


Non-Suicidal Self-Injury and Adolescents Attachment with Peers and Mother: The Mediating Role of Identity Synthesis and Confusion

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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.

Keywords Non-suicidal self-injury · Maternal attachment · Peer attachment · Identity confusion · Identity synthesis

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.

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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 associated 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 Blustein 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.

Method

Participants

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.

Procedure

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.

Measures

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 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.

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 ($\chi^2_{(41)} = 140.60$, CFI = .945, RMSEA = .068) had a better fit than a two-factor model ($\chi^2_{(43)} = 188.10$, 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 ($\chi^2_{(41)} = 215.81$, CFI = .910, RMSEA = .090) and two-factor-model ($\chi^2_{(43)} = 231.96$, 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).

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).

Analyses

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.

Results

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).

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

Table 1 Descriptive statistics of variables used in study

Study variables	Mean	SD	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 7 seven different forms of NSSI

NSSI form	Males (<i>n</i> = 20)	Females (<i>n</i> = 55)	Chi square (<i>df</i> ⁺ =1)
Scratching	5	14	.00, <i>ns</i>
Carving	9	29	.35, <i>ns</i>
Cutting	4	32	8.57*
Hitting or bruising	8	4	11.69*
Burning	3	3	1.62
Pricking with sharp objects	3	11	.24
Head banging	10	8	10.11*

* $p < 0.05$; ⁺ Degree of freedom**Table 3** Spearman's rank correlations between age, sex, identity synthesis/confusion, 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***	.36***	–.54***	–

 $p < 0.05$; ** $p < 0.01$; *** $p < .001$

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.

Figure 1, presents the unstandardized regression coefficients of the mediation models between peer attachment related constructs and lifetime NSSI. As shown in Fig. 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 ($B = -.199$, $SE = .088$, 95 % CI = $[-.418; -.071]$) and identity confusion ($B = -.105$, $SE = .058$, 95 % CI = $[-.262; -.020]$) was found to be significant while controlling for age and gender.

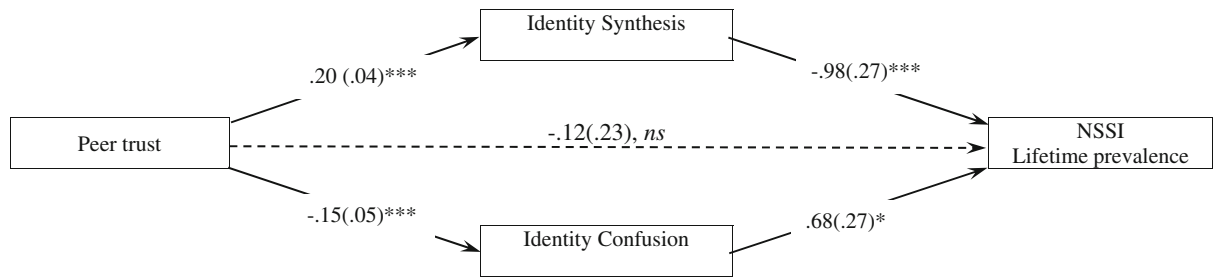
As shown in Fig. 1b, the total effect of peer alienation on lifetime NSSI was significant ($B = 1.371$, $SE = .215$, $p < .001$). The indirect effect of peer alienation on lifetime NSSI via identity synthesis was found to be significant ($B = .312$, $SE = .120$, CI $[-.113; .584]$). However, the

indirect effect of peer alienation on lifetime NSSI through identity confusion was found to be non-significant ($B = .180$, $SE = .160$, 95 % CI = $[-.116; .519]$). Based on the regression coefficients presented in Fig. 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 Fig. 2a, the total effect of mother trust on lifetime NSSI was significant ($B = -.778$, $SE = .195$, $p < .001$). The indirect effect of maternal trust on lifetime NSSI via identity synthesis ($B = -.222$, $SE = .086$, 95 % CI = $[-.427; -.087]$) and identity confusion ($B = -.176$, $SE = .082$, 95 % CI = $[-.348; -.033]$) was found to be significant.

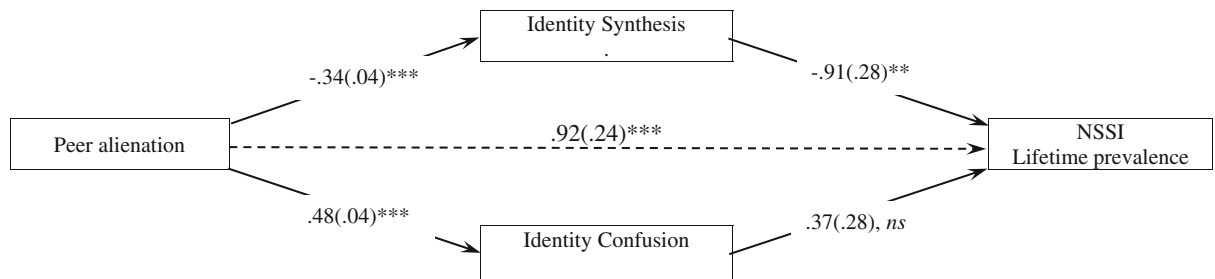
As shown in Fig. 2b, the total effect of mother alienation on lifetime NSSI was significant ($B = .890$, $SE = .228$, $p < .001$). The indirect effect of maternal alienation on lifetime NSSI through identity synthesis ($B = .288$, $SE = .112$, 95 % CI = $[-.109; .555]$) and identity confusion ($B = .331$, $SE = .136$, 95 % CI = $[-.086; .632]$) was

a



Total effect from Peer trust → NSSI: $B = -.401(.217)$, *ns*

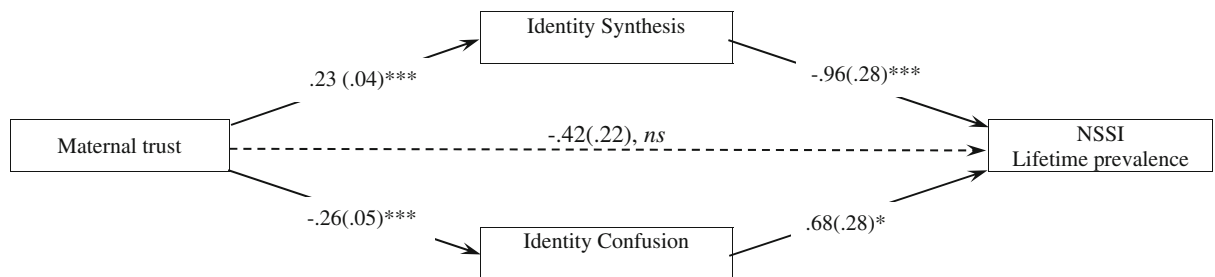
b



Total effect from Peer alienation → NSSI: $B = 1.371(.215)$ ***

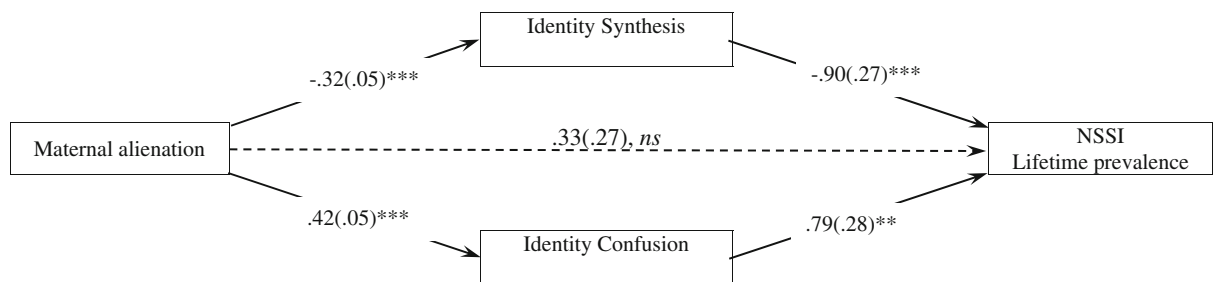
Fig. 1 Unstandardized coefficients for parallel mediation models for peers. Associations with gender and age are not shown. Numbers between parentheses are standard errors (* $p < .05$; ** $p < .01$; *** $p < .001$)

a



Total effect from Maternal trust → NSSI: $B = -.778(.195)$ ***

b



Total effect from Maternal alienation → NSSI: $B = .890(.228)$ ***

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

found to be significant. Hence, based on the values of the unstandardized regression coefficients (Fig. 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.

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.

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