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EMPIRICAL RESEARCH

Appreciating Complexity in Adolescent Self-Harm Risk Factors: Psychological Profiling in a Longitudinal Community Sample

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Abstract Past research identifies a number of risk factors for adolescent self-harm, but often fails to account for overlap between these factors. This study investigated the underlying, broader concepts by identifying different psychological profiles among adolescents. We then compared new self-harm rates over a six-month period across different psychological profiles. Australian high school students (n = 326, 68.1% female) completed a questionnaire including a broad range of psychological and socioenvironmental risk and protective factors. Non-hierarchical cluster analysis produced six groups with different psychological profiles at baseline and rate of new self-harm at follow-up. The lowest rate was 1.4% in a group that appeared psychologically healthy; the highest rate was 37.5% in a group that displayed numerous psychological difficulties. Four groups with average self-harm had varied psychological profiles including low impulsivity, anxiety, impulsivity, and poor use of positive coping strategies. Identifying multiple profiles with distinct psychological characteristics can improve detection, guide prevention, and tailor treatment.

Keywords Self-harm · Risk factors · Adolescence · Psychological profiles

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Introduction

Self-harm is common among teens, with community prevalence estimated at 5–15% and even higher (Brunner et al. 2014; Madge et al. 2008; Moran et al. 2012; Stallard et al. 2013). Self-harm rates are thought to peak in mid-adolescence, with an average onset of self-harm around age 12–14 (Jacobson and Gould 2007). Rates gradually decrease throughout older adolescence and the emerging adult years (Moran et al. 2012). Adolescent self-harm is a considerable source of stress for those supporting a teen through self-harm, including family and friends (McVey-Noble et al. 2006), and those who work with teens in schools and in other community settings (Best 2006). Two reasons for stress are: concern for the teen's physical safety, and the potential for contagion among peers. First, while self-harm often occurs without suicidal intent, self-harm is a strong risk factor for suicide attempt (Taliaferro and Muehlenkamp 2014) and completed suicide (Yoshimasu et al. 2008). Second, there is evidence that self-harm by friends is associated with increased risk of self-harm (O'Connor et al. 2009), leading to concern that social contagion may occur following self-harm. In light of these concerns, research is required in order to better understand, prevent, and treat self-harm (Robinson et al. 2016). This study contributes to this knowledge gap by developing our understanding of psychological risk factors for self-harm in adolescence using a profile analysis.

This study adopts a broad definition of the term 'self-harm" as any behavior that is intentionally self-inflicted with immediate physical consequences (Morgan 1979), including self-harm with and without suicidal intent. It is difficult to draw distinct categories between suicidal and non-suicidal self-harm since suicidal intent is complex and can be ambiguous and transient (Brunner et al. 2014; Hawton

et al. 2010; Kapur et al. 2013; Lofthouse and Yager-Schweller 2009). Indeed, Joiner's interpersonal theory of suicide (2005) proposes that self-harm desensitizes people towards self-destructive behavior, which may increase the likelihood of people acting on suicidal thoughts.

There is a growing understanding of the factors associated with self-harm, although much is yet to be understood regarding the mechanisms and interactions at play (Hawton et al. 2012). In selecting factors to focus on in this study, we prioritized factors that were included in large community adolescent samples (for more detail see Stanford and Jones 2015). Notable large international studies include the Saving and Empowering Young Lives in Europe (SEYLE) project with 12,068 adolescents (Brunner et al. 2014) and the Child & Adolescent Self-harm in Europe (CASE) study consisting of 30,477 adolescents (Madge et al. 2011). These larger studies sit within a growing literature base that includes a number of smaller but nonetheless substantial studies. For example, Heerde and colleagues (2015) report on a longitudinal study of 3876 adolescents in Australia and the US participating in the International Youth Development Study; Mars and colleagues (2014) present findings from 4799 adolescents in the UK participating in the Avon Longitudinal Study of Parents and Children. Findings from this research body identify psychological risk factors that are consistently associated with increased self-harm; from these we selected depressive and anxiety symptoms, self-esteem, impulsivity, and attention and conduct difficulties. Prior work has focused more on risk factors rather than protective factors (Fortune and Hawton 2005) but protective factors are an important area for future research (Fliege et al. 2009). Psychological protective factors include coping strategies (Guerreiro et al. 2015), meaning in life (Kleiman and Beaver 2016) and life satisfaction (Heisel and Flett 2004). While the focus is on psychological factors, this study includes a number of social and environmental factors that are frequently included in risk factor research. Factors commonly measured in association with self-harm include age, gender, ethnicity, parental divorce/separation, bullying, and self-harm modeling (Brunner et al. 2014; Hawton et al. 2012). Protective factors include supportive relationships and spirituality (Brunner et al. 2014).

There are several limitations that are commonly acknowledged in past self-harm risk factor research. For example, using clinical samples limits generalizability to community settings, cross-sectional designs limit our understanding of the causal pathway, and using a narrow set of factors limits comparability between variables and fails to account for the effect of unmeasured variables (Wilcox et al. 2012). However, there is an important conceptual limitation that is less often discussed. Research typically approaches risk factors as distinct components. That is, depression, anxiety, and self-esteem, for example, are considered unique factors. Yet we know that there is considerable overlap between these factors. A potential problem with assigning risk factor status to a specific construct is that it might just be a proxy for the "real" risk factor. Therefore researchers are beginning to develop another way of approaching the risk factor problem to consider multiple overlapping variables simultaneously.

In recent years, a small contingent of research has begun to take a profile approach to investigate self-harm in more complex ways. Somer and colleagues (2015) explain that profile or latent class analyses identify comparatively homogeneous subpopulations from within the heterogeneous population of people who report self-harm. An improved understanding of these groups could assist in understanding people who self-harm, developing interventions, informing treatment decisions, and developing models to explain self-harm (Klonsky and Olino 2008; Somer et al. 2015). However, past profile research has primarily focused on the characteristics of self-harm behavior rather than on the psychological profile of those who self-harm. For example, research has identified subtypes within those who report self-harm based on severity and method of self-harm in adolescents (Somer et al. 2015) and in adults (Hamza and Willoughby 2013; Bracken-Minor et al. 2012; Klonsky and Olino 2008; Whitlock et al. 2008). A consistent finding across these studies is that increased self-harm severity and frequency was associated with increased psychological pathology and more severe suicidal behavior. Research using adolescent samples has also focused on combined psychological, suicidal and sociodemographic factors (Jiang et al. 2010), or a range of risk taking behaviors including self-harm (Thullen et al. 2015). In each of these studies, aspects of self-harm and/or suicidal behavior were included in the variables used to create the profiles along with other risk factors. Researchers have used the profile approach to identify variability in relationships with parents and peers in adolescent (Lundh et al. 2009) and university samples (Martin et al. 2016).

In contrast to prior work, this study focuses on psychological risk factors for self-harm. It will assign individuals to groups based entirely on psychological profiles and explore how these profiles relate to self-harm behavior at follow-up. Since this is a study of risk factors, self-harm behavior is not included in the profile creation. Instead, the analysis focuses on the variables thought to be earlier in the causal pathway (Kraemer et al. 2001). Research focused on psychological profiles is extremely limited. In our previous Australian community sample, adolescents grouped naturally into six distinct profiles of individuals based on a range of factors including depression, anxiety, low self-esteem, coping strategies, and impulsivity (Stanford and Jones 2012). Two profiles were characterized by having an

undesirable psychological profile that could be loosely described as psychopathology. The six profiles of individuals could be divided into three with comparatively low rates of self-harm (5–16% lifetime prevalence) and three with comparatively high rates (25–58% lifetime prevalence). Not surprisingly, the three groups that could be broadly described as having a "normal" psychological profile had low self-harm rates. Of the three high self-harm rate profiles, one was characterized only by high scores on impulsivity but was otherwise unremarkable (lifetime self-harm prevalence 33%). The two remaining high self-harm rate profiles were both characterised by psychological pathology, but distinguishable by their use of coping strategies. One pathological group demonstrated positive coping strategies, and lifetime self-harm prevalence was 25%. The other group with psychological pathology had poor coping and low social support; lifetime self-harm in this group was 58%. However its cross-sectional design and combining high school and university students in the sample limited this study.

Current Study

The current study reports on 326 Australian high school students who completed a baseline survey and a six-month follow-up. Since the mechanisms and interactions underlying self-harm are not yet well understood (Hawton et al. 2012), this study aims to deepen the current understanding of the psychological risk factors for self-harm. The aim is to compare the rate of new self-harm at six-month follow-up in groups with different psychological profiles. We hypothesize that profiles with poorer psychological function at baseline will be associated with higher rate of new self-harm at six-month follow-up, as found in past cross-sectional research (Somer et al. 2015; Stanford and Jones 2012). To further understand these groups, we will describe a range of social and environmental factors. The study extends prior work by using a longitudinal design in an adolescent sample. These results will assist teachers, counselors, and others who work with adolescents in community settings to identify adolescents who may be at risk of future self-harm. Applications of these findings are pertinent for both prevention and intervention strategies.

Methods

Participants

Data were collected as part of the Youth Coping Project to investigate youth coping and welfare. This article reports on the subset who completed the baseline survey and a six-month follow-up ($n = 326$), which is part of a larger baseline sample ($n = 1521$). Participants were in year 7–11 at baseline in 2014, and year 8–12 at follow-up 6 months later in 2015. The sample was 68.1% female ($n = 222$) and mean age was 14.1 (SD = 1.4). These students were drawn from four mainstream co-educational schools and one girls school. The majority of students were born in Australia (90.8%) and their biological parents were married (81.3%). All participating schools were private, fee-charging schools (Independent or Catholic), however the financial profile of the participating schools varied. Median weekly income (based on Census 2011) for the suburbs of the schools ranged from $711 to $2513 and annual school fees for a Year 7 student ranged from $5000 to $13,655. There was a small degree of variability in mental health and socio-demographic factors between the schools, as expected given the geographical area covered. Inclusion required a satisfactory level of competence in reading and comprehending English. Participants and their parents provided informed consent. The study had ethical approval from Macquarie University. Participation rate varied by school, depending the school's success in collecting parental consent and availability for students to participate during class time. Participating students received a small token of appreciation (i.e., chocolate or novelty gift) and participating schools received a welfare report summarising data for their school. The overall response rate for the first survey (Survey 1) was 30.2%; of these, 58.7% completed the follow-up survey (Survey 2).

Measures

Students completed the online questionnaire during class time and most students completed the survey in 15–25 minutes. Measures were selected to prioritize factors with strong prior association with self-harm and to include a number of protective factors. We selected brief, validated scales where possible. Scales were not diagnostic.

Self-harm

Self-harm behavior was assessed in two parts. The first question asked broadly about lifetime self-harm: "Have you tried to hurt yourself? You should answer "Yes" if you have TRIED to hurt yourself, whether or not you were successful. You should NOT include hurting yourself by accident" (response options No/Yes). The second part asked more specifically about six-month self-harm frequency, with response options "None, I have not self-harmed in the last 6 months; 1; 2–5; 6–10; 11+" (Lloyd-Richardson et al. 2007). This approach is similar to brief measures of self-harm used in prior research (Haavisto et al. 2005; Hay and

Meldrum 2010; Kaminski et al. 2010; Tolmunen et al. 2008) and past research indicates that adolescents are able to accurately self-code behavior (Stanford and Jones 2010). Self-harm frequency was dichotomized into Occasional (≤5 occurrences) and Repetitive self-harm (6+ occurrences). Self-harm modeling was measured by asking how many friends and how many family members have hurt themselves on purpose in the last six months.

Depression and anxiety

Depressive and anxiety symptoms were measured using the 14-item Hospital and Anxiety Depression Scale (HADS), originally developed by Zigmond and Snaith (1983). Participants responded on a four-point likert scale from "Most of the time" to "Not at all" to items such as "I feel tense or wound up" (anxiety symptoms) and "I still enjoy the things I used to enjoy" (depressive symptoms). The HADS has been used in previous adolescent self-harm research (e.g., Madge et al. 2008) and has been shown to have adequate test-retest reliability and good discriminant validity in adolescent samples (White et al. 1999). Internal consistency in our sample was good for depressive and anxiety symptoms (Cronbach's alpha .72 and .83, respectively).

Self-esteem

Self-esteem was measured with the ten-item Rosenberg Self-Esteem Scale (RSES). It measures self-acceptance, self-respect, and positive self-evaluation on a 4-point scale from "strongly agree" to "strongly disagree". The RSES has shown strong internal consistency, test-retest reliability, and convergent validity (Swenson 2003), and high self-esteem was negatively correlated with emotional and behavioral disorders for most age/gender combinations ($r = -.42$ to $-.65$) (Bagley and Mallick 2001). Internal consistency in our sample was good (Cronbach's alpha .90).

Conduct and attention difficulties

Difficulties with conduct and attention were measured using the Externalizing (conduct) and Attention subscales of the 17-item version of the Pediatric Symptom Checklist (PSC). The youth-report PSC-17 has been used previously in adolescent samples (Duke et al. 2005; Roffman et al. 2001). Higher total score correlated negatively with higher self-esteem ($r = -.37$, $p < 0.001$) and with getting into trouble ($r = -.37$) (Roffman et al. 2001). In our sample, Cronbach's alphas were adequate (attention subscale: .78; externalising (conduct) subscale: .70).

Impulsivity

Impulsivity was measured using six items from Plutchick's Impulsivity scale, as used in prior self-harm research (e.g., Madge et al. 2008). An example item is "I plan ahead," with four likert response options from "Almost never" to "Very often." As expected, impulsivity correlated with attention difficulties ($r = .42$, $p < .001$) and conduct difficulties ($r = .35$, $p < .001$). Internal consistency was lower than ideal in our sample (Cronbach's alpha: .58).

Coping strategies

Coping was measured using a 14 item shortened version of the Ways of Coping Questionnaire adapted by Piko (2001); see also Folkman et al. 1986. Students were asked to "think about a difficult or negative experience you have been through in the last year. How much did you use these ways of coping?" with five response options ("None" to "Very much"). An example item is "I made a plan of action and followed it." Exploratory factor analysis in two-thirds of the sample produced three factors according to Kaiser's criterion, which appeared to be positive coping, negative coping, and wishful thinking. For simplicity, we trialed a two-factor solution and wishful thinking sat well with the negative factors, offering a comparable fit to the three-factor solution (see Table 3). Each one of our factors aligned with two of Piko's factors. For example, Piko's support-seeking and problem-analyzing factors were represented by positive coping. There were two exceptions. "Tried to look on the bright side" sat with positive coping in our sample, whereas in Piko's sample this item was on the negative coping subscale. Prayer fit with the negative coping strategies in Piko's sample, but sat with the positive strategies in our sample, in which 70% identified as Christian. This may reflect cultural differences in optimism in the Australian culture and the Christian faith in the participating schools. Cronbach's alpha was adequate for positive (.78) and negative (.69) scales. Confirmatory factor analysis in the remaining one-third of the sample broadly supported the two-factor solution. The fit measures were lower than ideal, although broadly supportive of the two-factor solution. The likelihood ratio test suggests that the original and confirmatory models are different ($\chi^2 = 298.7$, $df = 71$, $p < .001$). The root mean square error of approximation and comparative fit index were slightly higher than ideal (.78 and .87, respectively). Further research is needed to explore the validity of this measure and applicability across different cultures and subcultures.

Meaning in life

Meaning in life was measured using the three-item (short-form) Meaning in Life scale, with a five-point scale for

responses ("Not at all true" to "Completely true"; Kobau et al. 2010). Participants were asked to take a moment to think about what makes your life feel important to them. An example item is "My life has a clear sense of purpose." Kobau reports acceptable internal consistency and reliability ($\alpha = .89$) and correlations with autonomy, competency, and relatedness show reasonable convergent validity ($r \geq .63$). In our sample Cronbach's alpha was high at .91.

Life satisfaction

The five-item Satisfaction With Life Scale (SWLS) measures global life satisfaction with good internal consistency, test-retest reliability, and correlations with other measures of subjective wellbeing and personality characteristics (Diener et al. 1985). The SWLS has been used in adolescent samples (Neto 1993). In our sample Cronbach's alpha was high at .89.

Sociodemographic variables

Participants reported age, gender, country of birth, parent's marital status and number of older and younger siblings.

Supportive relationships

The Vaux Social Support Record measured connectedness to family, peers, and adults at school (Vaux 1988). Three items for each domain measure practical and emotional support, rated on a three-point scale of "Not at all", to "A lot". This version has been used in previous self-harm research with Cronbach's alpha indicating good internal consistency (.85 for adults at school; .91 for family members; .90 for peers; Kaminski et al. 2010), which was similar to our sample (friends.82; family .80; school .82).

Bullying

Being a victim of bullying and bullying others were measured through selected items from Rigby's Bullying Prevalence Questionnaire (Rigby and Slee 1993). They report Cronbach's alpha showing adequate internal reliability for the victim (.75–.78) and bully (.78–.86) scales, and low correlation between the two scales ($r < .20$). Our sample showed similar patterns for Cronbach's alpha (victim .84; bully .67) and correlation between scales ($r = .27$).

Religious beliefs and practices

Students were instructed to mark "strongly disagree" or "not at all" if the statements were not relevant, and to substitute words that fit with your religious beliefs and practices. Importance of faith was measured using the five-item short version of the Santa Clara Strength of Religious Faith Questionnaire (SCSRFQ) (Plante et al. 2002). This measure is designed for use with multiple religious traditions and has demonstrated good reliability and validity in a range of settings (Plante et al. 2002). Religious coping was measured using a shortened, adapted version of the brief measure of religious coping (Brief RCOPE), which measures positive and negative patterns of religious coping methods (Pargament et al. 1998). Positive patterns include religious forgiveness and seeking spiritual support; negative patterns surveys spiritual discontent and viewing God as punishing. The scale was shortened from 14 items to eight by taking the top four items on each scale (positive and negative); two items were similar in the top four for negative coping, so one was excluded and the next highest loading item was chosen. The items were reworded to adapt to adolescents e.g., changed "Sought help from God in letting go of my anger" to "Asked God to help me let go of my anger". Responses on likert scale "Not at all" to "A lot". Cronbach's alphas were .93 for the positive scale and .90 for the negative scale. As expected, the two scales showed minimal correlation ($r = .13$). Positive religious coping was correlated with Strength of Faith ($r = .41$, $p < .001$) but negative religious coping was not ($r = -.13$, $p < .001$).

Procedure

We developed this project in collaboration with schools, with ethical approval from Macquarie University. Pre-testing from adolescents and adults provided positive feedback. We presented the survey as the Youth Coping Research Project, and invited students to participate to help us understand what life is like for young people and how they cope with challenges. The survey was broad and the self-harm measurement was brief, therefore it was not considered advantageous to draw attention to self-harm beyond listing it in the study description. The project had a dual-purpose in that participating schools received a welfare feedback report that overviewed mental health and wellbeing.

Students and parents provided informed consent after receiving the information and consent forms through printed and electronic communication. The information described the aim and procedures, and included a list of domains included in the survey. We reminded the school community about the survey using all forms of school communication available, including assembly announcements, roll call reminders, and paper and email newsletters. This communication emphasized that the survey was both voluntary and anonymous. Students completed the questionnaire online to reduce the risk of socially desirable responses and to enable efficient data collection (Booth-Kewley et al. 2007; LaBrie et al. 2006). After completing the survey, students were informed of support available within and outside the school

(verbally and through printed materials), and researchers were available to discuss any questions that arose. Students filled in a support request form, and members of the school's welfare team followed students who responded positively. To enable data matching with the second survey, students created an ID code. This included the last two letters of their first name, last two letters of their last name, first letter of their first name, their date of birth, and number of older siblings.

Analytic Approach

Step 1: we sought to create parsimonious measures of psychological traits by creating composite "components" that combine multiple individual variables. This helps to avoid any single construct from dominating the next step of forming profiles. This was achieved using principal components analysis followed by orthogonal (varimax) rotation with the following variables: depressive and anxiety symptoms, self-esteem, attention and conduct difficulties, impulsivity, positive and negative coping, meaning in life, and life satisfaction. Step 2: we used a non-hierarchical cluster analysis to allocate students to mutually exclusive groups (profiles) based on the latent components created in Step 1. The aim was to form independent groups that are internally homogenous but different from the other profiles. The non-hierarchical approach does not pre-determine how many profiles to form. Therefore we considered a number of profile solutions from one to ten profiles and identified the point of inflection where the within-profile homogeneity started to plateau using the Euclidean distance (Fig. 1). The profile of psychological variables was interpreted to characterize the distinguishing features of each profile. Step 3: we compared rates of new self-harm at six-month follow-up across profiles, which represent distinct psychological profiles. We compared the percentage within each profile who report new six-month self-harm among students who did not report recent self-harm at baseline. Step 4: we described the psychological profile and self-harm rates at baseline for each profile, followed by other social and environmental factors. Given the non-normal distribution present in many psychological and demographic variables, we compared traits across profiles using the Pearson Chi-Square tests for categorical variables and Kruskal-Wallis tests for numeric variables. Pairwise comparisons between groups similarly used Pearson Chi-Square tests and Mann-Whitney tests.

Results

Six-month self-harm prevalence at baseline was 12.3% occasional ($n = 40$) and 5.2% repetitive ($n = 17$). In Step 1 described above, we found three components that represented the individual psychological variables (Table 1). "Poor coping" included below average use of positive coping strategies, depressive symptoms, low self-esteem, and low life satisfaction and meaning in life. "Anxiety symptoms" featured high anxiety; it also included low self-esteem and above average use of negative coping strategies. "Impulsivity" was marked by high impulsivity and difficulties with attention and conduct behaviors. Factor loadings are available in Table 4. As expected, the correlation between the three components was weak (highest correlation $r = .17$, $p < .001$). In Step 2 described above, it appeared that the benefits of increasing complexity diminished after the six-profile solution (Fig. 1). The six-profile solution, therefore, was chosen to balance complexity and efficiency. The mean component score for each profile gave an overview of the psychological characteristics of each profile (Fig. 2).

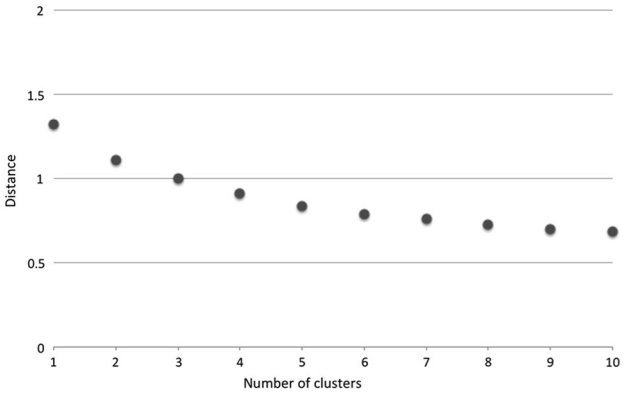

Fig. 1 Euclidean distance for profile solutions 1 to 10: the benefits of increasing complexity diminished after the six-profile solution

In Step 3 described above, we compared the percentage within each profile who reported new six-month self-harm among students who did not report recent self-harm at baseline (Table 1). As expected, new self-harm varied between the profiles, and rates appeared to vary in line with degree of psychological pathology (1.4% ($n = 1$) to 37.5% ($n = 3$)). The following section describes the psychological profile in more detail and briefly describes the social and environmental features of the groups, as described in Steps 3 and 4 above (Tables 1 and 2).

Profile 1: Psychologically Healthy—1.4% New Self-Harm

As evident in the psychological component scores in Table 1, this group ($n = 72$) had less anxiety and better than average use of coping strategies (higher on positive and lower on negative strategies). The individual psychological variables in Table 1 also showed an overall healthy score for this profile; low anxiety and high self-esteem were standout scores. This was accompanied by the lowest rate of

Table 1 Psychological profile of six profiles formed at baseline for the longitudinal sample ($n = 326$) and new self-harm at follow-up among those who did not self-harm at baseline ($n = 269$). Statistics are mean (SD) or % (n)

	1 Psychologically 'healthy' ($n = 72$)	2 Low impulsivity ($n = 58$)	3 Poor coping ($n = 59$)	4 Anxiety ($n = 58$)	5 Impulsive ($n = 42$)	6 Pathological ($n = 37$)	K-W or χ^2	p	Average
Psychological components									
Anxious symptoms	−0.80 (0.38)^{2,3,4,5,6}	0.27 (0.53)^{1,3,4,6}	−0.55 (0.47)^{1,2,4,5,6}	0.52 (0.48)^{1,2,3,5,6}	0.10 (0.56)^{1,3,4,6}	1.26 (0.51)^{1,2,3,4,5}	122.388	<.001	0.02 (0.82)
Poor coping	−0.70 (0.41)^{2,3,5,6}	−0.26 (0.50)^{1,3,4,5,6}	0.59 (0.44)^{1,2,4,5,6}	−0.69 (0.45)^{2,3,5,6}	0.26 (0.62)^{1,2,3,4,6}	1.23 (0.66)^{1,2,3,4,5,6}	122.116	<.001	0.03 (0.85)
Impulsivity	−0.26 (0.51)^{2,4,5,6}	−1.00 (0.40)^{1,3,4,5,6}	−0.28 (0.47)^{2,4,5,6}	0.21 (0.44)^{1,2,3,5}	1.26 (0.50)^{1,2,3,4,6}	0.14 (0.73)^{1,2,3,5}	106.735	<.001	−0.07 (0.82)
Individual variables									
Depression	5.1 (1.9)^{2,3,4,5,6}	6.4 (2.0)^{1,6}	7.1(2.4)^{1,6}	6.5 (2.3)^{1,6}	7.3 (2.5)^{1,6}	10.1 (2.9)^{1,2,3,4,5}	76.447	<.001	6.8 (2.7)
Anxiety	4.8 (2.1)^{2,3,4,5,6}	9.1 (3.7)^{1,3,4,5,6}	6.3 (2.7)^{1,2,4,5,6}	11.0 (3.3)^{1,2,3,6}	10.2 (3.1)^{1,2,3,6}	14.8 (2.6)^{1,2,3,4,5}	179.88	<.001	8.8 (4.3)
Self-esteem	24.2 (3.5)^{2,3,4,5,6}	16.4 (4.0)^{1,6}	17.4 (3.4)^{1,6}	17.1 (3.7)^{1,6}	15.8 (3.5)^{1,6}	7.4 (3.7)^{1,2,3,4,5}	186.781	<.001	17.3 (5.9)
Attention difficulties	3.8 (1.8)^{3,4,5,6}	3.5 (1.9)^{3,4,5,6}	4.7 (2.1)^{1,2,4,5,6}	6.6 (2.0)^{1,2,3,5}	7.8 (1.5)^{1,2,3,4,6}	6.7 (2.0)^{1,2,3,5}	136.901	<.001	5.3 (2.5)
Conduct difficulties	2.0 (1.9)^{4,5,6}	1.3 (1.4)^{3,4,5,6}	2.4 (1.7)^{2,4,5,6}	3.2 (1.9)^{1,2,3,5}	6.0 (2.1)^{1,2,3,4,6}	3.7 (2.3)^{1,2,3,5}	104.457	<.001	2.9 (2.3)
Impulsivity	2.1 (0.4)^{2,5,6}	1.6 (0.3)^{1,3,4,5,6}	2.1 (0.4)^{2,4,5,6}	2.2 (0.4)^{2,3,5}	2.9 (0.4)^{1,2,3,4,6}	2.3 (0.6)^{1,2,3,5}	141.398	<.001	2.2 (0.5)
Positive coping	3.6 (0.4)^{2,3,5,6}	3.4 (0.5)^{1,3,4,5,6}	2.4 (0.5)^{1,2,4,5}	3.6 (0.4)^{2,3,5,6}	2.7 (0.6)^{1,2,3,6}	2.1 (0.7)^{1,2,3,4,5}	184.505	<.001	3.1 (0.8)
Negative coping	2.0 (0.5)^{2,4,5,6}	2.4 (0.5)^{1,3,4,5,6}	2.1 (0.5)^{2,4,5,6}	2.9 (0.6)^{1,2,3,6}	3.0 (0.7)^{1,2,3,6}	3.4 (0.7)^{1,2,3,4,5}	144.237	<.001	2.5 (0.7)
Meaning in life	4.5 (0.5)^{2,3,4,5,6}	4.1 (0.7)^{1,3,5,6}	3.3 (0.9)^{1,2,4,6}	4.1 (0.7)^{1,3,5,6}	3.0 (1.0)^{1,2,4,6}	2.1 (0.9)^{1,2,3,4,5}	140.843	<.001	3.7 (1.1)
Life satisfaction	4.9 (0.9)^{2,3,4,5,6}	4.0 (1.0)^{1,3,5,6}	3.5 (1.2)^{1,2,4,6}	4.0 (1.1)^{1,3,5,6}	3.0 (1.2)^{1,2,4,6}	1.6 (1.0)^{1,2,3,4,5}	151.053	<.001	3.7 (1.4)
Six-month self-harm at baseline ($n = 326$)									
Baseline: None	98.6% (71)^{3,6}	91.4% (53)^{6}	84.7% (50)^{1,6}	87.9% (51)^{6}	85.7% (36)^{6}	21.6% (8)^{1,2,3,4,5}	139.013	<.001	82.5% (269)
Occasional	1.4% (1)^{3,6}	8.6% (5)^{6}	15.3% (9)^{1,6}	10.3% (6)^{6}	9.5% (4)^{6}	40.5% (15)^{1,2,4,5}			12.3% (40)
Repetitive	O^{6}	O^{6}	O^{6}	1.7% (1)^{6}	4.8% (2)	37.8% (14)^{1,2,3,4,5}			5.2% (17)
Six-month new self-harm at follow-up among those who did not self-harm at baseline ($n = 269$)									
New self-harm at follow-up	1.4% (1)^{4,5,6}	7.5% (4)^{6}	8.0% (4)	9.8% (5)^{1,6}	13.9% (5)^{1}	37.5% (3)^{1,2,4}	15.265	0.009	8.2% (22)

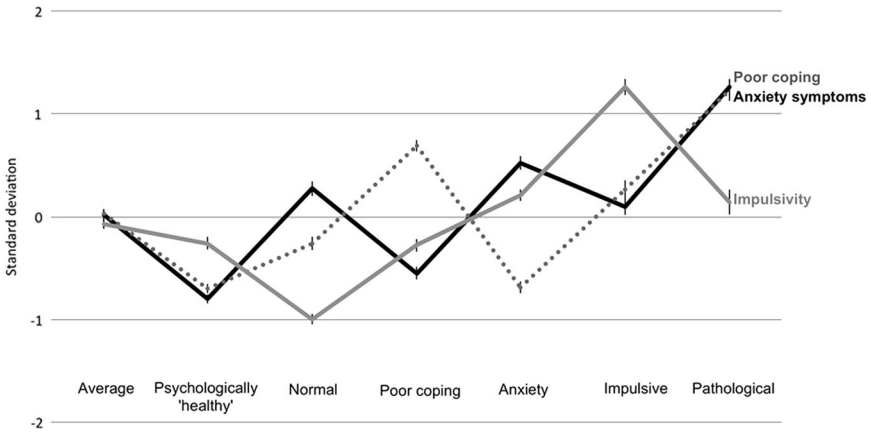

Fig. 2 Component mean scores for adolescents: average of the whole sample (*far left*) and the six profiles. The *shaded area* indicates +/− 0.5 SD, the expected variation of normal scores. The *vertical lines* at each mean indicate standard error

six-month occasional self-harm and no adolescents in this group reported repetitive self-harm. The social and environmental description of this group was similarly unremarkable (Table 2). As a group, these adolescents reported good support from family, friends, and adults at school. It is worth noting that this group reported the lowest level of self-harm modeling from friends: 16.7% reported having a friend who self-harmed compared with the group average of 30.1%. This was the largest profile. At six-month follow-up, there was only one case of new self-harm.

Profile 2: Low Impulsivity—7.5% New Self-Harm

This profile ($n = 58$) appears psychologically healthy, with scores for most psychological variables similar to the average. The only defining feature of this profile was a low score on the psychological component Impulsivity, and corresponding low impulsivity on the individual variables. This profile was significantly lower on the impulsivity component scores than the other five profiles, as evidenced by the pairwise comparisons. The social and environmental features largely reflected the averages for the whole sample, with notably high support from family and friends. Within the 53 without self-harm at baseline, four reported self-harm at follow-up.

Profile 3: Poor Coping and Low Anxiety—8.0% New Self-Harm

Component scores for this profile ($n = 59$) indicated below average use of positive coping strategies and lower than average anxiety. On the impulsivity component this profile was mid-range: higher than the low impulsivity profile (Profile 2) but lower than Profiles 4, 5 and 6. The social and environmental features on the whole reflected the averages for the sample, although support from family and friends was lower than that reported by Profiles 1 and 2. Among the 50 without self-harm at baseline, four reported self-harm at follow-up.

Profile 4: High Anxiety—9.8% New Self-Harm

Anxiety was slightly high in Profile 4 ($n = 58$); higher than in all profiles except the comparatively pathological Profile 6. The scores for positive and negative coping strategies were slightly above average. Social and environmental features of this profile were largely mid-range, apart from self-harm modeling from friends: it was much higher in this profile, on par with the highest level among all profiles (43.1%). Of 51 who did not report self-harm at baseline, five reported self-harm at follow-up.

Profile 5: Impulsive—13.9% New Self-Harm

Profile 5 ($n = 42$) was marked by high impulsivity on the psychological component scores. This was reflected in the individual variable scores: high impulsivity, and difficulties with attention and conduct. The standout social feature of this profile was high scores on both bullying others and being a victim of bullying. This profile had the highest percentage of males. Of 36 who did not report self-harm at baseline, five reported self-harm at follow-up.

Profile 6: Psychological Pathology—37.5% New Self-Harm

Profile 6 ($n = 37$) was the smallest group, and the psychological component scores revealed high levels of anxiety and difficulty coping. This was corroborated in the individual psychological variables, where we saw high depressive and anxiety symptoms, low self-esteem, low levels of positive coping strategies, high use of negative coping strategies, and low meaning in life and life satisfaction. The social and environmental profile in Table 2 added to the picture with the lowest levels of support from family,

Table 2 Social and environmental scores for the six profiles. Statistics are mean (SD) or %(n)

	1 Psychologically 'healthy' ($n = 72$)	2 Low impulsivity ($n = 58$)	3 Poor coping ($n = 59$)	4 Anxiety ($n = 58$)	5 Impulsive ($n = 42$)	6 Pathological ($n = 37$)	K-W or χ^2	p	Average
Age mean (SD)	14.1 (1.3)	14.2 (1.4)	13.8 (1.4)	14.1 (1.5)	14.0 (1.6)	14.2 (1.4)	.919	.469	14.1 (1.4)
Female % (n)	62.5% (45)	77.6% (45)	59.3% (35)	77.6% (45)	50.0% (21)^{6}	83.8% (31)^{5}	18.460	.002	68.1% (222)
Parents married % (n)	80.6% (58)	86.2% (50)	84.7% (50)	82.8% (48)	78.6% (33)	70.3% (26)	4.651	.460	81.3% (265)
Born overseas % (n)	4.2% (3)	8.6% (5)	13.6% (8)	5.2% (3)	9.5% (4)	18.9% (7)	8.862	.115	9.2% (30)
Supportive family	5.6 (0.9)^{2,3,4,5,6}	5.2 (1.2)^{1,3,4,5,6}	4.5 (1.5)^{1,2}	4.7 (1.4)^{1,2,5,6}	4.1 (1.4)^{1,2,4}	3.5 (1.8)^{1,2,4}	15.511	<.001	4.7 (1.5)
Supportive friends	4.9 (1.2)^{3,4,5,6}	4.6 (1.3)^{3,4,5,6}	3.7 (1.5)^{1,2}	4.0 (1.5)^{1,2,6}	3.7 (1.3)^{1,2,4,6}	2.8 (1.9)^{1,2,4,5}	13.515	<.001	4.1 (1.5)
Supportive adult at school	4.6 (1.5)^{2,3,4,5,6}	4.1 (1.5)^{1,5,6}	3.8 (1.5)^{1}	3.7 (1.7)^{1,2,5,6}	3.0 (1.6)^{1,2,4}	2.8 (1.7)^{1,2,4}	9.337	<.001	3.8 (1.7)
Self-harm modeling: friends	16.7% (12)^{4,6}	32.8% (19)	22.0% (13)	43.1% (25)^{1}	31.0% (13)	43.2% (16)^{1}	15.920	.007	30.1% (98)
Self-harm modeling: family	1.4% (1)	10.3% (6)	10.2% (6)	13.8% (8)	4.8% (2)	10.8% (4)	8.421	.135	8.3% (27)
Victim of bullying	1.7 (1.4)^{2,4,5,6}	2.5 (1.7)^{1,6}	2.4 (2.0)	2.8 (2.4)^{1,6}	3.2 (2.4)^{1}	3.9 (2.6)^{1,2,4}	6.777	<.001	2.6 (2.1)
Bully others	0.21 (0.6)^{5,6}	0.3 (0.8)^{5,6}	0.3 (0.6)	0.4 (1.0)^{5,6}	1.4 (1.4)^{1,2,4,6}	0.9 (1.4)^{1,2,4,5}	11.178	<.001	0.5 (1.0)
Importance of faith	3.2 (0.8)^{2,3,5,6}	2.9 (0.8)^{1,3,5,6}	2.5 (0.7)^{1,2,4}	3.0 (0.9)^{3,5,6}	2.5 (0.8)^{1,2,4}	2.3 (1.0)^{1,2,4}	10.577	<.001	2.8 (0.9)
Positive religious coping	3.2 (0.8)^{3,5,6}	3.0 (0.8)^{3,5,6}	2.4 (0.9)^{1,2}	3.0 (0.9)^{5,6}	2.5 (1.0)^{1,2,4}	2.2 (0.9)^{1,2,4}	10.772	<.001	2.8 (0.9)
Negative religious coping	1.6 (0.7)^{3,4,5,6}	1.8 (0.8)^{4,5,6}	1.9 (0.8)^{1}	2.1 (0.9)^{1,2,6}	2.2 (0.9)^{1,2,6}	2.7 (1.1)^{1,2,4,5}	9.619	<.001	2.0 (0.9)

friends, and adults at school, and the highest score on victim of bullying experiences. This profile was female dominated and had a lower percentage of biological parents married. This profile reported the highest levels of occasional (40.5%) and repetitive (37.8%) self-harm at baseline, along with the highest level of new self-harm at follow-up (37.5% of the eight without self-harm at baseline).

Five- and seven-cluster solutions were also considered, and while the profiles must necessarily differ in detail, they were not fundamentally different from those reported in the six-cluster solution in this article. For example, the five-cluster solution yields similar profiles, however the six-cluster solution offers greater clarity regarding scores for impulsivity.

Discussion

Adolescent self-harm is common, but poses concerns for the teen's physical safety, general mental health, and the potential for contagion among peers (O'Connor et al. 2009; Taliaferro and Muehlenkamp 2014). Past research identifies a number of risk factors for adolescent self-harm, but much is yet to be understood regarding the mechanisms and interactions at play (Hawton et al. 2012). An important limitation in past research is that research typically approaches risk factors as distinct components. Yet we know that there is considerable overlap between many risk factors (e.g., depression and anxiety). Therefore in recent years, a small contingent of self-harm research has adopted a profile approach to consider multiple overlapping factors simultaneously and identify distinct groups within those who report self-harm (Somer et al. 2015). This study focused on psychological risk factors for self-harm and assigned individuals to groups based entirely on psychological profiles, as in limited prior cross-sectional research (Stanford and Jones 2012). This study extended prior research by exploring how these profiles related to self-harm behavior at follow-up. We hypothesized that profiles with poorer psychological function at baseline would be associated with higher rate of new self-harm at six-month follow-up, as found in past cross-sectional research (Somer et al. 2015; Stanford and Jones 2012).

Australian high school students ($n = 326$, 68.1% female) completed a questionnaire including a broad range of psychological and socioenvironmental risk and protective factors. Non-hierarchical cluster analysis produced six groups with different psychological profiles at baseline and rate of new self-harm at follow-up. Overall six-month self-harm prevalence was 12.3% for occasional self-harm and 5.2% for repetitive self-harm. This is broadly in line with rates in other community samples (Stallard et al. 2013). The lowest rate of new self-harm was 1.4% in the psychologically

"healthy" profile; total self-harm across both time points for this group was 2.8%. This group appeared psychologically healthy, with good use of coping strategies and low anxiety. At the other end of the spectrum, the highest rate of new self-harm was 37.5% in the "pathological" profile; 86.5% of the pathological profile reported self-harm at either time point. This group appeared to have multiple difficulties, with scores indicating high anxiety and poor use of coping strategies. This concurs with prior work identifying greater psychological pathology in groups with higher self-harm rates, a common finding across studies creating profiles based on psychological (Stanford and Jones 2012) and self-harm (Somer et al. 2015) characteristics. An understanding of the highest risk profile for self-harm may assist teachers and counsellors in detecting those who are the highest priority for treatment (Somer et al. 2015) and at greatest risk for future self-harm.

In between these two endpoints, new self-harm was around average for the remaining four profiles (7.5% to 13.9%). The psychological scores for these four profiles were varied, and suggest a group with low impulsivity, a group with low anxiety but below average use of positive coping strategies, a group with mild anxiety but good use of positive coping strategies, and an impulsive group. This concurs with past research suggesting that there is no single profile to describe adolescents who self-harm (Stanford and Jones 2012), and therefore we require a more complex approach to understanding risk factors. Each group of adolescents may have different prevention and intervention needs. For example, while some adolescents may need assistance with coping strategies, others need help with anxiety, and still others need to bolster their ability to manage impulsive tendencies when faced with the desire to self-harm. Thus there is no "one size fits all" approach to preventing and reducing self-harm in community adolescents.

The results of this study concur with and extend prior research into psychological risk factors for self-harm. For example, past research has identified combined bully-victim status as a stronger risk factor for self-harm compared with either bully or victim status independently (Barker et al. 2008). In our sample, this combination was primarily evident in the impulsive profile—the group with the highest score on bullying others. The "pathological" profile also displayed this combination more subtly. Where previous research has identified bully-victim status as a strong risk factor for self-harm in general, our study gives insight into one subgroup in which this this risk factor is prominent. As another example, past research has identified that coping strategies are associated with self-harm (De Leo and Heller 2004; Hall and Place 2010; Lewinsohn et al. 1994). However, non-significant findings also exist (O'Donnell et al. 2004). In our results, below average use of positive coping strategies was evident in two out of the six profiles. These two profiles had different rates of new self-harm, with higher self-harm in the "pathological" profile in which poor coping was accompanied by elevated depressive and anxiety symptoms, and lower self-esteem. It would be difficult to capture these nuances in a typical predictive or cumulative risk model. Therefore there is a need for more complex models such as a profile approach.

A key finding in our work is identifying a group of adolescents who were average on all psychological measures (apart from low impulsivity) who reported new self-harm (7.5%) at a rate on par with the average for the whole sample (8.2%). These adolescents did not appear to experience above average difficulties in psychological domains, coping strategies, or relationships. Around one-third of this group reported awareness of self-harm among friends, which is in line with the average for the sample. It is beyond the scope of this study to investigate the role of social contagion in each group, but this flags an important area for future research (Jarvi et al. 2013). The absence of typical psychological self-harm risk factors in this group confirms the need to move beyond a single list of self-harm risk factors. In community settings, these adolescents may not be identifiable through any known risk factors. This is concerning, given that 25–65% of those who self-harm do not disclose the behavior to anybody (Armiento et al. 2014; Madge et al. 2008; Rubenstein et al. 1998). Therefore policies to respond to and reduce self-harm need to be designed with hidden behavior in mind.

Reflecting on the heterogeneity of adolescents who self-harm, we suggest three strategies for self-harm prevention and intervention in schools: screening, gatekeeper training, and mental health programs. These programs are designed to operate in addition to the existing student support systems (Juhnke et al. 2011).

Given the variability in, and indeed, absence of risk factors identified, we recommend universal screening for self-harm in schools. Initial research suggests that screening is largely well received and does not cause undue distress; however, further research is needed to ascertain sensitivity/specificity and financial viability (Robinson et al. 2011). Further research is also needed to better understand whether distress occurs for any participants and develop strategies to reduce potential distress (Hasking et al. 2015). However, even if screening is effective, low-risk, and financially viable in a cost-benefit analysis, schools may lack the resources to undertake universal screening for all adolescents. Where universal screening is not possible, we recommend targeted screening. Bearing in mind the variability of self-harm risk factors, we recommend that school counsellors use a brief mental health screening tool with all clients or students, regardless of the reason for referral. Screening should include a brief questionnaire, either

pencil-and-paper or, preferably, using an online platform to maximize detection (Ougrin and Boege 2013).

Gatekeeper training aims to equip staff or student peer leaders with skills to respond to students disclosing self-harm and/or suicidal thoughts. While much of the gatekeeper research centers on suicide prevention (e.g., Wasserman et al. 2015), evaluations of gatekeeper training for self-harm appear promising. For example, training for school welfare staff delivered by the Orygen Youth Health service reported increased knowledge of, and confidence and perceived skill in working with self-harm (Robinson et al. 2008). Improvements were greater among those with lower knowledge, confidence and skill at baseline. However, participants did not report reduced anxiety surrounding working with adolescents who self-harm. Future research should include randomized controlled trials and a broader range of outcomes including rates of self-harm, staff anxiety, and improvements in practice. Research into suicide prevention suggests that gatekeeper training is an important component of the solution, although improvements in skills, knowledge, and confidence may not translate directly to reductions in suicide attempts or self-harm (Wasserman et al. 2015; Wyman et al. 2008).

Mental health literacy and self-harm/suicide prevention programs are designed to increase awareness of mental health challenges and self-harm, reduce stigma, and encourage help-seeking. Programs should be universal where possible: prevention programs that target at-risk adolescents are likely to miss a proportion of adolescents with current or future self-harm, particularly those without discernible psychological pathology. General mental health literacy programs aim to reduce stigma and encourage help-seeking. For example, preliminary evidence using a randomized controlled trial suggested that the HeadStrong program reduced stigma, but failed to increase help-seeking behavior (Perry et al. 2014). Perry and colleagues suggest that sustained education is needed to change help-seeking behavior and maintain these effects. Mental health literacy programs can also include "contact", that is an interactive session with a young person with lived experience of mental illness. While potentially valuable, contact is yet to prove efficacious in adolescent samples and further research is needed (Chisholm et al. 2016). School-based self-harm programs appear to be a promising strategy for universal self-harm prevention (Robinson et al. 2016). However, schools are often concerned regarding the potential for iatrogenic effects when discussing self-harm. To address these concerns, we need large randomized controlled trials to review the positive and negative effects of programs on a range of outcomes (Robinson et al. 2013). One such program is the "Signs of Self-Injury" program. It is the only universal self-harm program currently evaluated (Robinson et al. 2016). Initial evidence for the program appears promising, with no increase in self-harm thoughts, behavior, or frequency (Muehlenkamp et al. 2010). To avoid iatrogenic effects, discussions about self-harm should be framed within broader mental health programs, with a large focus on protective behaviors and strengthening resilience (Juhnke et al. 2012; Knightsmith 2015; Robinson et al. 2016). Schools should also make students aware of avenues for support online, as there is emerging evidence to suggest that this may be less intimidating for adolescents and may lead to seeking in-person professional support (Frost et al. 2015).

Finally, efforts should be made to build supportive environments in which people are willing to disclose self-harm, and where people know how to respond in safe and supportive ways (Juhnke et al. 2012). It can be very difficult to disclose self-harm. Barriers to disclosure include fearing a negative response, concern that the disclosure would be spread in the community, and not viewing self-harm as problematic (Klineberg et al. 2013; Wadman et al. 2016). When adolescents do disclose, they do not necessarily open up to the school counsellor or a trained mental health professional. In an adolescent community sample, students were twice as likely to disclose to a peer rather than an adult (Hasking et al. 2015). When disclosing to an adult, the most common person was a parent rather than a mental health worker or teacher. Disclosure to peers can cause concern regarding the potential for "contagion" in schools (Jarvi et al. 2013). Indeed, one-third of participants in this study reported awareness of self-harm among peers. Therefore, we need multifaceted mental health programs that reduce stigma and empower all levels of the community.

This study has several strengths. For the first time, we explored psychological profiles longitudinally in a community sample. There are two key advantages to the psychological profiling approach. Firstly, we can consider multiple overlapping variables simultaneously rather than treating each variable as statistically independent. Secondly, we can identify multiple groups with varying profiles. Traditional risk factor models that create a single profile of risk factors cannot account for this variability. By using a longitudinal sample we were able to explore whether psychological profiles identified at Time 1 were associated with new self-harm at Time 2. Another strength of this study was the inclusion of a broad range of risk and protective factors.

There were, however, several limitations. It was not possible to cover all risk factors. The broad nature of the project necessitated utilizing brief, self-report measures which indicated symptomology; it would be good to clarify these findings using diagnostic scales. Despite considerable efforts to engage students in the research, using opt-in parental consent contributed to a lower than ideal participation rate and may have reduced the sample's representativeness. Although response rate varied depending on the

school's effort in collecting parental consent, all participating schools communicated that opt-in parental consent was very challenging to administer. Indeed, schools expressed that they have difficulty obtaining parental consent for activities with high desirability such as excursions. Further, timetabling challenges in two schools impacted upon the retention rate, as very few students in those schools were able to participate. The constraints of this project only enabled a six-month follow-up; therefore it was not possible to investigate psychological profiles over the course of adolescence. This study reports on data from fee-paying Independent schools. While a comparison of each school's fees and location indicates considerable variability in sociodemographic composition, future research should include a broader sample range including public schools.

Future research in larger samples should explore profiles for male and female adolescents separately, since the proportion of males varied between groups. Randomized controlled trials could explore the efficacy of universal and targeted prevention programs focused on one or more of the psychological risk factors identified, such as anxiety, impulsivity, and coping strategies. Programs could also target bullying, and strategies to improve supportive relationships. Program evaluation could consider whether adolescents in different profiles respond differently to the prevention or intervention strategy. It may be necessary to support tailored program strategies with brief mental health screening tools to enable efficacious program selection. Future research can build on the current study by recruiting larger samples and conducting longer follow-ups. This study focused on new self-harm rates; larger scale studies can explore trajectories and consider whether adolescent profiles remain stable over time (Klonsky and Olino 2008). This is an important question for profile research, given that self-harm severity, method, and function changes over time (Owens et al. 2015; Townsend et al. 2016; Wadman et al. 2016).

Conclusion

Past research identifies a number of risk factors for adolescent self-harm, but often fails to account for overlap between these factors. Thus the current understanding of the complex interactions between risk factors is limited. This study contributes to this knowledge gap by developing our understanding of psychological risk factors for self-harm in adolescence using a profile analysis. This article used psychological profiling to explore complexity in self-harm risk factors in a longitudinal adolescent community sample. We identified six groups with distinct psychological profiles. As expected, increased psychological pathology at baseline was associated with higher rates of new self-harm at follow-up. Notably, this study highlighted diversity in risk factors for adolescent self-harm. We identified a number of groups with similar self-harm rate that display disparate psychological profiles, including difficulties with anxiety, impulsivity, and coping strategies. Therefore adolescents who self-harm cannot be accurately described using a single list of risk and protective factors. A more complex understanding of the psychological risk factors for adolescent self-harm may assist in detecting those who are at greatest risk for future self-harm, and ultimately moving toward prevention.

Author Contributions S.S. participated in writing, design, and analysis, and carried out the data collection. M.J. contributed to writing, design, and analysis. J.H. provided clinical guidance and feedback on the manuscript. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval The study was reviewed and approved by the Macquarie University Human Research Ethics Committee, reference number 5201400575.

Informed Consent The project was approved by the School Principal, Executive and school counsellors in each school. Parents and students provided opt-in informed consent at the first time point; this consent covered the baseline and follow-up survey. At the follow-up, parents were provided the full study information and the opportunity to opt-out on behalf of their teen, and students again provided opt-in informed consent.

Appendix

Table 3, Table 4

Table 3 Factor loadings for positive and negative coping

	Coefficient (standard error)
Positive coping	
I made a plan of action and followed it	0.56 (0.03)
I did something which I didn't think would work but at least I was doing something	0.36 (0.04)
Tried to look on the right side of things	0.73 (0.03)
Accepted sympathy and understanding from someone	0.70 (0.03)
Changed or grew as a person in a good way	0.73 (0.03)
I asked a relative or friend I respected for advice	0.52 (0.04)
Came up with a couple of different solutions to the problem	0.49 (0.04)
I prayed	0.35 (0.04)
Negative coping	
Criticized or lectured myself	0.51 (0.04)
Tried to make myself feel better by eating, drinking, smoking, using drugs or medication, etc.	0.57 (0.04)
Took a big chance or did something risky	0.36 (0.05)
Kept others from knowing how bad things were	0.66 (0.04)
Wished that the situation would go away or somehow be over with	0.45 (0.04)
Took it out on other people	0.54 (0.04)

Table 4 Factor loadings from principal components analysis with orthogonal (varimax) rotation to distil the psychological variables into a smaller set of independent constructs

	Anxious symptoms	Poor coping	Impulsivity
Self-esteem: high is positive	−.668	−.512	−.126
Depressive symptoms	.482	.510	.181
Anxiety symptoms	.739	.224	.192
Attention difficulties	.367	.140	.533
Externalizing difficulties	.098	.132	.543
Impulsivity	.136	.138	.621
Positive coping	−.008	−.764	−.147
Negative coping	.634	.030	.371
Life satisfaction	−.493	−.579	−.203
Meaning in life	−.362	−.673	−.209

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