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Non-Suicidal Self-Injury in Adolescence and Emerging Adulthood: Role of Identity Formation in Belgium and India

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Gandhi Amarendra. Non-suicidal self-injury in adolescence and emerging adulthood: Role of identity formation in Belgium and India.

Supervisor : Prof. Dr. Laurence Claes
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Non-Suicidal Self-Injury (NSSI) is defined as the intentional and direct injuring of one's own body tissue without suicidal intent (Nock, 2009). Given that approximately 17.2% of adolescents and 13% of young adults report a history of NSSI (Swannell, Martin, Page, Hasking, & St John, 2014), it is being increasingly identified as an important mental health concern. Few studies to date have examined NSSI in relation to the core developmental task of adolescence, that is, identity formation. Additionally, insight in the prevalence and developmental associations of NSSI in non-Western countries (such as India) is still lacking (Gholamrezaei, De Stefano, & Heath, 2015). To address these gaps in the literature, the present PhD dissertation explored the association between NSSI and identity formation. We also investigated composite models combining antecedent factors (e.g., temperament, attachment) and identity formation and NSSI, to better understand NSSI. Finally, we also explored NSSI from a cross-cultural perspective.

Chapter 1 briefly introduces the theoretical framework that grounds the present PhD dissertation and provides a short overview of the manuscripts included. ***Chapter 2*** investigates the distribution of age of onset of NSSI in a pooled sample of Dutch-speaking adolescents and emerging adults. The findings of the study indicated that the probability of age of onset peaked around the age of 14-15 years in both community and psychiatric samples. A second peak was observed around the age of 20 and 24 years in the community and psychiatric samples, respectively. ***Chapter 3*** examines the relation between NSSI and identity distress in specific domains. We found that adolescents engaging in NSSI showed higher distress in domains of long-term goals, friendship, sexual orientation and behavior, values and beliefs. ***Chapter 4*** explores the directionality of effects between NSSI and identity synthesis/confusion using a longitudinal study design. Cross-lagged analyses indicated that associations between NSSI and identity synthesis and confusion are likely to be bi-directional. ***Chapter 5*** tests if the association between temperamental traits and NSSI is mediated by identity synthesis/confusion. The main findings of the study were: effortful control moderated the pathway between Behavioral Inhibition System (BIS) and NSSI; and Identity synthesis mediated the pathway between BIS and NSSI. In ***Chapter 6***, we investigate if identity synthesis/confusion mediated the association between dimensions of adolescents' attachment with mother/peers and NSSI. Mediation analyses indicated that pathways between peer/maternal trust and maternal alienation and NSSI were fully mediated by both identity confusion and synthesis. The association between peer alienation and NSSI was partially mediated by a lack of identity synthesis. ***Chapter 7*** briefly reviews the existing NSSI research in India. ***Chapter 8*** presents findings of a cross-cultural comparison of NSSI and its relation to identity formation between India and Belgium. Age of onset, functions, and methods of NSSI differed between the two countries. Additionally, associations between NSSI and identity variables were found to be stronger in Belgium than in India. ***Chapter 9*** summarizes the key findings and also discusses the strengths and limitations as well as directions for future research. Finally, we also discuss clinical implications of our findings.

Gandhi Amarendra. Zelfverwondend gedrag in de adolescentie en de jongvolwassenheid: De rol van identiteitsvorming in België en India.

Supervisor : Prof. Dr. Laurence Claes
Co-supervisor : Prof. Dr. Koen Luyckx and Prof. Dr. Shubhada Maitra

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Zelfverwondend gedrag (ZVG) wordt gedefinieerd als het opzettelijk en direct toebrengen van fysieke schade aan het eigen lichaam zonder de intentie om zichzelf van het leven te benemen. (Nock, 2009). Ongeveer 17.2% van de adolescenten en 13% van de jongvolwassenen rapporteren een geschiedenis van ZVG (Swannell, Martin, Page, Hasking, & St John, 2014), waaruit blijkt dat ZVG een toenemend en belangrijk gezondheidsprobleem is. Weinig studies hebben het verband onderzocht tussen ZVG en een belangrijke ontwikkelingstaak in de adolescentie, namelijk de identiteitsvorming. Verder is er weinig onderzoek over het voorkomen en de ontwikkeling van ZVG in niet-westerse landen (zoals bv. India) (Gholamrezaei, De Stefano, & Heath, 2015). Om deze leemten in de literatuur te vullen, exploreerden we in dit doctoraatsproefschrift het verband tussen ZVG en identiteitsvorming. We onderzochten eveneens modellen waarin we naar het verband keken tussen antecedente factoren (bv. temperament, hechting), identiteitsvorming en ZVG, om zodoende ZVG beter te begrijpen. Tenslotte bestudeerden we ZVG vanuit een cross-cultureel perspectief.

Hoofdstuk 1 beschrijft het theoretisch kader waarop de studies uit dit doctoraatsproefschrift gebaseerd zijn en er wordt een kort overzicht geboden van de verschillende manuscripten in dit proefschrift. ***Hoofdstuk 2*** onderzoekt de verdeling van de aanvangsleeftijd van ZVG in een grote samengestelde steekproef van Belgische adolescenten en jongvolwassenen. De resultaten toonden aan dat ZVG piekt rond de leeftijd van 14-15 jaar, zowel in bevolkings- als in psychiatrische steekproeven. Een tweede piek werd geobserveerd rond de leeftijd van respectievelijk 20 en 24 jaar in de bevolkings- en een psychiatrische steekproef. ***Hoofdstuk 3*** onderzoekt de relatie tussen ZVG en identiteits*distress* in specifieke domeinen. We vonden dat adolescenten die ZVG stelden meer stress rapporteerden met betrekking tot lange-termijn doelen, vriendschap, seksuele oriëntatie en gedrag, waarden en overtuigingen dan adolescenten zonder ZVG. ***Hoofdstuk 4*** exploreert de richting van het verband tussen ZVG en identiteitssynthese/diffusie met behulp van een longitudinale studie. *Cross-lagged* analyses toonden aan dat de associaties tussen ZVG en identiteitssynthese en -diffusie bi-directioneel bleken te zijn. In ***Hoofdstuk 5*** onderzoeken we of de associaties tussen temperamentsdimensies en ZVG gemedieerd worden door identiteitssynthese/diffusie. De belangrijkste bevindingen van deze studie kunnen als volgt samengevat worden: *effortful control* modereert de relatie tussen het gedragsinhibitiesysteem (BIS) en ZVG; en identiteitssynthese medieert het verband tussen BIS en ZVG. In ***Hoofdstuk 6*** onderzoeken we of identiteitssynthese/diffusie de relatie tussen hechting ten aanzien van moeder/leeftijdsgenoten en ZVG medieert. De resultaten van de mediatieanalyses tonen aan dat de verbanden tussen respectievelijk 'vertrouwen ten aanzien van moeder/leeftijdsgenoten' en 'vervreemding ten aanzien van moeder' en ZVG volledig gemedieerd werden door identiteitsdiffusie en –synthese. De relatie tussen 'vervreemding ten aanzien van leeftijdsgenoten' en ZVG werd partieel gemedieerd door een gebrek aan identiteitssynthese. In ***hoofdstuk 7*** geven we een kort overzicht van de studies over ZVG in India. ***Hoofdstuk 8*** schetst de bevindingen van de cross-culturele vergelijking van ZVG en de relaties tussen ZVG en identiteitsvorming tussen India en België. De aanvangsleeftijd, de functies en de methoden van ZVG verschilden tussen beide landen. Verder bleken de associaties tussen ZVG en de identiteitsvariabelen sterker in België dan in India. In ***hoofdstuk 9*** worden de belangrijkste bevindingen samengevat en bespreken we de sterktes en beperkingen van het onderzoek en geven we aanbevelingen voor verder onderzoek. Tot slot bespreken we de klinische implicaties van onze bevindingen.

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General Introduction

Chapter 1.

Non-Suicidal self-injury in adolescence and emerging adults: Theoretical framework and research objectives.

1. Introduction

In the present doctoral dissertation, we investigated non-suicidal self-injury (NSSI) and its association with identity formation in adolescents and young adults. Both NSSI and identity formation have been shown to be influenced by intra-personal (e.g., temperament) and inter-personal factors (e.g., maternal and peer attachment; Nock, 2009; Pittman, Keiley, Kerpelman, & Vaughn, 2011; Shiner & Caspi, 2012), Therefore, we additionally investigated composite models that combined NSSI, identity, and intra- and interpersonal factors. In the following chapter, we present a general theoretical framework within which the present doctoral research is grounded. First, we define NSSI and then briefly review some of its epidemiological features like lifetime/one-year prevalence, and age of onset. Second, we discuss Erikson's theory of identity formation as it is central to understanding the overall project. We also summarize the existing evidence supporting the association between NSSI and identity. Third, we review how intrapersonal (like temperament) and interpersonal (like attachment) factors can influence both identity and NSSI. Fourth, we outline the existing cross-cultural research on NSSI and enumerate the need for further studies in this domain. Finally, we conclude the introduction section by providing a short overview of the manuscripts included in the dissertation.

2. Defining NSSI

NSSI among adolescents and young adults is eliciting increased attention and concern. NSSI refers to the intentional and direct injuring of one's own tissue without suicidal intent (Nock, 2009) which is not socially sanctioned. Although a vast range of behaviors fall under the umbrella of NSSI, the commonly reported forms of NSSI include self-cutting, self-hitting, self-burning, and head-banging. Individuals who engage in NSSI are more likely to experience psychiatric disorders such as depression, anxiety, and suicidality, and features of borderline and other personality disorders (Klonsky & Olino, 2008). Repeated engagement in NSSI can lead to scaring and secondary infections which can in turn lead to feelings of guilt and shame. The scarring, guilt, and shame can also lead to isolation from others. Research has identified a variety of reasons for NSSI, including affect regulation, self-punishment, avoidance of acting on suicidal impulses, reducing dissociation or experiences of depersonalization, and establishment of one's self as autonomous and distinct from others (Klonksy, 2009). NSSI was

recently included in the DSM-5 (American Psychiatric Association, 2013) under the heading "Conditions that require further research" and may eventually become a formal diagnostic category.

3. Epidemiology of NSSI

In the Western population, approximately 5.5% of the adult population report engaging in at least one episode of NSSI in their lifetime (Swannell, Martin, Page, Hasking, & St John, 2014). In comparison to adults, approximately 17.2% of adolescents and 13% of young adults report a history of one or more NSSI behaviour(s) (Swannell et al., 2014) during their lifetime. NSSI appears to be more common among adolescents and young adults. One-year prevalence of NSSI has been reported to be around 7.3% (Taliaferro, Muehlenkamp, Borowsky, McMorris, & Kugler, 2012). Additionally, many studies report that females are more likely to engage in NSSI than males (Bresin & Schoenleber, 2015), whereas other studies find that males are equally likely to self-injure as females (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). These variations are accounted for by the type of NSSI studied (e.g., males are more likely to engage in self-battery, whereas females are more likely to report scratching/cutting) or the frequency of the NSSI (e.g., women are more likely than men to report repeated acts of NSSI; Whitlock et al., 2008).

In spite of the presence of a large volume of research reporting the lifetime/one-year prevalence of NSSI, one of the key epidemiological concept – the distribution of the age of onset of NSSI – has largely remained unexplored so far. The age-at-onset distribution can be defined as a plot of age-specific probability of manifestation of a disease (Chen, Faraone, Orav, & Tsuang, 1993). Understanding the distribution of age of onset of NSSI can provide insight in the age range during which the probability of first NSSI peaks. Individuals in the at-risk age can be subsequently targeted for prevention and research efforts. As far as we are aware, studies specifically targeting age of onset of NSSI are lacking in the extant literature. Most studies on NSSI generally report only the mean age of onset of NSSI which is known to be around 15-17 years (Plener et al., 2016; Whitlock, 2010). Although reporting mean age of onset is helpful to better understand NSSI, a mean value does not provide us with an additional information regarding the effect of time. Additionally, given that a mean does not take into account the effects of censored data, biased estimation of the true value of the effects cannot be refuted (Allison, 2014). Therefore, a probabilistic modelling of age of onset of NSSI may be urgently required.

4. Non-suicidal self-injury and Identity formation

The fact that the onset of NSSI and the process of identity formation both begin during adolescence may already be an indication that the two phenomena may be related. Yet, only a handful of researchers have systematically explored the association between NSSI and identity formation so far. Erikson's (1968) seminal lifespan theory views identity formation as a core developmental challenge which adolescents need to address on their way to adulthood (Kroger & Marcia, 2011; Luyckx, Goossens, & Soenens, 2006). For Erikson, identity refers primarily to a subjective feeling of sameness and continuity across time and across contexts, and it is best represented by a bipolar dimension ranging from identity synthesis to identity confusion. In addressing the identity task, each individual has to find a balance that favours synthesis over confusion. Identity synthesis refers to a reworking of childhood identifications into a larger and self-determined set of ideals, values, and goals; whereas identity confusion represents an inability to develop a workable set of goals and commitments on which to base an adult identity. Persistent identity confusion may be associated with both psychiatric symptoms and personality disorders (Demir, Dereboy, & Dereboy, 2009).

The association between NSSI and identity formation has been suggested in the literature on NSSI. For example, Podvoll (1969) proposed that patients engaging in NSSI may transform their symptoms into an identity (slashers, cutters, scratchers, etc.). Based on the observation of patients admitted in a psychiatric hospital, Podvoll reported that self-injuring individuals have an enduring feeling of emptiness and disbelief in their own growth potential. They often believe that the NSSI is all they possess and nothing else can substantially define their core sense of self. Podovll's observations have been echoed by a number of researchers. Asch (1979), for instance, also theorized that NSSI may serve as a way of counteracting a sense of emptiness and identity confusion. NSSI, according to Asch, serves as a means of investing in body-image and, consequently, in self-determination. Interestingly, more recent qualitative studies have drawn similar conclusions. Based on the online autobiographical accounts of NSSI, Breen, Lewis, and Sutherland (2013) concluded that NSSI may serve as a means of developing a sense of self-identity ("I am a self-injurer") by connecting with others who engage in similar behaviors. In line with the observations made by Podvoll (1969) and Asch (1979), Breen and colleagues (2013) also suggest that NSSI may provide a basic sense of a coherent self that can persist across time.

The studies reviewed so far imply an association between NSSI and social identity. A recent study by Claes and colleagues (2014) in a sample of high school students was one of the first studies to explore the relation between NSSI and identity from an Eriksonian perspective.

These authors found that NSSI was negatively associated with identity synthesis and positively associated with identity confusion. Further, when controlling for depression, age, and gender, the study found that identity confusion explained additional variance in NSSI. These findings were replicated by Luyckx, Gandhi, Bijttebier, and Claes (2015) in a sample of female high school adolescents and female psychiatric patients. Although existing research has established the association between identity formation and NSSI, a key issue with much of the literature is that it is based on cross-sectional research. Consequently, the directionality of the aforementioned associations remains unclear.

According to Erikson (1968), a successful resolution of identity crises can occur only if adolescents can self-reflect on and integrate some important domains of self (for e.g., vocation, religion, sexuality, etc.) in a coherent identity. If individuals are unable to achieve reconciliation of specific domain in the larger sense of identity, they may experience severe distress regarding that domain of self. This subjective feeling of distress over specific domains is termed as domain-specific identity distress (American Psychiatric Association, 1980). Although existing research indicates identity distress over sexual/gender identities are significantly associated with NSSI (Batejan, Jarvi, & Swenson, 2014; Arcelus, Claes, Witcomb, Marshall, & Bouman,.2016) the association of NSSI with distress experienced in other identity domains remains unexplored in adolescents. Identifying specific domains of identity distress associated with increased risk of NSSI can be further researched to develop targeted interventions that can aid in prevention and treatment of NSSI.

As previously mentioned, both NSSI and identity formation are likely to be influenced by the interplay of intrapersonal and interpersonal factors (Nock, 2009; Pittman, Keiley, Kerpelman, & Vaughn, 2011; Shiner & Caspi, 2012). Consequently, exploring composite models that combine identity formation and intrapersonal/interpersonal factors may be necessary to understand NSSI.

5. Intrapersonal and interpersonal factors that influence NSSI and identity formation

5.1. Antecedent intrapersonal factor: Temperament

Temperament is defined as constitutionally-based individual differences in reactivity and regulation in the areas of affect, activity, and attention (Rothbart, Ahadi, & Evans, 2000). Gray's (1991) Reinforcement Sensitivity Theory differentiates the temperamental system into the Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS). BIS is responsive to cues of threat and non-reward. Activation of BIS triggers anxiety that may serve to inhibit approach behavior in response to negative consequences and avoidance behavior (Gray, 1991). BAS is responsive to cues of reward and non-punishment (Bijttebier, Beck,

Claes, & Vandereycken, 2009). Activation of BAS triggers approach behavior to rewarding stimuli (Corr, 2008). Finally, regulative temperament or effortful control (EC) refers to the capability of modulating the reactivity of BIS and BAS so that a more adaptive behavioral response becomes possible (Derryberry & Rothbart, 1997).

Extant research on the association between BIS, BAS, EC, and NSSI has produced inconsistent results. For example, Jenkins, Seelbach, Conner, and Alloy (2013) found that the interaction between BIS and BAS significantly predicted NSSI. More specifically, they found that high scores on BAS and low scores on BIS or vice versa (high levels of BIS with low levels of BAS) predicted NSSI history. On the other hand, some studies have found only BIS (Baetens, Claes, Willem, Muehlenkamp, & Bijttebier, 2011) or BAS reactivity (Burke et al., 2015) to be associated with NSSI. From a theoretical perspective, investigating the influence of only BIS or BAS or their interaction on NSSI may not be sufficient as the effect of both BIS and BAS may be moderated by EC. Consequently, composite models that test the association of BIS/BAS and their interaction with EC are needed. As far as we know, only one study by Claes, Norré, Van Assche, and Bijttebier (2014) has explored such a model. These authors found that in eating disorder patients, the interaction of high BIS and low EC were associated with a higher probability of NSSI engagement. However, the model with integrated BIS/BAS and EC in the same model has not been tested in community samples.

The association between temperamental dimensions and identity formation has remained unexplored to date. However, given that both these constructs (temperamental dimensions and identity formation) are strongly related to the Big Five personality traits (Ozer & Benet-Martinez, 2006; Rothbart et al., 2000), some theoretical predictions can be made. It can be hypothesized that BIS (related to Neuroticism) may be negatively associated with identity synthesis, and positively with identity confusion. Further, BAS (related to Extraversion) and EC (related to Conscientiousness) may be positively associated with identity synthesis and negatively with identity confusion. In conclusion, the temperamental theory of Gray can offer a framework that can integrate biologically-based individual differences with developmentally relevant processes like identity formation to explain pathways leading to NSSI. However, an integrated perspective that combines these constructs has not been tested so far.

5.2. Antecedent interpersonal factor: Attachment

Like intrapersonal factors, interpersonal factors can also impact both NSSI and identity formation. Successful development through the adolescence has its basis in the context of secure and responsive family attachment (Lapsley, Rice, & FitzGerald, 1990). More

specifically, disturbances in three dimensions of parental attachment (alienation, trust, and communication) have been associated with NSSI. For example, in both cross-sectional and longitudinal samples, Yates et al. (2008) found that NSSI in adolescents was predicted by feelings of alienation between parents and adolescents. They further found that feelings of parental alienation, especially in males engaging in NSSI, were associated with a higher frequency of NSSI. Apart from alienation, trust and communication between adolescents and parents may also predict NSSI, as feelings of parental alienation could be a result of parental criticism and negative communication (Bureau et al., 2010). Like parents, peers also play an important role in the development of NSSI. Whereas a positive relationship with peers can lead to more well-being (Viner et al., 2012), peer networks also play an important role in the development of problematic behavior in adolescents (Antonishak, Sutfin, & Reppucci, 2005). For example, higher quality of communication with peers has been found to be associated with a lower probability of engaging in NSSI, especially in adolescent females (Hilt et al., 2008; Turner, Chapman, & Layden, 2012). A recent study by Yurkowski et al. (2015) in 1153 university students found that, although peer alienation predicted engagement in NSSI, it had less of an impact than parental alienation did. However, research exploring the associations between specific dimensions of attachment with peers and NSSI is still limited.

Attachment with parents and peers is also known to influence the process of identity formation. Based on the review of 29 longitudinal studies, Meeus (2011) found that a warm supportive relationship between parents and adolescents is positively associated with the formation of a more consistent and mature identity in adolescence. Meeus, Oosterwegel, and Vollebergh (2002) state that securely attached individuals are more likely to attain identity synthesis than their insecurely attached counterparts. Further, as compared to the vertical relationship (i.e., adolescents have less power than their parents) that adolescents share with their parents, a more horizontal relationship (i.e., adolescents have equal power) with peers can help adolescents in developing knowledge about the self (Hartup, 1989). Additionally, Meeus and Dekovic (1995) found that more than the parent-adolescent relationship, the quality of peer relationships may play a greater role in identity formation in a sample of high school and university students. A review of the current literature provides evidence that parental and peer attachment, identity formation, and NSSI may be associated. However, these associations have not been formally tested.

6. Cross-cultural comparison of NSSI and its association with identity formation

Almost all epidemiological statistics regarding NSSI cited so far are based on studies in the West as NSSI research in non-Western countries is mostly lacking. Additionally,

virtually no studies so far have compared NSSI between Western and non-Western countries. Cross-cultural comparison of NSSI can be useful in at least two ways. First, comparing epidemiology of NSSI between different countries may lead to a better understanding of the extent of the problem posed by NSSI. Second, cross-cultural comparison of how risk factors differentially influence NSSI in different cultures may help in identifying specific culturally relevant intervention mechanisms for targeting NSSI. Based on a review of 35 NSSI studies from non-Western countries, Gholamrezaei, De Stefano, and Heath (2015), have already reported that while some characteristics of NSSI remain similar throughout different cultures (e.g., prevalence rates, age of onset, and a preference for forms of NSSI), some differences in the characteristics and functions of NSSI are evident. For example, while individuals in the West engage in NSSI for the purpose of emotional regulation, individuals in the non-western cultures mainly engage in NSSI because of relational functions. However, the findings of Gholamrezaei and colleagues (2015) were not based on the comparison of data on NSSI between Western and non-Western countries. Therefore, further studies are required to confirm the suggestion by Gholamrezaei and colleagues (2015).

In the present work, we compared NSSI between India – predominantly an Eastern country and Belgium – predominantly a Western country. So far, only two studies have explored NSSI in India and these studies have reported somewhat conflicting findings. For example, the one-year prevalence of NSSI has been reported to range from 31% to 34% which is at least 27% to 30% higher than the global average. Large differences in one-year prevalence rates indicate that the available Indian estimates may be artificially elevated due to how information regarding NSSI was collected in these studies. Evidence regarding gender differences in NSSI were also conflicting. For example, whereas the study by Kharsati and Bhola (2015) reported a lack of any gender difference in one-year prevalence, Bhola and colleagues (2017) reported a higher one-year prevalence of NSSI in females than in males. However, consistent with the international literature, the age of onset of NSSI in India has been reported to be around 15.9 years (Kharsati & Bhola, 2015). Further studies may be required to better understand NSSI in India. On the other hand, although NSSI has been extensively studied in Belgian adolescents, so far, the study by Kiekens and colleagues (2016) is the only one that has explored NSSI in young adults. These authors found lifetime and one-year prevalence rates to be around 8% and 3%, respectively. Being female was also reported to be a higher risk factor for engaging in NSSI. In conclusion, apart from the gender distribution and age of onset, NSSI in young adults may differ significantly between India and Belgium. However, cross-cultural research is required to confirm these expectations.

Apart from the epidemiological differences, risk factors like disturbances in identity formation may also have a differential effect on the vulnerability to engage in NSSI depending on the culture one belongs to. For instance, distress associated with the lack of consistent sense of self – a hallmark of lack of identity synthesis or persistent identity confusion – does not seem to influence the Indian population as much as it may influence the Caucasian population. Given the strong multicultural and collectivistic nature of the Indian society, contradicting sense of selves and identities have been shown to be required to deal with diversity in beliefs, values, norms, and practices originating from varied religions, castes, and class hierarchies (Sinha, 2014). Consequently, ill-being or psychiatric symptoms (like NSSI) due to a lack of a consistent self and identity may be more likely in a Western context than in an Indian context. However, as previously mentioned, cross-cultural research is necessary to confirm these expectations.

7. Objectives of the present study

Based on the brief literature review presented above, it is clear that although significant research progress has been made in our understanding of NSSI, some important questions regarding epidemiology and risk factors of NSSI have remained unanswered (Prinstein, 2008). First, despite of the high volume of research on NSSI, almost no study so far has explicitly modelled the distribution of age of onset of NSSI. Second, in spite of the high prevalence of NSSI in adolescents, few studies to date have examined NSSI in relation to the core developmental task of adolescence, that is, identity formation. Third, from a methodological perspective, lack of longitudinal research is one of the most significant shortcomings of the extant NSSI literature. Fourth, insight in the prevalence and developmental pathways of NSSI in non-Western countries (such as India) is still lacking (Gholamrezaei et al., 2015).

The present work tries to address these shortcomings by investigating **four** broad objectives: (1) Investigating the distribution of age of onset of NSSI in a pooled sample of Dutch-speaking adolescents and emerging adults; (2) Examining the association between identity formation and NSSI in adolescents by making use of cross-sectional and longitudinal designs; (3) Investigating if identity formation functions as a potential mediator between intrapersonal/ interpersonal factors and NSSI; and (4) Examining NSSI, identity formation, and their association from a cross-cultural perspective. The overall theoretical model which we investigated is represented in Figure 1 below.

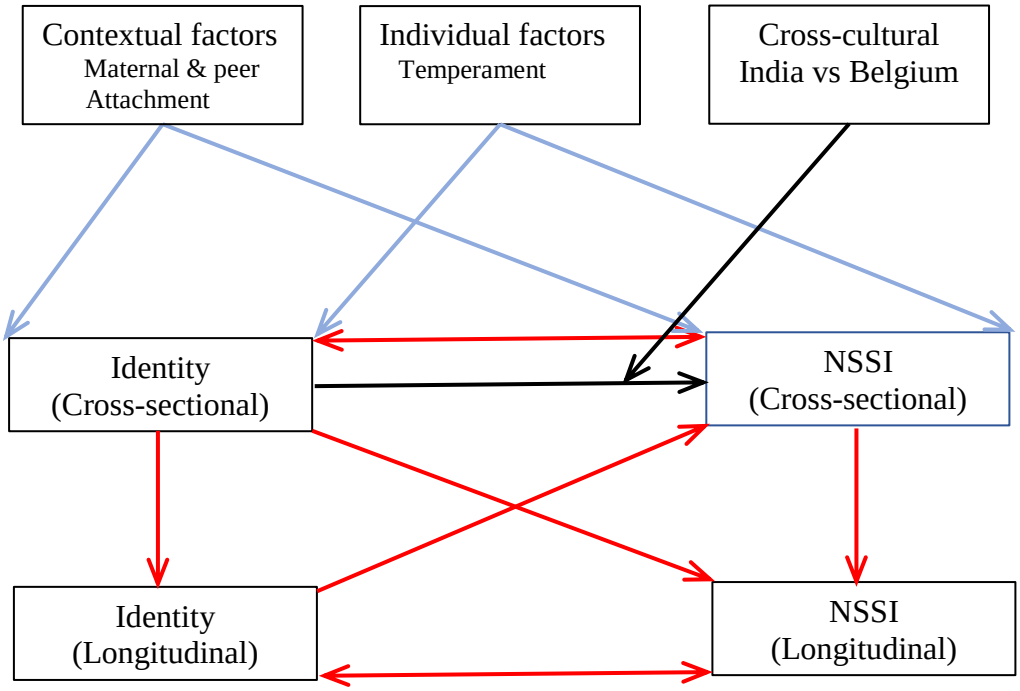


Figure 1. The theoretical model tested in the present PhD project. Objective 1 could not be presented in the figure. Pathways in red, blue, and black were for testing objectives 2, 3, and 4 respectively.

8. Outline of the thesis

The present PhD thesis is a collection of manuscripts that were written during the period 2014-2018. Given that each manuscript was expected to function as an independent text, significant overlap between the literature review presented in this chapter and the introduction section of each manuscript was unavoidable. The manuscripts in the present work have been arranged in four sections. The first section focuses on the epidemiological aspects of NSSI. The manuscripts included in the second section explore the association between identity and NSSI. The third section probes the interpersonal and intrapersonal antecedents to NSSI and identity formation. The fourth and the final section compares NSSI and its association with identity formation between India and Belgium.

In order to fulfil the first aim of this doctoral project, we investigated the age of onset distribution of NSSI using a discrete event analysis approach in Study 1 (Chapter 2). We also investigated the effect of gender and the presence of psychiatric disorders on the age of onset. The data for this study consisted of 11 pooled cross-sectional datasets. The final pooled dataset had 1,973 community males, 1,901 community females, and 505 clinical females. Overall, the findings of this study indicated that 21% of the participants from the community samples engaged in at least one episode of NSSI by the age of 25 years. Irrespective of the type of

sample (community or psychiatric disorder), the probability of age of onset peaked around the age of 14-15 years. A second peak was observed around the age of 20 and 24 years in the community and psychiatric samples, respectively.

Study 2 (Chapter 3) partially addressed the second aim of the project. The study had three aims. First, we examined if NSSI and identity distress in specific domains and the daily impairment accompanying this distress differed between male and female high school students. Second, we investigated if NSSI was influenced by distress on specific domains and the daily impairment due to this identity distress above and beyond age, gender, anxiety, and depression. Finally, we tested the hypothesis that gender differences in NSSI were mediated by gender differences in identity distress and related impairment. To fulfil these objectives, data were collected from high school students (n = 568; 61.8% female) studying in grades 9–12 from six different high schools located in different areas of the Flemish speaking part of Belgium. Mean age was 16.13 years (SD = 1.47, range = 13–21 years). Overall, the results indicated that it was not distress in specific domains as such but the impairment due to the daily impact of identity distress that explained additional variance in lifetime prevalence of NSSI above and beyond gender, age, depression, and anxiety. We also demonstrated that gender differences in lifetime prevalence of NSSI were mediated by differences in such identity impairment.

Data for studies 3, 4, and 5, described below, were a part of a single longitudinal study. Data were collected from students studying in a high school located in the Dutch speaking part of Belgium in three measurement waves. The first measurement wave was collected in the beginning of 2015 and the subsequent two waves was collected one year apart. Table 1. below provides the details regarding the year of data collection, sample sizes, mean ages, gender distribution, and attrition rate. Study 3 was based on the first and the second data waves. Studies 4 and 5 were based on the first wave of the data.

Table 1. Descriptive statistics (measurement waves 1 and 3)

Sr. no.	Data wave	Year	Sample size	Mean age (SD)	Age range	Gender distribution	Retention rate
1	Wave 1	2015	528	15 years (1.84)	11-19 years	50.4%	-
3	Wave2	2016	380	14.3 (1.68)	12-20 years	52.4%	72.07%

In Study 3 (Chapter 4), we investigated the directionality of effects between NSSI and disturbances in identity formation. As we used Erikson's psychosocial theory of development, disturbances in the process of identity formation were operationalised as a lack of identity synthesis and increased identity confusion. We also explored if identity synthesis and identity confusion differed among the control, cessation, onset, and maintenance NSSI groups over a period of one year. Our findings suggested that the associations between NSSI and identity synthesis and confusion are likely to be bi-directional. Mean differences in identity synthesis and confusion were also observed among control, cessation, onset, and maintenance NSSI groups.

Study 4 (Chapter 5) concentrated on the first part of the third aim of this study (intra-personal factor as an antecedent to identity and NSSI). In this chapter, we tested models that combined temperamental (BIS, BAS, EC) and identity variables to investigate how the interplay of two constructs relate to NSSI. The findings of the current study suggested that the association between BIS and NSSI was moderated by EC, such that higher levels of BIS and lower levels of EC predicted higher lifetime NSSI. Also, the association between BIS and NSSI was partially mediated by identity synthesis. The findings of the current study indicate that interventions that stabilize BIS reactivity, enhance EC, and promote identity synthesis may have important meaningful implications for the clinical management of NSSI.

In Study 5 (Chapter 6), addressed the second part of the third aim (influence of inter-personal factor on identity and NSSI). We investigated if the associations between dimensions of peer and maternal attachment and NSSI were mediated by identity synthesis and identity confusion. The findings of the study indicated that peer trust had a significant negative indirect effect on NSSI via identity synthesis and confusion. The positive association between peer alienation and NSSI was partially mediated by a lack of identity synthesis. Further, the pathways from maternal trust and alienation to NSSI were fully mediated by both identity confusion and synthesis.

Study 6 (Chapter 7) addressed the fourth aim of the PhD project. When reviewing the literature on NSSI in India, we noticed that the international confusion over using definitions of various forms of self-directed violent behaviours was also prevalent in Indian suicidology literature. Such a confusion can hamper assessment, treatment, and scientific communication. Therefore, in the present study, we reviewed definitions of various forms of self-directed violent behaviours investigated in India so far. We compared these definitions with present-day international usage. We also presented a brief review of NSSI related studies available in India so far.

Study 7 (Chapter 8) also addressed the fourth aim. In this chapter we compared different features of NSSI (one-year prevalence, age of onset, body parts injured, and functions of NSSI) between India and Belgium using a case-control approach. We also explored if the strength of the association between NSSI and disturbances in identity formation was similar in young adults in India and Belgium. We matched 132 young adults from India with the same number of young adults from Belgium on gender, age (with a variation of ± 1), and lifetime NSSI. Our findings indicated that some similarities (gender distribution and body parts harmed) and differences (one-year prevalence, age of onset, and methods of self-harm) between NSSI in India and Belgium. Moderation analysis indicated that the associations between NSSI and identity confusion/integration were stronger in the Belgian sample as compared to the Indian sample. Higher self-knowledge was protective against NSSI in both the Indian and the Belgian sample.

Finally, we present the general discussion in Chapter 9. In this section, an overview of the results is provided by contextualising them in existing research and theory on NSSI and identity formation. Clinical implications of the findings of the current research are also discussed. The discussion chapter was concluded by the limitations of the present work and identifying areas for further research.

Section 1: NSSI

Chapter 2.

Age of onset of non-suicidal self-injury in Dutch-speaking adolescents and emerging adults: An event history analysis of pooled data.

Gandhi, A., Luyckx, K., Baetens, I., Kiekens, G., Sleuwaegen, E., Berens, A., Maitra, S., & Claes, L. (2018)[1]

Abstract

Non-Suicidal Self-Injury (NSSI) has emerged as an important mental-health concern. However, epidemiological features like age of onset of NSSI have remained understudied. Therefore, the current study investigated the distribution of age of onset of NSSI in pooled sample of Dutch-speaking adolescents and emerging adults using event history analysis. Eleven datasets measuring age at first NSSI in community and clinical participants collected by researchers in the Dutch-speaking part of Belgium were pooled together. The final dataset consisted of 1973 community males, 1901 community females, and 505 clinical females. Discrete-time event history analysis was used to model the effect of gender and psychiatric disorders on the age of onset of NSSI. Twenty-one percent of adolescents from the community samples engaged in at least one episode of NSSI by the age of 25years. Irrespective of the type of sample (community or psychiatric disorder), the probability of age of onset peaked around the age of 14-15 years. A second peak was observed around the age of 20 and 24years in the community and psychiatric samples respectively. Psychosocial interventions for prevention of NSSI should not only target adolescence through school mental health programs but also target emerging adults at the university level.

[1] Published as: Gandhi, A., Luyckx, K., Baetens, I., Kiekens, G., Sleuwaegen, E., Berens, A., ... & Claes, L. (2018). Age of onset of non-suicidal self-injury in Dutch-speaking adolescents and emerging adults: An event history analysis of pooled data. *Comprehensive Psychiatry, 80,* 170-178.

1. Introduction

Non-suicidal self-injury (NSSI) is defined as repetitive, direct, and deliberate destruction of one's body tissue without an intention to die (Nock, 2009). According to two recent reviews (Muehlenkamp, Claes, Havertape, & Plener, 2012; Swannell, Martin, Page, Hasking, & St John, 2014), approximately 18% of adolescents, 13% of emerging adults, and 5% of adults have a history of at least one episode of NSSI. Although the prevalence of NSSI is generally known to be higher in adolescents with psychiatric disorders, it is especially elevated in individuals with borderline personality disorder (BPD) and eating disorders (ED). Approximately 70%–75% of patients with BPD (Kerr, Muehlenkamp, & Turner, 2010) and 27%–33% of patients with EDs engage in NSSI (Cucchi et al., 2016). A strong association between NSSI and various negative mental health outcomes such as low self-esteem, depression, anxiety, and suicide attempts has been established (Hamza, Stewart, & Willoughby, 2012; Kerr et al., 2010). Consequently, NSSI has emerged as an important public health concern.

In the recent years, significant advances have been made in understanding the factors that increase the vulnerability to NSSI. Nonetheless, more fundamental demographic question like the distribution of age of onset of NSSI (i.e., plot of first episode of NSSI as a function of age) has remained unanswered. Investigating the distribution of age of onset of NSSI can be useful in developing age-relevant prevention and intervention strategies that target individuals in the age group that are most vulnerable to NSSI (Kessler et al., 2007). Effective prevention strategies can be very relevant in the context of NSSI as early age of onset has been shown to be associated with greater NSSI frequency, the use of more diverse NSSI methods, and NSSI-related hospital visit (Ammerman, Jacobucci, Kleiman, Uyeji, & McCloskey, 2017). Although, no existing research has systematically investigated the distribution of age of onset of NSSI, some conclusions can be drawn from a recent literature review of 27 longitudinal NSSI studies by Plener, Schumacher, Munz, and Groschwitz (2015). These authors reported that the prevalence of NSSI steadily increases from the age of 12 years and peaks between 14 to 16 years of age; by the age of 18 years, the prevalence of NSSI appeared to decrease. Although Plener and colleagues (2015) focused on the prevalence of NSSI and not on the age of onset, we expect the later to follow a similar trend given that the majority of individuals engage in NSSI for the first time during the ages of 12–18 years of age (Muehlenkamp et al., 2012). However, further research is necessary to confirm this hypothesis.

Existing literature on NSSI has also indicated that gender and presence of psychiatric disorders like BPD and ED can influence the age of onset of NSSI (Andover, Primack, Gibb,

& Pepper, 2010; Groschwitz et al., 2015; 12. Jacobson & Luik, 2014). A recent large-scale review by Bresin and Schoenleber (2015) established gender as an important epidemiological factor that can influence NSSI. However, the extent of influence of gender on the age of onset of NSSI is still not clear. On one hand, individual studies have found that females had an earlier age of onset than males (Andover et al., 2010). Yet, a meta-analysis by Bresin and Schoenleber (Bresin & Schoenleber, 2015) did not find a main effect of age on gender differences in NSSI. In light of these inconsistencies, further research is needed to confirm the effect of gender on the age of onset of NSSI. Similarly, the association between psychiatric disorders like BPD and ED on the age of onset of NSSI is far from clear as this issue has not been extensively studied. The handful of studies that do address the association between psychiatric disorders and age of onset of NSSI suggest that on an average, NSSI started approximately 1.4 years earlier in adolescents with BPD than in adolescents without BPD (Groschwitz et al., 2015). Conversely, mean age of onset of NSSI in in-patients with ED can range from 16.8–17.5 years which was later than the individuals without ED (Claes, Vandereycken, & Vertommen, 2001; Muehlenkamp et al., 2011). However, more research is needed to corroborate these findings.

In addition to the lack of studies systematically investigating the distribution of age of onset of NSSI, the studies and the meta-analyses cited so far had one additional drawback: they were directly or indirectly based on the mean-statistic which did not consider the effects of censored data or the effect of time. This may lead to a biased estimation of the true value of the effects (Allison, 2014). In light of these limitations, the current study investigated the distribution of age of onset in pooled samples of Dutch-speaking adolescents and emerging adults using event history analysis. Use of event history analysis allowed us to develop probabilistic models that mapped the distribution of age of onset of NSSI while incorporating the effect of censoring, time, and the non-normal distribution of variables. As mentioned earlier, based on the work of Plener and colleagues (2015), we expected that the onset of NSSI in community samples would increase around the age of 12, peak around the age of 14–15 years, and subsequently reduce around the age of 18 years. We additionally investigated the influence of gender and the presence of psychiatric disorder like BPD and EDs on the distribution of age of onset as a function of time. Because of a lack of previous research, a detailed hypothesis regarding the effect of differences in gender distribution of age of onset of NSSI could not be formulated. However, based on the work of Andover and colleagues (2010), we expected that females would have an earlier age of onset than males.

2. Method

2.1. Data collection and processing

Four researchers working in the area of NSSI in the Dutch-speaking part of Belgium were requested to provide published or unpublished data if they met the following inclusion criteria: 1) NSSI was clearly defined as deliberate, self-inflicted, destruction of body tissue without an intent to die; 2) The studies were conducted in the Dutch-speaking parts of Belgium or the Netherlands; and 3) The studies also collected data regarding age at first episode of NSSI. The sample could be either clinical or from a community sample. For each study, copies of the original questionnaires, manuscripts or dissertations describing the study methods were also requested. As the focus of the present work was on adolescents and emerging adults, individual cases were included in the study only if the age of the participants were less than or equal to 25 years of age. Data with missing values on the variables relevant to the current study (presence/absence of NSSI, age of onset of NSSI, age, gender) were excluded from the final pooled dataset. Each individual study was approved by the ethics review board of the authors' university. Table 1 presents the characteristics of the 11 studies included in the current research. The pooled sample consisted of 4,379 participants.

All the datasets assessed the age of onset of NSSI by means of some version of the question “How old were you the first time you intentionally hurt yourself?” (Sansone, Wiederman, & Sansone, 1998). Finally, the pooled data were converted from a person-level data file to a person-period data file. Age was used as the time-scale such that each person entered the risk set at the age of one year and exited the study when they first engaged in NSSI (i.e., experienced the event) or if they reached the age at which they participated in the data collection process (i.e., the point of attrition). Additionally, the variables gender and the presence/absence of psychiatric disorders were included as time-invariant variables in the pooled dataset. Overall, the person-period data file had 60,853 data points (30,376 males, 30,477 females without psychiatric disorder, and 8627 females with psychiatric disorders (BPD or ED)).

Table 1. Details of the datasets included the current study. For more information regarding the datasets and the procedure adopted to collect the data can be found in the referenced manuscripts[2]

Dataset no	Study	Population type	Year of data collection	*N:* Original dataset (NSSI cases)			Cases selected for analysis (Cases of NSSI)			Assessment of NSSI
				Males	Females	Total	Males	Females	Total	
1	Dataset 1 (Baetens et al., 2015)	Community	2011	166 (20)	192 (28)	358 (48)	164 (19)	160 (27)	324 (46)	Checklist
2	Dataset 2 (Claes, Luyckx, & Bijttebier, 2014)	Community	2012	395 (95)	137 (26)	532 (121)	395 (95)	136 (25)	531 (120)	Single-item
3	Dataset 3*	Community	2012	246 (39)	375 (68)	651 (107)	240 (25)	294 (62)	534 (87)	Single-item
4	Dataset 4 (Kiekens et al., 2015)	Community	2012	511 (125)	408 (99)	1013 (224)	451 (81)	372 (74)	823 (155)	Checklist
5	Dataset 5*	Community	2013	163 (8)	218 (7)	397 (15)	55 (2)	68 (5)	123 (7)	Single-item
6	Dataset 6 (Gandhi, Luyckx, Maitra, & Claes, 2015)	Community	2014	220 (26)	447 (157)	705 (183)	215 (21)	406 (109)	621 (130)	Single-item
7	Dataset 7 (Gandhi, Luyckx, Goossens, Maitra, & Claes, 2016)	Community	2015	194 (23)	207 (43)	401 (66)	192 (21)	202 (40)	394 (61)	Single-item
8	Dataset 8 (Gandhi et al., 2017)	Community	2015	261 (20)	267 (55)	528 (75)	261 (20)	263 (52)	524 (72)	Single-item
Total							1973 (284)	1901 (394)	3874 (678)	
9	Dataset 9# (Vansteenkiste, Claes, Soenens, & Verstuyf, 2013)	Clinical (ED)	2002-2005	0	127 (53)	127 (53)	0	94 (47)	94 (47)	Single-item
10	Dataset 10# (Claes, Soenens, Vansteenkiste, & Vandereycken, 2012)	Clinical (BPD)	2002-2009	0	488 (209)	488 (209)	0	361 (172)	361 (172)	Single-item
11	Dataset 11# (Sleuwaegen et al., 2017)	Clinical (ED)	2013-2016	0	140 (111)	140 (111)	0	50 (45)	50 (45)	Single-item
Total							0	505 (264)	505 (264)	

[2] The data collection procedure for the published datasets can be accessed from the referenced manuscript.

* The data collection procedure for the published datasets community datasets were almost similar to the procedure described by Gandhi and colleagues (35)

In case of the clinical samples, the sample sizes mentioned in the present study may differ from the sample size mentioned in the corresponding manuscripts. This is because the data were collected in psychiatric units for more than a single study (each with proper ethics approval). Therefore, the manuscripts referred in the table above included patients who only had data available on the relevant variables.

2.2. Analysis

The analyses in the present work were performed using MLWin (version 2.36), SPSS (version 24), and STATA (version 13.1). To investigate heterogeneity, we considered the pooled data as a multi-level data with individual participants (level 1) nested within each dataset (level 2). We fitted a null frailty model (i.e., model without predictor variables but with random effects at the level of datasets) with presence/absence of NSSI as the outcome variable. In spite of being a dichotomous variable, the presence/absence of NSSI was modeled as a continuous variable to obtain the variance partitioning coefficient (VPC) using the Iterative Generalized Least Squares estimation procedure. The VPC represents the amount of variance (i.e., heterogeneity) explained at the level of datasets. This method of obtaining VPC is commonly referred to as the binary linear method. Note that use of the binary linear method was necessary as VPC in multi-level non-linear models are not otherwise comparable (Willett & Singer, 1993). A smaller VPC value indicated smaller heterogeneity.

In order to investigate the effect of gender and presence of psychiatric disorders on the distribution of age of onset of NSSI, the discrete-time event history analysis method outlined by Willet and Singer (1993) was adopted. As noted by Willet and Singer (1993), discrete-time event history analysis begins by computing the baseline or initial hazard model. A baseline hazard model does not differentiate between sample members (i.e., it does not have any covariates) and it aids in the examination of the main effect of time on the onset of the event. To visually inspect the main effect of age on the onset of NSSI, we plotted the temporal profile of risk of onset of NSSI. This plot was obtained by entering Age as the time-varying variable into the X-axis and presence/absence of NSSI in the Y-axis. The resulting graph represented the baseline hazard for experiencing NSSI during a given age. Additionally, by using the hazard function, we computed and plotted the cumulative survival function to investigate the probability of individuals who never experienced NSSI during the first 25 years of their lives.

Next, logistic regression was used to fit the hazard profile to statistically evaluate the main effect of age on onset of NSSI. The baseline logit hazards were obtained by entering presence/absence of NSSI as the dependent variable and age as the independent (factor) variable. Data across the first five years of age was aggregated together in single category as the probability of onset of NSSI was almost zero in the first five years of age. This collapsed category was treated as the reference group. We also investigated if the fit of the basic hazard model improved by the addition of gender to the main effect of age. To investigate if the assumption of proportionality was violated (i.e., effect of gender on onset of NSSI changed with age), we also tested if models with interaction of age and gender had a better fit than the

model only with main effect of gender and the baseline hazard model. The -2 log-likelihood statistic test and information criteria (Akaike information criterion [AIC] and Bayesian information criterion [BIC]) were used to evaluate the improvement in the model fit. The appropriate model was subsequently interpreted. For the sake of brevity, the results of all the survival functions and the parameter estimated of the relevant logistic regression models used to fit the hazard functions are presented in Appendix 1.

The above-mentioned procedure was also followed for evaluating the effect of psychiatric disorders on the age of onset of NSSI. However, unlike the community samples, the general hazard and survival function for the combined samples of community and clinical females were less informative than the model including the interaction with the presence/absence of psychiatric disorder. Therefore, the general hazard and survival functions are only briefly discussed. As the clinical data did not have male participants, the effect of psychiatric disorders was investigated in females only.

3. Results

3.1. Heterogeneity among the datasets

The VPC estimate obtained using the null frailty model indicated that most of the variance in presence/absence of NSSI was situated at the individual level as only 2% of the variance existed at the level of the datasets (σ_u^2 [SE] = .0003 [0.0001]). A low value of VPC indicated that the datasets were fairly homogenous. Given that use of random effects models offer limited advantage when VPC is less than .05 (Dyer, Hanges, & Hall, 2005), we continued the analysis using the regular logistic regression models.

3.2. Influence of gender on distribution of age of onset

Figure. 2 (Panel A) shows the distribution of age of onset of NSSI in the community sample. The graph indicates that the probability of onset of NSSI increased steadily through late childhood and it peaked at 14 years of age. Further, the probability of onset of NSSI decreased as the adolescents transitioned into emerging adulthood. A smaller second peak was also observed around the age of 20 years but NSSI was less likely to begin after the age of 21 years. Panel B of Figure. 1 shows the general survival function for the community sample. From the plot, it is clear that up to 25 years of age, the cumulative probability of onset of NSSI was around .21 (= 1 − .79 [cumulative survival function at age 25]). The details of the generalized logistic regression model used to fit the hazard function can be accessed through the Appendix 1. The fitted logistic regression model indicated that the odds of age of onset of NSSI is consistently higher in all age groups as compared to the age group of 1–5 years. The odds of onset of NSSI was highest in the age groups of 14 years (77.33 higher odds as compared

to the reference group) and 15 years (70.52 higher odds as compared to the reference group). The odds of onset of NSSI decreased around the age of 18 years before it increased to 24.62 at the age of 20 years as compared to the reference group.

Table 2 shows the comparison of the goodness of fit of the baseline model (only with the main effect of age) with the extended models that included gender (both main effect and interaction effect with age). Table 2 indicated that addition of interaction of gender and age (linear or categorical) to the baseline model significantly increased the overall fit of the model to the data. Model 3 was selected as the model best fitting the data as it was more parsimonious (indicated by low BIC value) than the interaction model 4. The parameters estimated for the interactive model are presented in the Appendix 1. The overall model indicated that interaction between gender and age was found to be significant ($\beta_{\text{age(linear)} * \text{gender}}$ = .18, SE = .03, z = 31.68, df = 1, p = < .001) in the interaction model.

Table 2. Goodness-of-fit and information criteria of models with main effect and interaction effect of gender

Model	Model Specification	-2LL	*df*	DID#	Δ*df*	$\chi^2_{(critical\ .05)}$	***AIC***	***BIC***
1	General specification	6500.90	20	-	-	-	6532.90	6677.07
2	General specification + Sex	6480.16	21	20.74	1	3.84	6514.16	6667.32
3	General specification + Sex + Age(Linear) * Sex	6444.25	22	56.65	2	5.99	6480.45	6642.42
4	General specification + Sex + Age(Categorical) * Sex	6408.31	41	92.59	21	32.67	6470.31	6749.53

Difference in Deviance

Figure. 1 (Panel C) presents the plot of predicted probabilities of onset of NSSI against age using the interaction model 3. The hazard functions for males and females crossed at about 11 years. Before age 11, males had a marginally higher probability of onset of NSSI. However, after the age of 11, females consistently had a higher probability of onset of NSSI than males. Interestingly, the second peak in the age of onset of NSSI which was observed around the age of 20 years was much sharper for females than males indicating the presence of a group of individuals with late onset of NSSI in females. Panel D of Figure. 1 shows the gender differences in the survival function. The figure indicates that by the end of age 25, females (1

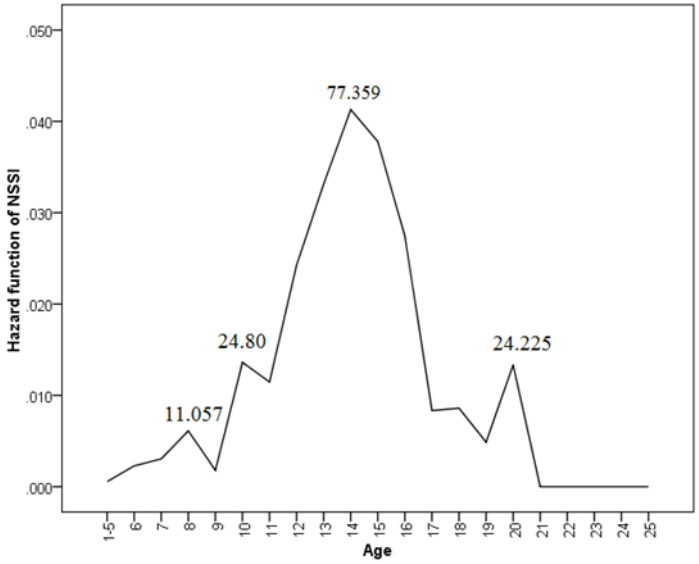
− .74 [cumulative survival function at age 25] = .26) had a higher cumulative probability of engaging in at least one episode of NSSI than males (1 − .83 [cumulative survival function at age 25] = .17).

3.3. Influence of psychiatric disorders on distribution of age of onset

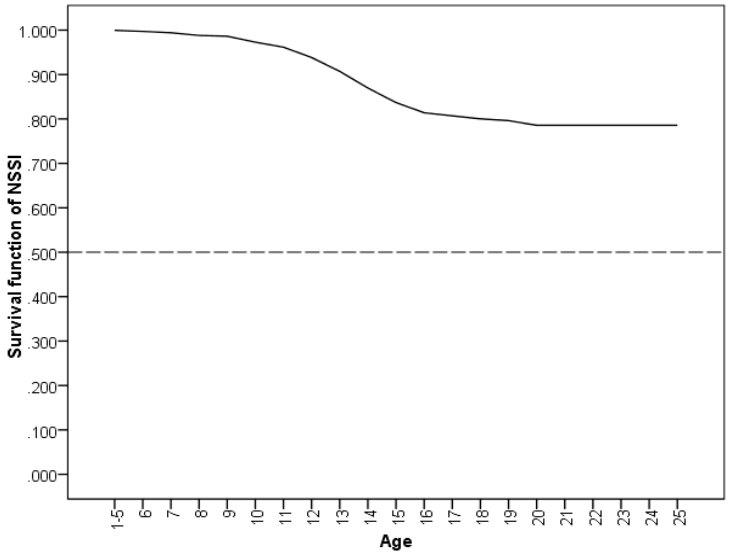
Figure. 2 (Panel A) shows the distribution of age of onset of NSSI in the community and clinical cohorts of females. Unlike the hazard function of the community sample, the hazard function of the combined female samples had a bimodal distribution of the probability of onset of NSSI with peaks around the ages 14 to 15 and a second peak at 24 years. The logistic regression model used to fit the hazard function shown in Figure. 2 (Panel A) is presented in the Appendix 1. The relevant odds ratios are shown in the Panel A of Figure. 2. The survival function (shown in Panel B of Figure. 2) indicates that up to 25 years of age, the probability of having a first experience of NSSI was around .45 (1 − .55 [cumulative survival function at age 25]). From Table 3, it is clear that adding the variable presence/absence of psychiatric disorder to the basic model (only with the main effect of age significantly reduced the value of the -2LL statistic hence indicating that the extended model had a better fit to the data than the basic model). Model 3 was again selected as the best model to represent the data as it was more parsimonious than the interactive model 4 (indicated by low BIC value). The parameters estimated for the interactive model 3 are presented in the Appendix 1 and the model indicates that interaction between the presence or absence of psychiatric disorders and age was significant ($\beta_{\text{age(linear)} * \text{disorder}}$ = .13, SE = .04, z = 14.09, df = 1, p = < .001).

Figure. 2 (Panel C) presents the plot of predicted probabilities of onset of NSSI against age using model 3. The plot indicated that the probability of onset of NSSI was virtually the same for the females with and without psychiatric disorders before the age of 9 years. After age 9, the probability of females with psychiatric disorders engaging in NSSI was higher than the hazard function for the females from the community samples. As observed in the community samples, after the peak around 14–15 years, the hazard of onset of NSSI decreased till the age of 18 years. However, after age 19, the probability of onset of NSSI in the females from the clinical samples increased again until it peaked around the age of 24. It should be noted that the peak at the age of 24 years may be an outcome of a methodological artefact

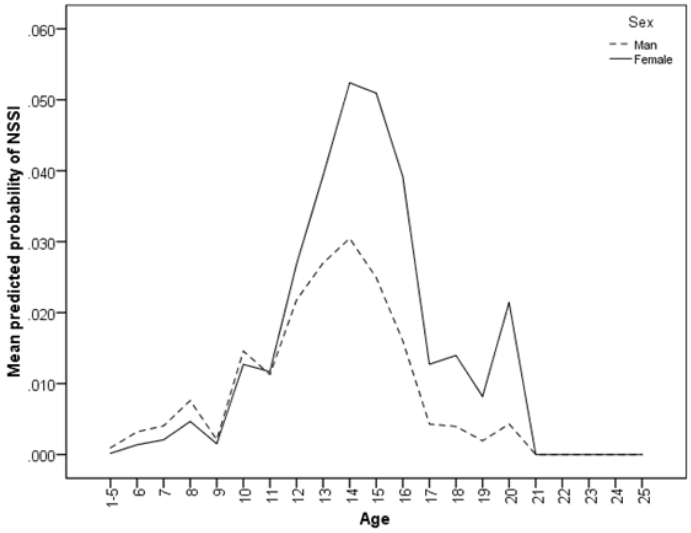
A.



B.



C



D.

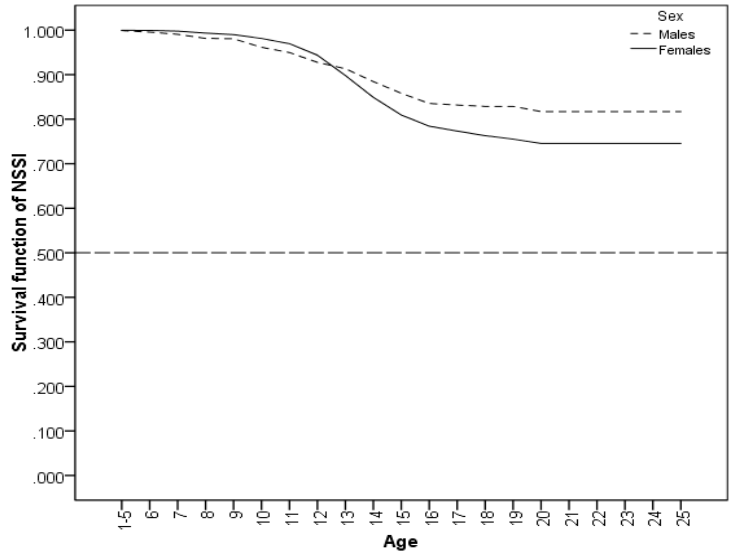


Figure 1. General hazard (Panel A) and survivor function (Panel B) for the age of onset of NSSI (in years) in adolescents and emerging adults. Numbers in the Panel A represents the odds of engaging in NSSI as compared to the reference category (1-5 years). The logistic regression used to obtain these odds is available in Appendix 1. Panel C shows the hazard and Panel D shows the survivor function for the age of onset of NSSI taking into account the influence of gender. The probabilities used to plot the survival function are available in Appendix 1.

Tall peaks towards the end of the measurement waves are common in discrete event history analysis because presence of even a single case in already small number of cases can artificially inflate the hazard ratio. Therefore, the second peak must be interpreted with caution. Panel D of Figure. 2 shows the differences in the survival function of females with and without psychiatric disorders. It is also clear from Figure. 2 that till the age of 25 years, the probability of females from the psychiatric samples engaging in first episode of NSSI was higher (1 − .36 [cumulative survival function at age 25] = .64) than females from the community samples (1 − 0.74 [cumulative survival function at age 25] = .26). The median survival rate for the females with psychiatric disorder reached around 19 years of age.

Table 3. Goodness-of-fit and information criteria of models with main effect and interaction effect of presence or absence of psychiatric disorders.

Model no	Model Specification	-2LL	*df*	DID[#]	Δ*df*	$\chi^2_{(critical\ .0}$	AIC	BIC
1	General specification	5592.48	20	Reference		-	5632.48	5803.95
2	General specification + Population type	5503.14	21	89.34	1	3.84	5545.14	5725.18
3	General specification + Population type + Age(Linear)* Population type	5486.92	22	105.56	2	5.99	5530.92	5719.52
4	General specification + Population type + Age(Categorical)* Population type	5446.26	41	146.22	21	32.67	5516.26	5815.67

Difference in Deviance

Figure. 2 (Panel C) presents the plot of predicted probabilities of onset of NSSI against age using model 3. The plot indicated that the probability of onset of NSSI was virtually the same for the females with and without psychiatric disorders before the age of 9 years. After age 9, the probability of females with psychiatric disorders engaging in NSSI was higher than the hazard function for the females from the community samples. As observed in the community samples, after the peak around 14–15 years, the hazard of onset of NSSI decreased till the age of 18 years. However, after age 19, the probability of onset of NSSI in the females from the clinical samples increased again until it peaked around the age of 24.

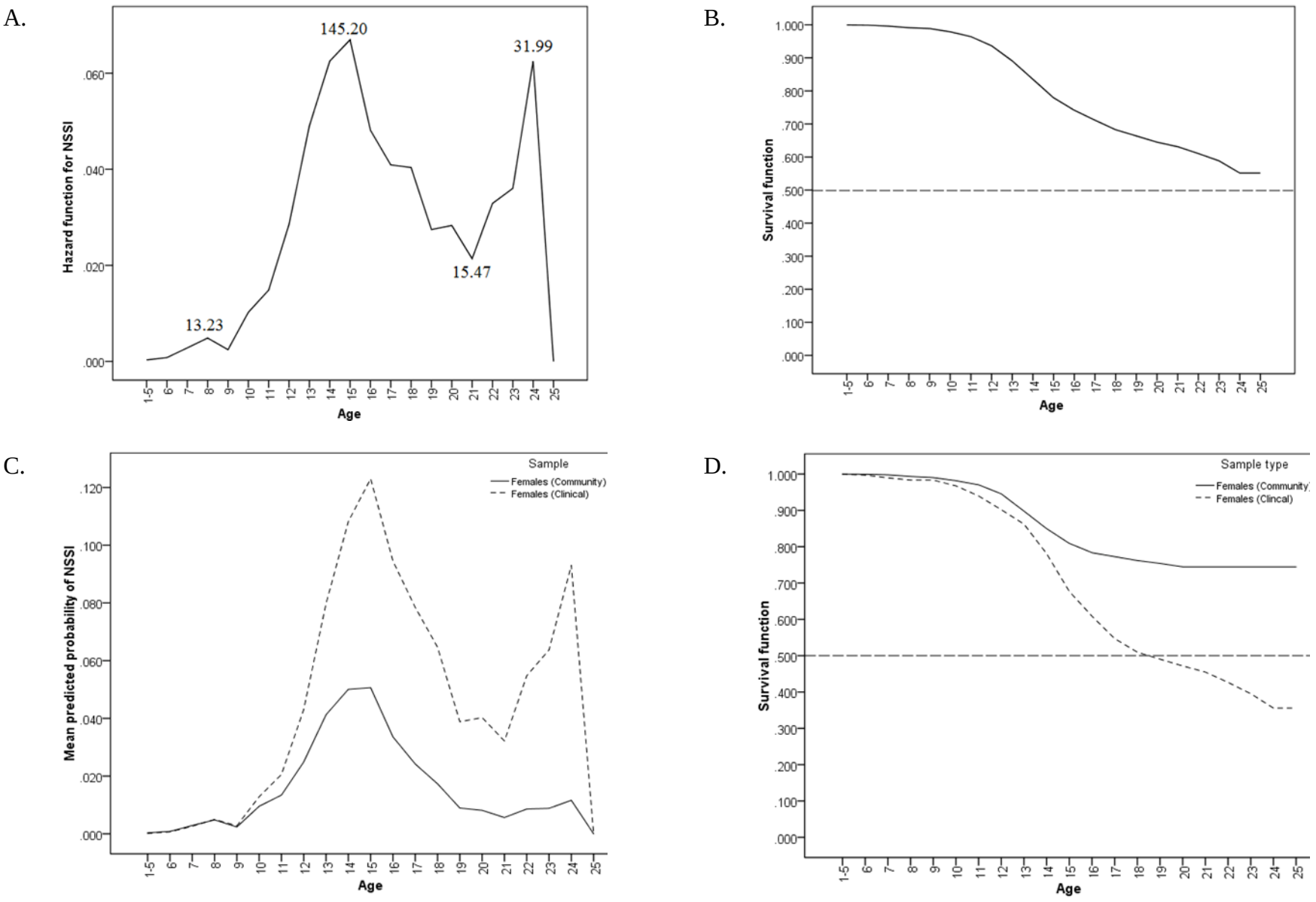


Figure 2. General hazard (Panel A) and survivor function (Panel B) for the age of onset of NSSI (in years) in females with and without psychiatric disorders. Panel C shows the hazard and Panel D shows the survivor function for the age of onset of NSSI taking into account the presence of psychiatric disorders. The probabilities used to plot the survival functions in panel D of the figure 2 are available in Appendix 1

It should be noted that the peak at the age of 24 years may be an outcome of a methodological artefact. Tall peaks towards the end of the measurement waves are common in discrete event history analysis because presence of even a single case in already small number of cases can artificially inflate the hazard ratio. Therefore, the second peak must be interpreted with caution. Panel D of Figure. 2 shows the differences in the survival function of females with and without psychiatric disorders. It is also clear from Figure. 2 that till the age of 25 years, the probability of females from the psychiatric samples engaging in first episode of NSSI was higher (1 − .36 [cumulative survival function at age 25] = .64) than females from the community samples (1 − .74 [cumulative survival function at age 25] = .26). The median survival rate for the females with psychiatric disorder reached around 19 years of age.

4. Discussion

With about 21% adolescents (about 26% females and 17 % males) engaging in at least one episode of NSSI by the time they reach the age of 25 years, our analysis indicated that NSSI may be a significant mental health issue in our Dutch-speaking samples of community adolescents and emerging adults. We found that although the first episode of NSSI could occur as early as 6 years, the probability of first NSSI episode increased dramatically after the age of 9 years. The age of onset of NSSI peaked around 14 years of age. Our findings also indicated that before the age of 9 years, males had a somewhat higher probability of engaging in NSSI as compared to females. The interaction model used in the current research did not permit us to investigate if the gender differences in the onset of NSSI observed in the first 9 years were statistically significant. In any case, these findings contradicted some earlier research (Andover et al, 2010) that found females to have an earlier age of onset than males. Although the peak in the age of onset of NSSI for both males and females was around the age of 14–15 years, in line with earlier studies (Bresin & Schoenleber, 2015) we observed that females had a significantly higher probability of engaging in at least one episode of NSSI than males in this age group.

The cumulative survival function differentiating between community and psychiatric samples indicated that about 64% females with psychiatric disorder engaged in at least one episode of NSSI before the age of 25 years. About 50% of females with a diagnosis of a psychiatric disorder engaged in at least one episode of NSSI before the age of 19 years. The comparison of the age of onset of NSSI between females with and without psychiatric disorders indicated that before the age of 9 years, the probabilities of onset of NSSI between these cohorts were virtually similar. After 9 years of age, the probability of onset of NSSI increased exponentially in females with psychiatric disorders. The onset of NSSI peaked for females at the age of 14 to 15 years and the probability of onset of NSSI was more than twice in the

clinical population as compared to the community population. This finding was not surprising as NSSI is known to be more prevalent in individuals with psychiatric disorders. A second peak in the first episode of NSSI was also observed in the clinical population at a much later age of 24 years.

The results of the age of onset of NSSI can be more insightful if juxtaposed with the onset of other psychiatric disorders. For example, onset of NSSI coincides with the onset of disorders like conduct disorder (9–14 years), impulse-control disorders (13–21 years), and mood disorders (13.9–15.1 years) (Ormel et al., 2015) indicating that NSSI may be an outcome of a combination of impaired impulse control and emotional dysregulation issues. Greater impulsivity and emotional dysregulation is common in adolescents as the areas in the brain associated with the reward system (e.g., caudate nucleus) and emotional regulation (e.g., amygdala) develop before the areas associated with the development of the regulatory systems (e.g., prefrontal cortex) (Ernst, 2014). Without effective regulatory capabilities, adolescents with high impulsivity may indulge in immediate affect regulation strategies like NSSI even when the behavior is ultimately self-destructive (Ernst, Pine, & Hardin, 2006). Once the regulatory system matures, individuals may be better equipped to control impulses and may use more healthy ways to regulate affect. This may partially explain the lower prevalence of NSSI in adults as compared to adolescents (Cha & Nock, 2011). The aforementioned neuro-regulatory mechanisms often fail to develop in individuals with BPD (Berlin, Rolls, & Iversen, 2005) and ED (Kaye, 2008) and, therefore, these individuals may continue to use NSSI as a means of regulating emotions. This fact is reflected by the higher probability of onset of NSSI even when the females suffering from psychiatric disorders reach the age of 25 years.

The bimodal distribution of the age of onset of NSSI has also been reported in other psychiatric disorders like anxiety disorder (Rhebergen et al., 2017), agoraphobia (Tibi et al., 2015), eating disorders (Volpe et al., 2016), obsessive compulsive disorder (Albert et al., 2015), and schizophrenia (Schürhoff et al., 2004). Although the reasons for the second peak in the age of onset of NSSI are not entirely clear, hypotheses regarding the late onset of NSSI can be formulated using the existing research on factors that increase vulnerability to psychiatric disorders in emerging adults. The most parsimonious explanation for the late onset of NSSI may be the presence of a recall bias. That is, emerging adults only remember the most recent instance of NSSI and fail to recollect earlier episodes that occurred during their adolescent years. Apart from the recall bias, a possibility of a “spill-over” of adolescent psychopathology has also been raised (Tanner, 2015). That is, any form of developmental issues (e.g., disturbances in identity formation) or mental illness during adolescence can present itself in

form of a secondary psychopathology, like NSSI during emerging adulthood. The effect of adolescent mental health issues may get expressed more potently as most of these psychiatric disorders rarely get treated (Wang, Shih, Hu, Louie, & Lau, 2010). Developmentally important issues like disturbances in identity formation may also help in explaining the observed bi-modal distribution of onset of NSSI. The process of identity formation is one of the key concerns in both adolescence and emerging adulthood (Arnett, 2000; Erikson,1968). In individuals with significant identity disturbances, NSSI may serve as a means to either develop a new sense of self (self-injurer, self-cutter, etc.) or as a means of managing negative affect associated with identity disturbances (Gandhi et al., 2017). Interestingly, association between identity disturbances and NSSI has been demonstrated to be stronger in patients with EDs and BPD (Luyckx, Gandhi, Bijttebier, & Claes, 2015).

Finally, comparative analysis of onset of internalizing disorders and NSSI highlights the fact that gender differences observed in NSSI are also observed in depression and anxiety. A surge in female gonadal hormones may play a role in the development of depression, anxiety, and possibly also in NSSI. This assertion is partly supported by the fact that the onset of these disorders closely follows the average age of menarche in Flemish and Dutch female adolescents (i.e., 13.13 ± 1.3 years; Roelants, Hauspie, & Hoppenbrouwers, 2009; Talma et al., 2013). There is increasing evidence to suggest that in females, estrogen and progesterone may modulate mood through their influence on GABA, 5-HT and/or dopamine systems – the neurotransmitters implicated in depression and anxiety (Parker & Brotchie, 2004). Further research should also consider researching the influence of gonadal hormones on NSSI behavior in females through their ability to influence mood. Overall, the distribution of age of onset of NSSI in community and clinical samples seems to be an outcome of a complex interaction of biological and psychosocial processes.

Although the present study was one of the first to systematically investigate the distribution of age of onset of NSSI and the effect of gender and presence of psychiatric disorders on the first episode of NSSI, it is plausible that a number of limitations may have influenced the results obtained. First, whereas the pooling of datasets considerably increased the overall sample size, the individual datasets in the present study were collected by means of convenience sampling. Therefore, the resulting findings may not be representative of the general Dutch-speaking population. Second, information regarding the distribution of age of onset of NSSI was based on retrospectively collected data. Due to the limitations in the way autobiographical memories are accessed, the use of self-report questionnaires to investigate the age of onset of NSSI may not be sufficient to develop an accurate picture of the age of onset

of NSSI (Schwarz, 2007). Long-term longitudinal studies may be required to confirm our findings. Given that such studies can be expensive and difficult to conduct, researchers can consider using tools like event history calendar (see Belli, 1998) as they may aid in forming a more accurate picture of retrospective data like age of onset of NSSI. Third, from Table 1, it is clear that presence/absence of NSSI was investigated either by using a single item with a forced Yes/No response or a checklist of self-harming behaviors. Although the use of different assessment methods does not lead to epidemiological inconsistencies in the estimation of the prevalence of NSSI (Muehlenkamp et al., 2012) and its age of onset, yet, some measurement error may be inevitably introduced in the analyses. Interview techniques like clinically informed event history calendar can again assist in developing an accurate picture of epidemiology of NSSI. Fourth, the current study probabilistically modelled the age of onset of NSSI. Further research exploring the association between the age of onset other features of NSSI like frequency, severity, and methods used to harm oneself is also required. Fifth, the bimodal distribution of age of onset, which has been observed in many psychiatric disorders (Albert et al., 2015; Rhebergen et al., 2017; Schürhoff et al., 2004; Tibi et al., 2015; Volpe et al., 2016), was also evident in NSSI. Whereas the first peak in the onset of NSSI was observed around the age of 14–15 years of age in both community and clinical samples, it is not clear why the second peak observed in the age of onset of NSSI was observed earlier in the community samples (20 years) and later in the clinical samples (24 years). Further research may be necessary to understand the theoretical and clinical significance of the aforementioned finding. Finally, as mentioned earlier, interpretation of the hazard probabilities towards the tail end of the hazard function should be interpreted with caution as these probabilities may be over-inflated because of the drop in the overall number cases in the denominator.

In spite of these limitations, the current study is one of the first to probabilistically model the distribution of age of onset of NSSI. Our findings re-iterate the fact that NSSI is highly prevalent in the Dutch-speaking countries. The present study also highlights the fact that mental interventions targeting adolescents in schools may not be sufficient. From a public health perspective, the early period of emerging adulthood may also be seen as an important age bracket to address untreated mental health issues that originate during childhood and/or adolescence. Consequently, universities, technical schools, or other higher educational institutes can serve as gateways to identify and treat individuals with a higher risk of late onset of NSSI engagement.

Section 2: NSSI and Identity

Chapter 3.

Non-suicidal self-injury and identity distress in Flemish adolescents: Exploring gender differences and mediational pathways.

Gandhi, A., Luyckx, K., Maitra, S., & Claes, L. (2018)[3]

Abstract

There is an increasing amount of research that examines non-suicidal self-injury (NSSI) in relation to identity formation in adolescents. However, little or no research to date has explored associations between NSSI and identity distress in specific domains. To address this shortcoming, we assessed NSSI, identity distress, anxiety, and depression using self-report questionnaires in 568 high school students. Gender differences in NSSI were found with lifetime prevalence of NSSI being twice as high in females as compared to males. Gender differences in terms of identity domains were also significant; adolescent females showed higher levels of distress in the identity domains of career goals, friendship, and group loyalties as compared to males. Adolescents engaging in NSSI showed higher distress in domains of long-term goals, friendship, sexual orientation and behavior, values and beliefs. Results indicated that it was not distress in specific domains as such but the impairment due to daily impact of identity distress that explained additional variance in lifetime prevalence of NSSI above and beyond gender, age, depression, and anxiety. We also demonstrated that gender differences in lifetime prevalence of NSSI were mediated by differences in such identity impairment. Clinical implications of these findings are discussed.

[3] Published as: Gandhi, A., Luyckx, K., Maitra, S., & Claes, L. (2015). Non-suicidal self-injury and identity distress in Flemish adolescents: Exploring gender differences and mediational pathways. *Personality and Individual Differences, 82*, 215-220.

1. Introduction

Non-suicidal self-injury (NSSI) refers to any socially unaccepted behavior involving deliberate and direct destruction of one's own body surface without suicidal intent (Claes & Vandereycken, 2007). Body-modification behaviors like tattooing and piercing are not considered as NSSI because of social acceptability and as they are often engaged in for aesthetic reasons (Claes, Vandereycken, & Vertommen, 2005). Prevalence rate of NSSI is around 2–5% in adults and 14.0–29.0% in adolescents (Swannell, Martin, Page, Hasking, & St John, 2014). A lifetime prevalence of at least one attempted suicide has been reported in 50–85% of people engaging in NSSI (Hamza, Stewart, & Willoughby, 2012).

Studies on gender differences in NSSI are conflicting. Whereas some studies have indicated no gender differences in lifetime prevalence of NSSI (Muehlenkamp & Gutierrez, 2004), other studies have indicated a higher prevalence in females (Brunner et al., 2014). NSSI is also associated with a host of mental health concerns, especially in adolescent populations. Adolescents engaging in NSSI exhibit higher levels of impairment than adolescents with other mental disorders (Giedd, Keshavan, & Paus, 2008). The most common co-morbid conditions seen among adolescents with NSSI include depression, anxiety, smoking and substance abuse (Moran, 2015).

Issues regarding identity development in adolescents have been identified as important risk factors for NSSI (Breen, Lewis, & Sutherland, 2013). According to Erikson (1968), adolescents face the important developmental task of identity consolidation – a successful outcome of identity integration or synthesis over confusion. With these commonalities in mind, NSSI may be conceptualized as a coping strategy for dealing with identity confusion. For example, Claes, Luyckx, and Bijttebier (2014) investigated the relationship between NSSI and identity formation in high school students and found that lifetime prevalence of NSSI was positively related to identity confusion and depression, and negatively to identity synthesis. Similar results were observed in eating disorder patients (Claes et al., 2015). Finally, Luyckx, Gandhi, Bijttebier, and Claes (in press) using the identity status paradigm (Kroger & Marcia, 2011), demonstrated that identity commitments as such do not predict a lower lifetime prevalence of NSSI, unless they have been achieved after a period of pro-active exploration. On the other hand, individuals engaging primarily in ruminative exploration without the ability to form identity commitments were at greater odds of engaging in NSSI.

Disturbances in role-identities can also cause well-being issues (Thoits, 1986) however so far only processes related to identity development in adolescents and their associations with NSSI have been investigated. A recent study involving college students has indicated higher

levels of identity distress in the domains of long-term goals, career choice, and friendships, whereas lower levels of identity distress were reported in domains of sexual orientation/behavior, religion, values or beliefs, and group loyalties (Samuolis & Griffin, 2014). While relationships between distress in the domain of sexual/gender identities and NSSI have been explored to some extent (Batejan, Jarvi, & Swenson, 2014), the association of NSSI to the distress experienced in other identity domains remains unexplored, especially in adolescence. Research aiming at identifying specific domains of identity that increase the risk of NSSI in adolescents can lead to better prevention, treatment, and management of NSSI.

With respect to gender differences in identity development, conflicting research exists with most evidence suggesting similar developmental trajectories for both sexes (Kroger, 1997). However, there are others who suggest that, because men are culturally expected to be more individualistic and women to be more concerned with interpersonal issues, their developmental trajectories would be different (Guyer, Caouette, Lee, & Ruiz, 2014). In terms of the identity distress accompanying specific domains in community adolescents, only a handful of studies have focused on gender differences. However, several studies targeting college students report conflicting findings. For example, Samuolis and Griffin (2014) found no gender differences on distress in specific identity domains among college students. Wängqvist and Frisén (2011), on the other hand, reported significant differences in emerging adults in the domains of friendship, group loyalties, and moral values. However, so far, no study has explored distress due to identity development in different domains (e.g., life plans, friendship, sexuality, etc.) and its effect on NSSI.

The research objectives of the current study were threefold. First, we examined if NSSI and identity distress in specific domains and the daily impairment accompanying this distress would be different for male and female high school students. In line with previous research, we expected lifetime prevalence of NSSI to be higher in females (Muehlenkamp & Gutierrez, 2007). In terms of specific domains, because of lack of substantial research no specific hypothesis could be formulated. We also examined if students with or without NSSI differed on distress on specific domains of identity. Apart from distress around issues of sexuality (Batejan et al., 2014), no specific expectations were formulated due to lack of existing literature on association between role specific identity distress and NSSI. Second, we explored if NSSI was influenced by distress on specific domains and the daily impairment due to this identity distress above and beyond age, gender, anxiety, and depression. Based on work of Wängqvist and Frisén (2011) it was expected that NSSI may be positively related to impairment due to identity distress above and beyond age, gender, anxiety, and depression. No specific

predictions could be made regarding associations of specific distress-related domains of identity with incidence of NSSI. Finally, we tested the hypothesis that gender differences in NSSI were mediated by gender differences in identity distress and related impairment. We expected female adolescents would experience more distress over identity issues, which, in turn, would affect rates of NSSI in males and females.

2. Method

2.1. Participants and procedure

Data were collected from high school students (n = 568; 61.8% female) studying in grades 9–12 from six different high schools located in different areas of the Flemish speaking part of Belgium. Mean age was 16.13 years (SD = 1.47, range = 13–21 years) and 96.5% reported to be of Belgian nationality. A total of 27.5% students were in a romantic relationship. In terms of sexual orientation, 95.8% participants were heterosexual, 2% were bisexual, and 1% gay. With respect to family structure, 69% of participants lived with their parents while 18% had divorced parents.

Informed consent forms for parents were provided to the students two weeks prior to the data collection and only those who obtained a signed consent form from their parents were included in the study. Data collection was completed during school hours. Students without signed consent forms were excluded from the study. Students were provided with an assent form and questionnaires in a sealed envelope. Completed questionnaires were resealed by the students and handed over to the researchers.

2.2. Measures

Non-suicidal self-injury was assessed by means of an adapted version of the Self-Injury Questionnaire-Treatment Related (SIQ-TR; Claes & Vandereycken, 2007). Lifetime prevalence of NSSI was assessed by asking participants "if they had ever engaged in NSSI" – a yes/no question. Those who answered positively on this question were further assessed for: age at which NSSI was initiated; if they currently engaged in NSSI (yes/no); lifetime prevalence on 7 different form of NSSI behavior derived from SIQ-TR (yes/no). Cronbach's alpha for NSSI was .72.

The Identity Distress Survey (IDS; Berman, Montgomery, & Kurtines, 2004) is a 10-items scale to measure distress around unresolved identity domains. The first seven items measure distress over seven identity domains on a five-point Likert scale ranging from 1 ("not at all") to 5 ("very severely"). The seven domains include: long term goals, career choices, friendship, sexual orientation, religion, values or beliefs and group loyalties. The last three items measure the severity (1 – "not at all" to 5 – "very severely"), intensity (1 – "not at all" to

5 – “very severely”), and duration (1 – “never or less than a month” to 5 – “more than 12 months”) of distress associated with the process of identity development. Cronbach’s alpha for IDS was .80.

IDS can be conceptualized as consisting of two subscales, a domain distress score (measured by the first 7 items) and an impairment score (measured by the last 3 items). Confirmatory factor analysis was performed and a two-factor model ($\chi^2_{(34)}$ = 193.734, CFI = .92, RMSEA = .08, SRMR = .05) had a better fit than a one-factor model ($\chi^2_{(35)}$ = 213.43, CFI = .91, RMSEA = .09, SRMR = .05) as based on the chi-square difference test ($\chi^2_{(1)}$ = 19.70, p < .001). Both factors (i.e., the domain distress score and the impairment score) were strongly interrelated (r = .69, p < .01). Alpha coefficients for domain and impairment scores were .66 and .80.

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a self-administered scale for non-psychiatric hospital and community settings. Anxiety and depression are measured on separate subscales, each having 7 items. Items are scored on a 4-point Likert scale ranging from 0 to 3. Composite score on each subscale can range from 0 to 21. Cronbach’s alpha for anxiety and depression were .81 and .67, respectively.

2.3. Analysis

Differences in (a) distress on the ten IDS items, (b) the two IDS subscales (domain distress and impairment scores), and (c) anxiety and depression, in function of gender, presence/absence of NSSI, and their interaction, controlled for age, were explored using 3 multivariate analyses of covariance (MANCOVA).

Next, we performed two hierarchical regression analyses to determine if domain distress and impairment scores predicted additional variance in lifetime prevalence of NSSI above and beyond gender, age, anxiety, and depression. In the first step, gender, age, depression, and anxiety were entered in the regression model. In the second step, domain distress and impairment scores were added.

Finally, steps suggested by Baron and Kenny’s (1986) were used to check whether gender differences on NSSI were mediated by gender differences on identity distress impairment. The mediating effect of domain distress scores on differences in lifetime prevalence of NSSI between genders was not examined because identity distress scores did not relate uniquely to lifetime prevalence of NSSI (as detailed below). Mediation was examined by regressing: (1) the dependent variable NSSI on the independent variable gender (path c); (2) the mediating variable impairment on the independent variable gender (path a); (3) the

dependent variable on the mediating variable impairment (path b); and (4) the dependent variable NSSI on the independent variable gender when controlling for the mediating variable impairment (path c′). Mediation was considered to be complete if the relationship between the independent variable and dependent variable became non-significant after inclusion of the mediation variable. If, however, only a significant reduction in relationship between independent and dependent variable mediation was seen, partial mediation was assumed. In all the regressions, age, anxiety, and depression were used as control variables. Additionally, a Sobel test was performed to test the significance of the mediation effect.

3. Results

3.1. Descriptive statistics: NSSI

Lifetime prevalence of NSSI in the high school sample was 16.5% (females = 12.8% and males = 3.9%; $\chi^2_{(1)}$ = 10.45, $p < .01$). Currently, a total of 5 % of the high school sample were still engaging in NSSI (females = 4.3%; males = 0.7%; $\chi^2_{(1)}$ = 7.13, $p < .01$). Mean age of onset of NSSI in males was 13.6 years (*SD* = 2.28) and in females 13.5 years (*SD* = 1.96).

3.2. Mean differences

The results of the MANCOVA with the 10 IDS items as dependent variables and gender and presence/absence of NSSI as independent variables, controlled for age, (Table 1) showed significant main effects for gender (Wilk's lambda = .94, $F(10, 522) = 3.36$, $p < .001$, $\eta_p^2 = .60$) and presence/absence of NSSI (Wilks' lambda = .85, $F(10, 522) = 9.00$, $p < .001$, $\eta_p^2 = .15$). Concerning gender, higher mean distress scores were seen in females in the domains of career choices, friendships, group loyalties, overall level of discomfort due to distress, distress interfering with life, and duration of distress as compared to males. Concerning NSSI (Table 2), adolescents with NSSI scored significantly higher on the domains of long-term goals, friendship, sexual orientation and behavior, values and beliefs, overall level of discomfort due to distress, distress interfering with life, and duration of distress compared to adolescent without NSSI. There was no significant interaction effect between gender and presence/absence of NSSI on the 10 IDS items (Wilks' lambda = .98, $F(10, 522) = 1.32$, *ns*, $\eta_p^2 = .03$).

Table 1. A comparison of means (with standard deviations) for male and female adolescents for 10 items of IDS, two subscales of ids and anxiety/depression.

	Males (n =201)		Females (n = 335)		F (1, 531)
	M	(SD)	M	(SD)	
Long term goals	2.71	(1.11)	2.79	(1.16)	2.10
Career choice	2.90	(1.23)	3.13	(1.12)	10.50**
Friendships	2.66	(1.22)	3.41	(1.20)	17.92***
Sexual orientation & behavior	1.70	(1.70)	1.73	(1.07)	0.02
Religion	1.20	(0.56)	1.30	(0.71)	1.89
Values and beliefs	1.93	(0.99)	2.24	(1.13)	0.45
Group loyalties	2.01	(1.09)	2.47	(1.23)	12.68***
Overall level of discomfort	2.33	(1.02)	2.84	(1.03)	13.68***
Interferance with life	2.08	(0.98)	2.56	(1.15)	12.91***
Duration of distress	1.86	(1.19)	2.18	(1.23)	6.86**
	Males (n = 201)		Females (n = 339)		F (1, 535)
	M	(SD)	M	(SD)	
Domain distress scores	2.16	(0.60)	2.44	(0.63)	14.72***
Impairment scores	2.09	(0.89)	2.53	(0.96)	16.68***
	Males (n = 215)		Females (n = 347)		F (1, 557)
	M	(SD)	M	(SD)	
Anxiety	6.40	(3.56)	8.38	(3.78)	14.96***
Depression	4.33	(2.82)	4.17	(3.07)	0.66

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

The results of the MANCOVA with the two IDS subscales – domain distress scores and impairment scores as dependent variables and gender and presence/absence of NSSI as independent variables controlled for age, showed significant main effects for both gender (Wilks' lambda = .97, $F(2, 534) = 9.53$, $p < .001$, $\eta_p^2 = .04$) and presence/absence of NSSI (Wilks' lambda = .89, $F(2, 534) = 32.48$, $\eta_p^2 = .11$).

Table 2. A comparison of means (with standard deviations) for presence/absence of NSSI for 10 items of ids, two subscales of ids and anxiety/depression.

	NSSI = 0 (n = 448)		NSSI = 1 (n = 88)		F (1,531)
	M	(*SD*)	*M*	(*SD*)	
Long term goals	2.70	(1.11)	3.03	(1.24)	4.29*
Career choice	3.07	(1.14)	2.93	(1.31)	2.63
Friendships	3.06	(1.26)	3.49	(1.23)	5.58*
Sexual orientation & behavior	1.64	(0.96)	2.13	(1.44)	10.68**
Religion	1.25	(0.65)	1.33	(0.71)	0.40
Values and beliefs	2.08	(1.04)	2.34	(1.30)	5.50*
Group loyalties	2.26	(1.14)	2.47	(1.46)	0.06
Overall level of discomfort	2.52	(1.00)	3.30	(1.08)	30.34***
Interferance with life	2.24	(1.05)	3.09	(1.16)	29.76***
Duration of distress	1.88	(1.09)	2.99	(1.41)	48.36***

	NSSI = 0 (n = 450)		NSSI =1 (n = 90)		F (1, 535)
	M	(*SD*)	*M*	(*SD*)	
Domain distress scores	2.29	(0.61)	2.53	(0.72)	5.50*
Impairment scores	2.21	(0.87)	3.14	(1.02)	55.17***

	NSSI = 0 (n = 450)		NSSI =1 (n = 90)		F (1, 557)
	M	(*SD*)	*M*	(*SD*)	
Anxiety	7.09	(3.45)	10.28	(4.42)	36.72***
Depression	3.82	(2.63)	6.30	(3.66)	39.11***

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

However, effect sizes indicated that the mean differences for gender were quite small. Again, no significant interaction effect emerged. Concerning gender, it was observed that females had higher mean scores for both domain distress scores and impairment scores than males. Concerning NSSI, adolescents with NSSI scored significantly higher on domain distress and impairment scores compared to adolescents without NSSI.

Finally, the MANCOVA with anxiety and depression as dependent variables and gender and presence/absence of NSSI as independent variables controlled for age, showed

significant main effects for gender (Wilks' lambda = .97, $F(2, 556) = 9.83$, $p < .001$, $\eta_p^2 = .03$) and presence/absence of NSSI (Wilks' lambda = .91, $F(2, 556) = 26.30$, $p < .001$, $\eta_p^2 = .09$), whereas the interaction was not significant (Wilks' lambda = .99, $F(2, 556) = .92$, *ns*, $\eta_p^2 = .003$). It was observed that females had higher mean scores for anxiety. However, mean scores on depression did not differ between the two genders (Hyde, Mezulis, & Abramson, 2008). Additionally, adolescents with NSSI scored significantly higher on anxiety and depression compared to adolescents without NSSI.

3.3. Regression analysis

Table 3. Hierarchical linear regression analysis with lifetime prevalence of NSSI as the dependent variable and gender, age, anxiety, depression and domain distress scores as independent variables

Hierarchical Step	Predictor variable	B	SE	*t*	β	R^2
1	Gender	.069	.032	2.15*	.090	.141
	Age	-.008	.011	-.74	-.029	
	Anxiety	.018	.005	3.88***	.181	
	Depression	.029	.006	5.01***	.227	
2	Gender	.072	.033	2.20*	.093	.142
	Age	-.007	.011	-.66	-.027	
	Anxiety	.019	.005	3.78***	.193	
	Depression	.029	.006	5.04***	.229	
	Domain distress scores	-.015	.028	-.55	-.026	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 4. Hierarchical linear regression analysis with lifetime prevalence of NSSI as the dependent variable and gender, age, anxiety, depression and impairment scores as independent variables

Hierarchical Step	Predictor variable	B	SE	*t*	β	R^2
1	Gender	.059	.033	1.81	.077	.140
	Age	-.009	.011	-.80	-.033	
	Anxiety	.018	.005		.185	
				3.90***		
	Depression	.029	.006	4.93***	.227	
2	Gender	.034	.033	1.05	.044	.175
	Age	-.017	.011	-1.57	-.064	
	Anxiety	.006	.005	1.22	.065	
	Depression	.022	.006	3.85***	.179	
	Impairment scores	.096	.020	4.75***	.246	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Results from the hierarchical regression analyses, as seen in Tables 3 and 4, demonstrated that impairment scores did and domain distress scores did not significantly explain variance in lifetime prevalence of NSSI above and beyond gender, age, depression, and anxiety.

3.4. Mediation analysis

As mentioned above, since domain distress scores did not explain additional variance in presence/absence of NSSI and lifetime prevalence of NSSI, only impairment score was considered as a potential mediator. Step 1 of the mediation analysis involved regressing differences in lifetime prevalence NSSI on differences in gender (β = .09, p < .05). Step 2 involved regressing differences in gender on the impairment score (β = .13, p < .001). Step 3 involved regressing impairment score on differences in lifetime prevalence of NSSI (β = .26, p < .001). Finally, Step 4 involved regressing lifetime prevalence on differences in gender and impairment scores simultaneously. It was observed that the gender effect on NSSI (β = .04, *ns*) was no longer significant when taking identity impairment into account, pointing to complete mediation. Further, Sobel's test also confirmed the significance of the indirect effect (z' = 2.98, p < .01).

4. Discussion

In the present study, we examined if distress on specific domains of identity and impairment due to this identity distress differed between male and female high school students and between students with and without NSSI. We also explored if NSSI was influenced by distress on specific domains and impairment due to identity distress above and beyond anxiety and depression. Finally, we investigated if differences in lifetime prevalence in NSSI between males and females were mediated by impairment due to identity distress caused.

Overall prevalence of NSSI in our sample was 16.5%, which was close to the average suggested by Swannell et al. (2014). The lifetime prevalence of NSSI was significantly higher in female adolescents as compared to males. Similarly, higher numbers of females were actively engaging in NSSI at the time of the study than male high school students. Results strengthen previous findings that suggest that NSSI is more common in female adolescents than males (Muehlenkamp & Gutierrez, 2007).

We observed that impairment due to identity distress was more elevated in females as compared to males. Our results also indicate that gender differences in NSSI are strongly associated with impairment scores and distress scores above and beyond anxiety, depression, and age. Our study verifies and corroborates the association between identity issues and NSSI noted in the literature (Breen et al., 2013).

In terms of distress related to specific identity domains, it was found that the domains of career, friendship, and group loyalties were more distress provoking in females than in males. These findings provide some support for the observation that women, in general, are more affected by interpersonal issues but also indicate that they are equally distressed about intrapersonal issues (Archer, 1989). Significant differences in distress related to specific domains of identity were also found between those with and without lifetime NSSI. It was found that those who had ever engaged in NSSI reported higher levels of distress in domains of long-term goals, friendships, sexual orientation and behavior, values and beliefs. Though there is very little research on associations between identity domain distress and NSSI, our findings confirm the positive association between NSSI and sexual identity – a frequently investigated topic in NSSI literature (Batejan et al., 2014). This may be because of the fact non-hetero-normative identities may be use NSSI as a means of dealing with the minority stress (Meyer, 2003; Sornberger, Smith, Toste, & Heath, 2013).

Our results indicate that gender differences in NSSI were mediated by differences in impairment due to distress over identity issues; and not mediated by differences in distress on specific identity domains. Contextualizing our results in previous work on identity

status/processes and NSSI can indicate possible pathways by which these constructs are related. Wängqvist and Frisén (2011) already found that perceived distress over specific identity issues mediated the association between identity exploration and increased psychological symptoms. Claes et al. (2014) established that identity confusion is positively related and identity synthesis is negatively related to NSSI. Further, Luyckx et al. (in press) also reported that individuals engaging primarily in ruminative exploration without the ability to form identity commitments were at greater odds of engaging in NSSI. Based on the present findings, the association between problematic identity development and NSSI may also be mediated by impairment due to daily impact of identity distress – a conclusion in line of Wängqvist and Frisén (2011). We further hypothesize that impairment due to daily impact of identity distress may lead to affect disturbances. Such affect disturbances may further tax the already fragile affect regulation system of the adolescents (Gross, 2013). Vulnerable adolescent may endorse NSSI as a means to regulate affect (Franklin et al., 2010). Clinical implications of the present study suggest that though many adolescents may struggle with distress related to specific identity domains as they move toward successful identity consolidation or unsuccessful identity diffusion, clinical focus on impairment caused by identity distress may be more helpful.

Some limitations of the study warrant discussion. First, the study was cross-sectional in nature, which makes it impossible to draw conclusions regarding the directionality of effects. Therefore, future studies should use longitudinal designs to establish the directionality of effect between lifetime prevalence of NSSI and severity of distress related to identity issues. Second, the study was exclusively based on self-report measures, which could increase the associations among the variables due to shared method variance. Further research with diagnostic interviews of those endorsing NSSI may offer a more fine-grained picture of NSSI. Finally, our sample included only Caucasian adolescent population and, hence, results may not be generalizable. Studies involving multiethnic population are needed.

In spite of these limitations, the present study adds a new perspective to the emerging research area of identity and NSSI. Through this study, attention has been drawn to gender differences in identity development distress. Through this study, attention has been drawn to gender differences in identity development distress. Most importantly, gender differences in NSSI were found to be mediated by gender differences in the impairment due to the daily impact of identity distress.

Chapter 4.

Directionality of effects between non-suicidal self-injury and identity formation: A prospective study in adolescents.

Gandhi, A., Luyckx, K., Maitra, S., Kiekens, G., Verschueren, M., & Claes, L. (2017)[4]

Abstract

The aim of the present 1-year longitudinal study was to investigate the directionality of association between NSSI and identity formation. We also explored if identity synthesis and identity confusion differed among the control, cessation, onset, and maintenance NSSI groups over a period of one year. We collected data on NSSI and identity from 380 high school students (Mean age = 14.3 years; SD = 1.68; range 12 to 19 years; 52.4% females) using self-report questionnaires at two measurement waves separated by a one-year period. The lifetime prevalence of NSSI at Time 1 was 14.2% and the 12-month prevalence of NSSI at Time 2 was 7.7%. We performed cross-lagged analyses using structural equation modelling techniques to investigate the directionality of effects. Our findings suggest that the associations between NSSI and identity synthesis and confusion are likely to be bi-directional. Mean differences in identity synthesis and confusion were also observed among control, cessation, onset, and maintenance NSSI groups. Clinical implications of these findings are discussed.

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1. Introduction

Non-Suicidal Self-Injury (NSSI) refers to 'the intentional destruction of one's body tissue without suicidal intent' (Nock, 2009). Common forms of NSSI include self-cutting, self-hitting, self-burning, head-banging, etc. Apart from the obvious physical sequelae of scarring and the risk of tissue infections, NSSI is also associated with psychiatric disorders like depression, anxiety, eating disorders, and personality disorders like Borderline Personality disorder (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Peterson, Freedenthal, Sheldon, & Andersen, 2008). NSSI is also related to increased risk of suicidal ideations and suicidal attempts (Nock et al., 2006). NSSI often has its onset in adolescence and its prevalence peaks during 14–15 years of age (Plener, Schumacher, Munz, & Groschwitz, 2015). In fact, a meta-analysis has indicated that NSSI is more prevalent in adolescents than in adults (Swannell, Martin, Page, Hasking, & St John, 2014). As effective treatment modalities for clinical management of NSSI are generally lacking (Calati & Courtet, 2016), identifying factors that increase vulnerability to NSSI is essential for prevention and early intervention.

The onset of NSSI and the subsequent peak in its prevalence coincides with the identity crisis phase of adolescence. According to Erikson, the adolescent identity crisis represents a normative developmental phase of transition in which one's childhood identity is no longer experienced as suitable, but a new identity is yet to be established (Erikson, 1968). A successful resolution of this crisis leads to identity synthesis, in which adolescents develop a set of self-identified ideals, values, and goals. However, if this crisis persists, identity confusion ensues (Schwartz, 2001). Identity synthesis leads to a coherent sense of self which is consistent across time and is often associated with higher self-esteem, purpose in life, and agency (Schwartz, 2007). On the other hand, identity confusion in adolescents is often associated with the inability to form intimate relationships, mood swings, rebelliousness, and heightened physical complaints (Erikson, 1950). Persistent identity confusion has also been connected to psychiatric disorders and personality disorder symptoms (Demir, Dereboy, & Dereboy, 2009).

Existing qualitative and observational research indicates that disturbances in the process of identity formation and NSSI may be related. For example, based on the online autobiographical accounts of NSSI, Breen, Lewis, and Sutherland (2013) concluded that NSSI may serve as a means of developing a sense of self-identity ("I am a self-injurer") by connecting with others who engage in similar behaviors. Breen and colleagues also suggested that NSSI may provide a basic sense of a coherent self that can persist across time. Observational studies in community and clinical samples provide more direct evidence for the association between disturbed identity formation and NSSI. For example, in a sample of high school students, Claes,

Luyckx, and Bijttebier (2014) found that NSSI was negatively associated with identity synthesis and positively associated with identity confusion. Further, they also reported that identity confusion explained additional variance in lifetime NSSI beyond age, gender, and internalizing symptoms. These findings have been replicated in adolescent community samples (Gandhi, Luyckx, Maitra, Kiekens, & Claes, 2016; Luyckx, Gandhi, Bijttebier, & Claes, 2015) as well as in clinical samples. For example, Claes et al. (2015) found that eating disorder patients who engaged in NSSI reported significantly lower identity synthesis and higher identity confusion than eating disorder patients who did not engage in NSSI. This study also found that lack of identity synthesis explained additional variance in lifetime NSSI beyond age, gender, and internalizing symptoms.

Overall, the existing literature suggests that both identity synthesis and identity confusion may be uniquely and incrementally associated with NSSI. However, it is not clear if disturbances in identity formation precede or are a consequence of NSSI. Cross-sectional research has demonstrated that individuals who engaged in NSSI in the past are more likely to lack identity synthesis, whereas individuals who are currently engaging in NSSI are more likely to be experiencing identity confusion (Luyckx et al., 2015). These findings suggest a bi-directional association between disturbances in identity formation and NSSI such that a more cyclic pattern may be possible. That is, adolescents may engage in NSSI as a means of coping with the emptiness associated with disturbed identity formation, whereas engaging in NSSI may also give rise to developmental delays in identity formation. However, longitudinal research is necessary to confirm this hypothesis.

The present study serves to extend the work of Claes et al. (2014) and Luyckx et al. (2015) regarding the positive association between adolescents NSSI and disturbances in identity formation. More specifically, using a prospective study design we investigated if disturbances in identity formation in high school students' increases vulnerability to NSSI or if engaging in NSSI increases vulnerability to identity formation (i.e. the directionality of effect between NSSI and identity formation). In line with previous cross-sectional research (Luyckx et al., 2015), we expected this association to be bi-directional. We also explored if there were mean level differences in identity synthesis and identity confusion over a period of 1 year in the following four groups: (1) individuals who did not engage in NSSI at Time 1 and Time 2; (2) individuals who engaged in NSSI only at Time 1 and not at Time 2; (3) individuals who engaged in NSSI only at Time 2 and not at Time 1; and (4) individuals who engaged in NSSI at Time 1 and Time 2. Similar to the previous research, these groups were referred to as control, cessation, onset, and maintenance, respectively (Tatnell, Kelada, Hasking, & Martin, 2014).

Given the small number of participants in the aforementioned four groups, this objective was treated as an exploratory research question. Nonetheless, based on the findings of the cross-sectional studies (Claes et al., 2014, 2015; Gandhi et al., 2016; Luyckx et al., 2015;), we expected the maintenance group to have greater identity disturbances (characterized by lower identity synthesis and higher identity confusion) as compared to the other groups.

2. Method

2.1. Participants and procedure

Data for the present longitudinal study were collected through convenience sampling from high school students located in the Dutch speaking part of Belgium in two measurement waves. The first measurement wave was collected in the beginning of 2015 and the second measurement wave was collected one year later. The students were allowed to participate in the study only if they had informed consent from their parents. Data collection was carried out during school hours. Students were provided with an envelope including an assent/consent form and the questionnaires. They were requested to return completed forms in a sealed envelope to the researchers who were present during the data collection. The same procedure was used at Time 2. Additionally, at Time 2, participants who had completed their high school education or left the school for other reasons were contacted via email and requested to complete the questionnaires online. All students who participated at Time 1 and Time 2 were given a movie ticket as a compensation for participation. To ensure confidentiality, all students were assigned a unique code number. The study was approved by the ethics committee of the Faculty of Psychology and Educational Sciences, University of Leuven.

Out of the total 1115 students contacted, 528 students participated at Time 1 (50.4% female; 95.5% Belgian nationality). Given the sensitive nature of the research topic and as we sought parental consent, the lower response rate of 47.35% was not unexpected. The mean age of the participants was 15 years (*SD* = 1.84 years; range 11 to 19 years). Overall, 382 students who participated at Time 1 also participated at Time 2 (Retention rate = 72.07%). Data from two participants were removed due to missing values. Hence, the final sample size consisted of 380 participants (Mean age = 14.3 years; *SD* = 1.68; range 12 to 19 years; 52.4% females). Attrition analyses indicated that, except for age ($F(1, 354) = 26.33$, $p = .001$), students who did and did not participate at Time 2 were similar in gender, nationality, and identity variables measured at Time 1. Higher mean age in the participants who left the study was expected as older participants who left the school after completing their high school education mostly did not participate at Time 2. Finally, a chi-square test indicated that attrition (non-participation in

Time T2) was not associated with engagement or non-engagement in NSSI at Time 1 (χ^2 = .199, p = .656). Further details of the attrition analysis are presented in Appendix 2.

2.2. Measures

2.2.1. Non-suicidal self-injury

At Time 1, we assessed the lifetime prevalence of NSSI by means of a single-item measure (i.e., “Have you ever injured yourself on purpose without an intent to die?”). At Time 2, new cases of NSSI (since Time 1) were again identified by means of a single-item measure (i.e., “In the past 12 months, have you deliberately injured yourself without an intent to die?”). We further assessed lifetime prevalence of seven different forms of NSSI (scratching, carving, cutting, hitting or bruising, burning, pricking with sharp objects, and head banging). At Time 2, the 12-month prevalence of the same seven forms of NSSI was measured again.

2.2.2. Identity formation

The identity subscale of the Erikson's Psychosocial Inventory (EPSI; Rosenthal, Gurney, & Moore, 1981) was used to measure identity synthesis and confusion at Time 1 and Time 2. The EPSI is a 12-item questionnaire that measures the extent to which participants have a clear sense of who they are and what they believe in (Schwartz, Zamboanga, Wang, & Olthuis, 2009). The EPSI has two subscales: identity synthesis (6 items; sample item: “The important things in life are clear to me”) and identity confusion (6 items; sample item: “I don't really know who I am”). The Cronbach's alpha coefficient for identity synthesis was 0.74 both at Time 1 and Time 2. The Cronbach's alpha coefficient for identity confusion at Time 1 was .67 and at Time 2 it was .70. As an alpha coefficient above 0.60 is considered to be acceptable for scales up to 6 items (Giacobbi, 2002), reliability of all the scales was adequate.

2.3. Analysis

To establish the directionality of effects between NSSI and identity synthesis/confusion, we performed cross-lagged analyses using structural equation modelling. A cross-lagged model (shown in Figure. 1) estimates cross-lagged, within-time, and stability relations between variables that are longitudinally measured. In line with Gandhi et al. (2016), we tested two separate cross-lagged models for synthesis and confusion, using version 7 of Mplus (Muthén & Muthén, 2012). We used the weighted least squares means and variance (WLSMV) adjusted estimation in Mplus as it is the preferred estimator for modelling categorical variables (NSSI at T1 and T2; Brown, 2006). We regressed all the variables in both the models with age and sex to control for these variables. Finally, to investigate if there were significant differences in identity synthesis and confusion among the four NSSI groups over a period of one year, we performed a mixed-design analysis of covariance (i.e., within and

between subject factors ANCOVA). Identity synthesis and confusion were selected as the within-subject factors, the four trajectories (control, cessation, onset, and maintenance) were selected as the between-subject factor, and gender and age were added as covariates.

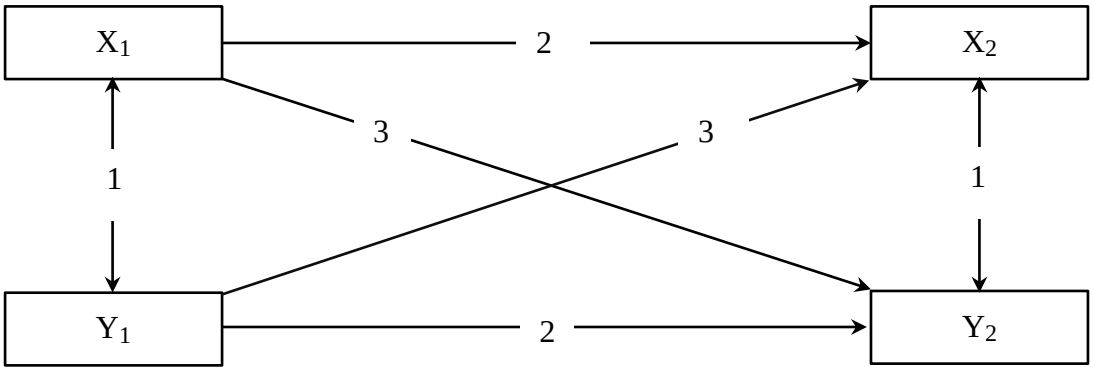

Figure 1. Cross-lagged model (1: within-time relations; 2: stability relations; 3: cross-lagged relations)

3. Results

3.1. Descriptive statistics

Lifetime prevalence of NSSI during Time 1 was found to be 14.2%, with higher prevalence in females than in males ($\chi^2_{(1)}$= 18.28, p < .001). Around 20.8% of females and 7.7% of male participants engaged in NSSI at Time 1. In terms of versatility of NSSI, almost 48% of participants who were engaging in NSSI used only one method, whereas 17.3% used two, 17.3% used three, and 12% used four or more different methods of NSSI. Female participants engaged more often in severe cutting, whereas bruising behaviors (head banging and hitting oneself) were the commonly endorsed NSSI methods in male participants (see Table 1). At Time 2, 7.7% (females = 5.3% and males = 2.4%) reported to have engaged in NSSI in the past 12 months. Around 10.1% of females and 5.0% of male participants engaged in NSSI at Time 2. Although no gender differences were observed in 12-month prevalence measured at Time 2 ($\chi^2_{(1)}$ = 3.36, p = .067), females and males continued endorsing different methods of NSSI. As seen in Table 1, female participants were more likely to engage in cutting, whereas male participants were more likely to engage in head banging. In terms of versatility, 3.7% used one method, 1.3% used two methods, 1.6% used three methods, and .3% used four methods.

Table 1. Gender wise distribution of seven different forms of NSSI at Times 1 and 2

NSSI form	Time 1			Time 2		
	Males (*n*)	Females (*n*)	Chi-square (df^{+}=1)	Males *(n)*	Females *(n)*	Chi-square (df^{+}=1)
Scratching	5	14	.00	0	4	2.09
Carving	9	29	.35	3	10	.70
Cutting	4	32	8.57*	2	14	5.73*
Hitting or bruising	8	4	11.69*	3	2	2.37
Burning	3	3	1.62	0	0	-
Pricking with sharp objects	3	11	.24	0	3	1.51
Head banging	10	8	10.11*	4	1	6.77*

* $p < .05$; $^{+}$ Degree of freedom

In terms of the trajectory of NSSI over a period of one year, it was observed that 319 participants (83.9%) never engaged in NSSI (Control group); 32 participants (8.4%) engaged in NSSI only at Time 1 (Cessation group); 9 participants (2.8%) engaged in NSSI only at Time 2 (Onset group); and, finally, 20 participants (5.3%) engaged in NSSI at both Time 1 and Time 2 (Maintenance group).

3.2. Directionality of association between NSSI and identity variables

Figure. 2(a) presents the longitudinal cross-lagged model for NSSI and identity synthesis. Cross-lagged coefficients indicated that identity synthesis at T1 negatively predicted NSSI at T2 whereas NSSI at T1 negatively predicted identity synthesis at T2. Cross-lagged coefficients for NSSI and identity confusion are displayed in the Figure. 2(b). Identity confusion at T1 positively predicted NSSI at T2 whereas NSSI at T1 positively predicted identity confusion at T2.

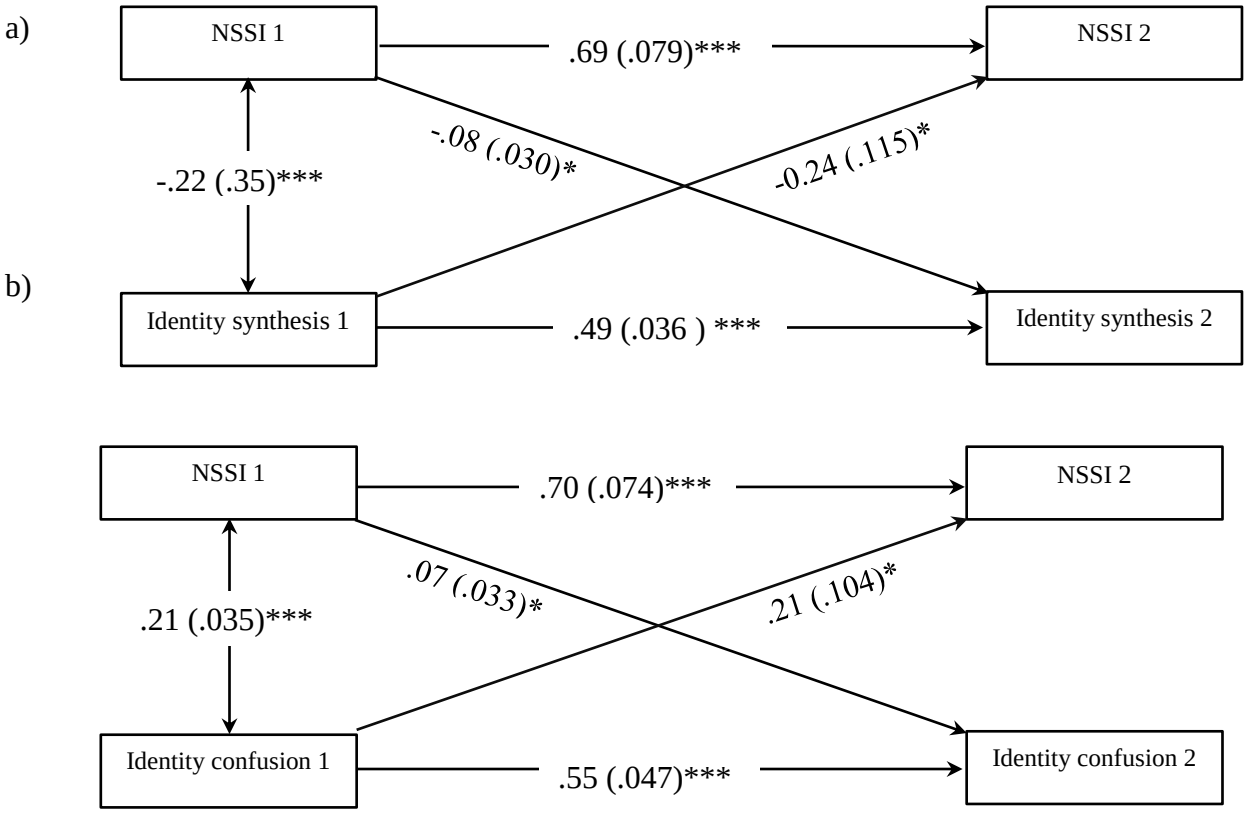

Figure 2. Cross-lagged path model linking NSSI and identity synthesis (a) and identity confusion (b). Only the significant relations are shown. Both models were controlled for age and sex. Both models were saturated. Associations between age and sex are not shown.
**p < .05, **p < .01, ***p < .001.*

3.3. Exploratory analysis of mean-level differences in identity variables over one year

Within and between subjects factors ANCOVA (Table 2) did not show any significant main effect of time for both identity synthesis (F(1, 368) = .50; p = .480; η_p^2 = .00) and confusion (F(1, 368) = 3.04; p = .082; η_p^2 = .00). However, a main effect of group membership was observed for both identity synthesis (F(3, 368) = 18.72; p < .001; η_p^2 = .13) and identity confusion (F(3, 368) = 15.30; p < .001; η_p^2 = .11). Post-hoc comparison of estimated marginal means (with Bonferroni's adjustment) indicated that at Time 1, the Maintenance group had a significantly lower mean for identity synthesis than the Control (p < .001), Cessation (p < .001), and Onset (p < .001). Similarly, higher mean for identity confusion was observed in the Maintenance group as compared to the other groups (i.e. Control (p < .001), Cessation (p < .001), and Onset (p < .001)). Similarly, at Time 2, as compared to the Control groups, the Maintenance group had a significantly lower mean for identity synthesis (p < .001) and a higher mean for identity confusion (p < .001).

Table 2. Means and standard deviation of identity synthesis and identity confusion at Times 1 and 2 for Control, Cessation, Onset, and Maintenance groups.

	Total		Control		Cessation		Onset		Maintenance	
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
	n = 374	*n* = 374	*n* = 313	*n* = 313	*n* = 32	*n* = 32	*n* = 9	*n* = 9	*n* = 20	*n* = 20
Identity synthesis	3.70 (.58)	3.71 (.57)	3.78 (.51)	3.78 (.51)	3.51 (.64)	3.47 (.71)	3.78 (.66)	3.53 (.56)	2.78 (.69)	3.09 (.70)
Identity confusion	2.63 (.61)	2.58 (.62)	2.56 (.54)	2.52 (.58)	2.81 (.77)	2.79 (.76)	2.43 (.65)	2.73 (.70)	3.51 (.54)	3.22 (.61)

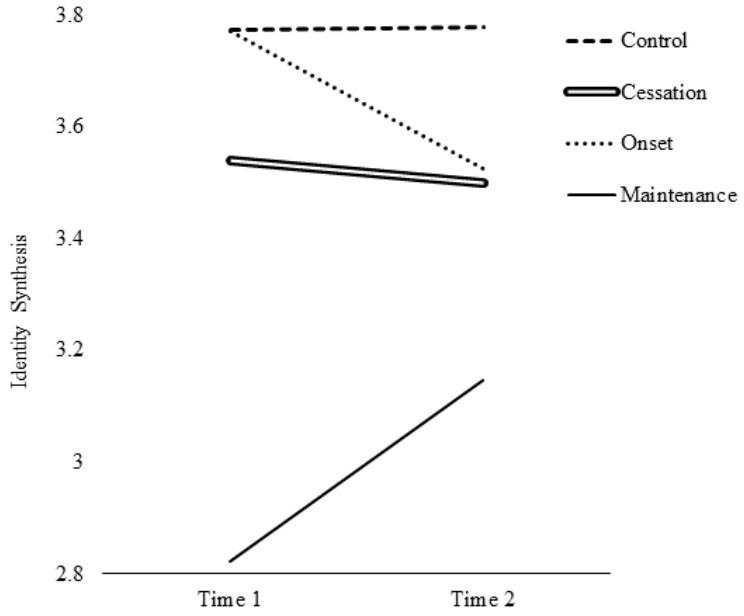

Figure 3. Changes in the estimated marginal means of identity synthesis for the Control, Cessation, Onset, and Maintenance groups at Time 1 and Time 2.

Further, results also indicated that the time × group membership interaction was significant for identity synthesis ($F(1, 368) = 4.18$, $p = .017$, $\eta_p^2 = .02$). Results of the post-hoc comparison of estimated marginal means (with Bonferroni's adjustment, see Figure. 3) showed that although the levels of identity synthesis for the Control ($p = .835$), the Onset ($p = .650$), and the Cessation groups ($p = .159$) did not differ significantly over a period of one year, statistically significant changes were observed only in the Maintenance groups. More specifically, the Maintenance group ($p = .038$) showed a significant increase in identity synthesis. Finally, time × group membership interaction was not significant for identity confusion ($F(1, 368) = 2.32$, $p = .100$, $\eta_p^2 = .01$).

4. Discussion

The current study investigated the directionality of the association between NSSI and disturbances in identity formation using prospective data. We supplemented this primary research objective with analyses to explore if levels of identity synthesis and confusion differed among four different NSSI trajectories over a period of one year. The lifetime prevalence of NSSI at Time 1 (14.2%) and the 12-month prevalence of NSSI at Time 2 (7.7%) in our sample was considerably high and highlight the importance of examining factors that increase vulnerability to NSSI especially in adolescents.

In agreement with our expectations, the cross-lagged models tested in the present study indicated presence of a bi-directional association between NSSI and identity synthesis/confusion. The bi-directional association suggests that individuals with disturbed identity formation (characterized by reduced identity synthesis and increased identity confusion) can increase the vulnerability to NSSI. As mentioned above, engaging in NSSI can alleviate disturbances in identity formation more directly by means of the formation of the pseudo-identity of "self-injurer" (Breen et al., 2013). More indirectly though, NSSI can also function as a means of regulating negative emotions that may be an outcome of the persistent identity confusion (Claes et al., 2014, 2015). However, our results also support the findings of Luyckx et al. (2015) who observed that engagement in NSSI can lead to further identity disturbances (characterized by decrease in identity synthesis and increase in identity confusion). This finding is indicative of the detrimental influence of NSSI on the normative developmental process and re-emphasizes the need for addressing NSSI in adolescents.

Ancillary exploratory analysis involving mean level changes in identity synthesis and confusion in different trajectories of NSSI based on two measurement waves provided additional information regarding the tested relationship. As expected, at both Time 1 and Time 2, individuals who continued to engage in NSSI reported higher disturbances in identity formation (characterized by lower identity synthesis and higher identity confusion) as compared to other groups especially the Control (no NSSI) group. Hence, the levels of identity synthesis and confusion clearly differentiated between participants who never engaged in NSSI and those who engaged in NSSI at both time points. The Cessation group, that is, participants who engaged in NSSI at Time 1 and not at Time 2, did not show any change in values of identity synthesis over a period of one year indicating that engagement in NSSI at Time 1 was not associated with a subsequent increase in disturbances in identity formation.

Finally, only the Maintenance group (participants who engaged in NSSI at both Time 1 and Time 2) showed a significant increase in identity synthesis at Time 2 as compared to the

baseline. The increase in identity synthesis observed in the Maintenance group can be attributed to a temporary “recovery” associated with the use of NSSI as an identity substitute (Breen et al., 2013). This strategy appears to be unsuccessful in achieving complete recovery from the disturbances in identity formation as identity synthesis score in these individuals was still significantly lower than individuals who never engaged in NSSI or those who engaged in NSSI only at Time 1. However, further research is required to confirm this hypothesis. Additionally, research is also required to investigate why increase in identity synthesis from Time 1 to Time 2 is not accompanied by a corresponding decrease in the identity confusion in the maintenance group. The lack of changes in the level of identity confusion can be either attributed to the small sample size or to the fact that identity synthesis and confusion function as independent constructs (Schwartz et al., 2009) rather than as two ends of the same continuum (Erikson, 1968).

In spite of extending the cross-sectional research on the relation between disturbances in identity formation and NSSI, our research is not without limitations. First, one of the main limitation of our study is its smaller sample size. Due to the lack of power, some significant results may have not been detected. Further research with larger samples is therefore warranted. Second, in the present study we used convenience sampling for data collection. Therefore, the possibility of presence of selection bias cannot be ruled out. Further studies using larger, randomized samples may be necessary to validate our findings. Third, we used Erikson's two-dimensional model of identity formation. Prospective research integrating identity dimensions proposed by more nuanced models of identity development may provide a more fine-grained picture of the association between identity and NSSI (Luyckx, Goossens, Soenens, & Beyers, 2006). Fourth, in the current research we only concentrated on the association between identity development and the prevalence of NSSI (lifetime at Time 1 and one-year prevalence at Time 2). Further research may include the relation between identity variables and other features of NSSI like the severity, frequency, and different methods of NSSI (versatility of NSSI). Finally, the development of adolescents is known to be an outcome of a complex interaction between identity formation and other developmentally relevant factors like personality (Klimstra, 2013). More research is needed to investigate the influence of such interactions on the vulnerability to NSSI. Such research endeavors can also inform the trait specified personality disorder model (especially BPD) introduced in DSM-5 (American Psychiatric Association, 2013) as this alternate model operationalizes personality disorder as an interaction of one's sense of identity and personality traits (Krueger & Markon, 2014).

Notwithstanding these limitations, our results can have some important implications for the prevention and management of NSSI. First, to some extent, our findings can explain the well-noted difficultly in the treatment of NSSI. A considerable body of existing literature together with the findings of the current study support the observation that adolescents may be engaging in NSSI to form a negative identity (Erikson, 1950) which may compensate for the lack of a consistent sense of self. Hence, treating NSSI without addressing identity issues may be difficult as adolescents may not be willing to forego the only identity they believe they possess. Developing healthy alternative identities in order to enable adolescents to see themselves as someone other than a "self-injurer", "slasher", "cutter", etc. may be a key step in the management of NSSI. Second, within the context of Erikson's psychosocial theory of development, resolution of a conflict of a particular developmental stage depends on successful resolution of previous developmental conflicts. Therefore, the disruptive influence of NSSI on the process of identity formation may extend well beyond adolescence. Adolescents who engage in NSSI may be at higher risk of social isolation and lack skills to develop intimate relationships because of their inability to resolve their identity issues. Hence, in clinical settings, it may be necessary to not only focus on the termination of NSSI but also to address the sequelae that develop as a result of NSSI. Finally, persistently low levels of identity synthesis and high levels of identity confusion coupled with repeated NSSI represents a constellation of symptoms that are common in psychiatric disorders like Borderline Personality Disorder and eating disorders (Claes et al., 2015; Marcia, 2006). Further research should investigate how identity disturbances and NSSI can interact to contribute in the development of these psychiatric disorders. Furthermore, individuals who exhibit persistent identity disturbances and NSSI may benefit from continued monitoring as early management of these conditions can also have preventive implications in these individuals.

In conclusion, the current research was the first to study the association between normative developmental processes like identity formation and NSSI in community adolescents using a longitudinal design. Our findings support previous theoretical observations, qualitative and quantitative cross-sectional research that adolescents may engage in NSSI to cope with disturbances in identity formation. Using these findings, we also demonstrated that addressing issues of identity formation may be important in the management of NSSI.

Section 3: NSSI and identity: Interpersonal and intrapersonal antecedents

Chapter 5.

Reactive and regulative temperament and non-suicidal self-injury in Flemish adolescents: The intervening role of identity formation.

Gandhi, A., Luyckx, K., Maitra, S., Kiekens, G., & Claes, L. (2016)[5]

Abstract

In the present study, we combined temperamental and identity models to investigate the influence of these two constructs on the vulnerability to non-suicidal self-injury (NSSI). We assessed NSSI, reactive [behavior inhibition system (BIS)/behavior activation system (BAS)] and regulatory temperament [effortful control (EC)], and identity synthesis and confusion using self-report questionnaires in 528 high school students (Mean age = 15 years, SD = 1.84, 50.4% female). The lifetime prevalence of NSSI was 14.2%. Our findings suggested that the association between BIS and NSSI was moderated by EC, such that higher levels of BIS and lower levels of EC predicted higher lifetime NSSI. Also, the association between BIS and NSSI was partially mediated by identity synthesis. The findings of the current study indicate that interventions that stabilize BIS reactivity, enhance EC, and promote identity synthesis may have important meaningful implications in the clinical management of NSSI.

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Reactive and regulative temperament and non-suicidal self-injury in Flemish adolescents: The intervening role of identity formation

1. Introduction

Non-suicidal self-injury (NSSI) is defined as 'the intentional destruction of one's body tissue without suicidal intent' (Nock & Favazza, 2009, *p*. 9). A review of the international literature has indicated that the lifetime prevalence of NSSI in adolescence is estimated to be around 18% (Muehlenkamp, Claes, Havertape, & Plener, 2012) indicating that NSSI is an important health concern in this age group. Hence, investigating factors that lead to increased susceptibility to NSSI is essential. In the present study, we combined temperamental and identity models to investigate the influence of these two constructs on NSSI. Temperamental theories offer a framework that can integrate biologically-based individual differences with developmental processes, such as identity formation, to explain pathways leading to NSSI. However, an integrated perspective that combines both these constructs has not been tested so far.

1.2. Temperament, identity, and NSSI: Conceptual and empirical associations

1.2.1. Temperament and NSSI

Temperament is defined as constitutionally-based individual differences in reactivity and regulation in the areas of affect, activity, and attention (Rothbart, Ahadi, & Evans, 2000). In the current study, we used Gray's (1991) Reinforcement Sensitivity theory (RST) to operationalize the reactive component of temperament. The original version of RST identifies three reactive systems: behavioral inhibition system (BIS), behavioral activation system (BAS), and Flight Fight/Flight System (FFS). BIS is responsive to cues of threat and non-reward. Activation of BIS triggers anxiety that may serve to inhibit approach behavior in response to negative consequences. BAS is responsive to cues of reward and non-punishment and its activation triggers approach behavior to rewarding stimuli (Gray, 1991). Finally, the FFS responds to unconditioned aversive stimuli by initiating defensive aggression or escape behavior. The FFS system will not be discussed further as it is not the focus of the current study.

The older version of RST was revised by Gray and McNaughton (2000). In the revised form of RST (rRST), BIS does not function as a punishment system but is conceptualized as a conflict detection and resolution system. BIS activity is experienced as worry, anxiety, or rumination. Further, unlike the original version of RST, the emotions of panic and fear were associated with the flight/freezing/fight system (FFFS) and not with BIS. The functioning of

BAS was extended to mediate responses to all appetitive stimuli (unconditioned and conditioned). Given that the older version of RST has been more extensively tested using questionnaires than the revised version (Corr, 2016), the present study continues to use the older version.

The regulatory component of temperament was operationalized as effortful control (EC), which is defined as the capacity to modulate the reactivity of BIS and BAS to elicit more adaptive behavioral response (Derryberry & Rothbart, 1997).

Interaction of temperamental reactivity (i.e., BIS and BAS) and regulation (i.e., EC) is known to increase vulnerability to various clinical diagnoses including anxiety, conduct disorder, ADHD, etc. (Nigg, 2006). However, only a handful of studies have explored this interaction with respect to NSSI. For example, in a sample of eating disorder female patients who engaged in NSSI, Claes, Norré, Van Assche, and Bijttebier (2014) observed that besides the main effects of BIS and EC, the interaction between BIS and EC was significantly associated with NSSI. More specifically, higher levels of BIS combined with lower levels of EC was associated with the highest probability of NSSI engagement. Similar results were observed in male eating disorder patients who engaged in NSSI (Claes et al., 2012). These findings are similar to those of Baetens, Claes, Willem, Muehlenkamp, and Bijttebier (2011), who reported that higher levels of BIS combined with lower levels of EC were strongly associated with NSSI in a community sample of adolescents. These findings support the idea that individuals with increased BIS and reduced EC may be more vulnerable to increased distress and they may use NSSI as a means to regulate emotional distress (Claes, Luyckx and Bijttebier, 2014; Claes, Norré,et al., 2014).

1.2.2. Identity formation and NSSI

Erikson (1968) defines identity as a sense of self, resulting from the integration of past, present, and future experiences. The process of identity formation begins in adolescence. A stable identity or identity synthesis is a process of reworking childhood identifications into a larger and self-determined set of ideals, values, and goals (Schwartz, Zamboanga, Wang, & Olthuis, 2009). Identity synthesis can lead to positive self-image and social relationships. However, the inability to develop a workable set of goals and commitments on which an adult identity can be constructed leads to identity confusion (Schwartz et al., 2009). Persistent identity confusion has been associated with both clinical syndromes and personality disorders (Demir, Dereboy, & Dereboy, 2009).

Disturbances in the process of identity formation have been implicated in the development of vulnerability to NSSI. Recent evidence suggests that NSSI may serve as a means to counteract a sense of loss of self (Breen, Lewis, & Sutherland, 2013). Associations between specific identity processes and statuses and NSSI have also been explored to some extent. In high school students, Claes, Luyckx, et al. (2014) found that NSSI was negatively associated with identity synthesis and positively associated with identity confusion. They also reported that identity confusion explained additional variance of NSSI above and beyond depression. Based on these findings, Claes and colleagues suggested that adolescents may engage in NSSI to cope with distress associated with identity confusion. Similar findings were reported by Luyckx, Gandhi, Bijttebier, and Claes (2015) in a sample of female high school students and female clinical population.

1.2.3. Temperament and identity formation

The influence of temperament on normal developmental processes like identity formation has not been studied as extensively as its role in clinical disorders. However, based on the influence of affective and behavioral outcomes of high BIS/BAS on identity formation some connections can be hypothesized. For example, it can be postulated that high BIS can have a disruptive influence on identity formation by triggering chronic anxiety. Adolescents with chronic anxiety may develop an "overcontrolling" personality which is characterized by resistance to taking decisions that would lead to changes in their lives. Ability to make and endure changes, however, is essential to the process of reworking old identities and forming new ones — i.e. identity synthesis (Crocetti, Klimstra, Keijsers, Hale, & Meeus, 2009). On the other hand, individuals with higher BAS may experience more positive feelings such as hope, elation, and happiness (Carver & White, 1994). Positive affect promotes exploration, enjoyment of new ideas and possibilities, and new ways of looking at things (Isen, 2008) — a process central to identity synthesis. Hence, high BAS may have positive influence on identity formation. Finally, high EC may help adolescents to navigate the period of identity crisis as it promotes higher attention to generate solutions, inhibit task-irrelevant thoughts, and persistence of a response in face of anxiety (due to high BIS; Rothbart & Ahadi, 1994). Hence, higher EC can promote identity synthesis and prevent identity confusion. However, as noted earlier, further research is needed to test these theoretical predictions.

1.2.4. The present study

The brief review of the literature presented above suggests that high temperamental reactivity (BIS, BAS) unregulated by regulatory temperament (EC) can lead to disturbances in identity formation and also increase vulnerability to NSSI. However, disturbances in identity

formation have also been associated with NSSI engagement in adolescents. Hence, investigating a model that integrates the combined influence of temperamental factors and identity development on the vulnerability to NSSI seems warranted. Therefore, the present study had two goals. First, we investigated the correlations between BIS, BAS, EC, identity synthesis/confusion, and lifetime NSSI. Second, we integrated the temperament and identity development theories to test a moderated mediation model (Figure. 1). More specifically, we tested if the associations between BIS/BAS and NSSI were mediated by identity synthesis and confusion, and, if so, whether EC moderated the associations between BIS/BAS and lifetime NSSI (*a* path in Figure. 1) and between BIS/BAS and identity synthesis/confusion (*b* path in Figure. 1).

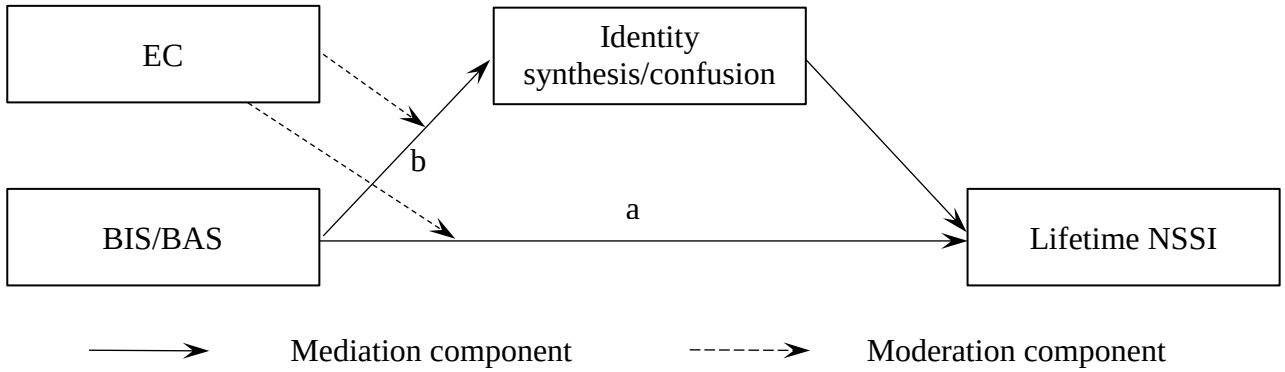


Figure 1. The moderated mediation model hypothesizing the relationship between Rothbart's temperament dimensions, identity formation, and lifetime NSSI.

2. Method

2.1. Participants and procedure

The data for the current study were collected from high school students from a school located in the Dutch speaking part of Belgium[6]. Out of the total 1115 students in the school, 530 students participated. Two responses had to be excluded because of missing data on the study variables. Consequently, the final sample consisted of 528 students (50.4% female; response rate = 47.35%). The age of the sample ranged from 11 to 19 years (grade 7 to 12), with a mean of 15 years (*SD* = 1.84 years). The majority of the participants were Belgian nationals (95.5%).

The high school students were provided with informed consent forms about 4 weeks prior to the day of data collection. Only students who obtained the signed consent form from

[6] The present data were also used in a manuscript by Gandhi et al. (2015) in which the association between maternal/peer attachment and NSSI was shown to be mediated by identity synthesis/confusion.

their parents were allowed to participate. Data collection was completed during the school hours. Students were provided with an assent form and questionnaires in a sealed envelope. Researchers were present during the process of data collection to answer any questions. Students were asked to hand over the completed questionnaires in sealed envelopes. Contact details of the principal investigator and other mental health services were provided to the students if they wanted help after participating in the survey. All participants were compensated for participation with a movie ticket. The ethics committee of KU Leuven (University of Leuven) approved the research protocol of the study.

2.2. Measures

We assessed NSSI by means of a single-item measure (i.e. “Have you ever injured yourself on purpose without an intent to die?”). Usage of single-item measures is common in NSSI research and often leads to a consistent estimation of prevalence of NSSI (Muehlenkamp et al., 2012).

The temperamental reactivity was assessed by means of the Behavior Inhibition System and Behavior Activation System Scales (BISBAS; Carver & White, 1994). The BISBAS scale consist of 20 items. Each item is scored on a 4-point Likert scale ranging from 1 (Very true for me) to 4 (Very false for me). The BIS subscale measures punishment sensitivity (sample item: “Criticism or scolding hurts me quite a bit”). The BAS subscale measures sensitivity to reward (sample item: “I go out of my way to get things I want”). In the present study, the Cronbach's alpha for BIS subscale and BAS subscale were .81 and .73 respectively. The BISBAS scale can also be used to measure BIS (conceptualized as anxiety and FFFS) and BAS as they are defined in the revised version of rRST (for further information, see Corr, 2016).

The Dutch version of Effortful Control Scale from the Adult Temperament Questionnaire (ATQ-SF-EC; Evans & Rothbart, 2007) was used to measure the individual differences in EC (regulative temperament). The ATQ-SF-EC has 19 items and items (sample item: “I am often late for appointments”) are measured on a Likert-type scale ranging from 1 (not at all applicable) to 7 (completely applicable). In the present study, the Cronbach's alpha for ATQ-SF-EC was .77.

Erikson Psychosocial Inventory was used to measure adolescent identity (EPSI; Rosenthal, Gurney, & Moore, 1981). EPSI is a 12-item self-administered scale used to measure identity synthesis (6 items; sample item: “I′ve got a clear idea of what I want to be”) and confusion (6 items; sample item: “I don't really know who I am”). The items are scored on a 5-point Likert scale ranging from 1 (Totally disagree) to 5 (Totally agree). In the present study, the Cronbach's alpha for identity synthesis and identity confusion were .75 and .67 respectively.

2.3. Analysis

All the analyses were performed using SPSS (v23). In order to facilitate comparisons between dependent variables that were measured on different scales, the study variables were standardized. First, associations between all the study variables were tested using Pearson product-moment correlation coefficients.

Next, moderated mediation was performed using a modified version of the piece-meal approach (Edward & Lambert, 2007). In this procedure, we tested the moderated mediation models only if specific parts of the hypothesized models (i.e. moderation and mediation pathways using bootstrap procedure) showed significant results. This procedure allows highlighting significant results from specific pathways even if the overall models do not fit the data.

We first used Model 1 from the PROCESS macro (v2.15; Hayes, 2013) to test if the associations between BIS, BAS, and lifetime NSSI were moderated by EC. Next, we tested if the associations between BIS, BAS, and identity synthesis/confusion were moderated by EC. To correct for multiple-testing, statistical significance was accepted only after Bonferroni correction. As we tested six separate moderation models, α was set at .008 (.05/6).

In the next step, we used Model 4 from the PROCESS macro to test if associations between temperamental dimensions (BIS and BAS) and lifetime NSSI was mediated by identity synthesis/confusion. The α was set to .05 to generate 95% CIs for the indirect effects.

Finally, if the findings of moderation and mediation analyses point to significant results, we investigated a direct effect and first-stage moderation model (Edwards & Lambert, 2007). We used Model 8 from the PROCESS macro to test this hypothesis.

Appropriate probability distribution was used in the regression analyses (i.e., the normal distribution for continuous outcome variables and the binomial distribution for a binary outcome; Agresti, 2013). All the analyses (moderation, mediation, and moderated mediation models) were controlled for age and gender. The number of bias-corrected bootstraps for all the analyses were set to 5000.

3. Results

3.1. Descriptive statistics

In our sample of adolescents, lifetime prevalence of NSSI was reported to be 14.2% (females = 10.4% and males = 3.8%; $\chi^2_{(1)} = 18.28$; $p < .001$).

3.2. Correlation analysis

The Pearson's product-moment correlations (see Table 1) indicated that lifetime NSSI was positively associated with BIS and identity confusion and negatively associated with

effortful control and identity synthesis. BIS was negatively associated with EC and identity synthesis, and positively associated with identity confusion. BAS was negatively associated with EC and positively associated with identity synthesis.

Table 1. Means, standard deviation, and correlations of the main study variables.

		1	2	3	4	5	6	7	8
1	Lifetime NSSI	1							
2	Sex	.18***	1						
3	Age	.13**	-.09*	1					
4	BIS	.28***	.41***	.09*	1				
5	BAS	-.06	-.10*	.10*	.03	1			
6	EC	-.20***	-.01	-.08	-.24***	-.19**	1		
7	Identity synthesis	-.33***	-.15**	-.07	-.31***	.16***	.35***	1	
8	Identity confusion	.31***	.12**	.10*	.42***	.06	-.41***	-.59***	1

3.3. Moderation analyses

Figures. 2, 3, and 4 (the left panels) indicate the main effects and interactions of BIS and EC on lifetime NSSI, identity synthesis, and confusion. The main effects of BIS and EC, and the interaction between BIS and EC (BIS ∗ EC) were significantly associated with NSSI. Post-hoc probing indicated that the probability of engagement in NSSI was highest for adolescents with high BIS and low EC. Further, although main effects of BIS and EC were significantly associated with identity synthesis and confusion, their interaction (BIS ∗ EC) was not significantly associated with identity synthesis/confusion.

3.4. Mediation analyses

Figures. 2, 3, and 4 (the right panels) indicate that the association between the main effect of BAS and its interaction with EC (BAS ∗ EC) were not significantly associated with NSSI. Further, although main effects of BAS and EC were significantly associated with identity synthesis, their interaction (BAS ∗ EC) was not significantly associated with identity synthesis. Also, only EC was found to be significantly associated with identity confusion, whereas the main effect of BAS and the interaction between BAS and EC (BAS ∗ EC) were not significantly associated with identity confusion. As the main effect of BAS was not significantly associated with NSSI and identity confusion, and the interaction between BAS and EC (BAS ∗ EC) was

not significantly associated with NSSI and identity synthesis/confusion, BAS was excluded from further analysis.

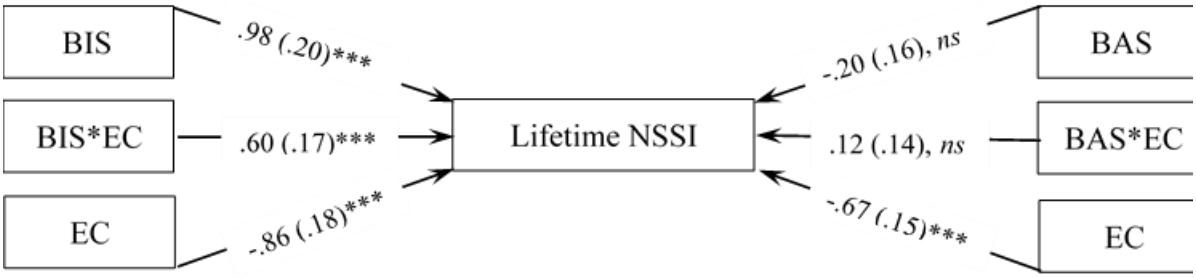


Figure 2. Standardized coefficients for main effects BIS/BAS, and EC and the interaction between BIS/BAS and EC in the prediction of lifetime NSSI. Numbers between the parentheses are standard errors. (* $p < .05$. ** $p < .01$. *** $p < .001$[7]

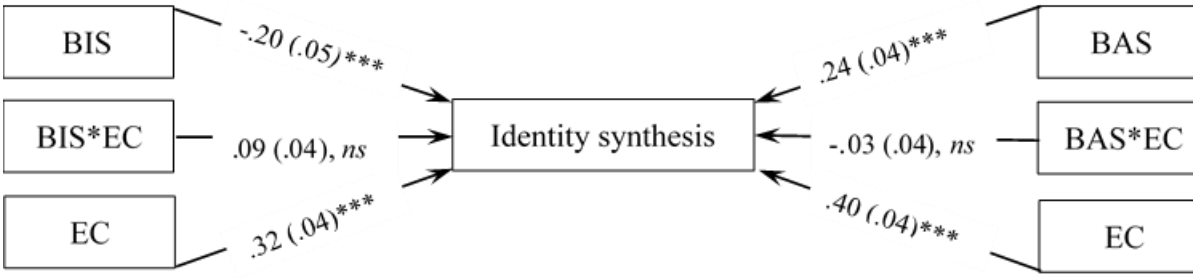


Figure 3. Standardized coefficients for main effects BIS/ BAS, and EC and the interaction between BIS/BAS and EC in the prediction of identity synthesis. Numbers between the parentheses are standard errors. (* $p < .05$. ** $p < .01$. *** $p < .001$)[7].

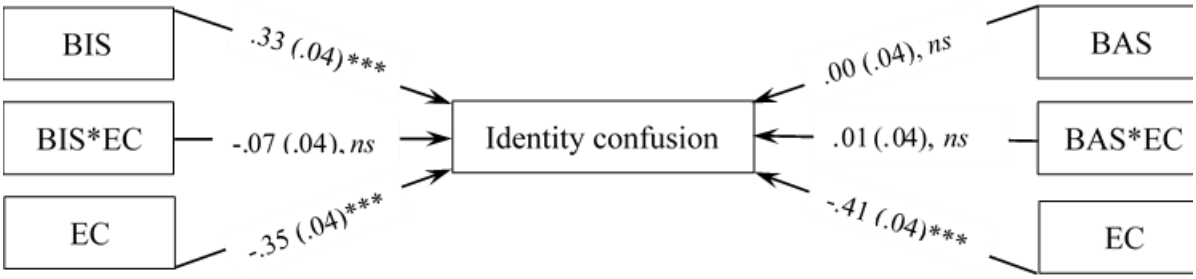
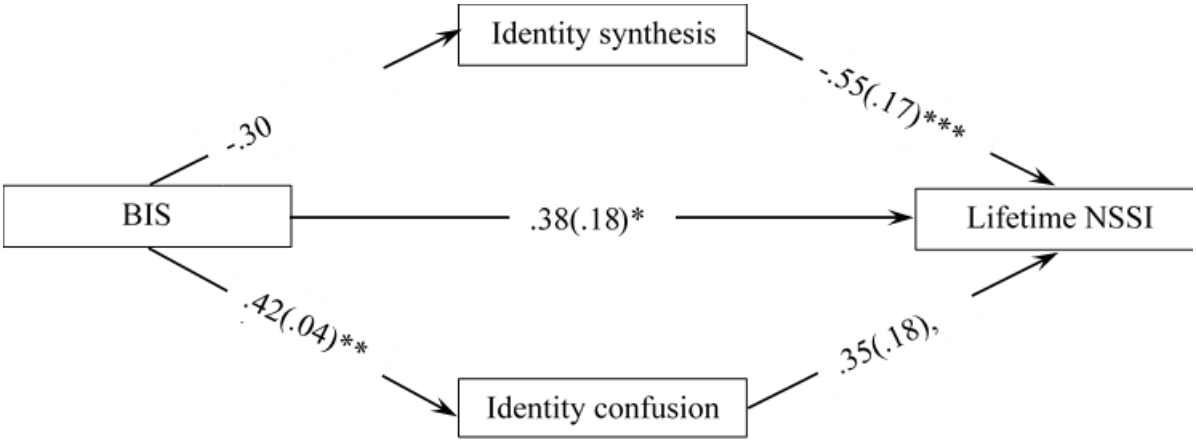


Figure 4. Standardized coefficients for main effects BIS/BAS, EC and the interaction between BIS/BAS and EC in the prediction of identity confusion. Numbers between the parentheses are standard errors. (* p < .05. ** p < .01. *** p < .001)7

As shown in Figure. 5, whereas the indirect effect of BIS on lifetime NSSI via identity synthesis (β= .164; *S.E.*= .065; 95% CI = [.060; .318]) was found to be significant, the indirect effect via identity confusion (β = .151; *S.E.* = .094; 95% CI = [− .039; .341]) was not. Given

[7] All moderation models were executed separately but are shown together here only for representational purpose.

that both the total and direct effects were significant, it can be concluded that the pathway between BIS and lifetime NSSI was partially mediated by identity synthesis.



Total effect from BIS → NSSI: β = .78 (.16)***

Figure 5: Standardized coefficients for parallel mediation models between BIS/EC and lifetime NSSI through identity synthesis/confusion. Associations with gender and age are not shown. Numbers between the parentheses are standard errors. (* p < .05. ** p < .01. *** p < .001).

As some findings of the moderation analyses were inconsistent with our hypotheses [i.e., the interaction of BAS and EC (BAS ∗ EC) were not significantly associated with NSSI or identity synthesis; and the interaction between BIS and EC (BIS ∗ EC) were not significantly associated with identity synthesis/confusion], the first stage moderation mediation model is not presented[8].

4. Discussion

The present study investigated the associations between reactive/regulative temperament, identity formation and vulnerability to NSSI, confirming and expanding the literature in several ways.

In line with previous research, BIS was found to be positively associated with NSSI, and EC was negatively associated with lifetime NSSI (Baetens et al., 2011; Claes, Luyckx, et al., 2014; Claes, Norré, et al., 2014). Further, identity synthesis and confusion were found to be significantly (positive and negative, respectively) related to NSSI (Claes, Luyckx, et al.,

[8] We tested the direct effect and first stage moderated mediation model for BIS but, as expected, no moderated mediation was found for the indirect effects via identity synthesis/confusion. Additionally, we also tested the moderated mediation for the revised version of BIS (rBIS) using the procedure mentioned above. We calculated the FFFS (α = .64) and anxiety (α = .74) subscales of rBIS using the factor solution for BISBAS scale suggested by Heym, Ferguson, and Lawrence (2008). Our finding indicated that EC moderated the association between NSSI and FFFS/anxiety and also the association between identity synthesis and FFFS (but not anxiety). Next, we found that pathway between FFFS/anxiety and NSSI was mediated by identity synthesis. Finally, moderated mediation was encountered for the FFFS subscale (via identity synthesis) but not for anxiety. However, these results should be interpreted with caution as the BISBAS scale does not adequately parse the revised version of RST (Corr, 2016). Details of the results are available from the first author upon request.

2014; Luyckx et al., 2015). Finally, lower scores of BIS and higher scores of BAS and EC were associated with a higher degree of identity synthesis. Also, higher BIS and lower EC scores were associated with a higher degree of identity confusion. These novel findings confirmed our hypotheses regarding the associations between temperamental dimensions and identity formation. The current findings also highlight the need for further exploration of these associations.

The moderation analysis showed that the interaction between BIS and EC was significantly associated with NSSI. More specifically, higher levels of BIS combined with lower levels of EC were associated with a higher probability to engage in NSSI. These findings are similar to the observations made by Claes et al. (2012), Claes, Luyckx, et al. (2014), Claes, Norré, et al. (2014) in eating disorder patients engaging in NSSI and by Baetens et al. (2011) in community adolescents engaging in NSSI.

Results of the mediation analyses indicated that associations between BIS and NSSI was mediated by identity synthesis and not by identity confusion. More specifically, higher levels of BIS may lead to a higher probability to engage in NSSI by partially suppressing identity synthesis. Greater identity synthesis, in turn, was associated with a lower probability to engage in NSSI. The current findings suggest that the lack of identity synthesis, rather than the presence of identify confusion may increase susceptibility to NSSI in adolescence. Although it is not clear why we encountered this discrepancy, these findings do reflect the views of Schwartz et al. (2009) who suggest that synthesis and confusion function more as independent constructs rather than as two ends of the same continuum, as suggested by Erikson (1968). Findings of this study support the idea that emotional distress secondary to increased BIS and reduced EC may lead to an increase in NSSI as it can help to regulate distress (Claes, Luyckx, et al., 2014; Claes, Norré, et al., 2014). In light of this finding, the lack of any relation between BAS and NSSI is unsurprising as BAS is exclusively represented by positive affect in the BISBAS scales (Carver and White, 1994).

Provided that our findings can be replicated longitudinally, our results have potential to inform clinical practice. The current study indicates that interventions that stabilize BIS reactivity, enhance EC, and promote identity synthesis may have important implications in the management of NSSI (Baetens et al., 2011; Claes, Luyckx, et al., 2014; Claes, Norré, et al., 2014). For example, Strauman's self-system therapy (Strauman et al., 2001) can decrease inhibition behaviors (governed by BIS) and hence can be helpful in the treatment of NSSI. Further, innovative techniques like videogames-based interventions (e.g., Braingame Brian; Prins et al., 2013) are likely to be successful in enhancing effortful control or self-regulation.

Finally, adventure programs like Actionques (Kaly & Heesacker, 2003), a ship-based program that integrates water-sports and activities that promote ego-identity development, may particularly work well in adolescents in promoting identity synthesis and hence may reduce vulnerability to NSSI.

The present study has some limitations. First, given the cross-sectional design of our study, no claims regarding causal relations between temperament, identity formation, and NSSI can be made. Most significant associations observed in the mediation analysis are expected to be bi-directional. Prospective research is required to replicate our current findings. Second, as mentioned above, although the use of a single Yes/No question to assess lifetime engagement in NSSI leads to consistent estimations of NSSI prevalence (Muehlenkamp et al., 2012), researchers should also investigate if the participants understanding of NSSI is similar to that of the researchers (Rodham & Hawton, 2009). Use of follow-up interviews or qualitative questions checking participants' understanding of NSSI can help researchers to address this issue. Third, in the present study, the alpha coefficient of the identity confusion sub-scale was marginally less than the conventionally accepted value (0.70). Although, for scales with six or less than six items, alpha co-efficient values above 0.60 are considered as satisfactory (Peter, 2002), our findings should be still interpreted with caution. Finally, whereas the original RST is more commonly used in personality research, our preliminary analyses (see Footnote 2) indicated that two components of rBIS (fear and anxiety) may also play an important role in development of NSSI through complex developmental mechanisms. Hence, future researchers should consider exploring NSSI from the context of rRST.

Chapter 6.

Non-suicidal self-injury and adolescents attachment with peers and mother: The mediating role of identity synthesis and confusion.

Gandhi, A., Claes, L., Bosmans, G., Baetens, I., Wilderjans, T. F., Maitra, S., Kiekens, G. & Luyckx, K. (2016)[9]

Abstract

Non-suicidal self-injury (NSSI) is highly prevalent in adolescents. Secure attachment with family and peers can reduce vulnerability to NSSI and can optimize the outcomes of developmental challenges such as identity formation. Problems experienced in these developmental processes and contexts can increase vulnerability to NSSI. Hence, the present study examined associations between attachment with mother and peers, identity formation, and NSSI, using self-report questionnaires in 528 high school students (Mean age = 15.0 years, SD = 1.84, 11–19 years, 50.4 % females). The lifetime prevalence of NSSI was found to be 14.2 %. Mediation analyses indicated that peer trust had a significant negative indirect effect on NSSI via identity synthesis and confusion. The positive association between peer alienation and NSSI was partially mediated by a lack of identity synthesis. Further, the pathways from maternal trust and alienation to NSSI were fully mediated by both identity confusion and synthesis. Clinical implications and suggestions for future research are discussed.

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Non-suicidal self-injury and adolescents attachment with peers and mother: The mediating role of identity synthesis and confusion

1. Introduction

Non-suicidal self-injury (NSSI) is defined as 'the intentional destruction of one's body tissue without suicidal intent' (Nock and Favazza 2009). Due to high lifetime prevalence rates of NSSI, combined with physical, social, and mental health implications, it has emerged as a major public health concern. NSSI is generally found to have its onset in adolescence (Jacobson and Gould 2007) and its lifetime prevalence in community samples of adolescents is about 18 % (Muehlenkamp et al. 2012; Swannell et al. 2014). Adolescence is considered as a period of transition and constitutes the key life stage for identity development (Hopkins 2014). Because of increased incidence of emotional and behavioral disorders, suicide, and drug and alcohol (ab)use, it is also a period of heightened biopsychosocial risks (Sells and Blum 2013). Successful development through this transitional phase has its basis in the context of secure and responsive family attachments (Lapsley et al. 1990). Peer relationships also become increasingly important through adolescence and have been shown to shape developmental outcomes (Marion et al. 2013). Although parental/peer attachment, identity formation, and NSSI seem interrelated, these variables have not been integrated in a single model.

Bowlby's attachment theory explains how early experiences of infants with their caregiver lead to the consolidation of an internal working model—a framework that guides further relationships (Bowlby 2008). Caregiver's sensitivity and availability are important factors that determine the type of attachment the infant forms (Ainsworth et al. 2014). For example, infants whose caregivers are responsive and sensitive to their needs, generally develop secure attachments. Infants and young children with secure attachments are characterized by higher self-reliance, emotional regulation, social competency, and positive mental health (Bowlby 1973). On the other hand, neglect and maltreatment evokes insecure attachments in infants and children (Main and Solomon 1993). Although attachments formed during childhood remain open to revision in light of future life experiences, some degree of individual differences in attachment styles remain stable across significant portions of life span (Fraley and Roisman 2015; Zayas et al. 2011). Given the transitional nature of adolescence, attachment systems assume significant interest in this developmental phase (Allen and Land 2008).

A positive association between a conflictual or low supportive family environment and NSSI is well documented (Adrian et al. 2011), yet so far, only a handful of studies have focused on associations between specific dimensions of parent-adolescent attachment and NSSI

(Bureau et al. 2010). For example, dimensions like communication, trust, and alienation have been demonstrated to be significantly associations with disturbances in specific behavioral and emotional problems, including NSSI in adolescents (Roelofs et al. 2013; Yates et al. 2008) hence, investigating these specific dimensions seems necessary.

In a cross sectional and a longitudinal sample of 1036 and 245 adolescents respectively, Yates et al. (2008) found that NSSI in adolescents was predicted by feelings of alienation between parents and adolescents. They further found that feelings of alienation towards parents, especially in males engaging in NSSI, were associated with a higher frequency of NSSI acts. Apart from alienation, trust and communication between adolescents and parents may also predict NSSI, as feelings of alienation towards parents could be a result of parental criticism and negative communication. For example, Bureau et al. 2010, in a sample of 1238 students, found that emerging adults engaging in NSSI reported their parents to be less caring, less trustful, and more difficult to communicate with. Finally, the quality of the relationship especially with the mother seems to play a significant role in the development of NSSI. Di Pierro et al. (2012) reported that in a sample of 247 adolescents who had a poorer relationship (reported as lack of support, communication, and love) with their mothers were more likely to engage in NSSI as compared to those adolescents who reported a better relationship with their mothers. Although similar findings were observed regarding the relationship with the father, the results showed a weaker pattern. Similar observations have been made in more clinical populations. In an inpatient sample of 125 emerging young adults from a psychiatric clinic (Kaess et al. (2013) observed that inpatients reporting higher maternal antipathy and neglect were seven times more at risk to engage in NSSI as compared to other clinical controls.

Similar to adolescent-parent attachment, relationship with peers assumes increased importance during the childhood-adolescence transition (Moretti and Peled 2004). In fact, the relationship with peers can function as an important influence on the development of adolescents (Harter 2012). Intimacy with peers increases during adolescence and adolescents tend to rely more on peers than on their families. Whereas a positive relationship with peers can lead to higher well-being (Viner et al. 2012), peer networks also play an important role in the development of problematic behavior in adolescents (Antonishak et al. 2005). Literature suggests that peers may be simultaneously responsible for both increasing and decreasing NSSI by diverse mechanisms. Peers can contribute to initiation of NSSI via a contagion effect (Jarvi et al. 2013). Further, peer victimization in the form of bullying also can also predict NSSI (Claes et al. 2015; Hilt et al. 2008). However, research regarding associations between specific dimensions of attachment with peers is limited. For example, higher quality of communication

with peers has been found to be associated with a lower probability of engaging in NSSI, especially in adolescent females (Hilt et al. 2008; Turner et al. 2012). A recent study by Yurkowski et al. (2015) in 1153 university students found that though peer alienation predicted engagement in NSSI, it had lesser impact than parental alienation.

Identity formation in adolescents is an important developmental process that involves resolution of the dialectic between identity synthesis and confusion (Erikson 1968). Identity synthesis refers to 'reworking of childhood identifications into a larger and self-determined set of ideals, values, and goals,' whereas identity confusion represents an 'inability to develop a workable set of goals and commitments on which an adult identity is based' (Schwartz 2001). There is increasing evidence to suggest that NSSI may be linked to disturbances in identity formation. The earliest support to this claim comes from Breen et al. (2013) who performed a qualitative analysis of 56 websites with online narratives of adolescents engaging in NSSI. Findings of Breen et al. (2013) suggest that adolescents may use NSSI as a means of attaining a sense of group identity ("We the self-injurers") and of counteracting a loss of self. Claes et al. (2014) provide a more direct evidence of association between issues in identity formation and NSSI. In a sample of 532 high school students, they found that NSSI was positively associated with identity confusion and negatively associated with identity synthesis in adolescents. Luyckx et al. (2015b) also observed similar results in an adolescent sample of 568 high school students.

Several researchers have extended and revised Erikson's theoretical model for empirical research (Schwartz 2001). Marcia (1980) proposed that adolescents deal with the issue of identity formation along four possible statuses based on presence or absence of exploration (a process of actively questioning identity alternatives and experimenting with different social roles) and commitment (the extent of personal investment in an identity). The four statuses are: achievement (commitment after systematic exploration), foreclosure (commitment without prior exploration), moratorium (exploring alternatives without committing to an identity), and diffusion (neither commitment nor systematic exploration). Subsequent researchers have further unpacked these processes of exploration and commitment and have proposed more refined, process-oriented models of identity (e.g., Luyckx et al. 2008). The extant research in community samples has suggested that associations between the aforementioned identity processes and NSSI are not as robust as compared to associations between the more overarching dimensions of identity confusion/synthesis and NSSI. For example, when controlling for age, gender, anxiety, and depression, Luyckx et al. (2015a, b) found that not so much individual identity processes of exploration and commitment were

uniquely related to NSSI, but that identity diffusion was uniquely related to NSSI. Given these findings, exploring associations between identity synthesis/confusion and NSSI seems more promising.

Attachment to parents and peers may contribute to identity formation (Pittman et al. 2011). Based on the review of 29 longitudinal studies, Meeus (2011) found that a warm supportive relationship between parents and adolescents is positively associated with the formation of a more consistent and mature identity in adolescence. Meeus et al. (2002) state that securely attached individuals are more likely to attain identity synthesis than their insecurely attached counterparts. In a meta-analysis incorporating 14 studies, Årseth et al. (2009) found weak to moderate positive association between secure attachment and identity achievement. They also found weak to moderate negative association between secure attachment and identity diffusion. There is some evidence to suggest that there are gender differences in how the relationship with parents affects adolescents' identity development. Erikson (1968) theorized that infants' relationship with their mother forms the foundation of mature identity development. There is some empirical support for Erikson's claim (see Weinmann and Newcombe 1990). For example, in a community sample of 148 adolescents from various ethnic background, Meeus et al. (2002) found that communication with mother was associated with exploration, whereas paternal trust was associated more with commitment. Further, in a sample of 139 university students, Schultheiss and Blustein (1994) reported that parental attachment plays a more significant role towards identity formation in females than in males. Schultheiss and Bluestein drew particular attention to the importance of the relationship with mother for identity development in adolescents. They found that a strong mother-daughter relationship was positively associated with commitment but was also a more prominent predictor of foreclosure.

Relationships with peers may also play an important role in identity formation (Pugh and Hart 1999). As compared to the vertical relationship (i.e., a relationship with individuals who have greater knowledge and social power; Hartup 1989) that adolescents share with their parents, a more horizontal relationship (i.e., a relationship with individuals with social power that is similar to theirs; Hartup 1989) with peers can help adolescents in developing knowledge about the self (Hartup 1992). For example, Meeus and Dekovic (1995), in a sample of 2699 high school and university students, found that more so than the parent-adolescent relationship, the quality of peer relationships may play a role in identity formation. Meeus et al. (2002) also found that peer trust and communication were important for both exploration and commitment. However, systematic studies to support this claim are lacking.

Review of current literature provides evidence that parental and peer attachment, identity formation, and NSSI may be associated. However, this association has not been formally tested. The current study attempts to fill this gap by exploring the associations between NSSI, attachment with peers/mother, and identity formation. First, we investigated associations between the dimensions (trust and alienation) of adolescents' attachment with mother/peers, identity synthesis/confusion, and NSSI. In the present study, we focused on mothers and peers because there is evidence suggesting that specifically the relationship with mothers is strongly associated with both identity development (Weinmann and Newcombe 1990) and NSSI (Kaess et al. 2013), and that the quality of the relationship with peers is associated with NSSI (Jarvi et al. 2013). Finally, we tested if identity synthesis/confusion mediated the association between the dimensions of adolescents' attachment with mother/peers and NSSI. In other words, we investigated if adolescents' relationships with their mother and peers predicted NSSI directly or either partially or completely through its potential influence on identity synthesis and confusion.

2. Method

2.1. Participants and procedure

Data were collected from high school students (grade 7–12) studying in a school located in the Dutch speaking part of Belgium. Overall, 530 (out of the total 1115) students participated in the study. Two students had to be excluded because of missing responses. The final sample consisted of 528 students (50.4 % female), yielding a response rate of 47.35 %. The lower response rate may be partly explained by the fact that we sought active informed consent from the parents. Given the sensitive nature of the research, they may have been reluctant to provide consent (Lloyd-Richardson et al. 2015). Mean age of the participants was 15.0 years (SD = 1.84, 11–19 years) and 95.5 % reported to be of Belgian nationality. With respect to family structure, 76.3 % of participants lived with their parents while 16.1 % had divorced parents, and 7.5 % were living in other family structures.

Informed consent forms for parents were provided to the students about 4 weeks prior to the day of data collection and only those who obtained a signed consent form from their parents were included in the study. Data collection was completed during school hours. Students without signed consent forms were not allowed to participate in the study. Students were provided with an assent form and questionnaires in a sealed envelope. Completed questionnaires were resealed by the students and handed over to the researchers. All participants were compensated for participation with a movie ticket. In order to ensure participant safety, all participants were provided with contact details of the researchers and

various mental health services. The study was approved by the institutional ethics committee of University of Leuven.

2.2. Measures

2.2.1. Non-Suicidal Self-Injury

The lifetime prevalence of NSSI was assessed by asking a single-item question : 'Have you ever engaged in self-injury without an intent to die?' (answer format 0/1). It should be noted that use of a single-item item measure is common in NSSI research. Further, in a review of 52 international studies, Muehlenkamp et al. (2012) found that such a single-item measure leads to consistent estimation of prevalence. For descriptive purposes, we also assessed the lifetime prevalence of seven different forms of NSSI (scratching, carving, cutting, hitting or bruising, burning, pricking with a sharp object, and head banging) with yes/no questions.

2.2.2. Parent and Peer Relationships

The Inventory of Parent and Peer Attachment (IPPA; Armsden and Greenberg 1987) assesses quality of attachment to parents and peers. IPPA is a self-report questionnaire developed to assess positive/negative affective and cognitive dimensions of adolescents' relationships with their parents and peers, more particularly the psychological security derived from these relationships. The abbreviated version of the questionnaire has three separate subscales for mother, father, and peers with 12 questions for each subscale. As mentioned earlier, only scales for mother and peers were used in this study. The subscales measure three dimensions of attachment: (a) The trust dimension measures the degree of mutual understanding and respect in the attachment relationship (sample item: "I like to hear the opinion of my friends/mother about things important to me"); (b) The communication measure assesses the extent and quality of spoken communication (sample item: "When I am angry about something, my friends/mother try to understand that"); and (c) The alienation dimension assesses feelings of anger and interpersonal alienation (sample item: "It seems like my friends/mother are annoyed by me for no apparent reason"). Items are rated on a 5-point Likert scale ranging from 1 (Never/almost never true) to 5 (almost always/always true).

The factor structure of IPPA needs some consideration. One factor (Armsden and Greenberg 1987), two-factor (grouping communication and trust score together; Johnson et al. 2003), and three-factor models (Pace et al. 2011) have been suggested. In the present study, confirmatory factor analysis (CFA) on IPPA scores for peers showed that a three-factor model ($\chi(41)2 = 140.60$, CFI = .945, RMSEA = .068) had a better fit than a two-factor model ($\chi(43)2 = 188.10$, CFI = .92, RMSEA = .080; Cheung and Rensvold 2002; Vandenberg and Lance 2000). However, communication and trust were highly correlated ($r = 0.91$, $p < .001$). Hence,

in line with Johnson et al. (2003), we continued with a two-factor model consisting of Trust (including communication and trust) and Alienation as it had an acceptable fit and was more parsimonious. CFA on the data of the relationship with mother showed that both the three-factor model ($\chi(41)2 = 215.81$, CFI = .910, RMSEA = .090) and two-factor-model ($\chi(43)2 = 231.96$, CFI = .903, RMSEA = .091) had an acceptable fit to the data. The two-factor model was again selected. Items 3 and 18 ("I wish I had other friends/another mother") were removed from the CFA as they showed significant cross-loadings based on the modification indices. Cronbach's alphas were as follows: Peers-Trust = .84, and Peers-Alienation = .67; Mother-Trust = .85, and Mother-Alienation = .62. The lower alpha values for the maternal and peer alienation subscales were expected as the alienation factor is measured only by 4 items (Muris et al. 2014). IPPA has been extensively used to measure attachment in adolescent population (Årseth et al. 2009).

2.2.3. Identity Formation

The Identity subscale of Erikson Psychological Stage Inventory (Rosenthal et al. 1981) is a 12-item scale used to measure identity synthesis and confusion. Both synthesis and confusion are measured with 6 items each. Sample items for identity synthesis include "I've got a clear idea of what I want to be" and for Identity confusion include "I don't really know who I am." Each item has to be scored on a 5-point Likert scale ranging from 1 (Totally disagree) to 5 (Totally agree). Cronbach's alpha for identity synthesis and identity confusion was .75 and .67 respectively. Though the Cronbach's alpha observed for identity synthesis in our study was equal to that observed by Schwartz et al. (2009), alpha for identity confusion in our data was lower than that observed by Schwartz et al. (Cronbach's alpha = .74; 2009). However, it should be noted that an alpha coefficient value above .60 are considered as adequate when factors are measured by six or less than 6 items (Peter 2002).

2.3. Analysis

The associations between all study variables were assessed using Spearman's Rho correlation coefficients. A bootstrap procedure was used to investigate if the associations between the two dimensions of adolescent-mother/peer relationship (trust and alienation) and lifetime NSSI were mediated by identity synthesis and confusion. Such a procedure involves repeated sampling with replacement from the data set and can be used to calculate a confidence interval for the indirect effect in the case when the sampling distribution of this effect is unknown. Here, the indirect effect is the product of coefficients obtained by: (a) regressing the independent variable on the proposed mediators ('a path' in Baron and Kenny 1986), and (b) regressing the proposed mediator on the dependent variable while controlling for the

independent variable ('b path' in Baron and Kenny 1986). The indirect effect tests the statistical significance of the difference between the total effect (path from the independent variable to the dependent variable) and the direct effect (path from the independent variable to the dependent variable adjusted for the mediators). Readers are referred to Preacher and Hayes (2008) for further details. Mediation is absent if the indirect effect is not significant (i.e. when its 95 %-confidence interval contains zero); partial mediation occurs if total, indirect, and, direct effects are significant; complete mediation occurs if the direct effect is not significant and there is a significant indirect effect (Preacher and Hayes 2004). Non-parametric resampling techniques, like bootstrapping, are preferred over parametric statistical tests, like the Sobel test, as the former require less assumptions (e.g., normality of the product of coefficients term) and may have more statistical power (MacKinnon 2008).

In the current study, we used model 4 from the PROCESS macro (v2.13) for SPSS developed by Hayes (2012) to calculate the 95 % confidence intervals of the indirect effect. In the PROCESS macro, four separate models were tested for peer trust, peer alienation, maternal trust, and maternal alienation as the independent variables. Identity synthesis and confusion were used as the mediating variables and lifetime NSSI was used as the dependent variable in all the models. All the models were adjusted for age and sex. The number of bootstraps was set to 5000.

3. Results

3.1. Descriptive statistics

Table 1 provides details of descriptive statistics of the study variables. The lifetime prevalence of NSSI was 14.2 % (females = 10.4 % and males = 3.8 %; $\chi^2_{(1)} = 18.28$, $p < .001$). At the time of data collection, 3 % of the high school students were still engaging in NSSI. Mean age of onset of NSSI in males was 12.3 years (*SD* = 2.28) and in females 13.6 years (*SD* = 1.70). In terms of versatility of NSSI, almost 48 % used only one method of NSSI, whereas 17.3 % used two, 17.3 % used three, and 12 % used four or more different methods of NSSI. Female participants engaged more often in severe cutting, whereas head banging and hitting oneself were the most commonly endorsed NSSI methods in male participants (see Table 2).

Table 1. Descriptive statistics of variables used in study

Study variables	Mean	S.D.	Range
Age	15.00	1.84	8.00
Peers Alienation	1.67	.58	2.75
Peers (Communication+Trust)	2.92	.60	2.86
Maternal Alienation	1.59	.51	3.00
Mother (Communication+Trust)	3.08	.64	3.00
Identity Synthesis	3.68	.60	3.67
Identity Confusion	2.64	.62	3.67

Table 2. Gender wise distribution of seven different various forms of NSSI

NSSI form	Males (*n*)	Females (*n*)	Chi-square (df^{+}=1)
Scratching	5	14	.00, *ns*
Carving	9	29	.35, *ns*
Cutting	4	32	8.57*
Hitting or bruising	8	4	11.69*
Burning	3	3	1.62
Pricking with sharp objects	3	11	.24, *ns*
Head banging	10	8	10.11*

* $p < 0.05$; $^{+}$ Degree of freedom

3.2. Correlation analysis

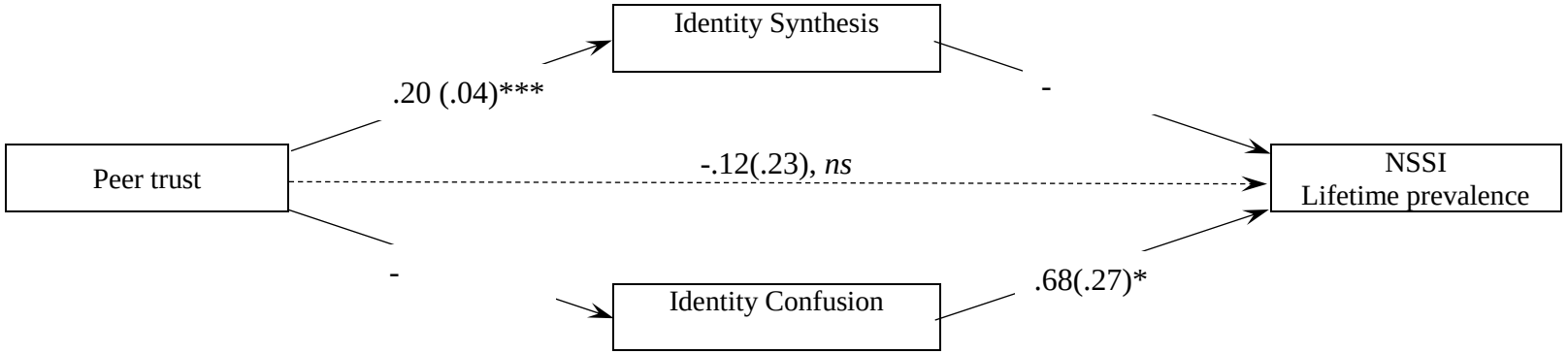
The Spearman's rank correlations can be seen in Table 3. NSSI was found to be positively related to identity confusion and maternal and peer alienation; it was negatively related to identity synthesis and maternal trust scores. Identity synthesis was positively related to trust (i.e., communication and trust) but negatively related to peer alienation. Similarly, for mothers, identity synthesis was positively related to trust and negatively correlated to alienation. Identity confusion was positively related to maternal and peer alienation and it was negatively related to maternal trust.

Table 3. Spearman's rank correlations between age, sex, identity synthesis/confusion, three dimensions of relationship between adolescents and mother/peers and lifetime prevalence of NSSI

	Study variables	1	2	3	4	5	6	7	8	9
1	NSSI (Lifetime prevalence)	-								
2	Age	.12**	-							
3	Sex	.19***	-.09*	-						
4	Identity Synthesis	-.29***	-.07	-.18***	-					
5	Identity Confusion	.29***	.07	.12**	-.58**	-				
6	Peer (Communication+Trust)	-.02	.00	.21***	.15**	-.07	-			
7	Peer Alienation	.28***	.08	.06	-.29***	.43***	-.32***	-		
8	Maternal (Communication+Trust)	-.18***	-.15**	-.03	.24***	-.25***	.32***	-.31***	-	
9	Maternal Alienation	.16***	.11*	-.01	-.28***	.35***	-.16***	.356***	-.54***	-

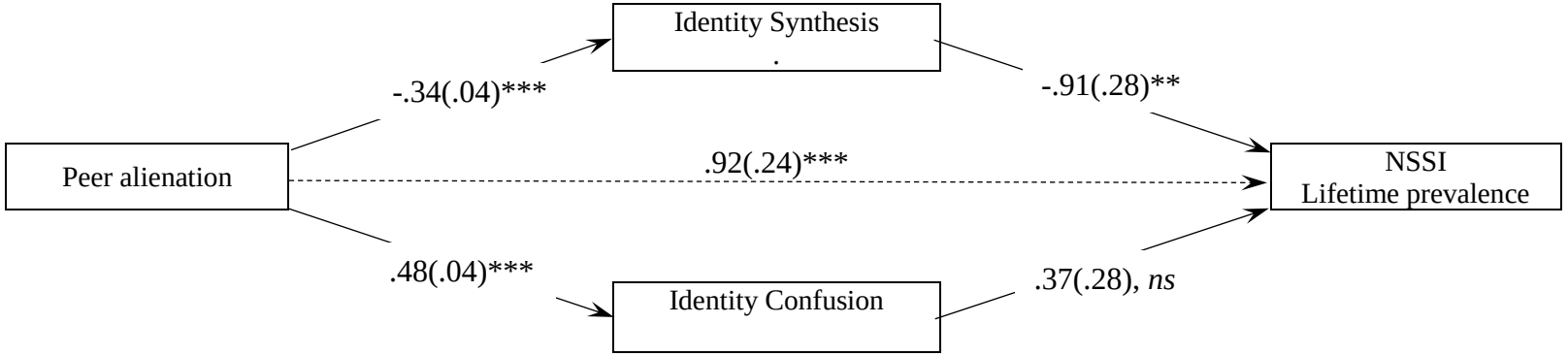
* $p < 0.05$, ** $p < 0.01$, *** $p < .00$

1a.



Total effect from Peer trust → NSSI: B = -.40(.22), *ns*

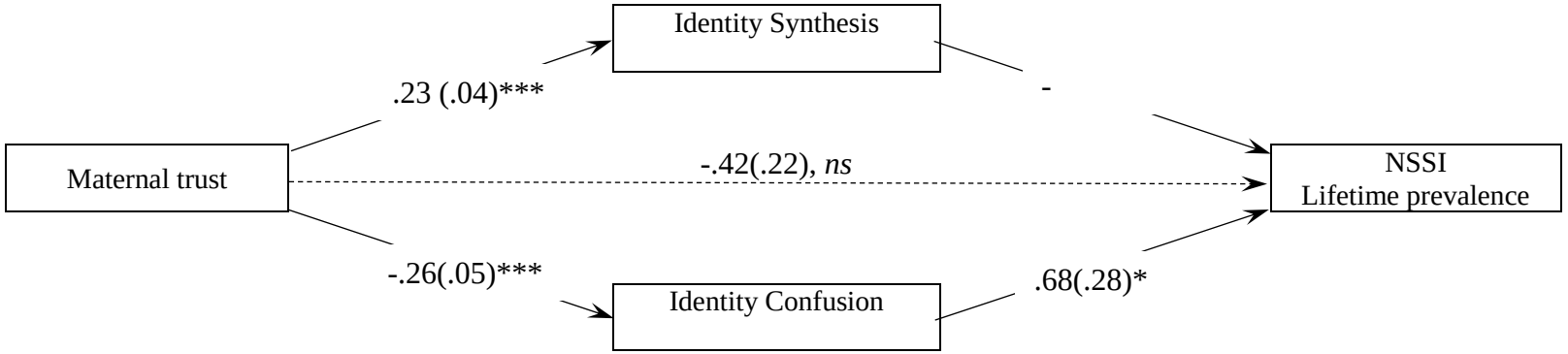
1b.



Total effect from Peer alienation → NSSI: B = 1.37(.22)***

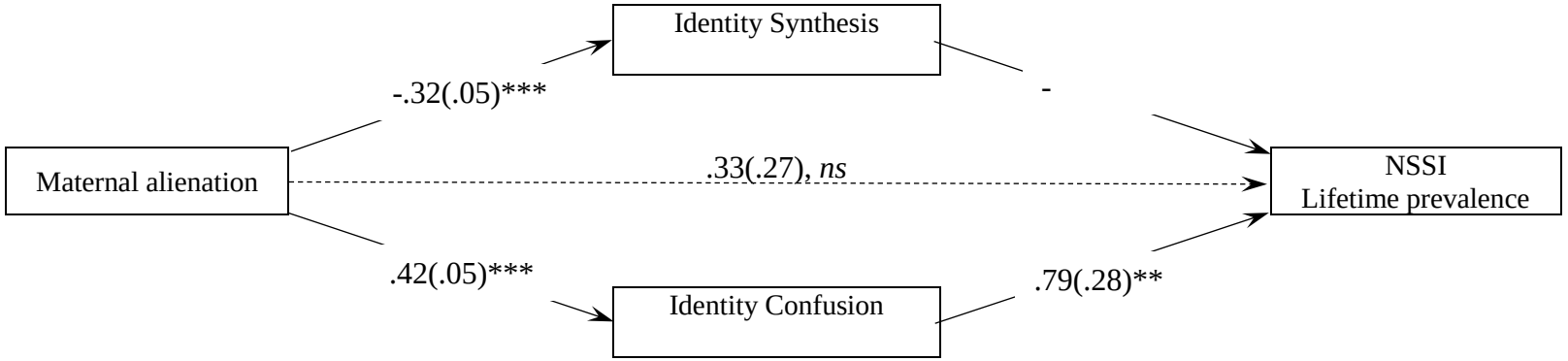
Figure. 1: Unstandardized coefficients for parallel mediation models for peers. Associations with gender and age are not shown. Numbers between parentheses are standard errors. (* $p < .05$. ** $p < .01$. *** $p < .001$).

2a.



Total effect from Maternal trust → NSSI: B = -.78(.20)***

2b.



Total effect from Maternal alienation → NSSI: .89(.23)***

Figure. 2: Unstandardized coefficients for parallel mediation models for mothers. Associations with gender and age are not shown. Numbers in between parentheses are standard errors. (* $p < .05$. ** $p < .01$. *** $p < .001$).

3.3. Mediation Analyses

Figure. 1, presents the unstandardized regression coefficients of the mediation models between peer attachment related constructs and lifetime NSSI. As shown in Figure. 1a, the total and direct effects of peer trust on lifetime NSSI were not significant. However, the indirect effect of peer trust on lifetime NSSI via identity synthesis (β = −.199, SE = .088, 95 % CI = [−.418; −.071]) and identity confusion (β = −.105, SE = .058, 95 % CI = [−.262; −.020]) was found to be significant while controlling for age and gender.

As shown in Figure. 1b, the total effect of peer alienation on lifetime NSSI was significant (B = 1.371, SE = .215, p < .001). The indirect effect of peer alienation on lifetime NSSI via identity synthesis was found to be significant (β = .312, SE = .120, CI[.113; .584]. However, the indirect effect of peer alienation on lifetime NSSI through identity confusion was found to be non-significant (β = .180, SE = .160, 95 % CI = [−.116; .519]). Based on the regression coefficients presented in Figure. 1b, it can be concluded that the association between peer alienation and lifetime NSSI was partially mediated by identity synthesis.

Figure. 2 presents the unstandardized regression coefficients of the mediation models between constructs related to maternal attachment and lifetime NSSI. As displayed in Figure. 2a, the total effect of mother trust on lifetime NSSI was significant (β = −.778, SE = .195, p < .001). The indirect effect of maternal trust on lifetime NSSI via identity synthesis (β = −.222, SE = .086, 95 % CI = [−.427; −.087]) and identity confusion (β = −.176, SE = .082, 95 % CI = [−.348; −.033]) was found to be significant.

As shown in Figure. 2b, the total effect of mother alienation on lifetime NSSI was significant (β = .890, SE = .228, p < .001). The indirect effect of maternal alienation on lifetime NSSI through identity synthesis (β = .288, SE = .112, 95 % CI = [.109; .555]) and identity confusion (β = .331, SE = .136, 95 % CI = [.086; .632]) was found to be significant. Hence, based on the values of the unstandardized regression coefficients (Figure. 2a, b), it can be concluded that the path between maternal trust and alienation and lifetime NSSI was completely mediated by identity synthesis and confusion.

4. Discussion

The goal of the present study was to explore the linkages between relationships with peers/mother, identity development, and lifetime NSSI. Given that dysfunction in these developmental processes and contexts can cause increased vulnerability to NSSI (Yates 2009), the findings of the present study can potentially inform further research and clinical practice. We also investigated the mediation effect of identity synthesis/confusion on the relationship between adolescents' attachment with mother/peers and lifetime NSSI. Exploring these

developmental linkages is especially important as they may highlight factors that increase vulnerability of adolescents to engage in NSSI. It should be noted that due to the cross-sectional design of our study we were not able to make authoritative claims with respect to directionality of the observed effects. However, the observed associations might suggest the presence of important pathways potentially leading to NSSI. For making more authoritative claims, future longitudinal research is required.

The lifetime prevalence of NSSI in our sample was found to be 14.2 %, which was close to international prevalence rates (Muehlenkamp et al. 2012; Swannell et al. 2014). Our overall findings were in line with previous research that has identified NSSI in adolescents as a significant public health concern. Similar to previous research, gender differences were found in lifetime NSSI. Females were more likely to engage in NSSI than males (Bresin and Schoenleber 2015). Females in our sample reported endorsing severe cutting more often than males, whereas males engaged more in head banging and hitting oneself, a consistent finding in literature on NSSI (Andover et al. 2010).

Both identity synthesis and confusion were significantly related (negatively and positively, respectively) to NSSI. Lifetime NSSI was also found to be negatively associated with maternal trust (communication and trust) and positively associated with maternal and peer alienation. The findings in the present study replicated those obtained by previous researchers (Claes et al. 2014; Luyckx et al. 2015a, b; Yates et al. 2008). Additionally, the observed relations between identity synthesis/confusion and attachment with mother were also in line with previous research (Meeus 2011).

Findings from the mediation analysis indicated that peer and maternal trust and alienation as perceived by adolescents may be important predictors of NSSI in adolescents. Though our findings indicate that positive attachment with peers (forged through positive communication and trust) may not be directly associated with NSSI, mediation analysis indicated that stronger attachment with friends may be one of the potential factors that may reduce risk of NSSI by promoting identity synthesis and reducing identity confusion. Similarly, a supportive relationship with mother can facilitate a better sense of self (by leading to better synthesis and reduction in identity confusion), which in turn may lead to reduction in vulnerability to NSSI. Conversely, peer alienation may increase the likelihood of NSSI not only by its direct effect on NSSI but also through its suppressing effect on identity synthesis. On the other hand, maternal alienation may possibly increase NSSI indirectly through decreasing feelings of identity synthesis and increasing feelings of identity confusion.

Although we investigated only the relationship between adolescents and mothers, the relationship with fathers may also be important in predicting NSSI (Tatnell et al. 2014). Hence, the relationship with both parents may be important in the development of vulnerability for NSSI because they may lead to disturbances in identity formation. Because of the cross-sectional nature of our study, results from the mediation analysis should be interpreted cautiously as most linkages between the study variables are likely to be bi-directional. For example, identity confusion may lead to isolation or at best to only formalized and stereotyped relationships (Erikson 1968; Zimmerman and Becker-Stoll 2002). Further, the association between NSSI and identity development may also be bi-directional, such that NSSI may contribute to issues in identity development. For example, NSSI earlier on in the lifespan has been suggested to be associated with a developmental delay in adolescent identity formation (Luyckx et al. 2015b). Finally, NSSI may lead to interpersonal alienation though there is some evidence suggesting the contrary to be true (You et al. 2012).

If the present findings can be replicated longitudinally, our findings may inform clinical intervention strategies that may assist in the reduction of NSSI. Promoting identity synthesis in adolescents may lead to a reduction in the incidence of NSSI, as a lack of a guiding identity framework may increase vulnerability to NSSI (Luyckx et al. 2015b). Our findings provide further support for the observation that family therapy may be an important form of intervention to achieve this (Kissil 2011). A more secure, caring, and warm relationship between adolescents and their caregivers may further consolidate identity and decrease identity confusion, which may further contribute to a reduction of NSSI. If adolescents successfully develop more secure attachments with parents, their interactions with others, such as peers, may also improve (Bostik and Everall 2006). From a public health perspective, school mental health programs based on life skills training (World Health Organization 2010) with special emphasis on empathy, communication, and interpersonal relationship skills may help adolescents to communicate more effectively with their families and peers (e.g., Aussie Optimism; Roberts et al. 2004). Our findings also support the findings that better communication skills may also reduce interpersonal alienation, further augmenting a sense of self and reduction in NSSI (Turner et al. 2012). Additionally, given that the development of secure attachment precedes the onset of adolescence, parenting programs that promote attachment even before the onset of adolescence can lead to better emotion regulation (Juffer et al. 2008) and prevention of behavioral and emotional problems (Sanders 1999), including NSSI (Yurkowski et al. 2015) in adolescents.

Some limitations to our study require consideration. First, as mentioned earlier, the cross-sectional nature of this study limits our ability to draw conclusions regarding directionality of the observed effects. Longitudinal studies are required to replicate the present findings. Second, in the present study, we only measured dimensions of adolescent and mother/peers attachment as perceived by adolescents themselves. Further research may also include perceptions of parents and peers of their relation with the target adolescents. As mentioned earlier, the perceived relationship between fathers and adolescents may also be associated with lifetime NSSI. Further research involving measures of quality of relationship with fathers is also warranted. Third, because of the sensitive nature of the research topic, the response rate in our study was rather low (Babbie 2007; Lloyd-Richardson et al. 2015). Whereas, a low response rate does not automatically indicate presence of a non-response bias (Lavrakas 2008), further research incorporating strategies that improve response rates in sensitive research issues (e.g., De Schrijver 2012) should be considered. Fourth, as some scales in our study were measured by six or less than six items (peer and maternal alienation, identity confusion), they had low but acceptable internal consistencies (Peter 2002); nonetheless, our findings should be interpreted with caution. Finally, it should be noted that our sample was homogenous in terms of nationality hence further research may be necessary to ascertain the cross-cultural validity of our findings. Attempts should also be made to situate the developmental (for example identity formation) and attachment related factors within the larger network of biological and environmental elements that are likely to influence the vulnerability to NSSI (Linehan 1993).

In spite of these limitations, by demonstrating mediational pathways between adolescent relationships with mother/peers and NSSI via the processes of identity formation, the current study provides some insights that may inform clinical practice and current literature on the developmental vulnerability for NSSI. More specifically, our study highlights the importance of considering secure relationships with parents (especially mother) and peers as potential important factors that may contribute to the reduction of the risk of engagement of adolescents in NSSI.

Section 4: NSSI and identity: Cross-cultural comparison

Chapter 7.

Non-suicidal self-injury and other self-directed violent behaviors in India: A review of definitions and research.

Gandhi, A., Luyckx, K., Maitra, S., & Claes, L. (2016)[10]

Abstract

The interpersonal theory of suicide suggests that most forms of self-directed violent behaviors lie on a continuum, with each behavior successively increasing the capability of committing suicide. There is increasing evidence to suggest that the continuum may begin with Non-Suicidal Self-Injury (NSSI). This theory can be important in developing interventions for suicide prevention. However, in India, consistent usage of definitions of various forms of self-directed violent behaviors is lacking. In the present study, we reviewed definitions of various forms of self-directed violent behaviors that have been investigated in India. Further, we compared the usage of these definitions with the usage by WHO. Additionally, we reviewed NSSI research in India. Thirty-eight publications were identified by a comprehensive electronic search undertaken in Indian psychiatry, psychology, and mental health-related databases. Inconsistent definitions of eight self-directed violent behaviors were observed in Indian literature. Agreement on consistent definitions of various forms of self-directed behaviors is essential. Based on the findings of the current review, it can be suggested that culturally relevant large-scale research on NSSI in India is required to confirm the limited evidence that suggests high prevalence of NSSI in India.

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Non-suicidal self-injury and other self-directed violent behaviors in India: A review of definitions and research.

1. Introduction

Suicide is a major public health concern in India. In the year 2012, about 0.25 million suicides were reported in the country (World Health Organization, 2014a). The National Crime Records Bureau (2014) reported a 21.6% rise in suicide rates from 2003 to 2013. The suicide statistics suggest that targeted interventions for suicide prevention are needed in India. However, as Van Orden et al. (2010) suggest, because most prevention strategies are not based on comprehensive theories that explain dynamic interaction between personal and environmental factors, few prevention strategies are effective in reducing suicide.

The Interpersonal theory of Suicide (Joiner, 2009) is one of the most comprehensive theories proposed to explain this interaction. Joiner argues that because of the extreme and lethal nature of suicide, most people are fearful to attempt suicide. In the presence of certain enabling factors, individuals may feel more courageous to engage in suicidal acts. Joiner (2009) argues that individuals acquire a 'capability to suicide' through the interaction of three factors: (a) perceived burdensomeness: the perception that one is a burden on loved ones (b) thwarted belongingness: a function of social alienation; and (c) learned fearlessness: reduced fear of death because of various reasons including high pain tolerance (see Figure. 1).

In the West, Non-Suicidal Self Injury (NSSI) has been identified as an important self-directed violent behavior with major public health implications. NSSI is defined as 'intentional destruction of one's body tissue without suicidal intent' (Nock and Favazza, 2009). Extant literature suggests that about 70% of people engaging in NSSI behavior also report a lifetime prevalence of at least one attempted suicide (Nock et al., 2006). Further, the presence and frequency of NSSI can predict the history of suicide attempts more than depressive symptoms and hopelessness can (Andover and Gibb, 2010).

Given that repeated engagement in NSSI may lead to increased pain tolerance and reduction in the fear of death, which in turn, may increase the risk for suicide attempts, some theorists consider NSSI as a gateway to suicide (Joiner et al., 2012). There is also evidence to suggest that disclosure of NSSI may lead to a reaction of confusion, fear, or disgust from health professionals (Muehlenkamp et al., 2013), teachers (Heath et al., 2010), and peers (Favazza, 1998). Self-injuring individuals may also isolate themselves as they worry about possible rejection, stigmatization, or punishment as a reaction to the discovery of NSSI (Turner et al., 2014). Strong reactions from others toward NSSI and perceived isolation may lead to a decreased sense of belongingness to others. Finally, the shame and guilt associated with NSSI,

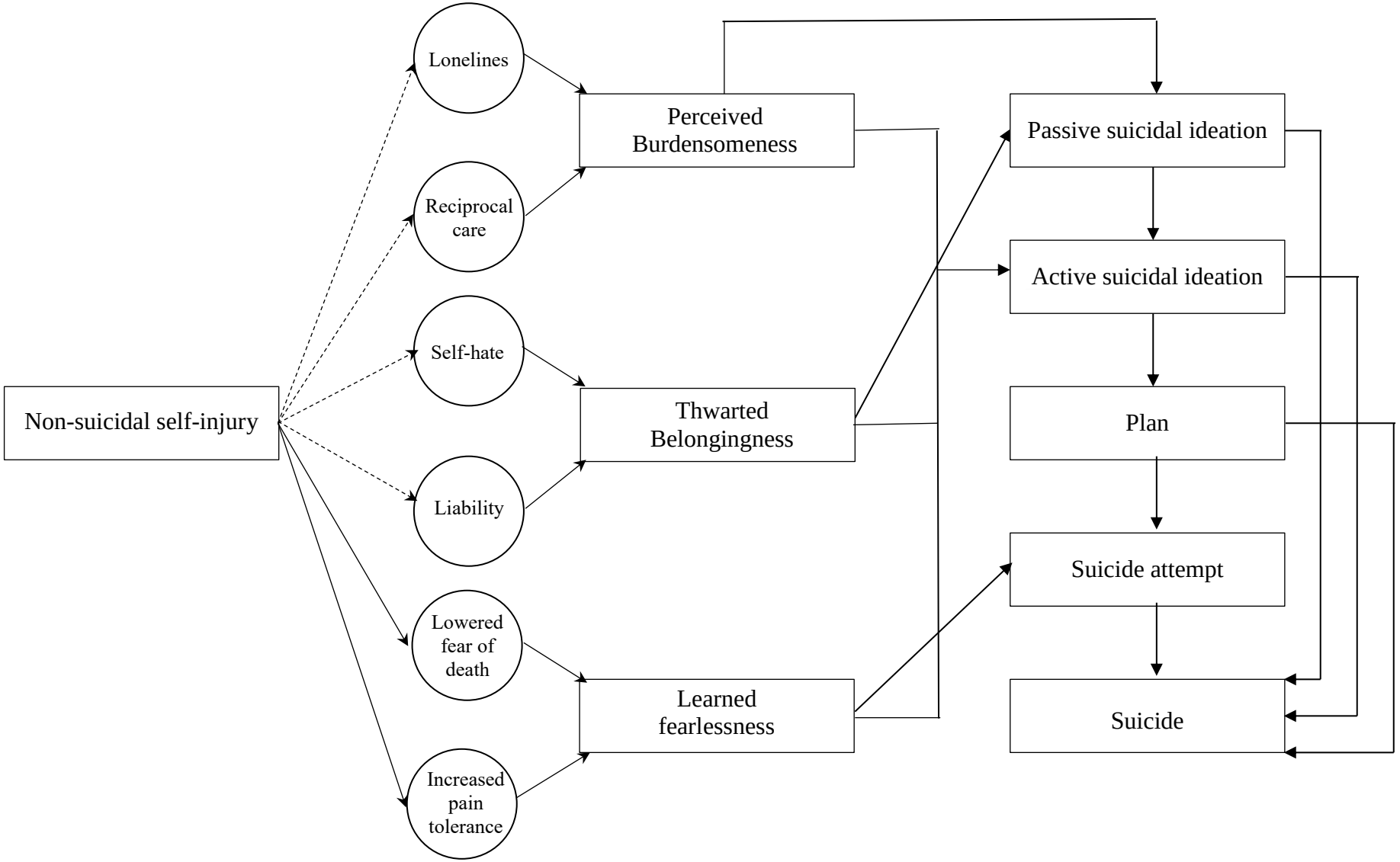


Figure 1. Pathway from non-suicidal self-injury to various form of self-directed violent behavior (based on process-based suicide models of Joiner, Ribeiro and Silva (2012) and Baca-Garcia and colleagues (2011)

may lead to an increase in perceived burdensomeness. NSSI, hence, may predispose individuals to the three factors proposed by Joiner, which, in turn, may increase the risk for suicidal ideation and suicide (see Figure. 1).

Apart from its association with suicide, NSSI has other public health implications. Existing research suggests strong associations between NSSI and disorders like anxiety, depression (Wilkinson and Goodyer, 2011), eating disorders (Muehlenkamp et al., 2011), and personality disorders (especially Borderline personality disorder; Welch et al., 2008). NSSI is also associated with developmental and personality related vulnerabilities (Barrocas et al., 2011). Hence, NSSI may serve as an indirect indicator of the aforementioned mental health disorders in community settings and may be helpful in early assessment and interventions.

Based on the public health utility of NSSI, it can be suggested that researching NSSI in community and clinical settings may be necessary. However, overlapping usage of various forms of self-directed violent behaviors including NSSI in Indian research is a major concern impeding this endeavor. Inconsistent definitions of self-directed violent behaviors are a major hurdle in developing clinical (e.g., assessment of risks), research (for e.g., estimation of burden), and epidemiological (for e.g., international reporting and comparison of prevalence rate) knowledge about these behaviors. So far, attempts to streamline use of definitions is lacking in India. To fill these gaps, the present study reviewed definitions of various forms of self-directed violent behaviors investigated in India so far. We compared these definitions with present-day international usage. Further, given that NSSI may be an important risk factor for developing suicide, we identified publications that investigated NSSI behavior, although under different names, and summarized the findings of these studies.

2. Method: Search and inclusion criteria

PRISMA guidelines (Moher, 2009) were followed to identify articles that defined and investigated various types of self-directed violent behaviors in India. Articles were searched in the following databases: ProQuest, PubMed, Pubmed Central, Indian Citation Index, IndMED, and Google scholar. Query strings like self-injury, self-harm, self-damage, self-aggression, self-mutilation, NSSI, India, etc. were used in various combinations for the literature review. Articles that did not define the self-directed violent behavior being investigated, non-English articles, letters to the editor, and editorial articles were excluded from the review. Overall, 38 studies were included in the review (see Figure. 2 for details). The list of studies included in the review can be found in Appendix 3.

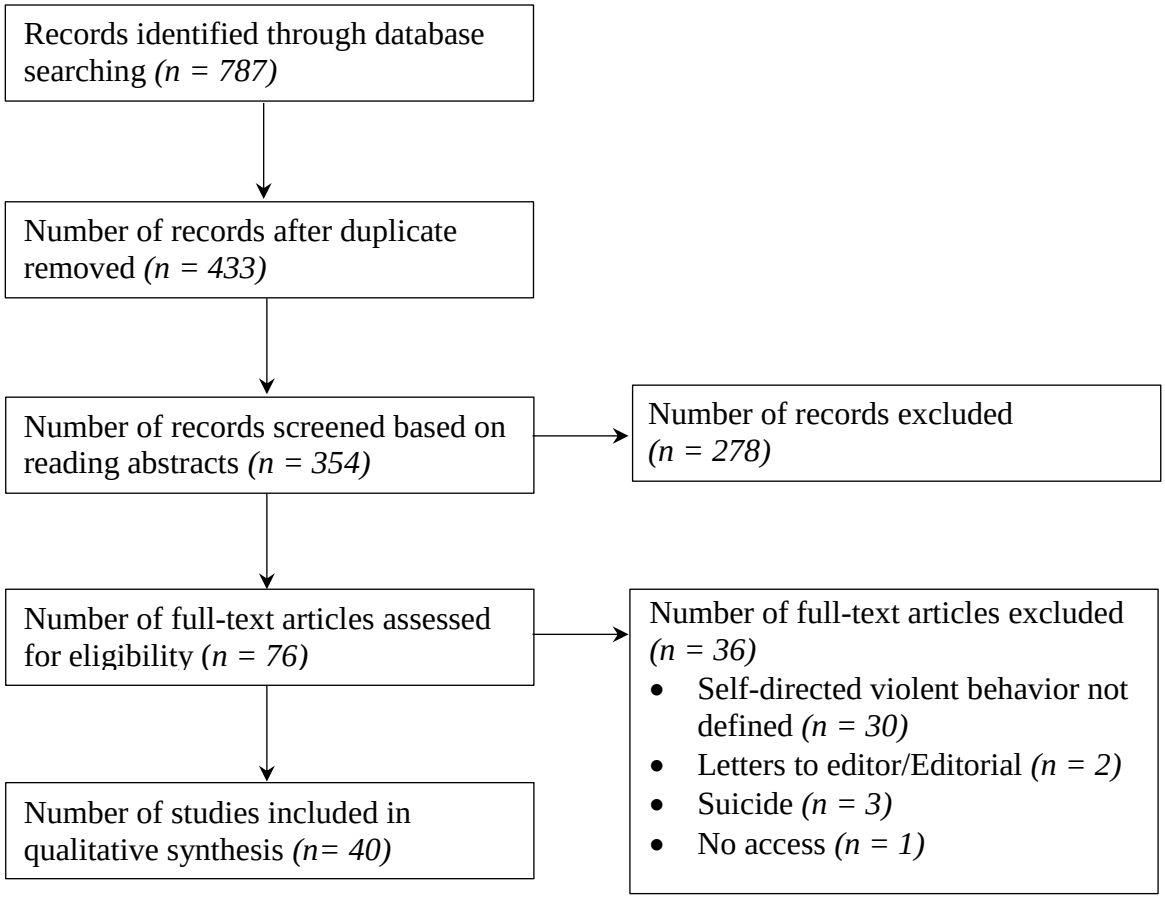


Figure 2: Flowchart for study selection for the review (Based on PRISMA guidelines)

3. Defining various forms of self-directed violent behaviors: A review

Defining various forms of suicidal behaviors is difficult since internationally accepted guidelines in Diagnostic and Statistical Manual of Mental Disorders (5th edition; American Psychiatric Association [APA], 2013) or ICD-10 are lacking. However, since agreeing on some conventions regarding definitions of these behaviors is essential, we used the WHO guidelines for classification of various forms of self-directed violent behaviors (see Figure. 3 for more details). Intent to die is the core element that not only differentiates between self-directed violent behaviors and other reasons of death, but also between various subtypes of self-directed violent behaviors (World Health Organization, 2002, p. 6). Although elementary differentiation between presence and absence of intent may be possible to some extent, quantifying intent as high and low is often difficult because of its vague and interpretive nature (De Leo et al., 2004). Hence, WHO favors an outcome-based classification of self-directed violent behaviors. With these observations as the guiding framework, in the following sections, we review various terminologies and definitions of self-directed violent-behaviors used in India.

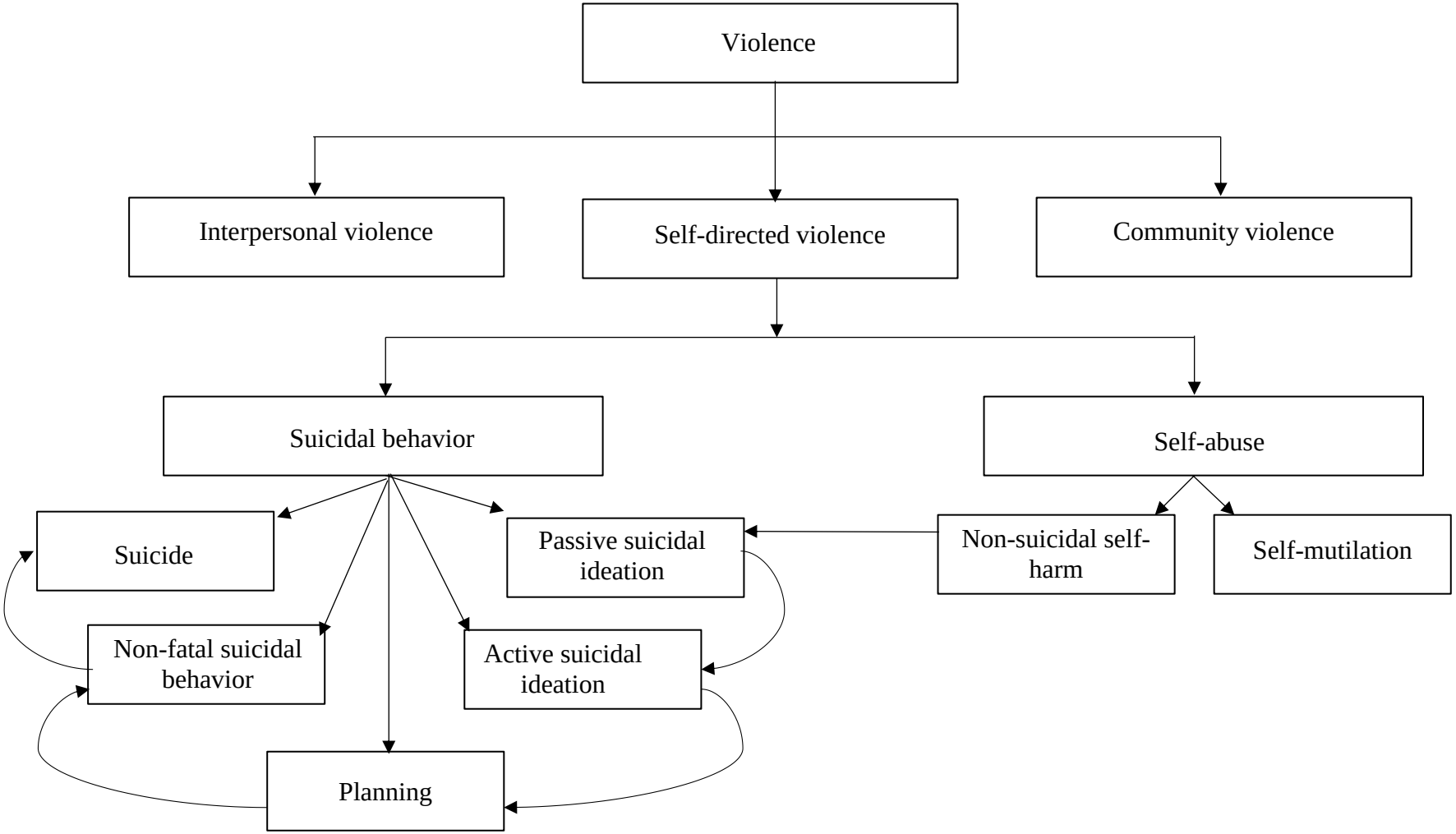


Figure 3. Classification of various forms of self-directed violent behaviors (Based on WHO (2002) and Nock and Favazza (2009))

Table 1. Definitions of various forms of Self-directed violent behaviors discussed in the review.

Sr. No	Self-directed violent behavior	Definitions
1	Suicidal ideation	Thoughts of killing oneself, in varying degrees of intensity and elaboration (WHO, 2002, p. 185)
2	Non-fatal suicidal behavior	Intentional self-inflicted poisoning, injury or self-harm which may or may not have a fatal intent or outcome (WHO, 2014a).
3	Parasuicide	Act with a nonfatal outcome in which an individual deliberately initiates a non-habitual behavior that, without intervention from others, will cause self-harm, or deliberately ingests a substance in excess of the prescribed or generally recognized therapeutic dosage, and which is aimed at realizing changes which the subject desired, via the actual or expected physical consequences (WHO, 1986).
4	Suicide attempts	Self-initiated sequence of behaviors by an individual who, at the time of initiation, expected that the set of actions would lead to his or her own death (APA, 2013).
5	DSH	Act with nonfatal outcome, in which an individual deliberately initiates a non-habitual behavior that, without intervention from others, will cause self-harm, or deliberately ingests a substance in excess of the prescribed or generally recognized therapeutic dosage, and which is aimed at realizing changes which the subject desired via the actual or expected physical consequences (Hjelmeland and Grøholt, 2005).
6	Self-Injurious Behavior	As all behaviors involving the deliberate infliction of direct physical harm to one's own body without any intention to die as a consequence of the behavior. (Simeon and Favazza, 2008)
7	Self-mutilation	The definition of self-mutilation is very similar to NSSI. However, in contemporary usage, the term is generally reserved for self-directed violent behavior involving extreme degrees of destruction of body tissues that may result in permanent disfigurement or impairment (Klonsky et al., 2011).
8	NSSI	Intentional destruction of one’s body tissue without suicidal intent (Nock and Favazza, 2009).

3.1. Suicidal behaviors

Since suicide has been almost consistently defined in Indian literature, in the present work, we only reviewed suicidal behaviors like suicidal ideation and non-fatal suicidal behavior.

3.1.1. Suicidal ideation

Few Indian studies so far have defined suicidal ideation. Srivastava and Kulshreshtha (2000) defined suicidal ideation as ‘thoughts, talk, or writing about suicide without expression of any definite intent or performing any relevant action.’ Although this definition is similar to the

definition of suicidal ideation proposed by WHO (see Table 1 for definition), it should be noted that WHO's definition is more inclusive as it is not contingent on expression of intent and performance of suicidal acts.

3.1.2. Non-fatal suicidal behavior

WHO currently prefers the outcome-oriented term 'Non-fatal suicidal behavior' over terms like parasuicide and suicide attempts. Yet, few researchers in India have used this term so far. Jena and Sidhartha (2004) and Sidhartha and Jena (2006), define non-fatal suicide behavior as 'a global category that involves all forms of self-directed violent behaviors except completed suicide.' They further classify non-fatal suicidal behavior with intent to die as suicide attempt and as deliberate self-harm when intent is unknown. However, in accordance to the current WHO guidelines that rely more on an outcome based approach than intent, distinct categorization suggested by these researchers may be unnecessary.

3.1.3. Parasuicide/suicide attempts

WHO/EURO officially adopted the term parasuicide in the year 1986 (see Table 1 for definition). However, the prefix 'para' when translated to some languages means 'mimicking' or 'pretending', which failed to represent the real nature of the acts in question (De Leo et al., 2004). Because of these linguistic difficulties, the term parasuicide was eventually replaced by other terms like suicide attempt and non-fatal suicidal behavior.

Although WHO continues to use the term suicide attempt (see Table 1 for definition) interchangeably with the term Non-Fatal Suicidal Behavior, the latter is preferred over the former. In the present review, the terms parasuicide and suicide attempts are considered here together since the two terms have been consistently used to define similar behaviors in the Indian literature.

Indian researchers have used the term parasuicide to describe two forms of behaviors: non-fatal, self-inflicted direct injury or self-poisoning (see for example, Kumar et al., 2013a,b). Although this definition of parasuicide/suicide attempt is similar to WHO's definition, as suggested earlier, the term non-fatal suicidal behavior (De Leo et al., 2006) may be preferred in accordance to the WHO guidelines (World Health Organization, 2014b).

3.1.4. Intentional self-harm

The tenth edition of the International Classification of Diseases (ICD-10; World Health Organization, 1992) introduced a new taxonomical category called 'Intentional Self-Harm' to indicate 'purposefully self-inflicted poisoning or injury and suicide (attempted).' While this was done to avoid value-laden terms such as suicide and suicide attempts, the term itself remains

undefined. Intentional self-harm behavior in ICD-10 is further classified based on the method used for inflicting injury (e.g., drowning, jumping from a high place, etc.). In the Indian literature, Das et al. (2008) used this term to indicate non-fatal suicidal behavior. It should be noted that though the ICD-10 diagnostic category of intentional self-harm includes suicide attempts, the term non-fatal suicidal behavior may be used instead of intentional self-harm because the latter term is of more recent origin (World Health Organization, 2014b).

3.1.5. Deliberate self-harm

The term Deliberate Self-harm (DSH) originated in Europe and is less commonly used in America (Silverman, 2011). In Europe, the term was originally used to indicate any type of self-directed violent behavior (including both self-injury and self-poisoning) irrespective of the intent behind it. The term DSH was however replaced by the term parasuicide (Silverman, 2011). On the other hand, American scholars like Pattison and Kahan (1983) used the term deliberate self-harm to describe NSSI behavior. In recent years, DSH has also been used to indicate NSSI even in Europe (Cerutti et al., 2012), which added to the already existing confusion over the usage of the term.

The term DSH has been used to refer to two forms of self-directed violent behavior in Indian literature: (a) non-fatal suicidal behavior or suicide attempts (Bhattacharya et al., 2011; Sreelatha et al., 2014); and (b) NSSI-like behavior (Sarkar et al., 2006).

Based on intentionality, lethality, mode, and age, Bhattacharya et al. (2011) and Sarkar et al. (2006) differentiated hospitalized cases of self-harm into two categories: individuals with high intent to die (classified as ‘failed suicide’) and those with low intent to die (classified as deliberate self-harm). However, as mentioned earlier, such classification may be difficult to implement, as clinically quantifying intent to die, is not always feasible. Additionally, most DSH cases in study by Bhattacharya et al. (2011) perpetrated self-directed violence using organo-phosphates. Hence, they cannot be classified as NSSI. On the other hand, most DSH cases classified by Sarkar et al. (2006) engaged in self-cutting (coupled with ‘low’ or no suicidal intent), and hence these cases may be classified as NSSI-behavior. To minimize overlap in usage of terms, we suggest current ICD-10 nomenclature is followed: a non-fatal suicide attempt with or without an intention to die can be classified as non-fatal suicidal injurious behavior, whereas self-directed violent behaviors (involving direct injury to the body) without intention to die can be classified as NSSI.

3.1.6. Self-injurious behavior

In the international literature, the term Self-injurious behavior (see Table 1 for definition) has been used to indicate NSSI. Rao et al. (2008) documented a series of cases involving self-directed violent behaviors from a general hospital under the rubric of self-injurious behavior. Rao and colleagues suggested redefining the term self-injurious behavior as 'commission of deliberate injury to one's own body without the aid of the other person causing tissue damage.' They argue that self-injurious behavior should be a phenomenological category that includes all cases involving direct tissue damage (and excluding self-poisoning) irrespective of intent. Such a broad category seems unnecessary as most cases reported by Rao and colleagues can be classified as self-mutilation, non-fatal suicidal injury, and NSSI.

3.2. Self-abuse

Self-abuse is the second major sub-category of self-directed violent behaviors. It includes at least two behaviors: NSSI and self-mutilation. Both forms of behaviors have been researched in India.

3.2.1. Self-mutilation

Literature on self-mutilation in India exists in the form of case studies. The common types of self-mutilative cases reported in India include: genital self-mutilation (e.g., Mago, 2011; Nerli et al., 2008), pricking with multiple pins (Bharath et al., 1998; Gaur et al., 2013); evisceration; and repeated stabbing (Patra et al., 2014), enucleating of eye (Rao and Begum, 1996), and sever tongue biting (Bhat et al., 2011) were found.

Based on the current definition of self-mutilation (see Table 1), it is clear that some cases mentioned above can be classified under other categories of self-directed violent behaviors. For example, the case report by Rao et al. (2002) (an 82 years old man attempted suicide by amputating his testicles and scrotum using a razor blade) as the authors clearly report a high intent to die. On the other hand, the cases reported by Bharath et al. (1998) (a 56 years old man inserted 40 needles in his lower limbs) and Gaur et al. (2013) (a 23 years old man who inserted 10 simple needles in the skin around his eyes) are better diagnosed as severe NSSI as an intent to die was absent.

3.2.2. Non-suicidal self-injury

Although many researchers have attempted to define NSSI (Lloyd-Richardson et al., 2007; Nock and Favazza, 2009), most of these definitions have certain common elements that distinguish NSSI from the previously mentioned self-directed violent behaviors. First, NSSI is characterized by direct and deliberate destruction of one's own body tissue (e.g., cutting, burning, etc.) hence

behaviors that cause indirect harm (e.g., self-poisoning, starvation) are excluded. Second, NSSI is characterized by lack of intention to die. Third, NSSI is a repetitive behavior hence single acts of self-mutilation (self-castration, etc.) are not classified as NSSI. Finally, culturally sanctioned behaviors like tattooing, mutative rituals, etc. are not diagnosed as NSSI.

A recent community-based study by Kharsati and Bhola (2015) and case studies reported by Chittoria et al. (2014) are the only Indian studies that have used NSSI in the way it is defined in the international literature.

4. NSSI in India: Research so far

Studies on NSSI in India can be classified under three categories: case studies, hospital-based studies, and community-based studies.

Apart from the case studies already mentioned (Bharath et al., 1998; Gaur et al., 2013; Sarkar et al., 2006), Chittoria et al. (2014) also reported three cases of camphor related burns on the palms as NSSI. In all the cases, the burning of blocks of camphor was a religious ritual and in all the three cases, extensive tissue damage was reported. If existing diagnostic criteria for NSSI are followed, cases reported by Chittoria and colleagues cannot be considered as NSSI because burning camphor on hands is a culturally accepted ritual in some parts of India (Al-Qattan and Al-Zahrani, 2009). However, on closer examination of the cases, it can be noticed that injuries resulting from camphor burning were extensive enough to require medical or surgical intervention. Although none of the reported cases were evaluated for psychiatric disorders, Chittoria and colleagues reported that at least one of the patients did report psychotic features. This observation indicates that genuine cases of pathological NSSI may remain masked due to religious sanctioning of various forms of self-mutilative rituals in India. Further research should also be directed towards developing culturally informed theoretical and diagnostic approaches that assist differentiation between clinical cases of NSSI with diagnosable psychopathology and religious self-mutilative rituals.

Hospital-based studies from India generally involved patients who were admitted in a tertiary care center after an episode of self-directed violence. As mentioned above, Sarkar et al. (2006) differentiated between patients with high intent to die and those with low or no intent to die. They found that patients from the latter group (about 85% of their total sample) were young adults or adolescents and most of them endorsed self-injurious behavior with low lethality (e.g., superficial cutting). The majority of the ‘Deliberate Self-Harm’ cases did not have any major diagnosable psychiatric condition. Although, Sarkar and colleagues did not use the term NSSI, it is clear that some of the participants from their sample were in fact engaging in NSSI.

The only Indian community-based study on NSSI by Kharsati and Bhola (2015) reported a lifetime prevalence of almost 31% in a sample of emerging adults. Around 19.8% of this sample engaged in moderate and severe forms of NSSI (e.g., erasing skin to draw blood). The average age of onset of NSSI in their sample was 15.9 years. The most common reasons reported for engaging in NSSI behavior were: to feel relaxed, to get control of the situation, to stop feeling bad, and to punish oneself (Kharsati and Bhola, 2015). One of the possible conclusions to be drawn from the existing limited data is that lifetime prevalence of NSSI in India may be higher than international average (lifetime prevalence of NSSI among adolescents is 17.2%, among young adults is 13.4%, and 5.5% among adults; Swannell et al., 2014). However, this conclusion may be premature given that Indian NSSI research is in a nascent stage and future large-scale research with a special consideration of the unique cultural and other contextual factors is essential to confirm these preliminary findings.

5. Conclusion

Findings of the review suggest that an international lack of consensus over the use of various forms of self-directed violent behaviors has permeated in Indian literature on suicidology. It could also be observed that most terms and definitions used to describe various self-directed violent behaviors evolve over time and, therefore, presenting concrete guidelines is difficult. However, as agreeing to some standardized conventions to define various forms of self-directed violent behaviors are important, internationally applicable WHO guidelines were presented in this paper. Indian research on NSSI is in its early stages of development. However, even in these initial stages, a need for development of culturally informed and contextually relevant research is necessary. Developing contextualized knowledge regarding NSSI may be important as it may have important public health implications.

Chapter 8.

Non-suicidal self-injury and its association with identity formation in India and Belgium: A cross-cultural case-control study.

Gandhi, A., Luyckx, K., Adhikari, A., Parmar, D., De Sousa, A., Shah, N., Maitra, S., Claes, L. (2018)[11]

Abstract

The aim of the present study was to compare different features of non-suicidal self-injury (NSSI) between India and Belgium using a case-control design. We also explored if the strength of the association between NSSI and disturbances in identity formation – a risk factor that can increase vulnerability to NSSI – was similar in young adults in India and Belgium. Data regarding NSSI and identity formation were collected from 182 young adults in India (56% females, Mean age = 21.5 years, SD = 3.70, 17-38 years). The Belgian data used for case-control matching were derived from four existing datasets. Of the 182 Indian cases, 138 cases could be matched with the Belgian sample on age, gender, and lifetime NSSI. Lifetime prevalence of NSSI in the total India sample was found to be around 21.4%, with higher prevalence in females than in males. Comparison of features of NSSI between India and Belgium indicated that the age of onset of NSSI was found to be higher in the Indian sample (around 17 years) than the Belgian sample (around 15 years). Additionally, self-bruising behavior was more commonly endorsed in India and scratching/ cutting was more often reported in Belgium. Finally, the Belgian sample endorsed intra-personal functions of NSSI more often than the Indian sample. One-year prevalence of NSSI and the commonly injured body parts did not differ between the two samples. Moderation analysis indicated that the associations between NSSI and identity confusion/integration were stronger in the Belgian sample as compared to the Indian sample. Higher self-knowledge was protective against NSSI in both the Indian and the Belgian sample. Theoretical and clinical implications of our findings were discussed.

[11] Unpublished: Gandhi, A., Luyckx, K., Adhikari, A., Parmar, D., De Sousa, A., Shah, N., Maitra, S., Claes, L. (2018). Non-suicidal self-injury and its association with identity formation in India and Belgium: A cross-cultural case-control study. Unpublished manuscript.

Non-suicidal self-injury and its association with identity formation in India and Belgium: A cross-cultural case-control study.

1. Introduction

Non-suicidal self-injury (NSSI) refers to the intentional destruction of one's body tissue without an actual intention to die. The most common forms of NSSI include self-cutting, hitting, head-banging, and burning oneself (Nock, 2009). Engagement in even a single episode of NSSI has been demonstrated to be associated with a history of emotional, physical, or sexual abuse; suicidal behaviors (ideation, plan, gesture, or attempt); high levels of distress; and eating disorders symptoms (Whitlock, Eckenrode, & Silverman, 2006). Much of the work on NSSI in the West indicates that although the age of onset of NSSI peaks during mid-adolescence (around 15-16 years of age), risk of NSSI continues to be high even during young adulthood (Gandhi et al., 2017). Based on the review of observational studies, lifetime prevalence of NSSI in young adults have been found to be around 13% (Swannell, Martin, Page, Hasking, & St John, 2014). Consequently, NSSI is being increasingly identified as an important mental health concern even in young adults (Hamza & Willoughby, 2016).

Existing research clearly indicates that NSSI is a universal phenomenon which occurs in both Western and non-Western countries (Gholamrezaei, De Stefano, & Heath, 2015; Swannell et al., 2014). However, the similarities and differences between the manifestation of NSSI in different countries remains unclear as no research so far has compared NSSI between Western and non-Western populations. Cross-cultural research may be instrumental in not only knowing the extent of the problem posed by NSSI in the different countries but also in identifying culturally-specific risk factors. To remedy this shortcoming, the present study compared different features of NSSI (e.g., age of onset, one year frequency, and function) between India – a country with predominantly an Eastern culture and Belgium – a country with predominantly a Western culture. Additionally, we explored if the association between NSSI and disturbances in identity formation – a risk factor that can increase vulnerability to NSSI – was similar in these two countries.

1.1.NSSI in India and Belgium

As far as we are aware, only two studies (Bhola, Manjula, Rajappa, & Phillip, 2017; Kharsati & Bhola, 2015) have researched NSSI in India and they have produced somewhat conflicting results. The one-year prevalence of NSSI in India has been reported to vary between 31% and 34%. However, as Bhola and colleagues (2017) point out, both studies used a very broad

definition of NSSI. Therefore, the resulting one-year prevalence may be inflated. Note that both studies did not investigate the lifetime prevalence of NSSI. Apart from the prevalence of NSSI, evidence regarding gender differences is also conflicting as one of the studies reported a lack of gender differences (Kharsati & Bhola, 2015), whereas the other study reported a higher one-year prevalence of NSSI in females than in males (Bhola et al., 2017). Consistent with the international literature, the age of onset of NSSI in India has been reported to be around 15.9 years (Kharsati & Bhola, 2015). Given the small number of studies and their inconsistent findings, further research is necessary to understand NSSI in India.

So far, the study by Kiekens et al. (2016) is the only study that has specifically investigated NSSI in young adults in Belgium. Kiekens and colleagues (2016) reported a lifetime prevalence of 8% and a one-year prevalence of NSSI of 3%. These authors also reported higher risk of NSSI in females. The age of onset of NSSI in Belgium has been shown to peak between 15-16 years (Gandhi et al., 2017). Based on the limited evidence, it appears that, apart from the age of onset, NSSI in India and Belgium may significantly differ from each other on other characteristics. However, cross-cultural research is required to confirm these differences.

Apart from the epidemiological features, the functions of NSSI are also likely to be culturally influenced (Gholamrezaei et al., 2015). The functional approach suggests that NSSI is maintained through different reinforcement processes (Nock, 2009). These processes are referred to as the functions of NSSI (Sadeh et al, 2014). Functions of NSSI can be broadly categorized into two groups: intra-personal and interpersonal functions. Within each group, functions can be further classified into positive and negative reinforcement types. Accordingly, functions of NSSI can be classified into four categories: 1. Intrapersonal positive functions: to generate certain feelings/stimulation (e.g., to get into a trance or numb state); 2. Intrapersonal negative functions: to suppress aversive feeling or thoughts (e.g., to avoid or suppress negative feelings); 3. Interpersonal positive functions: to elicit support from others (e.g., to get attention from others); 4. Interpersonal negative functions: to escape undesirable social situations (e.g., to avoid doing chores or tasks; Nock, 2009).

A review of 35 NSSI studies in non-Western countries suggests that individuals from these countries may engage in NSSI for more relational reasons as compared to their Western counterparts. On the other hand, individuals from the West may engage in NSSI more for intrapersonal reasons (e.g., emotional regulation; Gholamrezaei et al., 2015). However, this assertion regarding cultural differences made by Gholamrezaei and colleagues (2015) is not based

on an actual comparison between Western and non-Western samples and, as such, it is not entirely supported by evidence from India. For example, although Kharsati and Bhola (2015) reported that individuals engaging in mild forms of NSSI more often endorsed social functions, they also mentioned that those engaging in major NSSI behaviors were more likely to endorse intrapersonal functions like regulating negative emotions.

1.2.Disturbances in identity formation and NSSI

Of the many intrapersonal and interpersonal issues that increase vulnerability to NSSI, recent research suggests that disturbances in identity formation may be an important factor in both adolescents and young adults (Gandhi et al., 2017). Identity formation, according to Erikson (1968), is a process that begins during adolescence when one's childhood identifications are no longer experienced as suitable, but a new identity is yet to be established. If individuals successfully develop an autonomous identity and a sense of sameness, identity synthesis is achieved. On the other hand, if individuals fail to develop an integrated sense of self, identity confusion ensues (Schwartz, 2001). Both cross-sectional (Claes, Luyckx, & Bijttebier, 2014; Luyckx, Gandhi, Bijttebier, & Claes, 2015) and longitudinal research (Gandhi et al., 2017), emerging mainly from Belgium, has demonstrated that whereas identity synthesis can reduce one's vulnerability to NSSI, persistent identity confusion can increase vulnerability to NSSI. However, the aforementioned association is likely to be bi-directional, as engagement in NSSI can hamper identity synthesis and increase identity confusion as well (Gandhi et al., 2017).

The process of identity formation is known to be influenced by cultural differences (Stevens, 2009) at least in two ways. First, unlike most Western cultures that encourage development of an autonomous self, most Eastern cultures emphasize development of a relational self (Mascolo, Misra, & Rapisardi, 2004). Consequently, it has been proposed that individuals in Eastern cultures mainly develop a sense of identity and self-knowledge based on the input from families and the larger society and less so on the basis of self-exploration and self-discovery (Cheng & Berman, 2012). Second, identity distress due to lack of a consistent self does not necessarily lead to lower psychological adjustment in the East as much as it does in the West (Suh, 2002). That is, Indians, like other Eastern cultures, may not be as significantly affected by an inconsistent sense of self (Suh, 2002) as their Western counterparts are. Although the exact reason for the tolerance of inconsistencies in self and identity in the Indian context is not clear, theoretical (Sinha, 2014) and empirical research (Berman et al., 2014; Rao et al., 2013) has indicated such an ability may originate from the strongly multi-cultural and collectivistic nature of the Indian society. Acceptance of

paradoxes and contradictions regarding self and others may be necessary in a culture in which simultaneous existence of diverse beliefs, values, norms, and practices originating from varied religions, castes, and classes is a norm (Sinha, 2014). In sum, given the cultural differences in the process of identity formation and the differential effect of identity distress on general psychopathology, the extant research establishing the association between identity formation and NSSI in a Belgian context may not be sufficient and cross-cultural confirmation of this association is necessary.

1.3.The present study

The present study had two main objectives. First, we compared epidemiological features of NSSI in young adults between India (predominantly representing an Eastern culture) and Belgium (predominantly representing a Western culture). More specifically, we compared: one-year prevalence, lifetime prevalence of seven different forms of NSSI, age of onset of NSSI, body parts most often injured in NSSI, and functions of NSSI between Indian and Belgian young adults. Based on the existing literature (Gholamrezaei et al., 2015), we expected the prevalence of the seven different forms of NSSI, body parts injured, and age of onset to be comparable between the Indian and the Belgian sample. Indian participants were expected to score higher on social or relational functions of NSSI, whereas the Belgian participants were expected to score higher on the self-related functions of NSSI (Gholamrezaei et a., 2015). Second, we investigated if the strength of the association between identity formation and NSSI was influenced by nationality. Given the lack of existing research, this research question was considerate as exploratory. Nonetheless, based on the work of Suh (2002), we expected the association between identity variables and NSSI to be stronger in Belgium than in India.

2. Method

2.1. Participants and procedure

Indian data for the present study were collected at two institutes of higher education located in Mumbai, India using convenience sampling. The first sample consisted of 120 (out of the total 150) first year bachelor of medicine and bachelor of surgery students (MBBS; 51.7% females) from a government medical college. Mean age was 19.7 years (*SD* = 2.16, 17-28 years). The second sample consisted of 62 students (72.2% females) from a large government funded social sciences university. Mean age was 24.9 years (*SD* = 3.67, 20-38 years). Therefore, the total sample from India consisted of 182 participants (56% females). Mean age of the total sample was 21.5 years (*SD* = 3.70, 17-38 years).

The Indian data were matched on age, gender, and presence/absence of lifetime NSSI with a sample of Belgian individuals. The Belgian data that were used for case-control matching were derived from four existing datasets with information on age, gender, NSSI, and identity formation. These datasets were collected by the first, second, and/or the last authors in Belgium during the years 2012-2016. Whereas the Indian and the Belgian sample were matched exactly for gender and lifetime NSSI, a deviation of $\pm$ 1 year was allowed around age. Of the overall 182 cases from India, 138 cases could be matched with the Belgian participants from the pooled datasets. The mean age of the participants in the reduced sample (n = 138, 57.2% females in both the samples) was 19.82 years (SD = 3.20) for the Indian sample and 20.28 years (SD = 2.90) for the Belgian sample.

Using a consent form, the first year MBBS students were informed about the purpose of the study, on and off campus mental health services available to them, and contact information of the researchers. The data collection procedure was completed during the college hours. One of the researcher was present throughout the data collection procedure to answer any questions from the students. The students were not compensated for participating in the study. The study was approved by the institutional ethics committee of the medical college. The students of the social sciences university were invited to participate in the study via an e-mail which explained the purpose of the study, contact details of the researchers, and the URL to the electronic survey form. The landing page of the data form provided detailed information of the study, instruction to complete the study, and on and off campus mental health services available to them, and electronic consent form. The researchers were available via e-mail to answer any questions the students had regarding the data collection procedure or the survey. Students were compensated with a Rs. 200 gift voucher for participating in the study. The study was approved by the institutional ethics committee of the Belgian university to which the first author belongs to. Necessary permissions were also obtained from the Director of the Social Sciences Institute who waived off the requirement of a local ethics committee approval.

The data collection procedure for the four Belgian samples was similar to the procedure followed for the MBBS students. All the studies were approved by the ethics committee of the university of the first author.

2.2. Measures

2.3.1.Non-suicidal self-injury. The lifetime prevalence of NSSI was assessed by asking a single-item question: ‘Have you ever engaged in self-injury without an intent to die?’ (YES/NO answer format). If the participants answered the above question positively, they were further asked

to indicate the lifetime prevalence of seven different forms of NSSI (scratching, carving, cutting, hitting or bruising, burning, pricking with a sharp object, and head banging) with yes/no questions. The participants were also asked to indicate the age at which they started engaging in NSSI; if they were currently engaging in NSSI (YES/NO); and the body parts that were most often injured during NSSI. Finally, the participants were asked to indicate the degree to which they endorsed 18 functions of NSSI (for the list of the 18 functions, see Table 3; Claes & Vandereycken, 2007) on a five-point Likert scale ranging from 1 (*'not applicable'*) to 5 (*'very applicable'*).

2.3.2. Identity formation. The Identity subscale of Erikson Psychological Stage Inventory (EPSI; Rosenthal, Gurney, & Moore, 1981) is a 12-item scale that measures the extent to which the participants have a clear sense of who they are and what they believe in. Each item has to be scored on a 5-point Likert scale ranging from 1 (*Totally disagree*) to 5 (*Totally agree*). Schwartz, Zamboanga, Wang, and Olthuis, (2009) suggested a bi-factor structure with 6 items measuring identity synthesis and 6 items measuring identity confusion. However, Bayesian confirmatory factor analysis indicated that a three-factor solution (*posterior predictive p-value* (*PPP*) = .065; 95% CI for observed versus replicated χ^2 = -6.409, 59.368; see methods section below for cutoff's) fitted the data better than a two-factor solution (*PPP*=.000, 95% CI observed versus replicated χ^2 = 27.860, 107.393), for the Indian sample. Similarly, in the Belgian sample, the three-factor solution (*PPP*=.177, 95% CI observed versus replicated χ^2 = -19.370, 50.508) had a better fit than the two-factor solution (*PPP*=.134, 95% CI observed versus replicated χ^2 = -15.807, 57.495). Therefore, the following three-factor solution for the EPSI scale was selected: (1.) a factor measuring confusion (α_{India} = .73, $\alpha_{Belgium}$ = .79); (2.) a single factor measuring Integration (α_{India} = .59, $\alpha_{Belgium}$ = .81); (3.) a single factor measuring Self-knowledge (α_{India} = .77, $\alpha_{Belgium}$ = .56). In order to increase the fit of the model, two items with standardized factor loadings less than .40 were removed from the CFA model. The factor loadings for the EPSI items are presented in Table 1.

Table 1. Factor structure and factor loadings of the EPSI scale in India and Belgium. The correlation between the three factors is shown below the factor structures. Factor 1: identity confusion; Factor 2: integration; Factor 3: self-knowledge.

Sr. no.	EPSI items	India			Belgium		
		1	2	3	1	2	3
1	I don't really know who I am.	.87			.92		
2	I can't decide what I want to do with my life.	.74			.67		
3	I feel mixed up.	.58			.74		
4	I don't really feel involved.	.54			.65		
5	I've got a clear idea of what I want to be.		.80			.82	
6	I've got it together.		.64			.81	
7	The important things in life are clear to me.		.62			.78	
8	I know what kind of person I am.			.89			.81
9	I like myself and am proud of what I stand for.			.79			.81
10	I have a strong sense of what it means to be male/female.			.41			.51
11	I work to keep up a certain image when I'm with people.	-	-	-	-	-	-
12	I change my opinion of myself a lot.	-	-	-	-	-	-

2.3. Analysis

2.3.1. Cross cultural comparison of NSSI

Cross-cultural differences in the one-year prevalence of NSSI, seven different forms of NSSI, and the body parts involved in self-harm were investigated using the χ^2 test of differences. The Mann–Whitney U test was used to investigate group differences in the 18 functions of NSSI. The *p*-value was not adjusted for multiple testing as, given the small sample size, there was an increased probability of committing a type-2 error. Next, we used the discrete event history analysis method described by Gandhi and colleagues (2017) to investigate if the distribution of the age of onset of NSSI significantly differed between the Indian and the Belgian samples. We investigated an appropriate model that best captured the shape of the baseline hazard function. Using logistic regression with presence/absence of NSSI as the outcome variable and various specifications of age (a measure of time in our model) as the independent variable, we investigated which specification of age (linear, quadratic, cubic, or general) best fitted the data. The -2 log-likelihood statistic test

and information criteria (Akaike information criterion [AIC] and Bayesian information criterion [BIC]) were used to evaluate the model fit. The model with lowest AIC and BIC was selected as the best representation of the baseline hazard function. Once an appropriate model for the baseline hazard function was identified, the main effect of nationality and the interaction of nationality and age (age*nationality) were added to the baseline model.

2.3.2. Bayesian approximate measurement invariance of the EPSI scale

In the context of cross-cultural research, the traditional multi-group measurement invariance (MI) method for establishing equivalence of a scale is often considered to be too strict (Davidoff et al., 2015) and hence the approximate MI procedure (van de Schoot et al., 2013) was used to establish measurement invariance of the EPSI scale between India and Belgium. We used the mixture model routine in M*plu*s (v7.4) to execute the Bayesian approximate MI model. The EPSI scale items were modelled as categorical variables and the difference between the factor loadings between the two groups were allowed to vary by a factor of .05 (van de Schoot et al., 2013) by specifying appropriate model priors. This model is almost equivalent to the metric model which is tested in the traditional (i.e., strict) measurement invariance. Note that a model which would be equivalent to the scalar invariance for the three-factor model could not be tested as the difference between the thresholds cannot be estimated using any available software (M*plus* or *Blavaan* (*R)*).

The model fit of the Bayesian approximate MI (and CFA) models were evaluated using the Posterior Predictive p-value (*PPP*) and the credibility interval (CI) for the difference between the observed and the replicated chi-square. The Bayesian model fits to the data well if the value of *PPP* greater than .05 and if the difference between the observed and the replicated chi-square CI contains zero (Muthén & Asparouhov, 2012).

2.3.3. Moderation analysis

Finally, to investigate if the strength of the association between the identity variables and lifetime NSSI was influenced by nationality, three separate (one for each of the three factors of the EPSI scale) binomial logistic regression based moderation models were tested. In each model, lifetime NSSI was entered as the dependent variable; main effects of an identity variable and nationality, and their interaction were added as independent variables. To aid model interpretation, the predicted probability of NSSI for both nationalities, obtained from each model, was plotted against the relevant identity variable. Using the delta method (Xu & Long, 2005, STATA, v14.1), we plotted 95% confidence intervals around the differences between the predicted probability of NSSI between India and Belgium for various values of each of the identity variables. This procedure

allowed us to investigate the values of identity variables which were associated with significant differences in the predicted probability of lifetime NSSI between India and Belgium. The predicted probability of lifetime NSSI is considered to be significantly different between the two countries, if the zero line does not pass through the area between upper and the lower limits of the confidence intervals.

3. Results

3.1. Epidemiological features of NSSI in India

The lifetime prevalence of NSSI in the total sample from India (n = 182) was 21.4% (n = 39). One-year prevalence of NSSI was 4.3% (n = 6). Females (n = 29) were more likely to engage in NSSI than males (n = 10; $\chi^2 = 6.377$, df = 1, p = .012). The χ^2tests indicated that there were no significant gender differences in the seven different methods of NSSI.

3.2. Cross-cultural comparison of NSSI

One-year prevalence of NSSI did not differ significantly between the two countries ($\chi^2 =$ .02, df = 1, p = .897). The results of the χ^2 test to examine associations between nationality and seven different forms of NSSI are shown in Table 2 (section A). In Table 2, scratching oneself till one bleeds and cutting oneself were more often seen in Belgium, whereas head banging was more often reported in the Indian sample. Section *b* of Table 2 indicated that there was no significant association between nationality and the different body parts injured in NSSI.

Table 3 displays the findings of the Mann–Whitney U test to investigate the group differences in the 18 functions of NSSI. Table 3 shows that the distributions of items 2 (to avoid or suppress negative feelings), 3 (to avoid or suppress painful images or memories), 4 (to get into a trance or numb state), 9 (to avoid or suppress suicidal thoughts), and 16 (to avoid or suppress feelings of confusion/aimlessness) were significantly different from each other. The medians for the abovementioned items were higher for the Belgian sample than the Indian sample.

Table 4 shows the -2loglikelihood test and goodness of fit indices for models with various specifications of the baseline hazard function. The quadratic specification best fitted the data (fit better than the linear model and the lowest BIC) and therefore it was used as the baseline model. The coefficients of the quadratic model with nationality and its interaction with linear specification of age are shown in Table 4. The interaction of nationality and age was significant indicating that the hazard of NSSI differed between the Indian and the Belgian sample. Figure 1 shows the plot of the predicted hazard function for the Indian and the Belgian samples (obtained from the model

shown in Table 4) plotted against age. The plot indicated that the age of onset of NSSI peaked between the ages of 16-18 years (peak at 17) in the Indian sample, whereas in the Belgian sample, the age of onset peaked between the ages of 14-16 years (peak at 15).

Table 2. Nationality based differences in the seven different forms of NSSI and the body parts involved in self-injury. Significant results are highlighted

a. Seven different forms of NSSI				
	Indian (*n=29*)	Belgium (*n=29*)	Chi-square (df^{+}=1)	*p*-value
Scratching	***4***	***12***	***5.524***	***.019***
Carving	10	11	.075	.785
Cutting	***1***	***12***	***11.997***	***.001***
Hitting or bruising	9	16	3.445	.063
Burning	1	5	2.974	.085
Pricking with sharp objects	6	6	.000	1.000
Head banging	***17***	***8***	***5.695***	***.017***
b. Body-parts injured in self-injury				
	Indian (*n=29*)	Belgium (*n=22*)	Chi-square (df^{+}=1)	*p*-value
Head and neck	13	5	2.675	.102
Arms, hands, fingers, and nails	17	15	.110	.741
Torso, belly, and buttocks	4	6	1.248	.264
Legs, feet, and toes	2	4	1.535	.215
Breasts and genitals	0	0	NA	NA

+ *df* = degrees of freedom

Table 3. Mann–Whitney U test to investigate group differences in the 18 functions of NSSI. Significant results are highlighted

Sr No	18 Functions of NSSI	Median		*U*	*p*	*r*
		India *n* = 29	Belgium *n* = 26			
1	To obtain a feeling of pleasure	1	1	320	.782	-.05
2	***To avoid or suppress negative feelings***	***3***	***4***	***217.5***	***.028***	***-.30***
3	***To avoid or suppress painful images or memories***	***1***	***3***	***193***	***.006***	***-.38***
4	***To get into a trance or numb state***	***1***	***2***	***226***	***.020***	***-.32***
5	To get attention from others	1	1	291.5	.334	-.14
6	To escape from a trance or numb state	1	1	244.5	.062	-.26
7	To punish myself	2	3	274.5	.256	-.16
8	To make myself unattractive	2.5	1	304.5	.191	-.22
9	***To avoid or suppress suicidal thoughts***	***1***	***2.5***	***201.5***	***.003***	***-.41***
10	To show myself how strong I am	1	1	307.5	.545	-.10
11	To show others how strong I am	1	1	329	1.00	-.02
12	To avoid doing chores or tasks I don’t want to do	1	1	290	.143	-.20
13	To escape from doing school, work, or other activities	1	1	318.5	.649	-.06
14	To avoid being with other people	1	1	302.5	.283	-.13
15	To avoid or suppress inner feelings of emptiness	1	3	260.5	.155	-.20
16	***To avoid or suppress feelings of confusion/aimlessness***	***1***	***3.5***	***204***	***.012***	***-.35***
17	To define myself as a person	1	1	328.5	1.00	-.02
18	To provide myself a sense of identity or individuality	1	1	302.5	.387	-.14

Table 4. The -2loglikeligood test and the information criteria [AIC and BIC] for models with different specifications for the hazard function for the age of onset of NSSI.

Sr. No.	Model	-2LL	*df*	Δ-2LL	Δ*df*	Critical	AIC	BIC
1	General	505.565	35				525.564	583.680
2	Linear	590.211	1	84.646	34	48.602	594.211	607.473
3	Quadratic	527.391	2	21.826	33	47.400	533.390	553.283
4	Cubic	520.112	3	14.547	32	46.194	528.112	554.637

Table 5. Parameter Estimates, Standard Errors, Wald statistics test, and odds ratios for the hazard model fitted to the age of onset of NSSI using a quadratic specification. Main effect of nationality and its interaction with age were also added to the model.

	B	*S.E.*	*Wald*	*df*	*p*	*OR*
Constant	-21.624	3.996	29.277	1	<.001	0
Age	2.448	.547	20.043	1	<.001	11.569
Age^2	-.082	.019	18.974	1	<.001	.922
Nationality	-4.424	2.072	4.561	1	.033	.012
Age*Nationality	.282	.133	4.473	1	.034	1.326

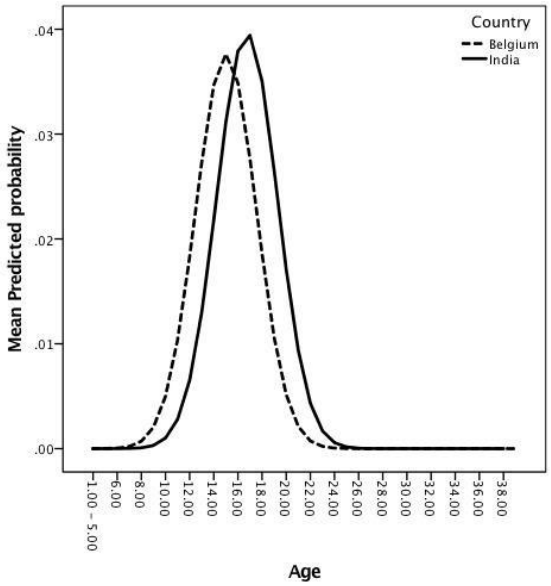


Figure 1. The quadratic specification of the hazard function for the age of onset of NSSI taking into account the influence of nationality.

3.3. Measurement invariance of the EPSI scale

The model fit criteria for the Bayesian approximate measurement invariance model suggested that the three factor-solution suggested above was approximately invariant across the Indian (*PPP* = .073; 95% CI observed versus replicated χ^2 = -9.578, 59.833) and the Belgian samples (*PPP* = .173; 95% CI observed versus replicated χ^2 = -17.275, 47.082).

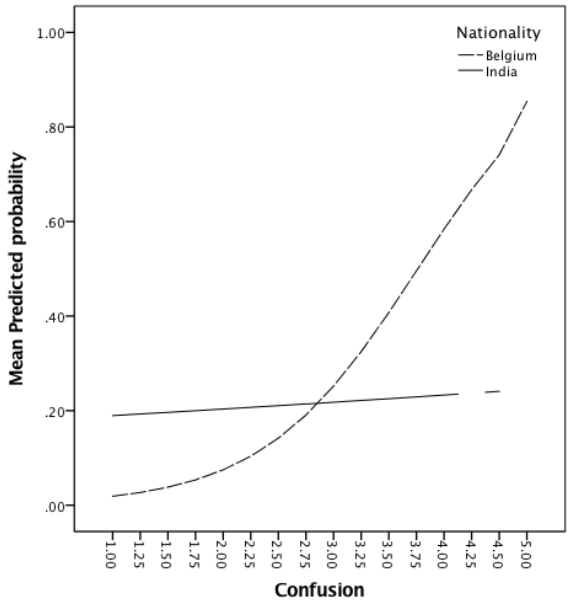
3.4. Moderation analysis

Table 6 shows the regression coefficients for the moderation models which tested the effect of nationality on the strength of association between NSSI and the three identity variables. The regression coefficient indicates that, whereas the association between identity confusion and integration and NSSI was moderated by nationality, the association between self-knowledge and NSSI was not. The predicted probability plots for lifetime NSSI obtained from the three models are displayed in Figure 2. From the first plot (Panel A1), it can be seen that confusion positively predicted the probability of NSSI. Overall, the association between confusion and the probability of lifetime NSSI appeared to be relatively weak in the Indian sample. It is interesting to note that the probability of NSSI (approximately .20) was significantly higher in the Indian sample even when confusion scores were low and that the probability of NSSI only increased by a few points even as the confusion score increased to its maximum. In contrast to India, the association between confusion and NSSI was much stronger in the Belgian sample. The probability of lifetime NSSI increased almost exponentially to more than .80 as the degree of identity confusion achieved its maximum score. The second plot (Panel B1), indicated that the association between integration and the probability of lifetime NSSI was negative. Difference in the predicted probability of NSSI between the two countries was significant only for very low values of integration (= < 1.5; see Panel B2). Even with the low values of the integration scores, the predicted probability of lifetime NSSI was significantly higher in the Belgian as compared to the Indian sample. Finally, the third plot (Panel C1) shows that there was a negative association between self-knowledge and the probability of lifetime NSSI for both countries. Although it appears that the aforementioned association was stronger in Belgium than in India, this difference was not statistically significant (see Panel C2).

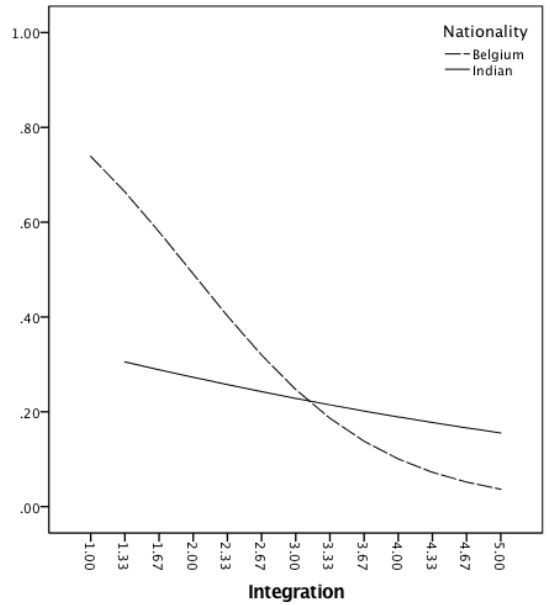
Table 6. Logistic regression models with lifetime NSSI as the outcome variable, the main effect of three factors of the EPSI scale, main effect of nationality, and the interaction of the main effects.

	x = Confusion				***x*** = Integration				***x*** = Self-knowledge			
	B	*S.E.*	Wald (*df* =1)	*p*	*B*	*S.E.*	*Wald* (*df* =1)	*p*	*B*	*S.E.*	Wald (*df* =1)	*p*
Constant	-5.37	.96	31.42	<.001	2.12	.84	6.39	.011	2.40	1.02	5.54	.019
x	1.43	.31	21.57	<.001	-1.08	.27	16.43	<.001	-1.07	.298	13.012	<.001
Nationality	.45	.35	1.65	.199	-2.62	1.22	4.59	.032	-1.84	1.42	1.69	.194
x*Nationality	-1.34	.39	11.67	.001	.84	.37	5.2	.023	.58	.39	2.20	.138

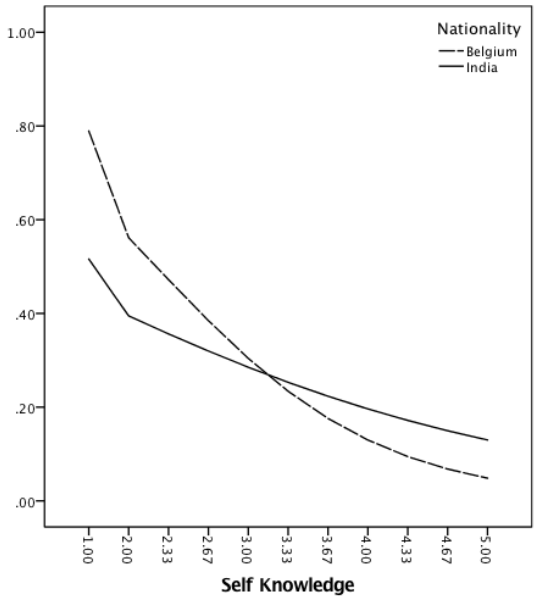
Panel A1



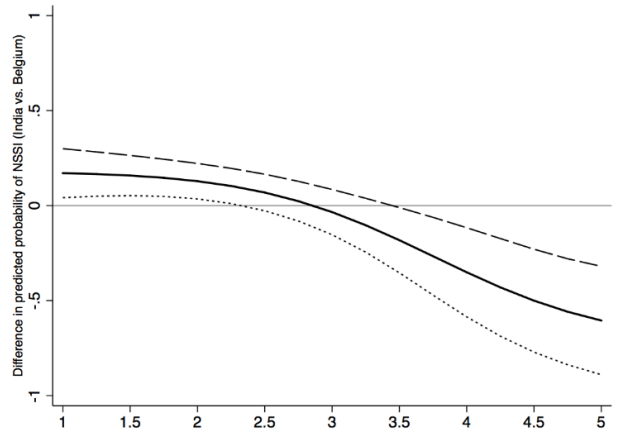
Panel B1



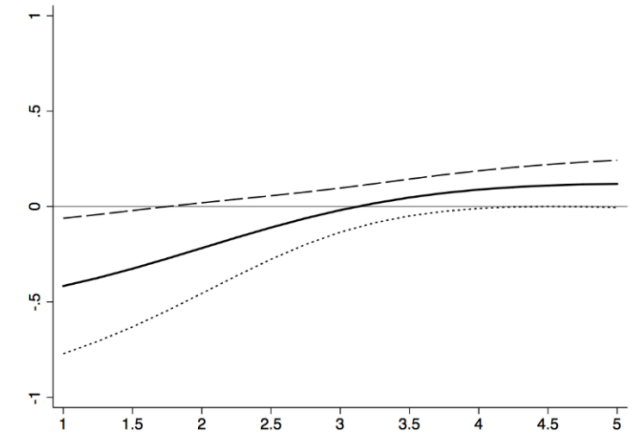
Panel C1



Panel A2



Panel B2



Panel C2

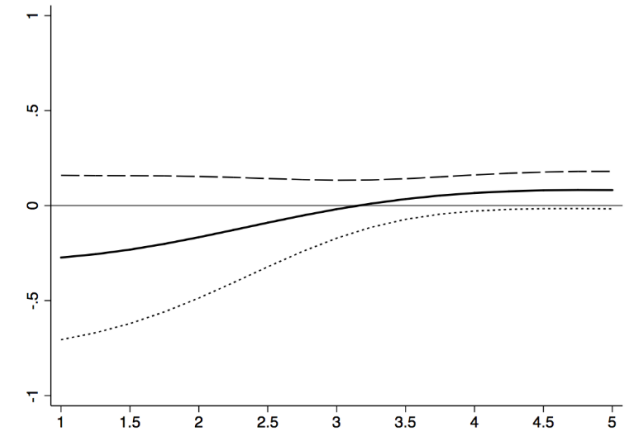


Figure 2. The plots of the predicted probability of lifetime NSSI for India and Belgium vs confusion (Panel A1), Integration (Panel B1), and Self-knowledge (Panel C1). The plot of difference in the predicted probabilities of NSSI between India and Belgium (bold black lines) with 95% confidence intervals for different values of identity confusion (Panel A2), Integration (Panel B2), and Self-Knowledge (Panel C2) (the dashed line represents the upper limit of the 95% CI and the dotted line represents the lower limit of the 95% CI) are shown in the lower row.

4. Discussion

The present study is one of the first to compare NSSI between two culturally distinct countries: India and Belgium. Findings indicated that the lifetime prevalence of NSSI in young adults may be higher in India than in Belgium. Further, apart from these differences in prevalence, NSSI also differed phenomenologically between the two countries. Finally, the strength of the association between identity confusion and lifetime NSSI differed the most between India and Belgium. Each of these findings is discussed below.

First, although we did not directly compare the lifetime prevalence of NSSI between India and Belgium, the findings of the current study indicate that the lifetime prevalence and the one- year prevalence of NSSI in Indian young adults was around 21% and 4%, respectively. Therefore, the lifetime prevalence and one-year prevalence of NSSI may be higher in India than in Belgium (Kiekens et al., 2016). Note that the one-year prevalence of NSSI in the Indian sample in this study was almost 27% to 30% lower than that reported by earlier studies conducted by Kharsati and Bhola (2014) and Bhola and colleagues (2017). Although the difference in the one-year prevalence of NSSI may be because of the difference in the measurement methods (single YES/NO question vs. checklist), future studies with larger samples and a research design which combines both survey and interview techniques may be necessary to better understand NSSI in India. Consistent with the international literature (Bresin & Schoenleber, 2015), we also found that females had a higher lifetime prevalence of NSSI than males in both countries.

Second, cross-cultural comparison of NSSI between India and Belgium indicated that there were several phenomenological differences between the two countries. Comparison of the seven different forms of NSSI indicated that whereas head banging was more often reported by Indian young adults, their Belgian counterparts reported more cutting and scratching. Based on these results, and the findings of the previous studies (Kharsati & Bhola, 2014), it appears that Indian young adults may engage more often in self-bruising behaviors to harm themselves. Although the exact reason for favoring self-bruising over cutting is not clear, we hypothesize that behaviors like cutting and subsequent wound care may require considerable privacy which may not be easily available to urban Indians who live in close proximities with their families in relatively small residential spaces (Laungani, 2007). In terms of the body parts that were commonly injured, it was observed that the Indian and the Belgian participants did not statistically differ from each other in their preference for injuring specific body parts. Comparison of functions of NSSI between the Indian and the Belgian young adults indicated that the Belgian participants engaged in NSSI for more intrapersonal reasons as compared to

the Indian participants. The differential endorsement of functions of NSSI may be due to differential cultural contexts of the two countries (Gholamrezaei et al., 2015). Given that Belgian culture is predominantly individualistic (Goossens & Luyckx, 2006), preponderance of self-related functions in Belgian young adults is not surprising. Additionally, given the interdependent and collectivistic nature of the Indian society (Laungani, 2007), social functions were expected to be more often endorsed by Indian participants. However, the medians of interpersonal functions did not significantly differ between the two nationalities. Although it is not clear why the countries in our sample did not differ on the social functions, the possibility of a non-significant result due to higher type 2 error resulting from a small sample size cannot be ruled out (Button et al., 2013).

In line with research emerging from Belgium (Claes et al., 2014; Luyckx, et al., 2015), the overall findings indicated that increased identity confusion also increased vulnerability to lifetime NSSI. However, as expected, the strength of the association between identity confusion and lifetime NSSI differed significantly between India and Belgium. Low confusion was more protective against NSSI and high confusion was associated with higher vulnerability to NSSI in the Belgian sample than in the Indian sample. The moderation effect of culture on the association between identity confusion and NSSI may be an outcome of differences in how concepts like self and identity develop and operate in India and Belgium. As previously noted, an inconsistent self which lacks integration may be more acceptable in an non-Western than in a Western country like Belgium (Suh, 2002). On the other hand, identity integration and self-knowledge appeared to reduce one's vulnerability to NSSI. Findings of the moderation analysis indicated that the association of integration with lifetime NSSI significantly differed between the two cultures. However, a more fine-grained analysis using confidence intervals clarified that the predicted probability of lifetime NSSI was significantly higher in Belgium than in India only when there was a substantial lack of integration. This finding was an additional confirmation of the observation made by cross-cultural researchers that the presence of an inconsistent self may be more easily tolerated (Berman et al., 2014; Rao et al., 2013; Sinha, 2014) and, therefore, may lead to less negative outcomes in the Indian context than in Western countries like Belgium.

Provided that they can be replicated in further longitudinal studies with larger samples, the findings of the current study may have important clinical implications. First, the current study reiterates the need for addressing identity issues in the management of NSSI (Gandhi et al., 2017). However, managing identity distress may be associated with a more marked reduction in NSSI in the Western context than in the Indian context. Second, although

increasing identity synthesis by improving integration and self-knowledge may be protective against NSSI in both Western and non-Western individuals, the way of achieving this goal may depend on culture . For example, given that individuals in the West often rely on self-exploration to consolidate their identity (Cheng & Berman, 2012), introspective strategies to promote identity consolidation may work well in a Western context (Wilson & Dunn, 2004). On the other hand, the interdependent nature of self and identity development observed in India may necessitate the use of additional relational approaches (e.g., seeing oneself through the eyes of others; Wilson & Dunn, 2004) to help individuals from these countries to develop a better understanding of their identities.

The findings of the current study should be interpreted in the context of some limitations. First, the data in the current study were collected using a convenience sampling approach. Consequently, our findings may not be representative of the Indian or Belgian population. Second, the results obtained in this study were based on a relatively small sample size. Therefore, the possibility of higher type 2, type S, and type M errors (Button et al., 2013; Gelman & Carlin, 2014) cannot be ruled out. Further studies with larger samples are recommended. Third, because of the cross-sectional design of our study, no claims regarding causal relations between identity formation and NSSI can be made. Cross-cultural longitudinal research is required to understand directionality of effects between these variables. Fourth, a review of international studies clearly indicates that NSSI often occurs in adolescence. Therefore, cross-cultural research with adolescent samples should also be attempted in future research. Finally, extant research has demonstrated that both NSSI and identity formation may differ even between Western countries with similar cultural values (Plener, Libal, Keller, Fegert, & Muehlenkamp, 2009). Given that a homogenous Western versus a homogenous Eastern dichotomy is less likely to exist, multinational multisite cross-continent explorations of NSSI and factors that increase its vulnerability may be essential.

In spite of these limitations, the present study is not without its strengths. By using a case- control design and a robust analytical strategy, the current study indicates that an increase of research efforts to explore epidemiological and causal factors of NSSI may be urgently required in non-Western countries like India. Additionally, as demonstrated in the present study, the underlying risk factors that increase vulnerability to NSSI are likely to differ between different countries. Therefore, further research is also necessary to develop targeted interventions that are tailored to the psychosocial needs and cultural norms of the population being treated.

General Discussion

Chapter 9.

General Discussion.

1. Review of Hypotheses

The present doctoral project had four aims: (1) Investigating the distribution of the age of onset of NSSI in a pooled sample of Dutch-speaking adolescents and emerging adults; (2) Examining the association between identity formation and NSSI (directionality of the association, relationship between domain-specific identity distress, and NSSI); (3) Investigating if identity formation functions as a potential mediator between intrapersonal/interpersonal factors and NSSI; and (4) Examining NSSI, identity formation, and their association from a cross-cultural perspective. To this end, seven manuscripts were included in the dissertation. In this chapter, we summarize the findings of these empirical studies and contextualize them in the existing literature on NSSI. We then highlight some of the limitations of our work and suggest some avenues for further research. The chapter concludes with a short discussion on the clinical relevance of our findings.

1.2. Objective 1: Investigating the distribution of the age of onset of NSSI in a pooled sample of Dutch-speaking adolescents and emerging adults

Based on the empirical findings in Chapters 3 and 4, the lifetime prevalence of NSSI in Belgium was found to be 16.5% and 14.2%, respectively. The cumulative survival function (Chapter 2) indicated that about 21% of individuals engaged in at least one episode of NSSI. The average of the lifetime prevalence rates obtained using different studies included in the present dissertation was about 17.2%. One-year prevalence of NSSI (Chapter 4) was found to be around 7.7%. Overall, the lifetime and one-year prevalence were found to be very close to prevalence rates reported by Swannell and colleagues (2014) and Taliaferro and colleagues (2012).

The discrete event history analysis approach (Chapter 2) indicated that in Belgium the probability of NSSI engagement increases from the age of 9 years, which is at least 5 years earlier than the age of onset reported in the international literature (Hankin & Abela, 2011). After 9 years of age, females had a higher probability of engaging in NSSI as compared to males. In the community sample, the probability of NSSI peaked between the ages of 13-15 years for females and around the age of 14 years for males. These findings are in line with other studies which indicate that the age of onset of NSSI is between 12-14 years of age (Heath, Toste, Nedecheva, & Charlebois, 2009). The probability of onset of NSSI subsequently

decreases with a second smaller peak in young adults around the age of 20 years. The later age of onset of NSSI was more likely to be seen in females than in males (Figure 1). Overall, the current findings strengthen the existing evidence indicating that NSSI is more prevalent in females than in males (Bresin & Schoenleber, 2015).

Interestingly, the age of onset of NSSI did not differ significantly between the community and clinical female samples. This finding was in contrast to earlier reports that suggest a later onset of NSSI in clinical samples (Claes, Vandereycken, & Vertommen, 2001). As expected, the probability of at least one episode of NSSI continued to be higher in clinical samples as compared to community samples.

1.3. Objective 2: Examining the association between NSSI and identity formation

The second objective of the current PhD was to investigate the association between NSSI and identity formation. To meet this objective, we conducted two studies. In the first study (Chapter 3), we explored the association between NSSI and domain-specific identity distress. In the second study (Chapter 4), we explored the directionality of effects between NSSI and identity confusion/synthesis.

9.3.1. NSSI, domain specific identity distress, and distress due to identity impairment:

As far as we are aware, Chapter 3 was the first study that explored the association between NSSI and distress associated with seven different domains of identity (long-term goals, career choice, friendships, sexual orientation and behavior, religion, values and beliefs, and group loyalties). The findings of this study revealed the presence of gender differences in distress associated with specific identity domains. More specifically, we found that females were more likely than males to score higher on distress related to identity domains of friendship and group loyalties. This finding contradicted the results of Berman, Montgomery, and Kurtines (2004) who found distress related to friendship to be more severe in men than in women and those by Gfellner and Ana Córdoba (2011) who did not find any gender differences in any of the domains. Although the reasons for these differences are not clear to us, higher distress associated with intrapersonal factors observed in our study is not unexpected given that women tend to be more relationally oriented than men (Frey, Tobin, & Beesley, 2004). Consequently, they may be more prone to distress in these domains. Along with the interpersonal factors, women also scored higher on the distress related to career issues.

When comparing the individuals with and without lifetime NSSI, we found that those with lifetime NSSI reported higher distress in the identity domains of long-term goals, friendships, sexual orientation and behavior, values and beliefs. Interestingly, these domains have been theorized to be the key issues that adolescents often rework on during identity crises

phases (Erikson, 1968), and disturbances in these domains in self-injuring individuals were anticipated. Our findings also provide further evidence for the positive association observed between distress due to sexual identity and behavior (Batejan et al., 2015).

Whereas distress associated with specific domains differed between females/males and individuals with/without NSSI, a composite score for distress across seven identity domains did not significantly predict lifetime NSSI (when controlling for age, gender, depression, and anxiety). On the other hand, the impairment score (combining severity, intensity, and duration) significantly and positively predicted lifetime NSSI. Finally, we also found that the differences in impairment may be an important factor contributing to females reporting higher NSSI than men. In line with Bresin and Schoenleber (2015), we also found the prevalence of NSSI to be higher in females than in males. One of the reasons for the apparent gender differences in NSSI is that perhaps women tend to experience more impairment due to identity distress than males. Resulting impairment may be experienced by females in form of worries and anxieties which have been demonstrated to be more common in females than in males (Chaplin, Gillham, & Seligman, 2009).

1.3.2. Directionality of effects between NSSI and identity

Chapter 4 helped us to further clarify the association between NSSI and identity formation. The findings of this study demonstrated that the association between NSSI and disturbances in identity formation were bi-directional. This finding was in partial agreement with the work of Luyckx and colleagues (2015). These authors reported that adolescents with a history of NSSI in the past were more likely to report a lack of identity synthesis, whereas current NSSI was associated with higher identity confusion.

1.3.3. Four different NSSI trajectories and identity synthesis and confusion

In Chapter 4, we identified four possible trajectories of NSSI based on engagement in NSSI at Time 1 and/or Time 2: Control (No NSSI at both Times 1 and 2); Cessation (NSSI at Time 1 but not at Time 2); Onset (NSSI at Time 2 but not at Time 1); Maintenance (NSSI at both Times 1 and 2). Our analysis indicated that individuals with a history of NSSI (Cessation, Onset, and Maintenance) reported higher disturbances in identity formation at Time 1 and Time 2 (as compared to the Control group). Assuming that the findings can be replicated in a larger sample, it can be concluded that a dose-response relationship may exist between NSSI and identity synthesis/confusion. Finally, it was interesting to note that although the Maintenance group scored lower on identity synthesis than the other groups at both time points, within-group mean comparison of identity synthesis indicated that identity synthesis for this group increased at Time 2 as compared to baseline. The exact reason for this increase in identity synthesis is

not clear. The increase in identity synthesis by implicitly identifying with NSSI may be minimal as the Maintainers continued to demonstrate identity synthesis lower than other trajectories of NSSI. More in depth qualitative and quantitative research is needed to confirm this hypothesis.

1.3.4. NSSI and identity formation: The hypothesized pathways

Based on the findings of Chapters 3 and 4, the hypothesized bi-directional relationship between disturbances in identity formation and NSSI is shown in Figure 1.

Based on our own findings and the extant literature on NSSI, it is possible that engagement in self-harm can help individuals experiencing identity disturbances in two ways:

a) Regulating negative affect secondary to distress associated with a lack of identity. Overall, identity confusion can lead to identity distress which may be experienced in the form of negative affect. As demonstrated in Chapter 3, domains of long-term goals, friendships, sexual orientation/behavior, and values and beliefs may be more distress provoking than other domains of identity, especially in adolescents. NSSI may help such individuals to regulate distress and negative affect associated with identity formation.

b) NSSI may help some individuals to form an identity of a self-injurer. Previous research has demonstrated that such an identity can be formed in both offline and online contexts (Breen et al., 2013). This identity of a self-injurer may help individuals to fill the sense of inner emptiness (Podvoll, 1969), to invest in body image and consequently in self-determination (Asch, 1971), or form a basic sense of a coherent self that can persist across time (Breen et al., 2013). Findings of Chapter 4 provided some evidence to this hypothesis. As discussed in the preceding sections, we found that Maintainers (individuals who engaged in NSSI at Times 1 and 2) showed a significant increase in identity synthesis scores between the two time points.

From an Eriksonian perspective, the identity of a self-injurer can be considered as a negative identity. Negative identities, according to Erikson (1968), are identities that go against the values and attitudes prevalent in the society. Negative identities by definition are socially sanctioned and as such not supported (Côté & Levine, 1987). Without social support, the self-injurer identity is likely to be prone to destabilization. This phenomenon was also somewhat evident in the study presented in Chapter 4. The synthesis score in Maintainers improved at Time 2 because these individuals started identifying with the self-harm. Yet, the synthesis scores continued to be lower than participants who either never engaged in NSSI or engaged in NSSI less frequently. Consequently, identity confusion is likely to increase along with the negative affect associated with it.

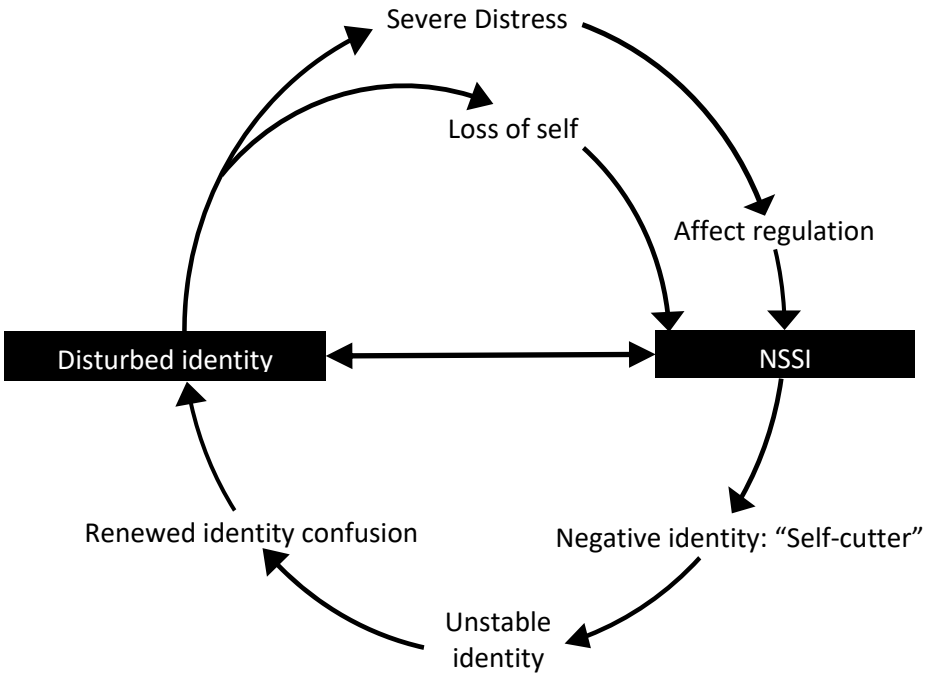


Figure 1. The hypothesized bi-directional relationship between NSSI and disturbances in identity formation

1.4. Objective 3: Investigating if identity formation functions as a potential mediator between intrapersonal/interpersonal factors and NSSI

As previously mentioned, both identity formation and NSSI are likely to be influenced by a host of intrapersonal and interpersonal factors. The third objective of the present project was to investigate if identity formation functioned as a mediator between temperament (intrapersonal factor; Chapter 5) and maternal and peer attachment (interpersonal factor; Chapter 6) on the one hand and NSSI on the other hand. Findings of both chapters are discussed below.

1.4.1. Temperament → identity formation → NSSI

Overall, the results of Chapter 5 indicated that Behavioral Inhibition System Reactivity (BIS/Effortful Control (EC) and not Behavioral Activation System Reactivity (BAS) were associated with both NSSI and identity confusion/synthesis. BIS was found to be positively associated with NSSI and identity confusion and negatively associated with identity synthesis. From existing literature, we know that a chronic overactive BIS can lead to pathological anxiety and the avoidance of novel experiences (Oosterlaan, 2001). Therefore, it can be hypothesized that NSSI can help with the regulation of negative affect which may be a result of a chronically overactive BIS. Likewise, successful resolution of an identity crisis requires exploration of a

variety of options and, therefore, tolerance of new experiences (Erikson, 1968). An overactive BIS can trigger anxiety when adolescents face novel situations that are inevitably associated with exploring and experimenting with various identities.

In contrast to BIS, EC provides the ability to regulate one's attention and inhibit one's dominant response in an effort to initiate a subdominant action. EC can help individuals to reduce bias to negative affect and also to shift the attention to neutral or positive thoughts (Deryberry & Rothbart, 1997). Consequently, the negative correlation between EC and NSSI/identity confusion and the positive correlation between EC and identity synthesis observed in Chapter 5 were also not surprising. Additionally, in line with the work of Claes and colleagues (2014), we also found that the association between BIS and NSSI was moderated by EC. These results are also in agreement with the dynamic relation between the activity of BIS and EC previously discussed (i.e., EC, by its ability to shifting attention, can regulate excessive negative affect generated by an overactive BIS).

Finally, we also found that although higher levels of BIS were not only directly associated with a higher probability of lifetime NSSI but also through its indirect effect on identity synthesis. High BIS leads to a lack of identity synthesis which can, in turn, increase the probability of lifetime NSSI.

1.4.2. Maternal/Peer attachment → Identity formation → NSSI

Like the intrapersonal factor "temperament", interpersonal factors like maternal and peer attachment can also play an important role in shaping identity and increasing vulnerability to NSSI (Jiang, You, Zheng, & Lin, 2017; Pittman, Keiley, Kerpelman, & Vaughn, 2011). Therefore, we explored if the association between maternal and peer attachment and NSSI was mediated through identity confusion/synthesis in Chapter 6.

Our findings indicated that whereas there was no direct association between maternal trust and alienation, these dimensions did have an indirect effect on lifetime NSSI through their association with identity synthesis and confusion. Maternal trust contributed to greater synthesis and reduced confusion. A more integrated sense of self (through greater synthesis and/or reduced confusion) was protective against NSSI. As expected, the effect of maternal alienation was exactly opposite to that of maternal trust. Maternal alienation weakened synthesis and promoted confusion and ultimately increased the risk of NSSI. Unlike the maternal dimensions of attachment, peer trust and alienation had both a direct and indirect effect on NSSI. More specifically, peer trust fostered synthesis and decreased confusion and decreased the risk of NSSI. Finally, peer alienation weakened synthesis and ultimately

increased the risk of NSSI. Overall, the findings support the idea that nurturing maternal and peer attachment may serve as an important component in the management of NSSI.

The findings of Chapter 6 indicate that whereas maternal attachment may be an important factor in predicting NSSI (Claes, De Raedt, Van de Walle, & Bosmans, 2016; Di Pierro et al. 2012), the role of the peer relationship is somewhat unclear. For example, in line with Hilt and colleagues (2008) and Turner and colleagues (2012), we found a significant association between the peer relationship and NSSI. However, a recent study by Jiang, You, Zheng, and Lin (2017) did not report any significant differences between individuals with and without NSSI on dimensions of peer attachment. The differences in results may be due to the difference in the cultural context in which these studies were conducted. Whereas most studies that report a significant association between NSSI and peer relationships are based in the West, the study by Jiang and colleagues (2017) was based in Taiwan. There is some evidence to indicate that due to emphasis on harmony and group conformity, most adolescents in Taiwan report lower conflict in friendships than their Western counter-parts do (Benjamin, Schneider, Greenman, & Hum, 2001). Accordingly, peer relationships may be weaker predictor of NSSI in the East as compared to the West. Further cross-cultural research is necessary to confirm these findings.

1.5. Objective 4: Examining NSSI and its association with identity formation from a cross-cultural perspective

The fourth objective of the current research project was to compare NSSI and its association with identity formation from a cross-cultural perspective. However, before this goal could be achieved, we first briefly reviewed the literature in India to identify studies on NSSI (Chapter 7). Next, using a case-control approach, we compared epidemiological features of NSSI between India and Belgium. We also investigated if the association between NSSI and identity formation was moderated by the culture of origin of the participants (Chapter 8).

Our review (Chapter 7) identified an inconsistent usage of eight self-directed violent behaviors common in the Indian literature. It was also observed that although Indian researchers have addressed the issue of NSSI to some extent, it has been mostly done in form of case studies. Large scale studies investigating NSSI behavior have only been recently published in India. However, as previously discussed, findings of these studies have produced somewhat conflicting results. The findings of the cross-cultural comparison of NSSI (and its association with identity formation between India and Belgium) may therefore be especially relevant to better understand NSSI from an Indian perspective (Chapter 8).

The findings of Chapter 8 indicate that lifetime prevalence and one-year prevalence of NSSI in Indian young adults was around 21% and 4%, respectively; these prevalence rates are similar to those reported in the international reviews and meta-analysis (Swannell et al., 2014, Taliaferro et al, 2012). Consistent with international literature (Bresin & Schoenleber, 2015), females were more likely to report NSSI than males. Comparison between India and Belgium indicated that some aspects of NSSI (e.g., one-year prevalence and body-parts commonly injured) did not differ between the two countries. However, other aspects like methods of self-injuring and functions of NSSI differed significantly. More specifically, head banging was more often reported by Indian participants and self-cutting was more often endorsed by Belgian participants. Additionally, in line with Gholamrezaei et al. (2015), Belgian participants reported engaging in NSSI more for intrapersonal functions than the Indian participants.

Like other studies included in the present dissertation, Chapter 8 also showed a positive association between NSSI and identity confusion. However, this association was stronger in Belgian individuals than in Indian participants. This finding was in line with research that highlights the fact that an incoherent sense of self often leads to less distress in Indian individuals than in other countries (Berman et al., 2014; Rao et al., 2013; Sinha, 2014). On the other hand, aspects of identity synthesis like integration and self-knowledge were equally protective against lifetime NSSI in both samples.

2. Limitations and directions for further research

Although this doctoral dissertation does fill in some important gaps in the literature on NSSI, it is not without limitations. We have already addressed limitations of individual empirical studies in each chapter separately. In the subsequent section, we address some general limitations of the present work. The shortcomings are broadly divided into two categories: limitations due to conceptualization or operationalizing of study variables and limitations due to sampling issues or study design. We also identify how these limitations could be resolved in further research.

2.1 Limitations due to conceptualization or operationalization of study variables:

First, in all the empirical models tested in the present doctoral dissertation, the outcome variable NSSI was operationalized as the presence/ absence of lifetime prevalence of NSSI. However, the association between other features of NSSI (current NSSI, versatility of NSSI, and frequency of episodes) may also be essential. Additionally, given that "NSSI syndrome" has been included in DSM-5 (APA, 2013), future research testing our models in individuals meeting the criteria of the "NSSI syndrome" may also be necessary.

Second, by defining identity as "a subjective feeling of sameness and continuity across time and across contexts" we modeled it as ego-identity from Erikson's psychosocial theory of development. However, identity is a complex and a multifaceted construct. Identity theorists often differentiate among personal, relational, social, and Erikson's ego-identity. Personal identity refers to one's goals, values, and beliefs (Schwartz, 2001), relational identity taps into *how role occupants enact their respective roles vis-á-vis each other* (Sluss & Ashforth, 2007, p. 6), and social identity refers to the part of the self-concept that is based on group membership (Tajfel, 1978). The current project focused only on the association between ego-identity and lifetime NSSI. However, extant literature demonstrates that personal (Luyckx et al., 2015) and social (Breen et al., 2013) identity processes may also be associated with engagement in NSSI. Further, as far as we are aware, no study so far has explored the association between relational identity and NSSI, which may also be essential especially in cultures that value interdependence over autonomy. Therefore, further research should consider exploring the relation between different aspects of identity and their influence on NSSI.

Third, exploring the moderating effect of culture on the association between various aspects of identity (ego, personal, relational, and social) and NSSI may be especially interesting as the strength of the association between a particular form of identity and NSSI is expected to change according to the culture in question. For example, in Chapter 8 we observed that disturbances in identity formation (high confusion or low integration, or low self-knowledge) had a stronger relation with NSSI in the Belgian sample as compared to the Indian sample. This conclusion was in agreement with the understanding that Belgian culture is likely to be more autonomous, whereas Indian culture is likely to be more collectivistic (Goossens & Luyckx, 2006; Laungani, 2007). Extending this reasoning, it can be argued that disturbances in relational and social identities would have a stronger relationship to the probability of engagement in NSSI in Indians than in Belgians. However, further research is needed to explore these research questions.

2.2. Limitations due to sampling issues or study design

Chapters 3, 5, 6, and 8 were based on cross-sectional designs. Therefore, it may be difficult to draw conclusions regarding the directionality of effects between the study variables. Further research using longitudinal designs may be necessary to confirm the findings of the cross-sectional studies included in this dissertation. Although the study presented in Chapter 4 was based on longitudinal data, the small number of NSSI cases at Time 2 (n = 29) does increase the risk of committing Type 2 errors (Button et al., 2013). That is, the power to detect significant associations may be undermined because of the smaller sample size.

All the empirical studies presented in this doctoral dissertation were based on data that were collected using the convenience sampling method. Therefore, presence of self-selection bias cannot be ruled out and the generalizability of the findings to a larger population may not be possible.

Besides the small sample size, Chapter 4 also faced the problem of missing data due to drop-outs. As mentioned in Chapter 4, the retention rate at Time 2 was 72.07%. That is, 27.93% of students who had participated at Time 1 also participated at Time 2. In Chapter 4, we demonstrated that missingness due to dropout was likely to be at random, that is, missingness at Time 2 were not related to lifetime NSSI at Time 1. However, evaluating the influence of missingness on the model estimates using sensitivity analysis is recommended in future longitudinal research (Robins, Rotnitzky, & Scharfstein, 2000).

The descriptive statistics for the samples used in most of the studies (Chapters 4, 5, 6, and 8) indicate that the age range of the participants across these studies was significantly large. A larger range of data can lead to the relatively larger standard deviations, not only in the age variable, but also in other variables. Large standard deviations can reduce the precision of estimation. Additionally, cases at the extremes may increase or decrease the estimates obtained in the models tested in the present study. Yet, the use of data from participants with a relatively wide age range allowed us to trace the association of the study variables (most importantly identity synthesis/confusion) with the rise and fall of prevalence NSSI.

3. Clinical Implications

In spite of these limitations, the findings of the present dissertation can make several important contributions to the clinical management of NSSI. In the subsequent sections, the clinical implications at the level of individuals, community, and culture will be discussed.

3.1. Implications at the level of the individual

3.1.1. Disturbances in Identity: A transdiagnostic risk factor?

Available research has already demonstrated the association between disturbances in identity formation and mental health issues like borderline personality disorder (Wilkinson-Ryan & Westen, 2000), eating disorders (Claes et al., 2015), compulsive buying (Claes, Müller, & Luyckx, 2016), and anxiety disorders (Marcia, 1967). By demonstrating the association between NSSI and disturbances in identity formation, the findings of this research extend the list of mental health issues associated with identity formation. Based on these studies, it can be hypothesized that identity formation may be a fundamental process underlying multiple disorders, that is, it behaves like a transdiagnostic factor. Transdiagnostic factors can aid in understanding comorbidity among disorders and also in developing effective assessment and

treatment interventions (Nolen-Hoeksema & Watkins, 2011). Interestingly, while identity formation is not one of the components of the Research Domain Criteria (RDoC) – a transdiagnostic classification proposed by National Institute of Mental Health (Insel et al., 2010) – self-knowledge is. Self-knowledge, in the RDoC framework is conceptualized as "*being aware of or accessing knowledge about, and/or making judgments about the self"* (Kozak & Cuthbert, 2016, p. 291). The conceptual similarity between identity formation and self-knowledge from RDoC provides some evidence that disturbances in identity may be further explored as a possible transdiagnostic factor even within the RDoC framework. In summary, we support calls to include developmental processes (e.g., identity formation) in the RDoC framework (Franklin, Jamieson, Glenn, & Nock, 2015).

3.1.2. Addressing issues of identity formation in individuals who engage in NSSI

Our findings also present evidence that addressing issues of identity formation may be important in the management of NSSI. From a clinician's perspective, it may be especially relevant to explore if the act of engaging in NSSI has become a part of the individual's identity system. Implicit identification with NSSI (Nock, 2009) often means that the identity of a "self-injurer" becomes the predominant identity of self-injuring individuals. In adolescents and emerging adults, the identity of a self-injurer is likely to be maintained and in some cases encouraged by social engagement with others who also self-injure. Apart from internet-based chat services and discussions forums on self-injury, peer groups in schools or early university years may also serve to reinforce the self-injurer identity. As mentioned in the Chapter 1 early literature on self-cutting indicates that implicit identification with NSSI may also occur even in psychiatric units (Asch, 1971; Podvoll, 1969). If the clinician observes presence of implicit identification with NSSI, addressing the issue of identity may be necessary. This is important because individuals who identify themselves as self-injurers may actively resist any attempt to stop their self-harming behavior as stopping it would mean they lose the behavior that gives them a sense of self. Exploring and instilling a more healthier sense of identity may therefore be a necessary component of NSSI management. In addition to addressing issues regarding NSSI, given that disturbances in identity appears to be a risk factor for multiple psychiatric symptoms, managing distress due to identity formation may be helpful in lessening vulnerability to the aforementioned psychiatric conditions.

3.2. Interventions targeting antecedents: Family therapy and strengthening effortful control (EC)

The findings of this project also reinforce the need for involving parents in treatment of NSSI (Washburn et al., 2012). A nurturing bond with family members may help in the

management of NSSI in at least two ways. First, positive parenting behaviors like skill encouragement, problem solving, and effective but non-intrusive monitoring and sanctioning have been shown to alter social appraisal patterns and to help in strengthening self-regulatory mechanisms (Todd & Lewis, 2011). Second, positive parenting behaviors can also encourage adolescents to rely on their parents for support and guidance when they transition through the identity crisis phase. A successful resolution of the identity crises phase can reduce the vulnerability to NSSI.

Strengthening EC capability may also help individuals not to rely on NSSI for managing their negative affect. Both Cognitive Behavior Therapy and Mindfulness techniques have been proposed to be helpful in increasing awareness of emotional reactions and boast the ability to control emotional responses (Todd & Lewis, 2011). A strengthened EC can override the overactive BIS and hence help the individual to better manage negative affect and consequently NSSI may increase.

3.2. Implications at the level of the community: NSSI in schools and universities

With almost 21% of lifetime prevalence in both Belgium (Chapter 2) and India (Chapter 8), NSSI is rightly considered as a major mental health concern. The studies included in the current PhD provide strong evidence for the fact that engaging in at least one episode of NSSI can be associated with disruption of normative developmental tasks like identity formation. Resolution of the identity crises according to Erikson's theory is necessary for the resolution of the next stage of development, that is, intimacy versus isolation. Engagement in NSSI can therefore additionally contribute to loneliness in young adults by reducing the ability to form intimate relationships. Addressing the issue of NSSI by developing effective prevention programs at the level of school education may therefore be necessary. Given that the onset of NSSI can also occur in young adults, prevention programs that promote mental health in early university years may also be helpful. The prevention programs should certainly include components on health strategies to regulate emotions and supporting students as they develop an independent sense of identity so that exploring various options does not overwhelm them. Additionally, modules on interpersonal skills may also also be an important component in any prevention program. Interestingly, these components are already a part of the life skills training program developed by the World Health Organization (1997). Other school mental health programs like Aussi Optimism may also show promising results (Myles-Pallister, Hassan, Rooney, & Kane, 2014). This program includes 10 sessions that target areas such as the identification and awareness of comfortable and uncomfortable feelings, understanding feelings in others, cognitive re-structuring, a fear hierarchy, pleasant events scheduling and

weekly relaxation training (Myles-Pallister et al., 2014). Peer and family relationships are also targeted. Implementing these or similar programs in schools may be helpful in the prevention of NSSI. The position paper by Hasking and colleagues (2016) and a review by De Riggi, Moumne, Heath, and Lewis, (2017) may serve as an important resource for schools interested in developing early intervention programs.

3.3. Implications at the level of culture

However, it should be noted that the nature of interventions should also be culturally relevant. For example, the cross-cultural research indicates that whereas promoting identity formation may be relevant in management of NSSI in countries like Belgium and India, the way identity is achieved in these countries may differ. Given the emphasis on autonomy in Belgium, clinicians may have to rely on individual's self-experience as a way of resolving identity related issues. However, in an Indian context there is a heavy emphasis on interdependence. Consequently, in addition to self-discovery, the relational nature of the self may also have to be explored for managing identity issues in Indian individuals.

4. Conclusion

In summary, the current project expanded the literature on NSSI in several ways. Using a cross-sectional, cross-cultural, and repeated measures design, the current project demonstrated that disturbances in identity formation are important factors that can increase vulnerability to NSSI in both Eastern and Western countries. We additionally demonstrated how the association between NSSI and identity may be a function of an interplay of intra- and inter-individual factors.

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Appendix

Appendix 1

Online appendix accompanying the manuscript – Age of onset of non-suicidal self-injury in Dutch speaking adolescents and emerging adults: An event history analysis of pooled data (Chapter 2)

Table 1. Calculation of the survival function for the community sample.

Age	Total sample size	New cases of NSSI	Hazard	1-Hazard Function	Cumulative Survival function
1-5 years	19730	11	0.000558	0.999442	0.999442
6 years	3936	9	0.002287	0.997713	0.997157
7 years	3927	12	0.003056	0.996944	0.99411
8 years	3915	24	0.00613	0.99387	0.988016
9 years	3891	7	0.001799	0.998201	0.986238
10 years	3884	53	0.013646	0.986354	0.972781
11 years	3831	44	0.011485	0.988515	0.961608
12 years	3785	92	0.024306	0.975694	0.938235
13 years	3555	118	0.033193	0.966807	0.907092
14 years	3215	133	0.041369	0.958631	0.869567
15 years	2693	102	0.037876	0.962124	0.836631
16 years	2036	56	0.027505	0.972495	0.81362
17 years	1199	10	0.00834	0.99166	0.806834
18 years	464	4	0.008621	0.991379	0.799879
19 years	204	1	0.004902	0.995098	0.795958
20 years	150	2	0.013333	0.986667	0.785345
21 years	132	0	0	1	0.785345
22 years	125	0	0	1	0.785345
23 years	102	0	0	1	0.785345
24 years	50	0	0	1	0.785345
25 years	29	0	0	1	0.785345

Table 2. Parameter Estimates, Standard Errors, Wald statistics test, and odds ratios for the hazard model fitted to the age of onset of NSSI in the pooled community data. Note that no estimates were reported for the ages 21-25 years as no new NSSI cases were reported in these age groups.

	B	SE	Wald	*df*	*p*	*Exp(B)*
Constant	-7.491	.302	616.995	1	<.001	.001
Age			485.419	20	<.001	
Age (6 years)	1.413	.450	9.869	1	.002	4.108
Age (7 years)	1.704	.418	16.631	1	.000	5.495
Age (8 years)	2.403	.365	43.457	1	.000	11.057
Age (9 years)	1.173	.484	5.875	1	.015	3.231
Age (10 years)	3.211	.332	93.648	1	.000	24.800
Age (11 years)	3.036	.338	80.904	1	.000	20.828
Age (12 years)	3.799	.320	141.358	1	.000	44.658
Age (13 years)	4.120	.316	170.193	1	.000	61.545
Age (14 years)	4.348	.314	191.382	1	.000	77.359
Age (15 years)	4.257	.318	179.128	1	.000	70.571
Age (16 years)	3.926	.331	140.987	1	.000	50.701
Age (17 years)	2.713	.438	38.380	1	.000	15.077
Age (18 years)	2.747	.586	21.984	1	.000	15.588
Age (19 years)	2.178	1.047	4.330	1	.037	8.831
Age (20 years)	3.187	.773	16.997	1	.000	24.225
Age (21 years)	(empty)					
Age (22 years)	(empty)					
Age (23 years)	(empty)					
Age (24 years)	(empty)					
Age (25 years)	(empty)					

Table 3. Parameter Estimates, Standard Errors, Wald statistics test, and odds ratios for the model with time (age), sex, and their interaction.

	B	**SE**	**Wald**	***df***	***p***	***Exp(B)***
Constant	-6.962	.307	514.405	1	<.001	.001
Age			300.218	20	<.001	
Age (6 years)	1.220	.450	7.348	1	.007	3.388
Age (7 years)	1.455	.418	12.107	1	.001	4.285
Age (8 years)	2.091	.365	32.812	1	<.001	8.095
Age (9 years)	.790	.484	2.659	1	.103	2.203
Age (10 years)	2.749	.333	68.079	1	<.001	15.629
Age (11 years)	2.488	.340	53.549	1	<.001	12.038
Age (12 years)	3.157	.324	94.862	1	<.001	23.491
Age (13 years)	3.377	.324	108.890	1	<.001	29.277
Age (14 years)	3.501	.327	114.803	1	<.001	33.165
Age (15 years)	3.295	.337	95.649	1	<.001	26.982
Age (16 years)	2.844	.357	63.317	1	<.001	17.177
Age (17 years)	1.516	.467	10.559	1	.001	4.555
Age (18 years)	1.434	.615	5.434	1	.020	4.197
Age (19 years)	.716	1.070	.448	1	.503	2.047
Age (20 years)	1.518	.816	3.464	1	.063	4.563
Age (21 years)	(empty)					
Age (22 years)	(empty)					
Age (23 years)	(empty)					
Age (24 years)	(empty)					
Age (25 years)	(empty)					
Sex	-1.903	.407	21.906	1	<.001	.149
Age * Sex	.176	.031	31.677	1	<.001	1.193

Table 4. Survival function considering the influence of gender

Age	Males					Females				
	Total sample size	New cases of NSSI	Hazard	1-Hazard Function	Cumulative Survival function	Total sample size	New cases of NSSI	Hazard	1-Hazard Function	Cumulative Survival function
1-5 years	9865	9	0.000912	0.999088	0.999088	9865	2	0.000203	0.999797	0.999797
6 years	1965	8	0.004071	0.995929	0.99502	1971	1	0.000507	0.999493	0.99929
7 years	1957	9	0.004599	0.995401	0.990444	1970	3	0.001523	0.998477	0.997768
8 years	1948	15	0.0077	0.9923	0.982818	1967	9	0.004575	0.995425	0.993203
9 years	1933	1	0.000517	0.999483	0.982309	1958	6	0.003064	0.996936	0.990159
10 years	1932	36	0.018634	0.981366	0.964005	1952	17	0.008709	0.991291	0.981536
11 years	1896	22	0.011603	0.988397	0.95282	1935	22	0.01137	0.98863	0.970377
12 years	1874	43	0.022946	0.977054	0.930957	1911	49	0.025641	0.974359	0.945495
13 years	1766	28	0.015855	0.984145	0.916196	1789	90	0.050307	0.949693	0.89793
14 years	1617	47	0.029066	0.970934	0.889566	1598	86	0.053817	0.946183	0.849606
15 years	1352	38	0.028107	0.971893	0.864563	1341	64	0.047726	0.952274	0.809058
16 years	1025	24	0.023415	0.976585	0.84432	1011	32	0.031652	0.968348	0.783449
17 years	624	2	0.003205	0.996795	0.841614	575	8	0.013913	0.986087	0.772549
18 years	248	1	0.004032	0.995968	0.83822	216	3	0.013889	0.986111	0.761819
19 years	107	0	0	1	0.83822	97	1	0.010309	0.989691	0.753966
20 years	71	1	0.014085	0.985915	0.826414	79	1	0.012658	0.987342	0.744422
21 years	56	0	0	1	0.826414	76	0	0	1	0.744422
22 years	53	0	0	1	0.826414	72	0	0	1	0.744422
23 years	46	0	0	1	0.826414	56	0	0	1	0.744422
24 years	26	0	0	1	0.826414	24	0	0	1	0.744422
25 years	15	0	0	1	0.826414	14	0	0	1	0.744422

Table 5. Parameter Estimates, Standard Errors, Wald statistics test, and odds ratios for the hazard model fitted to the age of onset of NSSI in the pooled female-only sample with and without psychiatric disorders (BPD and ED).

	B	SE	Wald	*df*	*p*	*Exp(B)*
Constant	-8.038	.500	258.356	1	<.001	
Age			438.970	20	<.001	
Age (6 years)	.918	.866	1.124	1	.289	2.505
Age (7 years)	2.174	.627	12.016	1	.001	8.793
Age (8 years)	2.718	.578	22.128	1	<.001	15.148
Age (9 years)	2.027	.646	9.851	1	.002	7.593
Age (10 years)	3.465	.539	41.320	1	<.001	31.962
Age (11 years)	3.844	.528	53.104	1	<.001	46.720
Age (12 years)	4.510	.515	76.690	1	<.001	90.916
Age (13 years)	5.073	.510	99.128	1	<.001	159.688
Age (14 years)	5.330	.508	109.907	1	<.001	206.433
Age (15 years)	5.404	.509	112.611	1	<.001	222.274
Age (16 years)	5.054	.516	95.850	1	<.001	156.661
Age (17 years)	4.884	.530	84.948	1	<.001	132.097
Age (18 years)	4.870	.558	76.162	1	<.001	130.298
Age (19 years)	4.471	.630	50.345	1	<.001	87.401
Age (20 years)	4.502	.649	48.072	1	<.001	90.189
Age (21 years)	4.215	.711	35.140	1	<.001	67.683
Age (22 years)	4.657	.676	47.469	1	<.001	105.323
Age (23 years)	4.751	.714	44.318	1	<.001	115.757
Age (24 years)	5.330	.719	54.976	1	<.001	206.433
Age (25 years)	(empty)					

Table 6. Calculation of the survival function for the female community and clinical samples.

Age	Total sample size	New cases of NSSI	Hazard	1-Hazard Function	Cumulative Survival function
1-5 years	12394	4	0.000323	0.999677	0.999677
6 years	2476	2	0.000808	0.999192	0.998869
7 years	2479	7	0.002832	0.997168	0.996040
8 years	2477	12	0.004868	0.995132	0.991192
9 years	2459	6	0.002446	0.997554	0.988767
10 years	2472	25	0.010217	0.989783	0.978665
11 years	2458	36	0.014864	0.985136	0.964119
12 years	2452	68	0.028523	0.971477	0.936619
13 years	2353	110	0.049041	0.950959	0.890686
14 years	2159	127	0.062500	0.937500	0.835018
15 years	1848	116	0.066975	0.933025	0.779093
16 years	1393	64	0.048157	0.951843	0.741574
17 years	865	34	0.040915	0.959085	0.711233
18 years	438	17	0.040380	0.959620	0.682514
19 years	262	7	0.027451	0.972549	0.663778
20 years	218	6	0.028302	0.971698	0.644992
21 years	191	4	0.021390	0.978610	0.631195
22 years	157	5	0.032895	0.967105	0.610432
23 years	115	4	0.036036	0.963964	0.588435
24 years	68	4	0.062500	0.937500	0.551657
25 years	28	0	0	1	0.551657

Table 7. Parameter Estimates, Standard Errors, Wald statistics test, and odds ratios for the model with time (age), presence of psychiatric disorders, and their interaction.

	B	SE	Wald	*df*	*p*	*Exp(B)*
Constant	-7.909	.502	248.209	1	<.001	
Age			411.383	20	<.001	
Age (6 years)	.833	.866	.924	1	.336	2.299
Age (7 years)	2.065	.627	10.834	1	.001	7.882
Age (8 years)	2.582	.578	19.966	1	<.001	13.225
Age (9 years)	1.862	.646	8.311	1	.004	6.438
Age (10 years)	3.267	.539	36.717	1	<.001	26.243
Age (11 years)	3.612	.528	46.809	1	<.001	37.051
Age (12 years)	4.242	.516	67.629	1	<.001	69.555
Age (13 years)	4.763	.511	86.875	1	<.001	117.117
Age (14 years)	4.967	.511	94.493	1	<.001	143.529
Age (15 years)	4.978	.513	94.026	1	<.001	145.198
Age (16 years)	4.549	.523	75.644	1	<.001	94.574
Age (17 years)	4.212	.543	60.289	1	<.001	67.512
Age (18 years)	3.871	.583	44.106	1	<.001	47.991
Age (19 years)	3.200	.666	23.118	1	<.001	24.534
Age (20 years)	3.105	.695	19.954	1	<.001	22.316
Age (21 years)	2.739	.764	12.850	1	<.001	15.466
Age (22 years)	3.161	.742	18.140	1	<.001	23.596
Age (23 years)	3.189	.790	16.284	1	<.001	24.264
Age (24 years)	3.466	.818	17.950	1	<.001	31.999
Age (25 years)	(empty)					
Population type	-1.032	.502	4.234	1	.040	.356
Age * Population type	.133	.036	14.092	1	<.001	1.143

Table 8. Survival function considering the influence of presence of psychiatric disorder

Age	Females from the community sample					Females from the clinical sample				
	Total sample size	New cases of NSSI	Hazard	1-Hazard Function	Cumulative Survival function	Total sample size	New cases of NSSI	Hazard	1-Hazard Function	Cumulative Survival function
1-5 years	9865	2	0.000202	0.999797	0.999797	2523	2	0.000792	0.999208	0.999208
6 years	1971	1	0.000507	0.999492	0.999290	502	1	0.001988	0.998012	0.997221
7 years	1970	3	0.001522	0.998477	0.997768	498	4	0.007968	0.992032	0.989275
8 years	1967	9	0.004575	0.995424	0.993202	495	3	0.006024	0.993976	0.983316
9 years	1958	6	0.003064	0.996935	0.990159	495	0	0.000000	1.000000	0.983316
10 years	1952	17	0.008709	0.991290	0.981536	487	8	0.016162	0.983838	0.967424
11 years	1935	22	0.011369	0.988630	0.970376	473	14	0.028747	0.971253	0.939613
12 years	1911	49	0.025641	0.974358	0.945495	454	19	0.040169	0.959831	0.901870
13 years	1789	90	0.050307	0.949692	0.89792	434	20	0.044053	0.955947	0.862140
14 years	1598	86	0.053817	0.946182	0.849605	393	41	0.094470	0.905530	0.780693
15 years	1341	64	0.047725	0.952274	0.809057	339	52	0.132992	0.867008	0.676867
16 years	1011	32	0.031651	0.968348	0.783449	286	32	0.100629	0.899371	0.608755
17 years	575	8	0.013913	0.986086	0.772549	230	26	0.101563	0.898438	0.546928
18 years	216	3	0.013888	0.986111	0.761819	191	14	0.068293	0.931707	0.509577
19 years	97	1	0.010309	0.989690	0.753965	152	6	0.037975	0.962025	0.490226
20 years	79	1	0.012658	0.987341	0.744421	128	5	0.037594	0.962406	0.471796
21 years	76	0	0	1	0.744421	107	4	0.036036	0.963964	0.454795
22 years	72	0	0	1	0.744421	75	5	0.062500	0.937500	0.426370
23 years	56	0	0	1	0.744421	51	4	0.072727	0.927273	0.395361
24 years	24	0	0	1	0.744421	36	4	0.1	0.9	0.355825
25 years	14	0	0	1	0.744421	14	0	0	1	0.355825

Appendix 2

Online appendix accompanying the manuscript – Directionality of effects between non-suicidal self-injury and identity formation: A prospective study in adolescents (Chapter 4)

Attrition analyses

This document is an appendix to the manuscript "Directionality of effects between non-suicidal self-injury and identity formation: A cross-lagged prospective study in adolescents" and presents the attrition analyses. The main aim of the current study was to investigate the directionality of association between NSSI and identity formation using a 1-year longitudinal study. To fulfil this hypothesis, we collected data from high school students by convenience sampling. As mentioned in the manuscript, 528 students participated in the first wave whereas 382 participants participated in the second wave.

To capture attrition, a new variable was created with an individual getting a value of one if they left the study at wave 2 and value of zero if they participated in wave 2.

In order to investigate if there were mean differences in the dependent variables (age, identity synthesis, and identity confusion; for description of these variables, please refer to the manuscript) amongst students who participated in wave 2 and those who did not participate at time 2 a MANOVA was performed. In MANOVA, the variable attrition was added as the independent variable whereas age, identity synthesis, and identity confusion were entered as the dependent variables.

The results of the MANOVA did not show significant mean differences in identity synthesis (F = .219, p = .193) or identity confusion (F = .532, p = .466). However, mean differences were observed for age (F = 107.086, p < .001), with participants who left the study having a higher mean age (*Mean* = 16.25 years, *SD* = 1.674) than individuals who continued to participate in the wave two (*Mean* = 14.56 years, *SD* = 1.68). As mentioned in the manuscript, higher mean for age was expected students not participating in the study, given that the biggest source of attrition was older students who left the school after completing the education.

A chi-square test was performed to test if attrition (non-participation in Time T2) between gender and engagement or non-engagement in NSSI at Time 1. The findings of the chi-square test indicated that attrition was not significantly different for gender ($\chi^2 = 3.85, p = .050$) and NSSI engagement at Time 1 ($\chi^2 = .20, p = .656$).

In order to further investigate if older participants indeed had a higher probability of leaving the study we performed a logistic regression by categorizing participants into three

groups: younger (11 – 13 years); middle-range (14 – 16 years); and older (17 – 19 years) students. Also, to investigate if probability of attrition was associated with gender and engagement in NSSI at time 1, we also added sex, NSSI at time 1, and their interaction with age as independent variable in the above logistic regression. The findings of the multiple logistic regression are presented in table 1 below.

Table 1. Multiple logistic regression with attrition as the dependent variable whereas Age, Sex, NSSI, and their interaction as the independent variable.

	B	*S.E.*	Wald	*df*	*p*	exp(*B*)
Age			115.385	2	<.000	
Age (14-16 years)	.39	.354	1.188	1	.276	1.471
Age (17-19 years)	3.08	.361	72.931	1	<.000	21.825
Sex	-.23	.256	.789	1	.374	.797
NSSI	-.74	1.016	.530	1	.466	.477
Age * NSSI * Sex			.814	2	.666	
Age (14-16 years) * NSSI * Sex	.42	.623	.451	1	.502	1.519
Age (17-19 years) * NSSI * Sex	.12	.605	.039	1	.844	1.127

Findings of the multiple logistic regression indicated that attrition was not associated with gender and NSSI at Time 1 or their interaction with age. However, main effect of age on attrition was found to be significant. Logistic regression indicated that odds of attrition were 21.83 times higher for students in the age group of 17-19 years than the students in the age group 11-13 years. Findings of the logistic regression are in line with those of the MANOVA.

Appendix 3

Appendix accompanying the manuscript – Non-suicidal self-injury and other self-directed violent behaviors in India: A review of definitions and research (Chapter 7)

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