Mindfulness-Based Interventions Among Adolescents With Behavior Disorders: Feasibility, Efficacy and Psychological Processes

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Thèse présentée en vue de l'obtention du grade de Docteur en sciences psychologiques et de l'éducation

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Collection de thèses de l'Université Catholique de Louvain, 2021

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Résumé

De nombreuses recherches ont mis en exergue l'intérêt des interventions basées sur la pleine conscience (IBPC) pour le traitement de la symptomatologie anxieuse et dépressive en population générale. Pourtant, peu de recherches ont été réalisées auprès de jeunes en population clinique. À ce titre, les adolescents atteints de troubles du comportement pourraient bénéficier grandement de ce type de prise en charge. L'objectif de cette thèse est donc d'étudier la faisabilité et l'efficacité des IBPC auprès d'adolescents souffrant de troubles du déficit de l'attention avec ou sans hyperactivité, de troubles oppositionnels avec provocation et des troubles des conduites. Entre autres, trois catégories de variables ont été mesurées : les capacités attentionnelles, la symptomatologie externalisée et la symptomatologie internalisée. Les résultats ont indiqué que les IBPC ont eu un effet positif sur les capacités attentionnelles. Néanmoins, les effets positifs observés sur la symptomatologie externalisée et internalisée semblent similaires à ceux obtenus par une prise en charge institutionnelle ou un groupe contrôle actif. D'autres recherches sont nécessaires pour clarifier les bénéfices psychologiques des IBPC auprès d'adolescents atteints de troubles du comportement.

Abstract

Numerous studies have highlighted the efficacy of Mindfulness-Based Interventions (MBIs) for treating anxiety and depressive symptomatology in the general population. While adolescents with behavior disorders could benefit from this type of intervention, little is known about the relevance of MBIs in clinical and young populations. Therefore, the objective of this thesis is to investigate the feasibility and the efficacy of a MBI on adolescents with attention-deficit/hyperactivity disorder, oppositional defiant disorder, or conduct disorder. Three categories of variables were measured: attention capacities, externalized symptoms and internalized symptoms. Overall, the results indicated that MBIs could have a positive effect on attention. However, the positive effects observed for externalizing and internalizing symptoms appear to be similar to those obtained through institutional care or active control groups. Further research is needed to clarify the psychological benefits of MBIs among adolescents with behavior disorders.

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Remerciements

Au début de chaque thèse, il est d'usage de trouver une partie intitulée "Remerciements" où le doctorant remercie toutes les personnes qui l'ont aidé dans son parcours de doctorat. Je ne vais pas déroger à la règle, bien que j'aimerais insister sur le fait que, malgré le caractère formel et traditionnel de la démarche, ces quelques paragraphes revêtent une importance et une résonnance toute particulière pour moi.

Un nombre non négligeable de doctorants arrêtent leur thèse pour toutes sortes de raisons : des difficultés relationnelles avec leur directeur de recherche, une perte de motivation et de confiance dans leur projet de doctorat, un épuisement provoqué par une surcharge de travail… La vérité, c'est que je n'ai jamais été concerné par ces problèmes. Bien entendu, je n'irai pas jusqu'à affirmer que la thèse est un long fleuve tranquille, j'énonce simplement le fait que j'ai apprécié profondément cette étape de ma vie, qui m'a vu mûrir et grandir plus que jamais. C'est pourquoi j'aimerais remercier toutes les personnes qui ont contribué, de près ou de loin, à cette expérience si enrichissante.

Tout d'abord, et sans surprise, j'aimerais remercier sincèrement mon directeur de recherche, le professeur Pierre Philippot, qui m'a donné l'opportunité de faire ce doctorat alors qu'il me connaissait à peine. Il m'a donné sa confiance, de nombreux et judicieux conseils pour améliorer mon travail de chercheur. J'ai apprécié la liberté que tu m'as donnée, tes commentaires, tes corrections, tes explications qui m'ont aidé à comprendre l'univers de la psychologie et ses subtilités, tes idées inspirantes, ton indéniable optimisme malgré les déconvenues, ta présence malgré les nombreuses affaires que tu devais gérer en parallèle, ta souplesse devant les imprévus, ta capacité – qui m'a toujours impressionné – à résoudre les multiples problèmes auxquels nous avons dû faire face durant ma thèse, et, bien entendu, ton attitude bienveillante à mon égard. Je te remercie pour tout ce que tu m'as enseigné pendant ces années. Merci, Pierre, pour ton soutien émotionnel inconditionnel, pour ton humour et ton lâcher-prise. Cela a été un réel plaisir de travailler à tes côtés, n'en doute pas un seul instant.

Je suis également reconnaissant à mon jury de thèse pour le temps qu'il m'a consacré, pour les commentaires réfléchis et pertinents qu'ils m'ont faits afin d'améliorer mon manuscrit et stimuler les discussions. Merci à Isabelle Roskam pour sa réflexion rigoureuse et structurée, sa bienveillance malgré ses désaccords, sa qualité de chercheuse indéniable et son authenticité. Merci à Katleen Van der Gucht, pour ses retours constructifs, son solide

soutien, son empathie et sa présence, incarnant sans nul doute cet état de pleine conscience dont je parle si souvent. Merci à Caroline Braet et Baptiste Barbot d'avoir accepté d'être lecteurs de cette thèse, d'y avoir consacré du temps et de l'énergie, d'avoir joué le jeu de la discussion constructive, bienveillante et intéressée lors de ma soutenance privée.

En particulier, j'aimerais remercier la Fondation Huoshen et sa présidente, Mme Meeùs, sans qui cette thèse n'aurait sans doute jamais vu le jour. Merci pour leur soutien matériel et leur implication dans le suivi de ce projet. Merci à la Fondation pour sa profonde générosité et son dévouement pour le bien-être des adolescents en difficulté. Je suis convaincu que c'est grâce à ce genre de fondation, à ses membres et leur état d'esprit, que le monde se portera mieux.

Un énorme merci à l'équipe de Reumonjoie qui m'a accueilli avec tant de naturel, de bienveillance, de simplicité, d'enthousiasme. Merci à vous, Francine, Isabelle, Carine, Corentin pour votre implication, votre motivation à toute épreuve, pour tous ces moments uniques, parfois difficiles mais toujours riches de sens, que nous avons vécus ensemble pendant les groupes thérapeutiques et leur mise en place. Vous êtes des personnes exceptionnelles, vraiment, et croiser votre chemin a été une chance formidable. Merci à la direction, Anick et Carine, d'avoir fait preuve d'ouverture d'esprit et de flexibilité quant à la mise en place de ce projet. Merci également à toute l'équipe de Clair Val et de la Sapinette, et en particulier à Véronique, Grégory et Bernard, qui ont rendu ce projet possible. Merci infiniment à tous les éducateurs et tous les jeunes qui ont croisé mon chemin. Aucune étude n'aurait été possible sans leur aide. Qu'ils sachent qu'ils m'ont énormément appris sur mon métier, sur moi-même. J'ai tellement de souvenirs incroyables de cette période, de ces moments incongrus partagés avec des jeunes ô combien attachants, que je pourrais en écrire plusieurs livres, mais terminons déjà cette thèse.

Je n'aurai jamais assez de place pour remercier toutes les autres personnes qui ont contribué à l'aboutissement de cette thèse. Toutes les personnes que j'ai rencontrées au cours de ma vie ont en réalité participé, d'une manière ou d'une autre, à l'enrichissement de la personne que je suis. Ils font ainsi partie des pièces qui ont permis la réalisation de ce grand puzzle qu'est ma thèse.

J'aimerais remercier tous mes collègues de Louvain, qui sont devenus des amis pour la plupart, et avec qui j'ai passé de formidables moments. Merci pour votre soutien, votre bonne humeur, votre humanité. Merci à vous de m'avoir démontré, une fois de plus, que l'humain est fondamentalement bon. Merci à mes collègues du LEP, des CPS, à tous mes amis de la formation de 3ème cycle en psychothérapie de m'avoir apporté autant de joie et de stimulation intellectuelle pendant ces années. Merci à mes amis de Master de Bordeaux qui m'ont conforté dans l'idée de faire une thèse et avec qui je garde d'excellents souvenirs. Merci à mes étudiants, mes anciens maîtres de stages, et directeurs de mémoire, mes patients, merci à eux tous, sincèrement.

Évidemment, je ne peux terminer ces remerciements sans mentionner mes amis et ma famille. Merci à Antoine et Quentin pour leur amour et leur soutien. Au-delà de nos moments de taquinerie et de rigolade, je ressens le profond besoin d'exprimer ma gratitude envers les personnes que vous êtes et pour tout ce que vous m'avez apporté dans la vie et qui reste invisible pour les yeux. Merci également à mon groupe d'amis pour leur joie et leur bonne humeur. Merci à deux grandes amies, Marbella et Anne, pour leur aide dans la correction de mes écrits, dont mon anglais parfois approximatif, et leur bienveillance inconditionnelle. Merci à Anouk pour son affection, sa présence et sa douceur, merci à elle pour son soutien si précieux.

Merci à ma famille, ma sœur, ma mère et mon père pour l'amour qu'ils m'ont donné et qui m'a construit jour après jour. Merci à mes grands-parents, pour leur aide, leur exemplarité, leur sagesse. Merci à tous mes cousins, oncles et tantes, pour ces joies partagées, merci à tous, du fond du cœur, merci.

Et parce que cette partie commence à devenir bien trop longue, je vais devoir m'arrêter là. Je terminerais ainsi par exprimer ma reconnaissance envers la vie en générale, une chance inouïe.

Outline of the thesis

In order to answer to the questions: “Are Mindfulness-Based Interventions feasible and effective for adolescents with behavior disorders?” and “What are the psychological processes implied?”, this thesis is divided into three parts.

The first part groups Chapter 1 and 2 and presents the theoretical framework of mindfulness (Chapter 1) and behavior disorders (Chapter 2). Chapter 1 provides an introduction of the mindfulness concept, its overall effect on mental health as well as the models and the psychological processes that underpin its efficacy. In particular, it will be seen why the implementation of MBIs among adolescents with behavior disorders is of interest. Chapter 2 investigates the clinical characteristics of behavior disorders and provides an overview of the existing interventions. This chapter will also explore the results obtained by previous MBIs in this population.

The second part groups Chapter 3, 4 and 5 and presents the design and the results of the experimental studies conducted in this thesis. This empirical section starts with the Chapter 3, which briefly introduces the aims and the design of the studies as well as the research questions. Chapter 4 describes a preliminary study investigating the effect of a MBI compared to a treatment as usual group on depressive symptomatology, mindfulness, impulsivity and externalizing symptoms among boys with behavior disorders. In the same way, Chapter 5 reports the results of a randomized controlled study conducted over three years among girls and boys with behavior disorders.

The third part of this thesis, Chapter 6, includes the discussion and the general conclusion of the experimental studies. Notably, this part will try to answer the three questions on feasibility, efficacy and processes of MBIs, presented in Chapter 3. A detailed interpretation of results, limitations and future research will be provided.

Chapter 1

A comprehensive approach to mindfulness

Abstract: Mindfulness-based interventions (MBIs) are now common interventions in the field of psychotherapy. However, its theoretical bases and its way of functioning are not well understood. On the one hand, this Chapter aims to present the history of the emergence of mindfulness and the theoretical concepts underlying its use, such as attention regulation or non-judgment. On the other hand, a large literature review has been conducted to identify the psychological benefits of MBIs in general population in order to justify the interest of its use in clinical populations. Special attention was given to existing programs for children and their efficacy. The last part of the Chapter is devoted to a review of potential psychological processes that could play an important role in providing mindfulness benefits.

A comprehensive approach to mindfulness

"*The present moment is the only thing of which anyone can be deprived, at least if this is the only thing he has and he cannot lose what he has not got."*
— Marcus Aurelius, Meditations, p. 13.

1. Introduction

Based on the fact that it is often easier to change psychological phenomena when they are brought into the light of consciousness, a large part of psychology, such as cognitive psychology and, more recently, neuropsychology, has been particularly interested in understanding the mental state associated with attention and self-consciousness. This might partly explain the growing number of studies devoted to this topic during the last decade and the emergence of a new approach called mindfulness.

In this chapter, we will present the notion of mindfulness: its definition, its theoretical models and the efficacy of mindfulness-based interventions.

2. Mindfulness: origins and definitions

2.1 History

In conjunction with the fundamentals of psychology, a first question introducing this part could be: "What are the specific characteristics of the human species?". If one poses this question to a large number of people, the grand majority would most likely respond that self-awareness is the defining feature of humans. More accurately, animals also possess some kind of self-awareness, as shown by the numerous primates who can recognize themselves in a mirror (Gallup, 1977; Kuczaj, Tranel, Trone, & Hill, 2001), but only humans have this very high level of self-awareness (by demonstrating, for example, meta-awareness, that is the capacity to be aware of being aware) that allows them to feel, express and deal with their emotions and behaviors in a more complex manner. In this view, consciousness could be seen as a continuum on which human is at the extreme in comparison with other living species.

Around 2500 years ago, Shakyamuni Buddha, the founder of the Buddhist religion, embraced a true interest in the knowledge of consciousness, by exploring the capacity of the mind (Shonin, Van Gordon, & Singh, 2015). This former prince sacrificed his life of opulence to devote himself to the practice of meditation and the teachings of his precepts. More

specifically, the Buddha argued that a healthy mind is a mindful mind. In this way, he defined mindfulness as a process of being fully aware of that which is, as opposed to that which was or that which might be (Shonin, Van Gordon, & Griffiths, 2014). To achieve equanimity, he proposed to observe the mind, understand its fluctuations, its tendencies, in a compassionate way, and, finally, succeed in taming it by reducing its thirst for desires and needs. These beliefs gave birth to the Buddhist religion and contemplative practices.

Over time, some philosophers advocated for states of mind close to what is considered today as mindfulness. For example, Marcus Aurelius argued that, based on the stoic doctrine, happiness and tranquility can be reached by appreciating the present moment with a clear knowledge of our own judgments: “Remember also that each man lives only the present moment: The rest of time is either spent and gone, or is quite unknown”, “If you are grieved about anything external, it’s not the thing itself that afflicts you, but your judgment about it; and it is in your power to correct this judgment and get quit of it” (Aurelius, 2013, p. 180). According to him, this attitude or state of being, characterized by the observation of the present moment without trying to respond, was already a source of interest long before modern psychology.

Despite these considerations, it is only during the last century that psychological sciences began the investigation of attention and meta-awareness and finally became interested in the therapeutic properties of the contemplative mind. In this respect, research on relaxation and transcendental meditation prepared the ground for mindfulness by bringing evidence of the positive effect of these techniques on mental health (Goleman, 1978; Wallace, 1970). Researchers like Richard Davidson, Daniel Goleman, and Eugene Gendlin initiated and emphasized the investigation of constructs such as attention, focus, and physical sensations and their role in a therapeutic setting. Notably, the work of Jon Kabat-Zinn, an American professor of medicine with a PhD in molecular biology, considered as one of the pioneers of mindfulness, has significantly contributed to the emergence of studies in this field. Influenced by the Zen tradition and Buddhism, Kabat Zinn created the Stress Reduction Clinic and the Center for Mindfulness in Medicine, Health Care, and Society at the University of Massachusetts Medical School in 1979 to teach a secular form of meditation in order to help patients with chronic pain (Kabat-Zinn, 1982). The success of this approach for these patients (Kabat-Zinn, Lipworth, Burncy, & Sellers, 1986) led him to write a key book, “Full catastrophe living” (Kabat-Zinn, 1990), and develop a therapeutic protocol based on eight weeks named Mindfulness-Based Stress Reduction (MBSR). Ever since, psychology has carried on exploring the potential benefits of mindfulness on mental health.

2.2 Definitions

It is difficult to clearly define what mindfulness is or to define it as a homogeneous construct considering its many components and characteristics. The most commonly used definition is the one given by Jon Kabat Zinn in 2003: “Mindfulness is the awareness that

emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment". According to this definition, Jon Kabat Zinn considers mindfulness as the mental effort of maintaining attention on the personal and phenomenological part of one's experience (what is perceived by the senses and the mind) without reaction.

In order to go further, Bishop et al. (2004) proposed a model of mindfulness based on two main components: self-regulation of attention and orientation to experience. On the one hand, self-regulation of attention is defined as the capacity to sustain attention on the current experience (e.g. body sensations, emotions, thoughts) and to be able to disengage from mental distractions by redirecting the attention on the here and now. This operational view of the attentional component of mindfulness has, theoretically, the advantage to be quantified although it may reduce mindfulness to its mechanical side. For instance, the time spent on the breath (or other current experiences) before the first distraction and the time needed to redirect attention to the present moment can be considered as attentional self-regulation markers. Moreover, some behavioral tasks were developed on the basis of this view. For example, Levinson, Stoll, Kindy, Merry and Davidson (2013) created a breath counting task to assess mindfulness in a more ecological and reliable way. On the other hand, orientation to experience is defined as an attitude of curiosity towards the present experience. This state of observation is an active process in which the mind pulls itself out of its expectations or avoidances and adopts a state of acceptance of what is going on at the present moment. Bishop et al. (2004) point out that this state does not consist in trying to suppress thoughts and is not limited to meditation. They also proposed to see mindfulness as a skill that can be developed with practice.

However, this definition is discussed by Brown and Ryan (2004) who argue with empirical data (factor analyses and correlations) that the orientation to experience (acceptance) is already taken into account by attention regulation. They explain that an individual who does not accept what is occurring at a given moment will seek to avoid or escape from the present event or present experience. Their assumption leads them to consider mindfulness as the awareness of ongoing events and experience.

Other definitions - very similar to each other - were proposed, such as the one of Philippot, Nef and Deplus (2016) that considers mindfulness as a way of being in relation to one's own experience (what is perceived with the five senses, body sensations and thoughts). It results from deliberately focusing attention on one's present experience and exploring it openly, whether it is considered as pleasant or not, while developing an attitude of tolerance and patience towards oneself. This attitude leads to engaging in actions in accordance with values and objectives.

All these definitions share the same core component based on attentional flexibility. To sum up, Young (2016) proposes a metaphor to explain what mindfulness is in a simple way.

He compares a non-training mind to a defective television set which is not able to stay a long time on a specific channel. In these conditions, it is difficult to watch any program long enough to follow the story and to appreciate it. Moreover, sometimes the screen has a really low quality which leads to a distortion of reality. Thus, mindfulness helps us to gain the ability to move from one "channel" to another when we want (attentional component) and see reality in a more reliable way (non-judgment component).

2.3 Theoretical models

In this part, we will discuss the most recent and validated models that could explain the psychological benefits of practicing mindfulness and its way of action. Three kinds of variables are presented in these models. The variables defined as sub-dimensions of mindfulness, psychological benefits (e.g., well-being, positive health outcomes) and psychological processes.

According to the processual approach[1], the therapeutic efficacy largely depends on the therapies capacity to target the main mechanisms associated with maintaining the pathology (Philippot et al., 2019). A psychological process is a mechanism that transforms a psychological element into another psychological element. For instant, thoughts caused by a negative event (first psychological element) can lead to depressive symptoms (second psychological element) due to abstract repetitive thinking (psychological process). As noted by Philippot et al. (2019), a symptom is often the result of the activation of a process, but it is not a process in itself. Symptoms are often directly observable and measurable whereas psychological processes can only be assumed.

2.3.1 Shapiro's model

One of the first models is the one proposed by Shapiro, Carlson, Astin, and Freedman (2006). They postulated that mindfulness can be divided in three axioms or psychological properties. The first axiom is intention (i.e., why one is practicing). Shapiro (1992) showed that the intention of meditators shifts along a continuum from self-regulation, to self-exploration, and finally to experiencing the feeling of wholeness. The second axiom is attention, which is defined as observing the operations of moment-to-moment, internal and external experience. The third and last axiom is attitude, which refers to the capacity to bring attention with acceptance, kindness and openness. According to Shapiro et al. (2006), these

[1] The processual approach stems from a clinical analysis focusing on the dynamic of psychological interactions that maintain pathologies. Psychological processes are characterized by their transdiagnostic nature.

three axioms determine the mindfulness construct and act on a meta-mechanism that they have termed reperceiving. This meta-mechanism is defined as a fundamental shift in perspective that involves an observation of emotions and thoughts as they are experienced in the body and the mind. To go further, they propose that reperceiving consists of four processes that positively impact mental health: Value clarification (i.e., awareness of the values that drive our life), Self-regulation (i.e., stability of emotional functioning), Cognitive, emotional and behavioral flexibility (i.e., adaptative responding to the environment), and Exposure (i.e., experiencing strong emotions voluntarily).

In order to test this model, Brown, Bravo, Roos, & Pearson (2015) conducted a cross-sectional study in a population of 944 college students. However, the authors have made some changes. Firstly, they renamed the construct "reperceiving" into "decentering". Secondly, they operationalized mindfulness as a five facets construct (describing, non-reactivity, acting with awareness, nonjudging, and observing) as suggested by data collected by Baer, Smith, Hopkins, Krietemeyer, and Toney (2006) and, thus, deviated from Shapiro and her colleagues' tripartite conception (Intention, Attention, Attitude). Indeed, no validated questionnaire was available to test the three assumed components of mindfulness suggested by Shapiro et al. (2006). In addition, Brown et al. (2015) postulated that the five facets defining mindfulness act on four psychological processes (Value-clarification, Self-regulation, Cognitive flexibility and Exposure) that finally lead to positive health outcomes. The final model of Brown, Bravo, Roos, & Pearson (2015) is presented in Figure 1.1.

On the one hand, Value clarification, Self-regulation and Cognitive, emotional and behavioral flexibility were highly correlated in the model and can be considered as one single construct in their study. On the other hand, the mediation path attested that four mindfulness facets (describing, non-reactivity, acting with awareness, nonjudging, but not the observing facet) were predictive of a higher reperceiving level, which in turn was related to the four supposed mechanisms, which were in turn related to psychological health outcomes such as anxiety, stress and depressive symptomatology. The model was largely validated (CFI=.94, TLI=.93, RMSEA=.044, SRMR=.048) although reperceiving did not fully mediate all associations between mindfulness and the psychological mechanisms nor did the mechanisms fully mediate the association between mindfulness and positive health outcomes. Overall, these results tend to support the model of Shauna Shapiro and her collaborators but also suggest that other constructs, which were not taken into account in this model, may play a significant role in the association between mindfulness and positive health outcomes.

Interestingly, a cross-sectional study in a non-clinical population, which focused on the relation between decentering, mindfulness and psychological outcomes, found a different pattern (Bhambhani & Cabral, 2016). Indeed, their data suggested that mindfulness mediates the association between decentering and psychological outcomes (e.g., depression, anxiety, and stress) and, therefore, indicated that nonattachment (i.e., viewing experience in a more

objective way as a third-person observer) increases the capacity to be aware. However, and not surprisingly, mindfulness and non-attachment are very similar constructs and were highly correlated in this study (r = .69), limiting the conclusions reached by the authors.

Finally, it is still important to note that these studies used a cross-sectional design and longitudinal or experimental protocols should be conducted to support these preliminary findings.

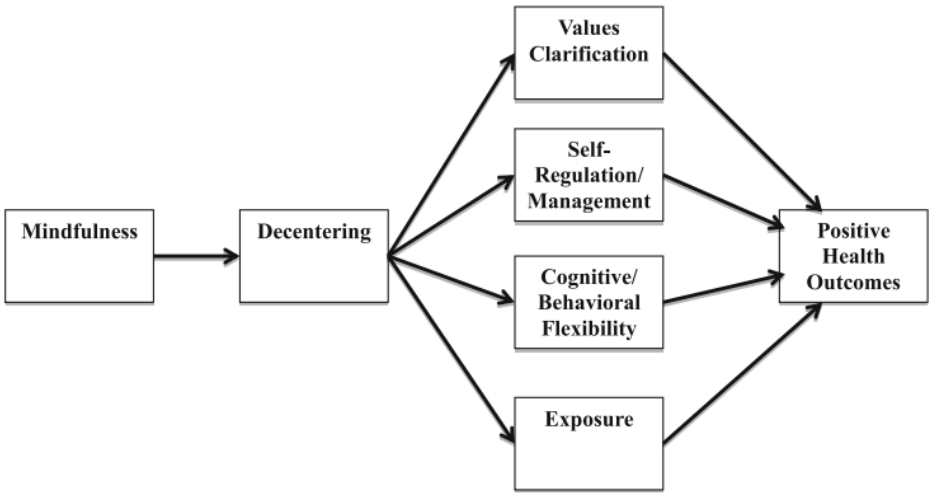

Figure 1.1. Shapiro et al.'s (2006) theoretical model of mindfulness mechanisms.

2.3.2 Hölzel's model

The team of Hölzel and her collaborators developed an alternative model to explain the action process of mindfulness (2011). They based their definition of mindfulness on the two-component-model of Bishop (2004). In addition, they assumed that mindfulness affects four mechanisms: attention regulation, body awareness, emotion regulation (reappraisal and exposure), and change in perspective on the self. The authors indicated that these processes could be very close to each other and, therefore, difficult to distinguish. Additionally, they also suggested that these psychological mechanisms proceed in a linear way with a specific order. Attention regulation could be the first process of action that maintains the attention on the current internal and external experience with an attitude of acceptance and nonjudgment. Then, body awareness helps to detect physiological aspects of the present feelings and enhances emotional identification. In these conditions, emotion regulation can be activated by applying a mindful observation to the present experience that, in turn, leads to a detachment from self-identification. This model was tested by Cebolla et al. (2017) in meditators and non-meditators and found a good fit (see Figure 1.2). Their results, based on structural equation modelling, suggested that attentional control might be a primary

mechanism and that body awareness may play an important role only as a mediator. Yet, this model has two important limitations: (1) it derives from cross-sectional studies making it difficult to establish causal relationships, and (2) it does not include any psychological outcome measures such as anxiety, depressive symptomatology or well-being.

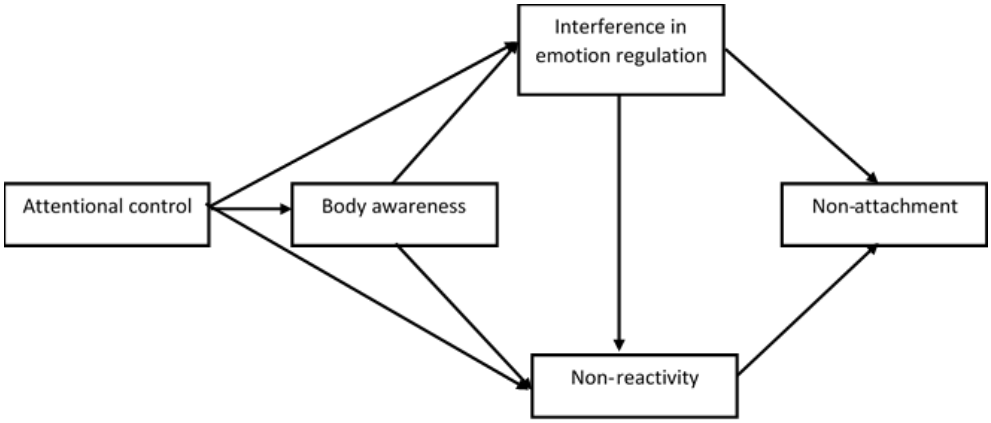

Figure 1.2. Cebolla et al.'s (2017) theoretical model of mindfulness mechanisms based on Hölzel et al. (2011).

2.3.3 Deplus' model

The cognitive model proposed by Deplus, Lahaye, and Philippot (2014) provides some clarifications about the potential impact of mindfulness in younger populations (see Figure 1.3). In their perspective, mindfulness is perceived as a cognitive training that acts on executive functions and attention. Children who practice mindfulness could be more attentive and develop better cognitive capacities such as working memory or inhibition. Empirical data tend to support these theoretical assumptions (Dunning et al., 2018; Flook et al., 2010; Tang, Yang, Leve, & Harold, 2012). Deplus et al. (2014) also defined two other components of mindfulness: orientation toward internal experience, consistent with one of the two components proposed by Bishop et al. (2004) and the attitude axiom of Shapiro's model, and commitment to acting in accordance with values. It is interesting to note that cognitive training and commitment in action are also considered as psychological processes by some authors.

These mindfulness components are assumed to influence numerous processes such as attentional bias (less attention to irrelevant stimuli), experiential avoidance (less fear of facing situations), ruminations (fewer repetitive thinking) and impulsivity (fewer automatic

responses) and, finally, modify meta-cognitions on the self, such as self-esteem. Deplus, Billieux, Scharff and Philippot (2016) provide some evidence for this model. After a Mindfulness-Based Intervention[2] (MBI), the level of mindfulness dimensions in children seems to be higher and negatively associates with impulsivity (urgency and lack of perseverance facets) and depressive symptoms while this latter association was mediated by a decrease in abstract and analytical repetitive thinking and internal dysfunctional emotion regulation strategies. Overall, this model has the advantage of linking transdiagnostic psychological processes of mindfulness to larger psychopathological mechanisms but presents some limitations notably due to its lack of specificity regarding mindfulness variables and its broad scope, which makes empirical validation difficult.

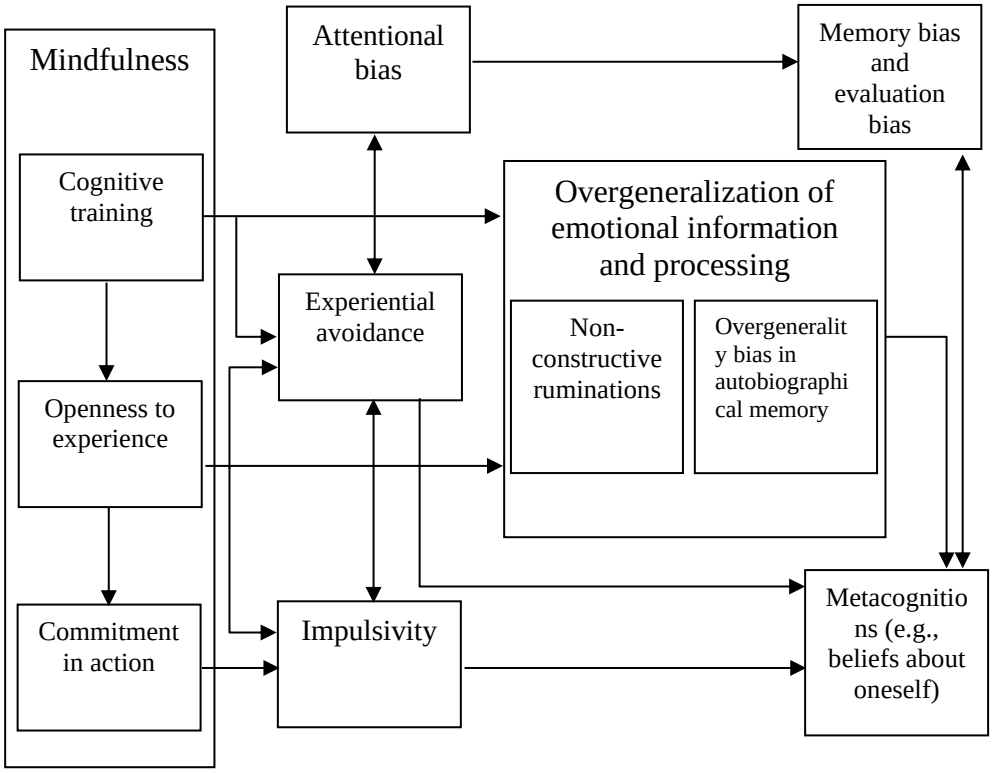

Figure 1.3. Deplus et al.'s (2014) theoretical model of mindfulness mechanisms in children.

[2] Mindfulness-Based Intervention is a program based on Mindfulness-Based Stress Reduction or Mindfulness-Based Cognitive Therapy protocols (described in the next part) that received some modifications to be adapted to the targeted population.

2.3.4 An integrative model proposed by Philippot

To go further, an integrative model of mindfulness ant its psychological processes, which can be applied to both children and adult populations, was recently proposed by Philippot (see Figure 1.4). This model attempts to integrate the previous theories and emphasizes the constructs that have been proven to play a role in MBIs. Furthermore, the model proposes a theoretical causality of the processes in action. Three components are initially supposed to be the consequences of mindfulness practice: (1) inhibition of automatic responses, which is defined as the capacity to prevent automatic behaviors stemming from emotions, (2) attentional control, which is the ability to engage or disengage the attention from stimuli, and (3) change in perspective of the self, which refers to an acceptance and decentering state of mind. By a cascading effect, these three consequences increase the centration on internal experience and body sensations, which in turn leads to a better emotional awareness. Finally, the model posits that this emotional awareness is more likely to increase the capacity to identify and engage meaningfully in life values and goals. Although this model has not yet been tested, several of its aspects will be investigated as part of this thesis.

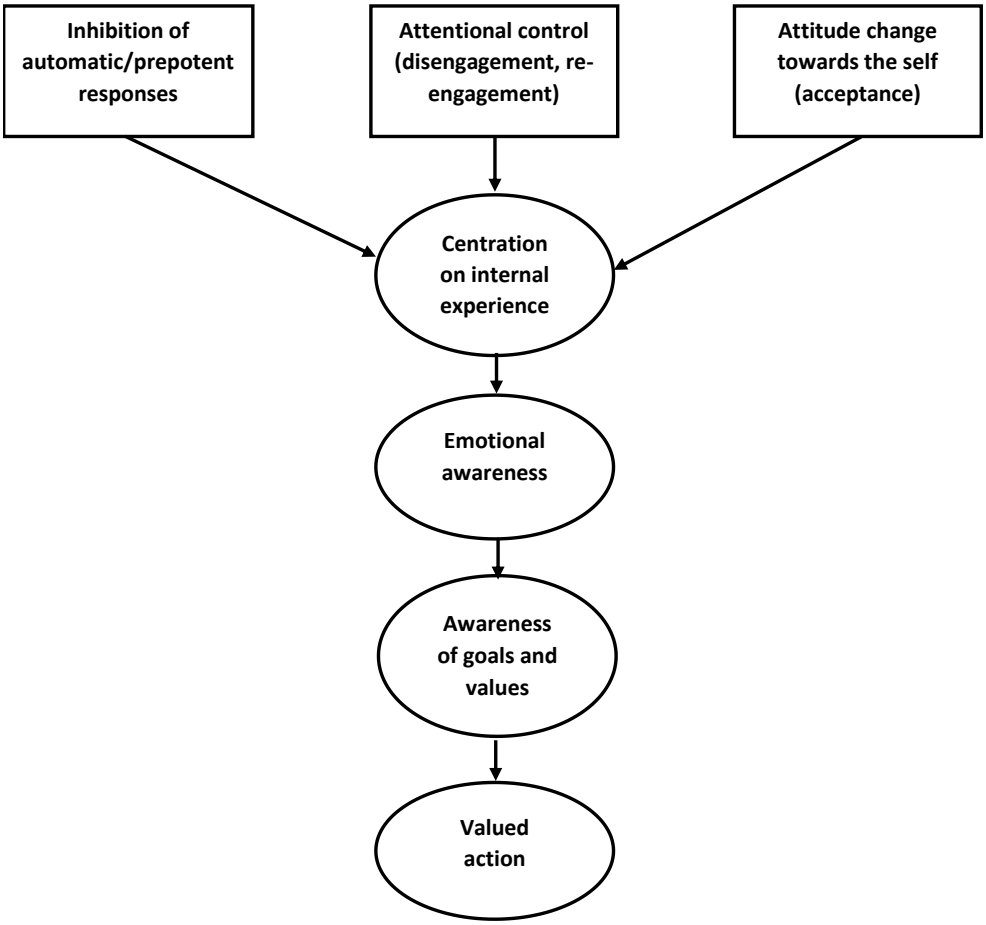

Figure 1.4. Philippot's theoretical model of mindfulness mechanisms.

2.4 Mindfulness implementation and programs

Now that we have defined the concept of mindfulness and its potential functioning, it is important to identify the practical aspects of its transmission, in particular through a better knowledge of the therapies and programs used, their format and themes.

2.4.1 In adults

The current standard format of mindfulness programs based on eight weekly sessions is the result of many years of development. At the beginning, Jon Kabat Zinn proposed a 10-week program named Stress Reduction and Relaxation Program (Kabat-Zinn, 1982). In order to be more specific, the term "meditation" was added to the name of the program (Kaplan,

Goldenberg, & Galvin-Nadeau, 1993) and subsequently transforming into mindfulness to form the MBSR program (Roth, 1997; Shapiro, Schwartz, & Bonner, 1998). In addition, the length of the program was reduced to eight weeks. Thus, the MBSR program consists of 8-week sessions of 2.5 hours with exercises such as sitting meditations (i.e, awareness of emotions, thoughts, body sensations and breath), body scan (i.e, awareness of body sensations in each part of the body) and hatha yoga (i.e, awareness of body sensations during simple postures and movements). Overall, this program has demonstrated a moderate effect size on mental disorders, such as depression and anxiety, across very different clinical and non-clinical populations (Hofmann, Sawyer, Witt, & Oh, 2010). The clinical interest of the MBSR program has not gone unnoticed and some psychologists have taken up its guidelines to create another program, the Mindfulness-Based Cognitive Therapy (MBCT), by adding cognitive therapy components, in order to prevent depressive relapse (Segal, Teasdale, & Williams, 2004). From there, a large number of mindfulness programs have been developed to be adapted to many clinical populations (see for example: Philippot, Nef, Clauw, de Romrée, & Segal, 2012). While originally dedicated to adults, Mindfulness-Based Interventions (MBIs) have also been designed for youth.

2.4.2 In children and adolescents

In continuity with MBIs for adults, many programs for youth have emerged in recent years. Although numerous mindfulness programs can be cited (for a review of existing programs, see Meiklejohn et al., 2012), Table 1.1 presents ten programs designed for children or adolescents that have been empirically validated. Overall, Deplus and Lahaye (2015) propose to distinguish two kinds of MBI families for youth. On the one hand, the therapeutic interventions that used mindfulness exercises with other therapeutic tools (such as Acceptance and Commitment Therapy or Dialectical Behavioral Therapy). And, on the other hand, interventions specially dedicated to mindfulness (such as the programs detailed in Table 1.1). There is no consensus concerning the age at which children can begin practicing mindfulness because the exercises can always be adapted. However, formal mindfulness practice, as described by awareness of the present moment, thoughts and body sensations, seems difficult before the age of seven considering the limited attentional capacities and the non-acquisition of abstract thinking mode (Thompson & Gauntlett-Gilbert, 2008).

Compared to adult programs, MBIs for youth have been adapted to be more suitable for children and adolescents. For example, sessions are more numerous and shorter, as are the practices, in order to respect the attention capacities of youth. In the same vein, the groups are often smaller and have more than one therapist. Finally, playfulness has a central role in the sessions to stimulate the interest of youth: Mindfulness concepts are often introduced through games, stories, movies, or pictures. Deplus and Lahaye (2015) propose seven points to watch out in order to maximize psychological benefits of MBIs in youth: (1) the group format (allowing social interactions between participants), (2) the language (the vocabulary

must be adapted to the participants' development age), (3) the formal practice of mindfulness (in terms of length and frequency), (4) playful aspect of activity (in order to maintain attention), (5) link with daily life (the use of metaphors and examples that are directly linked with their daily experience), (6) sharing the experience (emotional expression), (7) involvement of the family or caregivers (e.g., parents, teachers, educators). Moreover, it is worth noting that more and more programs require the involvement of parents or teachers.

In the same manner as MBIs for adults, MBIs for youth aim to enhance emotion regulation by improving emotional awareness. Indeed, it can be postulated that the capacity to identify emotions (with the help of bodily sensations) is associated with the capacity to use them smartly, i.e. as a guide for action (Ciarrochi, Heaven, & Supavadeeprasit, 2008). Likewise, the capacity to be aware of one's emotions is associated with the disengagement from emotional intensity and, therefore, reduces the risk for automatic responses and bad habits (Hessler & Katz, 2010).

Across 24 studies investigating the impact of MBIs in a school setting, Zenner, Herrnleben-Kurz, and Walach (2014) found that the theoretical framework of the programs always includes mindfulness but also integrates positive psychology or social and emotional learning (38%) and executive function (25%). In 62% of cases, the MBI was based on a manual although the majority of the programs used common exercises such as breath awareness, working with thoughts and emotions, psycho-education, awareness of senses and practices of daily life, group discussion or body-scan. The training varied from a period of 4 weeks to 24 weeks with 45 minutes once a week in most programs. However, it is important to keep in mind that these data only concern programs designed for a non-clinical population of students. In a more recent meta-analysis of MBSR programs in youth, Chi, Bo, Liu, Zhang, and Chi (2018) found that, out of the 18 studies included in their meta-analysis, 44% had the same number of sessions than the original program (i.e., 8 sessions), 22% had more than eight and 34% had less. However, program length or session frequency seem to not be associated with psychological outcomes (Zoogman, Goldberg, Hoyt, & Miller, 2015). In contrast, Deplus and Lahaye (2015) proposed three therapeutic factors that can enhance the quality and facilitate the implementation of MBIs among youth. The first factor is the co-facilitation of the sessions by two – or more – professionals. This functional aspect could enhance session management by increasing instructor availability and creating the possibility to have a more individual approach towards behavioral problems encountered by youth. According to these authors, it is also important that one instructor does the exercises like children to set the example (indeed, it is well known that vicarious learning is particularly important in youth). The second fundamental factor of MBI implementation in children and adolescents is to encourage home practice. Although studies reported mixed results concerning the role of practice time on psychological benefits (Parsons, Crane, Parsons, Fjorback, & Kuyken, 2017), mindfulness training is based on practice as is the case for sport or music performance. Thus, instructors should focus on homework and review the exercises requested. Finally, the last factor refers to the context of the program. The rules but also the place of ritual moments (e.g., sharing the internal experience at the beginning of the session, review of the exercises,

meditation at the end, etc.) are important for children and adolescents because they give them a habitual, reassuring and structuring rhythm. A common thread of sessions, which can be fostered by a story for instance, could support the continuity of mindfulness themes with a gradual evolution of the difficulty (e.g., from concrete exercises, such as body awareness, to abstract exercises, such as awareness of thoughts).

Concerning contra-indications, most studies have highlighted the importance of a serious screening of participants, notably on psychiatric problems, psychosis, personality disorders, major depressive disorders, addictions, and posttraumatic stress disorders, which are associated with no outcomes or negative ones (Dobkin et al., 2012; Goldberg et al., 2018; Shapiro & Carlson, 2017). These children could be confronted with very difficult images or emotions during the meditation. By closing their eyes, they increase their attention to their inner experience and may have a strong sensation of losing control. In addition, it can be difficult to ignore the environmental cues that indicate that there are no threats. Thus, mindfulness for severe psychiatric disorders should not be considered as a first-line treatment. In the same way, participants with clinical symptoms (e.g., high anxiety) must be treated appropriately by a qualified practitioner or medication in parallel with the program. For youth, it is important to propose a secure setting by giving them the opportunity to talk about their difficulties outside of the sessions. Since mindfulness can be a challenge for adolescents with psychiatric disorders, especially behavior disorders, this thesis will also examine the feasibility of this kind of intervention among this population in a next section. But before going further in the implementation of MBIs, it is important to conduct a literature review on their psychological benefits in order to justify their use in a clinical setting.

Table 1.1. Well-validated mindfulness-based interventions for children and adolescents.

Program name	Population and age	Number of sessions	Main topics	Website
Mind UP (Maloney, Lawlor, Schonert-Reichl, & Whitehead, 2016)	3 adapted programs in school setting: For 5-8 years For 8-11 years For 11-14 years	15 sessions	"Getting Focused," "Sharpening Your Senses," "It's All about Attitude," "Taking Action Mindfully,"	https://mindup.org/

Program name	Population and age	Number of sessions	Main topics	Website
.b (Kuyken et al., 2013)	2 adapted programs in school setting: For 7-11 years For 11-18 years	10 sessions	Paying attention, Taming the Animal Mind, Recognising Worry, Being Here Now, Moving Mindfully, Stepping Back, Befriending the Difficult, Taking in the Good, Pulling it all Together	https://mindfulnessinschools.org/
Learning to BREATHE (Broderick & Metz, 2009)	Adolescents	Several formats: 6 sessions 12 sessions 18 sessions	Body awareness, understanding and working with thoughts, understanding and working with feelings, integrating awareness of thoughts, feelings and bodily sensations, reducing harmful self-judgments, and integrating mindful awareness into daily life	http://learning2breathe.org/
Taming the Adolescent Mind mindfulness-based intervention (Tan & Martin, 2015)	Clinical population of adolescents (13–18 years)	5-week, one hour per week (5 session)	Regulation of attention, observing present moment, acceptance, mindful action	none
MYmind (Chan et al., 2018)	Children with ADHD aged 8 to 12 years (and recently validated among children with Autism Spectrum Disorders) Involvement of the parents	8 weekly 90 min group sessions	Bodily awareness, Automatic responding, Breathing meditation, yoga, body-scan	https://www.uvamindsyou.nl/site/professional/mymind-training-amsterdam

Program name	Population and age	Number of sessions	Main topics	Website
MindfulKids (van de Weijer-Bergsma, Langenberg, Brandsma, Oort, & Bögels, 2014)	children, aged 8 to 12 years in school setting	12 sessions of 30 min during 6 weeks	Bodily awareness, sustaining and switching attention, being nonreactive, curious attitude, Empathy, awareness of emotions, Awareness of thoughts, Nonjudgmental awareness	https://www.mindfulkids.nl/
Mindfulness among children and adolescents (Deplus & Lahaye, 2015)	Children or adolescents	9 sessions	Emotions, body awareness, thoughts, nonjudgment	http://www.emotions-enfant.be/index.php
Mindfulness for children (Dewulf, 2015)	Children	16 sessions	Paying attention with mindfulness, awareness of breath, emotional awareness, empathy	http://davidd ewulf.be/en/for-kids-and-teens/
Mindfulness for teens (from David Dewulf; Raes, Griffith, Van der Gucht, & Williams, 2014)	Adolescents	8 sessions of 100 minutes	"Attention to the breath and the moment, "Attention to the body and pleasant moments", "Attention to your inner boundaries and to unpleasant moments", "Attention to stress and space", "Attention to thoughts and emotion", "Attention to interpretations and communication", "Attention to your attitudes and your moods", and "Attention to yourself and your heartfulness"	http://davidd ewulf.be/en/for-kids-and-teens/
Boost Your Mind program (Van der Gucht, Takano, Labarque, et al., 2017)	Adolescent and young adult cancer survivors	8 sessions of 90 minutes	Automatic pilot, breath, body scan, breathing space, mindful yoga, insight meditation, walk meditation, psycho-education (e.g., stress, depression, fear of cancer recurrence, self-care)	https://ppw.kuleuven.be/leuven-mindfulness-centre/Open-Source

3. Efficacy and psychological processes in the mindfulness field

Considering MBIs' increase in popularity, it seems important to ensure their psychological efficacy on mental health and, consequently, whether they can be considered as empirically supported treatments. Recently, a significant part of experimental psychology has focused on Evidence-Based Practice (EBP) which is defined as a practice that incorporates best-available research evidence, clinical expertise (e.g., training for psychologists), patient values and contextual factors (APA, 2005). Therefore, this chapter section will first review the evidence of MBI efficacy across adults and youth. Then, we will discuss the models and psychological processes proposed in the literature that could explain the observed changes.

3.1 Efficacy

3.1.1 Efficacy in adult population

In order to have an overview of the literature concerning MBIs among adults, the words "Mindfulness" AND "Meta-analysis" were used as search terms in the PsycINFO database. Between 2003 and 2018, the database has collected 216 articles that are related to these keywords, almost half of which were published between 2017 (*n*=51) and 2018 (*n*=48). This very high rate of publications highlights a growing interest in mindfulness over the last decade but also allows us to draw conclusions about its therapeutic effects.

For example, numerous meta-analyses have supported the efficacy of MBIs for treating anxiety (Abbott et al., 2014; Goyal et al., 2014; Hofmann et al., 2010; Sedlmeier et al., 2012), some of them considering this therapeutic effect as the main benefit of these interventions. A systematic review and multilevel meta-analysis of 10 randomized controlled trials were performed by de Abreu Costa, de Oliveira, Tatton-Ramos, Manfro, and Salum (2018) among patients with anxiety and stress-related disorders. Their results indicated that, compared to a control group, MBCT/MBSR program reduced internalizing symptoms (Difference in Standardized Mean Change [DSMC] = − 0.38; 95% CI [− 0.64, − 0.12]; $p < .01$), distress symptoms (DSMC = −0.45; 95% CI [− 0.7, − 0.21]; $p < .001$] but not fear symptoms (DSMC = − 0.028; 95% CI [− 0.45, 0.4]; $p > .10$). In addition, the analyses did not show any difference between Cognitive and Behavioral Therapy (CBT) and MBI on these outcomes except for fear symptoms in favor of CBT. These results suggest that patients who suffer from anxiety can benefit from MBI as well as CBT. However, it seems important to note that MBI may not have a sufficiently precise action to target psychological processes implied in phobic

disorders compared to CBT. For instance, the exposure component of CBT might be critical to reducing phobic symptoms. Globally, the effect of MBIs on anxiety seems consistent across the literature and suggests a small to medium effect size with no difference with CBT even if long-term effects are still uncertain (Ren, Zhang, & Jiang, 2018; Vøllestad, Nielsen, & Nielsen, 2012). Thus, considering the cost-beneficial aspect of MBIs, some authors recommend their wide dissemination (Singh & Gorey, 2018).

Just as anxiety, depressive symptoms seem positively impacted by MBIs in clinical and non-clinical populations with a small to moderate effect size (De Vibe et al., 2017; Goyal et al., 2014; Klainin-Yobas, Cho, & Creedy, 2012; Wang et al., 2018). First studies conducted on MBCT found the program efficient to prevent depression relapse in patients with three or more previous episodes of depression by significantly reducing the risk of relapse/recurrence (Ma & Teasdale, 2004; Teasdale et al., 2000). More recently, studies indicate that MBCT is equal to an antidepressant treatment, and to CBT, in preventing relapse in patients with previous major depressive episodes over a two-year period (Farb et al., 2018; Kuyken et al., 2015).

However, the clinical enthusiasm for MBIs should not make us forget the limits shown by some studies. Firstly, MBIs may not be adapted to treat high levels of symptomatology. As demonstrated by the meta-analysis of Hedman-Lagerlöf, Hedman-Lagerlöf and Öst (2018) conducted among patients with psychiatric disorders, MBIs may be more effective than no treatment (DSMC = 1.07) or treatment as usual (DSMC = 0.40) but not in comparison to placebo (DSMC = 0.17) or other active treatments (DSMC = -0.01). Secondly, methodological quality was negatively related to outcomes (suggesting an overestimation of MBI efficacy in low quality studies) and a large number of studies suffered from methodological bias. For instance, meta-analyses are always limited by literature which tends to publish false positive results (Dickersin, 1990; Sterne, Gavaghan, & Egger, 2000). The authors concluded that MBIs cannot yet be regarded as an evidence-based treatment for common psychiatric disorders.

In contrast to this statement, another meta-analysis conducted by Goldberg et al. (2018) supports the efficacy of MBIs for treating depression. On the one hand, the various and mixed results retrieved from the literature suggest that MBIs may have a real and positive impact on mental health among adults considering numerous studies that support its effect. On the other hand, MBIs may not be better than other treatments such as CBT and may also be ineffective for some kind of pathologies and some kind of individuals. Therefore, the enthusiasm behind the practice of mindfulness should be moderated but can partially be explained by the broad range of disorders that appear to be impacted by MBIs. However, it is still important to note that mindfulness practice has therapeutic benefits that are not inherent to mindfulness (such as group format) and that MBIs require a real commitment as reflected by the many hours of practice which is not the case for other psychological treatments with similar benefits.

3.1.2 Efficacy in youth

3.1.2.1 Overview

In order to investigate the overall efficacy of MBIs in youth, an overview of existing meta-analyses has been performed. The words “Mindfulness” AND “Meta-analysis” AND “Adolescent” OR “Children” OR “Youth” were used as search terms in the PsycINFO, PubMed, Google Scholar and ScienceDirect databases. Eleven meta-analyses were found. Table 1.2 depicts the design and the results of each meta-analysis.

Table 1.2. Meta-analyses of MBIs efficacy among children and adolescents

Meta-analysis	Population	General procedure	Overall effect size (Pre-Post)
Chi, Bo, Liu, Zhang, & Chi (2018)	Clinical and non-clinical populations of youths aged 12 to 25 years	18 studies (N = 2,042) Comparison between a MBSR program and an inactive or active control group (Pre-Post, follow-up) Only randomized controlled trials	Hedges’ g *Depression*, g = −0.45 (95% CI [−0.63, −0.27]) *Depression (follow-up, 2 to 6 months)*, g = −0.24 (NS, 95% CI [−0.54, 0.06]),

Meta-analysis	Population	General procedure	Overall effect size (Pre-Post)
Dunning et al. (2018)	Clinical and non-clinical populations of youths aged 18 years or younger	33 studies (N = 3,666) Comparison between a MBI and an inactive or active control group (Pre-Post) Only randomized controlled trials	Standardised mean differences **All RCTs** *Overall*, g = 0.19 (95% CI [.14, .23] *Mindfulness*, g = 0.24 (95% CI [.01, .46]) *Social behavior*, g = 0.16 (NS, 95% CI [-.05, .37]) *Negative behavior*, g = 0.27 (95% CI [.07 to .47]) *Depression*, g = 0.27 (95% CI [.06, .49]) *Anxiety/Stress*, g = 0.16 (95% CI [.04, .27]) *Executive functions*, g = 0.30 (95% CI [.12, .49]) *Attention*, g = 0.19 (95% CI [.04, .34]) **RCTs with active control conditions** *Overall*, g = 0.20 (95% CI [.14, .26] *Mindfulness*, g = 0.42 (95% CI [.16, .67]) *Social behavior*, g = -0.07 (NS, 95% CI [-.46, .31]) *Negative behavior*, g = 0.19 (NS, 95% CI [-.16, .59]) *Depression*, g = 0.47 (95% CI [.22, .72]) *Anxiety/Stress*, g = 0.18 (95% CI [.05, .31]) *Executive functions*, g = 0.10 (NS, 95% CI [-.03, .23]) *Attention*, g = 0.13 (NS, 95% CI [-.01, .28])

Meta-analysis	Population	General procedure	Overall effect size (Pre-Post)
Maynard, Solis, Miller, & Brendel (2017)	Students from clinical and non-clinical populations	35 studies (N = 6,207) Comparison between a MBI and an inactive or active control group (Pre-Post)	Hedges' g *Cognitive outcomes*, g = 0.25 (95% CI [0.06, 0.43]) *Socioemotional outcomes*, g = 0.22 (95% CI [0.14, 0.30]) *Academic outcomes*, g = 0.27 (NS, 95% CI [-0.04, 0.57]) *Behavioral outcomes*, g = 0.14 (NS, 95% CI [-0.02, 0.30])
Carsley, Khoury, & Heath (2018)	Students aged 6 to 18 years	24 studies (n = 3,977) Comparison between a MBI and an inactive or active control group (Pre-Post)	Hedges' g **Within-group** *Mental health* (Pre-Post), g = 0.23, 95% CI [.12, .34]) *Mental health (Follow-up)*, g = 0.17, 95% CI [.04, .30]) **Between-group** *Mental health (Pre-Post)*, g = 0.24, 95% CI [.14, .34] *Mental health (Follow-up)*, g = 0.17 (NS) NB: Late adolescence revealed higher pre-post effects than middle childhood (g = 0.20) **Type of interventions (Pre-Post*)*** *Various mindfulness activities*, g = 0.39 *Yoga*, g = 0.29 *Mindfulness program*, g = 0.11 (NS)

Meta-analysis	Population	General procedure	Overall effect size (Pre-Post)
Chimiklis et al. (2018)	Youth diagnosed with ADHD and aged 5 to 17 years	11 studies (N = 251) Comparison between a MBI/yoga intervention and an inactive or active control group (Pre-Post) or a MBI/yoga alone (Pre-Post)	Hedges' g **Reported by parents** *ADHD symptoms*, g = 0.57 (95% CI [.03; 1.11]) *Inattention and attention problems*, g = 0.34 (95% CI [.13, .55]) *Hyperactivity*, g = 0.39 (95% CI [.046, .73]) **Reported by Teacher** *ADHD symptoms*, g = 0.23 (95% CI [.07, .50]) *Inattention and attention problems*, g = 0.31 (95% CI [.12, .49]) *Hyperactivity*, g = 0.22 (95% CI [.025, .41]) *On-task behavior*, g = 1.22 (95% CI [.92, 1.52]) *Executive function*, g = 0.31 (95% CI [−.12, .74]) **Reported by children** *Child-parent relationship*, g = 0.50 (95% CI [.25, .75]

Meta-analysis	Population	General procedure	Overall effect size (Pre-Post)
Zhang, Díaz-Román, & Cortese (2018)	Youth diagnosed with ADHD and aged 5 to 24 years	7 studies (N=270) Comparison between a MBI/yoga intervention and an inactive or active control group (Pre-Post)	Hedges' g *ADHD core symptoms*, g = -0.44, (95% CI [−0.69, −0.19]), *Inattentive symptoms*, g = −0.52 (95% CI [–0.81, −0.23]) *Hyperactive-impulsive symptoms*, g = −0.40 (95% CI [–0.68, −0.12]) *Neuropsychological measures of inhibition*, g = −0.35 (NS, 95% CI [–0.91, 0.21]) *Neuropsychological measures of inattention*, g = −0.35 (NS, 95% CI [–0.86, 0.17])
Klingbeil et al. (2017)	Clinical and non-clinical populations of youth aged 4–18 years	76 studies (N=6121) Comparison between a MBI and an inactive or active control group (Pre-Post and follow-up) or MBI alone (Pre-Post and follow-up)	Hedges' g **Within-group** *Overall (Pre-Post)*, g = 0.30 (95% CI [0.22, 0.39]) *Overall (Follow-up*), g = 0.46 (95% CI [0.20, 0.72]) **Controlled studies** *Overall (Pre-Post)*, g = 0.32 (95% CI [0.24, 0.40]) *Overall (follow-up)*, g = 0.40 (95% CI [0.22, 0.58])

Meta-analysis	Population	General procedure	Overall effect size (Pre-Post)
Kallapiran, Koo, Kirubakaran et Hancock (2015)	Clinical and non-clinical populations of youths aged 6 to 20 years	11 studies (N = 1454) Comparison between a MBI and an inactive or active control group (Pre-Post) Only randomized controlled trials	Hedges' g *Stress*, g = 0.31 (95% IC [.05, .57]) *Anxiety*, g = 0.96 (95% IC [.55, 1.37]) *Depression*, g = 0.42 (95% IC [.22, .62])
Zoogman, Goldberg, Hoyt et Miller (2015)	Clinical and non-clinical populations of youths aged 6 to 21 years	20 studies (N = 1772) Comparison between a MBI and an inactive or active control group (Pre-Post) or MBI alone (Pre-Post)	Becker's del *Overall*, del = 0.23, (95% IC [.15, .30]) *Objective measures*, del = 0.23, (95% IC [0.10, 0.36] *Psychological measures*, del = 0.37 (95% IC [.25, .49]) *Not psychological symptoms*, del = 0.21, (95% IC [.12, .29]) *Attention and mindfulness measures*, del = 0.28 (95% IC [0.07, 0.49])
Borquist-Conlon, Maynard, Brendel et Farina (2017)	Youth with anxiety disorders aged 5 to 18 years	5 studies (N = 188) Comparison between a MBI and an inactive or active control group (Pre-Post)	Hedges' g *Anxiety*, g = -.62 (95% IC [.20, 1.04])

Meta-analysis	Population	General procedure	Overall effect size (Pre-Post)
Zenner et al. (2014)	Students aged 6 to 19 years	24 studies (N = 1348) Comparison between a MBI and an inactive or active control group (Pre-Post) or MBI alone (Pre-Post)	Hedges' g **Within-group** *Overall*, g = 0.41 (95% IC [0.28, 0.55]) *Cognitive performance*, g = 0.68 (95% IC [0.33, 1.03]) *Emotional problems*, g = 0.31 (95% IC [0.19, 0.42]) *Stress*, g = 0.36 (95% IC [0.05, 0.66]) *Factors of resilience*, g = 0.38 (95% IC [0.20, 0.55]) *Third person Ratings*, g = 0.34 (95% IC [0.08, 0.60]) **Between-group** *Overall*, g = 0.40 (95% IC [0.21, 0.58]) *Cognitive performance*, g = 0.80 (95% IC [0.35, 1.26]) *Emotional problems*, g = 0.19 (NS, 95% IC [-0.03, 0.41]) *Stress*, g = 0.39 (95% IC [0.07, 0.71]) *Factors of resilience*, g = 0.36 (95% IC [0.09, 0.62]) *Third person Ratings*, g = 0.25 (NS, 95% IC [-0.10, 0.61])

Before going any further in the interpretation of the results, it is worth considering some methodological points that will allow for a better understanding of the scientific framework of mindfulness studies in youth. At first, several meta-analyses included non-randomized controlled studies - or studies with no control group - without performing separate analyses (e.g., Chimiklis et al., 2018; Zoogman, Goldberg, Hoyt, & Miller, 2015). As a matter of fact, numerous meta-analyses emphasized the high risk of bias in the method and design used by

the studies (blinding of the participants, publication bias, reporting bias etc.), which limits the scope of interpretation and may lead to an overestimation of MBIs' efficacy. Secondly, there is an inevitable overlap of studies in these different meta-analyses. For instance, Klingbeil et al. (2017) included 90% of the studies selected by the previous meta-analysis of Zoogman et al. (2015). However, most of the meta-analyses investigated the effect size on different pooled outcomes (e.g., differentiate ADHD symptoms or group them into a behavioral outcomes category). Finally, the conclusions drawn by the meta-analyses also depend on the type of population (in terms of age, diagnosis etc.). Three studies (Cairncross & Miller, 2016; Chimiklis et al., 2018; Zhang et al., 2018) were not included in those results because of their specific population of youth with ADHD and will be discussed in detail in Chapter 2.

Taking all this into consideration, it is possible to infer the overall effects of MBIs on children and adolescents. Regarding the impact of MBIs on all psychological outcomes put together, five meta-analyses (k = 5) reported an effect size ranging from 0.19 to 0.41, which suggests a small to moderate effect. At follow-up, this effect ranged from 0.17 to 0.46 (k = 2).

For depressive symptomatology, the effect size found (k = 3) ranged from 0.27 to 0.45 and indicates a small to moderate effect. Only one study reported a non-significant follow-up effect size on depression (effect size [es] = 0.24).

For anxiety and stress, the effect size ranged from 0.16 to 0.96 (k = 4). However, when we consider only the three meta-analyses that distinguished stress and anxiety, it appears that MBIs have a better effect on Anxiety (es ranged from 0.62 to 0.96, indicating a moderate to large effect) than Stress (es ranged from 0.31 to 0.39, indicating a small to moderate effect). Yet, this difference is difficult to interpret given the diversity of questionnaires used (e.g., the Perceived Stress Scale, the Stress and Coping Questionnaire for Children [for stress] and the State Anxiety Inventory for Children, the Symptom Checklist 90-Revised anxiety and depression subscales [for anxiety]) but also considering the overlaps of the two constructs between two meta-analyses.

For mindfulness, only two meta-analyses investigated this measure and found a small to moderate effect size ranging from 0.24 to 0.42.

For cognitive outcomes, the meta-analyses indicate an effect size ranging from 0.25 to 0.80 (k = 2). This large interval could come from the huge diversity of cognitive measures used in the study and therefore, does not allow us to draw conclusions.

For behavioral outcomes, the effect size ranged from 0.14 to 0.34, indicating a small effect size (k = 3). This variable refers to externalizing symptoms in a large extent (e.g.,

opposition, aggressive behaviors but also compliance and social inhibition) rated by a third person or by the youth. The details of the results on behavior disorders will be discussed in the next chapter.

In addition to these studies, a recent meta-analysis conducted by Pandey et al. (2018) investigated the efficacy of several interventions on self-regulation, in children and adolescents, in a school setting. Compared to a control group, MBIs came in third place (es = 0.44), behind Social and personal skills interventions (es = 0.64) and Exercise-based interventions (es = 0.46), and ahead of Curriculum-based interventions (es = 0.34). Importantly, four of the eight MBI studies included in the meta-analysis did not provide a significant effect on self-regulation. Moreover, authors suggest prioritizing the use of curriculum-based interventions (a combination of teachers' professional training and classroom-based activities such as games, storytelling, book reading, or self-talk) because of their low need in terms of time and staff. These conclusions do not remove the potential effectiveness of MBIs on self-regulation but indicate that MBIs may be more effective in clinical populations. This is what is suggested by the meta-analysis of Zoogman, Goldberg, Hoyt, and Miller (2015) which found, across combined dependent variables, that clinical samples benefit more from a MBI than non-clinical ones (respectively, es = 0.50, es = 0.19). This result can also be understood by the fact that improvements are easier to achieve in clinical populations. It is also possible that MBI targets other outcomes such as anxiety, depressive symptomatology or attentional capacities as previously developed.

Two main conclusions can be drawn from these results. First, MBIs among children and adolescents seem to be effective in treating internalizing symptomatology such as depression and anxiety as evidenced by the consistency of the effect size on these variables. However, the small to moderate effect associated with a large part of the results also demonstrate the limit of these interventions in terms of efficacy. A second question naturally emerges from this observation and concerns the specific effect, or moderators, that underlie MBIs' efficacy.

3.1.2.2 Moderators of MBIs' efficacy in youth

Meta-analyses have the advantage of providing conclusions on the overall effect of interventions. However, their results must be interpreted with caution as they do not consider all specific conditions and contexts that could modulate MBI effectiveness. For example, MBIs could be effective for depressed adolescents, but not for bipolar ones. Indeed, the positive impact of MBIs in youth may depend on a large variety of contextual and psychological factors. The study of Van der Gucht, Takano, Kuppens, & Raes (2017) showed that, among students, MBIs could be particularly effective in helping adolescents with high levels of symptomatology in the long-term but did not find any other moderators such as gender or age. Yet, results in the literature are mixed, and some studies suggest a moderation of gender, with increased benefit for girls (Johnson, Burke, Brinkman, & Wade, 2016; Kang et al., 2018), while others do not find a significant effect (van de Weijer-Bergsma et al., 2014;

Zoogman et al., 2015). Girls might benefit more from MBIs because of their lower natural level of mindfulness than boys (Kuby, McLean, & Allen, 2015) or because of their higher level of internalizing symptomatology (Leadbeater, Kuperminc, Blatt, & Hertzog, 1999).

With regards to age as moderator of MBI efficacy, studies are more consensual and many of them did not find a significant effect (Chi et al., 2018; Gould, Dariotis, Mendelson, & Greenberg, 2012; Johnson, Burke, Brinkman, & Wade, 2017; Zoogman et al., 2015). Nevertheless, these results may differ depending on the variables examined. For instance, Dunning et al. (2018) found that older children have a greater improvement in executive functions and, on the contrary, that younger children have a greater improvement in negative behavior.

The influence of practice time is also a question that remains difficult to solve. Johnson et al. (2017) found that the amount of homework explains a small portion of the variance of changes in mindfulness facets (5% to 9%) but remains non-significant for depression and anxiety. In the same way, Dunning et al. (2018) also reported a significant and positive effect of practice time on negative behaviors, but not for the other outcomes. However, another study of Johnson et al. (2016) did not find any moderating effect of practice time on the outcomes.

Finally, the unique and significant moderator frequently reported in the literature is the level of symptomatology. Indeed, MBIs seem to decrease psychopathological problems especially when individuals present higher levels of symptoms at baseline (Blake et al., 2018; Fung, Guo, Jin, Bear, & Lau, 2016; Van der Gucht, Takano, Kuppens, et al., 2017; Zoogman et al., 2015) although one study found the inverse association (Gould et al., 2012).

3.1.2.3 Neurobiological markers

The results of Marusak et al. (2018), obtained in a cross-sectional study conducted in children and adolescents, suggest that the effect of mindfulness is a dynamic process that can be observed by a measure of neurobiological changes in the functional network over time rather than a measure of static connectivity. This may point to a difference with adult populations where associations between trait mindfulness and static connectivity have been observed (Doll, Hölzel, Boucard, Wohlschläger, & Sorg, 2015). In addition, more mindful children showed a greater number of state-transitions during the resting-state scan indicating that they are more likely to explore the different facets of their present experience and to volitionally switch their attention from mental speeches to body sensations. Firstly, children with higher level of mindfulness spent less time in state 2, which is characterized by a positive connectivity between mind-wandering (default mode network[3]) and the left and right

[3] The default network is an interconnected set of brain regions including the posterior cingulate cortex, medial prefrontal cortex, angular gyrus and medial temporal lobes, which is related to daydreaming and rest state.

components of the central executive network[4] and a negative connectivity between the salience network[5] and the default mode network. Secondly, more mindful children may show a greater neuronal flexibility by demonstrating a greater capacity to shift between different neuronal states.

From a neurological point of view, mindfulness in pre-adolescents can also be defined as the balance between top-down and bottom-up processes, that is to say the flexibility to use the process needed in the adapted context (e.g., use controlled attention for exercises that require concentration and use open attention to be aware of relevant environmental stimuli). During childhood, the strong association between the ventral attention network[6] and salience network testifies to the strong predominance of the bottom-up process, which tends to decrease across the development period in favor of the use of the prefrontal cortex and, then, the top-down process (for a review see Kaunhoven & Dorjee, 2017). In this way, mindfulness could help to develop cognitive abilities and executive functions in children. This is the conclusion of several studies that have demonstrated the positive impact of a MBI on attentional capacities and executive functions measured by laboratory tasks (Kiani, Hadianfard, & Mitchell, 2017; Sanger & Dorjee, 2016; Tarrasch, 2017).

3.2 Processes: What are the mechanisms of mindfulness?

If the positive influence of MBIs on mental health tends to be supported by a large part of the literature, the question of the psychological processes involved in these therapeutic effects are still uncertain. Psychological processes can be perceived as the principal mediators of MBIs efficacy and answer to the question: how the practice of mindfulness can bring a psychological change? It has already been mentioned in the models presented in section 2.3 that attention/body awareness, impulsivity/non-reactivity and emotion regulation can be major processes of mindfulness.

[4] The activation of the central executive network is related to cognitive capacities (such as attentional tasks) and includes the dorsolateral prefrontal cortex and posterior parietal cortex.
[5] The salience network includes the ventrolateral prefrontal cortex, anterior insula and the anterior cingulate cortex. It is involved in the attention allocation to stimuli that is salient to the individual.
[6] The ventral attention network is involved in top-down volitional orienting of attention in relation to a goal and responds when behaviorally relevant stimuli occur unexpectedly. It comprises the temporoparietal junction and the ventral frontal cortex

Figure 1.5 shows how the processual approach can shed light on mindfulness efficacy. This part will focus on the exploration of the factors and mediators that can explain the action modalities of mindfulness. On the one hand, we will investigate the underlying components of mindfulness and their influence, and, on the other hand, we will examine other processes (other than mindfulness) that can mediate the link between MBIs and outcomes.

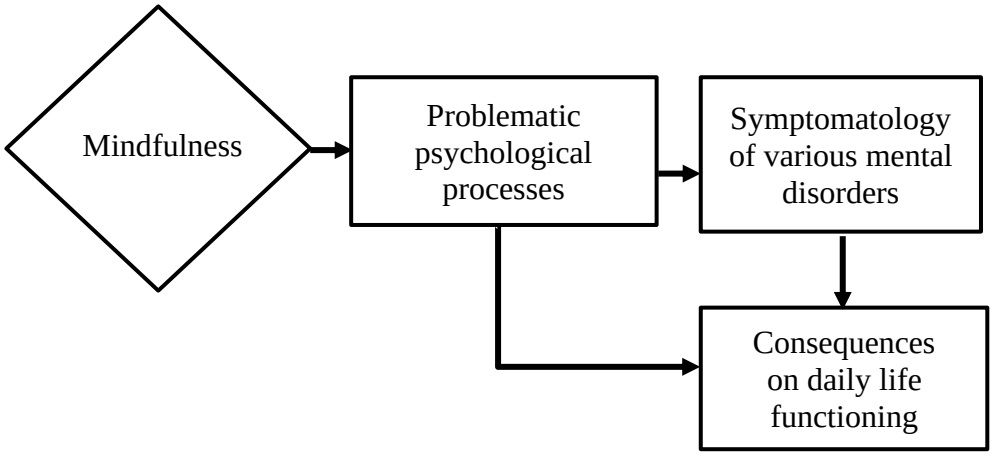

Figure 1.5. Processual approach of mindfulness efficacy viewed by Deplus et al. (2014)

3.2.1 Mindfulness

Considered as an evident mechanism of MBIs, mindfulness has been largely studied, and demonstrated, as a main process in these interventions (Alsubaie et al., 2017; Gu, Strauss, Bond, & Cavanagh, 2015). For example, the results of Kuyken and al. (2010) showed that the therapeutic effect of MBCT is mediated by the improvement of mindfulness and self-compassion. In another Randomized Controlled Trial, participants of a MBSR program with higher levels of mindfulness at baseline showed a larger increase of mindfulness and well-being (Shapiro, Brown, Thoresen, & Plante, 2011).

Several questionnaires were created to capture mindfulness in order to target its specific action. A first observation is that mindfulness has been largely considered as a trait construct although some questionnaires and tasks, such as the Toronto Mindfulness Scale (Lau et al., 2006), were developed on the theoretical hypothesis that mindfulness can be viewed as a state. In the same vein, some questionnaires consider mindfulness as a unique construct (Baer, Smith, & Allen, 2004; K. W. Brown & Ryan, 2003) while some others view mindfulness as a multi-factors construct (Baer et al., 2006; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007). For instance, the widely used Five Facets Mindfulness Questionnaire (FFMQ) proposes five factors: observing the present experience, describing the present experience, acting with awareness, nonjudging of inner experience, and nonreactivity of inner experience. Although the Observing dimension seems inconsistent across studies, the role of the other dimensions, and particularly nonjudgement, could be negatively associated with symptomatology. The results found by Cash and Whittingham (2010) go in this direction and showed that a low level of nonjudgment predicts depression, stress and anxiety and that acting with awareness predicts a lower level of depression. Similar results were found by Medvedev, Norden, Krägeloh, and Siegert (2018) who demonstrated that nonjudgment predicts lower levels of depression, anxiety, and stress and that nonreactivity predicts lower levels of stress and depression while acting with awareness predicts anxiety and stress. Nonreactivity, nonjudgment and acting with awareness are also significant predictors of worry symptoms (34% of the variance explained in the model, Fisak & Von Lehe, 2012). Overall, a change in the FMMQ score is associated with changes in self-regulation, values, flexibility, or exposure (Carmody, Baer, Lykins, & Olendzki, 2009). In addition, cross-sectional studies showed that length of meditation practice seems associated with nonreaction, observing and nonjudgement and that mindfulness facets mediated the link between practice time and well-being (Josefsson, Larsman, Broberg, & Lundh, 2011). Finally, experimental studies support these results. After a MBCT program, participants increased their scores on all facets of the FFMQ and decreased their general psychopathological symptomatology compared to a wait-list group (Heeren et al., 2015). However, some studies did not find a moderation of mindfulness facets on the relation between social anxiety schemas and behavioral avoidance (e.g., Parsons, Luebbe, & Clerkin, 2017).

3.2.2 Other processes

As we have already seen in the section presenting the models, mindfulness was not the only process that could explain the therapeutic effects of MBIs. In a review of 93 articles, Tomlinson, Yousaf, Vittersø, & Jones (2018) found six kinds of cognitive processes that may be involved in MBIs: coping strategies, rumination, pain catastrophizing, neuroticism, executive function, and impulsivity. In addition to this proposition, a large number of other processes were suspected to be at the origin of MBIs benefits such as decentering, attention regulation, emotion regulation, self-compassion, exposure, increases in positive resources, values clarification, self-awareness, and transcendence (Cebolla et al., 2017). According to Gu et al. (2015) strong and consistent evidence was identified for cognitive and emotional reactivity, moderate and consistent evidence for rumination or worry, and preliminary, but insufficient evidence, for self-compassion and psychological flexibility. Although few studies have investigated the psychological processes involved in mindfulness, the vast majority of studies have focused on ruminations and emotional regulation. Therefore, we will briefly summarize the findings that emerge from the literature on these two processes, that is to say: emotional reactivity and rumination/worry.

Concerning emotional reactivity (which can be considered similar to non-judgement of inner experience and emotional acceptance), participants who engage in long-term mindfulness meditation training tend to have a lower amygdala activation than a control group when confronted with positive pictures (but not negative pictures), suggesting a lower emotional reactivity concerning positive stimuli which may be viewed as a marker of lower positive urgency level (Kral et al., 2018). Interestingly, their findings also suggest that this decrease of amygdala activation is more associated with a decreased desire to approach positive stimuli than with a loss of pleasure or appreciation. Moreover, mindfulness practice time could enhance daily low-arousal positive emotions (i.e., feeling calm and quiet) but it does not seem to be associated with high-arousal positive emotions (i.e., feelings of peppiness, enthusiasm and happiness), high and low-arousal negative emotions or emotion variability (i.e., the degree to which individuals vary on average in their emotions over time) (Jones, Graham-Engeland, Smyth, & Lehman, 2018). To complete these results, some authors speculated that mindfulness could be specifically related to greater recovery from negative emotions when negative stimuli are presented (Cho, Lee, Oh, & Soto, 2017). Initially, there may be a similar impact on mood state in people with high and low mindfulness levels but, subsequently, there may be a faster attenuation of the emotional response in the long term for those who presented a high level of mindfulness. Thus, mindfulness could not affect the sensitivity of the individuals (emotional response to environment) but may protect them from emotional vulnerability (better coping over time). Overall, emotional reactivity as a central mechanism of psychological changes in MBIs received a large amount of empirical support (Feldman, Lavallee, Gildawie, & Greeson, 2016; Lindsay et al., 2018; Taylor et al., 2011) and leads to the conclusion that mindfulness

benefits could be underpinned by emotional acceptance. However, it is difficult to state whether emotional acceptance is a psychological process trained by mindfulness practice or a psychological construct that is an integral part of mindfulness.

Rumination (i.e., the tendency to have repetitive thinking about oneself) is also suspected to play a central role in the benefits of MBIs on mental health (Heeren & Philippot, 2011). For example, rumination could mediate the positive impact of MBI on depression in depressed patients (Shahar, Britton, Sbarra, Figueredo, & Bootzin, 2010; Shahar et al., 2010; Van Aalderen et al., 2012). A similar pattern has been found in non-clinical populations, ruminative thinking mediates the effects of mindfulness on depressive symptoms (Jimenez, 2009). In brief, the detachment from mental activity may be a one of the central processes of MBIs.

For children, few studies have investigated the psychological mechanisms implied in MBIs although some findings suggest similar processes to those of the adult population. For instance, Schuit (2017) found that emotion regulation partially mediates the link between mindfulness and perceived stress in adolescents. In the same way, Deplus et al. (2016) have shown that the negative association between positive changes in mindfulness scores and depressive symptomatology was mediated by a decrease in rumination and internal dysfunctional emotion regulation strategies. Additionally, the mindfulness training seems to affect impulsivity with a decrease in urgency and lack of perseverance facets. Thus, children and adolescents who practice mindfulness could develop self-control through a better ability to non-react to their cognitive and emotional experiences. More recently, the randomized trial conducted by Fung et al. (2018) among ethnic minority youths, demonstrated that the effect of mindfulness on internalizing symptoms and perceived stress could be underpinned by the decrease in rumination and emotional suppression. Interestingly, the authors did not find a mediating effect for cognitive fusion, cognitive reappraisal or emotional expression. The lack of studies on this topic does not yet allow to draw definite conclusions about the psychological processes that play an important role in mindfulness, in particular in youth.

4. Conclusion

In this chapter, we first demonstrated that MBIs were largely used in the psychology field and that their therapeutic efficacy was partly supported by empirical data. Numerous models and psychological processes have been proposed to explain their impact on mental health. As a result, the mindfulness construct began to be better understood and MBIs have been extended to new populations such as children and adolescents. Studies demonstrated promising results in youth although the effect of MBIs in specific clinical populations as well as the psychological processes underlying their efficacy are still unclear.

In this view, the population of adolescents presenting behavior disorders could particularly benefit from MBIs. As we will see, these adolescents present difficulties in line with MBIs' benefits (impulsivity, anxiety, aggressive behaviors, etc.). Therefore, the next chapter will focus on this population and will depict the relevance of MBIs in adolescents with behavior disorders.

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Chapter 2

Understanding behavior disorders in adolescence

Abstract: Behavior disorders are increasingly common among adolescents. This literature review aims to examine the specificities of behavior disorders by highlighting their similarities and differences from an etiological and developmental point of view. A new model, emphasizing the interaction between genetic and environmental factors, is proposed. From this perspective, attention-deficit hyperactivity disorder (ADHD), callous-unemotional trait (CU), and conduct disorder (CD) symptoms may be largely hereditary while oppositional defiant disorder (ODD) and intermittent explosive disorder (IED) may be more determined by emotion regulation difficulties induced by the child environment. In the same way, some behavior disorders are characterized by aggressiveness and externalizing symptoms while others are characterized by an impairment of attentional capacities and executive functions. Psychological interventions and processes involved in behavior disorders were investigated to determinate relevant treatments and therapeutic targets. Overall, behavioral and peer-based interventions have been shown to be effective in treating behavior disorders as well as medication for ADHD. Similarly, mindfulness-based interventions could have a small to moderate effect size on ADHD symptoms, inattention, hyperactivity, and executive function. Psychological processes, such as emotional regulation, impulsivity and self-awareness, may also play a central role in therapeutic efficacy. Finally, this literature review sheds a new light on behavior disorders by proposing a holistic view on behavior disorders onset. Health professionals working with children and adolescents who suffer from behavior disorders should be aware of these etiological differences in order to adapt their therapeutic interventions.

Understanding behavior disorders in adolescence

"*You know, it feels good to break everything, you show that you're not weak, you get respect. But it's true that, afterwards, you can regret a little because you haven't thought about what will happen next.*"

— Testimony of Joan, an adolescent who suffers from behavior disorders

1. Introduction

Growing is a natural part of life. Everyone goes through a variety of developmental stages reaching a more sophisticated psychological functioning and, therefore, a better adaptation to the environment. As we know, adolescence is a major step in the acquisition of many psychological skills such as the construction of self-identity and the development of emotion management (Viner et al., 2015). Adolescence is not only the stage during which an individual grows up in terms of physical and biological development. It is also a critical period during which the mind is forged, sometimes frozen or battered, through many experiences of life underpinning the challenge that the society in the 21st century represents for youth (e.g., the ubiquity of social networks and media).

This context of psychological vulnerability fosters the emergence of behavior disorders. Behavior disorders are a series of diagnoses, such as Oppositional Defiant Disorder, mainly defined by externalized symptoms (a detailed definition of this group of diagnoses will be given in section 1.2.1). Externalizing symptomatology (or externalizing problems) refers to pathological behaviors that are manifested outside such as aggressiveness, hyperactivity or delinquency. Overall, they can be classified into three core symptom clusters: (1) Inattention (e.g., difficulty in sustaining attention), (2) Hyperactivity (e.g., inability to wait quietly), and (3) Oppositional behaviors (e.g., aggressiveness). In addition, internalizing symptoms can also be present in the diagnoses of behavior disorders. This symptomatology refers to symptoms that are not directly visible such as depressive symptoms or anxiety. They are very common in the criteria of numerous diagnoses established in the Diagnostic and Statistical Manual of mental disorders and they can also be found in diagnoses related to behavior disorders such as Oppositional Defiant Disorder (e.g., irritable mood appears in the list of symptoms; APA, 2013).

Since psychopathology plays a crucial role during adolescence, this chapter will firstly attempt to bring a better understanding of adolescent development and will briefly discuss the trajectory of internalizing symptoms which cannot be separated from that of externalizing

symptoms. Then, factors that foster the onset of externalizing symptoms, general characteristics of adolescents with behavior disorders and their interactions with psychological processes will be reviewed. Finally, therapeutic issues and efficacy of interventions in this field, notably the impact of MBIs, will be discussed.

2. Behavior disorders: towards a developmental psychopathological approach

2.1 Adolescence: a critical period of life

2.1.1 What is adolescence?

Adolescence is a critical developmental period of human life. Its beginning is often associated with the physical changes of puberty but these changes never occur at a specific time (ranged approximatively from 9 to 12 years old for girls and 11 to 13 years old for boys). Likewise, there is no consensus about the end of adolescence but some authors propose that social independence could be considered as a main criterion (Steinberg, 2014). As a consequence, the period of adolescence can vary from 9 to 26 years old according to different studies but a large part of them focuses on the period from 11 to 18. Many biological transformations occur during this developmental period. For instance, we can mention the acceleration in physical growth, metabolic and hormonal changes (gonadal steroids), changes in circadian patterns and sleep, sexual maturation (genital organs development), changes in facial structure, muscles, voice, body distribution, and breast (Dahl, Allen, Wilbrecht, & Suleiman, 2018). These changes act on, and are influenced by, psychological maturation which is supported by brain, behavioral and cognitive development (Steinberg, 2005). Adolescence is also characterized by the construction of identity (i.e., the development of one's own opinion, needs and desires). Distancing oneself from the customs of the family home, the increase in new encounters and new life experiences are factors that lead the adolescent to grow. Among the most influential life events, we can cite romantic breakup, family disruption and, more globally, interpersonal relationships (e.g., disruptions in friendly relationships; Low et al., 2012). Although life events may temporarily affect adolescents, their influence on identity construction may be limited (de Moor et al., 2019). Overall, adolescence can be viewed as a sensitive period underpinned by different developmental stages implying emotional, cognitive and physical changes.

2.1.2 A developmental perspective of internalizing symptoms in adolescence

The developmental perspective strives to understand how individuals evolved over the course of development and tries to identify the degree of convergence and divergence in psychological, biological and social aspects. Consequently, developmental psychopathology, that is to say the study of psychological deviance from an established norm, can shed light on adolescent psychological functioning by providing knowledge about the characteristics of the evolution of psychopathological disorders during adolescence (Cicchetti & Rogosch, 2002). In this way, an overview of the developmental trajectory of internalizing symptoms in adolescence, that are associated with a central outcome (i.e., adolescent well-being), could help provide a better understanding of behavior disorders development. Therefore, this section will propose a brief review of the general dynamics of internalizing symptoms among youth.

The study conducted by McLaughlin and King (2015) showed that anxiety tends to decrease over a one-year period in early adolescence whereas depressive symptoms remain stable. However, high depressive symptoms prevent anxiety from declining. Over a longer follow-up period (10 years), a longitudinal study conducted by Bongers, Koot, Van der Ende, and Verhulst (2003) indicated that anxious and depressive symptoms followed a curvilinear relationship with a slight increase in childhood, followed by a slight decrease (for adolescent boys) and a stagnation (for adolescent girls). When looking independently at the evolution of anxiety and depression, Van Oort, Greaves-Lord, Verhulst, Ormel, and Huizink (2009) reported that anxiety (when controlling for depression in their model) in boys and girls decreased during early adolescence but increased from middle to late adolescence while depression (when controlling for anxiety) remained stable over time. Although the findings are not always consistent, some conclusions can be drawn from this literature.

Firstly, it seems that early adolescence is accompanied by a decrease in anxiety. An interpretation of this result could be that, after a slight increase in anxiety due to physical changes but also due to the change from primary school to secondary school (i.e., an increase in the number of stressors), a decrease in anxiety can occur until middle adolescence where autonomy starts emerging with a sense of freedom and new experiences. However, over time, this increase in autonomy can also rapidly turns into a sense of responsibility in the face of social pressure (academic performance, quality of the relationships etc.), which can increase anxiety once again.

Secondly, it appears that internalizing symptomatology is more present in adolescent girls than adolescent boys. This gender difference could be explained by several factors including a higher risk in girls to develop depressive states because of stereotypical gender roles, more submissive behavior and a self-focused style resulting in ruminative thinking and self-criticism (Nolen-Hoeksema & Hilt, 2013). Thirdly, high symptomatology in anxiety or

depression is related to persistent and high levels of psychopathology over time leading to a vicious circle. However, some studies suggest that symptoms of anxiety may precede depressive symptoms among children (Cole, Peeke, Martin, Truglio, & Seroczynski, 1998; Starr, Stroud, & Li, 2016). According to this hypothesis, it is possible that repeated experiences of negative and anxious affects during childhood – for instance due to social or familial adversities – could lead to a depressive mood. In this context, it may be noted that protective factors against depression and social anxiety, such as affiliation with a peer group, positive relationships with a best friend or engagement in romantic relationships, may play an important moderating role (La Greca & Harrison, 2005).

The review proposed by Meeus (2016) pointed out several patterns of adolescent psychosocial development . Among them, the relationship between the adolescent and his/her parents is a good predictor of interpersonal relationships later in life. In the same way, adolescents' internalizing symptoms are associated with an overinvolvement of the parents and difficulties achieving independence from them. In addition to the fact that parental interference in adolescent's personal problems often negatively impacts the adolescent's mental health (i.e., externalizing and internalizing symptoms plus positive outcomes such as well-being) and that adolescent psychopathology frequently leads to a decrease in the quality of social relationships, a downward spiral of mental deterioration may emerge from these interactions. Adolescent mental health is also related to several other outcomes. For example, in a cross-sectional study among 485 adolescents, Gilman & Huebner (2006) showed that adolescents' global satisfaction is associated with hope ($r = .67$), depression ($r = -.62$), social stress ($r = -.58$), parent relations ($r = .52$), locus of control ($r = .51$), self-esteem ($r = .49$) and a good opinion of their school experiences ($r = .41$).

In addition, some processes have been identified as underpinning the development of adolescent psychopathology. For example, the association between self-reported exposure to stressful life events and anxiety (but not depression) could be mediated by rumination over time (Michl, McLaughlin, Shepherd, & Nolen-Hoeksema, 2013).

Overall, we can identify three kinds of factors that explain internalizing symptoms in adolescence, and probably adolescent mental health: (1) Parental style or family relationship quality (Williams, Ciarrochi, & Heaven, 2012), (2) Genetic and personality factors (e.g., neurological impairment, pessimistic style, neuroticism etc.), (3) Negative events (e.g., school bullying, death of a relative etc.; see for example Ge, Lorenz, Conger, Elder, & Simons, 1994) or any interaction between these factors (e.g., Belsky & Beaver, 2011).

In the next section, we will see why externalizing symptoms play a role as crucial as internalizing symptoms in adolescent psychopathology, how they occupy a central position in the onset of behavior disorders, and why they must be addressed as soon as possible by peers and health professionals.

Summary (section 2.1)

1) Adolescence is a sensitive period which starts with puberty.

2) Developmental studies suggest that youth are subject to internalizing symptoms. Moreover, anxiety symptoms may precede depressive symptoms.

3) Gender differences exist and suggest that girls experience more internalizing symptoms than boys with an increase during the adolescent period.

4) Overall, research suggests that three factors can be at the root of psychopathology in youth: familial setting, personality traits, and repeated (or intense) negative events.

5) In particular, personal relationships and social abilities seem to play a moderating role in adolescent psychopathology.

2.2 Behavior disorders

2.2.1 Definitions and diagnoses

The worldwide prevalence of mental disorders in children and adolescents is around 13.4%, while 9.1% of them suffer from a behavior disorder (i.e., attention-deficit hyperactivity disorder or any disruptive disorder; Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015). The DSM-5 (APA, 2013) created a category named "Disruptive, Impulse-Control, and Conduct Disorders" (DICCD) which includes Oppositional Defiant Disorder (ODD), Intermittent Explosive Disorder (IED), Conduct Disorder (CD), Antisocial Personality Disorder, Pyromania, Kleptomania, Other DICCD and Unspecified DICCD. No less than eight diagnoses were identified and divided into two factors (both present in each disorder but with a different intensity): emotional self-control difficulty (Intermittent Explosive Disorder at the extremity) and behavioral self-control difficulty (Conduct Disorders at the extremity). These two dimensions were partly retrieved in the literature (Lavigne, Bryant, Hopkins, & Gouze, 2015). The authors specify that Pyromania and Kleptomania are not commonly used diagnoses and are often considered as a specific expression of CD or antisocial personality without completely overlapping. Before going any further, we will briefly define these diagnoses to understand their main differences according to the DSM-5.

ODD is characterized by near constant dissatisfaction with high levels of anger, defiant behaviors, irritable and vindictive mood (notably against authority figures). Children or adolescents with IED, on the other hand, tend to occasionally act out with more aggressive

behaviors and violent crises in response to provocation or physical assault. Finally, CD is the most serious disorder of DICCD. This disorder often appears during adolescence with identifiable first signs in childhood. CD is characterized by a repetitive and persistent pattern of threats, aggressive behaviors towards other people, as well as societal norms and rules frequently transgressed that may lead to serious problems with the law.

Interestingly, the Attention-Deficit/Hyperactivity Disorder (ADHD) was not considered as a DICCD by the DSM-5 but as a neurodevelopmental disorder. Generally, ADHD is defined as an impairment of cognitive capacities with low attentional abilities and low inhibition faculties and is characterized by two features: inattention (e.g., difficulty to stay on task) and hyperactivity/impulsivity (e.g. overactivity, inability to stay seated). Despite its similarities to DICCD diagnoses, and although the authors highlighted the frequent overlaps between ADHD and externalizing symptoms included in DICCD such as ODD and CD (see for example: Witkiewitz et al., 2013), ADHD was classified in the neurodevelopmental disorders category because of its neuronal bases (Thapar, Cooper, Jefferies, & Stergiakouli, 2012). However, its proximity with the other diagnoses, particularly in terms of externalizing symptomatology, should not be denied. Moreover, it is interesting to note that the work group that participated in the creation of DICCD and ADHD diagnoses - conducted under the direction of David Shaffer - was the same and was named “ADHD and Disruptive Behavior Disorders”. As a result, we chose to use the word “behavior disorders” in reference to the following diagnoses: ADHD, ODD, IED and CD.

From a neurodevelopmental perspective, studies pointed out the existence of several abnormalities in the functioning of cerebral connections in behavior disorders. For example, children with ADHD present a dysfunction of inferior prefrontal and striatal leading to cognitive and inhibitory control deficits (Arnsten & Rubia, 2012). On average, the cerebral structure observed for 7-year-olds children without ADHD is reached at age 10 for children with ADHD (Shaw et al., 2007). This developmental delay can lead to difficulties in controlling emotions (e.g., suppression of emotional responses). That is why the use of violent or impulsive behaviors would take precedence over verbal expression.

These deficits are partially found in ODD and CD. Actually, the dysfunction of the inhibitory control system is less pronounced but is accompanied by emotional dysfunction whereas for ADHD children emotional problems are probably the consequence of cognitive deficits (Bonham et al., 2020; Hwang et al., 2016). For ODD and CD, studies have demonstrated a more predominant abnormalities in the paralimbic system such as dysfunction of the ventromedial and orbitofrontal prefrontal cortex or the anterior cingulate and superior temporal cortices (Arnsten & Rubia, 2012). These abnormalities imply difficulties in motivation and emotion regulation. Contrary to ADHD physiopathology, ODD and CD are characterized by reduced amygdala and ventromedial prefrontal cortex responses to negative stimuli, which directly leads to irritable mood, defiant behaviors and vindictiveness.

2.2.2 Psychological features of externalizing symptoms

Externalizing symptoms are the core symptoms of behavior disorders. They affect 9.5% of adolescents in a high severity form and 28.8% of them in a mild severity form (Colman et al., 2009). As evidenced by numerous studies, externalizing symptoms are more frequently reported by boys than girls and vice versa for internalizing symptoms (Bongers et al., 2003; Colman et al., 2009; Leadbeater, Kuperminc, Blatt, & Hertzog, 1999). Externalizing symptoms can start with non-pathological features but can also quickly lead to behavior disorders. For males, the peak age of offending behaviors occurs between 15 and 19 years old, when upwards of 90% of males break laws during their adolescence (Moffitt, 2018).

In general, the literature tends to demonstrate a reduction in externalizing symptoms from early childhood to adolescence in most but not all adolescents (Roskam, 2018). Despite this average decrease in externalizing symptoms during adolescence, studies on developmental trajectories showed that about 5% to 8% of adolescents tend to increase their externalizing symptoms over time (Korhonen, Luoma, Salmelin, Siirtola, & Puura, 2018; Nivard et al., 2017). This increase, when it occurs, frequently starts with the advent of adolescence (Nivard et al., 2017; Petersen, Bates, Dodge, Lansford, & Pettit, 2015).

Concerning the influence of internalizing symptoms on externalizing ones, the interaction between the two symptomatologies remains too obscure to draw definitive conclusions. Some studies report that externalizing symptoms increase internalizing symptoms (Loth, Drabick, Leibenluft, & Hulvershorn, 2014; Stringaris, Lewis, & Maughan, 2014) while other studies report the reverse effect (Petersen et al., 2015), no reciprocal relation (Stone, Otten, Engels, Kuijpers, & Janssens, 2015) or bidirectional relationship (Lee & Bukowski, 2012). Overall, it is likely that internalizing and externalizing symptoms occur for different reasons but influence each other over time.

2.2.3 Etiology

To understand the crucial role of behavior disorders in adolescent psychopathology, as well as their origins and influence on mental health, a wide range of studies were reviewed, and global trends were explored.

The question of the etiological factors involved in the onset of externalizing symptoms will be addressed for two mains reasons. First, it is important to determine the part of the variance that can be modified by therapeutic interventions. Indeed, if genetic factors account for a large part in the onset and the evolution of externalizing symptoms, it is likely that therapeutic interventions will only have a small influence on externalizing symptoms (an

extreme example of this postulate is that psychological interventions cannot change a person's gender). Conversely, if externalizing symptoms are mainly determined by environmental factors, there is a strong chance that therapeutic interventions will have a large influence. Second, some etiological factors may lead to psychological processes that maintain or exacerbate externalizing symptoms. For this reason, it seems important to know which factors would have a predominant role in the onset of behavior disorders.

2.2.3.1 Genetic factors

The influence of genetic factors on the development of externalizing symptoms has been well documented (DiLalla, 2017). Scientific studies on mice have already shown that genetic manipulation can lead to different levels of aggressiveness (Cairns, MacCombie, & Hood, 1983; DeVries, Young, & Nelson, 1997). Obviously, it is not possible to conduct such experiments on humans but longitudinal studies conducted on twins also suggest the existence of a genetic background of externalizing symptoms (Hatoum, Rhee, Corley, Hewitt, & Friedman, 2018; Hicks, Foster, Iacono, & McGue, 2013). The heritability ratio of externalizing symptoms varies across studies but remains at a generally high level. For example, Hicks et al. (2013) showed a medium effect for the general transmission of biological parents and offspring but no effect for adoptive parents and offspring among almost 2000 families. Biological children exhibited greater similarity than adoptive ones to the same rearing parents. The authors concluded that the general externalizing liability was highly heritable but the genetic effect may be less pronounced when looking at specific disorders, notably for ODD. Indeed, in a similar study, Bornovalova, Hicks, Iacono and McGue (2010) found a large effect of genetic factors on ADHD, and a modest effect for both ODD and CD whereas Ehringer, Rhee, Young, Corley, and Hewitt (2006) reported a large effect on CD and a moderate effect on ADHD and ODD. Specifically, ADHD components may be highly heritable with 88% for the hyperactive–impulsive dimension and 79% for the inattentive dimension (McLoughlin, Ronald, Kuntsi, Asherson, & Plomin, 2007). To go further, it is important to introduce the construct of Callous-Unemotional Traits (CU), which has attracted the attention of many researchers in the behavior disorders field. This psychopathological profile refers to a child psychological functioning based on fearlessness, lack of guilt, lack of empathy, thrill seeking, behaviorally uninhibited temperament with high proactive and reactive aggressive behaviors as well as a positive view of aggression, a high sensitivity to reward and a low sensitivity to punishment (for a review see Frick & Viding, 2009). Although CU is not considered as a behavior disorder per se but as a personality trait, it is highly related to delinquent behaviors, violent offenses and aggression in addition to predicting ODD and CD symptoms among children (Jezior, McKenzie, & Lee, 2016; Robertson et al., 2018). Like behavior disorders, findings suggest that genetic factors strongly contribute to the onset of CU, between 40 and 81% (Frick & Viding, 2009; Moore et al., 2017; Viding & McCrory, 2012).

No significant unique genetic influences were found in the literature but some genes are suspected to be linked to the onset of externalizing symptoms (e.g., 5-HTTLPR, DRD4,

DRD2, DAT1, MAOA and COMT) and numerus studies have demonstrated the involvement of the dopaminergic pathway (Beauchaine, Hinshaw, & Pang, 2010; Weeland, Overbeek, de Castro, & Matthys, 2015). According to Nigg (2006), gene expression produces different temperaments that impact the onset of behavior disorders. For instance, low fear response and high anger reactivity temperaments could be conducive to CD whereas low effortful control and strong approach temperaments could be conducive to ADHD. In the same way, the longitudinal study conducted by Lahey et al. (2008) indicates that maternal ratings of conduct problems across 4–13 years were predicted by maternal ratings of infant activity level, infant fussiness, infant predictability and infant's positive affect. These results also support the hypothesis that early characteristics, likely due to genetic differences, increase risk for early-onset conduct problems. Similarly, several studies pointed out the neuropsychological deficits of children with ODD (and also ADHD): atypical frontal lobe activation pattern, low levels of salivary cortisol and higher increases in heart rate in response to induced frustration (Loeber, Burke, & Pardini, 2009).

In addition to genetic factors, the role of temperament can also be mentioned. According to Shiner et al. (2012), temperament traits are early emerging basic dispositions in the domains of activity, affectivity, attention, and self-regulation, and these dispositions are the product of complex interactions among genetic, biological, and environmental factors across time. Numerous studies highlighted the role of the temperament in the emergence of psychopathology, especially in behavior disorders. For instance, ODD is associated with a predisposition to negative affect, low effortful control, low agreeableness and high surgency (Hoffmann et al., 2019; Martel et al., 2012; Zastrow et al., 2018). In contrast, ADHD is associated with a predisposition to lower levels of effortful control, conscientiousness, benevolence and emotional stability, and higher levels of emotionality, activity, and negative affect (De Pauw & Mervielde, 2011; Hoffmann et al., 2019). Finally, higher levels of approach-sociability and lower levels of persistence were related to higher trajectories of CD (Forbes et al. 2017). Taken together, these results indicate that temperament traits play a role in predisposing to certain behavior disorders.

In view of these results, it is no longer possible to ignore the impact of genetic factors on the development of behavior disorders. However, genetic predispositions evidently interact with environmental factors.

2.2.3.2 Environmental factors

In contrast to the assumption of genetic predominance, several studies found that environmental factors could influence the onset and the evolution of externalizing symptoms with a large effect size. It is important to identify these environmental factors because some of them can be directly addressed by therapeutic interventions.

The analyses of the longitudinal study conducted by Petersen, Bates, Dodge, Lansford and Pettit (2015) demonstrated in their final model that being male, presenting peer deviance in early and late adolescence, and experiencing stress and internalizing symptoms in late adolescence are predictive of high levels of externalizing symptoms at the age of 27. However, high initial levels of externalizing symptoms predicted higher levels of internalizing symptoms and peer deviance. This final model - which also included harsh discipline, spanking, low father caregiving, sociability and language ability -, explained 70% of the variability in externalizing symptoms over time. Of the 66 variables assessed, 58 were associated with externalizing symptoms, such as family and individual stress, and sleep problems. Nevertheless, many variables overlapped with each other (e.g., harsh discipline and spanking). In addition, the authors concluded that two profiles were particularly at risk for arrest: 1) high peer deviance in later adolescence and 2) males with high individual stress in later adolescence (i.e., number of stressful life events). These results highlight the crucial role of environmental factors in the onset of externalizing symptoms.

As already mentioned, stressful life events can also affect the onset or the trajectory of externalizing symptoms. Considered as a transdiagnostic factor, the number of stressful life events is associated with externalizing symptoms (Eisenbarth et al., 2019). In their structural equation model based on one-year interval measures among 460 boys and girls aged between 11 and 14, Leadbeater and colleagues (1999) found that stressful life events and self-criticism were associated, one year later, with externalizing behaviors for both genders. In addition to a significant and positive correlation between stressful life events and externalizing symptoms, the meta-analysis conducted by March-Llanes, Marqués-Feixa, Mezquita, Fañanás, and Moya-Higueras (2017) also reported that stressful life events could be both a cause and a consequence of these symptoms.

However, the most important environmental factor of behavior disorder development, or at least the most studied, is parenting. Do parents play a role in the development of externalizing disorders? It would seem so, to a certain extent. Family relationships often appear to be a major factor in the development or onset of behavior disorders in children (Gryczkowski, Jordan, & Mercer, 2010; Jiménez-Barbero, Ruiz-Hernández, Llor-Esteban, & Waschgler, 2016; Mackler et al., 2015; Roskam, Meunier, & Stievenart, 2016). In two-year-old children, the frequency of fathers' corporal punishment predicts child externalizing symptoms one year later (Mendez, Durtschi, Neppl, & Stith, 2016). Harsh discipline and

parental control could aggravate externalizing symptoms, at least on the short-term. Indeed, cross-lagged models demonstrated that adolescent aggression positively predicted parental psychological control one-year later (Time 2) and that parental control at Time 2 predicted adolescent aggression one year after (Time 3) (He, Yuan, Sun, & Bian, 2019). Similarly, a poor relationship with parents may be a predictor of externalizing symptoms only among girls. More precisely, Ahmad and Hinshaw (2017) reported a moderating effect of parenting. Girls with higher levels of hyperactivity/impulsivity in childhood were more likely to develop delinquent behaviors five years later, especially since their mother had an authoritative profile (i.e., high level of control and low level of emotional support) compared to those with a less authoritative mother. Nevertheless, it is noteworthy that the reverse effect was observed in early adulthood (10 years later). This result suggests that the use of an authoritarian style among girls with a high level of impulsivity may have a negative effect on the short term (during adolescence) and a positive long-term effect on behavior disorders. In addition, adolescents with higher self-esteem, better social integration and parental emotional support, notably mothers' emotional support, reported fewer externalizing symptoms (White & Renk, 2012). In the same way, the 10-year prospective longitudinal study conducted by Roskam (2018) found that the increase in externalizing symptoms was related to low attachment security and high mothers' coercive parenting, whereas executive functioning, father coercive parenting, and language abilities were not. Even personality traits such as CU, which is considered as highly genetically determined, may be impacted by parenting. Structural equation modeling performed by Wagner, Mills-Koonce, Willoughby, Zvara and Cox (2015) revealed that less sensitive parenting at 24, 36, and 58 months predicted higher levels of CD and CU symptoms after controlling for earlier CD and CU symptomatology.

The model proposed by Patterson, DeBaryshe and Ramsey, (1989) also brings an example of an interesting perspective on the developmental process of behavior disorders - and their severity across time - which appear principally in the case of environmental factors (see Figure 2.1). According to their model, a lack of parental monitoring increases the risk of behavior disorders in childhood which, in turn, lead to social difficulties and ultimately delinquency. Although the model gives only one environmental factor concerning the origin of behavior disorders (i.e., poor parental discipline and monitoring), each link hypothesized in the model has been well-supported. This developmental and ecological approach of behavior disorders has the merit of providing a better understanding of the stages of change that occur during childhood and adolescence. More generally, other studies suggest that parent-child interaction and parental attachment style are associated with ODD (Li et al., 2018; Liu et al., 2018). In addition, more recent findings attest to a multi-trajectory of physical aggression, depending on irritability, anxiety, and hyperactivity/impulsivity symptoms (Dugré & Potvin, 2020). Although parental characteristics can contribute significantly to explaining the onset of behavioral disorders, the trajectory of the disorder itself during childhood may depend on the child's profile.

However, parental attitudes or educational style are not the only environmental factors that impact externalizing symptoms. Indeed, the significant part of variance explained by parental control could be relatively low, from 8.2% to 10.9% according to Symeou and Georgiou (2017). Moreover, some studies indicate that ODD predicts poorer communication and decreases parent involvement, while CD predicts poorer supervision, and ADHD is neither predictive of, nor predicted by, parenting behaviors (Burke, Pardini, & Loeber, 2008). More importantly, it has been shown that psychological interventions on children who suffer from ADHD reduced the depressive symptomatology of their mother at post-treatment. This result highlights the fact that, if parents can accentuate or reduce externalizing symptoms, they are also affected by them. Thus, in order to avoid an unnecessary societal pressure of positive parenting that often leads to parental burnout (Roskam, Raes, & Mikolajczak, 2017), the role of parents' attitude in the onset and maintenance of behavior disorders should not be overestimated. In this way, some studies claim that parenting plays only a minor role in the development of behavior disorders (Shaffer, Lindhiem, Kolko, & Trentacosta, 2013; Weeland et al., 2015).

Other environmental factors have been reported such as the school context, and notably teacher–child conflicts resulting from child's behavior disorders, which can aggravate the externalizing symptomatology (Doumen et al., 2008). Even the type of nutrition may influence behavior disorders (Curtis & Patel, 2008; Jansen et al., 2017; San Mauro Martín et al., 2018).

In view of this large body of literature, it seems important to synthesize the current knowledge about etiology of behavior disorders.

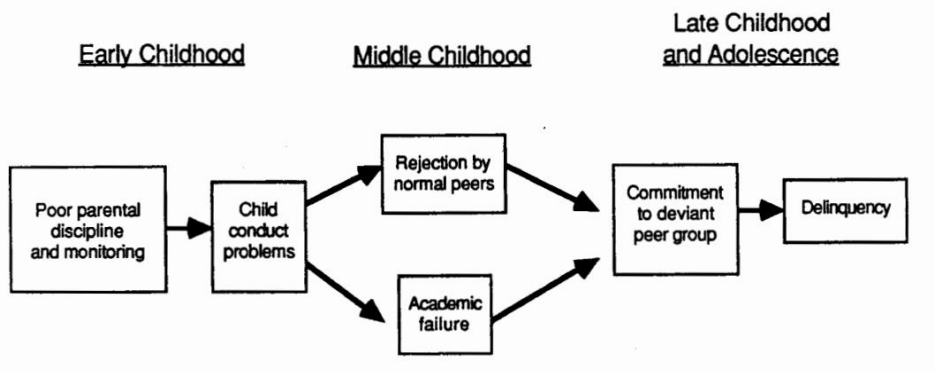

Figure 2.1 Developmental progression for antisocial behavior proposed by Patterson, DeBaryshe, and Ramsey (1990)

2.2.3.3 Interaction between genetic and environmental factors

We saw in the previous sections that genetic and environmental factors play a role in the onset of externalizing symptoms. The most widely shared idea on this topic is the existence of an interaction between environmental factors and genetic factors (E x G). To summarize this general interaction, Liu (2004) proposed the Biosocial Interaction Model of Childhood Externalizing Behavior, inspired by the model of violence of Raine, Brennan, and Farrington (1997), which provides a relevant view of the factors influencing the emergence and evolution of externalizing behaviors (see Figure 2.2). Overall, this model suggests that the interaction between biological factors (e.g., genetic predisposition, maternal pathophysiology) and psychosocial factors (e.g., poverty, high psychosocial stress) has a strong impact on the development of externalizing symptoms such as aggression, delinquency and hyperactivity. In this way, parental education, and notably parental monitoring, can be included in the psychosocial category. Some moderators, such as gender, can also change the effect of these associations. For example, we know that the parental relationship has a greater impact on girls than boys (Leadbeater et al., 1999). Although this model, as a whole, has not been tested, it seems to recap, in a very simple way, the results previously identified in the literature. In a more thorough way, the review of Weeland et al. (2015) indicates that there are too many inconsistencies to draw conclusions about the existence of an E x G interaction (i.e., differences in sample composition, conceptualizations, measures…). However, they proposed a theoretical model that explains, according to them, this interaction:

In the case of G x E in the development of externalizing behavior, we assume that genetic make-up strengthens or weakens the effect of family adversity on externalizing problem behaviors, which is explained by individual differences in biopsychosocial functioning shaped by a combination of genetic predisposition and previous interactions with environmental adversity (Weeland et al., 2015, p. 427).

The existence of these two types of influence on behavior disorders (environmental and genetic) implies several conclusions. At first, some behavior disorders may present more genetic predispositions than others. Indeed, genetic factors accounted for 36% of variance in ADHD symptoms, 5% in ODD symptoms, and 37% in CD symptoms (Tuvblad, Zheng, Raine, & Baker, 2009). This result is consistent with the literature that showed a high heritability of ADHD. More precisely, genetic factors could contribute to the stability of inattention dimension, whereas shared environmental factors could contribute to the stability of hyperactivity/impulsivity (Zheng, Pingault, Unger, & Rijsdijk, 2019). Also, numerous studies that compared genetic and environmental factors reported a larger contribution of the genetic factors in the development of externalizing symptoms (e.g., Azeredo, Moreira, & Barbosa, 2018; Hicks et al., 2013).

To sum up, we hypothesize that the inattention dimension, CD and CU are importantly driven by genetic factors whereas ODD, emotional self-control difficulty, and frustration intolerance are mostly driven by environmental factors. These findings have important implications. First, the large contribution of genetic factors in behavior disorders indicates that psychological interventions' benefits could be limited and that significant time is probably needed to achieve a significant change (therapeutic issues will be addressed in a next section). Second, parental liability in the development of behavior disorders is real but may be less important than one might think considering the importance of genetic factors. This is also the case for other environmental factors such as school context or adverse events. But these conclusions are more relevant to some kinds of behavior disorders, such as ADHD, than other diagnoses, such as ODD, where parenting could play a more important role. From the non-deterministic conception, externalizing symptomatology could be considered as a full-fledged therapeutic target (e.g., learning to respect rules or appropriate social interactions).

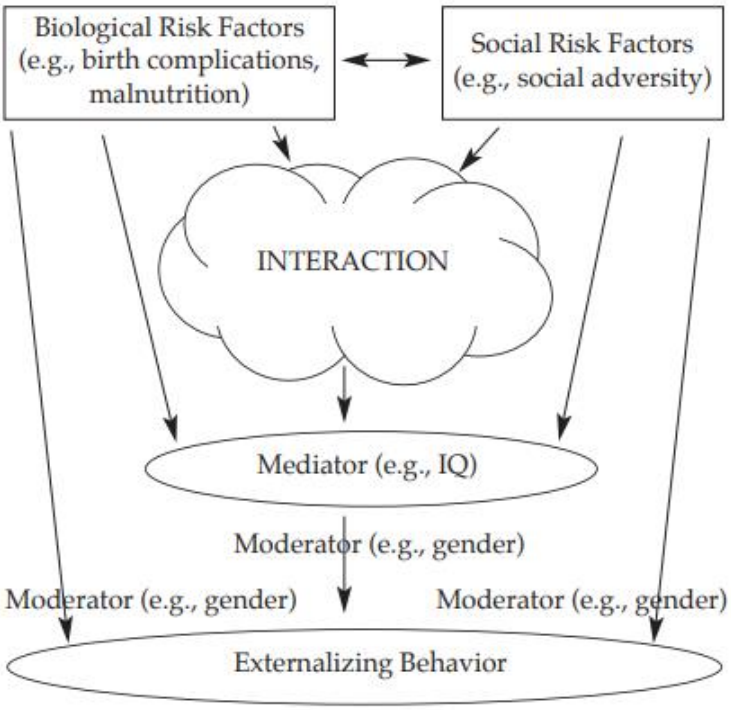

Figure 2.2. Biosocial Interaction Model of Childhood Externalizing Behavior proposed by Liu (2004)

The co-dependence of genetic and environmental factors also leads to the hypothesis of a developmental progression of externalizing symptoms and, therefore, suggests a continuum rather than the existence of definitive and well-delimited categories (Ahmad & Hinshaw, 2016; Fanti & Henrich, 2010; Krueger et al., 2018). This dynamic process implies several factors and indicates that the interaction E x G constantly updates the trajectory of externalizing symptoms over time. It may be useful to summarize the previously studies in order to understand the different types of behavior disorders.

At first, adolescents with behavior disorders can be separated from adolescents with no behavioral symptoms. The non-clinical category also includes adolescents with punctual behavioral problems related to adolescence (adolescence-limited antisocial behaviors). Indeed, studies have shown that both, youth with antisocial behaviors limited to adolescence and youth with non-conduct problems, have a similar profile although adolescents with adolescence-limited antisocial behaviors may present more difficulties with respect to problem solving, distractibility, and family conflict (Halliburton et al., 2017; Moffitt, 2017). In contrast, life-course-persistent antisocial behaviors are positively correlated with impulsivity, social contagion, anger coping and negatively correlated to school commitment. Carlisi and al. (2020) found that 12% of the adolescents can be classified as having life-course-persistent antisocial behaviors, 23% as having adolescence-limited antisocial behaviors, and 66% as having low antisocial behaviors. However, by studying the brain structure, these researchers concluded that several differences existed between adolescents with life-course-persistent antisocial behaviors and the other adolescents while it was not the case between adolescents with adolescence-limited antisocial behaviors and adolescents without antisocial behaviors. Therefore, environmental factors may play an important role in adolescence-limited antisocial behaviors.

In addition, the level and the kind of aggressiveness may be different according to the kind of behavior disorders. ADHD is associated with more aggressive behaviors than non-clinical population (Kofler et al., 2015). However, this characteristic corresponds more to the hyperactivity and impulsivity dimensions than to the inattention dimension of ADHD (Storebø & Simonsen, 2016). Moreover, aggressiveness in ADHD is more about a deficit of executive function and cognitive capacity (such as inhibition) than a real willingness to lash out at others. For ODD, emotional dysregulation leads to intolerance to frustration and, finally, aggressive behaviors. This pattern is approximatively the same than aggressiveness in CD, but occurs for older adolescents, and, thus, takes the form of antisocial behaviors. Indeed, ODD is a strong predictor of CD and CD are more often observed at a later age (Eskander, 2020). Taken together, these observations demonstrate a form of continuity of aggression, moving from the absence of aggressive behaviors to oppositional behaviors and, finally, antisocial behaviors.

According to these different etiological factors and the role of aggressiveness, we hypothesize four kinds of behavior disorder

1. Adolescence-limited antisocial disorders. This category refers to occasional symptoms of ODD or IED (short and limited period of time) or non-pathological aggressive behaviors (such as conflicts with parents), with a high prevalence of environmental factors (e.g., trauma, lack of affection) and specific aspects related to adolescence (e.g., sensation seeking or playing with limits).

2. Impulse-inattentive disorders without aggressive behaviors. This category refers to ADHD diagnosis (notably inattentive subprofile) but also to Sluggish Cognitive Tempo (SCT), which is defined as a slow cognitive functioning causing adaptation difficulties (del Mar Bernad, Servera, Grases, Collado, & Burns, 2014). Genetic factors bare an important contribution to this category.

3. Behavior disorders in childhood mostly due to environmental dysfunctions (e.g., educational style) that may persist into adolescence. This category refers to IED and ODD and may lead to CD in its more severe form. These disorders also have a high co-morbidity with ADHD and are often linked to emotional management difficulties that lead to opposition crises.

4. Aggressive behavior disorders in childhood, which may persist beyond adolescence, with significant genetic determinants (attentional difficulties are secondary or non-existent and the voluntary nature of the aggressions is often identifiable). This category refers to CD and ADHD (notably hyperactive/impulsive sub-profile) as well as other personality traits associated with behavior disorders such as CU. This category is associated with intentional aggressive behaviors (or impulsive behaviors in the case of ADHD).

Based on these categories, behavior disorders can be classified into two dimensions as shown in Figure 2.3.

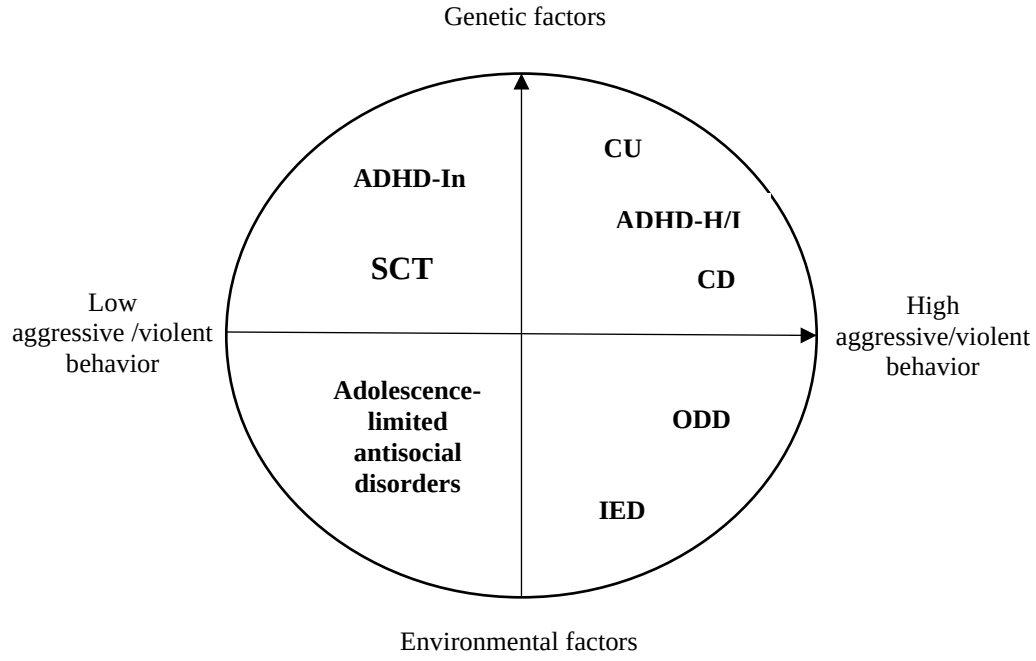

Figure 2.3 Classification of behavior disorders according to their etiological features

NB. ADHD-In = Attention-Deficit/Hyperactivity Disorder - Predominantly inattentive profile; SCT = Sluggish Cognitive Tempo; CU = Callous-Unemotional Trait; ADHD-H/I = Attention-Deficit/Hyperactivity Disorder - Predominantly hyperactive/impulsive profile; CD = Conduct Disorder; ODD = Oppositional Defiant Disorder; IED = Intermittent Explosive Disorder.

Based on this knowledge of behavior disorder development, therapeutic issues can be considered. CU, ADHD and CD may be more robust across time and may require the use of major means to be modified (e.g., institutional support). Conversely, IED, ODD and adolescence-limited antisocial disorders could be treated by psychological interventions on emotion management or on parental practice. The next section will present the psychological processes involved in therapy of behavior disorders, as well as the therapeutic perspectives that exist for treating these disorders, and their limitations.

Summary (section 2.2)

1) In the DSM-5, the ADHD diagnosis was classified as a neurodevelopmental disorder whereas IED, ODD, and CD were classified as "Disruptive, Impulse-Control, and Conduct Disorders". Considering their similarities (e.g., high level of impulsivity, emotion regulation difficulties…), we propose to group these four diagnoses under the name of « behavior disorders ».

2) Behavior disorders result from an interaction between genetic and environmental factors.

3) Parenting has a significant, but minor, influence on behavior disorders. Parents are also emotionally impacted by the externalizing symptoms of their children.

4) CU, ADHD, and CD symptoms may be largely hereditary while IED and ODD may be more determined by emotion regulation difficulties induced by the child environment.

5) The level and kind of aggressiveness could also help to distinguish the different diagnoses. On the one hand, low aggressiveness is present in the inattentive profile of ADHD while high aggressiveness is present in CU, CD, ODD and the hyperactive /impulsive profile of ADHD. On the other hand, aggressiveness in ADHD is based on deficit of executive function while it is based on deficit of emotion regulation for CU, CD and ODD.

3. Behavior disorders: psychological processes, therapies and mindfulness-based interventions

3.1 Targeted processes in behavior disorders

The previous sections presented several factors that could be at the origin of behavior disorders (or, at least, increase externalizing symptoms). These etiological factors lead to specific psychological functioning that can be addressed by therapeutic interventions. On this basis, the present section discusses the psychological processes that maintain externalizing symptoms.

As already mentioned in a previous section, a psychological process is a mechanism that transforms a psychological element into another psychological element. There is also conceptual confusion between the symptoms associated with behavior disorders and the

psychological processes that maintain them. Symptoms are often directly observable and measurable whereas psychological processes can only be assumed. Hence, the three main symptoms of behavior disorders (i.e., hyperactivity, inattention, and oppositional behaviors) can be underpinned by three hypothetical psychological processes: impulsivity, self-awareness and emotion regulation, respectively. First, hyperactivity, but also inappropriate behaviors associated with haste and impatience, can be considered as symptoms (observable behaviors), as the five ones proposed in the DSM-5 (e.g., "Often has difficulty waiting his or her turn") and, thus, can be theoretically separated from impulsivity. Indeed, it seems more consistent to consider impulsivity a psychological process that underlies hyperactivity. For example, the impulsivity of some children who face external distractions in a classroom will push them to leave their seats. This last behavior can be considered as hyperactivity. Importantly, a symptom can be caused by different processes. Therefore, difficulty to wait one's turn may be caused by a very specific social context that is not related to impulsivity (e.g., a woman who is about to give birth). Self-awareness ability may also be considered as a process that underpins attention capacities. For instance, being aware of what is important to us increases our motivation to focus our attention on tasks related to our objectives. Concerning the processes that underlie oppositional behaviors, emotion dysregulation, and notably irritability and low frustration tolerance, can be good candidates. But, as we will see, these emotional processes are likely to be more related to ODD and ADHD than CD.

3.1.1 Emotional processes

Numerous studies pointed out the involvement of emotional processes in behavior disorders. Among them, we can mention the lability to negativity (also named emotional reactivity), which can be defined as a high sensitivity or reactivity to negative experiences. The meta-analysis of Graziano and Garcia (2016) suggests that youth with ADHD present greater levels of negative lability (d = .95) and greater emotion regulation difficulties (d = .80). Interestingly, the analyses demonstrated that cognitive functioning moderated the association between ADHD and negative lability, suggesting that a deficit of the top-down process would be at the origin of a high emotional reactivity. To go further, some externalizing symptoms could come from emotion dysregulation, a central process in many disorders, caused by environmental factors (such as poor parental discipline). This is the conclusion drawn by Cavanagh, Quinn, Duncan, Graham and Balbuena (2017) who found that, in a population of 4,380 children, ODD conveys the same factors than emotion dysregulation (i.e., a lack of temper control, affective lability, and emotional overreaction). Conversely, CD was found as a distinct factor in their analyses. These results suggest that emotion regulation can be considered as a main process in ODD (i.e., quick mood changes, easy frustration, irritability, excessive emotionality, unstable relationships) whereas CD may be considered as a pure form of behavior disorders (i.e., aggression to people, destruction of property, theft) with processes that refer more to a deficit in social learning, moral norms, self-awareness or empathy. As a result, interventions may target different processes

according to the diagnosis (e.g., emotion regulation for ODD and or self-awareness for CD). Similarly, emotional lability (i.e., irritability, hot temper, low frustration tolerance, frequent and unpredictable shifts towards negative emotions) in children with ADHD could be more closely linked to oppositional behaviors than to hyperactivity/impulsivity or inattention symptoms (Sobanski et al., 2010). Yet, the authors highlighted that 46% of children with low emotional lability also presented an ODD (despite the fact that ODD can appear as a long-term consequence of ADHD). In line with these results, neuropsychological dysfunctions were found to be strongly associated with ADHD while ADHD symptoms fully mediated the relation between neuropsychological dysfunctions and emotional lability, suggesting, again, that externalizing symptoms of ADHD may be the origin of emotional problems, which in turn can lead to ODD (Banaschewski et al., 2012). Taking together, these findings indicate that behavior disorders, principally due to genetic factors that affect brain function such as ADHD, may lead to emotional problems while emotional problems due to environmental factors may lead to behavior disorders (such as ODD). Therefore, interventions focusing on emotional competencies could be first-line treatments for ODD while interventions that focus on externalizing symptoms could be first-line treatments for ADHD and CD. Overtime, ADHD symptoms predict increases in ODD and CD, which also supports the hypothesis of a long-term comorbidity (Pardini & Fite, 2010). A summary of the literature is proposed by the theoretical model provided in Figure 2.4. This model assumes that processes such as impulsivity and lack of self-awareness may increase externalizing symptoms which, in turn, lead to emotion regulation difficulties, while emotion regulation difficulties lead to externalizing symptoms such as ODD which, in turn, lead to an increase in impulsivity and a decrease in self-awareness. This dynamic can quickly lead to a vicious circle where the two issues feed into each other. On the one hand, parents who do not teach their children how to manage frustration would cause them difficulties in managing emotions that would finally lead to externalizing disorders (e.g., aggressiveness, violence). On the other hand, some youth may present high levels of externalizing disorders from a very early age, which would result in a pronounced search for risk, despite all the efforts of the parents or the school environment to silence this genetic expression (as a reminder, the model presented in Figure 2.3 reflects this hypothesis). Among others, these children are often easily recognizable by their agitation, aggressiveness or attraction to fighting. However, it should be noted that genetic factors could positively or negatively moderate the relationship between the environmental influence and emotional disorders (e.g., emotionally stable temperament), and environmental factors could in turn moderate the relationship between genetic factors and externalizing disorders (e.g., safe and caring education).

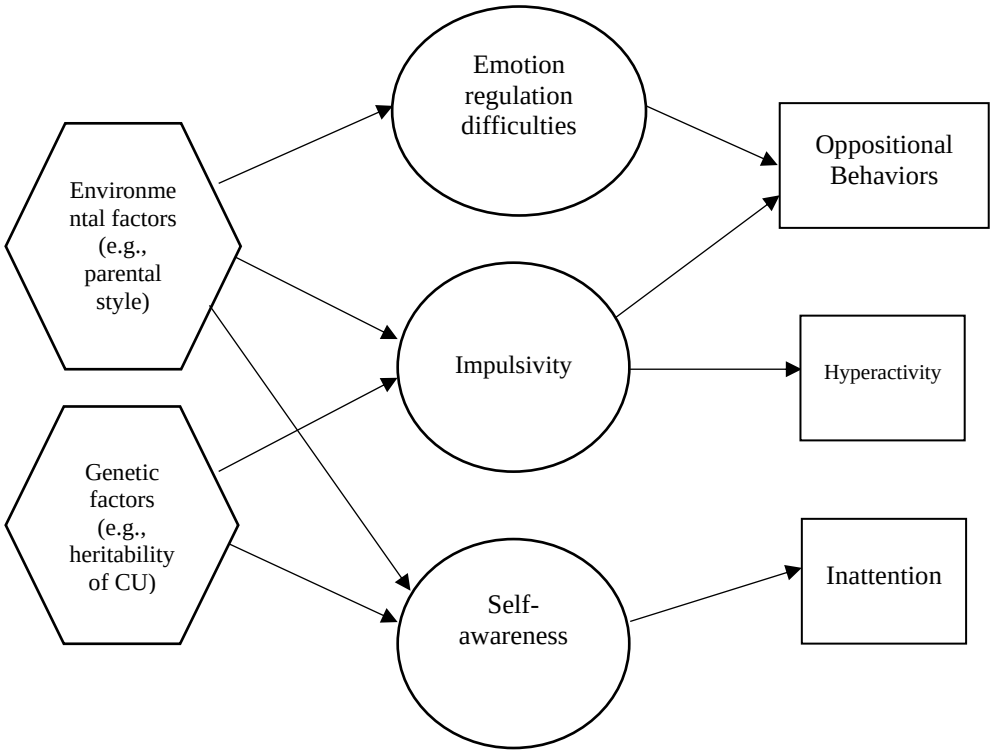

Figure 2.4. Theoretical model of the interaction of general processes in behavior disorders

NB. CU = Callous-Unemotional Traits

3.1.2 Impulsivity

Impulsivity is also considered as a main, neural, bottom-up process in behavior disorders (Beauchaine, Zisner, & Sauder, 2017). Children with ADHD who were more emotionally impulsive experienced more emotional and behavioral difficulties (Rosen & Factor, 2015). Moreover, cross-lagged analyses showed that impulsivity predicted ODD symptoms while the reverse was not true (Burns & Walsh, 2002). Interestingly, inattention was not a predictor of ODD symptoms or criminal involvement (Babinski, Hartsough, & Lambert, 1999; Burns & Walsh, 2002). Impulsivity could have a moderating effect on the association between peer delinquency and child delinquency in pre-adolescence (Vitulano, Fite, & Rathert, 2010). In the same way, higher impulsivity levels were observed in children who presented both CU and CD symptoms than children with only CU (Wall, Frick, Fanti, Kimonis, & Lordos, 2016).

Thus, impulsivity could be a central process in the development of externalizing symptoms and behavior disorders.

A close process of impulsivity is the reward insensitivity. In face of a reward, boys with externalizing symptoms show lower response of the sympathetic nervous system, indicating a lack of motivational approach. Moreover, a lower reward sensitivity can be a risk factor for noncompliant and antisocial behaviors (Beauchaine, Gatzke-Kopp, & Mead, 2007).

3.1.3 Self-awareness

In connection with impulsivity, self-awareness is also considered as a psychological mechanism that is particularly associated with inattention, a central symptom in a sub-profile of ADHD. Self-awareness can be defined as the capacity to be conscious of metacognition, self-abilities and emotional states. It is based on a neurophysiological substrate and is essential to self-monitoring (Factor, Rosen, & Reyes, 2016; Lou, Changeux, & Rosenstand, 2017). Impaired self-awareness has been found to lead to low motivation and participation in rehabilitation efforts in populations with neurological injuries (Katz, Fleming, Keren, Lightbody, & Hartman-Maeir, 2002). In addition, lower levels of self-awareness could decrease empathy which plays a major role in CU and CD (Haley et al., 2017).

Summary (section 3.1)

1) Psychological processes active in behavior disorders are transdiagnostic mechanisms that maintain psychopathological symptoms.

2) Three main symptoms of behavior disorders (i.e., hyperactivity, inattention, and oppositional behaviors) can be underpinned by three hypothetical psychological processes: impulsivity, self-awareness and emotion regulation, respectively.

3) In behavior disorders, emotion regulation could be associated with difficulties to deal with negative experiences as evidenced by a disproportionate reaction (such as in ODD).

4) In the same way, impulsivity could be associated with difficulties in inhibiting self-focus behaviors (such as in ADHD and ODD).

5) Finally, self-awareness impairment could lead to a reduced knowledge of needs, a reduced awareness of personal achievement and low effortful control (such as in ADHD).

3.2 Characteristics of therapies for behavior disorders

3.2.1 Existing therapies

In order to identify the most effective treatments that can be offered to youth with behavior disorders, a review of the existing interventions was conducted.

3.2.1.1 Medication

Before addressing the role of psychological interventions, the first question that arises from the treatment of these disorders is the use – and the usefulness – of medication. Indeed, as discussed earlier, if genetic factors play a predominant role in the E x G interaction, medication should have a positive effect.

In their meta-analysis, Van der Oord, Prins, Oosterlaan, and Emmelkamp (2008) found that medication (i.e., methylphenidate such as RITALINE© or CONCERTA©) was more effective than psychosocial interventions in treating ODD and particularly ADHD symptoms, although both have a positive impact (large effect size for medication and medium effect size for psychosocial interventions, see also the meta-analysis of Pringsheim et al., 2015, which found the same results). However, the improvement produced by medication was not maintained when the treatment was stopped and, for both treatments, no effects were found on academic performance. Furthermore, adding medication secondary to initial behavior modification resulted in better outcomes on externalizing symptoms than adding behavior modification to initial medication (Pelham et al., 2016). Overall, strong evidence was found for psychostimulants (i.e., short- and long-acting formulations of methylphenidate and amphetamines) for children and adolescents with disruptive or aggressive behaviors associated with ADHD (Goman et al., 2015; Masi et al., 2017). In addition, risperidone, an atypical antipsychotic, seems to be the best medication in the absence of ADHD symptomatology. However, its adverse effects make it a second-line treatment. Thus, research tends to show that medication is important to improve behavior disorders but also that it should be accompanied by psychological interventions.

3.2.1.2 Behavioral therapy

Concerning the efficacy of psychological interventions, behavioral treatments among children (clinical parent training programs, consultations with teachers on behavior modification strategies, etc.) showed a larger effect size for treating ADHD symptoms than a control condition, cognitive-behavioral treatments and, to a lesser extent, medication (Fabiano et al., 2009; Pelham & Fabiano, 2008). It is possible that cognitive and behavioral therapy (CBT) focuses on anxious and depressive symptoms and thus impacts them in a more sensitive way than behavioral therapy which focuses specifically on externalizing

symptomatology and may have better results on this outcome. Thus, CBT could be less effective for adolescents with oppositional and aggressive behaviors who do not present high levels of internalizing symptoms (Antshel, Faraone, & Gordon, 2012; Houghton, Alsalmi, Tan, Taylor, & Durkin, 2017). However, it is often difficult to strictly separate CBT from behavioral therapy. In a recent meta-analysis, the authors assessed the effect of a cognitive or behavioral or cognitive-behavioral therapy in a total sample of 1960 children (21 studies; Battagliese et al., 2015). Their results indicated that CBT (in its general form) reduced ODD and ADHD symptoms, parental stress, externalizing symptoms, aggressive behaviors and improved social competence and attention. Of note, a large effect size was found when the intervention was delivered to parents only. These results attest that therapy can focus independently on both parents or children.

3.2.1.3 Peer-based interventions

Family therapy has also been shown to be effective in treating externalizing symptoms (von Sydow, Retzlaff, Beher, Haun, & Schweitzer, 2013). This confirms the important role of parenting among the environmental factors previously discussed.

With its own conclusions, the meta-analysis conducted by Evans, Owens, Wymbs and Ray (2018) identified five therapies as evidence-based treatments for ADHD (see Table 2.1). A notable feature shared by these five interventions was the involvement of peers in therapy (compared to other interventions such as neurofeedback, cognitive training or social skills training which focused exclusively on youth). Therefore, parents and authority figures seem to play a crucial role in the treatment of behavior disorders. Indeed, research suggests that an attitude that combines warmth and responsiveness could be a powerful protective factor against externalizing disorders. This could partly explain why family therapies are more effective in treating anxiety among children with high ADHD symptoms than a child CBT (Maric, van Steensel, & Bögels, 2018).

In the same way, youth who suffer from ODD with high levels of lability to negativity would be more sensitive to the characteristics of their environment such as maternal emotion coaching (i.e., accepting attitude and acknowledgement of their child's emotions) than those with low levels of lability to negativity (Dunsmore, Booker, & Ollendick, 2013). This result suggests that the integration of parents into therapy could depend on child behavior disorder features. Overall, the authors emphasized the importance of helping parents and their children with ODD to focus on positive affects and not only on negative ones. In the same vein, empirical data demonstrated that parents of children with ADHD are more hostile and critical towards their children than parents of healthy children (Christiansen, Oades, Psychogiou, Hauffa, & Sonuga-Barke, 2010). Parents who express negative emotions (i.e., hostility, criticism, low warmth) towards their children increase their level of oppositional behaviors. Therefore, therapists should consider a good parent-child communication as a protective factor against behavior disorders. Similarly, although ADHD children did not show higher

cortisol levels in response to a psychosocial stressor compared to healthy children, parents' negative feedback prevented cortisol level reduction in children with ADHD but not in children without ADHD (Christiansen et al., 2010). Particularly, maternal warmth was a strong protective factor against oppositional behaviors. Again, the importance that the child attaches to the quality of his or her relationship with his or her mother seems to play a key role in the development of behavior disorders. Perhaps trusting several authority figures, rather than just one, and disengaging from expectations of the maternal figure (the child's cognitive bias concerning the fact that a loving mother never reprimands him) could be a protective factor. However, youths' individual characteristics also play an important role in their parents' attitude. For instance, the study conducted by Schachar, Taylor, Wieselberg, Thorley, and Rutter (1987) showed that a decrease in symptoms of hyperactivity, thanks to medication, leads to an increase in maternal warmth, and a decrease in maternal criticism as well as negative relationship with siblings. Thus, working with both, children and their parents, seems to be a relevant therapeutic approach although, meta-analyses indicate that further studies are needed to clearly identify the real effect of peer inclusion on therapeutic efficacy (for a review see Cordier, Vilaysack, Doma, Wilkes-Gillan, & Speyer, 2018).

Table 2.1. Evidence-Based Treatments for ADHD according to Evans, Owens and Bunford (2014).

Level 1: Well-established	Behavioral Parent Training (P, E)	Behavioral Classroom Management (P, E)	Behavioral Peer Intervention (E)	Organization Training (E, A)	Combined Behavior Management Interventions (P, E)
Level 2: Probably Efficacious	Combined Training Interventions (CTI-1)				
Level 3: Possibly Efficacious	Behavioral Parent Training (A)	Neurofeedback-Training (E)			
Level 4: Experimental	Cognitive Training (E)	Combined Training Intervention (CTI-2)	Behavioral Parent Training (M)		
Level 5: Questionable Efficacy	Social Skills Training (E)	Physical Activity (E)	Omega 3/6 supplements (A)		

Note: P = preschool; E = elementary; A = adolescents; CTI-1 = combined training interventions that have extensive repetition of skills directly related to daily functioning; M = modified versions of behavioral parent training for specific populations of parents with elementary-school-age children; CTI-2 = combined training treatments that include skills relevant to daily functioning but with limited practice and feedback and includes cognitive behavioral techniques and brief behavioral parent training

3.2.1.4 Second-line therapies

Second-line therapies refer to therapies that are considered to be second intention due to poor treatment outcomes or because they are still being evaluated (i.e., therapies in parallel with first-line treatments or as an alternative if first-line treatments have not proven to be effective).

Among existing therapies, neurofeedback therapy has recently gained popularity in the treatment of behavior disorders. It aims to improve self-regulation of certain brain activity patterns by using a brain–computer interface. In children with ADHD, neurofeedback therapy has been shown to be effective in reducing hyperactivity/impulsivity and inattention with a medium effect size at posttreatment and a medium (for hyperactivity/impulsivity) to large effect size (for inattention) at follow-up (6 to 12 months) while non-active control groups reported a small effect size and groups with medication a medium to large effect size (Van Doren et al., 2018). In this way, neurofeedback could be a complementary treatment to ADHD medication or an alternative treatment for ADHD children who do not respond to ADHD medication (Sudnawa et al., 2018).

Similarly, we also know that externalizing symptoms negatively impact executive functions (Skogli, Andersen, Hovik, & Øie, 2017). For example, ADHD symptomatology is strongly related to an increase in reaction time and ODD/CD symptomatology is associated with premature responses (Leno et al., 2017). Trainings that exclusively focused on executive function, such as the Cogmed Working Memory Training, have also showed positive effects on cognitive capacities (van der Donk, Hiemstra-Beernink, Tjeenk-Kalff, van der Leij, & Lindauer, 2016). In their randomized controlled trial (RCT), Dovis, Van der Oord, Wiers, and Prins (2015) found that specific interventions on targeted executive functions (using a computer game) obtained the specific and expected effect. In other words, an intervention that focuses on short-term-memory, working memory, inhibition, and cognitive-flexibility will lead to an improvement on these four outcomes while an intervention that focuses only on inhibition and cognitive flexibility will solely lead to an improvement on these two variables.

Studies that have explored the impact of physical activity on executive functions in ADHD children have shown several benefits even though they are considered as inadequate in terms of psychological outcomes (Verret, Guay, Berthiaume, Gardiner, & Béliveau, 2012; Ziereis & Jansen, 2015).

Finally, a two-year psychoanalytic treatment (based on the manual developed by Staufenberg in 2011) also seems to bring similar effects than a brief behavioral therapy followed by medication on a 38-month period (Laezer, 2015). Although only few studies with a strong experimental method have been conducted to measure the impact of

psychoanalytic therapy on behavior disorders, the existing studies suggest a positive effect (for a review see Midgley & Kennedy, 2011).

In view of these different therapies, the question of the psychological processes involved in behavior disorder improvement should be addressed. As a matter of fact, a better knowledge of these mechanisms could help develop interventions that are specifically targeting the main difficulties of youth with behavior disorders (i.e., hyperactivity, inattention, and oppositional behaviors).

Summary (section 3.2)

1) Several therapies, such as behavioral therapies, have been identified as well-established interventions to treat behavior disorders

2) Medications have a positive effect on some behavior disorders, particularly on ADHD symptoms, and could help to reinforce therapeutic care

3) The integration of peers in the psychotherapy may be an important feature to improve the intervention efficacy

4) Further research is needed to validate recent treatments that had demonstrated a positive influence on externalizing symptoms

3.3 Mindfulness for treating behavior disorders

Since they specifically target the psychological processes encountered in behavior disorders (such as inattention, impulsivity, and emotion dysregulation), MBIs may appear as promising interventions (Bunford, Evans, & Wymbs, 2015). As we saw in the first chapter, MBIs have been implemented for a large number of psychopathologies and populations and demonstrated numerous benefits. However, the research on mindfulness and behavior disorders is still in its early stages. To identify the clinical interest of MBIs for youth who suffer from behavior disorders, this section will focus on MBIs feasibility, efficacy, its processes and its limitations in this specific population.

3.3.1 Feasibility and acceptability of MBIs

Before going further on the psychological benefits of MBIs, it is necessary to determine whether these programs are appropriate for a population of youth with behavior disorders. We have already seen in the section 2.4.2 of Chapter 1 that MBIs are globally adapted and

well accepted by young people in non-clinical populations. However, the symptomatology presented by adolescents with behavior disorders (e.g., impulsivity and hyperactivity) could be an obstacle to the practice of mindfulness. In order to evaluate the true benefits of MBIs, it is necessary to first ensure that the adolescents are motivated to engage in the mindfulness practice and that they are able to do it. Therefore, we investigated the rate of attrition observed in experimental studies in order to have a first clue of the acceptability of MBIs in this population.

The meta-analysis performed by Zhou et al. (2020) on the efficacy of MBIs among a population of adolescents with anxiety symptomatology indicated an average attrition rate of 9.88% in fourteen studies. However, this rate included control groups and was not specific to behavior disorders.

Concerning behavior disorders, the same low rate of attrition was observed. While the three meta-analyses conducted in the field did not mention the average rate of dropout (Chimiklis et al., 2018; Zhang et al., 2018; Cairncross & Miller, 2015), several studies, taken separately, reported attrition rates. A summary is presented in Table 2.2. The average attrition rate is 10.47%, which does not appear to be intrinsically high or different from the rate found in the clinical population of the study conducted by Zhou et al. (2020). The rate of attrition in control groups is lower (3.17%) but only three studies used a control group. In addition, most studies did not mention the reason for attrition or mentioned reasons that are not related to externalizing symptomatology (e.g., economic problems in Muratori et al., 2020). Nevertheless, two important remarks can be made. First, the very small sample sizes of the studies prevent definitive conclusions on feasibility in this population. Second, it is necessary to have an active control group in terms of comparing attrition rates in order to have a specific view of MBIs acceptability and not only the overall attrition in therapeutic cares. Moreover, parallel to the MBI for youth, several studies have included a MBI or, more broadly, help for parents. This can also affect the interpretation of the results because adolescents might have completed the program due to peer pressure, rather than out of interest in it. Thus, further investigation is needed to fully understand the feasibility and acceptability of MBIs among adolescents with behavior disorders.

Table 2.2. Attrition rate in MBI studies conducted among children or adolescents with behavior disorders.

Study	Total sample of the MBI (n)	Attrition rate (%)	Total sample of the control group (n)	Attrition rate (%)
Zylowska et al., 2018	21	13	None	
Huguet et al., 2017	6	16.6	None	
Haydicky et al., 2012	28	3.57	32	6.25
Zhang et al. 2017	11	9	None	
Van de Weijer-Bergsma et al., 2012	10	0	None	
Van der Oord et al., 2012	18	5	None	
Bögels et al., 2008	14	36	None	
Abdolahzadeh et al., 2016	15	13.3	15	13.3
Muratori et al., 2020	25	8	25	0
Weighted average		10.47		3.17

Note. *None* = No control group

3.3.2 Overall efficacy

One of the first studies that provided an overview of the research results obtained in the field of MBIs among youth with behavior disorders was conducted by Chimiklis et al. (2018). In this meta-analysis, eleven studies that evaluated the efficacy of MBIs and yoga in children with ADHD symptoms were investigated.

For teacher-reported ADHD symptoms, the Hedges'g was 0.23 (95% CI [.076, .50]; p = 0.008) while it was 0.57 (95% CI [.029; 1.11]; p = .039) for parent-reported ADHD symptoms, indicating a small to moderate effect size (ES). Importantly, two moderators were found. On the one hand, it seems that randomized-controlled trials reported small, insignificant ES compared to controlled or single arm multiple baseline design. This result

was in line with previous findings in the mindfulness field, which suggest that MBIs' efficacy was often overestimated. On the other hand, longer intervention sessions were found to be associated with larger ES (but not the number of sessions). Thus, this may indicate that ADHD symptoms could further improve with longer time of practice and exposure. It is possible that the strength of learning lies in intensive practice (i.e., the capacity to stay longer in relation to its inner experience). Interestingly, neither the sample size, formal ADHD diagnosis, number of intervention sessions nor the kind of intervention (yoga versus MBIs) were found as moderators of the intervention efficacy.

For inattention and attention problems, the ES was 0.31 (95% CI [.12, .49]; p = .001) when rated by teachers, and 0.34 (95% CI [.13, .56]; p = .001) when rated by parents, indicating a small to moderate ES. No moderator was found for this variable.

Concerning hyperactivity, the results showed a small to moderate ES according to the parents (g = 0.39; 95% CI [.04, .73]; p = .023) and a small ES according to the teachers (g = 0.22; 95% CI [.02, .41]; p = .027). Moderator analyses demonstrated that children with an ADHD diagnosis showed a larger decrease in hyperactivity than children without a formal diagnosis. Yet, it is possible that children with formal diagnoses present a higher level of hyperactivity at baseline and, thus, were more likely to reduce it. Furthermore, MBIs seem to have a better impact on hyperactivity than yoga interventions according to moderation analyses. This conclusion could lead to the hypothesis that mindfulness exercises that require immobility may be more beneficial for hyperactivity than mindful movements. However, the review of Evans et al. (2018) on MBIs among children with ADHD, found that, out of 16 studies, the highest ES (g = 2.2) was reported by a combined intervention for children involving yoga, meditation and behavioral therapy (Mehta et al., 2011). Since the study presented critical risk of bias and a mix of several interventions, it is difficult to draw definitive conclusions but other studies showed positive effects of yoga-based interventions (e.g., Cohen et al., 2018). In addition, it is important to highlight that numerous MBIs include yoga exercises.

The largest ES in this study was found for on-task behavior (g = 1.219; 95% CI [.92, 1.51]; p < .001). However, the authors did not specify the nature of this variable, thus it was not possible to clearly understand this result. No moderator was found for this variable.

The impact of MBIs and yoga on executive functions was also investigated. The ES associated with the child's ability to initiate, plan, organize, self-monitor, and sustain working memory (rated by teachers) was 0.31 (95% CI [−.12, .74]; p = .16), whereas it was 0.67 (95% CI [.20, 1.14]; p = .005) for the child's ability to shift cognitive set and modulate emotions and behavior via appropriate inhibitory control, suggesting a small to moderate ES. No moderator was found for these variables.

Finally, the ES for child-parent relationship, reported by children, was moderate (g = 0.50; 95% CI [.25, .75]; p < .001). This result suggests that children perceived an improvement in the quality of their relationship with their parents (moderate ES). No moderator was found for this outcome.

Overall, we can observe that parents reported larger improvements than teachers and that the effects of MBIs and yoga on ADHD symptomatology vary from small to moderate ES (except for on-task behavior). Thus, MBIs appear to be effective in improving the mental health of ADHD children to some extent. However, due to the low quality of numerous studies (only two studies – 18% – were randomized-controlled trials) and the small ES found for some variables, it remains unclear whether MBIs can be considered as a recommended and well-established treatment for ADHD children. Finally, the results of this meta-analysis should be considered with caution due to several limitations such as bias in the selection of the reported results, bias in deviating from the intended intervention or bias due to confounding.

The meta-analysis of Zhang, Díaz-Román, & Cortese (2018) conducted on seven RCTs in children and adolescents with ADHD symptomatology supplements these results. MBIs were found to have a positive and moderate ES compared to a control group for combined ADHD symptoms (g = −0.44; 95% CI [−.69; −.19]) with a larger effect on inattentive symptoms (g = −0.52, 95% CI [−.81; −.23]) than hyperactive-impulsive symptoms (g = −0.40, 95% CI [−.68; −.12]). However, no effect was found for neuropsychological measures of inattention or inhibition although the heterogeneity of the results prevented any definitive conclusion. Similarly to the meta-analysis of Chimiklis et al. (2018), the authors pointed out the lack of sufficient methodologically sound evidence for the use of MBIs among youth with ADHD.

The conclusions of the oldest meta-analysis performed in this field by Cairncross and Miller (2016) are also in line with the previous findings. The ES for inattention was moderate (d = −0.66; 95% CI [−.92, −.40]), as well as the ES for hyperactivity/impulsivity symptoms (d = −0.53; 95% CI [−.74, −.32]).

Of note, the measures are often reported by parents or teachers and rarely reported by children themselves. In addition, it seems important to achieve a better understanding of the interactions between all these variables and to determine the efficacy of MBIs in influencing the main processes involved in behavior disorders.

3.3.3 Therapeutic specificities of MBIs

3.3.3.1 Mindful parenting

Parents of children with ADHD experience greater levels of stress compared to parents of non-clinical children (Theule, Wiener, Tannock, & Jenkins, 2013). Thus, mindful parenting, defined by Kabat-Zinn (2009) as paying attention to your child and your parenting in a particular way: intentionally, here and now, and non-judgmentally, could help to achieve several psychological changes in parents that could positively influence their children. Townshend (2016) identified several processes involved in mindful parenting such as listening, emotional awareness, emotional regulation, attentional regulation, attunement, attention to variability, intentionality, reperceiving, compassion and non-judgmental acceptance. The overall postulate is that parents who become more mindful may develop better parenting skills and better relationships with their children or that the externalizing symptoms of their children may have a more limited effect on them. In addition, therapies that include children and their parents may obtain better results than therapies that only focus on children alone. Bögels, Lehtonen, and Restifo (2010) hypothesized that mindfulness-based parenting interventions could (1) reduce parental stress; (2) reduce parental preoccupation resulting from parental and/or child psychopathology; (3) improve parental executive functioning in impulsive parents; (4) break the cycle of repeating dysfunctional upbringing schemes and habits; (5) increase self-nourishing attention; and (6) improve marital functioning and co-parenting. Particularly, parents of children with externalizing symptoms (who themselves suffer from impulsivity and inattention problems most of the time) might benefit from mindful parenting. Several studies have partly proven this hypothesis. Moreover, parents with a high level of mindfulness may experience less stress than those with a low level of mindfulness (Chan & Lam, 2017). A pilot study showed that the MYmind Program for adolescents (from 13 to 18) and their parents had a positive effect on inattention, learning problems, executive functions, ODD, depression, anxiety and peer relations (Haydicky, Shecter, Wiener, & Ducharme, 2015). An enhancement was also found for parents' stress and mindful parenting. In addition to these results, Lo et al. (2017) found that, compared to a control group, children who followed a family-based mindfulness intervention decreased their level of inattention and hyperactivity with a moderate ES while they reduced their level of internalizing symptoms and externalizing symptoms with a small to moderate ES. No change was found on the attention network test (except for conflict monitoring) and mediation analyses revealed that the negative association between MBIs and parental stress as well as the association between MBIs and happiness were mediated by children's ADHD symptoms. The same patterns of results were observed by Behbahani, Zargar, Assarian, and Akbari (2018). In comparison to a control group, children with ADHD who benefitted from a MBI with their mother during 8 weeks reduced their level of inattention and impulsivity along with the overall symptomatology of ADHD (reported by parents). In addition, parents reduced their score on the stress questionnaire and scored lower on negative parent-child interactions. These improvements were maintained at an 8-week follow-up.

Finally, the review of Cassone (2015) nicely synthesizes the aforementioned results. While mindfulness-based parent training can be viewed as a useful intervention, this author recommends considering mindfulness as a complementary tool of behavioral parent training which remains a gold standard in the treatment of ADHD. Mindfulness could emphasize the empathic, nonjudgmental attitude of the parents and enhance the behavioral therapy efficacy by helping change maladaptive relationships and dysfunctional interactions within the family.

3.3.3.2 Impulsivity and neurobiological aspects

As mentioned above, impulsivity and inattention could play an important role in behavior disorders symptomatology. The study conducted by Deplus, Billieux, Scharff and Philippot (2016) suggests that adolescents from a clinical population who follow a MBI could decrease their level of urgency and lack of perseverance (i.e., two facets of impulsivity). Similar results were found in a population of students suffering from ADHD (Gu, Xu, & Zhu, 2018). Participants who received MBCT tended to decrease their level of hyperactivity/impulsivity symptoms compared to a control group. Other MBIs, such as one focused on martial arts (Sibalis et al., 2017), showed similar results. Indeed, adolescents with ADHD who participated to this MBI increased their inhibition during a Go/No-Go task (evidenced by a decrease in theta/beta ratio) compared to a control group. Although nonspecific of an ADHD population (Sanger & Dorjee, 2016), the neural changes identified by the authors attest that MBIs can change the brain structure (for a review of neurological and anatomical mechanisms that may play a role in ADHD children who practice mindfulness, refer to Schoenberg, 2016). Consistently, yoga-based interventions also demonstrate a positive impact on hyperactivity among preschool-aged children with ADHD (Cohen et al., 2018). However, this result must be considered by taking into account the findings of the meta-analysis of Chimiklis et al. (2018) which indicated a better effect of MBIs on hyperactivity than yoga-based interventions. Considering the young age of the children in the study of Cohen et al. (2018), it is possible that yoga-based interventions could be more appropriate for younger children, because movement exercises are more accessible than immobility given their developmental stage. Generally, MBIs show a positive effect on impulsivity which may partly explain their efficacy on hyperactivity.

3.3.3.3 Self-awareness

Mindfulness could help children and adolescents sustain their attention on their present-moment experience, even if it is unpleasant, and, thus, help them identify their emotions and needs, understand the temporary nature of their emotional experience, and, finally, act in a more mindful way by adopting an attitude closer to their values. This self-awareness capacity is closely associated with non-judgment and non-reactivity. Mindfulness could act as a protective factor against stress in adolescence (Ciesla, Reilly, Dickson, Emanuel, & Updegraff, 2012). Numerous studies demonstrated that youth who follow a MBI improve their level of mindfulness with a small to moderate ES (Dunning et al., 2018). Therefore, it

is likely that the improvement of mindfulness in adolescents who suffer from behavior disorders will positively impact their externalizing symptoms.

3.3.4 Limitations of MBIs

Despite the fact that studies tend to confirm the positive impact of MBIs on youth with behavior disorders, this general conclusion should be taken carefully for several reasons.

First, the design of numerous studies was not sufficiently adequate to draw definitive conclusions. Most of them were non-RCTs and even the RCTs suffer from high risk of bias such as lack of details about the randomization, no reported blinding of participants and evaluators, the use of non-manualized interventions, and no information about medication (Chimiklis et al., 2018). These methodological problems can lead to false positive results and an overestimation of MBIs efficacy in this population. In addition, this effect could be accentuated by the journals trend to reject negative and non-significant results (Fanelli, 2012; Ioannidis, 2005). Although a growing number of mindfulness studies are conducted in the field of behavior disorders, there is still a lack of well-designed studies and the enthusiasm for mindfulness should not make us lose sight of scientific rigor.

Second, few consistencies have been observed for several outcomes although a consensus has begun to emerge about the important role of peers and the impact on attention and hyperactivity dimensions. Significant differences were observed in ES depending on the characteristics of the intervention (e.g., length, exercises), child's diagnosis, self-report or parents/teachers reports, design of the study (e.g., RCT, within-subjects study design), or sample size. Research should clarify the importance of these features by replicating findings even though overall results suggest that MBIs have a positive and significant impact on the mental health of this population. As a consequence, it is difficult to position MBIs in relation to other interventions and notably to determine their place in Evidence-Based Treatments (Evans et al, 2014).

Third, the psychological processes involved in MBIs are still poorly understood. Few studies investigated mediating effects with several times of assessment. Therefore, it is difficult to say whether MBIs influence directly, or not, behavior disorder symptomatology. For example, a decrease in internalizing symptoms could lead to a decrease in externalizing symptoms but the reverse is also possible as well as a co-occurrence of these phenomena. The improvement could also come from other mechanisms than mindfulness such as group format or psychoeducation to emotions, which are common in MBIs.

Fourth, many studies focused on children with ADHD while behavior disorders include other diagnoses such as ODD and CD. In this respect, studies that explore the influence of MBIs on aggressiveness and violent behaviors in youth with ODD or CD could be very helpful. Although the feasibility of MBIs is well established in young people, few studies

examined the compliance of a population with high aggressiveness (and, particularly the barriers to practice) as children with behavior disorders could present serious difficulties understanding and practicing mindfulness. Thus, adapted MBIs must continue to be evaluated in order to know their therapeutic specificities (such as the order and number of sessions, the topics, the exercises) and must be supported by qualitative data to give a true picture of what is going on for the participants.

Fifth, research clearly lacks ecological designs. Indeed, a significant proportion of youth who suffer from behavior disorders are part of institutions and can rarely count on the active help of their parents or their family. Similarly, the practice outside of the sessions could be very complicated for them. Therefore, the identification of a favorable environment is needed as well as follow-up and longitudinal studies in order to ensure the long-term effects of MBIs.

The present thesis was born from this specific context and attempts to address these issues by applying a scientific and rigorous methodology coming from the field of psychology.

Summary (section 3.3)

1) Meta-analyses agree that MBIs have a small to moderate effect size on ADHD symptoms, inattention, hyperactivity, and executive function.

2) MBIs could also help the parents of children with behavior disorders by reducing stress and increasing mindfulness. In turn, mindful parenting could change the parents' attitudes towards their children by making them more aware of their emotions, more compassionate and more attentive.

3) Notably, MBIs could impact several processes involved in youth with behavior disorders such as impulsivity and self-awareness.

4) Given the many methodological limitations of mindfulness studies among youth with behavior disorders, it is important to continue conducting research in this field.

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Chapter 3

Research aims and plan

"*A host of sources can lead therapists, other observers, and clients themselves to infer therapeutic improvement in its absence. These factors provide a potent reminder of why rigorous research designs […] are essential, and why individuals cannot rely on their naïve realism to draw conclusions regarding therapeutic efficacy*".

— Scott Lilienfeld (2013, p. 889)

1. Introduction

1.1 An overview of MBIs

We saw in Chapter 1 that mindfulness was a way of being in relation to one's own experience resulting from a deliberate focus on one's present experience with an attitude of tolerance and patience towards oneself (Philippot, Deplus & Nef, 2016). This approach and its theoretical rationale, generally encompassed by the term "third wave CBT", have been largely developed in the field of psychology and a significant number of studies were conducted in order to ensure their psychological benefits. Overall, the empirical results suggest that MBIs are effective to improve numerous pathologies, to treat stress, anxiety and depressive symptomatology with a small to moderate effect size (Abbott et al., 2014; Goyal et al., 2014; Hofmann, Sawyer, Witt, & Oh, 2010; Sedlmeier et al., 2012). In addition MBIs have shown to be more effective than no treatment or treatment as usual for patients with psychiatric disorders (Hedman-Lagerlöf, Hedman-Lagerlöf, & Öst, 2018).

We saw that MBIs for youth were also a relevant therapeutic approach. In the same way as for adults, studies demonstrated a small to moderate effect size of MBIs for a wide range of outcomes in clinical and non-clinical populations. However, we noted that numerous studies suffered from poor methodological designs, which may lead to false positive results and an overestimation of MBIs efficacy. Furthermore, there is a lack of longitudinal data that would allow to support the long-term benefits of MBIs.

Also, we have seen that some psychological processes, such as mindfulness, attentional capacities, non-reaction/impulsivity, and ruminations, have been suggested as the main

mediators of MBIs efficacy. Despite these assumptions, few models were tested in children and adolescents and further research is needed to ensure the role of these mechanisms.

1.2 An overview of behavior disorders

In Chapter 2, we saw that adolescence is a vulnerable period for mental disorders and that the mental problems appearing during this period are often persistent in adulthood. Among the most common disorders in youth, behavior disorders (which group ADHD, IED, ODD, and CD) take a huge place and affect more than 9% of this population (Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015). These pathologies come from an interaction between genetic and environmental factors. In the psychiatric diagnosis classification, behavior disorders are mainly characterized by a set of externalizing symptoms. Still, they are determined by a set of impairments in psychological processes, mostly emotion regulation, inhibition and self-awareness, that have also an impact on internalizing symptomatology.

Globally, studies have shown that medications are effective to treat externalizing symptoms, notably associated with ADHD symptomatology (Van der Oord, Prins, Oosterlaan, & Emmelkamp, 2008). However, some psychological interventions also seem to impact positively externalizing symptoms. Particularly, behavioral therapies have demonstrated the best results and are consequently considered as Evidence-Based Treatments for ADHD (Evans, Owens, & Bunford, 2014). Several psychological mechanisms, which do not depend on a particular therapy, were also identified as important factors in the therapeutic process. For example, the improvement of emotion regulation, as well as impulsivity or attentional capacities, could directly affect the symptomatology of behavior disorders. The similarities that can be observed between the target processes in behavior disorders and those observed in MBIs suggest that mindfulness could be an appropriate approach to treat behavior disorders.

In this way, we saw that meta-analyses of MBIs in youth with behavior disorders reported a small to moderate effect size concerning several ADHD outcomes (Cairncross & Miller, 2016; Chimiklis et al., 2018; Zhang, Díaz-Román, & Cortese, 2018). Notably, we viewed that MBIs that included parents could produce better results due to the improvement of mindful parenting. Similarly, first results tend to indicate that MBIs could impact important processes involved in behavior disorders such as impulsivity and self-awareness. However, studies conducted on MBIs in youth with behavior disorders present a lot of limitations that must be addressed. For instance, there is a lack of controlled and randomized studies, the mediators and moderators that underpin the MBIs efficacy are unclear as well as the program adaptations that contribute to an improvement of the outcome (type of exercises, session length etc.). In addition, few studies explored the specific effect of MBIs on other behavior disorders than ADHD (e.g., ODD, CD) whereas these adolescents could benefit from these interventions. All these observations highlight the need to carry on the investigations on MBIs among adolescents with behavior disorders.

2. Research questions

2.1 Are MBIs feasible and well-accepted by adolescents with behavior disorders?

The first issue that emerges from this literature review is the possibility to implement MBIs among a population of adolescents presenting behavior disorders. As we already know, several studies were conducted among ADHD children and adolescents and showed a set of benefits (Chimiklis et al., 2018) but very few studies included ODD, IED or CD (with few exceptions such as Bögels, Hoogstad, van Dun, de Schutter, & Restifo, 2008). Although ADHD has a high comorbidity with these other behavior disorders, pure form of aggressiveness and opposition, notably during the adolescence, may lead to a systematic failure to implement these interventions. This may partly explain why there is a lack of studies on behavior disorders other than ADHD. Indeed, adolescents with such difficulties might be more likely to refuse to participate in a program of emotion management based on meditation that implied sitting, non-active and silent exercises in groups. Likewise, mindfulness may also be a difficult concept for teenagers to grasp. However, the previous studies on ADHD populations are encouraging and the adaptation of the MBCT program seems to be the core of the MBI therapeutic success (e.g., see the Soles of the Feet intervention; Felver, Frank, & McEachern, 2014).

The studies conducted in this thesis test the feasibility and acceptability of MBIs among adolescents with behavior disorders (dropouts, interviews of the participants etc.) and try to adapt the intervention by identifying the specific needs of this population. A one-year follow-up, consisting in self-reported questionnaires and qualitative interviews, has been performed.

We hypothesized that (H1.1) adolescents suffering from behavior disorders would adhere to an adapted MBI and (H1.2) that the amount of dropout in the experimental condition would be similar to the control conditions.

2.2 Do MBIs have a positive impact on the mental health of adolescents?

The second important issue to address concerns the efficacy of MBIs to treat externalizing symptomatology - and to a lesser extent internalizing symptoms - among adolescents with behavior disorders. Particularly, it seems essential to know whether the MBI can be considered as an empirically supported therapy in order to support its dissemination in this population. Studies have shown promising results on the symptomatology of behavior disorders. However, replications of these results with well controlled designs are still needed to confirm the positive role of these interventions and to extend the conclusions to the whole family of behavior disorders. Improvement in the well-being of the adolescents, their capacity to deal with negative emotions, to reduce their anxiety, their aggressiveness and their global distress are all the objectives set by the MBIs that must be tested by an empirical approach.

To achieve this purpose, a quasi-experimental study (Study#1) and a RCT (Study#2, Chapter 5) were conducted in two residential services for youth. Three groups of adolescents were randomly constituted and compared to each other. Two groups were control groups, one was a treatment as usual group (institutional care) and the other group was a group based on psychoeducation to health. The third group was based on psychoeducation to emotion and was followed by a MBI. The comparison of the outcomes evolution in the three groups will allow to determine the relevance of the MBI (by controlling the group effect and institutional care). Externalizing symptomatology was assessed before, during and after the program (a post-test plus a one-year follow-up). Of note, results of self-report questionnaires were supplemented by questionnaires completed by educators and behavioral tasks to get an overview of the changes.

We hypothesize that (H2.1) adolescents suffering from behavior disorders who participate in a MBI will decrease their externalizing and internalizing symptoms compared to an active and a non-active control group. In addition, we assume that (H2.2) these improvements will be maintained at one-year follow-up.

2.3 What are the psychological processes involved in the improvements observed in the MBI?

To go further in the understanding of MBIs efficacy, this research will explore the psychological processes that underpin the outcomes changes. Indeed, the identification of the processes that lead to an improvement of the well-being of these adolescents could help to answer to the question "Why does the MBI work?". Because many factors could explain a psychological improvement, this question is important to address. More precisely, it is important to isolate the main mechanisms to improve the specificity of therapeutic interventions. As we saw in Chapter 2, MBIs could reduce emotional dysregulation, impulsivity or lack of self-awareness, which lead, in a second step, to a decrease of externalizing and internalizing symptoms. Given the large number of measures used and the difficulty in obtaining valid measures of emotional dysregulation in this population, the studies of this thesis will focus on impulsivity and self-awareness. The theoretical model presented in the Chapter 2 (see Figure 2.4) will be partly confronted to empirical data. We expect that the MBI will show a significant impact on externalizing and internalizing symptoms and that this change will be mediated by a change in impulsivity and self-awareness. Mediation analyses will be conducted thanks to PROCESS modeling tool (Hayes, 2012).

In this way, we hypothesize that (H3) the psychological benefit on externalizing and internalizing symptoms of a MBI for adolescents suffering from behavior disorders will be mediated by a change in level of impulsivity and self-awareness.

The Table 3.1 displays a summary of the studies conducted in this thesis.

Table 3.1. Summary of the different studies conducted during this thesis.

Chapter	Year	Measure	Sample & Design	Group
Study#1 (Chapter 4)	2015-2016	Depressive symptomatology, Impulsivity, Inattention, Hyperactivity, Oppositional behaviors, general externalizing and internalizing symptomatology	Boys (n = 48) Quasi-experimental study + Follow-up	Treatment as usual; MBI group
Study#2 (Chapter 5)	2016-2019	Depressive symptomatology, Mindfulness, Attentional task Impulsivity, Inattention, Hyperactivity, Oppositional behaviors, General externalizing and internalizing symptomatology, Prosocial behaviors	Boys and girls (n = 129) RCTs + Follow-up	Treatment as usual; Health Psychoeducation; MBI

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Chapter 4

A Mindfulness-based program among adolescent boys with behavior disorders: a quasi-experimental study[1]

Abstract: Several studies have shown that mindfulness-based programs (MBPs) may bring promising benefits for youth. However, little is known about its efficacy in specific clinical populations and even less about the psychological processes that underlie the changes. This study investigates the efficacy of a MBP among a population of adolescent boys with behavior disorders and explores the mediating role of impulsivity in the observed changes. Participants included 48 adolescents presenting conduct disorders and mild cognitive impairments, living in a residential service for youth in Belgium. Two groups of 24 adolescents aged 12 to 19 years have been constituted. Only the experimental group followed a MBP. The program was divided into two parts: the first 6 sessions were devoted to group dynamic and introduction to emotional skills whereas the second part focused on mindfulness exercises. The level of depression and impulsivity as well as the symptomatology of attention deficit hyperactivity disorder were assessed before, during and after the program for both groups. Results showed that both groups decreased their depressive symptomatology but only the MBP group decreased in impulsivity and externalizing symptomatology. No mediating effects of the facets of impulsivity on the outcomes were found. MBPs may bring psychological benefits for adolescents who suffer from behavior disorders but further research on the efficacy of MBPs among this population is needed.

Reference: Roux, B., & Philippot, P. (2020). A Mindfulness-based program among adolescent boys with behavior disorders: a quasi-experimental study. *Journal of Child and Family Studies*, *29*(8), 2186-2200.

[1] The term "Mindfulness-Based Intervention" has been replaced by “Mindfulness-based program” in this article at the request of one of the reviewers “to better align it with its Buddhist roots because mindfulness was never designed to be used as an intervention or therapy”

A Mindfulness-based program among adolescent boys with behavior disorders: a quasi-experimental study

1. Introduction

Adolescence is a sensitive period during which psychological processes mature importantly (Casey et al., 2010). In this context, some adolescents may develop psychological difficulties associated with puberty changes (Avenevoli et al., 2015). One adolescent in five between 12 and 19 years of age suffers from a psychiatric disorder (Costello et al., 2011). Even though most teenagers do not go through a problematic period, some may experience difficulties that required the help of professionals. For instance, a study on adolescent mental health reported an increase in the 12-month prevalence of major depressive episodes between 2005 (8.7%) and 2014 (11.3%) (Mojtabai et al., 2016). This is particularly the case for adolescents with behavior disorders who are more likely to develop externalizing and internalizing symptoms (Lam & Ho, 2010; Lee et al., 2011). A longitudinal study showed that adolescents who presented conduct problems were likely to develop a comorbid depression, while adolescents with depression were no more likely to develop conduct problems (McDonough-Caplan et al., 2018). These results suggest that adolescents suffering from behavior disorders are a high-risk population and that internalizing symptoms, such as anxiety and depressive symptoms, should be addressed. Despite these observations, externalizing symptomatology remains the core symptoms of behavior disorders or, at least, the most salient. Globally, externalizing disorders affect 9.5% of the adolescents in a high severity form and 28.8% of them in a mild severity form (Colman et al., 2009). In addition, the literature demonstrated that boys are more at risk to develop behavior disorders than girls (Boden et al., 2010; Keenan et al., 2010).

Taken together, attention deficit/hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD) are the second type of psychological problems encountered in adolescence and affect more than 19% of youth (after anxiety disorders with 31.9%; Merikangas et al., 2010). These disorders are characterized by externalizing symptoms, such as anger, frustration, low activation and inhibitory control, hyperactive and aggressive behaviors, but can also lead to internalizing symptoms like depression or anxiety (Liu, 2004; Muris et al., 2007). Interestingly, the DSM-5 separated ADHD (in the Neurodevelopmental Disorders category) from ODD and CD (in the Disruptive, Impulse-Control, and Conduct Disorders category) due to early developmental deficits (e.g., executive functions impairment) that are supposed to be specific to ADHD. However, these diagnoses present a high comorbidity and the overlaps between ADHD and externalizing symptoms included in ODD and CD were frequently highlighted (e.g., Witkiewitz et al., 2013). In this way, the DSM-5 states that “on the basis of patterns of symptoms, comorbidity, and shared

risk factors, attention-deficit/hyperactivity disorder was placed with neurodevelopmental disorders, but the same data also supported strong arguments to place ADHD within disruptive, impulse-control, and conduct disorders" (American Psychiatric Association, 2013, p. 11). As a result, we choose the label "behavior disorders" in reference to the following diagnoses: ADHD, ODD, and CD.

Yet, solely relying on diagnostic categories may limit our understanding of the underlying psychological dynamics. Another way to grasp behavior disorders is to identify their underlying psychological processes as suggested by the processual approach (Nolen-Hoeksema & Watkins, 2011; Philippot et al., 2019). The processual approach poses that interventions should target transdiagnostic psychological mechanisms (i.e., attitudes or functioning common to several diagnoses, such as rumination, that maintain the psychological problems). In accordance with this view, research has suggested several psychological processes that may play a central role in behavior disorders. For example, impulsivity, that is to say the deficit in the ability to analyze responses to a stimulus and a tendency to act rashly, could be one of the major psychological processes underlying behavior disorders (Ahmad & Hinshaw, 2016; Barkley, 1997). Whiteside and Lynam (2001) have identified four dimensions underlying impulsivity: Urgency, Lack of Premeditation, Lack of Perseverance and Sensation seeking. High levels of impulsivity can be observed in ADHD as well as in ODD and CD. This lack of inhibition constitutes a central issue in behavior disorders due to its high prevalence and its strong associations with internalizing and externalizing symptomatology (d'Acremont & Van der Linden, 2007; Flory et al., 2003). Congruently, interventions, such as cognitive behavioral therapy, have been proposed to help adolescents to manage their impulsivity and improve their inhibition capacities (Cartwright-Hatton et al., 2004; Sonuga-Barke et al., 2013).

In line with the desire to act on transdiagnostic processes, Mindfulness-Based Programs (MBPs) have received increasing attention. Mindfulness is the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment (Kabat-Zinn, 2003). It can be defined by several mechanisms such as attention regulation, body awareness, emotion regulation, and change in perspective of the self (Hölzel et al., 2011). Mindfulness training does not directly focus on problem solving but fosters emotional acceptance and awareness of ongoing experience (Kahl et al., 2012). Exercises, such as breathing meditation, body scan, or mindful hatha yoga, are proposed to participants in order to develop their capacities to be mindful and to bring attention to the present moment. MBPs have proven effective in alleviating psychological problems such as anxiety, depression, or ruminations and in potentiating emotion regulation in adult populations (Chambers et al., 2009; Deyo et al., 2009; Grossman et al., 2004; Heeren & Philippot, 2011). Several meta-analyses were conducted and supported the MBPs efficacy with a small to moderate effect size (Grossman et al., 2004; Khoury et al., 2015; Sedlmeier et al., 2012). While a large number of studies have been conducted in adults, the implementation of MBPs has only recently been initiated among youth (Broderick & Jennings, 2012).

The first study on MBPs among children aged 7-8 was conducted by Semple, Reid, and Miller (2005) in a school context. A large number of MBPs followed thereafter (Zack et al., 2014), for instance, the manualized mindfulness program for anxious children (Semple & Lee, 2007), an adaptation of the Mindfulness-Based Stress Reduction program (MBSR) for adolescents (Biegel et al., 2009), the learning to breath program (Broderick & Metz, 2009), the .b program (Mindfulness in Schools Project; Kuyken et al., 2013) or the program for children and adolescents developed by Deplus et al. (2016). Overall, the MBPs dedicated to youth differ in terms of session number (from 4 to 16), length (from 30 to 90 minutes), target population (clinical versus non-clinical), and content (presence or absence of elements such as emotion- and stress-related psychoeducation, empathy or yoga exercises). Taken together, MBPs have a small to moderate effect size (ES) for depressive symptomatology (ranged from 0.27 to 0.45; Chi et al., 2018; Dunning et al., 2018), a moderate to large ES for anxiety (ranged from 0.62 to 0.96; Kallapiran et al., 2015; Zenner et al., 2014) and a small to moderate ES for mindfulness (ranged from 0.24 to 0.42, Dunning et al., 2018).

Yet, the large diversity of these MBPs for youth raises some questions about their heterogeneity and their comparability. This concern was addressed by the meta-analysis of Zoogman et al. (2015) that investigated the different modalities of MBPs implementation among youth aged between 6 and 21 years. The authors did not find any moderator on outcome concerning home practice, instructor previous experience, session length, treatment frequency or length, intervention type, age, sample size, gender or racial/ethnic minority composition of the sample, or publication year. Furthermore, all MBPs shared common components such as breath awareness, attention training, working on thoughts and emotions, psycho-education about emotion regulation, awareness of senses, group discussions, body-scan and home practice, which could reduce the apparent diversity of formats (Zenner et al., 2014). These MBPs have been adapted in order to be effective and well received in young populations. Indeed, developmental differences for younger populations compared to adults, such as shorter attention span or lower abstraction capacities, need to be considered. We identified four points that distinguish MBPs for adolescents from MBPs for adults: (1) Sessions are more numerus and shorter in order to respect the attention capacities of youth; (2) Groups are smaller and often have more than one therapist; (3) Mindfulness exercises and time required for home practice are shorter; (4) Playfulness is emphasized by integrating mindfulness through games, stories, movies, and pictures. By including these changes, the first studies that investigated MBPs for youth assessed the feasibility and acceptability of this approach (first step). The overall conclusion was optimistic and provided the green light for further investigations (Ames et al., 2014; Burke, 2010; Mendelson et al., 2010; Semple et al., 2005).

It follows that one can ask whether adolescents who suffer from behavior disorders would benefit from MBPs in the same way as the general youth population. A non-controlled study, on 10 adolescents with ADHD aged 11-15 years, tested the efficacy of a MBP for children based on 8 weekly 1.5 h sessions, accompanied with a parallel mindful parenting training for parents (Van de Weijer-Bergsma et al., 2012). Results are mixed but indicated that MBPs

may improve externalizing and internalizing symptoms as well as attention. Similar findings were supported by studies in younger populations (e.g., Van der Oord, Bögels, & Peijnenburg, 2012). More generally, adolescents with behavior disorders aged 11-18 reported a reduction of their externalized symptoms (Cohen's d = 1.1), a better achievement of personal goals (Cohen's d = 1.4), an enhancement of perceived attention (Cohen's d = 1.0), and a better score at an attentional task (Cohen's d = .60) after a Mindfulness-Based Cognitive Therapy (MBCT) adapted to youth (Bögels et al., 2008).

When looking at the meta-analyses on the effectiveness of MBPs among individuals who suffer from ADHD, results seems to be consistent. Thus, Cairncross and Miller (2016) showed that MBPs significantly reduced the score of hyperactivity on combined self-reports and observer-reports ratings (d = −.53; 95% CI [−.74, −.32]) as well as inattention (d = -.66; 95% CI [−0.92, −0.40]), although this last ES was larger for adults compared to children. Same conclusions were drawn by the recent meta-analysis of Chimiklis et al. (2018) conducted on eleven studies that explored the efficacy of MBPs and yoga in children with ADHD symptoms. For teacher-reported ADHD symptoms, the Hedges'g was 0.23 (95% CI [.076, .50]; p = 0.008) while it was 0.57 (95% CI [.029; 1.11]; p = .039) for parent-reported ADHD symptoms, indicating a small to moderate ES.

Two moderators were also identified by the analyses. First, it seems that randomized-controlled trials reported small or insignificant ES compared to controlled or single arm multiple baseline design. This result is in line with previous findings that suggests that MBPs efficacy is often overestimated. Second, longer intervention session was found to be associated with larger ES (but not the number of sessions). This may indicate that ADHD symptoms could improve better with longer time of practice and emotional exposure. It is possible that the strength of learning lies in intensive practice (i.e., the capacity to stay longer in relation to its inner experience). Interestingly, neither the sample size, formal ADHD diagnosis, number of intervention sessions or the type of intervention were found as moderators of the intervention efficacy. For inattention and attention problems, the ES was 0.31 (95% CI [.12, .49]; p = .001) when rating by teachers, and 0.34 (95% CI [.13, .56]; p = .001) when rating by parents, indicating a small to moderate ES. No moderator was found for this variable. Concerning hyperactivity, the results showed a small to moderate ES according to the parents (g = 0.39; 95% CI [.04, .73]; p = .023) and a small ES according to the teachers (g = 0.22; 95% CI [.02, .41]; p = .027). Moderator analyses demonstrated that the children with an ADHD diagnosis showed a better decrease in hyperactivity than the children without a formal diagnosis. Yet, it is possible that children with formal diagnosis present higher hyperactivity at baseline and, thus, were more likely to reduce their level of hyperactivity. Furthermore, MBPs seem to have a better impact on hyperactivity than yoga interventions according to moderation analyses. This last conclusion could lead to the hypothesis that mindfulness exercises that require immobility might be more beneficial for hyperactivity than mindful movements.

Importantly, the large majority of studies focuses on ADHD diagnoses and rarely consider other behavior disorders such as ODD or CD. Moreover, the internalizing symptomatology, and particularly depressive symptoms, are ignored even though they are directly related to adolescents' well-being. The interpretation of the results is also often limited by the lack of adequate control groups or well-validated measures (Burke, 2010; Zoogman et al., 2015). Another limitation of this body of literature is that the psychological processes that underlie MBPs efficacy have not been investigated.

Indeed, mindfulness targets different processes that are decisive for adolescents with behaviors disorders. As previously discussed, impulsivity may be a cornerstone of behaviors disorders. Some studies supported the influence of MBPs on impulsivity or aggressive behavior during adolescence (e.g., Singh et al., 2007). Adolescents seem to develop their inhibition capacities through mindfulness exercises and to reduce their propensity to act rashly (Deplus et al., 2016; Tan & Martin, 2015; Van Vliet et al., 2016). For instance, adolescents who participated in a MBP qualified themselves at the end of the program as less hyperactive and impulsive, and reported that the intervention had a positive impact on their ability to control physical and verbal aggression (Van Vliet et al., 2016).

In the present study, we addressed these issues by comparing a MBP with a control group, using validated tools for youth, and exploring which facets of impulsivity are potential processes that underlie improvements. This paper presents the implementation of a MBP among adolescent boys with behavior disorders in order to investigate its acceptability and its efficacy in this specific population and to identify whether impulsivity is a central process for these changes. We hypothesized that mindfulness training would lead to a global psychological improvement compared to a control group by reducing depressive, externalizing, internalizing symptoms thanks to a decrease in the processes underlying impulsivity. In this way, it is hypothesized that the changes on impulsivity facets will mediate the benefits on the outcomes. Furthermore, it was expected that the MBP would be well received by adolescents and accompanied by positive feedback.

2. Method

2.1 Participants

Fifty-six adolescent boys were recruited in a residential service for youth in Belgium. This institution accommodates only adolescent boys with behavior disorders. DSM-5 diagnoses were attributed either by the psychiatrist of the institution or by a consensus between the psychiatrist and the psychologists of the institution. Inclusions criteria were that participants should be between 12 and 19 years of age, expressed motivation to participate in the therapeutic program, fulfilled the DSM-5 criteria of a behavior disorder (ADHD, ODD

or CD), were fluent in French, and able to answer to questionnaires. Conversely, we excluded participants who presented a very high symptomatology of depression (scoring more than 76 on MDI-C at pre-test which indicates a severe depression). These adolescents were redirected to other professionals. Also, adolescents with an absenteeism rate of 50 percent or more during the treatment were excluded of analyses. Figure 4.1 displays the different steps of participants' selection. After recruiting 56 potential adolescents, 22 participants remained in both groups at post-test (N = 44). Adolescents had at least one behavior disorder: ADHD (n = 24, 54%), ODD (n = 30, 68%) or CD (n = 6, 13%). There was comorbidity between ADHD and ODD (n = 13, 29%) and ADHD and CD (n = 2, 5%). In addition, 59.1% of the total sample presented at least a mild depression according to the questionnaire of depression (MDI-C). The study was approved by the ethic committee of the authors' university. Written informed consent was provided by the parents and the adolescents, all accepted to participate.

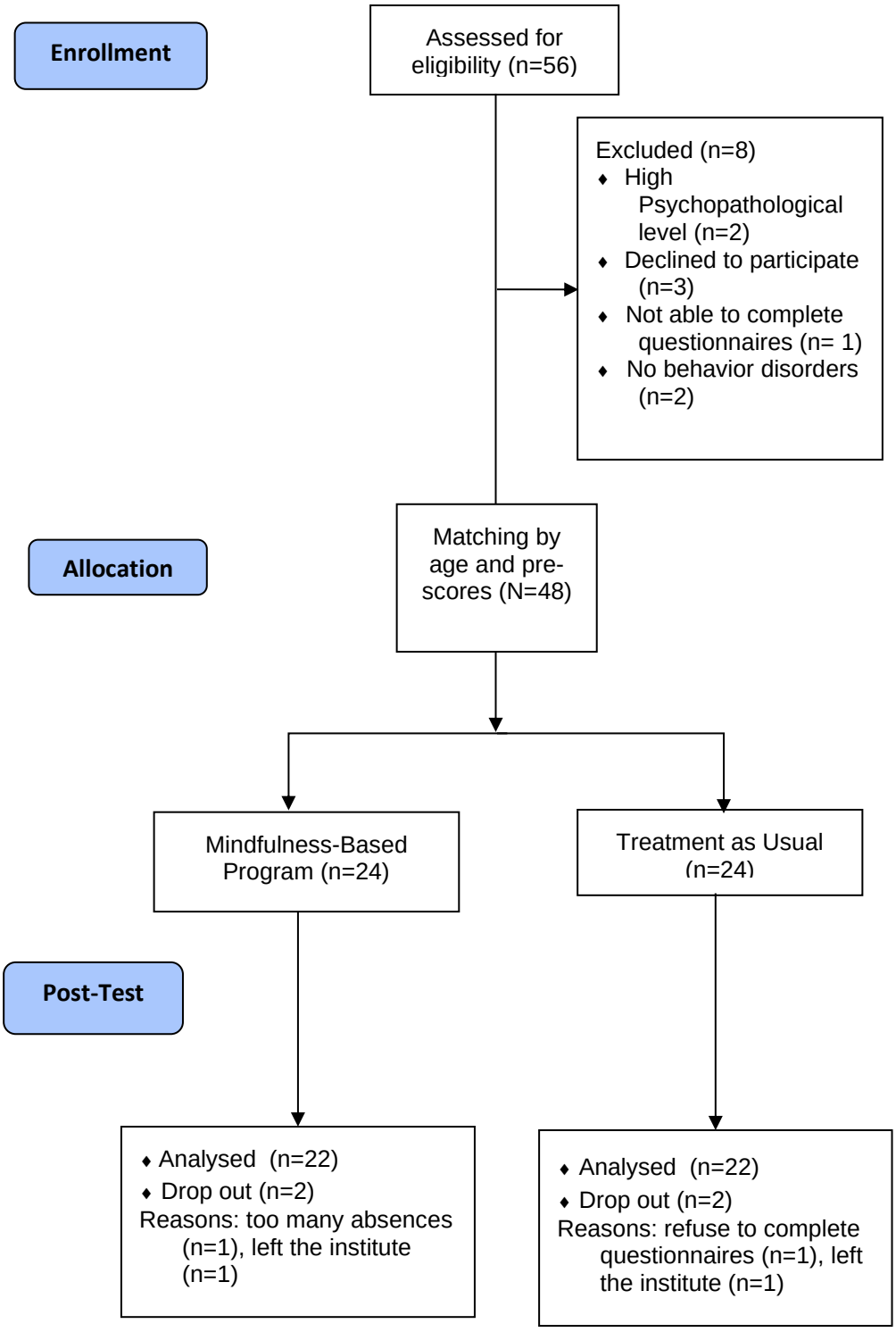

Figure 4.1. Participant flow chart.

2.2 Procedure

To introduce the intervention, the adolescents received a brief presentation of the program with a particular focus on emotion management. Two groups were constituted: a treatment group and a waitlist control group. Adolescents were randomly allocated to the experimental and control groups. Nevertheless, due to the organizational constraints of the institution, five adolescents could not be randomly allocated to groups, three were assigned to the experimental group and two were assigned to the control group based on their schedule constraints. The waitlist control group received the usual treatment of the institution while the experimental group additionally received the MBP. Of note, all participants were enrolled in some other treatments that were part of the usual treatment delivered by the institution. These "treatment as usual" consisted in psychotherapy, psychomotricity, and speech therapy, and did not exceed three hours per week for each participant. There were no precise data specifying the exact amount of each usual treatment followed by each participant.

The experimental group was subdivided in four subgroups of five and one subgroup of four adolescents of the same age (+/- one year). Indeed, as suggested by Lagor et al. (2013), homogeneity in age for a group is more important than homogeneity in gender or diagnosis.

There were three times of assessment during which the adolescents individually completed the MDI-C and the UPPS-P. A psychologist remained at their disposal to answer their questions. Nine participants received assistance from the evaluators (i.e., a psychologist and students in psychology) to read the questionnaires. The same educators completed the SNAP-IV and the CBCL for both groups. They were indirectly aware of the conditions because they knew that some adolescents were absent at times because of the research program. After a preliminary interview, the measures for both groups were collected before the intervention (Pre-test, T1), after the intervention based on emotion psycho-education and group dynamics (Mid-intervention test, T2) and after the MBP (Post-test, T3). The Pre-test was performed in October 2015, the Interim in January 2016 and the Post-test in May 2016.

To assess the acceptability of the program, we conducted a semi-structured interview nine months after the end of the MBP and asked participants if they appreciated the intervention, if they found it difficult and, finally, if they continue to practice mindfulness.

2.3 Intervention

As adolescents with externalized disorders might experience difficulties to participate in a group and to directly practice meditation, the MBP was preceded by six group sessions devoted to emotional competencies and group dynamic. The next 10 sessions focused on

mindfulness training per se and constituted the MBP. Each weekly session lasted 50 minutes. Table 4.1 shows the details of the program. It was inspired by two others programs for adolescents: the adolescent mindfulness-based intervention for enhancing emotional regulation (Deplus et al., 2016; Deplus & Lahaye, 2015) and the Taming the Adolescent Mind program (TAM program, Tan & Martin, 2013). More specifically, our program followed the session themes proposed by Deplus and Lahaye (2015) such as exploring body sensations, non-judgment, or thoughts observation, but also included exercises from the TAM program such as discussion of examples of difficulties experienced in the week, of how application of mindfulness may be utilized in these instances. The combination of the two interventions allows a more complete program than the only five sessions proposed by Tan and Martin (2013) and more adolescent-tailored activities than the program of Deplus and Lahaye (2015), which focuses on children.

Two professionals, one psychologist trained to MBCT and a psycho-motor therapist working in the institute and trained to MBP for adolescents, animated groups of five adolescents. Each point of the day's session was discussed before and after each session. The psycho-motor therapist ensured that the time dedicated to the activities was respected.

Table 4.1. Details of the mindfulness-based program (sessions' topic and exercises)

	Theme	Main objectives	Main exercises
Part 1: Emotion Psychoeducation			
Session 1	Presentation and introduction	Introduction to group rules Get to know each other Explain objectives of the program	Photolanguage
Session 2	Stay aware	Develop sensation awareness Stay attentive during the interaction with others	The Thief's game (a game developing noise awareness)
Session 3	Introduction to emotions	To learn what is an emotion and how it works	The walk of emotions
Session 4	Calm the mind	To stay calm and relax	Relaxation exercises
Session 5	Concentration and relaxation	To develop concentration To stay calm and relax	Mikado game
Session 6	Introduction to body awareness	Exploring the Five Senses/Understand the link between body reaction and emotions	Five senses game

Part 2: Mindfulness-based program

	Theme	Main objectives	Main exercises
Session 1	Mindfulness and automatic pilot	To train awareness in daily life	Raisin exercise
Session 2	Mindfulness and body awareness (1)	To enhance the body awareness	Mirror game
Session 3	Mindfulness and body awareness (2)	To enhance the body awareness	Body scan
Session 4	Mindfulness and focused attention	To develop focused and opened attention	Meditation of sounds
Session 5	Mindfulness and non-judgement (1)	To be able to recognize judgements	Is it a fact or a judgment?
Session 6	Mindfulness and non-judgement (2)	To be able to disengage from judgements	Mindful walk
Session 7	Mindfulness and thoughts (1)	To identify the thoughts in the mind and their relationship with emotions	Film extracts (Inside-out, Peaceful Warrior)
Session 8	Mindfulness and thoughts (2)	Develop the capacity to accommodate thoughts and emotions	Thoughts meditation
Session 9	Mindfulness and acceptation	Accept things that are not under our control	Let it go meditation
Session 10	That's only the beginning	State what they have learned and what it is important to remember	Review of the program

2.4 Measures

2.4.1 Swanson, Nolan, and Pelham-IV (SNAP-IV)

The SNAP-IV measures ADHD based on the criterion symptoms of the DSM-5 (Swanson, 1995). The 26 items-version (MTA-version) developed by Swanson et al. (2001)

were rated on a four point Likert scale ranging from 0 (not at all) to 3 (very much). This instrument includes three subscales: Inattention (α = .92), Hyperactivity (α = .90) and Oppositional behaviors (α = .86) and presents satisfactory reliability (α = .94). It was completed by educators in this French version (Caci, 2008). All Cronbach alphas reported here and in the following parts refer to this study.

2.4.2 Child Behavior Checklist (CBCL)

The CBCL version for ages 4 to 18 years was proposed by Achenbach (1991) to assess child and adolescent problems. It is one of the most widely used questionnaire to capture behavior problems among young people. Both internalizing (α = .80) and externalizing (α = .92) behavior subscales were used in this study. Overall, externalizing symptoms subscale refers to behaviors such as cruelty, bullying, meanness to others, breaking the rules or using substance while internalizing symptoms subscale refers to emotional difficulties such as crying, having fears or nightmares, being unhappy, or having worries. The French version of the CBCL was reported as a reliable measure (Fombonne, 1989) and shows a good reliability (α = .93). The questionnaire was completed by educators in charge of the adolescent boys.

2.4.3 Multiscore depression inventory for children (MDI-C)

The MDI-C was developed by Berndt and Kaiser (1996) to assess depressive symptoms in children and adolescents (the French version of Berndt & Kaiser, 1999, was used). This questionnaire was created to capture global depression as well as eight facets of the depressive symptomatology (i.e., Anxiety, Self-esteem, Sad mood, Instrumental helplessness, Social introversion, Low energy, Pessimism and Defiance) thanks to 79 true-false items. Internal consistency was high for the total score (α= .94). Its strengths lie in its short duration of completion and its easy understanding due to short sentences and a two-option response format.

2.4.4 Impulsive Behavior Scale (UPPS-P)

The UPPS impulsivity scale was originally created by Whiteside and Lynam (2001) in order to assess impulsive behavior. This 45-item version includes four factors: Lack of Premeditation (e.g., “I usually think carefully before doing anything”), Lack of Perseverance (e.g., “I finish what I start), Urgency (e.g., “When I am upset I often act without thinking”) and Sensation Seeking (e.g., “I quite enjoy taking risks). This study used the short, 20-item French version of the UPPS-P (Billieux et al., 2012) adapted for youth (Catale et al., 2014). The answers are self-reported and scored on a four point Likert scale ranging from 1 (strongly agree) to 4 (strongly disagree). Overall, the psychometric features in the current study were questionable for all dimensions: global Cronbach alpha = .60, Urgency (α=.69), Lack of Premeditation (α=.56), Lack of Perseverance (α=.64), Sensation Seeking (α=.50).

2.4.5 Data analyses

Correlations were performed between CBCL externalizing symptoms and inattention, hyperactivity and oppositional behaviors subscales of the SNAP-IV (respectively: $r(44) = .53$, $r(44) = .45$, $r(44) = .73$, $p < .01$). These correlations are globally consistent, demonstrating the reliability of the educators' rating. However, when looking at the correlation between the MDI-C (self-reported questionnaire) and the internalizing symptoms subscale of the CBCL (educators-reported questionnaire), the correlation coefficient was only equal to .12 ($p = .44$). This result could indicate a gap between the perception of the adolescents and the one of their educators about emotional difficulties.

In order to proceed to paired comparisons, each participant of the experimental group was matched with a participant of the control group based on similar global pre-scores of the MDI-C, the UPPS-P, the SNAP-IV and the CBCL questionnaires. The score difference for each questionnaire had to not exceed one standard deviation. These pairs constituted a repeated factor in subsequent analyses and improve the statistical power.

To test the MBP efficacy, MANOVAs were performed for each questionnaire. Questionnaire dimensions were considered as a multivariate factor while Time (T1, T2, T3), and Pair (Group variable) as within-subject factors. When the Time*Pair*Dimensions effect was not significant, we did not examine the dimensions of the questionnaire. We also explored the specific effects of the two parts of the program: the psycho-education part (T1 vs T2) and the MBP part (T2 vs T3). In order to do that, we used the Reliable Change Index (RCI) proposed by Jacobson and Truax (1991). This index is a reliable tool to assess clinical change with greater accuracy than a simple score difference. After calculating the RCI for each variable between T1 and T2 and between T2 and T3, we compared them with a paired t-test and we reported the number of individuals with a significant improvement ($RCI \geq 1.96$) and a significant deterioration ($RCI \leq -1.96$).

Finally, the potential mediating role of impulsivity on outcomes was investigated using the PROCESS modeling tool (Hayes, 2012, 2013). This statistical approach has the advantage of using bootstrap and does not require evidence of a total effect prior to the estimation of direct and indirect effects. However, we only performed the mediation when the group variable (IV) was significantly correlated to the facet.

3. Results

3.1 Descriptive analyses

On the 48 participants selected, 22 remained at post-test in each group ($N = 44$). Reasons of drop out were: (1) refusal to complete questionnaires ($n = 1$), (2) having left the institution

(n = 2), and (3) more than 50% of session missed (n = 1). There was no difference at baseline between the adolescents who did drop out and those who did not (ps > .44) nor between the control and experimental group on all scales and subscales (all ps > .21). Means and standard deviations for the four questionnaires can be seen in the Table 4.2.

3.2 Behavioral problems and ADHD

At time 1, the scores of the SNAP-IV ranged from 2 to 52 in the control group (M = 24.23, SD = 13.79) whereas they ranged from 8 to 63 in the mindfulness group (M = 27.45, SD = 15.13). No main effect of Time nor interaction were found for the total score of the SNAP-IV (Table 4.3). Consistent with these results, no differences on the RCI were found between groups during the psychoeducation part of the program (T1 vs T2) or during the mindfulness part (T2 vs T3; see Table 4.4).

For the internalizing symptoms subscale of the CBCL at time 1, the scores ranged from 1 to 24 in the control group (M = 10.54, SD = 5.77) and ranged from 1 to 25 in the mindfulness group (M = 11.13, SD = 7.19). For the externalizing symptoms subscale at time 1, the scores ranged from 3 to 42 in the control group (M = 16.72, SD = 9.55) whereas they ranged from 5 to 52 in the mindfulness group (M = 18.09, SD = 12.07). No significant effect was found for the internalizing symptoms subscale (Table 4.3). However, a significant interaction Time*Pair was observed for the externalizing symptoms subscale, $F(2,42) = 5.39$, $p = .008$. When looking at the RCI for the different parts of the program, we can observe a significant difference between the group after the MBP, $t(21) = -2.93$, $p = .008$ (Table 4.4). Consistent with hypotheses, this result indicates an improvement of behavioral problems for the experimental group compared to the control group after the MBP. However, considering the negative RCI in the control group (RCI = -.57) and the low RCI in the experimental group (RCI = .17), this significant difference could be the consequence of a protective effect of the MBP against a natural deterioration rather than its positive effect on externalizing symptoms.

Table 4.2 (part 1). Descriptive statistics of MDI-C, UPPS-P, CBCL and SNAP-IV: mean (standard deviation).

	Control group (n=22)			Experimental group (n=22)		
	T1	T2	T3	T1	T2	T3
SNAP-IV	24.23 (13.79)	24 (13.39)	28.77 (14.62)	27.45 (15.13)	22.73 (10.70)	24.95 (13.88)
Inattention	10.14 (6.16)	10.77 (6.42)	11.86 (6.09)	11.41 (6.39)	9.5 (5.82)	11.23 (6.42)
Hyperactivity	8.23 (5.92)	6.55 (5.03)	9.5 (6.34)	8.77 (6.44)	7.23 (4.56)	8.14 (5.08)
Oppositional Behaviors	5.86 (4.27)	6.68 (5.39)	7.41 (5.24)	7.27 (5.39)	6 (3.85)	5.59 (4.27)
Impulsivity	52.77 (6.36)	51.32 (8.05)	51.32 (7.97)	50.13 (7.42)	49.91 (8.13)	46.36 (8.82)
Negative Urgency	12.27 (2.94)	12.23 (2.75)	11.86 (3.49)	11.68 (2.67)	11.68 (3.03)	10.95 (3.06)
Positive Urgency	11.13 (3.05)	10.82 (2.83)	11 (3.32)	10.95 (2.53)	11.23 (3.2)	9.45 (3.26)
Lack of Premeditation	9.18 (2.46)	9 (2.54)	8 (2.46)	8.63 (2.42)	7.82 (1.81)	7.77 (1.87)
Lack of Perseverance	7.27 (2.43)	6.86 (2.19)	6.41 (2.78)	6.54 (2.26)	7.23 (2.39)	6.36 (1.84)
Sensation Seeking	12.90 (2.17)	12.41 (2.49)	14.05 (2.55)	12.31 (2.17)	11.95 (2.49)	11.82 (2.51)

Table 4.2 (part 2). Descriptive statistics of MDI-C, UPPS-P, CBCL and SNAP-IV: mean (standard deviation)

		Control group (n=22)			Experimental group (n=22)		
		T1	T2	T3	T1	T2	T3
CBCL							
	Internalizing symptoms	10.54 (5.77)	9.22 (5.33)	9.68 (5.52)	11.13 (7.19)	11.31 (6.86)	9.04 (6.09)
	Externalizing symptoms	16.72 (9.55)	16.13 (10.68)	20.5 (11.02)	18.09 (12.07)	17.81 (10.93)	16.5 (10.53)
Depressive symptomatology		57.59 (10.17)	54.91 (11.16)	52.86 (11.28)	56.54 (9.8)	55.32 (10.15)	51.23 (11.40)
	Anxiety	58.05 (9.59)	53.50 (9.50)	52.77 (10)	57.82 (9.26)	56.41 (10.07)	49.59 (10.47)
	Self-Esteem	56.05 (8.88)	52.23 (9.18)	51.50 (9.65)	54.91 (7.04)	54.45 (7.81)	53.82 (8.43)
	Sad Mood	54.45 (9.19)	54.68 (9.32)	52.50 (8.09)	51.91 (9.25)	53.64 (8.78)	51.27 (7.75)
	Instrumental Helplessness	54.23 (9.14)	49.95 (11.35)	50.09 (11.3)	53.95 (9.27)	53.73 (9.83)	50.5 (8.95)
	Social Introversion	55.77 (8.01)	53.23 (8.99)	51.45 (7.11)	54.14 (10.39)	54.32 (9.98)	50.32 (8.17)
	Low Energy	58.09 (9.72)	57.77 (12.05)	53.59 (11.36)	58.05 (10.81)	56.36 (13.09)	54.09 (11.76)
	Pessimism	51.95 (7.55)	54.05 (9.66)	52.86 (9.16)	53.59 (8.12)	52.23 (8.06)	49.18 (9.79)
	Defiance	56.41 (12.39)	54.27 (12.57)	53.23 (11.83)	52.68 (9.55)	(10.27)	51.82 (10.50)

3.3 Depressive symptomatology

At time 1, MDI-C scores ranged from 38 to 76 in the control group (M = 57.59, SD = 10.17) whereas they ranged from 39 to 74 in the mindfulness group (M = 56.54, SD = 9.8). The MANOVA revealed a main effect of Time, indicating an improvement of depressive symptomatology over time in the two groups, $F(2,42) = 8.13$, $p = .001$, but there was no interaction with Pair nor with Pair and Dimension (see Table 4.3). Consistently, we found no differences on the RCI between groups during the psychoeducation part of the program (T1 vs T2) or during the mindfulness part (T2 vs T3; see Table 4.4).

3.4 Impulsivity symptoms

At time 1, the scores on the UPPS-P ranged from 41 to 67 in the control group (M = 52.77, SD = 6.36) and ranged from 33 to 67 in the mindfulness group (M = 50.13, SD = 7.42). The MANOVA conducted on impulsivity score revealed no significant change (Table 4.3). However, the results of the RCI demonstrated a trend of improvement for the mindfulness group compared to the control group, $t(21) = -2.03$, $p = .055$ (Table 4.4).

3.5 Mediating role of impulsivity

Prior to test all the four subscales of impulsivity, we checked the correlation of the facets (the RCI score between T2 and T3) with the group variable (Control vs MBP). Two facets were correlated to the group variable: the Urgency facet (r = .32) and the Sensation Seeking facet (r = .35). Therefore, we only tested the mediation with these two variables. We used the externalizing symptoms as the outcome given that it is the only variable that showed a significant improvement. In order to perform the analyses, we used the free PROCESS macro of Hayes (2013) in SPSS 21 with the following script:

```
Process vars=x  y
med/y=y/x=x/m=med/total=1/normal=1/boot=10000/percent=1/model=4.
```

Where “x”, the independent variable, is the group variable (i.e., MBP or control group), “y”, the dependent variable, is the outcome variable (i.e., the RCI calculated with the externalizing symptoms scores at T2 and T3) and “med”, the mediator, is the two facets of impulsivity (i.e., RCI of Urgency and Sensation Seeking).

The code generates a bootstrap confidence interval for the indirect effect using 10,000 bootstrap samples with a 95% confidence level. The Sobel tests indicated no mediating effect

of the Urgency (β = .03, CI = [-.21; .24], p = .80) or the Sensation Seeking (β = -.16, CI = [-.38; .05], p = .22) on the association between MBP and externalizing symptoms.

Table 4.3. Results of the MANOVA for all variables

	F	*p*
SNAP-IV		
Time	1.58	.21
Time*Pair	1.87	.16
Time*Pair* Dimensions	1.2	.31
Internalizing symptomatology		
Time	1.12	.32
Time* Pair	1.18	.31
Pair	.41	.52
Externalizing symptomatology		
Time	.73	.48
Time* Pair	5.39**	.008
Pair	.01	.90
Depressive symptomatology		
Time	8.13**	.001
Time*Pair	.59	.54
Time*Pair* Dimensions	1.48	.11
Impulsivity		
Time	3.06	.057
Time*Pair	1.67	.20
Time*Pair* Dimensions	1.35	.22

Table 4.4. Clinical improvement and clinical deterioration in each group based on the Reliable Change Index

	T1 vs T2				T2 vs T3			
	RCI mean (*SD*)	Clinical improvement /Clinical deterioration (*n*)	Student *t*	*p*	RCI mean (*SD*)	Clinical Improvement/ Clinical deterioration (*n*)	Student *t*	*p*
SNAP-IV								
CG	.02 (1.07)	2/0	1.22	.23	-.18 (.80)	0/3	.77	.44
MG	.42 (.77)	1/0			-.39 (1.36)	0/1		
Internalizing symptomatology								
CG	.21 (1.06)	1/1	.79	.43	.06 (1.02)	0/1	1.29	.21
MG	-.02 (.89)	0/0			.34 (.88)	1/0		
Externalizing symptomatology								
CG	.08 (1.04)	1/1	.16	.87	-.57 (1.18)	1/2	-2.93**	.008
MG	.04 (.88)	1/1			.17 (.64)	0/0		
Depressive symptomatology								
CG	.36 (.99)	1/0	.76	.45	.30 (.96)	2/1	1.09	.28
MG	.16 (.85)	0/0			.61 (1.1)	4/0		
Impulsivity								
CG	.21 (1.25)	2/0	.58	.56	0 (1.21)	2/2	-2.03	.055
MG	.03 (.86)	1/0			.62 (.82)	1/0		

Note. *RCI* = Reliable Change Index; Clinical improvement is the number of participants who reach a score equal or superior to 1.96 at the RCI and Clinical deterioration is the number of participants who reach a score equal or inferior to -1.96; *CG* = Control group; *MG* = Mindfulness group.

3.6 Acceptability of the program

Fifteen of the twenty-two participants who followed the MBP were successfully contacted and interviewed nine months after the end of the program. At the question: “In your memories, was it easy to do the mindfulness exercises? Can you give me a score from 0 to 10? (knowing that 10 means very easy and that 0 means very difficult)”, the 15 participants gave a mean of 7.76. At the question “Did you enjoy participating in the mindfulness program? Can you give me a score from 0 to 10? (knowing that 10 means you really enjoyed participating and that 0 means you did not enjoy at all participating)”, the participants gave a mean of 8.53. Finally, nine participants stated that they continued to practice mindfulness. However, four participants mentioned in the interview that the activities were not appropriate to their age (two because the explanations were too complicated and two others because the activities were too childish). In addition, four participants indicated that they had difficulty remembering the content of the intervention.

4. Discussion

Some evidence supports that MBPs reduce anxiety and depressive symptomatology in young populations (Zack et al., 2014). In particular, adolescents with behavior disorders might benefit from this kind of intervention, as it focuses on attention, emotions regulation, and impulsivity. However, research on MBPs efficacy among this population focuses almost exclusively on ADHD and presents some limitations such as a lack of well-designed studies (absence of a control group) and a lack of well-established diagnoses (Lee et al., 2017). Several aspects of the present study aimed to address these issues.

According to the results obtained by the RCIs, the externalizing symptoms, evaluated by the educators, remained stable between T2 and T3 for the mindfulness group while they increased in the control group. These findings suggest that educators perceived adolescents who practiced mindfulness as youth with less inappropriate behaviors. This partly confirms the conclusions of studies that have observed similar results without using a control group. Indeed, in a population of adolescents suffering from externalizing disorders who followed a MBP, Bögels et al. (2008) found a trend improvement of the CBCL externalizing behavior score, rated by the parents, two weeks after the end of the program. Similar observations have been reported in small groups of children and adolescents with ADHD who improved their externalizing symptoms after a MBP (Haydicky et al., 2012, 2015; Van de Weijer-Bergsma et al., 2012; Zhang et al., 2017).

However, in the present data, the improvement in externalizing symptomatology was not evidenced by the SNAP-IV. The SNAP-IV focuses on the features of the ADHD diagnosis: inattention, hyperactivity, and oppositional behaviors (Swanson et al., 2012) while the externalizing subscale of the CBCL take into account ODD symptoms (which are, in fact,

partly assessed by the oppositional behavior subscale of the SNAP-IV) plus physical aggressiveness plus CD symptoms. This is probably why the correlation between oppositional behaviors subscale and externalizing symptoms was so high ($r = .73$, $p < .01$). Consistently, when looking at the oppositional behaviors subscale of the SNAP-IV (see Table 2), we notice the same pattern of evolution as the externalizing symptoms subscale of the CBCL (i.e., a decrease in the means for the experimental group and an increase for the control group between T2 and T3). Overall, adolescents may have less problems of behavior related to aggressiveness but continue to be hyperactive and inattentive. Yet, some studies suggest an impact of a MBP on ADHD symptoms (e.g., Van der Oord et al., 2012), indicating that more research is needed to precise the effect of mindfulness training on behavior disorders.

Despite the improvement on externalizing symptoms subscale, no changes were observed for the internalizing symptoms subscale. Congruently, several studies failed to observe a significant decrease in internalizing symptoms when assessed by parents or educators (Bögels et al., 2008; Haydicky et al., 2015; Van de Weijer-Bergsma et al., 2012). However, when the internalizing symptomatology was reported by the adolescents, most studies found a decrease in these symptoms. Similar findings were found in our study: the scores of the self-reported questionnaire on depressive symptomatology tended to decrease while no changes were observed for the internalizing subscale completed by the educators. In the same way, the coefficient of correlation between these two questionnaires was surprisingly low and not significant. Educators and parents might experience difficulties in identifying precisely internalizing symptoms contrary to externalizing symptoms. In addition, educators were aware of the group allocation. Their positive expectations could therefore limit the interpretation of the present results.

The results related to depressive symptomatology showed an improvement in both groups. In contrast, Biegel et al. (2009) observed in adolescent psychiatric outpatients a more pronounced decrease in the mindfulness group as compared to the control group. In the present study, the MBP did not bring better benefits on depressive symptomatology than the usual treatment alone, but, interestingly, both groups fell below the clinical threshold of the MDI-C at T3 (< 56; Berndt & Kaiser, 1999). The overall decrease in depressive symptomatology may be explained by the spontaneous positive evolution of a major part of male adolescents (Dekker et al., 2007) and by the many interventions (psychotherapy, psychomotricity, and speech therapy) routinely provided by the institution as usual care. Considering the intensity of this institutional treatment, MBP could hardly provide additional benefits.

If some improvements in behavior were observed, it seems important to identify the processes that underlie these changes. It was postulated that impulsivity was a central factor in obtaining benefits by providing a space for reflection and a better understanding of inner state before acting. Results showed that impulsivity score tends to decrease between T2 and T3 only for the experimental group. This finding may demonstrate the positive effect of the

MBP on inhibition, which is in line with the results obtained by Deplus et al. (2016) in a clinical population of adolescents. Concerning the facets of impulsivity, previous studies have documented that the reduction of urgency predicts a decrease in illegal drug use, alcohol consumption, risky sexual behavior or gambling problems (Cyders et al., 2010; Zapolski et al., 2009). However, no mediating effect was observed for the two facets of impulsivity (Urgency and Sensation Seeking) which were correlated to the group variable. It is possible that impulsivity only plays a minor role as a process of the MBP. Moreover, other processes not evaluated in this study may be involved. For instance, the study of Van der Gucht et al. (2018) showed that cognitive reactivity (i.e., the propensity to have negative thoughts in sad mood), and self-coldness (i.e., the lack of self-compassion), mediated the improvement obtained by the mindfulness intervention on the symptoms of depression, anxiety and stress.

Finally, the qualitative results indicated a good acceptability of the program. The high scores obtained for the question concerning the facility (M = 7.76) and the question concerning the appreciation of the program (M = 8.53) showed that the implementation of a MBP in this population is possible and well received. Also, by considering the participants feedbacks, it seems that the cognitive development differences observed among the adolescents (not only related to their age) should be taken into account. In this way, instructors should be careful about the use of metaphors, vocabulary, or games, and adapt their teaching to their audience. As regard the maintaining of the practice, more than half of the participants contacted nine months after the end of the program continue to practice. However, the 15 participants interviewed were still in the institution, which encouraged them to continue practicing. It is therefore difficult to know if they would have continued practicing without the institutional support.

5. Limitations and Future Research

Serval limitations of this study must be mentioned. Firstly, the conclusions drawn from the results must be considered carefully according to the limited sample size, the focus on adolescent boys and the partial randomization of the participants. Secondly, the control group was inactive, although the institution already provided intensive care to all participants. Still, future studies with active control group, such as education to health program, and full randomization are needed to specifically identify the benefits of the intervention. Thirdly, the use of self-reported questionnaires in a population with low cognitive resources may affect the sensitivity of the measures. The consideration of IQ would have been a plus. In the same way, the low psychometric quality of UPPS-P questionnaire limits the scope of conclusions. Thus, observations in behavioral tasks or experimental situations might lead to a more reliable assessment. Finally, the absence of a follow-up based on quantitative data did not allow to identify the potential long-term effects of the intervention.

Regarding future prospects, it could be useful to involve the parents into the program. Numerus studies conducted in ADHD populations that demonstrated a positive effect of the MBP, targeted youth and their parents (Cassone, 2015; Haydicky et al., 2015; Lo et al., 2017). Particularly, the involvement of the parents could improve the children motivation to keep mindfulness practice. In the same way, future research should address the role of practice time in daily life among this population and the program aspects that improve their involvement. Also, little is known about the benefits differences that can be observed among the several behavior disorders diagnoses. Maybe MBPs are more suitable for ADHD than for ODD and CD. For now, it is not yet possible to draw definitive conclusions. To our knowledge, no studies have examined the need to prepare youth with behavior disorders to mindfulness practice (such as psychoeducation to emotions in our study), which is quite surprising considering the characteristics of the population (who has difficulty sitting quietly for example) and our clinical experience. Still, previous studies did not mention the necessity of a preparation prior to the MBP. Beyond the effect on outcomes, processes that are implied in the efficacy of MBPs among adolescents are still unknown. For instance, mindfulness can bring a better emotional awareness of emotions or unwanted behaviors. Hence, studies should further the investigation of some psychological processes such as emotion regulation, awareness or psychological inflexibility (Chambers et al., 2015; Fung et al., 2019). Overall, MBPs may appear as relevant interventions to help adolescents with behavior disorders.

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Chapter 5

A Mindfulness-Based Intervention for Adolescents With Behavior Disorders: A Randomized Controlled Trial

Abstract: Mindfulness-based interventions (MBIs) are widely used in adults and children to treat anxiety and depressive symptomatology. However, only few studies with a rigorous design have been conducted among adolescents with behaviors disorders even though this population suffers from symptoms that can be addressed by MBIs such as inattention and hyperactivity. The present study investigated the effect of a MBI on internalizing and externalizing symptoms in a sample of 129 adolescents with behavior disorders living in a residential service for youth. Participants were randomly allocated to one of three treatment conditions: a treatment as usual condition, a health psychoeducation condition, and a MBI condition. The three groups were compared over a period of three assessment points plus a one-year follow-up on self-report questionnaires, questionnaires rated by adolescents' educators, and behavioral tasks. To test the MBI efficacy, multilevel analyses were performed, controlling for gender and medication. Results indicate that all groups improved on most measures, likely due to the intensive institutional care provided by default. The MBI significantly improved attentional capacities, but had no significant differential impact on depressive symptomatology, mindfulness, impulsivity, hyperactivity or oppositional behaviors in comparison to the other conditions. The absence of significant findings concerning externalizing and internalizing symptomatology is unexpected and may require an investigation of moderating factors. However, MBIs may help adolescents with behavior disorders at the attentional level. Further research is needed to specifically determine the potential benefits of mindfulness on externalizing and internalizing symptoms in this population.

Reference: Roux, B., Pérez-Peña, M., & Philippot, P. (*under review*). A Mindfulness-Based Intervention for Adolescents With Behavior Disorders: A Randomized Controlled Trial. *Mindfulness*.

A Mindfulness-Based Intervention for Adolescents With Behavior Disorders: A Randomized Controlled Trial

1. Introduction

Adolescents who suffer from a behavior disorder (i.e., Attention Deficit Hyperactivity Disorder [ADHD], Intermittent Explosive Disorder [IED], Oppositional Defiant Disorder [ODD] or Conduct Disorder [CD]) experience many psychological difficulties compared to other adolescents. For example, children with ADHD present emotional difficulties such as a low emotional threshold, loss of control in the face of intense emotions, and slow return to baseline (Bunford et al. 2018). Behavior disorders are characterized by externalizing symptoms that can be divided into three core symptom clusters: (1) inattention (e.g., difficulty sustaining attention), (2) hyperactivity (e.g., inability to wait quietly), and (3) oppositional behaviors (e.g., aggressiveness). Although there are overlaps between these clusters, the first two are very specific to the ADHD diagnosis while oppositional behaviors are more specific to the diagnoses included in the disruptive disorder category such as IED, ODD and CD.

As reflected by network analyses, inattention during adolescence is mainly characterized by distraction and forgetfulness (Martel et al. 2017). These difficulties are very common among adolescents with behavior disorders and constitute a constraining impairment of cognitive functioning. Overall, a higher level of inattention is a significant predictor of depression, academic impairment, social impairment, oppositional behaviors and hyperactivity (Servera et al. 2016). It even impacts the ability to recognize facial affect (Sinzig et al. 2008). More importantly, self-reported inattention in pre-adolescence predicts a poorer quality of peer relationships in middle adolescence even after controlling for depression and peer relationship quality at baseline (Connors et al. 2012). Individuals who have the ability to sustain their attention can consider their experience in more detail than those who present distractibility. In the same way, selective attention can lead to a better control of the environment thanks to an improvement in the ability to choose stimuli of interest. Thus, inattention appears as a central symptom in the development of behavior disorders and must be taken into consideration in therapeutic care.

Hyperactivity also plays a fundamental role in behavior disorders. It refers to excessive motor activity and includes a series of symptoms such as overactivity, fidgeting, inability to stay seated, intruding into other people's activities, or inability to wait (American Psychiatric Association, 2013). At a theoretical level, hyperactivity can be separated from impulsivity (Martel et al. 2017). Indeed, impulsivity refers to a hasty attitude and reaction occurring in

the moment without forethought, which may potentially harm the individual. This lack of inhibition occurs not only at the behavioral level but also at the emotional and cognitive levels (e.g., being aggressive in the face of a deception). From this perspective, impulsivity is considered as a psychological process that underlies hyperactivity, as well as other core symptom clusters such as inattention and oppositional behaviors (Billieux 2012). For example, the impulsivity of children facing external distractions in a classroom might push them to leave their seats. This latter behavior can be as a symptom of hyperactivity but impulsivity is the psychological process causing this observable behavior (hyperactivity symptom). Importantly, hyperactivity and impulsivity in early adolescence are associated with future antisocial behavior, major depressive disorder, and alcohol abuse (Giannotta & Rydell 2016; Hamilton et al. 2019; Meinzer et al. 2013). Hence, particular attention should be paid to identifying and treating these symptoms.

The third core symptom cluster, oppositional behaviors, is characterized by irritability (e.g., stubbornness, bad mood, bad temper) and defiance (e.g., argues, disobeys at home, disobeys in school; Ollendick, Booker, Ryan, & Greene 2018). It can also be accompanied by aggressiveness and violent behaviors in their most severe form such as those observed in CD (Evans et al. 2019). Without an adequate care, oppositional behaviors can quickly lead to general dysfunction. More specifically, it has been shown that the irritability dimension could lead to internalizing symptoms, such as depression and anxiety, while defiant behaviors could lead to externalizing symptoms such as antisocial behaviors (Waldman et al. 2018). The same pattern was found for aggressiveness which is a precursor of psychosocial difficulties, delinquency and antisocial behaviors (Van Stralen 2016).

In addition to these three main clusters, it is also important to note that, in the long term, externalizing symptoms lead to internalizing symptoms. Further, the psychological suffering caused by harassment or social exclusion may become as significant as the initial externalizing symptoms (Flouri et al. 2019).

In this context, psychological interventions for children who suffer from behavior disorders should target these three symptom clusters and, to a lesser extent, internalizing symptoms such as anxiety and depression. Because of the large number of specificities inherent in the interventions conducted in the field (e.g., peer interventions, cognitive training, neurofeedback training), it is difficult to isolate the therapeutic processes that affect these symptoms. In addition, few studies use a high-quality design, such as a Randomized Controlled Trial (RCT), to test the effects of their intervention.

Currently, research suggests that behavioral therapies remain the most effective treatment for behavior disorders (Evans, Owens, Wymbs, & Ray 2018). In particular, interventions that involve parents have received considerable evidence in the treatment of externalizing symptoms (Epstein et al. 2015; Evans et al. 2018). However, the therapeutic benefits of these interventions are less important in adolescent populations compared to children populations

(Evans et al. 2018). It is possible that, with age, parenting has less influence on children (Cecil et al. 2012). Moreover, a significant proportion of adolescents with behavior disorders, such as those living in certain institutions (e.g., psychiatric institutions, orphanages, residential services for youths), cannot rely on parental support. Therefore, further investigation is required to evaluate psychological interventions that target inattention, hyperactivity and oppositional behaviors, which are specifically dedicated to adolescents. Considering the aforementioned points, Mindfulness-Based Interventions (MBIs) are likely candidates in the treatment of behavior disorders.

1.1 Mindfulness-Based Interventions

MBIs aim at developing awareness of the present moment through breathing meditations, body scan exercises, and mindful hatha yoga. A large body of research has demonstrated the positive effect of MBIs on mental health in young populations (Dunning et al. 2018; Klingbeil et al. 2017; Maynard et al. 2017; Zoogman et al. 2015). Overall, the results of meta-analyses suggest a small to moderate effect size on general mental health outcomes with consistent effects on mindfulness/attention measures as well as on depression and anxiety.

In light of the positive results found among children with low levels of psychopathology, it can be expected that children and adolescents who suffer from more severe symptoms could benefit from MBIs. Notably, MBIs are potentially promising interventions for treating behavior disorders because they specifically target the psychological processes encountered in these disorders such as impulsivity and emotion dysregulation (Bunford et al. 2015).

A meta-analytic review on eleven studies conducted by Xue, Zhang and Huang (2019) supports this idea. MBIs have a significant impact on inattention (Hedges'g = -0.82) and hyperactivity (Hedges'g = -0.67) among participants with a diagnosis of ADHD in comparison to a control group. The effect is similar for mindfulness (Hedges'g = 0.53). However, these results must be interpreted with caution. First, only 30.79% of the participants were children and the rest were adults. Secondly, there was a high heterogeneity among studies on a number of variables such as participants' age, type of control condition, or study design quality. Thirdly, this meta-analytic review only reports data on individuals with ADHD without covering the full spectrum of behavior disorders that includes ODD, IED or CD.

Three other meta-analyses were conducted among children with ADHD (Cairncross & Miller 2016; Chimiklis et al. 2018; Zhang et al. 2018). Their findings indicate weaker effect sizes of MBIs on inattention and hyperactivity symptoms (small to moderate effect size) than the meta-analysis of Xue et al. (2019). More importantly, Chimiklis et al. (2018) reported a significant moderation effect of the study design quality. The studies using a non-randomized controlled design showed a large, significant effect of the intervention on ADHD symptoms, while studies using an RCT design reported a small or insignificant effect. In addition, very

few RCTs were included in this meta-analysis (only two studies out of eleven) and only two studies included more than 41 participants. Thus, no definitive conclusions can be drawn about MBIs' efficacy among children with ADHD given the high risk of bias across studies (Evans et al. 2018).

1.2 The present study

The present study applied a high-quality design (i.e., an RCT with two control groups) in a sample of adolescents who suffer from behavior disorders. Both gender and medication were controlled for. We hypothesized that the MBI would decrease externalizing and internalizing symptoms and increase attentional capacities and prosocial behaviors compared to active and inactive control groups. Self-report and hetero-reported measures, as well as behavioral tasks were used. In addition, exploratory analyses investigated whether participants' baseline characteristics (e.g., age, gender, externalizing symptomatology, etc.) predict psychological improvement during the treatment phase. Finally, we hypothesized that participants who continued their mindfulness practice at a one-year follow-up would show more benefits than participants who stopped practicing.

2. Method

2.1 Participants

Participants were 141 adolescents recruited from two residential services for youths with behavior disorders (RSY), one for boys and one for girls. The mean age was 14.05 (SD = 1.87), 86 of them were boys (66.7%) and 39 were taking psychotropic medications (30.2%). Both institutions host adolescents who present behavior disorder symptoms that can be accompanied by a mild to moderate intellectual disability. This population is characterized by a low socio-economic status and family difficulties that require institutional care. No formal diagnoses were given by psychiatrists but the Child Behavior Checklist completed by the institutions' educators indicated that 85.27% of the adolescents met the clinical cut-off for externalizing symptoms at baseline (41.08% for internalizing symptoms). The remaining 14.73% of adolescents who did not present the clinical cut-off for externalizing symptoms had higher scores for internalizing symptoms [$t(125) = 2.30$, $p = .023$], and lower scores for impulsivity [$t(125) = 2.51$, $p = .013$] than the adolescents with externalizing symptoms. To explore whether the inclusion of adolescents with low levels of externalizing symptoms introduced a bias to the results, results obtained from both groups were compared. Inclusion criteria included: being 11 to 19 years old, expressing a motivation to participate in the study, and being fluent in French. The only exclusion criterion was the impossibility to attend more than 50% of the sessions. Through access to adolescents' medical records, the number of psychotropic medications used was recorded. The study was approved by the ethical committee of the authors' university. All adolescents and their parents provided informed consent.

2.2 Procedure

After an information session, the researcher conducted individual interviews with the adolescents interested in participating in the research in order to assess whether participants met the inclusion criteria and in order to conduct the baseline assessment. The RSY's allowed the creation of 20 sub-groups over a two-year period (five adolescents with the same gender per group). Three treatment conditions were designed: a treatment as usual condition (TAU), a health psychoeducation condition (HP), and a MBI condition. The initial plan was to have 10 MBI sub-groups and 10 HP sub-groups. The participants for which there were no more open places in these groups were allocated to the TAU control. However, one of the institutions asked to replace one HP group by an MBI group for internal organization reasons. Hence, 11 subgroups were assigned to the MBI condition and 9 subgroups to the HP condition. Among the adolescents motivated to participate (N = 141), 55 were randomly allocated to the MBI condition and 45 to the HP condition. The remaining 41 participants were assigned to the TAU condition. All groups completed four assessment points: one at baseline (T1), a second after the first six sessions (T2), a third at the end of the program (T3) and the last one year after the end of the program (T4). The four assessments consisted of three self-report questionnaires and one attentional task. In addition, two questionnaires rated by the educators were completed at T1, T2, and T3 (institutional constraints did not allow an assessment at T4). During the first year of the experiment, we identified the limited nature of paper-and-pencil questionnaires in terms of validity in this population (e.g., social desirability, comprehension difficulties). Therefore, three behavioral tasks, especially designed for the present study, were added at T2, T3 and T4 starting with the second year of the experiment. Over the two years, 129 participants completed the questionnaires at T3 (91.5%) while 60 of them completed the questionnaires at T4 (46.5%). Figure 5.1 displays the flow of participants throughout the trial.

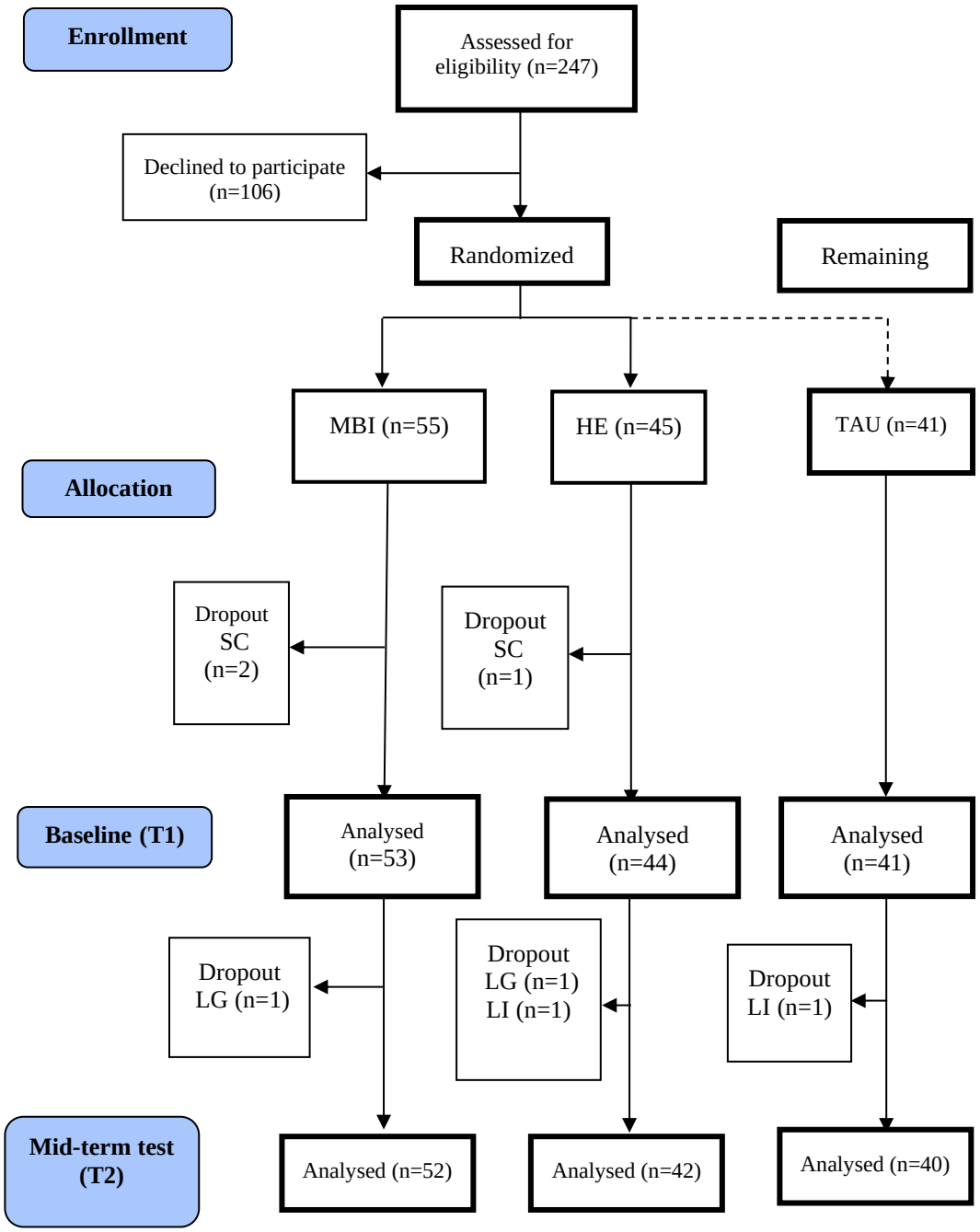

Figure 5.1. Participant flow chart (Part 1)

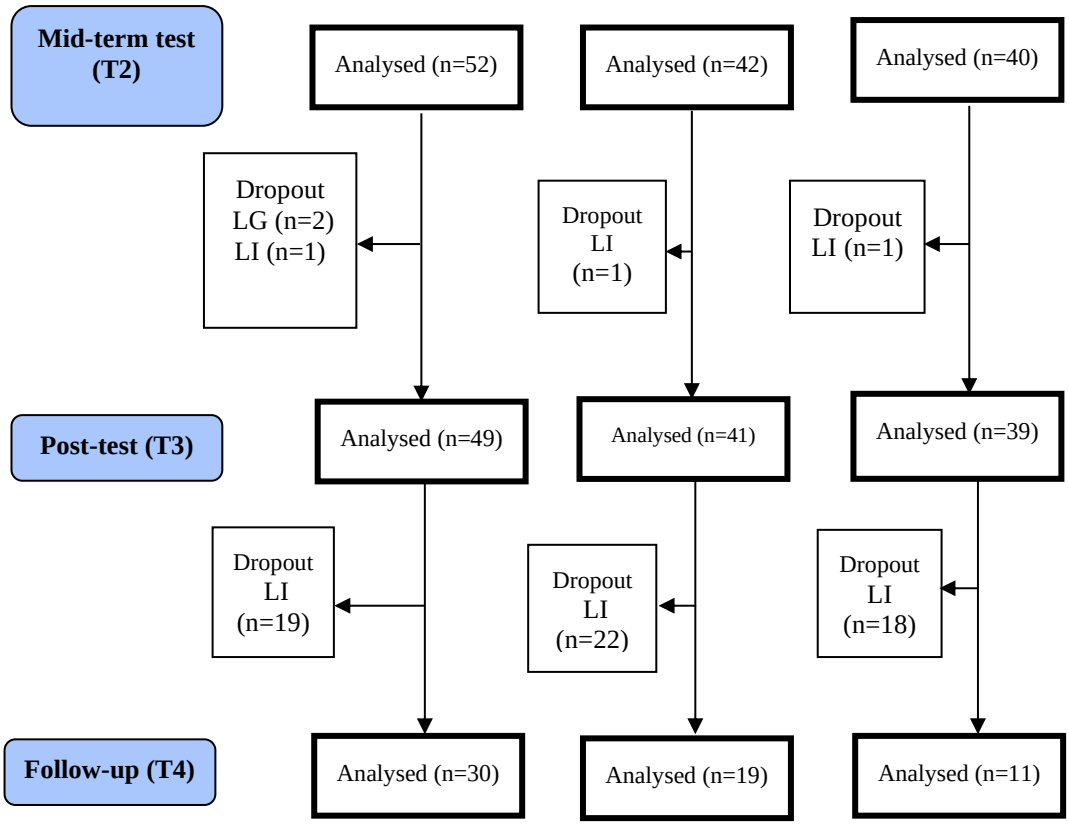

Figure 5.1. Participant flow chart (Part 2)

Note. *SC* = scheduling conflict; *LG* = leaving the group; *LI* = leaving the institution

2.3 Intervention

The TAU condition consisted of the standard care provided by the RSY's (i.e., psychotherapy, psychomotricity, speech therapy, and medication when appropriate). The HP condition consisted of TAU plus 16 50-minute sessions in which health topics related to tobacco, nutrition, sleep, hygiene, alcohol/drugs, stress management, conflict management, and social networks were discussed (two sessions of 50 minutes by topic, one session per week). Finally, the MBI condition consisted of six 50-minute sessions devoted to emotion psychoeducation and 10 50-minute sessions of mindfulness practice. Because externalizing symptoms make it difficult to practice mindfulness (e.g., inability to stay seated), the first

part of the intervention was designed to prepare participants for future formal practice. In addition to the group sessions, participants in the MBI groups were assigned weekly homework (i.e., meditation practice). The MBI program is depicted in Table 4.1 of Chapter 4. It was inspired by two others programs for adolescents: the adolescent mindfulness-based intervention for enhancing emotional regulation (Deplus et al. 2016; Deplus & Lahaye 2015) and the Taming the Adolescent Mind program (TAM program, Tan & Martin 2012). More specifically, our program followed the session themes proposed by Deplus and Lahaye (2015) such as exploring body sensations, non-judgment, or thoughts observation, but also included exercises from the TAM program such as discussion of examples of difficulties experienced in the week and how mindfulness may be utilized in these instances. The combination of the two interventions allows for a more complete program in comparison to the five-session program proposed by Tan and Martin (2012). Furthermore, our combined program contains more adolescent-tailored activities than the program of Deplus and Lahaye (2015), which focuses on children. The sessions were delivered by a certified mindfulness-based cognitive therapy instructor and a psycho-motor therapist who is also a certified mindfulness instructor for adolescents and who works in the institute. Educators and professionals of both institutions helped with the implementation of the group sessions and with questionnaire distribution.

2.4 Measures

2.4.1 Inattention, Hyperactivity and Oppositional behaviors

The Swanson, Nolan, and Pelham-IV (SNAP-IV) was used to measure behavior disorder symptoms (Swanson 1995; Swanson et al. 2001). Institution educators who were also the participants' direct referents completed the SNAP-IV at T1, T2 and T3. The French 26-item version (MTA-version; Caci 2008) was rated on a four point Likert scale ranging from 0 (not at all) to 3 (very much). This instrument includes three subscales: Inattention (α = .89), Hyperactivity (α = .89) and Oppositional behaviors (α = .86). All Cronbach's α reported in this paper were computed on the present data.

2.4.2 Internalizing and externalizing general symptomatology

Educators completed the internalizing (α = .78) and externalizing (α = .91) behavior subscales of the Child Behavior Checklist (CBCL) for ages 4 to 18 years at T1, T2 and T3 (Achenbach 1991). These two subscales contain 118 items rated on a three-step scale (0 to 2). The externalizing symptoms subscale captures behaviors such as cruelty, bullying, meanness to others, breaking the rules or using substances, whereas the internalizing symptoms subscale captures emotional difficulties such as crying, having fears or nightmares, being unhappy, or having worries.

2.4.3 Depressive symptomatology

To assess self-reported internalizing symptomatology, adolescents completed the French version of the Multiscore Depression Inventory for Children at each assessment point (MDI-C; Berndt & Kaiser 1999). This 79-item questionnaire has eight scales but only three of them were of interest to this study: the Anxiety subscale (α = .62), the Sad-Mood subscale (α = .74), and the Defiance subscale (α = .66) as well as the global score that captures overall depressive symptomatology (α = .90).

2.4.4 Impulsivity

Adolescents completed the French version of the 20-item Impulsive Behavior Scale adapted for youth at each assessment point (UPPS-P; Billieux et al. 2012; Catale, Geurten, & Billieux 2014; Whiteside & Lynam 2001). The answers are self-reported and scored on a four point Likert scale ranging from 1 (strongly agree) to 4 (strongly disagree). This questionnaire assesses the global score of impulsivity (α = .54) via four dimensions: Urgency (α = .59), Lack of Premeditation (α = .57), Lack of Perseverance (α = .52) and Sensation Seeking (α = .57). These psychometric features indicate a poor reliability in the present sample.

2.4.5 Mindfulness

Participants completed the French version of the Children and Adolescents Mindfulness Measure (CAMM) at each assessment point (Roux et al. 2019). This 10-item questionnaire is rated on a 5-point likert scale (0 = never true to 4 = always true) and was designed to assess mindfulness as a unique dimension defined by a focus on the present-moment and by nonjudgmental awareness (Greco et al. 2011). Adolescents with externalizing and emotional problems could have difficulty answering questions about self-awareness. From this perspective, the internal consistency of this questionnaire is acceptable (α = .63).

2.4.6 Attentional task

In order to measure sustained attention capacities, participants completed the d2-R test at each assessment point (Brickenkamp et al. 2015). This pencil-and-paper test consists of crossing out the relevant letters (“d” with two dashes) and ignoring the irrelevant, but similar, ones (e.g., “d” with only one dash or “p”). The d2-R lasts four minutes and forty seconds (timed task). The score used in this study is the Concentration Performance (CP) (i.e., the number of crossed-out target objects minus the number of commission/omission errors).

2.4.7 Behavioral tasks

2.4.7.1 The Waiting task

Participants were asked to sit as long as possible on a chair with their eyes closed, without moving or speaking (3 minutes maximum). As soon as the participant opened his/her eyes or interrupted the task with movements, the time was recorded (in seconds) and the next task was performed. The task was presented as a game. When a participant asked how much time it would take, the researcher answered that the maximum time would be five minutes in order to accentuate the perceived difficulty; however, the task always ended after 3 minutes. This task was used to assess participants' ability to sit quietly as well as their capacity to inhibit their impulsive behaviors. We hypothesized that participants in the MBI group would perform better than participants in the other groups.

2.4.7.2 The Lottery task

In this task, participants reported what they would do if they hypothetically won €100 from the national lottery. They could allocate variable amounts of this sum to six categories: three self-focused categories (buy something they want, do a fun activity, save money) and three other-focused categories (give to family, give to the institution, invite a friend over for a drink). The sum for each category was recorded. This task was used to assess prosocial behavior and generosity. Different versions of this task already exist (see for example: Van Cappellen, Saroglou, & Toth-Gauthier 2016). We hypothesized that the MBI would increase the sum allocated to the other-focused category.

2.4.7.3 Cookies task

After completing the battery of questionnaires, participants were given a cookie as a reward for the time spent on the evaluation. They could win another cookie by waiting two more minutes during which time they had to observe, touch, and smell the cookie without eating it. If they succeeded, another deal was proposed to them. They could leave with the two cookies or choose to wait one week in order to have four cookies instead. Finally, if they refused to wait one week to obtain the four cookies, a final proposition was made by offering them immediately one cookie, instead of two, but with a gain of two cookies after a week. The score on this task was based on the number of cookies received (one, two, three or four). This task was used to assess behavioral impulsivity and delay of gratification. Participants who did not like cookies did not take the test (n = 1 [MBI]; n = 1 [HP]; n = 2 [TAU]). We hypothesized that participants in the MBI group would be able to postpone their reward more frequently than participants in the other groups.

2.5 Statistical analyses

To test the efficacy of the MBI across the four assessment points (i.e., across three assessment points for the CBCL, the SNAP-IV and the behavioral tasks), a two-level multilevel linear model for repeated measures was applied (Hox et al. 2017). Multilevel models are more robust than ANOVAs when there are more than two assessment points. Moreover, multilevel analysis can include incomplete cases, which is an advantage for dealing with missing values (Field & Wright 2011).

In this study, the level-1 units consisted of the repeated measures for each subject (Time), while the level-2 unit was the individual. The level-2 equation is presented below:

$$y_{it} = \gamma_{00} + \gamma_{10}(Time)_{it} + \gamma_{01}(Group)_i + \gamma_{02}(Gender)_i + \gamma_{03}(Medic)_i + \gamma_{11}(Time*Group)_{it} + \gamma_{12}(Time*Group*Gender)_{it} + \gamma_{13}(Time*Group*Medic)_{it} + u_{0i} + e_{it}$$

Where y_{it} is the outcome (e.g., depression, hyperactivity etc.) at time t for individual i, γ_{00} is the intercept, $\gamma_{10}(Time)_{it}$ is the main effect of Time (T1, T2, T3, T4), $\gamma_{01}(Group)_i$ is the main effect of the group (TAU, HP, MBI), $\gamma_{02}(Gender)_i$ is the main effect of gender (boy or girl), $\gamma_{03}(Medic)_i$ is the main effect of taking medication (yes or no), u_{0i} is a random effect of the intercept and e_{it} is the residual error. The interactions between Time, Group and Medication or Gender were also added.

When a significant Group*Time interaction was observed in the model, another analysis was conducted between T2 and T3 in order to explore the specific effect of the MBI for the experimental group. In the same way, when a significant main effect of Time was observed for one variable, post-hoc comparisons, based on Bonferroni correction, were used to identify when the change occurred (i.e., looking at the significance of the Time effect between each assessment point).

Further analyses investigated whether participants' psychological profiles at baseline predicted an improvement during the treatment phase. The Reliable Change Index (RCI) proposed by Jacobson and Truax (1991) was used to calculate an improvement score between T2 and T3. This index is a reliable tool to assess clinical change with greater accuracy than a simple subtraction of scores. In order to limit the number of analyses, the RCIs of several variables were added together yielding three overall variables. Externalizing symptoms were dissociated from internalizing symptoms. In addition, the attention dimension was separated from externalizing symptoms to avoid grouping too many variables and also because this dimension can play an independent role in behavior disorders. Therefore, the three global variables were: externalizing symptoms improvement (Impulsivity [UPPS-P], Externalizing symptoms [CBCL], Hyperactivity [SNAP-IV], and oppositional behaviors [SNAP-IV] RCIs), internalizing symptoms improvement (RCIs of the MDIC and Internalizing symptoms [CBCL]), and attentional level improvement (RCIs of the CAMM, Inattention [SNAP-IV],

and the d2-R). Separate linear regression models were run with the three global improvement scores as outcome measures and baseline variables (T1) as predictors.

Finally, in order to test the effects of continued practice, we conducted t-tests comparing the RCIs (between T3 and T4) of participants who maintained their practice for one year to the RCIs of participants who did not. Variables assessed included: the MDI-C, CAMM, UPPS-P, and d2-R.

The statistical power of the present design to detect moderate or large effect is difficult to ascertain because no consensus has been reached in the literature about power analyses in multilevel modeling (Field & Wright 2011). However, based on the recommendations of Arend and Chafer (2019), our study design (i.e., parameters: L1 = 3, L2 = 125, intraclass correlation coefficient = .62) could identify moderate and large effect size for fixed effects, but might lack power for identifying interaction effects.

3. Results

3.1 Preliminary analyses

ANOVAs indicated no difference between the TAU, the HP and the MBI groups at baseline for all variables (all $p > .07$). Participants who dropped out ($n = 9$) had significantly higher scores on the CBCL externalizing disorders subscale than participants who remained in the study, $t(132) = 2.82$, $p = .005$. Since this sub-population presents differences with the overall sample, it was decided to exclude this data.

In addition, there were no differences between the RCI scores (T2-T3) of participants without externalizing symptoms ($n = 19$) and the RCI scores of participants with externalizing symptoms. Correlations among the different variables are presented in Table 5.1. A high correlation between externalizing symptoms and oppositional behaviors reported by the educators was observed ($r = .82$, $p < .001$) whereas a very weak correlation was found between internalizing symptoms reported by the educators and depressive symptoms reported by the adolescents ($r = .12$, $p = .04$). Surprisingly, no correlation between the attentional task and mindfulness was found ($r = .03$, $p > .05$).

Table 5.1. Correlations among all dependent variables (N = 129)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Depressive symptomatology[a]	–										
2. Anxiety[a]	.73**	–									
3. Sad-Mood[a]	.72**	.50**	–								
4. Defiance[a]	.63**	.41**	.32**	–							
5. Impulsivity[a]	.40**	.34**	.20**	.50**	–						
6. Mindfulness[a]	-.35**	-.44**	-.24**	-.15*	-.20**	–					
7. Attentional task	-.27**	-.23**	-.21**	-.14*	-.03	.03	–				
8. Internalizing symptoms[b]	.12*	.11*	.14*	.04	.08	-.04	.03	–			
9. Externalizing symptoms[b]	.01	.04	-.05	.15*	.24**	.05	.01	.51**	–		
10. Inattention[b]	.10	.15*	.05	.04	.11*	-.13*	-.17*	.30**	.42**	–	
11. Hyperactivity[b]	-.02	.02	-.07	-.02	.05	.04	.02	.35**	.66**	.53**	–
12. Oppositional behaviors[b]	.00	.01	-.03	.07	.14*	.06	.05	.49**	.82**	.38**	.66**

a. Self-report questionnaires
b. Questionnaires completed by the educators of the institution
* $p < .05$
** $p < .01$
*** $p < .001$

3.2 MBI efficacy

3.2.1 Inattention, Hyperactivity and Oppositional behaviors

Table 5.2 presents the results of the multilevel models. Several effects were found for the three dimensions of the SNAP-IV. Concerning Inattention, a main effect of Gender was found indicating that boys had a higher score than girls. In addition, the Time*Group interaction was significant, but the analysis specifically conducted between T2 and T3 revealed no significant Time*Group interaction [F(2,115) = 1.52, p = .22]. However, a significant contrast was observed when the MBI group was compared to the two other groups (C = -2.39, p = .018, Cohen's d = 0.25). The MBI group maintained the same means between T2 and T3 (M2 = 8.54, SD2 = .87; M3 = 8.68, SD3 = .85) whereas the means of the HP group (M2 = 10, SD2 = .98; M3 = 11.02, SD3 = .96) and those of the TAU group (M2 = 10.56, SD2 = .99; M3 = 12.43, SD3 = .97) increased.

Concerning the oppositional behaviors subscale, the model showed a main effect of Time, indicating an overall decrease in oppositional disorders for all groups between T1 and T2. Also, the model reported a main effect of Gender, indicating that boys had higher scores than girls. Finally, a main effect of Medication was also found indicating that youth who took medication had a higher score of oppositional behaviors than their peers.

No significant effects were found for the Hyperactivity subscale.

3.2.2 CBCL internalizing and externalizing symptoms

A significant main effect of Time was found for the externalizing subscale of the CBCL, revealing a decrease in externalizing symptoms between T1 and T2. Similarly, a main effect of Gender (boys had a higher score than girls) and a main effect of Medication (youth who took medication had higher scores than youth who did not) were found in addition to a significant interaction of Time*Group*Gender. More precisely, the analysis performed between T1 and T2 showed a significant interaction which reflected a decrease in externalizing symptoms for the HP group but only among girls [F(2,118) = 4.26, p = .016].

No effects were found for the internalizing symptoms subscale.

3.2.3 Depressive symptomatology

Multilevel models performed on the overall score of the MDI-C indicated a significant main effect of Time. The post-hoc comparisons between the different assessment points suggest a decrease in depressive symptoms for all groups between T1 and T3, [F(2,240) = 4.77, p = .009]. Moreover, a main effect of Gender was observed, indicating that girls had higher scores than boys.

The analyses on the anxiety subscale revealed a main effect of Time, suggesting an overall decrease between T2 and T3, $F(1,120) = 8.43$, $p = .004$. A main effect of gender was also found (i.e., higher scores for girls than boys).

Concerning the Defiance subscale, only a main effect of Gender was found, indicating that girls reported higher Defiance scores than boys.

No effects were found for the Sad-mood subscale.

3.2.4 Impulsivity and Mindfulness

No significant effects were found for the impulsivity total scores and its subscales.

The analyses revealed a main effect of Time for the CAMM questionnaire, suggesting an increase in the mindfulness score between T2 and T3 for the three groups, $F(1,120) = 8.36$, $p = .005$. Also, a main effect of Medication was found indicating that the mindfulness score was higher among participants who did not take medication.

3.2.5 Attentional and behavioral tasks

Multilevel models identified a significant effect of Time for the d2-R test, indicating an improvement in performance between T1 and T3 for the three groups, $F(2,238) = 67.93$, $p < .001$. In addition, the Time*Group interaction was significant. The analysis performed between T2 and T3 confirmed a significant Time*Group interaction, $F(2,119) = 3.14$, $p = .047$. A trend was observed for the contrast comparing the MBI group and the two other groups ($C = 10.16$, $p = .07$, $d = 0.45$). Inspection of the means revealed that the three groups improved their scores but the increase observed in the MBI group ($M2 = 107.02$, $SD2 = 4.88$; $M3 = 123.08$, $SD3 = 4.63$) was larger than those observed in the HP group ($M2 = 104.39$, $SD2 = 5.27$; $M3 = 108.61$, $SD3 = 5.01$) and in the TAU group ($M2 = 99.15$, $SD2 = 5.41$; $M3 = 107.39$, $SD3 = 5.14$).

3.2.6 Behavioral tasks

No effects were found for the Waiting task, the Lottery task or the Cookies task ($n = 89$ at T3, $n = 39$ at T4, $p > .05$).

Table 5.2 (Part 1). Results of the multilevel analyses for all variables (F-tests; N = 129).

	Inattention	Hyper	Oppositional behaviors	CBCL-Ext	CBCL-Int	Depression	Anxiety	SadMood
Time	2.30	2.75	3.83*	3.43*	.025	3.09*	4.08**	1.73
Gender	12.51**	3.01	6.06*	6.8*	.085	5.99*	8.64**	2.85
Group	.16	.36	.09	.17	.59	1.17	1.07	.74
Medication	1.03	3.48	4.82*	3.85*	.66	.03	2.93	.85
Time*Group	2.76*	1.38	1.69	2.17	1.58	.71	.37	1.68
Time*Group*Medication	.44	.71	.07	.61	1.19	.55	1.21	.68
Time*Group*Gender	.59	.63	1.38	3.15**	1.22	.67	1.03	.98

Note. Hyper = Hyperactivity (SNAP-IV); *CBCL-Ext* = Externalizing symptoms subscale (CBCL); *CBCL-Int* = Internalizing symptoms subscale (CBCL)

Table 5.2 (Part 2). Results of the multilevel analyses for all variables (F-tests; N = 129).

	Defiance	Impulsivity	Mindfulness	d2	Wait-T	Lottery-T	Cookies-T
Time	.88	.43	3.41*	53.83**	.26	.35	.53
Gender	13.65**	.06	1.85	.06	1.77	1.54	1.1
Group	1.39	.37	.60	2.8	.05	2.03	.29
Medication	1.53	1.8	4.73*	.01	.95	1.37	2.42
Time*Group	1.13	1.38	.32	2.9**	1.38	.72	.81
Time*Group*Medication	.35	.51	.55	1.76	1.09	.23	.21
Time*Group*Gender	.55	.81	.62	2.07	.89	.97	.83

Note. Wait-T = Waiting task; *Lottery-T* = Lottery task; *Cookies-T* = Cookies task.

3.3 Psychological profiles

No variables at baseline were found to predict an improvement between T2 and T3 for the MBI and the HP groups (see Table 5.3). However, in the TAU group, a lower score on oppositional behaviors predicted a greater improvement in externalizing symptoms while a lower level of mindfulness and a higher level of internalizing symptoms and hyperactivity predicted a greater improvement in internalizing symptoms and, finally, a higher level of externalizing symptoms and a lower level of oppositional behaviors predicted a better improvement in attention capacities.

Table 5.3. Results of the regression models (β) predicting the global improvement on the three types of variables between T2 and T3 for each group (N = 129)

	Externalizing symptoms			Internalizing symptoms			Attentional level		
	MBI	HP	TAU	MBI	HP	TAU	MBI	HP	TAU
Intercept[a]	5.52	-11.54	-8.51	1.75	-3.17	3.49	.38	2.85	-3.24
Age	-.04	.28	-.007	-.17	-.01	-.11	.08	-.09	-.05
Gender	.25	.21	-.35	.31	.000	.09	.30	.15	.18
MDIC	.004	.08	.37	-.18	.18	-.41	-.02	-.07	-.04
UPPS	-.21	.10	.09	.09	-.13	.33	-.11	-.01	.29
CAMM	-.12	-.07	-.09	-.03	.09	-.49*	.03	-.07	.20
D2	.001	.13	.010	.14	.47	-.16	.16	-.00	-.20
Internalizing	-.19	-.18	12	.002	.004	.51*	-.15	-.04	-.19
Externalizing	.06	-.16	.78	.22	-.33	-.01	-.04	.30	1.36**
Inattention	-.08	-.07	-.04	.18	.03	-.17	.04	-.16	.03
Hyperactivity	-.17	-.08	.38	-.09	-32	.62*	-.00	.03	.13
Oppostional behaviors	.23	.26	-1.24**	-.08	.42	-.56	.12	-.11	-1.05*

a. The coefficient for the intercept is the *B* index (non-standardized) instead of the β.
* $p < .05$
** $p < .01$

3.4 Continuity of practice

Contrary to our hypothesis, no differences were found between the 15 participants who reported continued mindfulness practice (at least once a month) and the 13 participants who did not, for the MDI-C [$t(26) = 1.00$, $p = .32$], the CAMM [$t(26) = .94$, $p = .35$], the UPPS-P [$t(26) = .07$, $p = .94$], and the d2-R [$t(26) = 1.12$, $p = .24$].

4. Discussion

The aim of the present study was to explore the impact of a MBI on internalizing symptoms and externalizing symptoms (i.e., inattention, hyperactivity, and oppositional disorders) in a population of adolescents with behavior disorders.

With regards to attention capacities, results of the questionnaire completed by the educators (inattention dimension of the SNAP-IV) indicated that the MBI protects adolescents from an increase in inattention observed in the TAU and HP groups. However, the effect size is slightly smaller than the one found in the literature on adolescents with ADHD (Cairncross & Miller 2016; Chimiklis et al. 2018). In contrast, results obtained with the more objective attentional task (d2-R) showed a significant improvement in attentional capacities in adolescents who followed the MBI program. More precisely, participants in the TAU and HP groups also showed significant improvements in attentional capacities but these improvements were less significant than those observed in the MBI group and may be attributed to learning resulting from repeated assessments and the natural improvement of executive functions. These results suggest that meditation exercises may help adolescents with behavior disorders reduce their tendency to be distracted. This finding has several clinical implications that could be tested in future studies. For instance, by enhancing attention, mindfulness exercises could help boost adolescents' reading comprehension abilities, numeracy skills, or other skills requiring concentration which may in turn improve their global academic performance. Enhanced attention via mindfulness may also increase adolescents' awareness of inner experience which may lead to improvements in emotion regulation.

Regarding mindfulness skills, results showed a significant increase in all groups. Contrary to our hypothesis, participants in the MBI condition did not show significant improvements in mindfulness skills in comparison to participants in the TAU or HP conditions. The fact that mindfulness improved in all groups may be attributed to the therapeutic care provided by and the rules set up by the staff of the institutions themselves. The staff encourages residents to avoid explosive emotional behaviors and to openly express their emotions. This may have contributed to improving participants' non-reactivity and non-judgment, which are skills measured by the mindfulness scale used in the present study. Without the support of the staff, we speculate that it would have been unlikely to observe significant improvements in mindfulness in this population.

With regards to hyperactivity, the second core symptom, and impulsivity, its associated psychological process, results were consistent and showed no effect of the MBI on hyperactivity perceived by the educators, impulsivity (including its facets) perceived by the youth, and the delay of gratification measured by the cookies task. This observation diverges from the literature that reports a small to moderate effect size on these outcomes (Chimiklis et al. 2018; Zhang et al. 2018). This difference may be due to the fact that, contrary to other studies, our sample did not only include adolescents with ADHD. However, linear regression models indicated that none of the variables associated with ADHD symptomatology at baseline (i.e., the level of hyperactivity, oppositional behaviors and inattention), predicted greater improvements during the MBI. In addition, no statistical differences were found for the waiting task. This may be due to a lack of statistical power given the small sample size for this task at T4 (n = 39). Therefore, it is possible that the MBI was not effective in treating hyperactivity and impulsivity. It is important to note that the greatest difficulty to which the MBI instructors were confronted in the present study was group misbehavior (i.e., the agitated behavior of several adolescents), which sometimes prevented the practice of formal meditation.

The third core symptom addressed in this study was oppositional behaviors. Contrary to our hypotheses, no interactions were found for the oppositional behaviors dimension and for the Defiant subscale of the MDI-C. The MBI did not appear to have a different effect from institutional care or health psychoeducation. It is possible that the program was too short (e.g., the dialectical behavior therapy for adolescents ranges from 12 to 24 sessions; Freeman, James, Klein, Mayo, & Montgomery 2016). Perhaps the emphasis should have been on the topic of non-judgment and non-reactivity, which could help manage the frustration that leads to oppositional behavior (this topic represents only two 50-minute sessions in the program). In addition to this result, the oppositional behaviors subscale completed by the educators, indicated that boys presented more oppositional behaviors than girls, which is highly consistent with the literature. However, when looking at the self-report questionnaire on Defiance, girls presented higher scores. Thus, it is possible that boys have higher oppositional behaviors than girls, but they minimize it while girls overstate it. On the other hand, a decrease in the oppositional symptoms was observed between T1 and T2, probably indicating a global positive effect of the institutional care.

The overall scores for externalizing symptoms followed the same pattern as the scores for the oppositional behaviors dimension but this result was not surprising given the high correlation between these two questionnaires. However, one additional effect was observed: a decrease in externalizing symptoms among girls for the HP group between T1 and T2. This result suggests that the first six sessions of the HP program (tobacco, nutrition and sleep) helped reduce the girls' externalizing symptoms. This finding is difficult to interpret because we do not know which topic in these sessions specifically helped them as all three topics are associated with behavior disorders.

Concerning internalizing symptomatology, educators did not notice any changes while adolescents reported feeling better over time. Because this decrease occurred in the three groups, it may be due to institutional care and, according to the results, may concern anxiety rather than sad mood.

The MBI had no significant effects on performance in the lottery task. This finding could be interpreted in various ways. It may suggest that MBIs do not affect prosocial behaviors, as suggested by some studies (Bayot et al. 2018; Ridderinkhof et al. 2017), but it would also be at odds with other studies (Donald et al. 2019). Another possibility is that the task was not sensitive enough to measure prosocial behavior. Lastly, the limited statistical power (n = 39) may also be a reason why no effect was observed.

We explored whether particular baseline characteristics (e.g., age, gender, baseline symptomatology, etc.) predicted improvements in attention, internalizing symptoms, and externalizing symptoms between T2 and T3. Results showed that none of the baseline characteristic predicted improvements in the aforementioned variables in the MBI and HP groups. This suggests that baseline variables may not play an important role in predicting improvement. Nonetheless, linear regression models for the TAU group found a significant predictive effect of several baseline characteristics. For instance, oppositional behaviors predicted a deterioration of externalizing symptoms and attention. Furthermore, and surprisingly, hyperactivity predicted an improvement in internalizing symptoms and mindfulness predicted an increase in internalizing symptoms. These results suggest that there is a natural increase in attentional and behavioral problems among adolescents who present higher levels of oppositional behaviors, which the institutional treatment fails to stabilize.

Finally, there was no significant effect of continued mindfulness practice on outcome measures at a one-year follow-up. However, the formal time of practice was not measured. Therefore, some adolescents could have practiced once per month while others could have practiced several times per week. In the same way, the quality of practice was not considered and the small sample (n = 30) associated with this result prevents us from drawing definitive conclusions.

As a whole, the present study's results provide evidence for the positive impact of a MBI on attention capacities in adolescents with behavior disorders who are part of an institution. However, results do not provide evidence for the impact of a MBI on internalizing symptoms, hyperactivity or oppositional behaviors in this population. Future research is needed to further assess whether MBIs are suitable for this population.

5. Limitations and Future Research

The current study has several limitations. First, the poor psychometric quality of some questionnaires limits the scope of the interpretations (e.g., UPPS-P). Indeed, numerous adolescents had difficulties understanding some questions, which is why the three behavioral tasks were added. However, these tasks were not validated and were completed by a small sample of participants. Secondly, since no formal diagnoses were made, we could not distinguish the effect between the different types of behavior disorders. In addition, and contrary to numerous studies that use family interventions, peers were not directly involved in the intervention. This could have decreased the efficacy and quality of the MBI possibly explaining the small effects observed in this study. Thirdly, since the amount of home practice was not assessed during the intervention, we were unable to account for its potential influence on intervention outcomes.

Overall, future studies should explore the efficacy of individual mindfulness sessions, the differences observed between different diagnoses (such as ADHD and ODD), and the differences between MBIs that involve parents and those that do not. In addition, a particular emphasis should be placed on the use of high-quality designs, such as RCTs, to avoid overestimating the benefits of MBIs in this population.

6. Conclusion

The present findings show that a MBI leads to an increase in attentional capacities among adolescents who suffer from behavior disorders. However, the MBI did not succeed in achieving substantial benefits compared to health psychoeducation and treatment as usual on externalizing and internalizing symptoms. Therefore, further RCTs with different types of measure are needed to ensure the reliable effect of MBIs in this clinical population and to determine which components are relevant.

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Chapter 6

General Discussion

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"*Mindfulness is not a magic bullet therapy; it does not provide the solution for all conditions of all people*".

— Singh et al. (2007, p. 62)

1. Introduction

Many mindfulness programs have been devoted to preserving the mental health of young people and helping them to develop their attention and their emotional awareness. However, the positive results observed in the general population should not make us forget the particularities of more vulnerable sub-populations such as adolescents who present behavior disorders. The difficulties encountered in this clinical population could notably interfere with the mindfulness practice (e.g., incapacity to stay motionless or to express emotions with clarity). Therefore, studies, using strong methodological designs, should assess the feasibility and the efficacy of MBIs in this population as well as the psychological processes involved in the potential changes. Accordingly, this thesis aimed to explore the effect of MBIs among a specific population of adolescents with behavior disorders on these three axes (i.e., feasibility, efficacy, processes). In this Discussion Chapter, I will propose interpretations and a global understanding of the results presented in Chapter 4 and 5 in light of the three research questions.

2. Research questions

2.1 Feasibility and acceptability

— Are MBIs feasible and well-accepted by adolescents with behaviors disorders?

The first concern about the implementation of an intervention among a new population is the feasibility, that is to say the possibility of carrying out the intervention without too much opposition from the participants (notably when oppositional behaviors are one of the mains symptom of the population).

A first issue concerns the recruitment of the participants. Previous studies suggest no difficulty to recruit adolescents with behavior disorders (e.g., Mendelson et al., 2010). However, clinical investigations conducted during this thesis demonstrated the need to use an attractive support to motivate adolescents to participate in the program. Indeed,

adolescents with behavior disorders, more than others, can find interventions based on exercises that require calmness, silence and emotional exploration boring or challenging. A presentation of the MBI nourished by short movies and pictures can help adolescents to understand the general aim of the intervention, which is not easy to grasp even for adults, and to consider it as attractive. This is, at least, the improvement we achieved between the first and second study, which yielded positive feedback from adolescents and professionals.

The adaptation of the classical programs (i.e., MBSR and MBCT programs) must also be taken into account. As we have seen in Chapter 1 (Table 1.1), several programs have been designed for adolescents and children. The chosen program for these studies was essentially inspired by the program of Deplus and Lahaye (2015), which was already validated among adolescents without behavior disorders (Deplus, Billieux, Scharff, & Philippot, 2016). Overall, the intervention was also adapted to institutional constraints. Neither the 50-minute-session nor the frequency of one session per week was reported by the institutional staffs as unsuitable. The data collected among the youth about the difficulty, adherence and benefits of the program are reported below.

• On the 15 participants of the MBI who completed the follow-up of Study#1 (68,18% of the initial sample):

At the question: “In your memories, was it easy to do the mindfulness exercises? Can you give me a score from 0 to 10? (knowing that 10 means very easy and that 0 means very difficult)”, the global mean was 7.76 (SD = 1.79).

At the question: “Did you enjoy participating in the mindfulness program? Can you give me a score from 0 to 10? (knowing that 10 means you really enjoyed participating and that 0 means you did not enjoy at all participating)”, the global mean was 8.53 (SD = 1.92).

• On the 30 participants of the MBI who completed the follow-up of Study#2 (61,22% of the initial sample):

At the question: “In your memories, was it easy to do the mindfulness exercises? Can you give me a score from 0 to 10? (knowing that 10 means very easy and that 0 means very difficult)”, the global mean was 6.89 (SD = 1.94).

At the question: “Did you enjoy participating in the mindfulness program? Can you give me a score from 0 to 10? (knowing that 10 means you really enjoyed participating and that 0 means you did not enjoy at all participating)”, the global mean was 7.51 (SD = 2.4).

At the question: “Did the program help you feel better? (knowing that 10 means it really helped you and that 0 means it did not help you at all)”, the global mean was 5.93 (SD = 3.11).

On the whole, the acceptability of the program is attested by the good scores in terms of ease and general satisfaction. Since the scores did not present a ceiling-effect for the program ease evaluation, this could mean that the program was not too easy and, thus, probably adapted to the age of the adolescents. However, the interviews reported that some adolescents found the intervention too easy or childish while others found it too difficult. This is also probably due to the wide range of age and profiles but no significant correlation was found between age and ease scores, satisfaction or perceived benefits (although the sample was small and that mental age could have been a more appropriate variable than chronological age). A clinical hypothesis is that games on mindfulness were more appropriate for younger adolescents while formal mindfulness exercises were more appropriate for older ones.

About attrition in the MBI group of Study#1 and #2, three adolescents left the group (two because they did not like the intervention, one because he did not like the atmosphere of the group), two adolescents left the institution and one was too often absent. This amount of dropout represents 8.45% of the total sample of the MBI and is in line with the rate reported in previous studies as well as the dropout found for the health psychoeducation group (7.31%). However, it is worth noting that some adolescents did not enjoy the program but continued to attend the sessions thanks to the encouragement of the institutional staff. Although this result could not be strictly quantified, 12.9% (n = 4) of the participants in the follow-up reported a mark equal to or lower than 5 out of 10 on the question “Did you enjoy participating in the mindfulness program?”. Yet, the question was asked after one year, which limits its validity. In contrast, other adolescents said they did not like the program during the MBI, but rated it positively on benefits and satisfaction at the one-year follow-up interviews. As a result, future research should use mixed methods to assess the profiles of adolescents who would be more likely to benefit from the intervention despite their reluctance to be involved in the program.

Overall, the results about feasibility and acceptability of the program are mixed. On the one hand, the majority of the adolescents found the program relevant and useful. Silence and meditation exercises were really appreciated by some youth but others could not bear it. Qualitative data and the low rate of dropout demonstrate that MBIs are feasible and well-designed for adolescents who suffer from behavior disorders. From a clinical point of view, it is clear that some adolescents enjoyed coming to the sessions. But this motivation was also partly due to the fact that they were seeing their friends and receiving attention (i.e., time specially dedicated to them). In this way, the quality of the interaction with the peers, and particularly with the instructors, may be more fundamental for the commitment in the program than the adaptation of the mindfulness exercises. Social desirability could play an important role in program evaluation and attendance at sessions. Indeed, in a previous study

that we conducted for the validation of a mindfulness questionnaire (Roux et al., 2020), the children's social desirability was moderately correlated to mindfulness (r = .21 for the Child and Adolescent Mindfulness Measure and r = .39 for the Five Facet Mindfulness Questionnaire). Adolescents could adapt their view of the intervention based on the state of mind of their peers about the intervention. For instance, a study conducted in school among urban youth indicated that some teachers prevented students from attending the intervention classes as a punishment for poor behavior in class (Mendelson, 2010). This way of functioning (i.e., to consider the intervention as a duty) does not allow children to invest themselves voluntarily in the process of change proposed by the therapeutic framework although the intervention may also be seen as a reward. In the same way, parents or educators who do not believe in the usefulness of the intervention will not support the mindfulness practice outside of the sessions. In our studies, educators did not prevent adolescents from attending the intervention session but there was sometimes a need to get an adolescent out of the session. Some adolescents who did not adhere to mindfulness still found a secure setting in the MBI by receiving attention and caring. Others, who were not receptive to mindfulness but attached to the instructors, changed their minds on the therapeutic tool over the course of the intervention. Thus, future research could explore the influence of instructor's attitude and experience, but also group dynamics, on the outcomes.

On the other hand, we agree with the conclusions of Bögels, Hoogstad, van Dun, de Schutter and Restifo (2008, p. 205) who wrote that: "The training process itself was 'hard work'. Children had difficulty concentrating and showed overt non-compliance. […] Another clinical impression was that some adolescents with ODD/CD tended to negatively influence the group, stimulating others to be noncompliant". This statement is in line with the result suggesting that participants who left the study presented higher externalizing symptoms than the adolescents who finished the program (according to their educators). This result is not surprising and could highlight the fact that adolescents with a high level of externalizing symptoms should probably be referred to treatments other than MBIs in first instance. In terms of feasibility and acceptability, MBIs might not be appropriate for adolescents with high levels of ODD symptoms, unlike adolescents with ADHD symptoms and notably inattention. However, the analyses on diagnoses performed in Study#1 as well as the results of the regressions conducted in Study#2 do not support this hypothesis. Nor ODD or ADHD symptoms at baseline predicted an enhancement or a deterioration of the outcomes during the MBI. It is also possible that the group format may not be suitable for adolescents who present oppositional behaviors. Therefore, it might be better for some adolescents to start mindfulness exercises in an individual setting without social pressure (Bögels et al., 2008, Reangsing et al., 2020). Finally, we can cite the work of Simard (2019) who wrote a thesis on feasibility of MBIs in children with ADHD. While the conclusion was optimistic about feasibility, the studies of the thesis took into account a very small sample size (N = 4). In addition, one of the children left the study because of aggressive behaviors. This example explicitly demonstrates the ambiguities that exist regarding the feasibility and acceptability of MBIs, a question surprisingly absent from the literature whereas isolated experimental studies that are optimistic used small sample sizes and present problematic attrition. Without

the help of peers or the involvement of families, adolescents with behavior disorders may not adhere easily to the MBI.

Overall, the results of this study suggest that MBIs are feasible in a population of adolescents with behavior disorders with a lot of adaptation efforts. The standard MBI programs require significant adjustments such as those proposed by Deplus and Lahaye (2015). From a clinical point of view, it seems irrelevant to apply the program without making changes that specifically take into account the characteristics of the adolescents (e.g., a group with difficulties in understanding, a group with difficulties in complying with the rules). As a result, future research may explore which adaptations are required by age and what are the sub-profiles of behavior disorder which are the most impacted.

2.2 Therapeutic efficacy

— Do MBIs have a positive impact on the mental health of adolescents?

The following section will present the conclusions that can be drawn from MANOVA analyses performed in Study#1 and multilevel analyses conducted in Study#2. Each outcome will be discussed in one of the three categories of symptoms.

2.2.1 Internalizing symptoms

At first, we will examine the influence of the MBI on internalizing symptoms. Two questionnaires were used in the studies to assess internalizing symptoms: the MDI-C (depressive symptomatology rated by the adolescents) and the internalizing symptoms subscale of the CBCL (general internalizing symptoms rated by the educators).

A very consistent pattern emerged from the analyses conducted on the self-report questionnaire (MDI-C) across the studies. Although we showed in Chapter 2 that depressive symptoms during the adolescence tend to remained stable over time, the global score of depression decreases for all groups with a linear evolution over the year. Therefore, it is likely that this effect was produced by an external factor common to the different groups such as institutional care. Indeed, only 8% of the adolescents follow a decreasing trajectory of their depressive symptomatology in general population (Shore, Toumbourou, Lewis, & Kremer, 2018). However, it is important to remember that the adolescents, even in the control groups, participated in several therapeutic activities, such as speech therapy or psychomotricity, and were in a safe environment supervised by educators, which can be very different from their family environment. Yet, we do not know which specific therapeutic factor, or interaction, led to this improvement. In addition, we must keep in mind that some studies demonstrated that a subsample of youth coming from a disadvantaged area decreased naturally their

depressive symptoms during adolescence (8.9%), but this rate remains too low to favor the hypothesis of a natural decrease in our study (Reinke, Eddy, Dishion, & Reid, 2012). Thus, the institutional care provided by the residential service may have improved adolescent's subjective well-being while MBIs did not bring additional benefits. In non-clinical populations, adolescents who followed a MBI tend to decrease their depressive symptomatology with a moderate effect size (Dunning et al., 2018) but only few studies have taken into account depressive symptomatology among adolescents who suffer from behavior disorders (because they focus primarily on externalizing symptomatology). The three studies that measured depressive symptomatology reported by adolescents with behavior disorders showed no changes on this outcome after a MBI (Bögels et al., 2008; Haydicky, Shecter, Wiener, & Ducharme, 2015; Zylowska et al., 2008). However, Haydicky et al. (2015), in the only study that included participants who were not part of a clinical institution, reported a decrease of depressive symptomatology 6 weeks after the last program session. Yet, the absence of a control group and the very small sample size (n = 14) prevent relying on this result. In both Study#1 and #2, no changes were observed at the one-year follow-up in the hierarchical model between T3 and T4 (no main effect of Time or interaction Time*Group). However, the findings at the follow-up in Study#2 suggest an increase in depressive symptomatology when the mindfulness group is considered alone, $t(29) = 2.33$, $p = .027$, suggesting a gradual loss of benefits.

The change observed for the global score of depression was supported by a decrease on the anxiety subscale in the three groups of Study#2. As already noted, this result could be due to the comforting institutional framework that provided a sense of emotional safety as well as institutional care. Although no changes were found at the one-year follow-up (T4) for anxiety in Study#1 and #2, the study of Haydicky et al. (2015), which also measured anxiety, observed a decrease 6 weeks after the program (but not directly after the MBI), suggesting that positive changes on anxiety and depression could appear after the end of the program but only for a limited period of time. Interestingly, secondary analyses revealed that girls in the MBI group benefited more from the intervention than boys when comparing their RCI between T2 and T3, $t(47) = -2.4$, $p = .023$.

No significant changes were found for the Sad-Mood subscale. Yet, it is possible that the effect was mitigated by the presence of the health psychoeducation group. Indeed, secondary analyses performed on the sad-mood subscale between T2 and T3, with only the TAU group and the MBI group, indicated a significant interaction, $F(1,86) = 3.90$, $p = .05$, suggesting a decrease of sad-mood in the MBI group ($M2 = 55.79$, $SD2 = 1.29$; $M3 = 52.55$, $SD3 = 2.25$) compared to the TAU group ($M2 = 57.07$, $SD2 = 1.45$; $M3 = 57.51$, $SD3 = 1.40$). However, when we combine together participants in the MBI and in the HP groups and compare them to the TAU group, the results suggest no difference. Since the "group effect" is the main difference between MBI/HP condition and TAU condition, it can be argued that the group effect may not be involved in the decrease of sad-mood scores.

No changes were found at the one-year follow-up (T4) for Sad-Mood subscales in Study#1 and #2. However, the participants of Study#1 reported a significant decrease on the Pessimism subscale between T3 and T4, $t(19) = 2.08$, $p = .05$, but analyses performed in this study did not included a control group. Although no differences in terms of practice time were reported between the two studies, the adolescents of the follow-up of Study#1 could have had a better quality of mindfulness practice between T3 and T4 than those of Study#2. Indeed, groups aiming at maintaining the mindfulness practice, facilitated by mindfulness instructors were implemented between T3 and T4, in Study 1. These groups could not be offered in the following years (Study#2) due to a lack of instructors. In addition, the absence of a decrease in sad-mood and anxiety between T3 and T4 observed in Study#1 (while it is the case for pessimism), could be explained by the fact that adolescents continued to experience negative emotions (below the clinical threshold of the MDI-C) but with fewer feelings of distress. In a sense, this result is very interesting because it is associated with mindfulness learning (i.e., no less sadness but less distress about it). Although non-significant, the findings of the mindfulness group on the subscales Instrumental helplessness ($M3 = 50.50$, $SD3 = 9.37$; $M4 = 47.85$, $SD4 = 6.54$) and Self-esteem problems ($M3 = 54.40$, $SD3 = 8.49$; $M4 = 49.75$, $SD4 = 6.09$) tend to support this hypothesis. Conversely, the findings at the follow-up in Study#2 suggest an increase in depressive symptomatology when the mindfulness group is considered alone. These results may indicate that longer programs, or at least continuity of mindfulness practice with a group after the end of the program (i.e., not only practice time), could help to keep the benefits of the MBI on the depressive symptomatology.

Contrary to our hypothesis, no significant changes were observed for internalizing symptoms rated by the educators of the institution in the two studies. This result is in contradiction with the results obtained by the self-report questionnaire. Adolescents reported to feel better as the school year progressed while their tutors did not notice it. In the same way, the correlation obtained in Study#2 between the MDI-C and the internalizing symptoms subscale was significant but very low ($r = .12$, $p = .03$). Independently of the intervention, it may be difficult for peers to identify the markers of the internalizing symptomatology for several reasons (Crowley, Worchel, & Ash, 1992). First, adolescent disclosure may be very difficult for youth with behavior disorders. More importantly, they often express their emotions through an external form that can be interpreted differently by educators than if they used the usual verbal expression (e.g., interpreting anger when the adolescent feels sadness). Second, it can be difficult for peers and educators to identify a significant change in the context of daily life.

Concerning the intervention, the MBI did not significantly decrease internalizing symptoms as observed by the educators. As mentioned above, it is possible that educators may have difficulty responding to this subscale, which would prevent the detection of an existing effect. However, it is also possible that the MBI produced no changes. This result is consistent with other studies in the literature that used the same questionnaire rated by tutors or parents (Bögels et al., 2008; Haydicky, Wiener, Badali, Milligan, & Ducharme, 2012; Van

de Weijer-Bergsma, Formsma, de Bruin, & Bögels, 2012). In the case of no effects of the MBI, it is quite surprising that the intervention did not success to enhance the well-being of the adolescents. Indeed, the program mainly focuses on emotional management. Therefore, MBIs may not be useful to improve the mood reflected by the adolescents' attitude but, as mentioned above, they can change the way to deal with negative emotions. It is also possible that more sessions are needed to reveal a significant improvement in the eyes of the educators. Also, the absence of a follow-up for this measure did not allow to investigate the evolution of this variable over the long term.

Overall, these mixed findings suggest that, more than MBIs, therapeutic cares, such as those provided in specialized institutions for adolescents with behavior disorders, may have a positive impact on depressive symptomatology. Thus, one hypothesis is that emotional awareness and an appropriate way of expressing and managing emotions has been taught by the professionals of the institution. In this way, it would have been interesting to explore their familiarity with mindfulness. Yet, without a control group that did not benefit from institutional care, definitive conclusions cannot be made.

2.2.2 Externalizing symptoms

As we know, externalizing symptoms are an important feature of behavior disorders. In our studies, externalizing symptomatology was measured by four subscales: the Defiance subscale of the MDI-C, the externalizing symptoms subscale of the CBCL, and the Hyperactivity and ODD subscales of the SNAP-IV. Of note, inattention can also be considered as a core symptom of externalizing symptomatology but will be discussed in a following section.

According to the self-report questionnaire (Defiance), no changes were observed in the two studies. The adolescents did not feel they had improved their overall conduct, which is consistent with self-reported externalizing symptoms in previous studies among adolescents with behavior disorders (Haydicky et al., 2015, 2012; Van de Weijer-Bergsma et al., 2012). This result may also be due to (1) the difficulty to admit a positive change, (2) the difficulty to notice it, or (3) no effects of the MBI. For the first hypothesis, clinical observations suggest that adolescents have secondary benefits in showing hostility. Indeed, oppositional behaviors towards other adolescents or professionals are a way to express their dominance, to feel recognized by their peers, and especially to be respected through intimidation. Adolescents try to regain control over their environment by adopting this attitude and are therefore less likely to admit a decrease in their defiance. Although dysfunctional, this way of functioning is well known in the literature (Gangel, Keane, Calkins, Shanahan, & O'Brien, 2017; Stoltz, Cillessen, van den Berg, & Gommans, 2016). Secondly, it may also be difficult for them to realize an emotional or behavioral change. In this sense, the MBI failed to improve their awareness or failed to improve their conduct. One explanation is that the intervention did not focus on therapeutic tools directly based on behavioral therapies. Indeed, the objective was not to directly change their inappropriate behaviors by proposing alternatives, but, in a more

subtle way, to help them to become aware of their emotions, values and life goals that may result in a change of attitude. The only essential rules were those concerning group dynamics (mutual respect of participants) and those concerning mindfulness exercises. Therefore, no judgements were given regarding their behaviors or attitude during their daily life.

Similarly, the questionnaire completed by the educators in Study#2 demonstrated no significant effects of the MBI compared to HP and TAU groups for general externalizing symptomatology, Hyperactivity and ODD. However, a significant effect of time was found for externalizing symptomatology and ODD. These two variables followed the same pattern, that is not surprising considering their very high correlation ($r = .82$, $p < .001$). Their scores decrease between T1 and T2 (i.e., from September to January). It is likely that this effect was caused by institutional rules at the beginning of the year. After the end of the summer, during which a large part of the adolescents returned to their families, they had to reintegrate the rules established by their educators and the institution. This learning is important and largely based on behavioral methods such as operant conditioning.

Secondary analyses revealed that girls in the MBI group benefited more from the intervention on oppositional behaviors than boys when comparing their RCIs between T2 and T3, $t(46) = -2.24$, $p = .03$. It can be assumed that the lower level of externalizing symptomatology at baseline among girls facilitates a decrease in oppositional behaviors because they are less likely to be opposed to therapy and more compliant. It is also possible that, in girls only, an improvement in emotion regulation obtained by the MBI may lead to an improvement in oppositional behaviors as suggested by our previous model presented in the Figure 2.4 (Chapter 2). However, a cross-lagged model with repeated measure during the MBI would have been necessary to explore this hypothesis.

The absence of result concerning hyperactivity is not in line with the meta-analyses that showed a small to moderate effect size on this outcome (Cairncross & Miller, 2016; Chimiklis et al., 2018; Zhang, Díaz-Román, & Cortese, 2018). On the one hand, we can assume that our studies differ in many ways from the studies included in the meta-analyses. For example, Chimiklis et al. (2018) took in consideration yoga-based interventions, Zhang et al. (2018) included only two studies with youth and Cairncross and Miller (2016) took into account seven studies out of ten with less than twenty participants.

On the other hand, we can hypothesize that other characteristics of the adolescents play a moderating role on the outcomes such as the level of hyperactivity at baseline. Although the regressions analyses performed in Study#2 did not find that hyperactivity predicted an improvement during the MBI, secondary analyses conducted on age demonstrated that older adolescents (i.e., from the age of 15) in the MBI condition had a better improvement during the program than younger ones, $t(46) = 2.13$, $p = .038$. At first, the difference in terms of attentional capacities was hypothesized but analyses revealed that attentional capacities did not contribute to this effect: Youth with high and low levels of attentional capacities

measured by the d-2 at baseline did not differ on the Reliable Change Index of hyperactivity between T2 and T3, $t(45) = -.18$, $p = .85$. Hence, it is possible that other variables, such as motivation as we will see below, may affect this outcome. Finally, it is also possible that the effect of MBIs on hyperactivity has been overestimated in the literature or that the outcomes depend on other factors such as the inclusion of parents or the age of the participants. In this way, future research should focus on moderators of therapeutic efficacy.

In Study#1, an interaction between Time and Group was observed for externalizing symptomatology during the MBI. The difference with the results found for Study#2 could be coming from the population (only boys) but the Time*Group between T2 and T3 was non-significant according to the hierarchical model when only taking boys in Study#2, $F(2, 79) = .32$, $p = .72$. Although a significant difference was found between the two samples of the MBI on age, $t(70) = 2.65$, $p = .01$ (older participants in Study#1), the correlations between age and the RCIs of externalizing symptomatology between T2 and T3 were non-significant in both studies, excluding age as an explanation. In addition, no differences at baseline were found between the two samples for the shared variables ($p > .05$). Thus, this difference could be caused by factors that are not assessed by our study such as the individual characteristics of adolescents or educators. However, the absence of a fully randomized-control design and the small sample in Study#1 do not allow to refute Study#2 null results. Further research is needed to established the real effect of MBIs on externalizing symptoms reported by peers.

In view of these results, it seems likely that the effect of the MBI on externalizing symptomatology is small or non-significant. More generally, the literature has difficulty in taking a position on the effect of mindfulness on externalizing symptoms. Among the three studies close to our design and measuring externalizing symptomatology, all of them found a trend for the global score of externalizing symptomatology reported by the parents or the tutors (Bögels et al., 2008; Haydicky et al., 2012; Van de Weijer-Bergsma et al., 2012). This finding is in line with the mixed and incongruent results obtained for Study#1 and #2. Another possibility is that externalizing symptomatology is a too large concept and only some subdimensions of these symptoms are affected. Yet, the results of the SNAP-IV do not support this hypothesis. In the same way, it is important to note that most studies in youth with behavior disorders that assessed hyperactivity were conducted on young children or adults (Behbahani, Zargar, Assarian, & Akbari, 2018; Lo et al., 2017; Van der Oord, Bögels, & Peijnenburg, 2012). Only one study was identified among adolescents and did not found an effect of the MBI on hyperactivity (Haydicky et al., 2015). Thus, it cannot be excluded that MBIs have no effect on hyperactivity in adolescents with behavior disorders. Similarly, when a control group was used, no changes were observed in ODD and CD symptoms in adolescents (Haydicky et al., 2012) while a positive change was observed in absence of a control group (Haydicky et al., 2015). An alternative explanation of the MBI inefficacy is the relatively low motivation to practice mindfulness in this specific population. Indeed, externalizing symptoms and vindictiveness at adolescence make the mindfulness practice more difficult (because it may seem boring, pointless, too difficult, or unpleasant) and, thus, create a vicious circle. Although the participation in the program was on a voluntary basis,

there was often a difference between the adolescents' expectations about the content of the intervention (wanting a relaxing effect) and the mindfulness exercises, which were not always pleasant and easy. Therefore, the amount of practice (or its quality) during the program might had been not sufficient to impact externalizing symptoms. Thus, future studies should take formal measures of the mindfulness practice time.

2.2.3 Attentional capacities and mindfulness

Attentional capacities were measured by one questionnaire and one attentional task: the inattention subscale of the SNAP-IV and the d2-R task. The results at the mindfulness questionnaire, conceptually associated with attention, were also investigated in this section.

Contrary to the results obtained in the literature (see for example: Bögels et al., 2008; Van de Weijer-Bergsma et al., 2012; Van der Oord et al., 2012; Zylowska et al., 2008), no significant results were found for inattention subscale of the SNAP-IV in Study#1. However, the results in Study#2 showed that the MBI had a protective effect against an increase of inattention. The mindfulness exercises performed during the program, such as breath awareness, may help adolescents to stay attentive to what is happening in the present moment. The training of this ability could help adolescents stay concentrated on their tasks, or to remember what is important to do. These specific behaviors may have been noticed by their educators. However, the absence of a clear decrease during the MBI is still questionable. Again, a more intensive training may be needed. In this way, a follow-up would have been an advantage in determining the evolution of this outcome over time.

Concerning the d2-R task, a significant interaction between Time and Group was found in Study#2 during the MBI (this measure was not used in Study#1). This result indicates that adolescents of the MBI condition improved more significantly their capacity to identify and cross out appropriate symbols with fewer errors than the TAU and the HP conditions. More interestingly, this finding was obtained with a behavioral task, that is to say an objective measure. Thus, adolescents could not claim to be able to perform better at this task without actually doing so. To some extent, this removes the inherent limitation of self-report questionnaires where adolescents can pretend to be attentive while it is not the case. This result is consistent with a large number of studies demonstrating the solid evidence for the positive effect of MBI on attention in youth with behavior disorders (Bögels et al., 2008; Zhang et al., 2018). Studies using other attentional tasks, such as the Attention Network Test, found similar results with a redundant pattern that indicates less monitoring conflict and less mistakes (Kiani, Hadianfard, & Mitchell, 2017; Lo et al., 2017; Van de Weijer-Bergsma et al., 2012; Zylowska et al., 2008). Even studies using EEG indices found an improvement in attentional ability after a MBI compared to a waitlist control group among ADHD adolescents (Sibalis et al., 2017). However, the effect size may be altered by other factors than formal practice of mindfulness (such as games that were used in the program, as psycho-educative or training tools). Indeed, a study showed that mindfulness silence alone produced better enhancement of attentional capacities than mindfulness silence plus cooperative play

(Berto & Barbiero, 2016). On the one hand, it is possible that the agitation of adolescents between the formal exercises of mindfulness (i.e., during games and stories related to mindfulness) may reduce the psychological benefits of the program. On the other hand, the absence of games associated with theoretical concepts of mindfulness would probably have reduced adolescents' understanding and motivation. Of note, secondary analyses revealed that the RCI of the d2 was correlated to the RCI of Sad-Mood subscale between T2 and T3 ($r = .36$, $p = .01$) and that oppositional behaviors at T1 was correlated to an improvement of the d2 between T2 and T3 for the MBI group ($r = .35$, $p = .018$), suggesting that adolescents with higher oppositional behaviors could benefit more from the MBI than adolescents without oppositional behaviors on attentional capacities.

Overall, the improvement of attentional capacities thanks to the MBI could help adolescents with behavior disorders to integrate more details of their daily life environment. To understand the clinical implications of this result, here is a very simple example from a real experience. An educator asked to an adolescent boy to take off his shoes. The adolescent started doing it but stopped when his friend arrived and forgot to finish what he had started by walking with his shoelaces untied. Obviously, this can be dangerous for him to fall but it was not the most important element here. Actually, when the educator who told him to take off his shoes saw that he had not, he became more authoritative towards him. This attitude, although necessary, may lead to negative feelings for the adolescent and can also be interpreted as an aggression (of note, mindfulness non-judgment can also play a moderating role at this point). If the youth had been a little more attentive by finishing what he had started, he could have avoided this negative feedback. Therefore, attentional capacities could indirectly affect interpersonal relationships and internalizing symptomatology. Another example is the influence of an improvement in attentional capacities on academic performance, which is associated with self-esteem. This hypothesis is supported by the significant correlation between the RCI of internalizing symptomatology and the RCI of the d2-R performance between T2 and T3 for the MBI condition, $r = .31$, $p = .037$. However, it is not possible to confirm a causal association due to the correlational nature of the data (i.e., an improvement of attention leads to an improvement of internalizing symptomatology). Intermediate assessments between T2 and T3 should have been performed. Concerning the one-year follow-up, secondary analyses between T3 and T4 revealed an main effect of Group, indicating a difference between the MBI condition and the TAU condition, $F(2,132) = 4.06$, $p = .019$. More interestingly, results suggest an increase in MBI ($M3 = 125.08$, $SD3 = 5.93$; $M4 = 130.38$, $SD4 = 6.13$) and HP ($M3 = 114.53$, $SD3 = 6.31$; $M4 = 123.14$, $SD4 = 7.42$) groups and a decrease in TAU group ($M3 = 106.29$, $SD3 = 5.48$; $M4 = 102.40$, $SD4 = 7.82$). This finding suggests that the benefits of the MBI on the attentional task are preserved after one year. However, the low sample size in T4 ($n = 29$[MBI]; $n = 13$[HP]; $n = 11$[TAU]) does not allow definitive conclusions to be drawn. One alternative hypothesis to the increase after one-year follow-up in the MBI and HP groups is that both interventions enhance self-awareness. In the MBI, self-awareness was developed thanks to body-awareness whereas in the HP group self-awareness was developed by considering one's own needs, making choices and arguing against the opinion of others.

A self-report questionnaire was also used to measure mindfulness. Theoretically, mindfulness can be seen as an outcome (i.e., the capacity to be in the present moment without judgment). Nevertheless, mindfulness can also be viewed as a concept very close to the psychological process named self-awareness (i.e., the capacity to be aware of its emotions and thought; Boden, Irons, Feldner, Bujarski, & Bonn-Miller, 2015; Philippot & Segal, 2009). In this way, mindfulness will be considered as an outcome in this section but its role as a psychological process will also be discussed in a next section.

Among the previous studies that assessed mindfulness changes, one study found a positive effect of MBIs (Bögels et al., 2008) while one other, with a similar design, did not (Van de Weijer-Bergsma et al., 2012). In Study#2, results indicated that mindfulness scores increased between T2 and T3 for all groups. Contrary to our hypothesis, MBI did not succeed to differ from the other groups in terms of mindfulness benefits, which is quite surprising. Moreover, the fact that the increase only occurred between T2 and T3 is difficult to interpret. It is possible that the therapeutic care provided by and the rules set up by the staff of the institutions themselves may take time to be integrated by the adolescents. Indeed, it is unlikely to observe significant and spontaneous improvements in mindfulness in this population. Another hypothesis is that the CAMM questionnaire has several dimensions and these dimensions could evolve differently in each group. However, secondary analyses did not support this hypothesis (no differences between the dimensions of the two-level factor structure).

No changes were found on this questionnaire after the one-year follow up. We firstly hypothesized that formal practice of mindfulness was one of the most important factors that affect this outcome but results on continuity of practice did not confirm this assumption, at least for the follow-up. No correlations were found between mindfulness improvement and practice continuity between T3 and T4. In addition, it is important to note that the internal consistency of the questionnaire was questionable ($\alpha = .63$) and may have led to some inconsistencies.

2.2.4 Moderating effect of age and gender

In addition to these findings, some moderators were investigated. Age seems only impacted the hyperactivity dimension of externalizing symptomatology in Study#2, with a better decrease in late adolescence compared to early adolescence. This result can be explained by the fact that older adolescents have a more advanced cognitive development and can allocate greater cognitive resources to the exercises. However, age did not impact the scores at the attentional measures. While a meta-analysis found that adults had better outcomes for executive functions than children and that children had better results on negative behaviors than adults (Dunning et al., 2018), other studies failed to find an effect of age on MBI outcomes during adolescence (Dawson, 2019; Van der Gucht, Takano, Kuppens, & Raes, 2017; Zoogman, Goldberg, Hoyt, & Miller, 2015). Therefore, at this stage, it is not

yet possible to determine the actual role of age differences in adolescence on the effects of MBIs.

As regards gender, the general results suggest no moderation effect (see Study#2). However, specific investigations indicated that girls in the MBI condition had better improvements than boys on anxiety and oppositional behaviors. This result is in line with the study of Bluth et al. (2017), which found that adolescent girls reported less stress than boys after a MBI. Since girls are more likely to use internalizing strategies to deal with their stress (e.g., rumination), it is possible that they can benefit more from MBIs. Yet, considering the small sample of Bluth et al. (2017) and the absence of results on the other measure of internalizing symptoms in our studies, further research is needed to establish the moderating role of gender.

2.3 Psychological processes

— What are the psychological processes involved in the improvements observed in the MBI condition?

It was hypothesized that the positive changes observed in the MBI condition were partly due to an effect of mindfulness on impulsivity. In Study#1, a significant Time*Group interaction between T2 and T3 indicated a decrease in impulsivity in the MBI condition, which brings partial support for this assumption. However, no mediating effects of impulsivity and its subscales were found on the association between the MBI and externalizing symptomatology during the MBI for the experimental group. In addition, no significant effects were found in Study#2 (including for the one-year follow-up). These findings suggest that MBIs might have no impact on impulsivity (or only a small one), which is not consistent with the literature. Indeed, several studies reported a positive effect of mindfulness on impulsivity (Cairncross & Miller, 2016; Deplus et al., 2016; Franco, Amutio, López-González, Oriol, & Martínez-Taboada, 2016). Yet, this finding could be firstly explained by the fact that numerous studies link hyperactivity with impulsivity as recommended by the DSM-V although we saw that these two variables can be distinguished (i.e., the first one can be considered as an outcome and the second as a psychological process). But even in the case of this conceptual differentiation, our studies did not find different results for hyperactivity. A second hypothesis is that MBIs have an impact on impulsivity but our studies failed to reveal this effect due to several limitations such as the low internal consistency of the questionnaire (<.60) that assessed impulsivity (UPPS-P). Moreover, this variable may be difficult to capture by self-report questionnaires. That is why two behavioral tasks were added to further assess impulsivity.

No significant results were found for the waiting task. Participants in the MBI condition did not show better performance to this task after the MBI than the HP and TAU conditions. Although non-significant, the means observed in this task indicated that participants in the

MBI group increased their performance by 17 seconds (M2 = 79.46, SD2 = 13.41; M3 = 96.46, SD3 = 12.56) while the HP group increased their performance by 7.59 seconds (M2 = 93.18, SD2 = 15.13; M3 = 100.77, SD3 = 14.17) and the TAU group decreased their performance by 6.97 seconds (M2 = 97.97, SD2 = 11.36; M3 = 91, SD3 = 10.64). Given the low sample size for this task (89 participants divided into three groups), it is possible that a lack of statistical power may lead to these non-significant results. This result is consistent with the findings of Sibalis et al. (2019). They demonstrated that ADHD adolescents who participated in a mindfulness-based martial arts intervention improved their attentional abilities (EEG measures and Go-No Go task) but did not change their neuronal activity at a rest task, which consisted of closing their eyes and staying at rest, compared to a control group. Overall, studies that used behavioral tasks, such as the d2-R or the Stroop's task, found a positive impact of mindfulness training on these tasks (Bögels et al., 2008; Kiani et al., 2017). However, this raises another conceptual consideration: Does the waiting task measure impulsivity or attention (or even other variable such as hyperactivity)? When looking at the correlations between the performance at this task and the other outcomes, the results are quite surprising. Indeed, the performance on this task is neither associated with self-reported impulsivity nor mindfulness but it is positively associated with the performance on the d2-R and also hyperactivity and inattention. Although the positive correlation with the d2-R was expected ($r = .34$, $p < .001$), and demonstrates that the task may also assess attentional capacities, the low, significant, and positive association with hyperactivity ($r = .19$, $p = .014$) and inattention ($r = .16$, $p = .045$) reported by the educators is unexpected. One hypothesis is that, thanks to their motivation, adolescents with high levels of hyperactivity who need to concentrate on a very short and simple task are able to perform better because they allocate all their energy to the task. However, this behavior requires real efforts, which could lead to a temporary increase in hyperactivity and inattention after the task.

Similarly, no significant effects were found for the cookies task. Correlations revealed that this task was only associated with the performance at the d2-R ($r = .21$, $p = .007$) and the waiting task ($r = .21$, $p = .015$). This result is consistent with the lack of significant results obtained for impulsivity and for the waiting task.

Overall, it is important to note that the tasks were not validated and the sample size was small. Moreover, the UPPS-S questionnaire had not a good internal consistency in our study. Globally, impulsivity seems to be a psychological process difficult to assess in this population. Since a positive effect was observed in Study#1 but not in Study#2, the role of impulsivity remains unclear. Moreover, the absence of significant results at one-year follow-up may also indicate that time does not bring additional benefits. On the one hand, other psychological processes, that can also affect impulsivity, may be more central in MBIs. On the other hand, longer practice time may be needed to observe positive effect on impulsivity but this objective is difficult to achieve given the difficulties encountered by this clinical population. Hence, additional studies with larger sample sizes and other measures are required to test the role of impulsivity in MBIs.

No measures of self-awareness were used in this thesis. However, mindfulness could also be considered as a psychological process associated with the benefits observed in the MBI. To test this hypothesis, the correlations between the RCIs of the CAMM and the other questionnaires were investigated between T2 and T3. Interestingly, results indicated that the RCI of mindfulness in the MBI were associated with the RCIs of general depressive symptomatology ($r = .36$, $p = .012$), impulsivity ($r = .29$, $p = .04$), anxiety ($r = .32$, $p = .025$), and sad-mood ($r = .43$, $p = .002$) while it was only associated with general depressive symptomatology ($r = .27$, $p = .016$) and anxiety ($r = .25$, $p = .03$) in the two other conditions. This finding suggests that the increase of mindfulness in the MBI group is more related to positive outcomes than the increase in mindfulness in the HP and TAU groups. Although this difference is difficult to interpret, the global association between the improvement in mindfulness and the improvement in depressive symptomatology and impulsivity may indicate that an increase in mindfulness leads to positive changes. It is also possible that an improvement in depressive symptomatology and impulsivity lead to an increase in mindfulness. A study conducted in adults with ADHD suggests that mindfulness, as well as its subdimensions, may not mediate the positive impact of MBIs on ADHD symptoms and mental health at 6-month follow-up (Geurts, Schellekens, Janssen, & Speckens, 2020). On the contrary, self-compassion and inattention could be ones of the mediators that impact positive mental health. In female adolescents with ADHD, emotion regulation, and particularly an enhancement of nonacceptance of emotion responses, could be a mediator of MBIs among adolescents with behavior disorders (Kiani et al., 2017).

Since no questionnaire of mindfulness facets was used in the studies, it is difficult to precise the specific facets of mindfulness that significantly impact the outcomes (i. e., observation, description, acting with awareness, nonjudgment, non-reaction). However, from a clinical point of view, adolescents who develop a non-judgmental mindset may benefit greatly from MBIs. Indeed, a decrease in automatic judgments could not only lead to a reduction in judgment of one's own emotions (self-deprecation), but also to a reduction in judgment towards others (more tolerance). However, this assumption needs to be supported by experimental data. Only two sessions had been dedicated to non-judgment in our program, which may not be enough to appreciate the benefits of non-judgment.

Overall, further research is needed to establish whether mindfulness plays a central role in MBIs by affecting self-reported internalizing symptomatology and if other psychological processes, such as emotion regulation, could play a major role in MBI efficacy.

3. General Conclusion

Previous studies on MBIs among youth with behavior disorders present numerous limitations such as no assessment of internalizing symptomatology, small sample sizes, no follow-up, no control or active control groups or no randomization of participants. In the same way, meta-analysis included studies that assessed different kind of interventions (e.g.,

family-based interventions, yoga interventions), at different ages (e.g., young children, adults), and often limited to ADHD diagnosis (Cairncross & Miller, 2016; Chimiklis et al., 2018; Evans et al., 2018; Zhang et al., 2018). In this context, this thesis aimed to investigate the feasibility, the efficacy and the psychological processes of a MBI that did not require the involvement of peers or parents among a specific population of adolescents who suffered from behavior disorders compared to standard institutional treatment. A quasi-experimental design was used in Study#1 and a randomized-controlled trial was used in Study#2.

The results suggest that MBIs are feasible and globally well-accepted by adolescents with behavior disorders. However, adolescents who present high level of externalizing symptoms may be more likely to disapprove of the intervention and leave it. In addition, the therapeutic context must be well thought out. Therefore, other treatments, or individual sessions of mindfulness, may be more suitable for adolescents with very high level of inattention, hyperactivity and oppositional behaviors.

Compared to institutional treatment, MBIs are useful to improve attentional capacities of adolescents with behavior disorders but further research is needed to establish its role in enhancing other outcomes such as depressive symptomatology, hyperactivity and oppositional behaviors. Depressive symptomatology decreases in the MBI group as well as in the TAU and HP groups. Conversely, mindfulness increases in the three groups. Therefore, the institutional treatment of Residential Service for Youth may provide psychological benefits to adolescents that may also limit the effect size of benefits achieved through the MBI. For example, it is possible that one important factor, common to all interventions for adolescents with behavior disorders who often feel distress about their disorders, is the social support and especially the fact that the adolescents feel that health professionals want to help them.

Contrary to what was expected, hyperactivity and oppositional behaviors may not be affected by MBIs in the short-term for adolescents. Because previous studies suggest that MBIS positively impacted these outcomes in children and adults with behavior disorders, this result may be related to the period of adolescence when youth are less compliant and motivated. However, the evolution of these variables after the intervention, and their association with mindfulness practice, should be explored in future studies.

In addition, age does not seem to have an impact on the MBI outcomes, which could mean that both younger and older adolescents with behavior disorders could benefit from MBIs. However, it might be that girls who participate in a MBI improve better on anxiety and oppositional behaviors than boys.

No psychological processes were identified in our studies, and impulsivity may have a less important role than previously suggested. Emotional processes, such as regulation of

positive and negative emotions (e.g., acceptance or suppression of emotional experience), should be investigated in future studies (Deng, Gao, Zhang, & Li, 2020; Young, Sandman, & Craske, 2019). Also, it is important to remember that, given their context of social precariousness, this population presents intellectual and self-awareness difficulties that can affect the validity of the self-report questionnaires. Indeed, the questionnaires that assessed impulsivity and mindfulness presented low internal consistencies, which prevents from drawing any definitive conclusions and limit the validity of using questionnaires that assess emotional processes.

In conclusion, MBIs for adolescents with behavior disorders (1) could be implemented to specifically target an increase in the attentional capacities, (2) might be more appropriate for girls, (3) should be complementary to evidence-based treatments for adolescents with behavior disorders or institutional care, and (4) may not be suitable for adolescents with very high externalizing symptomatology. Overall, the thesis shows that MBIs should be considered as second-line treatments for adolescents suffering from behavior disorders.

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