rêves dysphoriques à l'adolescence, ainsi que le rôle modérateur de l'émotivité négative précoce dans cette association. Les mesures de l'environnement social précoce et de l'émotivité négative précoce ont été recueillies auprès des mères de 410 enfants (âgés de 5 à 42 mois) et directement auprès des enfants (âgés de 13 à 18 ans) pour la fréquence des rêves dysphoriques. Des étapes préliminaires ont été effectuées pour identifier des sous-groupes de familles présentant des profils distincts d'environnement social à l'aide d'un modèle de profils latents, et pour saisir les changements dans la fréquence des rêves dysphoriques à l'aide d'un modèle de croissance latente. Des analyses de régression et de modération ont été effectuées pour tester les objectifs de l'étude. Les résultats ont démontré que les divers patrons familiaux étaient mieux représentés par deux profils qui reflètent des environnements sociaux adverses et positifs, et que la fréquence générale des rêves dysphoriques a diminué pendant l'adolescence. Les analyses de modération ont montré que lorsque l'émotivité négative précoce était élevée, la fréquence des rêves dysphoriques était non seulement plus élevée dans un environnement adverse, mais aussi plus faible dans un environnement positif. Ces résultats appuient l'idée que c'est la combinaison de facteurs individuels et environnementaux qui explique le mieux le développement des rêves dysphoriques. Notre étude ajoute à la littérature en raffinant notre conception des traits de tempérament et du développement des rêves dysphoriques et a des implications pour la prévention des mauvais rêves, des cauchemars et des psychopathologies associés.

Mots-clés : Rêves, rêves dysphoriques, environnement social précoce, émotivité négative précoce, adversité précoce, enfants, adolescents.

1. Introduction

Disturbing dreams (DD) represent dysphoric imagery produced during sleep, and are one of the most common sleep problems in the general population (Levin & Nielsen, 2007). DD, including bad dreams and nightmares, are characterized by themes high in negative emotions, including fear, confusion, anger, and sadness (Robert & Zadra, 2014). While no consistent definition of nightmares and bad dreams exists in the literature, researchers often distinguish the two based on their frequency and level of associated distress, with bad dreams being three to four times more prevalent than nightmares, and nightmares giving rise to greater levels of distress which typically awaken the sleeper (Levin & Nielsen, 2007; Robert & Zadra, 2014). The overall prevalence of DD in children varies as a function of the time window over which DD frequency is collected, the age of the participants, and the method of collection with higher prevalence rates when children self-report their DD (Gauchat et al., 2014). Overall, prevalence rates of DD in youth aged between 9 and 18 range from 30 to 60% (Gauchat et al., 2014).

Although DD are three to four times more prevalent in children and adolescents than in adults (Levin & Nielsen, 2007), studies on DD have mostly focused on adult populations. Recent studies in children and adolescents revealed that frequent DD are associated with a variety of internalizing and externalizing symptoms as well as more severe outcomes, including elevated suicide risk (El-Hourani et al., 2022; Gauchat et al., 2020; Lemyre et al., 2019). Given that DD can reflect negative daytime emotional states (Domhoff, 2011; Domhoff, 2018; Pesant et Zadra, 2006; Schredl & Hofmann, 2003), delineating risk factors for frequent DD in these younger populations is warranted.

The mechanisms underlying DD production and their development across the lifespan remain poorly understood (Nielsen, 2017). Recently, there has been an increasing interest in the Stress Acceleration Hypothesis of mental illness (Callaghan & Tottenham, 2016) as an

explanation for the more general development of negatively toned dreams (Nielsen, 2017). This hypothesis posits that an individual is more vulnerable to developing mental health difficulties if they experience one or more adverse events during a sensitive early childhood period, sometimes referred to as the infantile amnesia period, that occurs during the first few years of life (0 - 3 ½ years of age; Alberini & Travaglia, 2017; Rubin, 2000). An early experience of adverse events would theoretically (1) shorten this amnesic period allowing normally forgotten early memories to influence emotions, cognitions, and behaviors later in development, and (2) lead to several changes in normal human development both during wakefulness and sleep, i.e., early maturation of emotional regulation processes (Callaghan & Tottenham, 2016). Whereas this early maturation may benefit the individual in the short term, it could lead to negative consequences in the long term, including mental health issues (anxiety, depression) and possibly nightmares.

An event is said to be adverse when it is likely to result in deleterious effects on physical and mental health (Teicher & Samson, 2016). Childhood adversity increases the risk of developing later physical problems (Kalmakis & Chandler, 2015; Nusslock & Miller, 2016) and mental health disorders (Green et al., 2010; Nusslock & Miller, 2016). One study showed that in 45% of cases, early adversity was associated with psychiatric disorders in childhood, and in 30% of cases with disorders appearing later in development, underlining the importance of examining the longitudinal correlates of early childhood adverse events (Green et al., 2010). Consistent with this, recent findings highlight the critical role of childhood adversity exposure in shaping risk for psychopathology throughout adulthood (Walsh et al., 2017).

Nielsen (2017) adapted the Stress Acceleration Hypothesis to the development of DD, proposing that the experience of early adversity is associated with greater DD frequency later in the person's development. Several studies suggest that early adverse experiences may indeed lead to more nightmares later in life (Duval et al., 2013; Lereya et al., 2017; Simard et al., 2008).

However, the majority of these studies are cross-sectional and/or retrospective in nature and have not all taken into account the age at which the adverse experience occurred, failing to distinguish the effects of adversity in childhood from that experienced later in development. One prospective study based on maternal reports that specifically examined adversity during infancy and toddlerhood found associations between greater DD frequency and early family adversity between 0-4 years of age (Lereya et al., 2017). In sum, these cross-sectional and prospective studies suggest significant associations between the presence of early adversity and subsequent DD occurrence in childhood through adulthood.

In addition, while early temperament has been related to subsequent internalizing and externalizing problems (Kostyra-Allchorne et al., 2020), early temperament was also found to be a predictor of subsequent DD frequency (Lereya et al., 2017; Simard et al., 2008). More specifically, researchers have focused on negative emotionality (NE), a dimension of early temperament characterized by a disposition to experience heightened psychological distress and negative emotions, and which tends to remain stable through adolescence and into adulthood (Ellis, 2002; Kopala–Sibley et al., 2018; Rothbart et al., 2001). One study of children found a significant association between NE measured at 2 years old and persistence of nightmares from 2.5 to 9.5 years old (Lereya et al., 2017). These results are consistent with those found in another prospective study based on maternal reports of 987 children, where NE at 5 months and the presence of anxiety at 17 months predicted greater bad dream frequency at 29 months, and where bad dreams persisted at least until the age of 6 years (Simard et al., 2008).

However, some models suggest that, above and beyond the main effects of NE in the prediction of DD frequency, it is the interaction effects between the social environment and NE that are most important to consider (Carr & Nielsen, 2017; Levin & Nielsen, 2007). For example, in Levin and Nielsen's (2007) neurocognitive model of DD production, variations in nightmare

frequency and severity are viewed as reflecting the interactive influence of two underlying factors: *affect load*, or day-to-day variations in emotional stress, and *affect distress*, or a disposition to experience heightened distress and negative affect and to react with intense behavioral expressions. These two factors could each have an independent impact on DD and could also interact together and have a stronger impact. In this model, the construct of affect distress shares similarities with the NE dimension of temperament as they both involve heightened negative emotional reactivity.

Consistent with this model, one study found that NE measured at 17 months was a significant developmental moderator in the associations between DD frequency and externalizing problems later in adolescence, with the associations between DD frequency and externalizing problems being positive and stronger with increasing levels of early NE (Gauchat et al., 2020). When examined in the context of two-year-old children's social environment, a study of early NE found that it had a moderating effect on the link between a risk context measured at 18 months and parent-reported internalizing symptoms and sleep problems (Northerner et al., 2016). Specifically, children with high levels of early NE were sensitive to a risk context by showing high levels of internalizing symptoms and sleep problems, whereas children with low levels of early NE were not sensitive to their environment. These findings are consistent with a diathesis-stress model. These studies highlight the importance of examining early NE as a moderator in the associations between early risk factors with later DD frequency. However, the role of early NE combined with the early social environment remains unknown with regards to the development of DD.

More recently, Carr and Nielsen (2017) adapted the concept of *sensory processing sensitivity* (SPS), as proposed by Aron & Aron (1997), as a trait marker to define nightmare-prone individuals. According to this model, individuals who are high on the SPS trait experience

increased emotional reactivity, greater depth of cognitive processing of emotional information due to the perceived relevance of stimuli, and a heightened awareness of their environment. Thus, in contrast to the interactive model described above, which is consistent with a diathesis-stress approach to the development of behavior problems (Monroe & Simons, 1991; Zuckerman $ Riskind, 2000), this trait is described as a 'for better and for worse' factor as it is not only associated with negative outcomes in an adverse and stressful environment (as in a diathesis stress model), but also with positive outcomes in a supportive environment (as in a vantage sensitivity model; Belsky & Pluess, 2009). Carr et al.'s work (2021; 2017) suggests that SPS is associated with negative as well as positive outcomes, a conceptualization consistent with two other frameworks on environmental sensitivity, namely the differential susceptibility model (Belsky & Pluess, 2009) and the biological sensitivity to context model (Boyce & Ellis, 2005; Ellis & Boyce, 2008). These three frameworks (SPS, differential susceptibility and biological sensitivity to context) all share the notion that sensitive individuals may differ not only in their response to adverse contexts, but also to positive and supportive environments.

Consistent with these models, a sleep-related study found that high maternal sensitivity predicted decreased bedtime problems and longer sleep duration in children with high early NE, while opposite relations were observed in the context of low maternal sensitivity (Conway et al., 2018). Similarly, Carr et al.'s (2021) study found significant negative correlations between nightmare frequency and distress, and mental well-being and minor psychiatric problems at higher levels of SPS. The authors recommended that future research examine longitudinal developmental links between SPS, mental well-being and DD, and consider the role of sensitivity traits in negative as well as in positive environments.

We thus aimed to clarify the role of early NE in the subsequent development of DD by testing whether NE may be best conceptualized as a vulnerability factor to the early social

environment (as proposed in a diathesis-stress model) versus a broader susceptibility factor (as proposed in a differential susceptibility model).

1.1 Objectives

The first objective of the present study was to examine the main effects of early childhood social environment and early NE on the subsequent development of DD frequency during adolescence. The second objective was to test whether early childhood NE moderates the association between the early social environment and subsequent DD frequency. More precisely, given the diathesis-stress model (Monroe & Simons, 1991), we examined whether DD frequency was greater when higher NE was combined with an adverse environment. In the context of the differential susceptibility model (Belsky & Pluess, 2009), we examined whether DD frequency was greater when high NE was combined with an adverse environment, but with the expectation of lowered DD frequency when higher NE occurs within a positive environment.

2. Method

2.1. Participants

Participants were drawn from two cohorts of the Quebec Longitudinal Study of Child Development (QLSCD): a first cohort born in 1996 in which 1000 Quebec families were randomly selected from urban areas from the Quebec birth registry and a second cohort born in 1997 in which 2120 Quebec families were also randomly selected from the Quebec birth registry (Santé Québec et al., 1997). In the first cohort, 572 families agreed to participate. In order for a participant to be included in the present study, the participant had to endorse at least one item for each variable at any time point between the ages of 5 and 42 months, or 13 and 18 years old, which resulted in a total of 250 participants from the first cohort. A sub-sample of 170 participants from the second cohort, matched to the urban catchment areas of the first cohort, was added to the first cohort sample to increase the statistical power of the analyses just prior to the

age 14 years data collection, which resulted in a sample of 410 participants in total that underwent the same procedures across adolescence. The cohorts differed slightly in terms of procedures before age 14 years.

At the first assessment, when children were 5-month-old, the first cohort (n = 572) differed slightly on parents' highest level of education and on family income compared to the second cohort (n = 170). The second cohort had a greater proportion of children whose parents had reached higher levels of education (Cohen's d = 0.29, p = .001 for mothers and 0.21, p = .02 for fathers) and whose family had reached a higher income than in the first cohort (Cohen's d = 0.22, p = .01). The sample in the present study (n = 410) did not differ significantly from the rest of the original first cohort sample on family type (i.e., single parent or not), the mother's or the father's age, the father's highest level of education (p = .07 to .91), but did differ significantly in terms of the mother's highest level of education (Cohen's d = -0.25, p < .001) and on family income (Cohen's d = -0.24, p = .002) with a greater proportion of children whose mothers had reached higher levels of education and whose family had reached a higher income than in the original sample. Table 1 (p. 88) presents the sociodemographic characteristics for the study sample.

Prior to adolescence, data were collected annually throughout childhood. Consent was provided yearly by the parents until participants were age 17 years and by the children themselves when they reached age 18 years, and assent was provided by the child when the child was sufficiently mature to do so (i.e., 9 years old) until age 17 inclusively. Data were reported by parents until the child reached 11 years of age, after which data could be self-reported by the child. To increase the validity of the responses, confidentiality was assured to the adolescents. This research project was approved by the Institut de la statistique du Québec, the Sainte-Justine

Hospital Research Center, and the Louis-Hippolyte Lafontaine Hospital Research ethics committees.

Table 1
Sociodemographic characteristics of the study sample (n = 410)

Sociodemographic characteristic	%
Sex assigned at birth	
Girls	56.8
Boys	43.2
First language learned	
French	87.0
English	6.4
Race	
White	96.6
Black	2.2
Other	1.2
Mother's last completed degree	
Less than high school	8.6
High school	23.1
CEGEP[a], college, technique graduate	29.7
Undergraduate degree or higher	38.6
Family annual income (Canadian dollars)	
<30,000$	25.1
30,000$-59,999$	34.7
≥60,000$	40.2
Family composition	
Intact or recomposed	97.1
Single	2.9
Mother's age in years at first assessment (*SD*)	30.1 (4.8)

Note. CEGEP = Collège d'Enseignement Général et Professionnel.
[a] A technical professional or preuniversity degree usually required after high school graduation (grade 11) to enter university before age 21 in Quebec; equivalent to grades 13–14.

2.2. Measures

2.2.1. Disturbing dreams (DD)

Participants self-reported their DD frequency annually beginning at age 11. Adolescents were first asked, "On average, how frequently do you have bad dreams?" using a 5-point Likert scale (1 = *never*, 2 = *sometimes*, 3 = *often*, 4 = *always*, and 5 = *don't know*. Because "dysphoric dreams" is a less familiar term for many youths, the term "bad dreams," defined as "very

disturbing dreams," was used instead. Participants who reported experiencing DD were also asked to "Estimate the number of bad dreams you have had in the past month." The number of DD was coded as 0 for children who reported never having DD in the first question, while maximum frequency was set at 30 (i.e., 1 DD/day) to limit the impact of potential outliers. Thus, values for monthly DD frequency ranged between 0 and 30. The average between 13 and 14 years old, 15 and 16 years old, and 17 and 18 years old were computed to create 3 indicators of DD frequency. A one-month retrospective unit of measure was used rather than a one-year retrospective measure as the one-month retrospective measure is more consistent with prospectively collected log-based frequency measures of DD (Robert & Zadra, 2008; Zadra & Donderi, 2000).

2.2.2. Early social environment

The present study was designed a priori to collect several variables that are indicative of psychosocial adversity, that are similar to those used in other studies that examined the effect of adversity on sleep and dreams (Nielsen, 2017; Northerner et al., 2016). The early social environment was measured between 5 and 42 months (3 ½ years). The scales described in the following sections are those measuring the early social environment. Items were collected from mothers and were assessed at 5, 17, 30, and 42 months. Only items that were repeated across measurement times were selected to create the indicators for the early social environment. Items that needed to be reversed were recoded, so that a high score was transformed into the corresponding low score on the scale, or vice versa. Data were included for participants when responses were provided for at least 75% of the items. Following the creation of the indicators, the average was computed when two or more measurement times were available. The average interitem correlation (AIIC) for each of the measurement times are provided for internal consistency, and should be above 0.15 to be considered good (Clark & Watson, 2019).

Coercive parenting. Coercive parenting was assessed at 30 and 42 months using questions based on the Parent Practices Scale (Strayhorn & Weidman, 1988) and on the Parental Cognitions and Conduct Toward the Infant Scale (Boivin et al., 2005). Mothers reported on three questions (i.e., how often do you raise your voice, scold, or yell at him/her?), each rated on a 5-point Likert scale (1 = *never* to 5 = *many times each day or all the time*, depending on the question asked). The measures of coercive parenting showed good internal consistency with AIICs of 0.21 and 0.28.

Violence towards the mother. Violence towards the mother was only assessed at 42 months. Mothers were asked the following yes or no question: "Has your spouse/partner or someone important to you ever emotionally or physically abused you?". This question was based on the Abuse Assessment Screen (McFarlane et al., 1992). This measure was treated as a dichotomous variable.

Family functioning. Family functioning was assessed at 5 and 17 months using 6 items based on The McMaster Family Assessment Device (Epstein et al., 1983), one of the most widely used instruments to measure family functioning (Hamilton & Carr, 2016). Each item (i.e., we express feelings to each other, individuals (in the family) are accepted for what they are) was rated on a 4-point Likert scale (1 = *strongly disagree* to 4 = *strongly agree*). The measures of family functioning showed good internal consistency with AIICs of 0.40 and 0.38.

Social support. Parent's social support was assessed at 42 months using 3 items based on the Social Provision Scale (i.e., I have family and friends who help me feel safe, secure, and happy; Cutrona & Russell, 1987). Mothers were asked to answer each item, rated on a 4-point Likert scale (1 = *strongly disagree* to 4 = *strongly agree*). The measure of social support used in the present study showed good internal consistency with an AIIC of 0.55.

Maternal depressive symptoms. Maternal depressive symptoms were assessed at 5 and 17 months using a 12 items shortened version of the Center for Epidemiologic Studies Depression Scale (Radloff, 1997), which is a widely-used self-report measure to assess symptoms of depression in the general population (Jenkins & Curwen, 2008). Each item measured the occurrence and severity of depression symptoms during the previous week and was rated on a 4-point Likert scale (1 = *less than a day* to 4 = *5-7 days*). These scales showed good internal consistency with AIICs of 0.27 and 0.25.

Partner support. Partner support was assessed at 5 months using 5 items from the instrumental and emotional support scale developed by Valérie Saysset, Michel Boivin and Christiane Piché from the Laboratoire de recherche de l'École de psychologie de l'Université Laval (Thibault et al., 2001). Each item was rated on a 10-point Likert scale (0 = *not at all* to 10 = *full*). The items were related to caring for the baby, household chores, exhaustion on the part of the mother, difficulty experienced by the mother, and general support. The measure of partner support used in the present study showed good internal consistency with an AIIC of 0.58.

Sociodemographic variables. Family income was assessed at 5, 30, and 42 months. These three measurement times were averaged with a final scale of five categories ranging from <10,000$-19,000$ to ≥80 000$. The mother and father's highest completed degree were assessed at 5 and 30 months. These two measurement times were averaged with a final scale of four categories with 1 = *less than high school*, 2 = *high school*, 3 = *CEGEP, college, technical graduate,* and 4 = *university graduate or more*. The mother and father's highest completed degree as well as family income, were treated as ordinal variables. Family structure (single parent or not) was assessed at 5, 17, 30, and 42 months. If the mother answered "single parent" at least one of the measurement times, the value "single parent" was given. Immigration status (immigrant or

not) was assessed at 5 months. Family structure and immigration status were treated as dichotomous variables.

2.2.3. Negative emotionality (NE)

NE was assessed at 17 months using a shortened scale of 4 items developed by Vitaro et al. (2006) from the original fussy/difficult temperament scale developed by Bates et al. (1979). Mothers were asked to answer each item, rated on a 7-point Likert scale, with higher values meaning higher levels of NE (i.e., how often per day fussy, how much fussy/cry, how easily upset, and overall degree of difficulty). This measure of early NE, which was used in a recent study (Gauchat et al., 2020), showed good internal consistency with an AIIC of 0.41.

2.2.4. Control variable

Sex assigned at birth was included as a control variable as it has been shown to be associated with DD frequency in adolescence as well as in adulthood with girls/women reporting more DD than boys/men (Gauchat et al., 2014; Schredl & Reinhard, 2011).

2.3. Statistical analyses

Analyses were conducted using Mplus version 8.8 (Muthén & Muthén, 1998-2017). Full information maximum likelihood (FIML) was used to handle missing data and maximum likelihood estimation with robust standard errors (MLR) was used to handle severe normality deviations; see descriptive statistics presented in Table 2 (p. 95). The "don't know" answers for DD frequency varied between 2.7% and 3.7% (2.7% at 13-14 years old, 0.9% at 15-16 years old, and 3.7% at 17-18 years old) and were treated as missing variables because of the low percentages. Missing data rates for all study variables and models are provided in Supplementary Materials (see Table S1 on p. 238). Model fit was assessed by considering the following parameters and their criteria for acceptable fit: the model chi-square (χ^2; $p > .05$), the root mean

square error of approximation (RMSEA; < .08), the comparative fit Index (CFI; ≥ .90), the Tucker Lewis index (TLI; ≥ .90), and the standardized root-mean-square residual (SRMR; < .08). To compare the goodness of fit in the models, the Satorra-Bentler Chi-Square Difference Test was also used (Satorra, 2000).

First, quality of the early social environment was modelled using latent profile analysis to identify subgroups of families with distinct profiles of early social environment factors. Second, DD frequency was modelled using latent growth models to capture change in DD frequency from 13 to 18 years old. Unconditional and conditional models were conducted to find the model that fits the data well, and to test the prediction of the early social environment and early NE on later DD frequency. Third, a moderation analysis was modelled to examine the interaction between the early social environment profiles and early NE on later DD frequency.

2.3.1. Latent profile analysis for the early social environment

To determine the optimal number of the early social environment profiles in our sample, a latent profile analysis was conducted. Several models with different numbers of classes were estimated and compared by examining statistical measures of model fit: the Akaike's information criterion (AIC), the Schwarz's Bayesian Information Criteria (BIC), the sample-size adjusted BIC (SABIC), the Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT), and the Bootstrap LRT (BLRT). The model with the lowest AIC, BIC, and SABIC values is considered to have the best model fit. The LMR-LRT and BRLT indices are used to compare nested models. A significant *p*-value means that the model has a better fit than a solution with one fewer class (Nylund et al., 2007). Another index to consider is entropy which varies between 0 and 1, and where a higher value means a better classification quality of the model (Ramaswamy et al., 1993). If indices supported several models, theoretical interpretability was to be considered with a preference for a more parsimonious model (Nylund et al., 2007).

2.3.2 Latent growth analysis for DD frequency

To estimate the general pattern of intra- and inter-individual change in DD frequency between the ages of 13 and 18 years, unconditional latent growth models were run across 3 time points. Mean scores were computed at ages 13-14 (T1), 15-16 (T2), and 17-18 (T3) to limit the impact of variability on model convergence, and, as such, they defined our three measurement points. Five unconditional models including an intercept and a slope were estimated step-by-step to identify the best and most parsimonious model (Preacher et al., 2008). The slope describes the within-individual change across adolescence. The variance of the intercept and slope represent the between-individual variability in the change in DD frequency across adolescence. A conditional latent growth model was conducted to identify whether the early social environment and early NE predicted the DD frequency latent growth model, while adjusting for child sex.

2.3.3 Interaction analysis between the early social environment and early NE

To test if early NE moderated the association between the early social environment and the DD frequency latent growth model, an interaction term was created between the early social environment and early NE. The interaction term was then added as a predictor of the intercept and slope of the latent growth model of DD frequency across adolescence, as well as child sex, the early social environment and early NE. To interpret a significant interaction, the estimated values of DD frequency as a function of the early social environment was plotted at 1 standard deviation (*SD*) above the mean, the mean level, and 1 *SD* below the mean on NE, and followed by simple slope tests following recommendations for examining continuous moderators (Aiken et al., 1991; Frazier et al., 2004). Interactions were probed with early NE at its mean and at +/-1*SD,* as this is the most used low and high levels for moderators without a clinical or other meaningful cut-off (Frazier et al., 2004). Supplemental analyses were conducted to examine whether the

association between early NE and DD frequency differed as a function of the quality of early social environment, while controlling for sex.

3. Results

3.1 Descriptive statistics

Tables 2 and 3 (pp. 95-96) present the descriptive statistics and the frequencies for the key variables included in the models. DD frequency was the highest at ages 13-14 and the lowest at ages 15-16. At ages 13-14, 69.2% of participants reported at least one DD in the last month, while 65.3% did so at ages 15-16, and 66.5% at ages 17-18. The effect sizes of sex differences in DD increased until the age of 18: βs = 0.08 (p = .14) at ages 13-14, 0.18 (p < .001) at ages 15-16, and 0.24 (p < .001) at ages 17-18, showing that girls reported more DD than boys. These prevalences and effect sizes are consistent with the literature (Gauchat et al., 2014). Given that the skewness and kurtosis parameters for the variables included in the models were not between -1 and +1, MLR was used to take this non normality into account. Table S2 (see Supplementary Materials on p. 239) presents correlations between the variables used in the analyses.

Table 2
Descriptive statistics for the continuous key variables

Study variable	*n*	*M*	*SD*	Skewness	Kurtosis
DD 13-14 years old	356	1.89	2.77	3.29	14.9
DD 15-16 years old	364	1.38	2.19	3.65	18.8
DD 17-18 years old	359	1.52	2.55	4.39	28.9
Coercive parenting	674	0.46	0.35	1.29	3.54
Family functioning	734	3.59	0.35	-0.75	-0.37
Social support	637	3.72	0.41	-1.67	3.47
Maternal depression	734	1.40	0.33	1.48	3.85
Partner support	705	8.32	1.64	-1.57	3.51
Negative emotionality (NE)	676	1.64	0.94	0.64	0.10

Note. *M* = Mean, *SD* = Standard deviation.

Table 3

Frequencies for the categorical variables

Study variable	Percentage of sample
Violence towards the mother	19.6
Single parent	13.1
Immigration status	7.1
Mother and father's last completed degree	
Less than high school	4.2
High school	22.8
CEGEP, college, technique graduate	34.9
University graduate or more	38.2
Family annual income	
<40,000$	26.2
40,000$-79,999$	49.2
≥80,000$	24.5

3.2 Latent profile analysis

To identify the early social environment profiles, a latent profile analysis was conducted step-by-step. Table 4 (p. 96) reports the model fit indices for the different solutions examined. As shown in Table 4, the likelihood ratio tests (i.e., the LMR-LRT and BLRT values) were significant only for the two-profile solution, indicating that the additional profiles did not offer significant explanatory power. Thus, according to the AIC, BIC, and SABIC, the good entropy and theoretical coherence, the most optimal and parsimonious solution was the one with two profiles.

Table 4

Model fit indices for each estimated solution

Number of classes	AIC	BIC	SABIC	LL	Entropy
1	15403.63	15481.85	15427.87	-7684.81	N/A
2	14784.26	14913.09	14824.18	-7364.13*	0.819
3	14587.98	14767.43	14643.59	-7254.99	0.738
4	14439.20	14669.26	14510.49	-7169.60	0.789
5	14349.21	14629.88	14436.19	-7113.60	0.801
6	14304.83	14636.12	14407.49	-7080.41	0.822

Notes. LL = Log-likelihood, AIC = Akaike's Information Criterion, BIC = Schwarz's Bayesian Information Criterion, SABIC = Sample-Size Adjusted BIC. The significance flag on the LL values refer to the likelihood ratio tests (LMR-LRT and BLRT), which tests if a solution with one

less class would fit the data better. A non-significant LMR-LRT and BLRT indicates that a solution with one less class would provide a better fit to the data. *$p < .05$.

Among the two profiles, one profile (23.2% of the sample) was characterized by families at risk compared to the second profile. Families in this adverse environment profile had comparatively higher scores on coercive parenting and maternal depressive symptoms, lower scores on family functioning, social support, partner support, family income, and both parents' education level, as well as a greater likelihood that the mother was experiencing violence, that the parent was single and an immigrant. Figures 1 and 2 (p. 97) describe the two profiles according to the different scores found on the indicators of the early social environment.

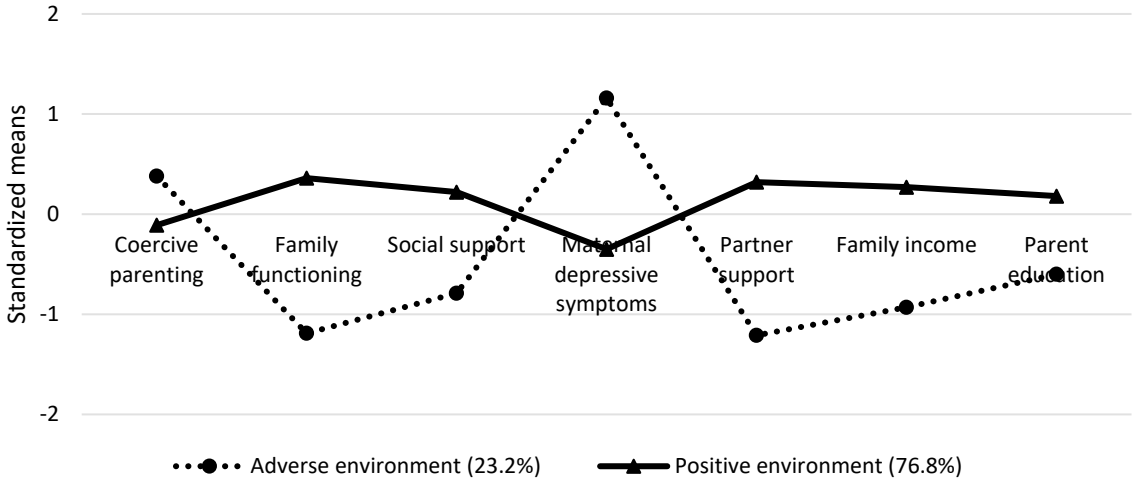

Figure 1. Standardized means for the two-profile solution for the early social environment. *Note.* $n = 736$.

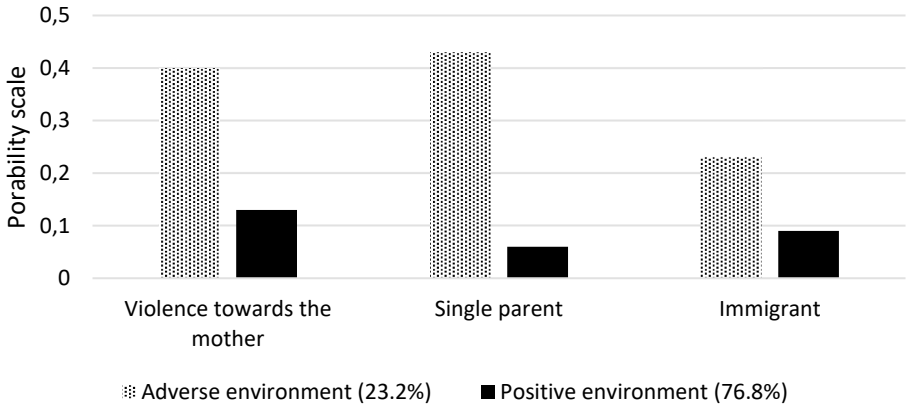

Figure 2. Probability scales for the two-profile solution for the early social environment of dichotomous variables. Probability scales represent the probability of an individual in class *x* being at a particular level of the observed variable.
Note. $n = 736$.

3.3 Latent growth model: Unconditional model

To examine the general pattern of change in DD frequency across adolescence, a latent growth model was estimated. Descriptive statistics for DD frequency are presented in Table 2 (p. 95). The model was centered at T2 (age 15-16), with the intercept representing the average of DD frequency at age 15-16, as it corresponds to the end of secondary schooling in Québec, and a key developmental milestone (after 15-16 years, youth can follow very different job or educational paths, e.g., enter job market, or follow technical training or pre-university training). A step-by-step model building was taken to find the most optimal solution. The fit indices for each of the estimated models are presented in Table 5 (p. 98). For parsimony, residual variances were set to be equal between measurement times. Preliminary latent growth models with a fixed intercept and a fixed linear slope were estimated. These models did not fit the data well. The final two models fit the data well, but model 4, which included a random intercept, a random slope and a freely estimated factor loading for T3 (age 17-18) was favored, as not only did it fit the data very well ($\chi^2(3) = 2.63$; CFI = 0.98; TLI = 0.97; RMSEA = 0.03; SRMR = 0.05), but it also represented the observed means more accurately (e.g. larger decrease from 13-14 years to 15-16 years).

Table 5
Model fit indices of unconditional latent growth models with 3 time points across adolescence

Model	χ^2	*df*	CFI	TLI	RMSEA	90% CI	SRMR	AIC	BIC	SABIC
0	30.21*	7	0.299	0.699	0.089	[0.058-0.122]	0.249	5060.43	5068.52	5062.18
1	11.61	6	0.831	0.915	0.047	[0.000-0.087]	0.141	4978.98	4991.12	4981.60
2	9.30	5	0.870	0.922	0.045	[0.000-0.090]	0.139	4975.92	4992.10	4979.40
3	3.43	3	0.987	0.987	0.018	[0.000-0.086]	0.069	4947.79	4972.06	4953.02
4	2.63	2	0.981	0.971	0.027	[0.000-0.104]	0.053	4938.947	4967.262	4945.048

Notes. n = 422. All residual variances were constrained to equality. Model 0 = Fixed intercept; Model 1 = Random intercept; Model 2 = Random intercept and fixed linear slope; Model 3 = Random intercept and random linear slope; Model 4 = Random intercept and random slope with a freely estimated factor loading for T3. Model 4 is the final model. *df* = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; CI = Confidence interval; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Schwarz's Bayesian Information Criterion; SABIC = Sample Size Adjusted Bayesian Information Criterion. *p < .05.

This model explained 64% of the variance in DD frequency at T1 (age 13-14), 50% at T2 (age 15-16), and 57% at T3 (age 17-18). In the final model, the results showed that in general, DD frequency decreased across adolescence with a mean of -0.30 (p = .02) for the slope. The variance of the slope was significant (variance = 2.99, p = .001), meaning that adolescents varied in their change pattern on DD frequency across time. The results also showed that the mean and the variance of the intercept were significant (M = 1.58, p < .001, variance = 2.76, p < .001), meaning that DD frequency at 15-16 years differed from zero, and that adolescents differed on their DD frequency score at age 15-16. Finally, the correlation between the slope and the intercept was not significant (r = 0.16, p = .48), meaning that there was no association between the mean level at age 15-16 and change across adolescence.

3.4 Latent growth model: Conditional model

We estimated the association of the early social environment profiles with the latent growth model of DD frequency across adolescence, while adjusting for sex. The model had an excellent fit: $\chi^2(5) = 3.05$; CFI = 1.00; TLI = 1.00; RMSEA = 0.000; SRMR = 0.04. First, the results showed that being female predicted the intercept (i.e., mean of DD frequency at age 15-16) and the slope (change) of the growth model. Being female had a greater mean of DD frequency at age 15-16 (β = .27, p < .001), and showed a slight increase in DD frequency through adolescence (β = .12, p = .09). Second, membership in the adverse environment profile predicted a greater mean DD frequency at age 15-16 (β = .19, p = .02). Early social environment profiles

and sex predicted 11% of the variance of the intercept (p = .003). However, early social environment profiles did not predict the pattern of change in DD frequency across adolescence.

3.5 Moderation analysis

First, the correlation between the early social environment profiles and NE was small (r = 0.05, p = .002), which is expected in a moderation analysis (Belsky et al., 2007). The main effects were examined when sex, the early social environment profiles, and early NE were taken into account. Results showed that being female positively predicted the intercept (i.e., DD frequency mean at 15-16 years old; β = 0.28, p < .001) and the slope (β = 0.13, p = .07). Early social environment positively predicted the intercept (β = 0.18, p = .01), but not the slope (β = 0.10, p = .24) and early NE did not predict the intercept (β = 0.03, p = .73), nor the slope (β = 0.06, p = .48). This model explained 11% of the variance of the intercept (p = .004).

To test the moderating effect of early NE on the association between early social environment and DD frequency in adolescence, an analysis was conducted by creating an interaction term between membership in the broader early social environment profile and early NE. The interaction model was also adjusted for sex. The model fit the data well: $\chi^2(7) = 10.34$; CFI = 0.95; TLI = 0.88; RMSEA = 0.04; SRMR = 0.04. Results showed that the interaction was significant (β = 0.27, p = .03) in predicting the intercept but not the slope (β = 0.10, p = .37) of the latent growth model. Thus, early NE had a moderating effect on the association between early social environment profiles and DD frequency at age 15-16, but had no such effect on the association between early social environment profiles and change in DD frequency throughout adolescence. This model explained 16% of the variance (ΔR^2 = 5% with the addition of the moderating effect). Simple slope analyses showed a crossover interaction: when early NE was high, DD frequency was greater in an adverse environment than in a positive environment,

whereas when early NE was low, there was no association between the environment and DD frequency. Figure 3 (p. 101) illustrates the crossover interaction (+1 *SD*, mean, -1 *SD* on NE). At high levels of early NE (1 *SD* above the mean), the early social environment was positively and significantly associated with DD frequency mean at ages 15-16 (β = 0.33, p = .002). However, among children with average or with low scores on early NE (at the mean and 1 *SD* below the mean), early social environment was not associated with DD frequency mean at ages 15-16 (β = 0.12, p = .08 and β = -0.09, p = .49, respectively).

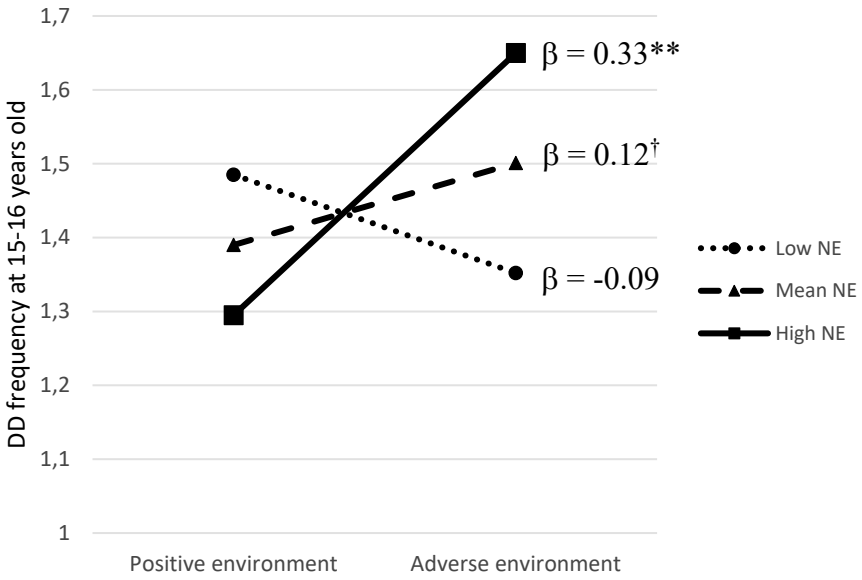

Figure 3. Early social environment class membership x Negative emotionality interaction, adjusting for sex.
Note. NE = Negative emotionality. DD = Disturbing dreams. Low NE = -1SD, High NE = +1SD. β = standardized Betas. †p < .10; **p < .01.

4. Discussion

Our study provides new findings regarding the association between the early social environment and later DD frequency, as well as the moderating role of early NE in this association. The main findings clarify under which conditions Nielsen's (2017) adaptation of the Stress Acceleration Hypothesis to the development of DD operates, namely by showing that early

adversity is particularly problematic at high levels of early NE. Findings support the idea that it is the combination of individual and environmental factors that explains the most the development of DD.

In our sample, the early social environment (comprising of 10 indicators between the ages of 5 and 42 months) was best captured by two distinct profiles, namely, a positive environment profile and an adverse environment profile. In comparison to participants with the positive environment profile, those with the adverse profile had lower scores on measures of family functioning, social support, partner support, family income, parental education, and higher scores of coercive parenting and maternal depressive symptoms, as well as a higher likelihood that their mother had experienced violence, was a single parent, and an immigrant. Furthermore, the latent growth analysis revealed a decrease in DD frequency across adolescence irrespective of profiles, consistent with a review showing that DD frequency tends to peak around the ages of 10-12, and then decreases during adolescence (Gauchat et al., 2014).

The main findings highlight the moderating effect of early NE on the association between the early social environment profiles and DD frequency at age 15-16, even when adjusting for sex. Later DD frequency was most strongly related to the early social environment when children showed high early NE compared to children with low and average levels of early NE. The results support the idea that early adversity can affect the normal development of emotion-related processes contributing to the production of DD in children with high levels of NE. More importantly, findings showed that when early NE was high, DD frequency was not only more elevated in an adverse environment, but lower in a positive environment.

The simple slopes figure, showing a crossover interaction, provides support for the emerging literature on NE as a susceptibility factor, and on SPS as a trait marker that characterizes nightmare-prone individuals (Carr & Nielsen, 2017). As such, these findings are

also consistent with the differential susceptibility model of development (Belsky et al., 2007; Rioux et al., 2016), which posits that while individuals with susceptibility factors are negatively affected by adverse environmental conditions, they may also benefit from positive environmental conditions or from an absence of adversity (Belsky & Pluess, 2009). These results are also in line with recent evidence showing that in children with high NE, high maternal sensitivity predicts lower sleep problems, whereas low maternal sensitivity yields opposite relations (Conway et al., 2018). Moreover, as our results showed, the authors of the latter study did not observe differences in children with low NE.

Future studies could explore these relations more fully by using continuous variables of environment and temperament as predictors and moderators of later outcomes to better test the differential susceptibility model. While studies recommend large sample sizes ($n \geq 500$) to properly detect effects due to differential susceptibility (Del Giudice, 2017), the model could be tested by examining (1) region of significance areas using the Johnson-Neyman technique (Roisman et al., 2012), which would identify at what levels of adversity children with high or low levels of early NE differ on their DD frequency, and (2) the proportion of interaction index to identify the proportion of the total area of the interaction attributable to the positive environment (e.g., Roisman et al. (2012) and Del Giudice (2017)). That said, the present findings suggest that when evaluating a child's risk for DD, a range of early social environment factors need to be considered in conjunction with the child's level of early NE. This could be especially important when designing prevention programs.

Our study principally focused on the developmental sequence between the early social environment and early NE, and subsequent DD frequency. Since there exist robust evidence that DD frequency is associated with a range of psychological difficulties (El-Hourani et al., 2022; Gauchat et al., 2020; Levin & Nielsen, 2007), and could be an indicator of negative daytime

emotional states (Domhoff, 2011; Domhoff, 2018; Pesant & Zadra, 2006; Schredl & Hofmann, 2003), it would be interesting for future work to examine the contribution of mental health problems to this developmental sequence. The interaction between the early adverse environment profile and early NE in childhood could lead to a high DD frequency in adolescence via its contribution to psychosocial adjustment problems (e.g., internalizing behaviors and suicide risk) measured later in childhood or early adolescence. For example, future studies could examine whether the interaction between the early adverse environment profile and early NE is mediated by psychosocial adjustment problems (El-Hourani et al., 2022; Liu et al., 2022) that are proximal to adolescence, and that have been shown to predict greater adolescent DD frequency, or whether adolescent DD frequency could act as a mediator and explain the occurrence of these psychosocial adjustment problems in adolescence. This could be explored using a mediated moderation model (Muller et al., 2005). Also, given that the early social environment and NE did not explain changes in DD frequency across adolescence, more research into other factors is needed to explain the decrease in DD frequency across adolescence, as well as the inter-individual variability in such changes.

4.1 Theoretical and practical implications

Our study has theoretical as well as practical implications. First, our findings provide independent support to theory-grounded hypotheses about DD production and add to the literature by using rigorous longitudinal analyses. The results clarify the Stress Acceleration Hypothesis, as adapted to DD (Nielsen, 2017), by specifying that early temperament is also important in the association between the social environment and DD development. The findings also support the neurocognitive model of DD production proposed by Levin and Nielsen (2007). In particular, we found that early adversity predicted DD frequency later in adolescence and, more important still, that our variable of early NE as a temperamental trait acted as a

developmental moderator in the association between early social environment and DD frequency. This finding is in line with previous work showing that early NE is a developmental moderator by interacting with DD frequency in the prediction of externalizing behaviors (Gauchat et al., 2020). The results of our study thus support the idea that early NE exacerbates DD production in individuals exposed to early adversity. Moreover, our findings add to and nuance the literature by indicating that early NE could be harmful in an adverse environment or beneficial in a positive one.

However, these results provide stronger independent support to recent conceptual work on SPS as a trait marker that defines individuals that are particularly sensitive to their environment (Carr & Nielsen, 2017). Considering early NE as solely a risk factor for later psychosocial adjustment problems and considering children evincing this trait as necessarily vulnerable does not take into account that they might show improved signs of adaptation when exposed to a positive environment. Thus, this trait may be mislabeled because of its negative connotation and thereby also misunderstood.

Taken as a whole, the present study's findings suggest that policy makers and mental health professionals should consider children's early NE in conjunction with the constellation of early family risk factors when designing prevention programs to reduce the prevalence of DD, such as bad dreams and nightmares. This is even more important given evidence showing that DD frequency is associated with suicide risk and internalizing symptoms (El-Hourani et al., 2022). Addressing children's NE and adversity early in life, in combination with parent education programs, could help prevent early behavior problems, and help limit NE's early interaction effects with a range of subsequent negative psychosocial outcomes. For instance, one longitudinal study of boys whose parents participated in a program personalized to the child's temperament profile showed a reduction in the boys' psychiatric visits across childhood by

making parents more sensitive to their child's temperament (Cameron et al., 2013). Future studies should also focus on the occurrence of bad dreams and nightmares as an outcome, considering their well-established associations with waking distress and well-being.

4.2 Strengths and limitations

The present study has several notable strengths. First, it is the first study to have focused on the association between the early social environment (before the age of 3.5 years) and the development of DD across adolescence, as moderated by early NE. Second, the use of a prospective and longitudinal design allowed the examination of predictive associations via a developmental perspective. Third, significant results were found in a normative sample of children which allows for greater confidence in the generalizability of results. Finally, the study's rigorous methods and the sample size add confidence to the reliability of our results.

This study also has several limitations. First, although parents provided an essential and valuable perspective, future studies should include observational measures of the early social environment and temperament, as well as measures from other informants to reduce problems associated with shared method variance. For instance, maternal depression could have biased the mothers' reports and represented a confounding effect. However, maternal depression was included in our environment latent profiles, and the correlation between NE and the latent profiles was low. Further, a recent study did not find an association between maternal depressive symptoms and biases in mothers' reports of youth temperament (Olino et al., 2020). Second, data measuring indicators of the early social environment and early NE were only reported by the mother. Observed effects may have been different for father-reported data on early social environment. Third, we used a self-reported retrospective measure of DD frequency, although findings suggest that the use of a single item to measure DD frequency yields comparable and equally valid results as those obtained with multiple items (Kelly & Mathe, 2020). That said,

since correlates of retrospective measures of dream recall frequency may differ from those obtained with prospective, log-based measures of dream recall and DD, prospective measures are usually favored (Zadra & Donderi, 2000). Relatedly, the yearly collection of narrative dream reports, including for DD, could further our understanding of how dream content, DD frequency, and waking distress interact across the early social environment profiles. Fourth, our measure of early NE at 17 months may not have been sensitive to the complete spectrum of manifestations for affect distress. For example, in contrast to observations in infants, studies have shown that toddlers high in emotional reactivity can manifest their reactivity through inhibition (Brown et al., 2022), and our measure of early NE did not include items specifically formulated to detect these behavioral manifestations of emotional reactivity. The items also did not capture the full spectrum of manifestations characterizing SPS. The 12-item Highly Sensitive Child (HSC) scale could be better suited to measure this concept as it is more focused on bivalent emotional sensitivity (Aron & Aron, 1997; Pluess et al., 2018). Fifth, we did not assess NE in adolescence, and therefore could not test whether NE remained a susceptibility factor to environment in adolescence. Sixth, instead of adopting a clinical definition of nightmares (e.g., repeated awakenings with recollection of intensely disturbing dream mentation), we opted for the more common and easily understood (for adolescents) term "bad dreams" which was defined as "very disturbing dreams." That said, this term avoids having young participants determine whether their awakening was caused by the dream itself, which can lead to confusion, and its use also resulted in the investigation of a more prevalent and broader dimension of disturbed dreaming (Levin & Nielsen, 2007) that could be better captured in a normative sample such as this one. Finally, the attrition rate may limit the generalizability of the results to the original sample, although attrition usually impacts the means and not the associations between variables (Gustavson et al., 2012), and FIML was used to handle missing data.

5. Conclusion

The present findings add to the literature by showing that an early adverse environment experienced in the first 3 ½ years of life predicted a greater DD frequency in mid-adolescence in children with higher levels of NE. However, in children with higher levels of early NE,a positive environment could be beneficial as they were at lower risk for DD in mid-adolescence. These findings help nuance the concept of individual vulnerability traits, add to our understanding of DD production, and inform mental health professionals interested in DD prevention about the importance of considering a combination of early temperament and environmental factors.

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3. Discussion générale

Les objectifs généraux de la thèse visaient, dans un premier temps, à mieux comprendre la séquence développementale entre les rêves dysphoriques et les idéations suicidaires à travers l'adolescence tout en considérant leurs liens avec les problèmes intériorisés. Dans un deuxième temps, la thèse visait à examiner les liens entre l'environnement social précoce et le tempérament chez les enfants en bas âge et les rêves dysphoriques plus tard à l'adolescence. Le premier article s'est alors concentré sur les associations longitudinales entre les rêves dysphoriques, les idéations suicidaires, les symptômes dépressifs et anxieux chez les adolescents de 13 à 18 ans. Cet article a permis de mettre en lumière la séquence et la direction des liens entre les rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés, tout en répondant à plusieurs failles méthodologiques retrouvées dans la littérature. Ensuite, afin d'élucider la genèse des rêves dysphoriques, le deuxième article s'est concentré sur l'environnement social précoce et sur l'émotivité négative précoce comme variables clefs dans le développement des rêves dysphoriques plus tard à l'adolescence. Dans ce même article, il a été possible de voir si le lien entre l'environnement social précoce et les rêves dysphoriques à l'adolescence variait en fonction du niveau de l'émotivité négative.

De manière générale, les résultats des articles convergent avec ceux des deux articles en annexe auxquels j'ai contribué et qui sont à la base de cette thèse (Gauchat et al., 2021; Gauchat et al., 2020). Alors que ces derniers avaient trouvé des résultats soutenant, dans un premier temps, l'existence d'associations positives significatives entre les rêves dysphoriques et les idéations suicidaires à 12 et 13 ans, et dans un deuxième temps, le rôle modérateur développemental de l'émotivité négative précoce dans les associations avec les rêves dysphoriques à 11 ans, les résultats des deux articles principaux de cette thèse vont dans le même

sens et ajoutent des composantes développementales novatrices à la littérature en s'étendant à toute l'adolescence. Les apports des résultats des articles principaux sont discutés ci-dessous.

3.1 Apport à la littérature existante

3.1.1 Rêves dysphoriques et problèmes d'adaptation psychosociale

Le premier article de cette thèse visait à répondre à certaines failles méthodologiques présentes dans la littérature. Alors que le risque suicidaire augmente le plus à l'adolescence (Gould et al., 2003; Nock et al., 2013), rares sont les études qui se sont concentrées sur les mécanismes développementaux du suicide et des rêves dysphoriques chez les adolescents (Pigeon et al., 2012). Les études sur les variables liées au sommeil comme facteur de risque au suicide sont importantes (p. ex. Liu et al., 2020) , puisque le sommeil joue un rôle clef dans la régulation des émotions (p. ex. Akkaoui et al., 2020; Palmer et al., 2017; Wall et al., 2022) et qu'il peut être considéré comme une échappatoire pour la détresse vécue à l'éveil, et en présence de perturbations de sommeil, cette échappatoire ne serait plus disponible, ce qui engendrerait alors plus de détresse (Littlewood et al., 2016).

Les études chez les adolescents se sont surtout intéressées aux comportements suicidaires en lien avec l'insomnie plutôt qu'avec les rêves dysphoriques (Abe & de Kernier, 2013). Qui plus est, les études qui ont examiné les associations entre les rêves dysphoriques et le risque suicidaire chez les adolescents sont souvent de nature transversale et corrélationnelle, utilisent des mesures rétrospectives et de petits échantillons (Andrews & Hanna, 2020; Liu, 2004; Pigeon et al., 2012; Russell et al., 2019). Non seulement des limites méthodologiques existent dans le peu d'études examinant l'association rêves dysphoriques et suicide, mais les mécanismes sous-jacents à cette association sont peu étudiés (Titus et al., 2018). D'ailleurs, une récente méta-analyse (Franklin et al., 2017) soulève le peu de progrès effectués dans les dernières 50 années dans l'étude du risque

suicidaire. Face à une constante augmentation du taux de suicide au cours de la dernière décennie, les auteurs soulignent la grande nécessité d'effectuer des recherches sur le suicide et sur les facteurs de risque potentiellement modifiables, tels que les rêves dysphoriques (Brown et al., 2000; Franklin et al., 2017; Titus et al., 2018; Andrews & Hanna, 2020).

De plus, les études qui se penchent sur les rêves dysphoriques chez les enfants utilisent des mesures rapportées par les parents. Ces mesures sont connues comme étant moins fiables et valides que celles auto-rapportées par l'enfant lui-même étant donné la sous-estimation du nombre de rêves dysphoriques par les parents (Floress et al., 2016). Ces failles limitent notre compréhension de l'association entre les rêves dysphoriques et le suicide, motivant à amener un éclairage nouveau. Ainsi, le premier article de la thèse a permis de pallier ces limites en ayant pour objectif d'examiner, dans un devis longitudinal rigoureux, les associations bidirectionnelles entre la fréquence des rêves dysphoriques, les idéations suicidaires et les symptômes dépressifs et anxieux entre 13 et 18 ans. Pour ce faire, des modèles autorégressifs à décalage croisé ont été utilisés.

Les résultats de cette étude ont révélé des patrons développementaux similaires aux symptômes dépressifs et aux symptômes anxieux. Tout d'abord, les résultats principaux ont montré qu'indépendamment des symptômes intériorisés, une fréquence élevée de rêves dysphoriques à 13 ans et une augmentation de la fréquence des rêves dysphoriques entre 13 et 14 ans prédisaient une plus grande probabilité de rapporter des idées suicidaires à l'âge subséquent, soit à 14 et 15 ans. Ce résultat est cohérent avec les résultats d'une étude récente chez les adolescents qui a trouvé un lien positif significatif entre les cauchemars et les comportements suicidaires (Liu et al., 2020). Il est aussi cohérent avec les résultats retrouvés chez les adultes montrant un lien positif significatif entre une fréquence élevée de rêves dysphoriques et les

idéations suicidaires, même après avoir contrôlé pour les symptômes dépressifs (Pigeon et al., 2012).

Alors qu'on observe qu'un niveau élevé et une augmentation des rêves dysphoriques prédisent une plus grande probabilité de rapporter des idéations suicidaires en début d'adolescence, les modèles analysés ont également permis de mettre en lumière une bidirectionnalité des liens entre rêves dysphoriques et idéations suicidaires. Plus précisément, on observe qu'une augmentation des idéations suicidaires entre 16 et 17 ans prédit une augmentation des rêves dysphoriques entre 17 et 18 ans, au-delà de leurs associations avec les symptômes dépressifs et anxieux. Les résultats ont également révélé une association négative entre un changement dans la présence d'idéations suicidaires à 14 ans et un changement dans la fréquence de rêves dysphoriques à 15 ans, soit une augmentation dans la présence d'idéations suicidaires à 14 ans était associée à une diminution de la fréquence des rêves dysphoriques à 15 ans et vice versa. Les études futures devraient donc se concentrer, dans un premier temps, à répliquer ce résultat et si tel est le cas, dans un second temps, à mieux comprendre les mécanismes sous-jacents à ce résultat inopiné. Les résultats des modèles autorégressifs à décalage croisé permettent d'ajouter à la littérature particulièrement en élucidant la séquence développementale et la direction des liens entre les rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés à travers l'adolescence.

L'exploration des associations bidirectionnelles et longitudinales entre les rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés ont également permis de mieux comprendre les mécanismes développementaux liant le risque suicidaire au développement des rêves dysphoriques. Les modèles ont révélé une cascade développementale importante, où la présence élevée de symptômes intériorisés (dépressifs ou anxieux) en début d'adolescence prédit une augmentation de la fréquence des rêves dysphoriques à l'âge

subséquent. Ceci prédit par la suite une plus grande probabilité de rapporter des idéations suicidaires à l'âge subséquent, qui prédit par la suite une augmentation des rêves dysphoriques à l'âge subséquent. Ainsi, ces effets de cascade permettent d'identifier la fréquence des rêves dysphoriques comme variable médiatrice potentielle entre la détresse à l'éveil (présence de symptômes intériorisés) et l'augmentation du risque suicidaire. À la lumière de ces résultats attendus, et malgré des tailles d'effet petites dans des modèles statistiques complexes, l'identification de rêves dysphoriques chez les adolescents pourrait néanmoins constituer un signe clinique supplémentaire permettant de mieux cibler les jeunes à risque aux idéations suicidaires.

3.1.2 Adversité précoce et rêves dysphoriques

Ayant maintenant des résultats qui montrent que les rêves dysphoriques à l'adolescence sont associés à un moindre bien-être, il est important de se concentrer sur la genèse des rêves dysphoriques plus tôt à l'enfance et sur les mécanismes développementaux sous-jacents afin de prévenir l'apparition de problèmes d'adaptation psychosociale qui y sont liés. Ainsi, le deuxième article de la thèse s'est intéressé aux facteurs de risque et de protection individuels et environnementaux contribuant au développement des rêves dysphoriques plus tard à l'adolescence. Cet article a permis de répondre à certaines limites dans la littérature. Tout d'abord, les études qui se sont intéressées aux associations entre l'adversité et les rêves dysphoriques sont souvent de nature rétrospective, ne permettant pas toujours de contrôler pour l'âge auquel l'adversité est survenue (Punamäki et al., 2005), et se font majoritairement chez les populations adultes (Agargun et al., 2003; Chambers & Belicki, 1998; Csóka et al., 2011; Cuddy & Belicki, 1992; Duval et al., 2013; Kales et al., 1980). Ces associations restent peu documentées chez les enfants et les adolescents. De plus, les études qui mesurent l'adversité en utilisant l'approche de risque cumulatif considèrent uniquement l'aspect quantitatif de l'adversité (Lereya

et al., 2017; Northerner et al., 2016; Williamson & Mindell, 2020). En d'autres mots, plus le nombre de facteurs adverses présents est élevé, plus le risque sera grand. Cette approche centrée sur les variables ne prend pas en considération les combinaisons de certains indicateurs d'adversité qui pourraient avoir des implications différentes et plus graves.

L'approche centrée sur les personnes, qui a pour but de décrire les similarités et les différences entre les groupes d'individus plutôt que de se concentrer sur les associations entre les variables, prend autant en compte l'aspect quantitatif que l'aspect qualitatif permettant d'observer quelle combinaison d'indicateurs d'adversité a le plus d'impact sur le développement des rêves dysphoriques. De surcroît, à notre connaissance, il n'existe pas d'étude ayant examiné le taux de changement des rêves dysphoriques entre 13 et 18 ans. Le deuxième article de la thèse a permis de répondre à ces limites en présentant un devis longitudinal et prospectif, dans lequel une approche centrée sur les personnes est utilisée pour la mesure de l'environnement social précoce, l'âge est pris en compte et le développement des rêves dysphoriques est mesuré.

Tout d'abord, les résultats de l'analyse des profils latents ont mis de l'avant deux profils d'environnement social précoce constitués de 10 indicateurs. Ces profils ont été nommés comme suit : environnement adverse et environnement positif. Plus précisément, le profil d'environnement adverse se composait de 23,2% de l'échantillon et se caractérisait par des familles ayant des niveaux plus élevés de pratiques parentales coercitives et de symptômes dépressifs maternels, ainsi que des niveaux plus faibles de fonctionnement familial, de soutien social, de soutien conjugal, de revenu du ménage et d'éducation parentale pour les deux parents comparativement au profil caractérisé par un environnement positif. Les mères appartenant au profil caractérisé par un environnement adverse avaient une plus grande probabilité d'avoir vécu une expérience de violence conjugale, d'être monoparentale et d'être issues de l'immigration comparativement aux mères appartenant au profil caractérisé par un environnement positif.

Ensuite, les résultats du modèle de croissance latente des rêves dysphoriques ont révélé que de manière générale, la fréquence des rêves dysphoriques diminuait à travers l'adolescence. De plus, les résultats ont démontré qu'il existait une variation significative dans le changement dans la fréquence des rêves dysphoriques, indiquant que ce ne sont pas tous les adolescents qui changent de la même façon dans leur fréquence entre 13 et 18 ans. Les résultats ont aussi démontré que la fréquence moyenne des rêves dysphoriques à 15-16 ans variait elle aussi significativement entre les adolescents. L'association entre les profils d'environnement social précoce et le changement dans la fréquence des rêves dysphoriques à travers l'adolescence a été testée, tout en considérant le sexe de l'enfant afin de comprendre ce qui explique cette variation inter-individuelle significative. Tout d'abord, chez les adolescents, les résultats ont démontré que les filles avaient une fréquence moyenne de rêves dysphoriques plus élevée à la mi-adolescence et montraient une augmentation dans la fréquence des rêves dysphoriques à travers l'adolescence comparativement aux garçons. Ainsi, le sexe attribué à la naissance permet de prédire une portion de la variation du changement dans la fréquence des rêves dysphoriques à travers l'adolescence. Ces différences de sexe sont également retrouvées dans la littérature, où l'appartenance au sexe féminin est associée à une fréquence plus élevée de rêves dysphoriques, comparativement aux individus de sexe masculin (Gauchat & Zadra, 2012; Levin & Nielsen, 2007; Liu et al., 2022).

De plus, les résultats ont révélé une association significative entre les profils d'environnement social précoce et la fréquence moyenne des rêves dysphoriques à l'âge de 15-16 ans, mais aucun lien significatif avec le changement des rêves dysphoriques de 13 à 18 ans. En d'autres mots, les adolescents appartenant au profil caractérisé par un environnement adverse précoce étaient plus à risque de rapporter une fréquence élevée de rêves dysphoriques à la mi-adolescence que les adolescents ayant été exposés à un environnement positif lorsqu'ils étaient enfants. Toutefois, cette association était seulement vraie lorsque les jeunes présentaient une

émotivité négative précoce élevée. D'une part, ces résultats étendent à l'adolescence ce qui a pu être observé chez les adultes, qui rapportent plus de cauchemars quand ils ont vécu des événements adverses plus jeunes (Agargun et al., 2003; Chambers & Belicki, 1998; Csóka et al., 2011; Cuddy & Belicki, 1992; Duval et al., 2013; Kales et al., 1980). D'autre part, ces résultats amènent une nuance en précisant sous quelles conditions le vécu d'expériences adverses précoces est associé à une plus grande fréquence de rêves dysphoriques. Le rôle de l'émotivité négative précoce sera davantage expliqué dans la prochaine section.

3.1.3 L'émotivité négative précoce comme modérateur

Afin de complémenter les résultats ci-dessus qui se concentrent notamment sur la contribution de l'environnement dans le développement des rêves dysphoriques à l'adolescence, la contribution du tempérament au développement des rêves dysphoriques à l'adolescence a également été explorée. Plus précisément, l'émotivité négative est une dimension du tempérament qui se rapporte également à la détresse affective reliée aux rêves dysphoriques et à la sensibilité au traitement sensoriel, et qui semble faire partie des styles de personnalité plus prompts à rapporter des rêves dysphoriques (Carr & Nielsen, 2017; Levin & Nielsen, 2007; Rothbart et al., 2001). Toutefois, son rôle reste méconnu dans l'association entre l'environnement social précoce et les rêves dysphoriques à l'adolescence.

Une analyse de modération a donc été effectuée afin de tester s'il existe une interaction entre l'environnement social précoce et le tempérament précoce dans le développement des rêves dysphoriques plus tard à l'adolescence. Les résultats ont révélé une interaction significative entre l'émotivité négative mesurée à 17 mois et les profils d'environnement social précoce dans la prédiction des rêves dysphoriques à 15-16 ans, tout en ajustant pour le sexe. Plus précisément, parmi les enfants avec un niveau élevé d'émotivité négative, les enfants dans un environnement

adverse rapportaient plus de rêves dysphoriques que ceux dans un environnement positif. À l'inverse, pour les enfants avec un niveau faible d'émotivité négative, l'environnement social précoce n'était pas associé à la fréquence des rêves dysphoriques à l'adolescence. Ces résultats sont cohérent avec les résultats trouvés dans l'étude de Northerner et al. (2016), où l'émotivité négative avait un effet modérateur significatif sur la relation entre un environnement à risque (risque cumulatif se composant d'un niveau faible d'éducation chez la mère, vivre dans un quartier dangereux, un niveau faible de soutien social, une taille excessive du ménage, provenir d'une famille monoparentale) et des problèmes de sommeil rapportés par les parents chez des enfants de 2 ans. Dans cette dernière étude, un haut niveau d'émotivité négative exacerbait les problèmes de sommeil dans un contexte à risque.

Encore plus intéressant, les résultats de notre étude ont démontré que chez les enfants avec un niveau élevé d'émotivité négative, un environnement positif était associé à une fréquence plus faible de rêves dysphoriques à 15-16 ans que ceux ayant des niveaux faibles et modérés d'émotivité négative. Ainsi, les enfants avec un niveau élevé d'émotivité négative bénéficieraient d'un environnement positif, puisqu'il serait à un risque moindre de rapporter des rêves dysphoriques à l'adolescence par rapport aux enfants ayant un niveau faible d'émotivité négative. Ces résultats convergent avec l'étude de Morgan, Shaw et Olino (2012) qui trouvent des bénéfices à avoir une émotivité négative élevée; chez les garçons avec un niveau élevé d'émotivité négative, avoir de bonnes relations positives avec la fratrie prédirait moins de problèmes intériorisés comparativement à ceux avec des niveaux plus faibles d'émotivité négative. Ces résultats soutiennent l'idée que c'est la combinaison des caractéristiques individuelles et environnementales qui est le plus fortement associée au développement des rêves dysphoriques. De plus, ils remettent en cause la nature de l'étiquette à connotation péjorative attribuée à cette dimension de tempérament. L'étiquette d'émotivité négative, qui est mieux

décrite par une sensibilité à l'environnement, ne prend pas en considération ses effets bénéfiques potentiels lorsque cette dimension est combinée à un environnement positif. Ces résultats soutiennent l'idée que l'émotivité négative ne devrait pas être perçue comme un facteur de vulnérabilité, mais plutôt comme un facteur de sensibilité (Belsky & Pluess, 2009; van Aken et al., 2007). Cette idée sera davantage discutée dans la prochaine section portant sur les apports théoriques.

3.2 Intégration théorique

Dans un premier temps, les associations et les interactions trouvées dans le cadre de cette thèse peuvent être expliquées par différentes hypothèses théoriques prises en compte dans le modèle neurocognitif proposé par Levin et Nielsen (2009; 2007), qui représente la théorie la plus intégrative dans le domaine d'étude des rêves dysphoriques. Cette théorie se base sur deux principes, soient (1) les rêves dysphoriques sont associés à un bris dans la régulation émotionnelle (Nielsen & Levin, 2007) et (2) la production des rêves dysphoriques est associée à un style de personnalité caractérisé par des réactions marquées d'une détresse émotionnelle intense (Belicki, 1992a, 1992b; Blagrove et al., 2004; Levin & Fireman, 2002). Dans un deuxième temps, nos résultats précisent dans quelles conditions l'hypothèse de l'accélération du stress des problèmes de santé mentale, adaptée par Nielsen (2017a) à la production des rêves dysphoriques, est pertinente. Enfin, nos résultats soutiennent les travaux récents effectués par Carr et Nielsen (2017) sur la sensibilité au traitement sensoriel.

L'intégration théorique des résultats trouvés dans les articles de cette thèse sera discutée ci-dessous en abordant en premier lieu les hypothèses justifiant les associations bidirectionnelles entre les rêves dysphoriques et les problèmes d'adaptation psychosociale, en deuxième lieu les hypothèses expliquant l'association entre l'adversité précoce et les rêves dysphoriques plus tard à

l'adolescence, et en troisième lieu, les hypothèses expliquant le rôle modérateur de l'émotivité négative précoce dans l'association entre l'environnement social précoce et les rêves dysphoriques plus tard à l'adolescence.

3.2.1 Hypothèses expliquant les liens entre les rêves dysphoriques et les problèmes d'adaptation psychosociale

Les associations bidirectionnelles trouvées entre les rêves dysphoriques et les problèmes d'adaptation psychosociale peuvent s'expliquer par deux concepts abordés dans la théorie de Levin et Nielsen (2007), soient la charge affective (*affect load*) et la détresse affective (*affect distress)*, tous deux présentés dans l'introduction de cette thèse. La charge affective se traduit par un état situationnel reflétant l'impact des événements émotionnellement négatifs ou stressants sur la capacité de l'individu à réguler ses émotions. La détresse affective représente une prédisposition stable de l'individu à éprouver des niveaux plus élevés de détresse et d'affects négatifs et à exprimer cette détresse plus fréquemment et avec plus d'intensité en réaction à des situations négatives. Ce dernier concept est relié à la détresse vécue associée aux rêves dysphoriques, qui elle est connue pour prédire fortement des hauts scores de psychopathologies (Levin & Nielsen, 2007). Ainsi, la détresse reliée aux rêves dysphoriques prédirait une plus grande probabilité de rapporter des idéations suicidaires et des symptômes intériorisés. Cette hypothèse est soutenue par l'étude de Lee et Suh (2016) qui ont trouvé que l'association entre la fréquence des cauchemars et les idéations suicidaires, tout en contrôlant pour l'insomnie, était complètement médiée par la détresse associée aux rêves dysphoriques. Ensuite, la charge affective ou alors la détresse à l'éveil semble également prédire une plus grande fréquence de rêves dysphoriques. Les associations entre les symptômes intériorisés et les idéations suicidaires avec les rêves dysphoriques peuvent s'expliquer par cette hypothèse. D'ailleurs les symptômes

dépressifs ou anxieux, représentant la charge affective, ont prédit une augmentation de la fréquence des rêves dysphoriques, et donc possiblement une plus grande détresse. Cette détresse se traduirait enfin par une augmentation de la probabilité de rapporter des idéations suicidaires.

Finalement, d'autres variables peuvent également expliquer ces interactions. Une revue systématique des mécanismes expliquant les associations entre cauchemars et suicide a mis en lumière que la régulation affective/émotionnelle joue un rôle majeur dans les associations entre les cauchemars et le suicide (Andrews & Hanna, 2020). Tout d'abord, la régulation émotionnelle semble être un facteur commun aux rêves dysphoriques, aux problèmes d'adaptation et aux idéations suicidaires. Le modèle de Levin et Nielsen (2007) postule que la présence de rêves dysphoriques est associée à un échec dans la régulation émotionnelle, qui par la suite entraînerait alors une plus grande détresse à l'éveil. En d'autres mots, un échec de la régulation émotionnelle lors du sommeil contribuerait à la présence de rêves dysphoriques, augmentant également l'impact des émotions négatives à l'état d'éveil (Nielsen & Lara-Carrasco, 2007), menant ainsi à une augmentation des idéations suicidaires. Cette hypothèse est également en cohérence avec l'idée qu'un individu peut avoir des comportements suicidaires dans le but de réguler ses émotions (Linehan, 1993). Enfin, plusieurs études démontrent de fortes associations entre les difficultés de régulation émotionnelle et les psychopathologies (Barlow, 2000; Kring & Sloan, 2009; Kring & Werner, 2004; Werner & Gross, 2010).

Les évaluations cognitives sont également un autre facteur à prendre en compte dans l'explication des associations entre les rêves dysphoriques et les idéations suicidaires (Andrews & Hanna, 2020). Une étude qui a exploré les évaluations cognitives comme mécanismes chez des patients souffrant d'un TSPT appuie l'idée que les cauchemars déclenchent certaines perceptions négatives (i.e., la perception d'échec), qui à leur tour mènent à un sentiment de désespoir et d'être piégé, ce qui peut engendrer un plus grand risque suicidaire (Littlewood et al., 2016). Une autre

étude, cette fois-ci chez des adolescents de 15-17 ans de la population générale, soutient aussi cette hypothèse, où le comportement suicidaire est interprété comme une solution à une situation empreinte de sentiments de défaite et d'être piégé (Russell et al., 2018). Ainsi, les évaluations cognitives pourraient expliquer les associations trouvées entre les rêves dysphoriques et les idéations suicidaires que surviennent plus tôt dans l'adolescence.

En somme, plusieurs hypothèses peuvent expliquer les interactions entre les rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés et elles peuvent toutes être interprétées comme étant complémentaires. Les résultats de l'article 1 sont en cohérence avec les hypothèses décrites ci-dessus : (1) la détresse associée aux rêves dysphoriques exacerbe les problèmes d'adaptation psychosociale; (2) la détresse associée aux problèmes d'adaptation psychosociale exacerbe les rêves dysphoriques; et (3) il semble qu'il y ait d'autres facteurs non mesurés qui expliqueraient une augmentation des rêves dysphoriques et des problèmes d'adaptation psychosociale.

3.2.2 Hypothèses expliquant les liens entre l'adversité précoce et les rêves dysphoriques

Les résultats de l'article 2, où l'adversité précoce prédit une fréquence élevée de rêves dysphoriques à l'adolescence seulement lorsque l'émotivité négative est élevée, soutiennent et nuancent l'hypothèse de l'accélération du stress des problèmes de santé mentale développée par Callaghan et Tottenham (2016) et adaptée par Nielsen (2017a). Cette hypothèse stipule que l'adversité précoce aurait pour effet de raccourcir la période d'amnésie infantile, estimée entre 0 et 3 ans et demi (Rubin, 2000), et de modifier les processus d'amnésie, contribuant au développement des rêves dysphoriques en augmentant l'accès aux émotions primordiales de grande intensité et à des fragments de souvenirs qui sont normalement oubliés (Nielsen, 2017a). Certaines études pointent vers cette hypothèse, où des individus qui ont été exposés à une

séparation parentale précoce vécue comme douloureuse ont rapporté des souvenirs d'enfance plus précoces (Artioli & Reese, 2014; Artioli et al., 2015). Par exemple, les individus qui ont vécu la séparation parentale lorsqu'ils étaient très jeunes (< 7 ans) avaient des souvenirs plus anciens que ceux dont les parents se sont séparés plus tard (Artioli & Reese, 2014). Finalement, l'étude rétrospective et récente de Nielsen (2017b) converge avec la littérature en démontrant qu'une plus grande accessibilité aux souvenirs découlant de la période amnésique infantile, soit avant 3 ans et demi, était associée à une plus grande fréquence de cauchemars chez les adultes. Malgré que les processus amnésiques n'aient pas été mesurés dans l'article 2, les résultats sont en cohérence avec ces hypothèses en démontrant que le vécu d'expériences adverses avant l'âge de 3 ans et demi était associé à une fréquence élevée de rêves dysphoriques à l'adolescence, et ce, seulement chez les adolescents ayant des niveaux élevés d'émotivité négative précoce.

L'adversité précoce engendre une série de changements sur les plans cognitif, neuronal et comportemental durant l'éveil et le sommeil, dont la maturation précoce des processus de régulation émotionnelle en lien avec l'expression, l'apprentissage et l'extinction de la peur (Nielsen, 2017a). Ces changements touchent plusieurs structures cérébrales et leurs interactions fonctionnelles, qui sont également impliquées dans la production de rêves dysphoriques. Plus précisément, ces processus passent prématurément à une forme semblable à celle des adultes, conférant une valeur adaptative à court-terme, tels que l'auto-régulation en absence de figure parentale, mais des conséquences négatives à plus long terme, tel que le développement de rêves dysphoriques. Ainsi, munis de processus de régulation émotionnelle non adaptés face aux émotions de peur, le vécu d'angoisses et la présence de craintes, qui caractérisent une grande partie des rêves dysphoriques, peuvent être des échos de souvenirs infantiles qui n'ont pas été atténués par les mécanismes amnésiques adaptés. Les résultats de cette thèse convergent avec l'idée que non seulement l'adversité contribue au développement des cauchemars liés au TSPT,

mais également aux rêves dysphoriques dits idiopathiques. Des études démontrent que l'adversité précoce contribue aux cauchemars qui ne sont pas reliés au TSPT (Chambers & Belicki, 1998; Cuddy & Belicki, 1992; Duval et al., 2013). Chez les adultes, on retrouve également des associations entre les cauchemars idiopathiques et les expériences adverses à l'enfance, vécues à l'âge préscolaire (0-4 ans) (Lereya et al., 2017), mais également dans la première année de vie (Csóka et al., 2011). En somme, ces hypothèses théoriques expliquent les associations trouvées dans l'article 2 entre le vécu d'expériences adverses précoces et une fréquence élevée de rêves dysphoriques chez les jeunes ayant une émotivité négative précoce élevée.

3.2.3 Hypothèses expliquant le rôle modérateur de l'émotivité négative précoce dans l'association entre l'environnement social précoce et les rêves dysphoriques

Les résultats de l'article 2 ont également appuyé le rôle modérateur de l'émotivité négative précoce dans l'association entre l'environnement social précoce et la fréquence des rêves dysphoriques plus tard à l'adolescence. Plus précisément, lorsque l'enfant avait un haut niveau d'émotivité négative, celui-ci était affecté négativement par un environnement adverse, mais positivement par un environnement positif précoce. Dans le premier cas, les enfants avec un haut niveau d'émotivité négative ayant vécu dans un environnement adverse précoce étaient plus à risque de développer des rêves dysphoriques à l'adolescence que leurs confrères avec des niveaux plus bas d'émotivité négative. Dans le deuxième cas, les enfants avec un haut niveau d'émotivité négative ayant vécu dans un environnement positif précoce étaient moins à risque de développer des rêves dysphoriques à l'adolescence que leurs confrères avec des niveaux plus bas d'émotivité négative.

L'effet de l'émotivité négative précoce combinée à un environnement adverse précoce s'aligne avec les travaux de Hartmann (1984a, 1984b, 1984c), où il propose qu'une combinaison

d'un vécu d'expériences précoces bénignes mais qui pourraient être interprétées comme adverses, et d'une présence de sensibilité chez l'individu serait suffisante pour favoriser l'apparition des rêves dysphoriques. Cette sensibilité s'apparente à un trait de tempérament, soit l'émotivité négative, qui réfère à la tendance à vivre une détresse psychologique lorsque confronté à de nouvelles situations ambigües (Rothbart et al., 2001). Ainsi, lorsqu'exposé à un environnement adverse, les enfants avec de hauts niveaux d'émotivité négative vivraient une forte détresse psychologique, qui se reflèterait autant à l'éveil que dans le sommeil. Tel que discuté plus haut, la détresse à l'éveil et la détresse liée aux rêves dysphoriques viendraient interagir l'une avec l'autre, augmentant les problèmes d'adaptation psychosociale, contribuant possiblement au risque suicidaire.

Encore plus intéressant, l'émotivité négative jouerait potentiellement un rôle bénéfique sur le bien-être de l'enfant lorsque combinée à un environnement positif. Cette sensibilité autant aux environnements soutenants qu'adverses peut s'apparenter à la sensibilité au traitement sensoriel définie par Aron (Aron et Aron, 1997; c.à.d., une tendance à avoir une grande réactivité émotionnelle, un traitement cognitif plus profond et une conscience des stimuli environnementaux plus prononcée), tel que proposée par Carr et Nielsen (2017) dans le contexte des cauchemars. Ainsi, il semblerait que la sensibilité au traitement sensoriel serait plus appropriée et plus englobante que le concept de détresse affective pour décrire les individus qui sont plus vulnérables à avoir des rêves dysphoriques.

Les résultats soutiennent également quelques études qui se sont concentrées sur l'étude des interactions entre le tempérament et l'environnement (van Aken et al., 2007). Plusieurs modèles d'interaction entre ces variables existent (p. ex. le modèle de diathèse-stress ou le modèle de sensibilité différentielle) et les résultats du deuxième article de cette thèse pourraient soutenir le modèle de sensibilité différentielle. Ce modèle propose que le tempérament agit

comme une sensibilité à l'environnement : les enfants avec une émotivité négative élevée seront influencés négativement par un environnement adverse, mais positivement par un environnement positif (Belsky & Pluess, 2009). Des études pointent vers cette idée, où l'émotivité négative serait perçue comme un trait de sensibilité aux environnements sociaux et non comme un trait de vulnérabilité, soutenant le modèle de sensibilité différentielle (Belsky & Pluess, 2009; van Aken et al., 2007). Par exemple, van Aken et ses collègues (2007) ont constaté que, par rapport aux garçons âgés entre 16 et 19 mois présentant des niveaux inférieurs d'émotivité négative, ceux qui avaient un tempérament « plus difficile » présentaient la plus forte augmentation de comportements extériorisés lorsque les mères utilisaient des pratiques parentales contrôlantes élevées, mais la plus faible augmentation lorsque les mères utilisaient des pratiques parentales sensibles (c.-à-d. une présence soutenante, habileté à donner des instructions claires, capacité à aider l'enfant, sentiment de confiance et de compétence).

Or, pour bien tester et confirmer que les résultats soutiennent bien le modèle de sensibilité différentielle, il faudrait effectuer des tests supplémentaires. La nature dichotomique de la variable d'environnement social précoce dans le deuxième article de la thèse ne permettait pas de faire ces tests étant donné la nécessité d'avoir une variable continue et plus sensible de l'environnement social précoce. Ainsi, les études futures devraient se pencher sur la réplication de ce résultat afin d'en déterminer la robustesse, en poussant les analyses afin de confirmer l'évidence pour le modèle de sensibilité différentielle. Dans le cas où les études futures convergent vers nos résultats, il serait bénéfique de repenser l'étiquette donnée à cette dimension de tempérament, tel que les auteurs (Carr & Nielsen, 2017) ont fait pour renommer la détresse affective par la sensibilité au traitement sensoriel dans le domaine des rêves, afin de considérer davantage ses effets bénéfiques dans un environnement positif.

3.3 Forces et limites de la thèse

Les études de cette thèse comportent plusieurs forces notables. Tout d'abord, l'utilisation d'un modèle prospectif et longitudinal a permis d'examiner les associations dans une perspective développementale. Cette force a permis d'adresser certaines limites retrouvées dans la littérature, dont la nature transversale des études limitant les conclusions sur la direction des associations. Ainsi, nos études ont mis en lumière, dans un premier temps, la séquence développementale des associations entre les rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés (symptômes dépressifs et anxieux) chez les adolescents entre l'âge de 13 et 18 ans. Dans un deuxième temps, les résultats ont démontré la valeur prédictive de la nature de l'environnement social précoce sur le développement des rêves dysphoriques plus tard à l'adolescence, tout en considérant le rôle du tempérament sur cette association. Il s'agit des premières études qui explorent ces associations et interactions à l'intérieur d'un devis méthodologique rigoureux, contribuant à augmenter la validité des données et à avoir davantage confiance dans les conclusions. Nos études ont également trouvé des résultats significatifs dans un échantillon normatif d'enfants et d'adolescents, ce qui confère une plus grande confiance dans la généralisation des résultats. Enfin, nos études ont pu fournir une plus grande compréhension des mécanismes associés au développement des rêves dysphoriques à l'adolescence, mais également au développement du risque suicidaire à l'adolescence.

Nos études comportent également quelques limites. Tout d'abord, le type de mesures utilisées ainsi que les répondants représentent une limite de la thèse. Dans un premier temps, l'utilisation d'une mesure rétrospective auto-rapportée pour la fréquence des rêves dysphoriques représente une limite, même s'il a été démontré que l'utilisation d'un seul item fournit des résultats comparables et valides à ceux obtenus avec des mesures à plusieurs items (Kelly &

Mathe, 2020). Les mesures prospectives qui mesurent la fréquence des rêves dysphoriques, telles que l'utilisation d'un journal de bord, sont généralement plus valides (Bernstein & Belicki, 1996; Wood & Bootzin, 1990; Zadra & Donderi, 2000). Par ailleurs, la collecte de journaux de bord sur les rêves dysphoriques pourrait nous offrir une meilleure compréhension des interactions entre le contenu des rêves, la fréquence des rêves dysphoriques et les niveaux de détresse à l'éveil. Dans un deuxième temps, bien que les parents fournissent une perspective essentielle sur les variables d'intérêt, les études futures devraient inclure des mesures observationnelles de l'environnement social et du tempérament ainsi que des mesures provenant d'autres répondants, afin de réduire les problèmes de variance commune lorsque plusieurs variables viennent du même répondant. Par exemple, les données mesurant les indicateurs de l'environnement social précoce et d'émotivité négative précoce n'ont été rapportées que par la mère, et les effets observés pourraient alors être différents en fonction du répondant.

Ensuite, en ce qui concerne la mesure des rêves dysphoriques, aucune différence n'a été faite entre les termes mauvais rêves et cauchemars dans le cadre de cette thèse. Ainsi, le terme plus englobant et accessible aux enfants « mauvais rêves » a été utilisé et la définition suivante « Un mauvais rêve est un rêve très déplaisant » a été fournie aux participants. L'utilisation de ce terme plus commun et général a pour avantage d'éviter la confusion chez les jeunes et est plus représentatif des échantillons normatifs, tel que celui étudié. Toutefois, cette limite aurait pour effet d'augmenter la prévalence des rêves dysphoriques dans nos études, en plus de la prévalence des mauvais rêves qui serait plus élevée que les cauchemars dans la population générale (Levin & Nielsen, 2007; Zadra & Donderi, 2000). Cette limite reflète néanmoins le manque de consensus sur une définition générale des cauchemars au sein de la communauté scientifique (Gauchat & Zadra, 2012).

En ce qui concerne notre mesure d'émotivité négative à 17 mois, elle peut ne pas avoir été sensible à l'ensemble des manifestations caractérisant la détresse affective ou la sensibilité au traitement sensoriel. Par exemple, contrairement aux observations faites chez les nourrissons, des études ont montré que les tout-petits ayant une forte réactivité émotionnelle sont plus susceptibles de manifester leur détresse par l'inhibition ou le retrait (Kagan & Snidman, 1991a, 1991b). Or, notre mesure de l'émotivité négative ne se composait pas d'items permettant de détecter ces manifestations comportementales de la réactivité émotionnelle. Les items ne capturaient également pas l'ensemble des manifestations caractérisant la sensibilité au traitement sensoriel. Le questionnaire *Highly Sensitive Child* (HSC) *scale* de 12 items serait plus adapté pour mesurer ce concept étant donné qu'il se compose davantage d'items plus englobants (Aron & Aron, 1997; Pluess et al., 2018).

De plus, nous n'avons pas testé si l'émotivité négative joue toujours un rôle modérateur comme un facteur de sensibilité à l'environnement social plus tard à l'adolescence, ce qui limite notre compréhension du rôle de cette dimension du tempérament. De plus, alors que l'émotivité négative s'apparenterait au concept de détresse affective proposé par Levin et Nielsen (2007) dans leur modèle de production des rêves, la détresse affective associée aux rêves dysphoriques rapportés par les adolescents n'a, quant à elle, pas été mesurée. Celle-ci pourrait être mesurée dans les futures études (Hedström et al., 2021; Titus et al., 2018) étant donné ses associations plus fortes avec les mesures concurrentes de psychopathologies (Belicki, 1992a, 1992b; Böckermann et al., 2014; Lee & Suh, 2016; Roberts & Lennings, 2006; Schredl et al., 2014). Un questionnaire spécifique à la détresse reliée aux cauchemars qui permettrait de répondre à cette limite est le *Nightmare Distress Questionnaire* de Belicki (1992b), questionnaire le plus utilisé dans le domaine.

Les modèles analysés dans nos études ont pour limite de ne pas prendre en compte d'autres variables pertinentes qui auraient pu expliquer les associations trouvées. Par exemple, d'autres troubles du sommeil (Liu et al., 2019), l'usage de substances (Berny & Tanner-Smith, 2022) et les processus de régulation émotionnelle qui pourraient être des variables importantes dans l'interprétation des associations trouvées. Étant donné qu'un grand nombre de variables a été exploré dans les modèles et que la taille de l'échantillon ne permet pas l'ajout d'autres variables pertinentes, seule la variable du sexe assigné à la naissance a été introduite comme contrôle en raison de ses fortes associations avec les variables explorées (rêves dysphoriques, symptômes intériorisés et idéations suicidaires). Le grand nombre de variables et la complexité des modèles ont également pour effet d'atténuer la taille d'effet des associations trouvées, qui se situent entre petites et moyennes, ce qui peut en limiter la pertinence clinique.

Enfin, le taux d'attrition de l'enfance à l'adolescence peut limiter la généralisation des résultats à l'échantillon initial, bien que l'attrition ait généralement un impact sur les moyennes et non sur les associations entre les variables (Graham, 2009; Gustavson et al., 2012). Cependant, le *Full Information Maximum Likelihood* (FIML) a été utilisé pour traiter les données manquantes dans les deux études, permettant l'utilisation de toute l'information pour estimer les paramètres.

3.4 Implications et avenues futures

Cette thèse comporte des implications à la fois théoriques et pratiques. Tout d'abord, nos études représentent des apports significatifs à la littérature. Plus spécifiquement (1) l'article 1 serait la première étude à mettre en évidence les associations bidirectionnelles et longitudinales entre la fréquence des rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés à travers l'adolescence, tout en tenant compte de la stabilité de ces effets dans le temps; (2a) l'article 2 serait la première étude à mettre en évidence sous quelles conditions l'adversité

précoce à l'enfance est associée à une fréquence élevée de rêves dysphoriques plus tard à l'adolescence, et (2b) à mettre en évidence le rôle à la fois néfaste et bénéfique de l'émotivité négative sur le développement des rêves dysphoriques plus tard à l'adolescence, dépendamment de l'environnement social auquel l'enfant a été exposé lors de son jeune âge. Ensemble, ces résultats soutiennent le modèle de production de rêves dysphoriques proposé par Levin et Nielsen (2007), qui se base sur une prémisse importante, soit la continuité affective entre le sommeil et l'éveil (Domhoff, 1996; Hall & Nordby, 1972). Cette prémisse stipule que certaines structures et processus impliqués dans la production de rêves dysphoriques sont également impliqués dans l'expression de symptômes pathologiques à l'éveil. En d'autres termes, l'hypothèse de continuité des rêves postule l'existence d'une correspondance entre l'expérience onirique et la pensée d'éveil, et peut expliquer la présence de certains corrélats psychologiques des rêves dysphoriques. Les résultats de cette thèse étendent cette hypothèse aux populations plus jeunes, où l'expérience répétée de rêves dysphoriques à tonalité négative durant l'adolescence pourrait être reliée aux problèmes d'adaptation psychosociale vécus durant l'éveil et à la détresse associée.

Qui plus est, nos résultats soutiennent l'idée que la production de rêves dysphoriques et ses comorbidités avec des symptômes psychopathologiques sont marquées par un style de réactivité émotionnelle intense et négative, qui se traduit également dans une haute détresse associée aux rêves dysphoriques. Ainsi, de futures études pourraient se concentrer sur l'effet de l'émotivité négative ou de la détresse affective associée aux rêves dysphoriques dans les associations longitudinales entre les rêves dysphoriques, les idéations suicidaires et les symptômes intériorisés. De plus, cette thèse s'est davantage concentrée sur les symptômes intériorisés, mais de futures études devraient également se pencher sur les symptômes extériorisés puisqu'ils sont aussi associés aux rêves dysphoriques (Gauchat et al., 2020; Liu et al., 2022),

mais également sur d'autres variables clés, tel que l'attachement, qui peut jouer un rôle important dans le contenu et le rappel des rêves (McNamara et al., 2001; Roisman et al., 2014).

Toujours sur le plan théorique, les résultats permettent de préciser l'hypothèse de l'accélération du stress des problèmes de santé mentale, telle qu'adaptée aux rêves dysphoriques par Nielsen (2017a) et soutiennent les travaux de Carr et Nielsen (Carr et al., 2021; Carr & Nielsen, 2017) sur la sensibilité au traitement sensoriel (Aron et Aron, 1997). Ils convergent avec l'idée que c'est la combinaison entre un environnement social précoce et une sensibilité individuelle précoce qui serait le plus fortement associée au développement des rêves dysphoriques. Nos résultats complètent et nuancent la littérature en montrant que l'émotivité négative précoce pourrait être à la fois néfaste dans un environnement adverse et bénéfique dans un environnement positif. Ainsi, sur le plan pratique, considérer l'émotivité négative précoce comme un facteur de risque uniquement et considérer les enfants présentant cette dimension du tempérament comme vulnérables ne tient pas compte du fait qu'ils pourraient montrer de plus grands signes d'adaptation lorsqu'ils sont exposés à un environnement positif. De plus, cette dimension du tempérament porte une étiquette à connotation péjorative, ne tenant pas compte des avantages associés lorsqu'elle est combinée à un environnement positif.

Dans son ensemble, cette thèse amène une meilleure compréhension du rôle de l'émotivité négative précoce en fonction de la nature de l'environnement social précoce, éclairant alors les politiques et les interventions qui se concentrent sur l'émergence précoce de problèmes de santé mentale et de sommeil. Les professionnels en santé mentale pourraient tenir compte de l'émotivité négative précoce des enfants, en conjonction avec la constellation de facteurs familiaux et environnementaux précoces, lors de la conception de programmes de prévention visant à réduire la prévalence des rêves dysphoriques. Cela est d'autant plus important sachant que les données montrent que la fréquence des rêves dysphoriques est associée au risque

suicidaire et aux symptômes intériorisés à l'adolescence. Les études futures devraient alors se concentrer sur l'occurrence des rêves dysphoriques tout en considérant leurs associations avec la détresse vécue à l'éveil. À titre d'exemple, une étude longitudinale a montré une réduction des consultations psychiatriques pendant l'enfance chez les garçons dont les parents ont participé à un programme personnalisé qui prenait en compte le type de tempérament de l'enfant (Cameron et al., 2013).

Toujours sur le plan pratique, la bidirectionnalité des associations trouvées dans l'article 1 met en évidence que la détresse vécue à l'éveil et celle reliée au sommeil s'exacerberaient l'une l'autre, et seraient associées à une augmentation de la souffrance psychologique et de la fréquence des rêves dysphoriques. Une implication majeure de cet article est l'identification de la fréquence des rêves dysphoriques comme une variable intermédiaire potentielle entre le niveau de détresse à l'éveil et la présence d'idéations suicidaires. Ainsi, la fréquence des rêves dysphoriques, identifiée dès l'âge de 13-14 ans, pourrait représenter une cible importante pour la prévention du risque suicidaire chez les adolescents. De plus, cette implication clinique est d'autant plus importante, sachant que les adolescents ne se sentent généralement pas confortables à rapporter leurs pensées suicidaires, notamment lorsque la confidentialité ne leur est pas assurée (Lothen-Kline et al., 2003). Ainsi, s'intéresser à l'expérience onirique et aux mécanismes développementaux associés au suicide pourrait être socialement et cliniquement significatif dans l'évaluation du risque suicidaire chez les adolescents. Finalement, étant donné que les interventions qui visent à réduire les rêves dysphoriques sont relativement simples à mettre en place et semblent efficaces (Gauchat & Zadra, 2012; Gieselmann et al., 2019; Morgenthaler et al., 2018), les études futures pourraient examiner l'effet de ces interventions sur l'adaptation psychosociale des jeunes, ainsi que sur le risque suicidaire.

4. Conclusion de la thèse

Cette thèse s'est concentrée sur l'expérience onirique, le risque suicidaire et les symptômes intériorisés des adolescents, ainsi que sur ses associations avec l'adversité précoce et le tempérament de l'enfant. Tout d'abord, il existe une séquence développementale significative d'associations prédictives et indépendantes entre les rêves dysphoriques et les idéations suicidaires. Ensuite, l'adversité vécue en bas âge est associée à une fréquence élevée de rêves dysphoriques à l'adolescence mais seulement chez les enfants avec une émotivité négative élevée. Finalement, lorsque les enfants avec une émotivité négative élevée sont exposés à un environnement positif précoce, ceux-ci sont moins à risque de développer des rêves dysphoriques que leurs pairs ayant des niveaux d'émotivité négative plus bas. D'une part, il est encouragé de poursuivre l'étude des corrélats psychosociaux aux rêves dysphoriques afin de mieux comprendre les mécanismes sous-jacents et de possiblement inclure cette variable dans des outils de dépistage du risque suicidaire. D'autre part, il est recommandé de poursuivre les études sur le rôle des interactions entre l'environnement précoce et le tempérament précoce sur le développement des rêves dysphoriques chez les jeunes. Il semble que l'émotivité négative précoce pourrait jouer un rôle à la fois néfaste et bénéfique dans l'expérience onirique des jeunes selon la qualité de l'environnement social auquel l'enfant a été exposé lors de la petite enfance. Enfin, il est important de continuer la recherche dans ce domaine afin de déterminer s'il est pertinent ou possible d'appliquer cliniquement ces résultats prometteurs, que ce soit pour la prévention du suicide ou pour mieux comprendre ainsi qu'améliorer l'adaptation psychosociale des jeunes. Étant donné le manque de consensus sur la fonction des rêves dans la communauté scientifique et la montée récente des études empiriques sur le domaine, davantage de recherches pourraient être

effectuées à ce sujet afin d'approfondir notre compréhension de l'expérience onirique et de ses corrélats psychopathologiques, ainsi que d'informer les professionnels en santé mentale.

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Annexe 1 – Article 1

Association between Recurrent Dreams, Disturbing Dreams and Suicidal Ideation in Adolescents

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Contribution des auteurs

Aline Gauchat : Conceptualisation de l'article, méthodologie, analyses statistiques, interprétation des résultats, rédaction et révision de l'article

Antonio Zadra : Soutien à la conceptualisation de l'article, méthodologie, soutien aux analyses statistiques et à l'interprétation des résultats, soutien à la rédaction, révision et soutien à la publication de l'article, financement de la recherche

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Abstract

Disturbing dreams and recurrent dreams have both been linked to a wide range of psychological difficulties in children. There is growing evidence that the experience of frequent disturbing dreams is associated with suicidal ideation in adults but studies in young adolescents have been limited and the results inconsistent. In addition, the possible relationship between suicidal ideation and recurrent dreams has yet to be studied. We thus investigated the relation between disturbing dreams, recurrent dreams and suicidal ideation in a sample of young adolescents. Self-report measures of disturbing dream frequency, recurrent dream frequency, and suicidal ideation were collected at age 12 years and again at age 13 years from 170 children from a prospective population-based birth cohort. While the rate of disturbing dreams and recurrent dreams dropped between ages 12 and 13, the rate of self-reported suicidal ideation increased between the ages of 12 and 13 years. Analyses taking sex and age into account revealed that young adolescents who reported having had suicidal thoughts over the past year had significantly greater frequencies of disturbing dreams and of recurrent dreams than adolescents who had not thought about suicide. These findings highlight the potential clinical value of assessing disturbing and recurrent dreams as part of the screening process for suicidal ideation in young adolescents.

Keywords: Dreaming, recurrent dreams, nightmares, suicidal ideation, adolescence

Résumé

Les rêves dysphoriques et les rêves récurrents ont été associés à un large éventail de difficultés psychologiques chez les enfants. Il existe de plus en plus d'évidences que l'expérience de rêves dysphoriques fréquents est associée aux idéations suicidaires chez les adultes, mais les études sur les jeunes adolescents sont limitées et les résultats sont incohérents. En outre, l'association possible entre les idéations suicidaires et les rêves récurrents n'a pas encore été étudiée. Nous avons donc étudié l'association entre les rêves dysphoriques, les rêves récurrents et les idéations suicidaires au sein d'un échantillon de jeunes adolescents. Des mesures auto-rapportées de la fréquence des rêves dysphoriques, de la fréquence des rêves récurrents et des idéations suicidaires ont été recueillies à l'âge de 12 ans et à nouveau à l'âge de 13 ans auprès de 170 enfants d'une cohorte de naissance prospective provenant de la population générale. Alors que le taux de rêves dysphoriques et de rêves récurrents a diminué entre 12 et 13 ans, le taux d'idéations suicidaires auto-rapportées a augmenté entre 12 et 13 ans. Des analyses tenant compte du sexe et de l'âge ont révélé que les jeunes adolescents qui ont déclaré avoir eu des idéations suicidaires au cours de la dernière année avaient une fréquence de rêves dysphoriques et de rêves récurrents significativement plus élevée que les adolescents qui n'avaient pas pensé au suicide. Ces résultats soulignent la valeur clinique potentielle de l'évaluation des rêves dysphoriques et récurrents dans le dépistage des idéations suicidaires chez les jeunes adolescents.

Mots-clés : Rêves, rêves récurrents, cauchemars, idéations suicidaires, adolescence

1. Introduction

Disturbing dreams (DD) are vivid dreams marked by intense negative emotions such as fear, sadness and anger (Gauchat et al., 2020; Nielsen & Levin, 2007; Robert & Zadra, 2014). Research on the correlates of DD in adolescents has been inspired by studies of adults in whom these relations have been investigated at length (Levin & Nielsen, 2007; Sandman et al., 2013). DD, including bad dreams and nightmares, are frequently experienced by children and adolescents (Gauchat et al., 2014; Gauchat et al., 2009; Ophoff et al., 2018) and their occurrence is linked to a range of psychological difficulties, including anxiety, depression and behavioural difficulties (Gauchat et al., 2014; Gauchat et al., 2020; Simard et al., 2008). One meta-analysis showed that frequent DD are positively associated with suicidal ideation in adults (Pigeon et al., 2012) and DD is the sleep-related problem most strongly associated with suicidal risk in people having attempted suicide (Nadorff, Anestis, et al., 2014; Sjöström et al., 2009). Similar results have been obtained in non-clinical adult populations (Bernert et al., 2017; Cukrowicz et al., 2006; Sandman et al., 2013).

Few studies, however, have examined these relations in adolescents. This lack of information is an important gap given that suicide constitutes a major public health concern and that suicide attempts increase markedly during adolescence (Brezo et al., 2008; Gould et al., 2003; Nock et al., 2013; Patton et al., 2009; Perou et al., 2013) and several authors have expressed concerns about the lack of studies on DD and suicidality in younger populations (Abe & de Kernier, 2013; Bernert & Joiner, 2007; Liu & Buysse, 2006; Russell et al., 2018). Identifying correlates of suicidal ideation in adolescents is particularly important since this population is often reluctant to share or report their suicidal thoughts (Bernert et al., 2015; Britto et al., 2010; Lothen-Kline et al., 2003; Russell et al., 2018). Moreover, about one third of

individuals experiencing suicidal ideations will plan a suicide, and 56% will make an attempt (Nock et al., 2008; Nock et al., 2013).

Furthermore, the few existing studies focusing on adolescent populations have yielded inconsistent results. One study (Choquet & Menke, 1990) of European adolescents aged between 13 and 16 found a significant association between frequent DD and suicidal ideation. Similarly, one study (Liu, 2004) of Asian adolescents aged between 12 to 18 found that those who reported having DD "sometimes" or "often" were 2 to 3 times more likely to report suicidal ideation than were those who rarely had DD. Moreover, the association between DD and suicidal ideation remained significant even after controlling for depression. By contrast, one study (Roberts & Lennings, 2006) of Australian adolescents between 12 and 18 years of age found that DD frequency was not significantly associated with suicidal ideation. As this finding was secondary to the study's main goals, no explanations were provided for this result.

In one prospective study (Wong et al., 2011) of American children, only "having trouble sleeping", but not the occurrence of DD, between the ages of 12 and 14 predicted suicidal thoughts at ages 15 to 17 when common risk factors and other sleep problems were controlled for. More recently, one study (Stanley et al., 2017) of children between the ages of 6 to15 years suffering from a bipolar disorder found that after controlling for depression, trauma history and generalized anxiety disorder, those presenting with a lifetime history of nightmare disorder had a two-fold increase in their risk for suicide. Finally, in a cross-sectional study of 15 to17 year-old adolescents, those reporting clinically salient nightmares were found to have a three-fold increase in suicidal ideation (Russell et al., 2018).

Although the contents of DD tend to vary over time, recurrent dreams (RD) are defined as a class of dreams that reoccur over time while maintaining the same theme and content (Brown & Donderi, 1986; Domhoff, 1993; Gauchat et al., 2015; Zadra et al., 2006). Only about 75% of

recurrent dreams are described as being negatively toned, with another 10% containing a mixture of positive and negative emotions (Zadra et al., 2006). Studies in adults converge in showing that people reporting RD obtain higher scores on measures of depression, anxiety, neuroticism and stress events, than people without RD (Brown & Donderi, 1986; Duke & Davidson, 2002; Gauchat et al., 2015; Kroth et al., 2002; Robbins & Tanck, 1992; Zadra et al., 1998). Two studies of "general sleep-related experiences," a construct composed of several dream and sleep-related experiences, including recurrent dreams, found that these experiences were significantly more frequent in clinical groups than in control participants and that recurrent dreams correlated significantly with psychological distress (Soffer-Dudek & Shahar, 2009; Soffer-Dudek et al., 2011).

More recently, a study of RD content, based on self-determination theory, found that these dreams were more likely to feature negative emotions in people experiencing "psychological need frustration" (Weinstein et al., 2018). Finally, the only study to have specifically examined the psychological correlates of recurrent dreams in adolescents found that by age 11, the presence of recurrent dreams was already associated with emotional difficulties in boys, but not necessarily in girls (Gauchat et al., 2009).

Studies have yet to investigate if recurrent dreams, much like DD, are also associated with suicidal ideation in adults or adolescent populations. The aim of the present study was to investigate the relations between DD, RD and suicidal ideation over a one year period in young adolescents between the ages of 12 and 13 years.

2. Materials and Methods

2.1 Participants

Participants were adolescents taking part in a broader longitudinal study focusing on the social, psychological and cognitive development of children from all urban socioeconomic

backgrounds in Québec, Canada. At the study's inception, 1000 families of newborns were randomly selected from the 1996 birth register (Jetté et al., 1997). Of these, 572 accepted to participate in the original study and were subsequently assessed annually in French (~82%) or English (Canada's two official languages) from when their infants were age 5 months. Due to annual attrition, variability in the participants' year to year availability for data collection and budgetary constraints to maintain follow-up, a total of 216 children (comprised equally of boys and girls) completed the present study at age 12, and 195 at age 13. These samples did not differ from the rest of the original sample of children in terms of socio economic level, including family income (at 12: p=.10; at 13: p=.47), family type (single parent or not) (at 12; p=.60; at 13 p=.14), and level of education of the child's mother (at 12: p=.62; at 13: p=.60).

2.2 Measures

Presence of suicidal ideation and frequency of DD and RD were assessed within a battery of self-reported questionnaires. Suicidal ideation was assessed with the following item: "Over the past 12 months, did you ever seriously consider attempting suicide?" which has been extensively validated (Bolanis et al., 2020; Geoffroy et al., 2016; Marschall-Lévesque et al., 2017; Orri et al., 2020). When interacting with adolescents, the term "bad dreams" (defined as very disturbing dreams) was used to refer to DD as the broader construct of DD was too unfamiliar of a concept given the age of our participants. Adolescents were required to answer the question: "On average, how frequently do you have bad dreams?" using the following choices: "Never," "Sometimes," "Often," "Always," or "Don't know." Those reporting bad dreams were also asked to estimate the number of bad dreams experienced over the past month (Gauchat et al., 2020; Gauchat et al., 2009; Liu, 2004; Liu et al., 2017; Robert & Zadra, 2008; Tanskanen et al., 2001). Responses for adolescents who reported "never" to the previous question were coded as 0 while a maximum frequency was set at 30 (i.e., 1 DD/day) to limit the impact of potential outliers. A one- month

retrospective frequency estimate was used instead of a one year estimate as it has been shown to correspond more closely to prospectively-collected log-based frequency measures of DD from the same individual. An RD was defined as "a dream that, when recalled, gives you the impression that you had it before." Adolescents were asked whether or not they experienced a recurrent dream in the past 12 months and, if yes, had to report the frequency of their RD (Gauchat et al., 2020; Gauchat et al., 2009). Responses for adolescents who reported that they did not have RD were coded as 0 for the frequency variable.

2.3 Procedure

When the adolescents were aged 12 and 13 years, each parent or person responsible for the adolescent received an invitation to participate in the study along with a consent form. Appointments were then scheduled where research assistants met the caregivers and adolescents. Adolescent participants could complete the questionnaires confidentially which reduces response bias, (Britto et al., 2010; Lothen-Kline et al., 2003) and were provided with a list of adolescent-oriented resources. Research assistants were trained to implement a clinical follow up safety protocol devised by JR in case of a need – no request was made. The study was approved by the CHU Ste-Justine Research Center and the study protocol also complied with the ethical guidelines of the American Psychological Association (2017).

2.4 Analyses

Adolescents with or without suicidal ideation were compared using repeated measure (ages 12, and 13) mixed-effects model analyses in SPSS (Version 18) to investigate the relationships between DD, RD and suicidal ideation in two separate models. We chose a mixed-effects model as opposed to a traditional repeated-measure ANOVA as it allows for an unbalanced design. In a mixed-effects model, if data for one of the years is missing, the other year is still included in the analyses, whereas traditional repeated-measures ANOVA requires

data from each time point for each participant to be entered in the analyses. Thus, the mixed effect model actually uses all the available information for parameter estimation. Two different models were tested because even if DD and RD are not independent disorders, they represent two different constructs that share less than 4% of variance: the correlations between RD and DD at age 12 was .11 ($p = .14$), and .21 ($p < .05$) at age 13. Suicidal ideation was treated as a predictor variable; the covariates were sex and age while DD or RD frequencies were the dependent variables.

3. Results

The proportion of adolescents reporting suicidal ideation at ages 12 and 13 as well as group mean frequencies and standard deviations of DD and RD are presented in Table 1 (p. 169). The prevalence of suicidal ideation found in the current sample (Bolanis et al., 2020; Geoffroy et al., 2016; Marschall-Lévesque et al., 2017; Orri et al., 2020) was comparable to that of other studies for this age group (Breton et al., 2002). Another health survey examining adolescents aged 15 years old or older reported a gradual increase in suicidal ideations rates throughout adolescence (Camirand et al., 2016). The proportion of adolescents with DD was comparable to other studies although comparisons across studies is difficult because of methodological differences in DD assessment (Gauchat & Zadra, 2012; Hasler & Germain, 2009). As can be seen in Table 1 (p. 169), DD and RD frequencies decreased between the ages of 12 and 13. Conversely, the rate of self-reported suicidal ideation more than tripled between the ages of 12 and 13 years, which coincides with the transition from primary to secondary school.

Table 1. Descriptive Statistics of Disturbing Dreams, Recurrent Dreams and Suicidal Ideation

Age (years)	DD mean frequency (SD)	RD mean frequency (SD)	% of adolescents with suicidal ideation
12	2.5 (3.1)	1.0 (2.4)	2.8
13	1.8 (2.8)	0.4 (1.2)	10.2

In the first model of the relation between suicidal ideation on DD frequency we tested interactions with sex (p = .21) and with age (p =.91) to verify the assumption of homogeneity of slopes, and both interactions were non-significant so were removed from the model. Sex and age therefore met criteria for being used as covariates in the model. The main effect of suicidal ideation was significant $F(1,315) = 4.1$, $p < .05$ and so was the main effect of age $F(1,315) = 5.43$, $p < .05$ whereas the main effect of sex was not significant $p = .27$. Adolescents had significantly fewer DD at age 13 than at age 12 (see table 1). Finally, adolescents without suicidal ideation had significantly fewer DD ($M = 2.2$; $SD = 3.0$) than adolescents with suicidal ideation ($M = 4.0$; $SD = 3.2$).

In the second model of the relation between suicidal ideation and RD frequency, we again tested interactions with sex ($p = .79$) and with age ($p = .87$) to verify the assumption of homogeneity of slopes, and both interactions were non-significant so were removed from the model. Sex and age were left as covariates in the model. The main effect of suicidal ideation was significant $F(1,337) = 11.1$, $p < .05$ and so was the main effect of age $F(1,337) = 20.67$, $p < .05$ whereas the main effect of sex was not significant (p = .35). Adolescents had significantly fewer RD at age 13 than at 12 (see Table 1). Also adolescents without suicidal ideation had significantly lower frequency of RD ($M = 0.6$; $SD = 1.9$) than adolescents with suicidal ideation ($M = 2.8$; $SD = 3.0$).

4. Discussion

This study is the first to report an association between self-reported frequencies of DD as well RD experiences and suicidal ideation in young adolescents. Specifically, our results indicate that by ages 12 and 13, and even after controlling for age and sex, young adolescents who reported having had suicidal ideations during the past 12 months experienced higher frequencies of DD and RD than those who had not thought about suicide. The results from our measures of DD frequency are consistent with findings described in adult populations (Becker et al., 2018; Bernert et al., 2017; Cukrowicz et al., 2006; Pigeon et al., 2012; Sjöström et al., 2009) as well as in some studies involving adolescents (Choquet & Menke, 1990; Liu, 2004; Russell et al., 2018; Stanley et al., 2017). Furthermore, the present study, which was the first to investigate the relation between RD occurrence and suicidal ideation in any population, also revealed a significant link between these two variables in young adolescents.

With respect to the association between DD and suicidal ideation, since the content of everyday dreams in adults has been shown to reflect the conceptions we have of ourselves, of other people, and our ongoing concerns (Bulkeley, 2018; Domhoff, 2011, 2018; Pesant & Zadra, 2006; Schredl & Hofmann, 2003), the repeated experience of intensely negatively toned dreams during adolescence may be related to negative emotional turmoil experienced during wakefulness. It is also possible that this association is partially explained by the presumed role of non-disturbed *dreaming* in emotional regulation (Abe & de Kernier, 2013; Levin et al., 2010; Littlewood et al., 2017; Scarpelli et al., 2019). In fact, dreaming (especially during REM sleep) may play a role in emotion regulation and thus contribute with a better waking adjustment. Finally, the directionality of the association between DD and impoverished well-being over a period of months or years may become bi-directional as it is also thought that negative dream

content can adversely affect emotional states upon awakening in adults (Lancee & Schrijnemaekers, 2013).

Given the mounting evidence linking DD to suicidal ideation, including in young adolescents, two clinical variables merit further study. First, the added value of including an assessment question on DD frequency in screening instruments targeting youth at risk of suicidal behaviors should be investigated. Second, the potential therapeutic effect of DD treatment on the frequency and intensity of suicidal ideation in at risk populations has yet to be explored. This is all the more important since there exist effective, short-term cognitive-behavioral treatments (e.g., imagery rehearsal therapy) for idiopathic, chronic, and trauma-related nightmares with well-established success rates in adults (Augedal et al., 2013; Krakow & Zadra, 2006; Morgenthaler et al., 2018; Nadorff, Lambdin, et al., 2014) and which have also been shown to be effective in young children and adolescents (Nadorff, Lambdin, et al., 2014; Simard & Nielsen, 2009; St-Onge et al., 2009).

Additional work is also required to clarify the nature and significance of the relation between RD and suicidal ideation. Studies of RD in adult populations (Brown & Donderi, 1986; Soffer-Dudek et al., 2011; Zadra et al., 1998) have shown that RD are associated with lowered scores on indices of psychological well-being and one study (Gauchat et al., 2009) in adolescents found that the presence of RD was linked to reactive aggression (defined as a defensive reaction to a stimulus which is perceived as threatening (Dodge et al., 1997) among boys. The present results add to the clinical importance of these findings and, taken as a whole, point to a need for additional studies of RD and their correlates.

One important limitation of the present study was the relatively small sample that did not allow to reliably control for other potential confounding variables and fully test mediating factors, such as victimization (Marschall-Lévesque et al., 2017) or depression, which is a

common risk factor to suicidal ideation and DD (Pigeon et al., 2012). Nonetheless, among adults the link between DD and suicidal thoughts seems to be maintained even after controlling for depression (Pigeon et al., 2012), which has been replicated in adolescents (Liu, 2004; Russell et al., 2018; Stanley et al., 2017). Furthermore, the increase noted in suicidal ideations between the age of 12 years old and 13 years old coincides with the transition between elementary school and high school and the numerous changes young adolescents face (Symonds & Galton, 2014; Virtanen et al., 2019). However, further research is needed to test that hypothesis. Finally, whereas in large community longitudinal cohort studies it may be most appropriate to study suicidal ideation in early adolescence (Marschall-Lévesque et al., 2017), or for specific research questions (Bolanis et al., 2020), such as we also report here, the assessment of actual suicidal behaviors, as they increase gradually with development, may index serious problem behavior later in adolescence. Therefore, it is important that questionnaires on suicidal thoughts and behaviors in longitudinal studies of children and youth also address a broader range of related behaviors in terms of frequency and intensity/seriousness, including actual attempts (Geoffroy et al., 2016; Orri et al., 2020).

Another limitation concerns the use of a retrospective self-report measure of nightmare frequency. While single versus multiple item measures of nightmare frequency have been shown to yield comparable validity coefficients (Kelly & Mathe, 2020), it is now well established that correlates of retrospective measures of dream recall (including of disturbing dreams) should not be assumed to be correlates of log measures of dream recall collected from the same individuals (Bernstein & Belicki, 1996; Wood & Bootzin, 1990; Zadra & Donderi, 2000). For example, a meta-analysis of studies examining the relationship between dream recall frequency and various personality dimensions found that scores on personality measures were not related to dream recall frequency *per se*, but rather to people's tendency to retrospectively underestimate or overestimate

their dream recall (Beaulieu-Prévost & Zadra, 2007). Thus, in addition to possible memory distortions and biases that can occur when completing questionnaires, important discrepancies can exist between the information collected via dream questionnaires and dream content and frequency findings obtained through the use of prospective dream journals. Future research efforts should therefore aim to include complementary measures of dream recall (e.g., multiple-item questionnaires as well as prospective dream logs).

In conclusion, although the direction of the association between RD, DD and suicidal ideation remains to be clarified over a longer period of time across adolescence, the present results add to those of previous studies in showing that disturbing and recurrent dreams show significant relations with the dreamer's awaken emotional state (Gauchat et al., 2020; Hartmann, 1998). Similarly, Weinstein and colleagues (2018) postulated that an accumulation of unresolved psychological need frustration might lead to bad dream reoccurrence, which may develop into RD. In the context of at-risk behaviors such as suicide, these observations are particularly important since adolescents are generally reluctant to talk about suicidal ideation, especially when confidentiality is not assured (Bernert et al., 2015; Britto et al., 2010; Lothen-Kline et al., 2003). Thus, collecting information on DD and its psychological mechanisms associated with suicide risk may be clinically valuable in the assessment of potential for suicide in at-risk individuals. Finally, work in adolescents and adult populations alike is required to delineate possible beneficial impacts of early treatments aimed at DD or RD on suicidal ideation.

Conflict of interests. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Annexe 2 – Article 2

Disturbing Dreams and Psychosocial Maladjustment in Children: A Prospective Study of the Moderating Role of Early Negative Emotionality

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Objectifs spécifiques de cet article : Examiner l'effet modérateur de l'émotivité négative précoce à 17 mois dans l'association entre la fréquence des rêves dysphoriques et les problèmes d'adaptation psychosociale (les comportements extériorisés et intériorisés) chez des jeunes de 11 ans.

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Aline Gauchat : Conceptualisation de l'article, méthodologie, analyses statistiques, interprétation des résultats, rédaction et révision de l'article

Antonio Zadra : Soutien à la conceptualisation de l'article, méthodologie, soutien aux analyses statistiques et à l'interprétation des résultats, soutien à la rédaction, révision et soutien à la publication de l'article, financement de la recherche

Mira El-Hourani : Recherche de la littérature, interprétation des résultats, rédaction, révision et publication de l'article

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Abstract

Although frequent disturbing dreams, including bad dreams and nightmares, have been repeatedly associated with poor psychological well-being in adults, considerably less information exists on their psychosocial correlates in children. Recent empirical and theoretical contributions suggest that the association between disturbing dream frequency and psychosocial adaptation in children may differ as a function of children's negative emotionality. The current study assessed the moderating effect of very early negative emotionality (17 months of age) in the relation between disturbing dream frequency and psychosocial maladjustment (i.e., externalizing + internalizing behaviors) in a sample of 173 11-year-old children. Mixed model analyses revealed that disturbing dream frequency was associated with some internalizing behaviors but that the association between disturbing dream frequency and most externalizing behaviors was moderated by early negative emotionality. The latter result indicates that the relation between disturbing dream frequency and externalizing behaviors was significant in 11-year-old children showing moderate negative emotionality early in life, but particularly strong in those children with high early negative emotionality. Whereas a moderating effect of early negative emotionality was not found between disturbing dream frequency and internalizing behaviors, the findings highlight the more specific role of early emotional negativity as a developmental moderator for the link between disturbing dreams and externalizing behaviors in children. The results are discussed in light of recent models of disturbed dreaming production.

Keywords: Disturbing dreams, nightmares, bad dreams, dreaming, psychosocial maladjustment, temperament, early negative emotionality.

Résumé

Bien que les rêves dysphoriques fréquents (c'est-à-dire les mauvais rêves et les cauchemars) aient été associés à plusieurs reprises à un moindre bien-être psychologique chez les adultes, il existe peu d'évidences sur leurs corrélats psychosociaux chez les enfants. Des contributions empiriques et théoriques récentes suggèrent que l'association entre la fréquence des rêves dysphoriques et les problèmes d'adaptation psychosociale chez les enfants peut différer en fonction de l'émotivité négative des enfants. La présente étude a examiné l'effet modérateur de l'émotivité négative précoce (à 17 mois) dans l'association entre la fréquence des rêves dysphoriques et les problèmes d'adaptation psychosociale (c'est-à-dire les comportements extériorisés et intériorisés) dans un échantillon de 173 enfants âgés de 11 ans. Des analyses de modèles mixtes ont révélé que la fréquence des rêves dysphoriques était associée à certains comportements intériorisés, mais que l'association entre la fréquence des rêves dysphoriques et la majorité des comportements extériorisés était modérée par l'émotivité négative précoce. Ce dernier résultat indique que l'association entre la fréquence des rêves dysphoriques et les comportements extériorisés était significative chez les enfants de 11 ans présentant un niveau modéré d'émotivité négative au début de leur vie, mais particulièrement plus forte chez les enfants présentant un niveau élevé d'émotivité négative précoce. Alors qu'un effet modérateur de l'émotivité négative précoce n'a pas été trouvé entre la fréquence des rêves dysphoriques et les comportements intériorisés, les résultats soulignent le rôle plus spécifique de l'émotivité négative précoce comme modérateur développemental du lien entre les rêves dysphoriques et les comportements extériorisés chez les enfants. Les résultats sont discutés à la lumière de modèles récents de production de rêves dysphoriques.

Mots-clés : Rêves dysphoriques, cauchemars, mauvais rêves, rêves, problèmes d'adaptation psychosociale, tempérament, émotivité négative précoce.

1. Introduction

Up to 20% of children experience psychosocial adjustment difficulties (Essex et al., 2009; Fechete et al., 2018) which are typically divided between externalizing and internalizing problems (Castellanos-Ryan et al., 2016; Ciccheti & Toth, 1991), although both categories evince common and unique risk factors (Bayer et al., 2011). Studies show that while good sleep quality is associated with optimal behavior development, poor sleep is related to both externalizing and internalizing problems (Alfano & Gamble, 2009; Alfano et al., 2007; Aronen et al., 2000; Becker et al., 2014; El-Sheikh et al., 2019; Gregory et al., 2005; Gregory & O'Connor, 2002; Gregory et al., 2009; Huhdanpää et al., 2018; Pieters et al., 2015; Quach et al., 2018; Rubens et al., 2017). Even after controlling for other risk factors, sleep problems appear to explain a small but significant proportion of the variance in both externalizing and internalizing behaviors (Pieters et al., 2015; Reid et al., 2009). However, different sleep problems appear to be associated to different externalizing or internalizing problems (Alfano & Gamble, 2009; Gauchat, 2015).

Among these sleep problems, disturbing dreams (DD; vivid dreams marked by intense negative emotions such as fear, anxiety and anger) are frequently experienced by children (Abdel-Khalek, 2006; Gauchat et al., 2014; Nielsen & Levin, 2007; Ophoff et al., 2018; Schredl et al., 2008). DDs may be associated with a wide range of psychosocial difficulties as they may signal problems with emotional regulation processes that normally occur during sleep as well as in dreams (for more details about this hypothesis see: (Ennis et al., 2017; Kramer, 1993; Levin & Nielsen, 2007; Nielsen, 2017; Nielsen & Levin, 2007). While frequent DD, including bad dreams and nightmares, have been repeatedly associated with poor psychological well-being and increased psychopathology in clinical and nonclinical adult populations (Levin & Nielsen, 2007), considerably less information exists on their psychosocial maladjustment correlates in children.

A recent review of the literature suggests that the occurrence of frequent DD during childhood and adolescence is associated with a range of difficulties (Gauchat et al., 2014). First, DD frequency is associated with other sleep-related problems including insomnia, sleepwalking, bruxism, sleep talking, sleep terrors, nighttime awakenings, and unwillingness to go to bed (Hawkins & Williams, 1992; Lebowitz et al., 2019; Russell et al., 2018; Salzarulo & Chevalier, 1983; Schredl et al., 2000; Schredl et al., 2009b; Shang et al., 2006; Simonds & Parraga, 1982; Stein et al., 2001). Second, DD have also been linked to a range of specific mental health symptoms and psychosocial problems, including low prosociality (Schredl et al., 2009b; Smedje et al., 2001), academic problems (Schredl et al., 2000), emotional excitability and being easily emotionally hurt (Fisher & Wilson, 1987), emotional symptoms (Lereya et al., 2017; Schredl et al., 2009b; Smedje et al., 2001), psychotic experiences (Fisher et al., 2014; Koopman-Verhoeff et al., 2019), borderline personality disorder (Lereya et al., 2017), other mental health disorders (Lemyre et al., 2019), as well as suicidal ideation and suicide attempts (Liu, 2004; Pigeon et al., 2012; Roberts & Lennings, 2006). A prospective study found that DD frequency at age 12 was related to symptoms of psychosis during adulthood (Thompson et al., 2015).

Moreover, DD frequency has been associated with internalizing problems in childhood and adolescence and repeatedly linked to anxiety (Alfano & Gamble, 2009; Floress et al., 2016; Gregory & Eley, 2005; Mindell & Barrett, 2002; Nielsen et al., 2000; Reynolds & Alfano, 2016; Schredl et al., 1996; Simard et al., 2008). Prospective studies of adolescents and late teenagers have similarly revealed links between parent-rated DD at 10-19 years of age and later symptoms of anxiety and depression at 18-32 years of age (Gregory et al., 2008). Moreover, DD frequency has also been linked to externalizing problems. Indeed, some studies of children show that DD are associated with conduct disorders (Schredl et al., 2009a), rule-breaking, aggression, impulsivity (Wong et al., 2018), and hyperactivity (Li et al., 2011; Muratori et al., 2019; Schredl

et al., 2009b). However, other studies did not find these associations (Smedje et al., 2001; Tsai et al., 2012). Some studies also reported significant associations between DD frequency and Attention Deficit Hyperactivity Disorder (ADHD) (Grünwald & Schlarb, 2017) as well as with ADHD subtypes (Chiang et al., 2010; Mayes et al., 2008), and one prospective study found that parent-rated DD at 10-19 years of age predicted symptoms of inattention and direct/indirect aggression at 18-32 years of age (Gregory et al., 2008).

Finally, some studies reviewed above combine sleep-related difficulties into one construct, thus not taking into account the differential relations of each sleep problem with unique measures of daytime functioning (Quach et al., 2018; Wang et al., 2019; Zhang et al., 2018). Thus, whether or not DD are related equally across internalizing and externalizing problems remains to be determined.

To further clarify inconsistencies in the literature, the construct of "affect distress," defined as a trait-like disposition to react to emotional stressors with heightened negative affect and distress (Gieselmann et al., 2019) should be taken into account as it may play a role in the association between DD and psychosocial adjustment difficulties. First, Levin and Nielsen's (Levin & Nielsen, 2007) model of DD production proposes that DDs occur out of an interaction between "affect load," or day-to-day variations in emotional stress, and the aforementioned construct of affect distress, which can be viewed a temperament subtype. Affect distress would fall under the negative emotionality dimension of temperament (Rothbart et al., 2001; Rothbart & Jones, 1998). In the developmental literature, negative emotionality encompasses individual differences in typical reactions to negative emotional experiences, which can be readily observed from birth (Gartstein & Rothbart, 2003; Sanson et al., 2004). In fact, negative emotionality was found to be stable from early childhood to early adolescence (Kopala-Sibley et al., 2018), and was found to have a moderate continuity 17 years later (3 – 20 years old) (Pesonen et al., 2003).

Second, negative emotionality or difficultness, which refers to the tendency to experience negative emotions (fear, anger, sadness, discomfort) and high emotional distress when confronted to novel, ambiguous and intense situations (Rothbart et al., 2001), has been related to psychosocial maladjustment throughout infancy and childhood (Clark et al., 1994; Rhee et al., 2015; Uhl et al., 2019). Recently, it is its moderating effect that has been mainly reported in the literature. Indeed, difficultness is already known to moderate relations between a variety of risk factors and children's behavior, such as the associations between cumulative contextual risk and children's externalizing, internalizing, and sleep problems (Bush et al., 2010; Northerner et al., 2016; Pluess & Belsky, 2010; Veenstra et al., 2006). Some early temperamental characteristics may indeed predispose children to develop later behavior problems, particularly when other risk factors are present (Davis et al., 2015; Edwards & Hans, 2015; Jessee et al., 2012; Karreman et al., 2009).

Taken together, Nielsen and Levin's (Levin & Nielsen, 2007) model of disturbing dreams production and developmental literature on temperament suggests that the link between the frequency of DD and psychosocial adaptation may differ as a function of a child's negative emotionality. This hypothesized moderator effect of negative emotionality has never been empirically tested. Furthermore, there is a lack of data on the relation between DD and externalizing problems and most studies of DD in children suffer from one of the following three methodological limitations. First, DD frequency in children is often assessed through parent reports, despite the fact that this method has been shown to underestimate DD frequency and distress in comparison to child self-reports (Floress et al., 2016; Mindell & Barrett, 2002; Schredl et al., 2009a, 2009b). Second, many studies did not include any adjustment for possible confounding factors, such as risk factors common to both psychopathology and DD (e.g., socio-economic status or comorbid sleep problems), despite the fact that taking such factors into

account has been shown to attenuate observed associations (Coulombe et al., 2010). Third, and finally, although it is important to measure children's psychosocial maladjustment through multiple informants due to differences in child behavior across contexts (Muratori et al., 2019; van der Ende et al., 2012), multiple informants have rarely been used in the reviewed studies (Gauchat et al., 2014).

The goal of the present study was to first investigate the relationship between DD frequency and psychosocial maladjustment in children across a wide range of internalizing and externalizing behaviors and second, to take into account the possible moderator effect of early emotional negativity. Methodological shortcomings characteristic of many studies in the field were also addressed: (a) measures of DD frequency were obtained from the children themselves, (b) socio-economic status and co-morbid sleep disorders were taken into account in the analyses, and (c) children' psychosocial maladjustment was assessed through multiple informants.

Two main and complementary predictions were tested: 1) DD frequency will be positively associated with psychosocial maladjustment across several internalizing and externalizing behavioral domains; 2) Negative emotionality will moderate this relation between measures of DD frequency and psychosocial maladjustment across several internalizing and externalizing behavioral domains. Specifically, we tested the hypothesis that the association between DD frequency and internalizing and externalizing problems would be strengthened with increasing levels of negative emotionality. These hypotheses will be tested separately for each internalizing (anxiety, social withdrawal, and emotional problems), and externalizing (opposition, physical aggression, reactive, proactive aggression, indirect aggression and ADHD) symptoms.

2. Materials and Methods

2.1 Participants

Participants were part of a longitudinal study focusing on the social, psychological, and cognitive development of children from urban socio-economic backgrounds in the province of Québec, Canada. At the study's inception, 1000 families were randomly selected from the Québec 1996-1997 birth register (Santé Québec et al., 1997). Of these, 572 accepted to participate in the original study and were then assessed annually in French (~82%) or English (Canada's two official languages) from the age of 5 months. Due to annual attrition, variability in the participants' year to year availability for data collection, and funding constraints which limited the capacity to follow-up all families, a total of 173 children (comprised equally of boys and girls) completed the present study (mean age = 11.4 years, SD = 0.1). These 173 children did not differ from the remainder of the original 572 five-month-old children in terms of their socio-economic level, including family income ($p = 0.68$), family type (single parent or not; $p = 0.57$), maternal level of education ($p = 0.33$), or age 17 months negative emotionality ($p = 0.54$). They did not differ on other behavioral measures at 17 months in term of hyperactivity ($p = 0.73$); inattention ($p = 0.89$); emotional troubles ($p = 0.77$); anxiety ($p = 0.74$); physical aggression ($p = 0.71$), except for opposition with children in the current sample being a little less oppositional ($M = 3.2$; $SD = 1$) than the remainder of the sample ($M = 3.5$; $SD = 1.1$); $t = 2.8$; $p < .05$.

2.2 Measures

2.2.1 Assessment of Disturbing Dreams. Participants from this longitudinal sample self-reported about their DD for the first time at 11 years. The instructions to children referred to DD using the expression "bad dreams" (defined as very disturbing dreams) because the term DD was too unfamiliar to them given their age. Children were required to answer the question: "On average, how frequently do you have bad dreams?" using the following choices: "Never"

"Sometimes", "Often", "Always", or "Don't know." Participants reporting bad dreams were also asked to estimate the number of bad dreams experienced over the past month. For children who reported "never" in the previous question, number of bad dreams was coded as 0 while maximum frequency was set at 30 (i.e., 1 DD/day) to limit the impact of potential outliers. Thus, values for monthly DD frequency ranged between 0 and 30. A one-month retrospective frequency estimate was used instead of a one-year estimate as it has been shown to correspond more closely to prospectively collected log-based frequency measures of DD from the same individuals (Robert & Zadra, 2008; Zadra & Donderi, 2000).

2.2.2 Measures of psychosocial maladjustment. Psychosocial maladjustment was measured using a battery of validated scales (Baillargeon et al., 2007; Gauchat et al., 2009; Vaillancourt et al., 2007) drawn from various instruments. Some scales from the Preschool Behavior Questionnaire (Tremblay et al., 1992), the Child Behavior Checklist (Achenbach, 1999) and the Reactive and Proactive Aggression Questionnaire (Dodge & Coie, 1987) were used to create the questionaire. The scales (and mean Cronbach alpha across informants) included measures of both internalizing problems: anxiety (4 items, $M\alpha = 0.72$, e.g., being nervous, high-strung or tense), social withdrawal (3 items, $M\alpha = 0.68$), e.g., prefers to play alone rather than with other children), and emotional problems (3 items, $M\alpha = 0.69$), e.g., has trouble enjoying him or herself); and externalizing problems: opposition (3 items, $M\alpha = 0.51$) e.g., punishment doesn't change the child's behavior), physical aggression (4 items, $M\alpha = 0.75$), e.g., physically aggresses people), reactive aggression (4 items, $M\alpha = 0.75$), e.g., reacts aggressively when someone takes a personal belonging, for example by hitting, pushing or slapping another child), proactive aggression (3 items, $M\alpha = 0.55$), e.g., scares other children to get what is wanted), indirect aggression (3 items, $M\alpha = 0.69$), e.g., when angry at someone, tries to get others to dislike the other

person), ADHD symptoms (7 items, Mα = 0.86), e.g., cannot settle on anything for more than a few moments; is impulsive / acts without thinking; is inattentive). These validated scales (Baillargeon et al., 2007; Vaillancourt et al., 2007) have been shown to be sensitive to various environmental, familial and perinatal risk and protective factors (Charrois et al., 2019; Huijbregts et al., 2008; La Buissonnière-Ariza et al., 2019; Paquin et al., 2019; Rioux et al., 2019) as well as to early sleep patterns (Touchette et al., 2007). At age 11 years the instrument was completed by the participants themselves as well as by each child's father and teacher in order to get a complete description of their difficulties across social context. Questions for the child version were read to them by the research assistant but they could record answers confidentially.

2.2.3 Covariables.

2.2.3.1 Socio-economic status. Three variables were used to evaluate each family's socio-economic status: family income (continuous variable), level of maternal education (dichotomous variable, with a high level being defined as having a secondary school diploma or higher), and whether or not the child was in a single parent family (dichotomous variable).

2.2.3.2. Sleep. Two sleep-related variables were included: Sleepwalking, since this sleep disorder has been repeatedly associated with DD (Fisher & Wilson, 1987; Hawkins & Williams, 1992; Li et al., 2011; Schredl et al., 2000; Shang et al., 2006) and daytime somnolence because poor sleep quality (which usually leads to daytime somnolence) is associated with poor mood and behaviors (Alfano & Gamble, 2009; Touchette et al., 2007; 2009). Two questions to the mother were “Does your child sleepwalk in his/her sleep?” and “In general, is your child sleepy during the day?” Both could be answered with “Never”, “Sometimes”, “Often” or “Always”.

2.2.3.3. Negative emotionality. Negative emotionality was assessed at 17 months using a shortened scale developed by Vitaro and colleagues (Vitaro et al., 2006) of the original

fussy/difficult temperament scale developed by Bates and colleagues (Bates et al., 1979) (example of item: intensity of the child's protest). This seven-item scale was completed by the mother, in order to avoid a shared-method variance problem with the informants who completed the psychosocial adjustment measures for our analyses (Vitaro et al., 2006). The measure of negative emotionality used in the present study showed good internal consistency with a Cronbach alpha of .71.

2.3 Procedure

Each parent or legal guardian responsible for the child, and teacher received an invitation by mail to participate in the study. Consent was obtained from parents or legal guardians and assent was obtained from the child. The study was approved by the Research Ethics Committee of the CHU Ste-Justine Research Center and the study protocol also complied with the ethical guidelines of the American Psychological Association ("Ethical Principles of Psychologists and Code of Conduct.," 2017).

2.4 Analyses

Model used: Mixed-effects model analyses were estimated in "Statistical Package for the Social Sciences » (Version 18) (IBM, 2012) to investigate relationships between DD and dimensions of psychosocial maladjustment. Nine models were tested, one for each measure of psychosocial maladjustment, three for internalizing problems and 6 for externalizing problems. Specifically, responses provided by the three informants (child, teacher and father) were included for each psychosocial maladjustment scale within the mixed-effects models where each of the informants represents a repeated component. A mixed-effects model as opposed to a traditional repeated-measure ANOVA allows for an unbalanced design. This model is also adapted for situations with unequal covariance as it does not assume equal correlations across informants. In a mixed-effects model, if one or two informants are missing, the other informants are still

included in the analyses, whereas traditional repeated-measures ANOVA requires data from all three informants for each participant entered in the analyses. Thus the mixed effect model actually uses all the available information for parameter estimation (Harrison et al., 2018). Responses were available from all three informants for 78 participants (42.6%), from the child and teacher for 38 participants (22%), from the child and father for 32 participants (18.6%), and only from the child in 32 cases (18.6%). There was no systematic pattern of missing responses related to child behavior outcomes.

2.4.1 Preliminary analyses. Sex differences on DD frequency measures were assessed with T-tests. Potential a priori covariates were selected for inclusion in the analyses on an empirical basis in order to enter only meaningful variables and avoid loss of power (Tabachnick & Fidell, 2013) as it has been done in other studies (Jessee et al., 2012). This was done by first computing correlations or ANOVAs between potential control variables (socioeconomic status; SES, sleepwalking, somnolence) and outcome variables to determine which control variables should be entered as fixed effects for which outcome measures. If a potential control variable was related to an outcome variable (at $p \leq .05$) assessed by at least one of the informants, it was entered in the analysis. Maternal level of education was thus entered in the analyses for anxiety, physical aggression, ADHD symptoms, and opposition whereas family income was entered in the analyses for anxiety, ADHD symptoms and opposition (for all those variables a higher socio-economic status was linked to less psychosocial maladjustment). The family type and sleep disorder variables were not related to any of the psychosocial maladjustment measures. Whenever interactions between two variables were not significant, the interaction term was removed from the analytical model and only the main effect was tested.

Our two overarching hypotheses were tested using mixed-effects model for each psychosocial maladjustment problem within internalizing and externalizing problems. Informant

source and child sex were always entered as fixed effects. Interactions between DD measures and child sex or informant source were tested since children's behaviors can be perceived differently at school versus at home and because behavioral difficulties differ between boys and girls (Carneiro et al., 2016; Costello et al., 2003; van der Ende et al., 2012) resulting in differences in observed associations between DD and behavioral difficulties as a function of context and sex.

Interactions between DD and early negative emotionality were investigated to test the second hypothesis which proposed that early negative emotionality moderates the relationship between DD frequency and psychosocial maladjustment. DD frequency and early negative emotionality were centered.

3. Results

3.1 Descriptive statistics

Of the 173 children that completed the questionnaires, 129 (82.7%) reported experiencing at least one DD per month. The mean frequency of DD reported per month by the entire sample was 3.6 (*SD* = 5.3), with 12 % of the sample having 10 or more DD per month. A significantly greater proportion of girls (88.7%) reported having at least one DD in the last month than did boys (76.3%), $\chi^2 = 4.21$, $p < .05$. However, there were no significant sex differences in the actual number of DD experienced in the past month. Using the MIXED models, none of the DD by informant interactions were significant, and early negative emotionality was not correlated to DD ($r = 0.04$; $p = .58$). Correlations between each informant for a given variable vary between $r = 0.03$ for opposition and $r = 0.28$ for anxiety with a mean of M$r = 0.17$.

Before testing the moderating effect of early negative emotionality on each childhood dependent variable, we examined its correlation with DD to determine if it met criteria for moderation analysis. DD and early negative emotionality were not correlated ($r = 0.04$; $p = .58$). We also examined associations between early negative emotionality and dependent variables.

Correlations ranged from $r = 0.03$ to $r = 0.07$ with a mean of M$r = 0.05$ for internalizing behaviors, and they ranged from $r = 0.05$ to $r = 0.20$ with a mean of M$r = 0.09$ for externalizing behaviors. None of those correlations were significant except the one between early emotional negativity and physical aggression ($r = 0.19$; $p \leq .05$).

3.2 Associations between DD frequency and internalizing behaviors.

When considering internalizing behaviors, none of the interactions between DD and temperament were significant (all ps > 0.50). They were therefore removed from the models. Table 1 (p. 199) shows main effects and effect sizes for the association between DD frequency and internalizing problems once control variables were included in the statistical models. DD frequency was positively related to 2 of the 3 measures of internalizing behaviors (social withdrawal and emotional problems), with Cohen's *d* statistics of effect size for continuous variables in the small to medium range (Cohen, 1992). This only partially supports the first hypothesis, as no moderating effect of early negative emotionality was found.

Table 1. Main Effects of DD Frequency on Internalizing Problems

Variables	*F*	*df(v1,v2)*	*p*	*d*
Social withdrawal	5.26	1,141.75	.02	0.39
Emotional problems	9.17	1,175.91	.003	0.45
Anxiety	2.89	1,131.75	.09	0.30

3.3 Associations between DD frequency and externalizing behaviors

The interaction term between early emotional negativity and DD was kept in all models examining externalizing behaviors because p values were consistently below 0.13 (ranging from 0.001 for proactive aggression and 0.13 for opposition), suggesting that this pattern was not random. Table 2 (p. 200) presents results of the analyses of main effects and interactions for each externalizing behavior.

Table 2. Main Effects of DD Frequency and Interactions with Early Negative Emotionality for each Externalizing Behavior Problem

	Main effects of DD				Main effects of negative emotionality				Interaction between DD and negative emotionality			
Variables	*F*	*df(v1,v2)*	*p*	*d*	*F*	*df(v1,v2)*	*p*	*d*	*F*	*df(v1,v2)*	*p*	*d*
Indirect aggression	0.85	1,160.9	.36	0.14	0.59	1,160.1	.44	0.12	6.64	1,154.8	.01	0.41
Physical aggression	0.68	1,136.9	.41	0.14	0.48	1,125.1	.49	0.12	6.21	1,129.1	.01	0.44
Reactive aggression	0.42	1,160.2	.52	0.10	0.36	1,154.7	.55	0.09	4.25	1,152.0	.04	0.33
Proactive aggression	0.10	1,140.8	.33	0.05	1.69	1,138.2	.19	0.22	9.41	1,134.1	.003	0.53
Hyperactivity, Impulsivity and Attention symptoms (HIA)	1.03	1,129.9	.31	0.17	0.51	1,118.2	.48	0.13	5.69	1,120.1	.02	0.44
Opposition	0.01	1,127.9	.97	0.02	0.34	1,114.9	.56	0.10	2.34	1,117.5	.13	0.28

Figure 1 (p. 201) plots these interactions using the method proposed by Aiken and West (Aiken & West, 1991) by showing the strength of the association between DD frequency and each dimension of externalizing behaviors plotted as a function of early negative emotionality level (low (-1 SD), average or high (+1 SD)).

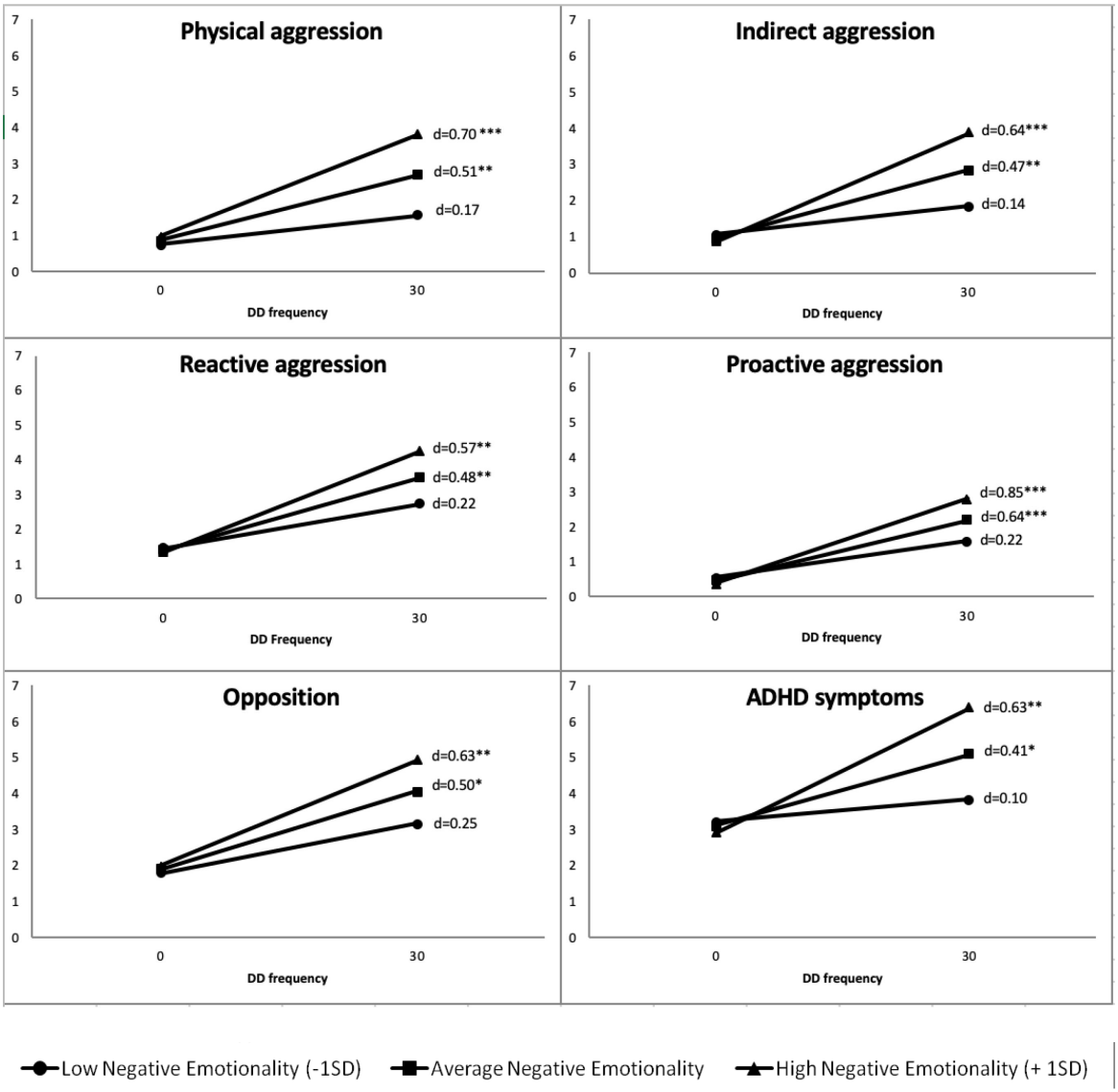

Figure 1. Strength of Association Between Monthly DD Frequency (x-axis) and Externalizing Behaviors (y-axis) as a Function of Averaged Negative Emotionality and ± 1 SD.
Note. * $p < .05$; ** $p < .01$; *** $p < .001$. Externalizing behaviors were standardized across a range from 0-7. Monthly DD frequency ranged from 0 to 30.

As can be seen in Figure 1 (p. 199), the pattern of interactions was highly consistent across dimensions of externalizing behaviors, where associations between frequency of DD and externalizing behaviors were systematically positive and significant for children with moderate to high levels of early negative emotionality. For these children, effect sizes were medium to large, ranging from $d = 0.41$ to $d = 0.85$ (Cohen, 1992). This pattern of interactions and absence of main effects only partially supports the second hypothesis.

4. Discussion

The results of the present study partially support our predictions that DD frequency would be positively associated with psychosocial maladjustment in children and that early emotional negativity would moderate this relationship. In line with previous adult and childhood literature, DD frequency was positively related to psychosocial maladjustment of the internalizing type: across informants, children with higher DD frequency scored higher on two of the three measures of internalizing problems (i.e., emotional problems and social withdrawal) without moderation by early emotional negativity. For psychosocial maladjustment of the externalizing type, there was a moderation effect of early emotional negativity: the association between DD and externalizing difficulties was stronger with increasing levels of early emotional negativity.

The associations between DD frequency and internalizing behaviors remained significant even after adjusting for socio-economic and sleep-related variables. That DD in children were associated with a range of internalizing problems (e.g., emotional problems and social withdrawal), is consistent with findings reported in children and adult populations (Gauchat et al., 2014; Lereya et al., 2017; Levin & Nielsen, 2007; Wong et al., 2018). However, unlike some reports, DD frequency in the present study was not significantly related to anxiety. The effect size for this relation ($d = 0.30$) was too small to reach statistical significance given our sample size.

By comparison, effect sizes in previous studies have ranged between 0.20 and 0.72 (M*d* = 0.53) (Gregory & Eley, 2005; Nielsen et al., 2000; Schredl et al., 1996). Differences in measures of anxiety themselves (e.g., source of informant, symptoms scale versus clinical diagnosis) may also partially account for this. The fact that none of the interactions with informants were significant shows that despite contextual differences in behaviors, the association between DD and psychosocial maladjustment is robust and did not differ as a function of informant source.

The absence of the hypothesized moderator effect of early emotional negativity on internalizing problems may have been related to the measure used in the present study. Specifically, our measure of early emotional negativity at 17 months may not have been sensitive to the complete spectrum of manifestations of affect distress. For example, in contrast to observations in infants, studies have shown that toddlers high in emotional reactivity are more likely to manifest their reactivity through inhibition or withdrawal (Kagan & Snidman, 1991a, 1991b; Kagan & Snidman, 2004; Putnam & Stifter, 2005). These behavioral manifestations have been associated with later proneness to internalizing difficulties (Chronis-Tuscano et al., 2009; Davis et al., 2015; Fox et al., 2001; Prior et al., 2000). By contrast, our measure did not include items specifically formulated to detect these behavioral manifestations of early emotional reactivity, which might explain why it did not correlate with, or moderate, later internalizing difficulties. Thus, our measure may be more sensitive to behavioral manifestations of toddlers' "affect distress", like aggression, that are linked to later externalizing problems than to subsequent internalizing problems.

The finding that early negative emotionality specifically moderated the relationship between DD and externalizing behaviors is new. In fact, this is the first study to document that DD in children with early moderate to high early emotional negativity are strongly associated to externalizing behaviors (with corresponding *d*s ranging between 0.60 and 0.90). The consistency

of results across externalizing problems may be due to a common underlying factor (Castellanos-Ryan et al., 2016; Krueger et al., 2002). How the relation between frequent DD and externalizing behaviors in children with a history of moderate to elevated negative early emotionality evolves over time remains to be clarified. However, some studies have shown that early emotional negativity may moderate other associations implicating later externalizing behaviors, such as the relation between early child care and externalizing behaviors during adolescence (Belsky & Pluess, 2012). Another study (Northerner et al., 2016) found that low early negative emotionality at 18 months emerged as a protective factor in children experiencing cumulative risk in developing internalizing and sleep problems at 24 months. Consequently, and in the absence of a concurrent measure of negative emotionality, this long-term effect noted across several studies also supports the hypothesis that negative emotionality is a relatively stable developmental characteristic.

The correlational nature of our study does not allow us to draw conclusions about the direction of the link between DD and psychosocial adjustment. On the one hand, it is possible that DD have an impact on psychosocial adjustment as it has been shown that DD could influence the dreamer's mood the following day (Lancee & Schrijnemaekers, 2013). Frequent DD in children could similarly result in negative emotions and distress during wakefulness much like the nightmare-related distress documented in adults (Belicki, 1992; Blagrove et al., 2004; Lee & Suh, 2016; Levin & Nielsen, 2007). Thus, it is possible that repeated and negative experiencing of DD elicits negative reactive emotions during wakefulness.

On the other hand, it is also possible that psychosocial adjustment problems and related perceived stress may have an impact on the frequency of DD (Kelly, 2018; Levin & Nielsen, 2007; Secrist et al., 2019). In this case DD would reflect issues and concerns experienced during wakefulness. Alternatively, it is possible that a third variable explains the relation between DD

and psychosocial adjustment. This would be consistent with suggestions that DD represent a failure in the emotional regulation function believed to occur during normal dreaming (Cartwright et al., 2006; Hartmann, 2010; Scarpelli et al., 2019). Psychosocial maladjustment problems are also known to be related to problems in emotional regulation (Aldao et al., 2010; Eisenberg et al., 2001; Kim-Spoon et al., 2013; Uhl et al., 2019). As discussed earlier, this interpretation would be consistent with the hypothesis of a moderator effect of emotional negativity and DD on psychosocial adjustment. While our study has some key strengths including the use of an early measure of negative emotionality, control variables, and multiple informants for the assessment of psychosocial maladjustment, it also has some shortcomings. With the exception of the children's early emotional negativity measure, this was essentially a cross-sectional correlational study and as such it cannot address the developmental sequence with regards to DD and psychosocial maladjustment.

Longitudinal studies are needed to clarify the nature and time course of DD in relation to psychosocial maladjustment. Also, as has been done in adults, the inclusion of measures of potentially more severe forms of maladjustment such as suicidality (which emerges in early adolescence) may be helpful as suicidal ideation has been linked to both internal distress and externalizing behaviors such as impulsivity and conduct disorders (Dougherty et al., 2004; Gould et al., 2003; Simon et al., 2001). In fact, one review found that impulsivity and emotional dysregulation could explain the link between sleep disturbances and suicidality (Winsper & Tang, 2014). More studies should investigate these associations specifically with DD. In addition, the study of other moderator variables could further our understanding of these complex developmental issues. Disorganized attachment, for instance, is a promising candidate as it has been related to both externalizing behaviors and DD and could play a moderator role in these

relations (Belfiore & Pietrowsky, 2017; Csoka et al., 2011; van Ijzendoorn et al., 1999; Wang et al., 2016).

In sum, the present study highlights the role of early emotional negativity as a developmental moderator for the link between DD and externalizing behaviors in children and points to the need to consider temperamental traits when investigating associations between DD and internalizing and externalizing problems from a developmental perspective.

Conflict of interests: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
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Annexe 3 – Matériel supplémentaire du premier article de la thèse

SUPPLEMENTAL MATERIALS

Longitudinal associations throughout adolescence: suicidal ideation, disturbing dreams, and internalizing symptoms

Table S1. Correlation matrix between DD frequency and suicidal ideation, depression symptoms and anxiety symptoms from 13 to 18 years old

	DD 13	DD 14	DD 15	DD 16	DD 17	DD 18
SI 13	.31**	.07	-.04	.15†	.00	.23**
SI 14	.34***	.12*	.04	.28***	.08	.21**
SI 15	.19*	.20**	.11†	.25***	.16**	.19**
SI 16	.12	.15*	.14*	.26***	.20**	.17**
SI 17	.07	.05	.16*	.21**	.16*	.22**
SI 18	.09	.06	.08	.13†	.07	.14*
DEP 13	.14†	.22**	.15†	.14†	.16*	.21**
DEP 14	.13	.18**	.21***	.25***	.26***	.25***
DEP 15	.05	.14**	.19***	.24***	.11	.11†
DEP 16	.00	.08	.11†	.26***	.19*	.14*
DEP 17	-.01	.09	.18**	.18**	.25***	.20**
DEP 18	.03	.05	.03	.17*	.18*	.20**
ANX 13	.23**	.26***	.23**	.36***	.25**	.18*
ANX14	.18*	.24***	.30***	.29***	.29***	.23***
ANX 15	.12	.19**	.23***	.27***	.24***	.20***
ANX 16	.22**	.12*	.16**	.37***	.35***	.22***
ANX 17	.14	.11†	.29***	.30***	.37***	.30***
ANX 18	.09	.24***	.16**	.30***	.27***	.31***

Notes. *** = p < .001, ** = p < .01, * = p < .05, † = p < .10. DD = Disturbing dreams. SI = Suicidal ideation. DEP = Level of depression. ANX = Level of anxiety.

Table S2. Correlation matrix between suicidal ideation, depression symptoms and anxiety symptoms from 13 to 18 years old

	SI 13	SI 14	SI 15	SI 16	SI 17	SI 18
DEP 13	.33***	.34***	.25**	.14	.21**	.12
DEP 14	.22*	.52***	.38***	.37***	.24***	.22**
DEP 15	.17*	.26***	.31***	.37***	.31***	.11†
DEP 16	.18*	.33***	.29***	.54***	.43***	.26**
DEP 17	.19*	.19**	.22***	.39***	.43***	.29***
DEP 18	.12	.26**	.29***	.43***	.32***	.41***
ANX 13	.34***	.26***	.19*	.24**	.19*	.10
ANX 14	.23**	.30***	.21***	.26***	.20**	.20**
ANX 15	.19*	.22***	.22***	.26***	.22***	.14*
ANX 16	.25**	.26***	.25***	.39***	.34***	.23***
ANX 17	.24**	.23***	.28***	.35***	.31***	.23**
ANX 18	.38***	.32***	.21**	.32***	.21**	.28***

Notes. *** = p < .001, ** = p < .01, * = p < .05, † = p < .10. SI = Suicidal ideation. DEP = Level of depression. ANX = Level of anxiety.

Table S3. Correlation matrix between depression symptoms and anxiety symptoms from 13 to 18 years old

	DEP 13	**DEP 14**	**DEP 15**	**DEP 16**	**DEP 17**	**DEP 18**
ANX 13	.57***	.52***	.31***	.40***	.29***	.34***
ANX 14	.44***	.56***	.45***	.42***	.44***	.39***
ANX 15	.40***	.39***	.55***	.48***	.37***	.38***
ANX 16	.43***	.48***	.52***	.63***	.51***	.48***
ANX 17	.36***	.46***	.49***	.53***	.64***	.51***
ANX 18	.42***	.46***	.41***	.47***	.42***	.62***

Notes. *** = $p < .001$. DEP = Level of depression. ANX = Level of anxiety.

Table S4. Model fit for each of the estimated model

Modèle	χ^2	df	CFI	TLI	RMSEA	90% CI	SRMR	AIC	BIC	SABIC	CM	Adjusted $\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	ΔRMSEA
1	264.58	90	0.860	0.767	0.067	0.058-0.076	0.094	14680.62	15083.85	14769.68	-	-	-	-	-	-
2	99.15	78	0.983	0.967	0.025	0.000-0.039	0.040	14515.92	14968.03	14615.77	1	138.49***	12	+0.123	+0.200	-0.042
3	132.48	101	0.975	0.963	0.027	0.011-0.039	0.057	14520.71	14879.14	14599.87	2	32.34	23	-0.008	-0.004	+0.002
4	172.72	126	0.963	0.955	0.029	0.017-0.039	0.072	14521.70	14778.30	14578.37	3	39.83*	25	-0.012	-0.008	+0.002
5	152.10	116	0.970	0.962	0.027	0.013-0.038	0.062	14516.26	14813.59	14581.93	3	20.49	15	-0.005	-0.001	0

Notes. Model 1 estimates a baseline model with autoregressive paths, cross-lagged paths, and correlation paths. Model 2 estimates the full model with autoregressive paths, cross-lagged paths, correlations paths, and higher order paths. Model 3 includes equality constraints on the autoregressive paths (stationarity assumption respected). Model 4 includes equality constraints on the cross-lagged paths (predictive equilibrium assumption 1 not respected). Model 5 includes equality constraints on the correlation paths (predictive equilibrium assumption 2 respected). Model 5 is the final model.
n = 434. * = p < .05, *** = p < .001.
χ^2 = Chi square test of model fit; df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; 90% CI = 90% Confidence interval; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample Size Adjusted Bayesian Information Criterion; CM = Comparison model.
Chi Square differences are adjusted using the Satorra-Bentler scaling correction (adjusted $\Delta\chi^2$) because of MLR estimator.

Table S5. Satorra-Bentler Scaled Chi Square differences when the higher order path is added

Higher order path	C1	C0	d1	d0	F1	F0	Satorra-Bentler Scaled Chi Square	Δdf	*p*-value
DD 15 → DD 17	1.11	1.12	89	90	241.10	264.58	14.10	1	<.001
DEP 15 → DEP 18	1.12	1.11	88	89	215.64	241.10	49.21	1	<.001
DEP 15 → DEP 17	1.11	1.12	87	88	199.29	215.64	12.40	1	<.001
DEP 14 → DEP 16	1.10	1.11	86	87	185.89	199.29	9.13	1	.003
DD 13 → DD 16	1.10	1.10	85	86	167.44	185.89	16.54	1	<.001
DEP 14 → DEP 18	1.10	1.10	84	85	160.99	167.44	6.67	1	.010
DD 13 → DD 15	1.10	1.10	83	84	148.22	160.99	13.97	1	<.001
DD 14 → DD 18	1.10	1.10	82	83	135.42	148.22	14.20	1	<.001
SI 14 → SI 18	1.09	1.10	81	82	121.34	135.42	8.85	1	.003
SI 13 → DD 18	1.10	1.09	80	81	113.67	121.34	10.53	1	.001
SI 13 → IS 15	1.08	1.10	79	80	106.81	113.67	4.10	1	.043
DEP 13 → DEP 15	1.08	1.08	78	79	99.15	106.81	6.18	1	.013

Notes. DD=Disturbing dream frequency; SI=Presence of suicidal ideation; DEP=Level of depression. C1 = The scaling factor from the freely estimated model. C0 = The scaling factor from the constrained model. d1 = The degrees of freedom from the freely estimated model. d0 = The degrees of freedom from the constrained model. F1 = The χ^2 value from the freely estimated model. F0 = The χ^2 value from the constrained model. Δdf = degrees of freedom difference.

Table S6. Model fit for each of the estimated model

Modèle	χ^2	df	CFI	TLI	RMSEA	90% CI	SRMR	AIC	BIC	SABIC	CM	Adjusted $\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	ΔRMSEA
1	254.42	90	.870	.783	.065	.056-.074	.096	12848.20	13251.43	12937.26	-	-	-	-	-	-
2	83.65	77	.995	.990	.014	.000-.031	.041	12673.63	13129.81	12774.39	1	148.39***	13	+.125	+.207	-.051
3	132.54	100	.974	.961	.027	.012-.039	.055	12693.39	13055.89	12773.45	2	44.51**	23	-.021	-.029	+.013
4	125.74	102	.981	.972	.023	.000-.036	.051	12670.81	13025.16	12749.07	2	42.16*	25	-.014	-.018	+.009
5	109.47	92	.986	.977	.021	.000-.035	.062	12673.68	13068.77	12760.94	2	25.45	15	-.009	-.013	+.007

Notes. Model 1 estimates a baseline model with autoregressive paths, cross-lagged paths, and correlation paths. Model 2 estimates the full model with autoregressive paths, cross-lagged paths, correlation paths, and higher order paths. Model 3 includes equality constraints on the autoregressive paths (stationarity assumption not respected). Model 4 includes equality constraints on the cross-lagged paths (predictive equilibrium assumption 1 not respected). Model 5 includes equality constraints on the correlation paths (predictive equilibrium assumption 2). Model 5 is the final model.
n = 434.
* = p < .05, ** = p < .01, *** = p < .001.
χ^2 = Chi square test of model fit; df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; 90% CI = 90% Confidence interval; SRMR = Standardized Root Mean Square Residual; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample Size Adjusted Bayesian Information Criterion; CM = Comparison model.
Chi Square differences are adjusted using the Satorra-Bentler scaling correction (adjusted $\Delta\chi^2$) because of MLR estimator.

Table S7. Satorra-Bentler Scaled Chi Square differences when the higher order path is added

Higher order path	C1	C0	D1	D0	F1	F0	Satorra-Bentler Scaled Chi Square	Δdf	*p*-value
ANX 14 → ANX 16	1.15	1.16	89	90	225.56	254.42	21.98	1	<.001
DD 15 → DD 17	1.15	1.15	88	89	202.27	225.56	18.29	1	<.001
ANX 13 → ANX 16	1.15	1.15	87	88	196.03	202.27	5.93	1	.015
ANX 16 → ANX 18	1.15	1.15	86	87	177.68	196.03	19.67	1	<.001
DD 13 → DD 16	1.14	1.15	85	86	161.27	177.68	12.27	1	<.001
ANX 14 → ANX 17	1.15	1.14	84	85	147.67	161.27	15.07	1	<.001
DD 14 → DD 18	1.15	1.15	83	84	136.66	147.67	11.51	1	.001
ANX 13 → ANX 15	1.15	1.15	82	83	122.43	136.66	19.70	1	<.001
SI 14 → SI 18	1.14	1.15	81	82	112.28	122.43	6.07	1	.014
DD 13 → DD 15	1.13	1.14	80	81	102.76	112.28	7.05	1	.008
SI 14 → SI 16	1.12	1.13	79	80	95.44	102.76	4.57	1	.033
DD 15 → ANX 17	1.12	1.12	78	79	87.46	95.44	9.80	1	.002
SI 13 → DD 18	1.13	1.12	77	78	83.65	87.46	4.34	1	.037

Notes. DD=Disturbing dream frequency; SI=Presence of suicidal ideation; ANX=Level of anxiety. C1 = The scaling factor from the freely estimated model. C0 = The scaling factor from the constrained model. D1 = The degrees of freedom from the freely estimated model. D0 = The degrees of freedom from the constrained model. F1 = The χ^2 value from the freely estimated model. F0 = The χ^2 value from the constrained model. Δdf = degrees of freedom difference.

Table S8. Regression and correlation coefficients for Model 1, Model 2 and Supplemental Model 3

	B (SE)	β / r / OR	*p*-value
MODEL 1			
Correlation paths			
DD 13 ↔ SI 13	-	.04	.079
DD 13 ↔ DEP 13	-	.08	<.001
SI 13 ↔ DEP 13	-	.26	<.001
DD 14 ↔ SI 14	-	.05	.070
DD 14 ↔ DEP 14	-	.12	<.001
SI 14 ↔ DEP 14	-	.39	<.001
DD 15 ↔ SI 15	-	.06	.070
DD 15 ↔ DEP 15	-	.14	<.001
SI 15 ↔ DEP 15	-	.30	<.001
DD 16 ↔ SI 16	-	.05	.075
DD 16 ↔ DEP 16	-	.14	<.001
SI 16 ↔ DEP 16	-	.33	<.001
DD 17 ↔ SI 17	-	.05	.071
DD 17 ↔ DEP 17	-	.12	<.001
SI 17 ↔ DEP 17	-	.28	<.001
DD 18 ↔ SI 18	-	.06	.076
DD 18 ↔ DEP 18	-	.13	<.001
SI 18 ↔ DEP 18	-	.34	<.001
Autoregressive paths			
DD 13 → DD 14	.32 (.02)	.32	<.001
DD 14 → DD 15	.32 (.02)	.36	<.001
DD 15 → DD 16	.32 (.02)	.29	<.001
DD 16 → DD 17	.32 (.02)	.33	<.001
DD 17 → DD 18	.32 (.02)	.32	<.001
SI 13 → SI 14	-	5.47	<.001
SI 14 → SI 15	-	5.47	<.001
SI 15 → SI 16	-	5.47	<.001
SI 16 → SI 17	-	5.47	<.001
SI 17 → SI 18	-	5.47	<.001
DEP 13 → DEP 14	.38 (.02)	.46	<.001
DEP 14 → DEP 15	.38 (.02)	.32	<.001
DEP 15 → DEP 16	.38 (.02)	.39	<.001
DEP 16 → DEP 17	.38 (.02)	.33	<.001
DEP 17 → DEP 18	.38 (.02)	.36	<.001
Cross-lagged paths			
DD 13 → SI 14	-	2.07	.005
DD 13 → DEP 14	.15 (.22)	.06	.501
SI 13 → DD 14	-.36 (.37)	-.08	.325

SI 13 → DEP 14	.69 (1.02)	.06	.492
DEP 13 → DD 14	.06 (.03)	.17	.019
DEP 13 → SI 14	-	1.26	.005
DD 14 → SI 15	-	1.35	.012
DD 14 → DEP 15	.004 (.14)	.001	.979
SI 14 → DD 15	-.73 (.21)	-.19	<.001
SI 14 → DEP 15	-.35 (.64)	-.03	.585
DEP 14 → DD 15	.07 (.02)	.19	<.001
DEP 14 → SI 15	-	1.15	.017
DD 15 → SI 16	-	1.15	.264
DD 15 → DEP 16	-.09 (.16)	-.03	.580
SI 15 → DD 16	.46 (.22)	.13	.031
SI 15 → DEP 16	.99 (.66)	.10	.120
DEP 15 → DD 16	.04 (.02)	.11	.038
DEP 15 → SI 16	-	1.19	.002
DD 16 → SI 17	-	1.17	.286
DD 16 → DEP 17	-.02 (.17)	-.01	.921
SI 16 → DD 17	.20 (.24)	.06	.394
SI 16 → DEP 17	.92 (.82)	.08	.252
DEP 16 → DD 17	.01 (.03)	.03	.658
DEP 16 → SI 17	-	1.17	<.001
DD 17 → SI 18	-	.88	.251
DD 17 → DEP 18	-.24 (.24)	-.07	.313
SI 17 → DD 18	.46 (.22)	.13	.036
SI 17 → DEP 18	.10 (.82)	.01	.902
DEP 17 → DD 18	.01 (.02)	.03	.622
DEP 17 → SI 18	-	1.12	.028
Higher order paths			
DD 13 → DD 15	.32 (.02)	.36	<.001
DD 13 → DD 16	.32 (.02)	.33	<.001
SI 13 → SI 15	-	5.47	<.001
SI 13 → DD 18	.80 (.27)	.18	.004
DEP 13 → DEP 15	.38 (.02)	.39	<.001
DD 14 → DD 18	.32 (.02)	.34	<.001
SI 14 → SI 18	-	5.47	<.001
DEP 14 → DEP 16	.38 (.02)	.32	<.001
DEP 14 → DEP 18	.38 (.02)	.26	<.001
DD 15 → DD 17	.32 (.02)	.30	<.001
DEP 15 → DEP 17	.38 (.02)	.33	<.001
DEP 15 → DEP 18	.38 (.02)	.31	<.001
MODEL 2			
Correlation paths			

DD 13 ↔ SI 13	-	.05	.057
DD 13 ↔ ANX 13	-	.09	<.001
SI 13 ↔ ANX 13	-	.17	<.001
DD 14 ↔ SI 14	-	.06	.050
DD 14 ↔ ANX 14	-	.12	<.001
SI 14 ↔ ANX 14	-	.20	<.001
DD 15 ↔ SI 15	-	.06	.051
DD 15 ↔ ANX 15	-	.16	<.001
SI 15 ↔ ANX 15	-	.18	<.001
DD 16 ↔ SI 16	-	.06	.053
DD 16 ↔ ANX 16	-	.16	<.001
SI 16 ↔ ANX 16	-	.19	<.001
DD 17 ↔ SI 17	-	.06	.050
DD 17 ↔ ANX 17	-	.14	<.001
SI 17 ↔ ANX 17	-	.18	<.001
DD 18 ↔ SI 18	-	.06	.054
DD 18 ↔ ANX 18	-	.13	<.001
SI 18 ↔ ANX 18	-	.18	<.001
Autoregressive paths			
DD 13 → DD 14	.46 (.08)	.46	<.001
DD 14 → DD 15	.24 (.07)	.27	.001
DD 15 → DD 16	.20 (.11)	.18	.069
DD 16 → DD 17	.22 (.08)	.22	.005
DD 17 → DD 18	.42 (.07)	.42	<.001
SI 13 → SI 14	-	11.08	<.001
SI 14 → SI 15	-	11.11	<.001
SI 15 → SI 16	-	4.15	.002
SI 16 → SI 17	-	9.20	<.001
SI 17 → SI 18	-	9.50	<.001
ANX 13 → ANX 14	.59 (.08)	.55	<.001
ANX 14 → ANX 15	.48 (.07)	.45	<.001
ANX 15 → ANX 16	.41 (.07)	.39	<.001
ANX 16 → ANX 17	.58 (.07)	.55	<.001
ANX 17 → ANX 18	.30 (.09)	.31	.001
Cross-lagged paths			
DD 13 → SI 14	-	1.63	.015
DD 13 → ANX 14	.11 (.12)	.08	.337
SI 13 → DD 14	-.45 (.32)	-.09	.154
SI 13 → ANX 14	.20 (.44)	.03	.645
ANX 13 → DD 14	.14 (.05)	.19	.006
ANX 13 → SI 14	-	1.34	.167
DD 14 → SI 15	-	1.33	.014
DD 14 → ANX 15	-.01 (.08)	-.01	.899
SI 14 → DD 15	-.57 (.22)	-.15	.010

SI 14 → ANX 15	.05 (.31)	.01	.884
ANX 14 → DD 15	.13 (.03)	.20	<.001
ANX 14 → SI 15	-	1.10	.380
DD 15 → SI 16	-	1.18	.361
DD 15 → ANX 16	-.12 (.08)	-.07	.155
SI 15 → DD 16	.42 (.24)	.12	.078
SI 15 → ANX 16	.55 (.26)	.09	.037
ANX 15 → DD 16	.11 (.04)	.17	.003
ANX 15 → SI 16	-	1.28	.005
DD 16 → SI 17	-	1.10	.498
DD 16 → ANX 17	-.05 (.09)	-.03	.535
SI 16 → DD 17	.09 (.23)	.03	.680
SI 16 → ANX 17	.54 (.34)	.08	.112
ANX 16 → DD 17	.11 (.04)	.19	.006
ANX 16 → SI 17	-	1.25	.017
DD 17 → SI 18	-	.94	.498
DD 17 → ANX 18	.04 (.11)	.02	.744
SI 17 → DD 18	.37 (.22)	.11	.095
SI 17 → ANX 18	.08 (.38)	.01	.823
ANX 17 → DD 18	.03 (.04)	.05	.468
ANX 17 → SI 18	-	1.10	.623
Higher order paths			
DD 13 → DD 15	.36 (.09)	.40	<.001
DD 13 → DD 16	.38 (.10)	.40	<.001
SI 13 → DD 18	.65 (.33)	.14	.049
ANX 13 → ANX 15	.34 (.08)	.30	<.001
ANX 13 → ANX 16	.31 (.09)	.26	.001
DD 14 → DD 18	.21 (.07)	.22	.001
SI 14 → SI 16	-	3.15	.021
SI 14 → SI 18	-	5.59	.014
ANX 14 → ANX 16	.27 (.08)	.24	.001
ANX 14 → ANX 17	.23 (.07)	.19	.002
DD 15 → DD 17	.37 (.08)	.35	<.001
DD 15 → ANX 17	.27 (.09)	.14	.003
ANX 16 → ANX 18	.40 (.09)	.38	<.001
SUPPLEMENTAL MODEL 1			
Correlation paths			
DD 13 ↔ SI 13	-	.27	.004
DD 13 ↔ DEP 13	-	.18	.023
DD 13 ↔ ANX 13	-	.29	<.001
SI 13 ↔ DEP 13	-	.34	<.001
SI 13 ↔ ANX 13	-	.36	<.001
DEP 13 ↔ ANX 13	-	.58	<.001

DD 14 ↔ SI 14	-	-.07	.292
DD 14 ↔ DEP 14	-	.001	.989
DD 14 ↔ ANX14	-	.04	.645
SI 14 ↔ DEP 14	-	.43	<.001
SI 14 ↔ ANX 14	-	.13	.056
DEP 14 ↔ ANX 14	-	.33	<.001
DD 15 ↔ SI 15	-	.02	.781
DD 15 ↔ DEP 15	-	.07	.290
DD 15 ↔ ANX 15	-	.07	.288
SI 15 ↔ DEP 15	-	.17	.040
SI 15 ↔ ANX 15	-	.11	.114
DEP 15 ↔ ANX 15	-	.44	<.001
DD 16 ↔ SI 16	-	.11	.088
DD 16 ↔ DEP 16	-	.15	.017
DD 16 ↔ ANX 16	-	.22	.001
SI 16 ↔ DEP 16	-	.39	<.001
SI 16 ↔ ANX 16	-	.23	.001
DEP 16 ↔ ANX 16	-	.38	<.001
DD 17 ↔ SI 17	-	.001	.995
DD 17 ↔ DEP 17	-	.14	.050
DD 17 ↔ ANX 17	-	.12	.081
SI 17 ↔ DEP 17	-	.20	.005
SI 17 ↔ ANX 17	-	.05	.450
DEP 17 ↔ ANX 17	-	.43	<.001
DD 18 ↔ SI 18	-	.05	.495
DD 18 ↔ DEP 18	-	.09	.314
DD 18 ↔ ANX 18	-	.12	.142
SI 18 ↔ DEP 18	-	.35	<.001
SI 18 ↔ ANX 18	-	.15	.014
DEP 18 ↔ ANX 18	-	.45	<.001
Autoregressive paths			
DD 13 → DD 14	.46 (.08)	.47	<.001
DD 14 → DD 15	.24 (.07)	.27	<.001
DD 15 → DD 16	.21 (.10)	.19	.034
DD 16 → DD 17	.22 (.08)	.23	.004
DD 17 → DD 18	.42 (.07)	.41	<.001
SI 13 → SI 14	-	8.77	.001
SI 14 → SI 15	-	4.29	.029
SI 15 → SI 16	-	3.00	.010
SI 16 → SI 17	-	5.84	<.001
SI 17 → SI 18	-	7.97	<.001
DEP 13 → DEP 14	.35 (.08)	.41	<.001
DEP 14 → DEP 15	.42 (.10)	.37	<.001
DEP 15 → DEP 16	.52 (.07)	.49	<.001
DEP 16 → DEP 17	.41 (.10)	.37	<.001

DEP 17 → DEP 18	.22 (.08)	.24	.004
ANX 13 → ANX 14	.51 (.08)	.50	<.001
ANX 14 → ANX 15	.47 (.07)	.44	<.001
ANX 15 → ANX 16	.35 (.07)	.32	<.001
ANX 16 → ANX 17	.59 (.08)	.56	<.001
ANX 17 → ANX 18	.32 (.09)	.33	<.001
Cross-lagged paths			
DD 13 → SI 14	-	1.73	.002
DD 13 → DEP 14	.06 (.22)	.03	.783
DD 13 → ANX 14	.08 (.15)	.06	.572
SI 13 → DD 14	-.69 (.31)	-.15	.033
SI 13 → DEP 14	.00 (1.0)	.00	1.00
SI 13 → ANX 14	-.07 (.43)	-.01	.877
DEP 13 → DD 14	.03 (.03)	.09	.349
DEP 13 → SI 14	-	1.25	.049
DEP 13 → ANX 14	.07 (.04)	.15	.103
ANX 13 → DD 14	.11 (.07)	.15	.101
ANX 13 → SI 14	-	1.01	.743
ANX 13 → DEP 14	.48 (.15)	.27	.001
DD 14 → SI 15	-	1.35	.017
DD 14 → DEP 15	-.08 (.14)	-.03	.587
DD 14 → ANX 15	-.04 (.08)	-.03	.640
SI 14 → DD 15	-.90 (.26)	-.24	.001
SI 14 → DEP 15	-.69 (.68)	-.06	.311
SI 14 → ANX 15	.01 (.36)	.002	.975
DEP 14 → DD 15	.05 (.03)	.15	.049
DEP 14 → SI 15	-	1.18	.006
DEP 14 → ANX 15	-.03 (.05)	-.05	.486
ANX 14 → DD 15	.08 (.04)	.12	.072
ANX 14 → SI 15	-	.93	.351
ANX 14 → DEP 15	.31 (.13)	.16	.012
DD 15 → SI 16	-	1.15	.374
DD 15 → DEP 16	-.22 (.17)	-.06	.201
DD 15 → ANX 16	-.14 (.08)	-.08	.082
SI 15 → DD 16	.31 (.24)	.09	.197
SI 15 → DEP 16	.40 (.68)	.04	.551
SI 15 → ANX 16	.27 (.27)	.04	.313
DEP 15 → DD 16	.03 (.02)	.09	.147
DEP 15 → SI 16	-	1.18	.002
DEP 15 → ANX 16	.10 (.03)	.17	.002
ANX 15 → DD 16	.06 (.04)	.09	.159
ANX 15 → SI 16	-	1.08	.490
ANX 15 → DEP 16	.29 (.12)	.14	.016
DD 16 → SI 17	-	1.08	.544
DD 16 → DEP 17	-.13 (.19)	-.04	.483

DD 16 → ANX 17	-.04 (.09)	-.02	.694
SI 16 → DD 17	.22 (.24)	.06	.359
SI 16 → DEP 17	.97 (.86)	.08	.252
SI 16 → ANX 17	.39 (.33)	.06	.248
DEP 16 → DD 17	-.03 (.03)	-.09	.332
DEP 16 → SI 17	-	1.12	.033
DEP 16 → ANX 17	.05 (.04)	.09	.153
ANX 16 → DD 17	.14 (.05)	.23	.003
ANX 16 → SI 17	-	1.14	.316
ANX 16 → DEP 17	.29 (.15)	.14	.016
DD 17 → SI 18	-	.89	.484
DD 17 → DEP 18	-.17 (.25)	-.05	.498
DD 17 → ANX 18	.04 (.11)	.02	.716
SI 17 → DD 18	.42 (.23)	.12	.064
SI 17 → DEP 18	.89 (.87)	.08	.309
SI 17 → ANX 18	.09 (.37)	.01	.811
DEP 17 → DD 18	-.02 (.02)	-.05	.485
DEP 17 → SI 18	-	1.11	.312
DEP 17 → ANX 18	.01 (.04)	.03	.721
ANX 17 → DD 18	.04 (.04)	.07	.368
ANX 17 → SI 18	-	.99	.795
ANX 17 → DEP 18	.23 (.13)	.13	.09
Higher order paths			
DD 13 → DD 15	.35 (.10)	.40	<.001
DD 13 → DD 16	.38 (.09)	.40	<.001
SI 13 → SI 15	-	4.71	.047
SI 13 → DD 18	.69 (.31)	.16	.027
DEP 13 → DEP 15	.24 (.11)	.25	.032
ANX 13 → ANX 15	.41 (.07)	.37	<.001
ANX 13 → ANX 16	.24 (.10)	.21	.011
DD 14 → DD 18	.21 (.07)	.22	.002
SI 14 → SI 16	-	2.97	.075
SI 14 → SI 18	-	6.36	.005
DEP 14 → DEP 16	.27 (.08)	.22	.001
DEP 14 → DEP 18	.20 (.09)	.16	.041
ANX 14 → ANX 16	.28 (.08)	.25	.001
ANX 14 → ANX 17	.15 (.07)	.13	.029
DD 15 → DD 17	.36 (.08)	.34	<.001
DD 15 → ANX 17	.25 (.09)	.13	.005
DEP 15 → DEP 17	.26 (.08)	.22	.001
DEP 15 → DEP 18	.27 (.09)	.26	.001
ANX 16 → ANX 18	.35 (.08)	.34	<.001

Notes. DD=Disturbing dream frequency; SI=Presence of suicidal ideation; DEP=Level of depression; ANX=Level of anxiety.

Supplemental Model 1: DD frequency, presence of suicidal ideation, level of depression and anxiety

In Supplemental Model 1, shown in Figure S1 (p. 236), longitudinal associations between DD frequency, presence of suicidal ideation, level of depression and anxiety were examined from ages 13 to 18. The model fit the data well: $\chi^2(141) = 180.1$, RMSEA = .03, 90% CI [.01 - .04], CFI = .98, TLI = .97, SRMR = .04. Standardized betas for the stability of DD frequency ranged from 0.19 to 0.47, for level of depression from 0.24 to 0.49, and for level of anxiety from 0.32 to 0.56. For presence of suicidal ideation, the odd ratios ranged from 3.00 to 8.77. The correlations between DD frequency and presence of suicidal ideation at each age were not significant, except at 13 years old (r = 0.27). Those between DD frequency and level of depression were significant only at 13, 16 and 17 years old (r = 0.14 - 0.18). Those between DD frequency and level of anxiety were only significant at 13 and 16 years old (r = 0.29 and 0.22). Those between level of depression and presence of suicidal ideation were all significant (r = 0.17 - 0.43). Those between level of anxiety and presence of suicidal ideation were significant only at 13, 16 and 18 years old (r = 0.15 - 0.36). Finally, the correlations between level of depression and anxiety were all significant (r = 0.33 - 0.58).

Note that in Figure S1 (p. 236) variables after 13 years old represent residual scores controlling from previous scores and cross-lagged associations. Similar patterns to models 1 and 2 were found in this model. High levels of DD frequency at age 13 and increases in DD frequency from ages 13 to 14 predicted increased odds of reporting suicidal ideation one year later (at 14 and 15 years; ORs = 1.73 and 1.35, respectively). In late adolescence, the model showed the same pattern as models 1 and 2 where increased odds of reporting suicidal ideation from ages 16 to 17 marginally predicted increased DD frequency one year later (β = 0.12) The model also showed specific associations to each internalizing symptom. First, high levels of

anxiety at age 13 and increased levels of anxiety predicted increases in DD frequency across adolescence. Second, increased levels of depression from ages 13 to 14 predicted higher DD frequency one year later ($\beta = 0.15$).

However, the cross-lagged paths found in model 2 between levels of anxiety and suicidal ideation were not significant in this model. Instead, supplemental model 1 shows cascades between levels of anxiety, levels of depression and suicidal ideation. First, high levels of anxiety at age 13 and increased levels of anxiety across adolescence predicted increased levels of depression at each time point ($\beta = 0.13 - 0.27$). Second, high levels of depression at age 13 and increased levels of depression across adolescence significantly and independently predicted increased odds of reporting suicidal ideation one year later (ORs = 1.12 -1.25). As seen in the first two models, even when considering the autoregressive and cross-lagged paths, high odds of reporting suicidal ideation at 13 significantly predicted increases in DD frequency 5 years later at age 18 ($\beta = 0.16$). The same patterns were also found when accounting for sex. In sum, this model revealed similar patterns, whether both internalizing symptoms are accounted for or only one at a time.

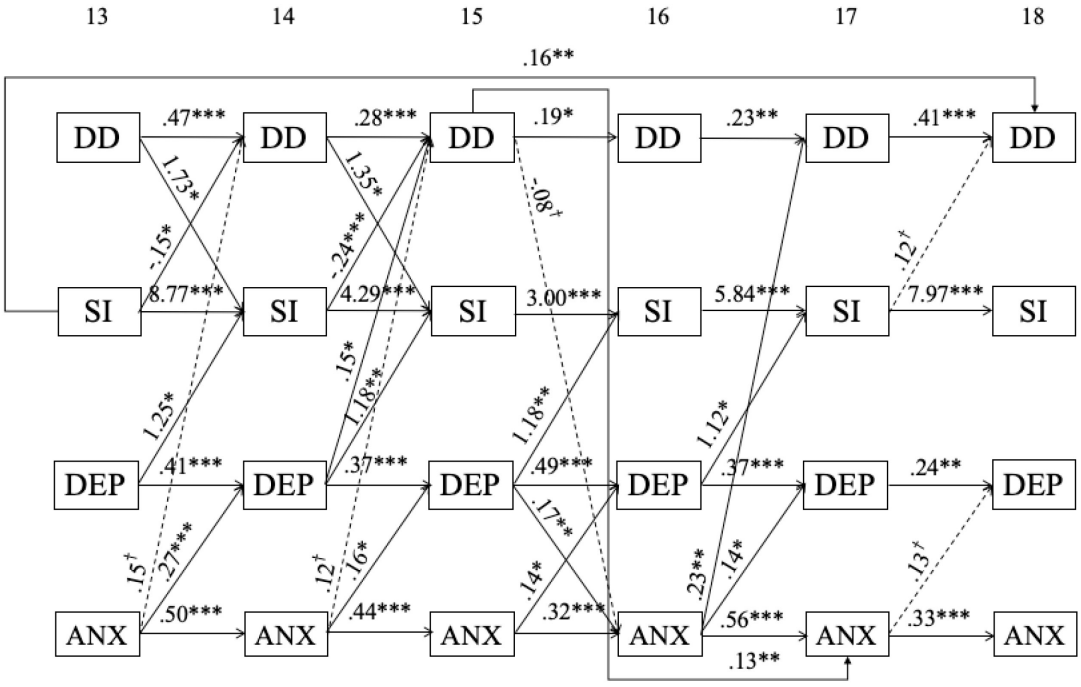

Figure S1. Standardized results for the cross-lagged model including level of depression and anxiety. n = 434. Model fit: χ^2=180.1, df=141, p = .01; RMSEA = .025; CFI = .98; TLI = .97; SRMR = .04. * = p < .05; ** = p < .01; *** = p < .001; † = p < .10. DD=Disturbing dream frequency; SI=Presence of suicidal ideation; ANX=Level of anxiety. All coefficients are standardized betas, except for associations predicting presence of suicidal ideation, which are odd ratios. The correlation paths were not included for clarity purposes. All model coefficients and p values are provided in Table S8 in the supplemental materials (p. 227).

Annexe 4 – Matériel supplémentaire du deuxième article de la thèse

SUPPLEMENTARY MATERIALS

Longitudinal study of early adversity and disturbing dream frequency: Moderating role of early negative emotionality

Table S1

Missing data rates for all study variables in percentage (%)

Variables	Total sample (n = 742)	Subsample for LPA (n = 736)	Subsample for LGA (n = 422)	Subsamble for interaction (n = 410)
Violence towards the mother	24.0	23.4	-	-
Single mother	17.0	16.3	-	-
Immigrant	3.5	2.7	-	-
Coercive parenting	9.2	8.4	-	-
Family functioning	1.1	0.3	-	-
Social support	14.2	13.5	-	-
Maternal depression	1.1	0.3	-	-
Partner support	5.0	4.2	-	-
Family income	11.3	10.6	-	-
Parents' level of education	1.8	1.0	-	-
DD frequency 13-14 years old	52.0	-	15.6	14.6
DD frequency 15-16 years old	50.9	-	13.7	12.7
DD frequency 17-18 years old	51.6	-	14.9	15.4
Negative emotionality (NE)	8.9	-	-	0
Sex assigned at birth	0.0	-	-	0
Latent profile	-	-	-	0

Note. DD = Disturbing dreams, LPA = Latent profile analysis, LGA = Latent growth analysis.

Table S2

Correlation matrix between the social environment variables, NE, sex, and DD frequency

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Violence towards the mother	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Single mother	0.32***	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Immigrant	-0.06	0.04	-	-	-	-	-	-	-	-	-	-	-	-
4. Coercive parenting	0.09*	0.10*	0.12*	-	-	-	-	-	-	-	-	-	-	-
5. Family functioning	-0.30***	-0.25***	-0.13**	-0.14***	-	-	-	-	-	-	-	-	-	-
6. Social support	-0.10*	-0.11*	-0.20***	-0.09*	0.28***	-	-	-	-	-	-	-	-	-
7. Maternal depression	0.15**	0.25***	0.21***	0.18***	-0.45***	-0.27***	-	-	-	-	-	-	-	-
8. Partner support	-0.19***	-0.20***	-0.03	-0.10**	0.45***	0.26***	-0.28***	-	-	-	-	-	-	-
9. Family income	-0.13**	-0.40***	-0.25***	-0.13**	0.21***	0.23***	-0.33***	0.16***	-	-	-	-	-	-
10. Parents level of education	-0.07	-0.20***	-0.01	-0.04	0.15***	0.21***	-0.20***	0.12**	0.56***	-	-	-	-	-
11. Sex assigned at birth	-0.10*	-0.02	0.03	-0.06	0.05	0.003	0.01	0.03	0.01	0.01	-	-	-	-
12. NE	0.11*	0.04	0.05	0.21***	-0.18***	-0.13**	0.17***	-0.18***	-0.08*	-0.03	-0.12**	-	-	-
13. DD frequency 13-14 years old	0.13*	0.06	-0.002	-0.02	0.10*	-0.07	0.04	-0.01	-0.05	-0.09	0.09(t)	-0.04	-	-
14. DD frequency 15-16 years old	0.07	0.09	0.04	0.01	-0.04	-0.12(t)	0.01	-0.11	-0.12*	-0.12*	0.19***	0.05	0.35***	-
15. DD frequency 17-18 years old	0.04	0.09	0.11	0.10*	-0.06	-0.06	0.12(t)	-0.13*	-0.14(t)	-0.06	0.21***	0.002	0.22**	0.49***

Note. *n* varied between 356 and 734. Violence towards the mother, single mother, immigrant, and sex assigned at birth are dichotomous. NE = Negative emotionality, DD = Disturbing dreams. *$p < .05$; **$p < .01$; ***$p < .001$.