

Original research

Non-Suicidal Self-injury in Medical Students

Jasveen Kaur FRANZCP¹, Graham Martin MD, FRANZCP^{1,✉}

¹ Department of Psychiatry, University of Queensland, Australia

Submitted to SOL: March 3rd, 2016 ; accepted: January 11th, 2017; published: February 11th, 2017

Abstract: Given medical students have been shown to be prone to high levels of stress and resulting mental health problems, we sought to explore whether they were also more prone to non-suicidal self-injury and, if so, whether this was related to high levels of perfectionism, reported in the literature to be implicated in poor mental health. A total 260 first year graduate medical students (mean age 23.1 years) from the University of Queensland completed a questionnaire on non-suicidal self-injury, the 28-item General Health Questionnaire, the Frost Multidimensional Personality Scale, a 14-item Resilience Scale, and The Multidimensional Scale of Perceived Social Support. Forty-five medical students (17.3%) admitted having ever deliberately self-injured, 36 (13.8%) in the past, and 9 (3.5%) current self-injurers. Female students were more likely to have self-injured than males. Of those reporting either current or past self-injury, 6 (13.3%) reported undertaking this with suicidal intent. There were highly significant correlations between total perfectionism scores, social supports and resilience. Both Depression ($p < .001$, d 0.82) and Anxiety ($p < .001$, d 0.65) were significantly higher in self-injurers. In logistic regression a one-unit increase in overall Psychological Symptoms was associated with a 4.6% increase in chance of self-injury, and a one-unit increase in Perfectionism was associated with a 2.6% increase in chance of self-injury. Medical students are a vulnerable population, suffering mental health problems at higher rates than the general population. High rates of self-injury may be an expression of this vulnerability.

Keywords: Non-suicidal Self-Injury, NSSI, Self-harm, University Students, Medical Students

Copyrights belong to the Author(s). Suicidology Online (SOL) is a peer-reviewed open-access journal publishing under the Creative Commons Licence 3.0.

Non-suicidal Self-injury ('lifetime' NSSI) is surprisingly common at an overall 8.1% in national community samples (Martin et al., 2010), with international pooled prevalence estimates of 17.2% among adolescents, 13.4% among young adults, and 5.5% among adults (Swannell et al., 2014). NSSI in surveys of university or college students, overlapping the adolescent/young adult groups, has been reported at between 15.3% (Whitlock et al., 2011) and 39.5% (Hamza et al., 2013).

Prevalence figures from studies on university students may be meaningful only in the context of universities given they focus on high achievers and samples of convenience, for instance psychology students (Rotolone & Martin, 2012; Horgan & Martin, 2015). Prevalence may be skewed because students have a particular interest in psychological problems, and may be more likely to respond to promotion of a study online actively seeking self-injurers. Nevertheless, university and college counselors report major concerns at increasing prevalence of NSSI in their students, in the context of a perceived lack of therapeutic skill to manage such problems, or the paucity of relevant and specific therapy programs for the problem (Whitlock et al., 2009), and longitudinal research

✉ Professor Graham Martin, University of Queensland
Department of Psychiatry, K Floor RBWH, Herston, 4006,
Queensland, Australia.
Email: g.martin@uq.edu.au
Phone: +61400080489

suggesting persistence over time (Zivin et al., 2009).

Within universities, medical students are a vulnerable population, experiencing higher levels of mental health problems, with risk escalating over the course of their training. From a systematic review of 40 research articles, Dyrbye et al., (2006), concluded: 'studies suggest a high prevalence of depression and anxiety among medical students, with levels of overall psychological distress consistently higher than in the general population and age-matched peers, by later years of training.' The authors suggested problems were more common amongst women medical students, but this contradicted earlier studies - for instance Guthrie et al. (1998) who, in a longitudinal study, noted levels of 'burnout' were similar. Medical students are less likely than the general population to receive appropriate management, despite their training and access to services. Potential reasons for this include stigma, guilt, shame, and concerns about impact on vocational and future employment options (Givens & Tjia, 2002). Dyrbye et al., (2008) reported high levels of suicidality (11.2%) in medical students from seven US universities, correlated with levels of burnout, and this has been confirmed more recently (Dyrbye et al., 2014, Rotenstein et al., 2016). In a model of stress in medical students, Dyrbye et al., (2005) suggested personality style, depression, and burnout as a reaction to stress may be implicated in becoming suicidal; this also appears to be so in physicians (Tyssen et al., 2001; Tyssen et al., 2004).

Different studies have used different or multiple constructs to describe personality style as a predictor of burnout or suicidality. These include 'Neuroticism' (Dahlin & Runeson, 2007; Dyrbye et al., 2005; McManus et al., 2004), 'Conscientiousness' (Dahlin & Runeson, 2007; Lue et al., 2010; Tyssen et al., 2007) and 'Introversion' (Henning et al., 2009; Tyssen 2004). Part of the complexity is that students may be chosen for a course like medicine on factors like conscientiousness which can be argued to make for more successful students and better or more ethical doctors (Enns et al., 2001; Lievens et al., 2002).

Only one previous study has reported non-suicidal self-injury in medical students (Allroggen et al., 2014). This estimated a lifetime prevalence of NSSI (14.3%) and suicide attempts (1.5%) in 714 German medical students (mean age 23.1 years); at least similar to population levels for the age group. Allroggen et al., (2014) used the NEO Five-Factor Inventory to explore personality, which showed higher levels of neuroticism and openness to

experience but lower levels of conscientiousness and extraversion.

Having researched non-suicidal self-injury in other undergraduate student samples (Caltabiano & Martin, 2016); Horgan & Martin, 2015; Rotolone & Martin, 2012), we sought to investigate a sample of Australian medical students to discern whether they are indeed 'a highly vulnerable population', whether self-injury occurs, and what factors might be associated with self-injury. We were particularly interested in perfectionism as a personality trait, general mental health concerns, resilience, social supports and perceived social connectedness.

Self-injury was defined in this study as 'the direct, deliberate destruction of body tissue in the absence of conscious, lethal intent' (Nock & Favazza, 2009). Several theoretical frameworks support our understanding of the aetiological basis of self-injury, the most common being affect regulation (Chapman et al., 2006). Self-injury is preceded by negative feelings or thoughts such as depression, anxiety, tension, anger, generalised distress, guilt or self-criticism. The act of self-injury causes relief from these negative feelings inducing a positive feeling state, which may be based in release of brain opiates, or result from the subsequent self-soothing and care of the wound.

Perfectionism is a personality trait with potentially negative consequences. Flett & Hewitt (2006) suggest a perfectionist holds highly rigid standards, places irrational importance on attainment of these, and this has personal and interpersonal consequences. They distinguish conscientiousness from perfectionism. Perfectionistic individuals may experience increased frequency of mental health problems, including depression and suicide. Although there is evidence supporting a higher rate of perfectionism as a factor in elevated rates of suicide among some professional groups (Hewitt et al., 2006), little is known about its association with self-injury in young adults, though studies do exist in adolescence (Hasking et al., 2010; O'Connor et al., 2010).

We used the Frost Multidimensional Perfectionism Scale (Stöber, 1998), with four subscales (concern over mistakes, parental expectations, personal standards and organisation). There has been recent criticism of factor analyses of the FMPS, but agreement it contains valence - that is maladaptive and adaptive perfectionism (Stallman & Hurst, 2011). Maladaptive perfectionism indicates an inordinate fear of mistakes, a tendency to second-guess decisions and procrastination, while adaptive perfectionism is thought to act as a motivating, rather than inhibiting, factor in the drive to achievement. There is some evidence suggesting parental criticism and alienation (one of the

subscales in the Frost Multidimensional Perfectionism Scale) may have a role in predicting NSSI (Baetens et al., 2013).

We hypothesized self-injury would be reported by medical students, and that self-injurers would have lower scores on Resilience and Social Supports, but higher scores on Psychological symptoms. We hypothesized that overall medical students would have high scores on Perfectionism, but that those with high scores on Maladaptive Perfectionism would be the ones more likely to self-injure.

Method

Participants

All participants were full-time graduate students in the first of four years medical training. With ethics approval from the University of Queensland, a potential 306 participants were encouraged to complete a pencil and paper questionnaire during a two-hour first-year lecture on 'Suicide and its prevention'. The purpose of the study was explained at the beginning of the lecture, as well as in written form attached to the front of each questionnaire. All students gave signed agreement, having been informed that participation was voluntary, and anonymity preserved. Students were advised that, if the questionnaire caused distress they should discuss with one of five support staff at the end of the lecture or later by telephone, or speak to someone at the University counselling centre, or use one of the standard suicide telephone support lines (numbers provided).

Measures

The Frost Multidimensional personality scale (FMPS-35) (Frost et al., 1990) is a widely used 35-item questionnaire assessing multiple aspects of perfectionism. Stallman & Hurst (2011) have supported the exclusion of six items (4,5,16,17,18 and 28), without the stability of the scale being compromised. Although there is evidence to indicate the factor structure of the FMPS-29 is robust for a university student population without the need for subgroup analyses, results of the scale were divided into 5 sub-subscales (concern over mistakes, doubts about actions, parenting standards/criticism, organisation and personal standards). Subscales were then grouped into either 'adaptive' or 'maladaptive' perfectionism (Stallman & Hurst, 2011).

Resilience. We sought responses to four probe statements drawn from the 14-item Resilience scale (RS-14) (Wagnild & Young, 1993), each with high correlation to the core construct. 'I usually take things in stride', 'I am determined', 'I can get through difficult times because I've experienced

difficulty before' and 'My belief in myself gets me through hard times'. Responses were scored on a 5-point Likert scale from Strongly Disagree to Strongly Agree with a neutral mid point.

General Health Questionnaire (GHQ28) (Goldberg & Hillier, 1979) has 28 items (4 point scales), relating to the last 12 months, measuring overall general mental health problems (Cronbach α .92), with subscales for somatic complaints (α .77), anxiety and insomnia (α .85), social dysfunction (α .81) and depression (α .80).

Deliberate Self-Injury Questionnaire (Rotolone & Martin, 2012). This begins with a definition: "For the purpose of this study, self-injury is defined as the deliberate and direct destruction or alteration of body tissue without suicidal intent. Such behaviours are likely to induce pain, bleeding and bruising and can include (but are not limited to): cutting, wound picking, hitting parts of your body, needle use, burning and skin carving. If you consider an act that you have engaged in to be deliberate self-injury, then (for the purpose of this study) it is!" This was followed by the question: "Have you ever engaged in deliberate self-injury? If only once, please still select yes", and then: "If you have self-injured in the past but are not currently self-injuring, how long has it been since you stopped?" Further questions asked about frequency, purpose, types of self-injurious behaviour, intervention received, and suicidality during self-injury. A final question related to confidence in those who had ceased self-injury: "If you have stopped self-injury, how confident are you that you will never self-injure again?" (scored on a five point scale).

The Multidimensional Scale of Perceived Social Support (MSPSS) (12-item scale) (Zimet et al., 1988) was used to measure perceived social supports on three subscales – 'family', 'friends' and 'significant other'. Reliability, validity and factor structure of the MPSS have been examined for university students. Overall, the Cronbach alpha coefficient for the current sample was α .94.

Statistical Analysis

All analyses were completed in SPSS version 21. Chi Square was used to clarify demographic differences between non-self-injurers and self-injurers, and then between current self-injurers and past self-injurers. The small group of current self-injurers precluded meaningful comparison on our main measures. One-way Analysis of Variance was used to compare all self-injurers (current plus past) with non-self-injurers. Further One-way Analysis of Variance compared Self-injurers with suicidal intent with those self-injuring without suicidal intent. Application of Cohen's d provided

effect sizes, calculated using the maximum likelihood estimator weighted for unequal sample sizes.

Logistic regression was used to determine the joint effect, as well as relative importance, of social support, resilience, psychological symptoms, and perfectionism in predicting 'self-injury' group membership. Despite the small numbers, a further logistic regression was used to examine the effect of these variables on the outcomes of 'current versus past self-injury' and 'self-injury with or without suicidal intent'.

Results

Descriptive Data. We excluded 46 incomplete questionnaires from further study, given they were missing more than 50% of responses. A total 260 questionnaires (139 males and 121 females) were completed (response rate 85%) and used in our analysis. Participants were aged between 19 and 36 years (mean age 23.1 years). More than half identified as Australian born (57.5%). English was predominantly the language spoken at home (82.3%). Half (49.8%) our participants were single, 13% were in a casual relationship, 29.9% in a committed relationship, and 5.7% married.

A total 45 students (17.3%) admitted having ever deliberately self-injured, 36 (13.8%) in the past, with 9 (3.5%) claiming to be 'current' self-injurers. Of those reporting either current or past self-injury, 6 (13.3%) reported undertaking this with suicidal intent whereas 36 (80%) denied suicidal intent. Three participants did not answer this question.

Participants in the three self-injury categories (no history of self-injury, history of past self-injury, current self-injury) did not differ in age ($F(2, 256) = 0.90, p = .407$), gender ($\chi^2(df 2, N 260) 5.39, p = .067$), nationality ($\chi^2(df 2, N 260) 1.50, p = .473$), or marital status ($\chi^2(df 8, N 260) 9.40, p = .907$). However, the small number of current self-injurers

resulted in low expected frequencies, and our results should be interpreted with caution. When analyses were re-run with self-injury categories combined (current with past history of self-injury, $n = 45$), female medical students were 1.6 times more likely to have self-injured compared to males ($\chi^2(df 1, N 260) = 3.96, p = .046$).

Among current self-injurers, 4 had self-injured once in the past year, 2 every few months and 2 weekly. For all self-injurers ($n = 45$), cutting (33.9%) was the most common method, followed by self-punching (29.0%), purging (14.5%), and skin carving (12.9%). Finally, 6.5% of respondents reported other forms of self-injury with a small number (3.2%) admitting burning.

Attempts to self-regulate negative emotion were the most endorsed reasons ("stress relief"), with efforts to replace emotional pain with physical pain ("to feel pain physically rather than emotionally") and "boredom". Self-punishment was also common ("for bad habits" and "Failing at what I should have/have not been doing"). Other responses included "because friends did it" and "to get out of work".

Commonly cited reasons for ceasing self-injury included receiving support ("support from family and my psychologist" and "better support") and personal growth and maturity ("I have matured" and "I grew up") or formal treatment from health professionals ("Therapy", "Antidepressants"). Just over one third (37.7%) of current/past self-injurers had sought medical treatment with 17.7% accessing counselling or psychotherapy, 8.8% requiring treatment at an emergency department and 11.1% had been admitted to hospital for their self-injury.

Group Comparisons. Descriptive statistics as well as the inter-correlation matrix for focal outcome variables are displayed in Table 1.

Table 1. Descriptive Information for Continuous Variables

	M	SD	Per	PEx	Con	Dou	PerS	Org	MP	AP	Res	PsyS	Som	Anx	Soc	Dep
Social Support	67.18	14.36	-.15*	-.13*	-.25***	-.11	.02	.09	-.23***	.07	.27***	-.22***	.06	-.13*	.22***	-.33***
Perfectionism Total	90.65	14.69		.66***	.80***	.44***	.62***	.44***	.90***	.61***	-.18**	.31***	.21**	.34***	-.09	.27***
Parental Expectations	12.66	6.79			.35***	.18**	.13*	-.06	.80***	.03	-.25***	.25***	.21**	.32***	-.17**	.35***
Concern	21.20	6.58				.38***	.41***	.15*	.82***	.31***	-.27***	.34***	.01	.00	.02	-.12
Doubts	5.43	2.12					.14*	.04	.49***	.10	-.23***	.34***	.08	.15*	.07	.01
Personal Standards	19.39	3.39					.43***	.32***	.80***	.21**	.04	.16**	.25***	-.09	.21**	
Organization	12.98	4.35						.06	.88***	.14*	-.05	.20***	.33***	.00	.30***	
Maladaptive Perfectionism	48.29	11.87							.21**	-.33***	.39***	.25***	.38***	-.14*	.37***	
Adaptive Perfectionism	42.37	6.56								.20**	-.01	.03	.08	.05	-.07	
Resilience	3.90	0.70									-.37***	.16*	-.31***	.19**	-.34***	
Psychiatric Symptoms	51.34	9.92										.82***	.87***	-.25***	.77***	
Somatic Symptoms	13.01	3.70											.67***	-.10	.45***	
Anxiety Insomnia	14.08	4.47												-.07	.53***	
Social Dysfunction	14.70	2.69													-.18**	
Severe Depression	9.54	3.65														

$p < .05, **p < .01, ***p < .001$ (2-tailed).

Perceived good Social Supports were highly correlated with Resilience (.27, $p < .001$, 2-tailed). Conversely, there were significant negative correlations between a lack of Social Supports and Concern over mistakes (-.25, $p < .001$, 2-tailed), Maladaptive Perfectionism (-.23, $p < .001$, 2-tailed) Psychiatric Symptoms overall (-.22, $p < .001$, 2-tailed) and GHQ subscales Somatic Symptoms (-.22, $p < .001$, 2-tailed) and Depression (-.33, $p < .001$, 2-tailed). Parental Expectations were highly correlated with Perfectionism overall (.66, $p < .001$, 2-tailed) and with Maladaptive Perfectionism (.88, $p < .001$, 2-tailed) in particular, as well as Concerns (.35, $p < .001$, 2-tailed), Depression (.35, $p < .001$, 2-

tailed) and Anxiety (.32, $p < .001$, 2-tailed). Adaptive Perfectionism correlated highly with Organisation (.88, $p < .001$, 2-tailed) and Personal Standards (.80, $p < .001$, 2-tailed). Finally, Resilience was negatively correlated with Maladaptive Perfectionism (-.33, $p < .001$, 2-tailed) as well as Concern (-.27, $p < .001$, 2-tailed) and Doubts (-.23, $p < .001$, 2-tailed).

With only 9 participants reporting current self-injury, meaningful statistical comparison with past self-injurers was not possible. All self-injurers were compared with non self-injurers, using one-way ANOVAs (please see Table 2).

Table 2.
Differences Between Participants With and Without a History of NSSI

	SI (n = 45) M (SD)	No SI (n = 215) M (SD)	ANOVA F(1, 258) ^a	EFFECT SIZE d ^b (η^2)
Social Support	62.00 (15.32)	68.27 (13.94)	7.26**	-0.44 (.05)
Resilience	3.72 (0.72)	3.94 (0.68)	3.97*	-0.33 (.03)
Psychological Symptoms Total	61.22 (14.11)	52.46 (10.67)	15.52***	0.78 (.13)
Somatic symptoms	14.60 (4.52)	12.67 (3.42)	7.29**	0.53(.06)
Anxiety symptoms	16.40 (4.83)	13.60 (4.24)	15.42***	0.65 (.09)
Social Dysfunction	14.44 (2.43)	14.76 (2.74)	0.51	0.12 (.00)
Severe Depression	11.89 (4.92)	9.05 (3.12)	13.82***	0.82 (.14)
Perfectionism Total	97.89 (18.35)	89.14 (13.36)	9.21**	0.61 (.09)
Parental Expectations	26.20 (5.32)	24.53 (4.17)	3.92**	0.38 (.04)
Concern	24.31(7.87)	20.54 (6.11)	9.16**	0.59 (.08)
Doubts	6.07 (2.43)	5.30 (2.03)	4.96*	0.37 (.03)
Personal Standards	20.27 (3.39)	19.21 (3.37)	3.65	0.32 (.03)
Organization	22.42 (4.19)	23.09 (4.39)	0.88	-0.16 (.01)
Maladaptive Perfectionism	55.20 (14.88)	46.84 (10.62)	12.85**	0.76 (.13)
Adaptive Perfectionism	42.69 (6.76)	42.30 (6.53)	0.13	-0.06 (.00)

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

Note. ^aDegrees of Freedom for analysis which satisfied the assumption of homogeneity of variance. The analysis of perfectionism (and subscales personal expectation, concern, and maladaptive perfectionism) and psychological symptoms violated this assumption (Levene's test was significant at $\alpha = .05$) and thus Welch's correction has been performed.

^bCohen's *d* calculated using the maximum likelihood estimator weighted for unequal sample sizes.

Mean differences for most between groups comparisons reached statistical significance in the expected direction, with the exception of adaptive perfectionism, and its components – personal standards and organisation. Overall, lower social support was reported by self-injuring participants (F (1, 258) 7.26, $p < .01$, *d* 0.44), a medium effect size explaining 5% of variance of self-injury. Self-injurers reported higher levels of maladaptive perfectionism compared to those denying self-injury (F (1, 258) 12.85, $p < .001$, *d* 0.76), accounting for 13% of total variance. A large group difference in overall psychological symptoms existed, with self-injurers scoring higher than those not self-injuring (F (1, 258) 15.52, $p < .001$, *d* 0.78) accounting for 13% of variance in self-injury. More specifically, scores on both the 'Severe Depression'

subscale of the General Health Questionnaire (F (1, 258) 13.82, $p < .001$, *d* 0.82) and the 'Anxiety' subscale (F (1, 258) 15.42, $p < .001$, *d* 0.65) were significantly higher in self-injurers.

Compared with non self-injurers, participants who self-injured reported higher scores on Perfectionism overall, as well as on each of the five subscales (see Table 2), with differences being least on 'personal standards' and 'organisation' (the two components of 'adaptive perfectionism'). Within Perfectionism, the largest effect was for 'Concerns' (F (1, 258) 9.16, $p < .01$, *d* 0.59). 'Maladaptive Perfectionism' was significantly higher in self-injurers (F (1, 258) 12.85, $p < .01$, *d* 0.76).

Table 3.
Differences Between Those Reporting Self-injury With and Without Suicidal Intent

	<i>Self-injury with Suicidal Intent (6)</i>	<i>Self-injury without Suicidal Intent (36)</i>	ANOVA	EFFECT SIZE
	<i>M (SD)</i>	<i>M (SD)</i>	<i>F(1, 40)</i>	<i>d^a (η²)</i>
Social Support	51.83 (21.10)	63.81 (13.73)	3.34 [†]	-0.83 (.15)
Resilience	3.96 (1.19)	3.70 (0.66)	0.61	0.35 (.03)
Psychological Symptoms	61.83 (19.52)	62.44 (13.11)	0.01	-0.04 (.00)
Somatic symptoms	13.17 (4.62)	15.36 (4.27)	0.32	0.52 (.06)
Anxiety symptoms	17.67 (4.89)	16.42 (4.96)	0.85	0.26 (.02)
Social Dysfunction	14.67 (3.44)	14.17 (2.18)	0.01	0.22 (.01)
Severe Depression	13.67 (7.66)	11.83 (4.55)	0.14	0.37 (.03)
Perfectionism Total	103.00 (23.41)	97.06 (17.82)	0.52	0.33 (.03)
Parental Expectations	26.50 (7.77)	26.31 (5.04)	0.01	0.04 (.00)
Concern	30.00 (8.15)	23.42 (7.37)	4.00 [†]	0.90 (.17)
Doubts	5.33 (2.66)	6.28 (2.25)	0.86	0.42 (.04)
Personal Standards	21.50 (3.39)	19.89 (3.44)	1.13	0.48 (.05)
Organization	24.33 (2.58)	22.06 (4.34)	1.54	0.56 (.07)
Maladaptive Perfectionism	57.17 (18.45)	55.11 (14.74)	0.09	0.12 (.00)
Adaptive Perfectionism	45.83 (5.19)	41.94 (6.94)	1.71	0.59 (.08)

[†] $p < .1$, $p < .05$, $p < .01$, $p < .001$

Note. ^aCohen's d calculated using the maximum likelihood estimator weighted for unequal sample sizes.

Self-injurers with suicidal intent appeared to differ from those without suicidal intent, but inadequate cell sizes hampered analyses (see Table 3). As expected with small numbers, all one-way ANOVA results for these comparisons were non-significant (at $\alpha = .05$), though lower social support for self-injurers with suicidal intent appeared to have a large effect size ($F(1, 40) 3.34$, $p = .075$, $d 0.86$). While total perfectionism did not differ significantly between the groups, self-injurers admitting suicidal intent reported higher 'personal concern' than those with no suicidal intent, with a large apparent effect size not reaching significance ($F(1, 40) 4.00$, $p < .1$, $d 0.9$).

Logistic Regression. Logistic regression was used to determine the joint effect, as well as relative importance, of social support, resilience, psychological symptoms, and perfectionism in predicting 'self-injury' group membership. The omnibus test of model fit was significant ($\chi^2(df = 14, N = 260) = 26.74$, $p < .001$). Overall, the model accounted for between 10% (Cox & Snell $R^2 = .10$) and 16% (Nagelkerke $R^2 = .16$) of total variance in-group membership and correctly classified 83.8% of self-injurers.

Table 4 contains parameter estimates representing the unique effect of each variable controlling for all other variables in the model. Two of the four theoretical predictors exerted a unique influence on participant group membership. Perfectionism and Psychological Symptoms both positively predicted group membership (greater chance of having engaged in self-injury). A one-unit increase

in perfectionism was associated with a 2.6% increase in chance of self-injury. Similarly, a one-unit increase in overall Psychological Symptoms was associated with a 4.6% increase in chance of self-injury.

Similar logistic regression models were applied to determine the effect of these variables on the other two self-injury binary outcomes: 'current versus past self-injury' and 'self-injury with or without suicidal intent'. The omnibus test of fit was not significant for either model (current or non-current SI: $\chi^2(df = 14, N = 46) = 2.82$, $p < .589$; SI with or without suicidal intent: $\chi^2(df = 14, N = 42) = 6.67$, $p < .155$). However, for current versus past self-injury, the model did appear to account for between 6% (Cox & Snell $R^2 = .06$) and 10% (Nagelkerke $R^2 = .10$) of total variance and correctly classified 80% of self-injurers. For, self-injury with or without suicidal intent, the model did appear to account for between 15% (Cox & Snell $R^2 = .15$) and 26% (Nagelkerke $R^2 = .26$) of total variance and correctly classified 85.7% of cases.

Table 4 also contains the parameter estimates representing the unique effect of each variable controlling for all other variables in the model. No predictor exerted a unique influence on current or past self-injury. However, high social support predicted group membership (lesser chance of self-injuring with suicidal intent). A one-unit increase in overall perfectionism was associated with a 7.2% decrease in the chance of engaging in SI with suicidal intent.

Table 4.
Logistic Regression Estimates for Full Model Predicting Self-Injury Group Membership

	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>df</i>	<i>P</i>	^a <i>exp B</i>
Criterion: Self-injury vs non-Self-injury Group						
Social Support	-0.02	0.01	1.32	1.00	.251	0.99
Maladaptive Perfectionism	0.04	0.02	5.69	1.00	.017	1.04
Adaptive Perfectionism	-0.01	0.03	0.07	1.00	.791	0.99
Resilience	0.12	0.29	0.16	1.00	.689	1.12
Somatic Symptoms	0.05	0.06	0.60	1.00	.440	1.05
Anxiety Insomnia	0.03	0.06	0.21	1.00	.648	1.03
Social Dysfunction	0.04	0.07	0.29	1.00	.593	1.04
Severe Depression	0.09	0.05	2.92	1.00	.088	1.10
Constant	-5.36	2.08	6.65	1.00	.010	0.01
Criterion: Current Self-injury vs Prior Self-injury Group						
Social Support	0.03	0.04	0.73	1	.393	1.03
Maladaptive Perfectionism	0.07	0.04	3.15	1	.076	1.08
Adaptive Perfectionism	-0.03	0.08	0.12	1	.724	0.97
Resilience	0.70	0.73	0.93	1	.335	2.01
Somatic Symptoms	-0.12	0.15	0.61	1	.437	0.89
Anxiety Insomnia	-0.11	0.12	0.84	1	.358	0.89
Social Dysfunction	-0.12	0.19	0.36	1	.548	0.89
Severe Depression	0.06	0.13	0.21	1	.650	1.06
Constant	-4.55	5.44	0.70	1	.403	0.01
Criterion: Self-injury with or without suicidal intent						
Social Support	-0.13	0.08	2.81	1	.094	0.88
Maladaptive Perfectionism	-0.01	0.06	0.01	1	.941	1.00
Adaptive Perfectionism	0.46	0.27	2.81	1	.094	1.58
Resilience	0.33	1.04	0.10	1	.752	1.39
Somatic Symptoms	-1.06	0.52	4.09	1	.043	0.35
Anxiety Insomnia	-0.05	0.20	0.06	1	.812	0.95
Social Dysfunction	-0.36	0.33	1.19	1	.276	0.70
Severe Depression	0.36	0.30	1.37	1	.242	1.43
Constant	-0.01	8.42	0.00	1	.999	0.99

^aOdds ratios for the predictors (the exponentiation of the coefficients)

Discussion

It has long been recognised that medical students may be a highly vulnerable population, under stress, and suffering mental health problems at higher rates than the general population or age-matched peers (Firth, 1986; Guthrie et al., 1998; Pitts et al., 1961; Saslow, 1956). More recent North American research confirms this (Dyrbye et al., 2005; Dyrbye et al., 2008) and is supported by a comprehensive review (Dyrbye et al., 2014) and a recent large systematic review and meta-analysis (Rotenstein et al., 2016). Studies from many countries confirm medical student ill health as an international problem (Aktekin et al., 2001; Allroggen et al., 2014; Casey et al., 2016; Henning et al., 2009; Lue et al., 2010; Shaikh et al., 2004; Tyssen et al., 2001). The issues explored relate to whether a certain type of personality is drawn to medicine (Lievens et al., 2002), how much influence early negative experiences may have, whether course-related and examination stress are the central problems (Tyssen et al., 2007), the psychiatric morbidity that emerges (Dahlin & Runeson, 2007), reluctance to seek help on the

grounds it may cause problems in later selection for jobs (Givens & Tjia, 2002), and significant and pervasive risk and safety issues (Dyrbye et al., 2014), including suicidality (Rotenstein et al., 2016). Longer-term issues reported are persistence of problems after graduation including the impact on later performance as a physician and the higher rate of suicide in physicians (Tyssen et al., 2001; Tyssen et al., 2004). Recent work has suggested medical students have higher 'Conscientiousness' scores than the general population (Dahlin & Runeson, 2007; Lue et al., 2010), though a study from Germany disputes this (Allroggen et al., 2014).

The current study was based on our belief that a percentage of graduate medical students in their first year would admit to non-suicidal self-injury, and the hypothesis that rates of self-injury would be consistent with rates from our population studies (Martin et al., 2010; Swannell et al., 2014), and a series of studies with psychology students at The University of Queensland (Caltabiano &

Martin, 2016; Horgan & Martin, 2015; Rotolone & Martin, 2012).

Forty-five students of our 260 students admitted to self-injury at some time, and nine of these claimed to be 'current' self-injurers. Overall, six had self-injured with suicidal intent. These numbers, and the pattern of self-injury and suicidal intent are consistent with our other studies on this young adult age group. Our study is also consistent with the literature in demonstrating an association between self-injury, high levels of perfectionism (in particular maladaptive perfectionism) and psychological symptoms (in particular depressive symptomatology), accompanied by low levels of resilience and social support, suggesting this is a group at considerable risk.

Our logistic regression showed that Perfectionism and Psychological Symptoms both positively predicted group membership (greater chance of having engaged in self-injury), and also appeared to influence whether a self-injurer was current and had some suicidal intent. However, these results are based on tiny numbers, did not reach statistical significance, and we can have only limited confidence in them. They do, however, point the way to further study to unravel the complexities in this at risk group of medical students on their way to becoming future doctors.

While perfectionism has been a highly valued attribute in high-achieving populations, there is evidence it may be detrimental. Consistent with current evidence, our results suggest maladaptive perfectionism is more likely to be associated with self-harm. Maladaptive perfectionism centres around a fear of making mistakes, a tendency to second-guess and doubt. Frost et al. (1990) postulated that maladaptive perfectionism reflects a tendency to feel that projects or work are never completed to satisfaction and there is always a lingering doubt about the quality of one's performance. As such, it is easy to understand how these traits may contribute to a dysphoric state, which may precipitate self-harm.

Conversely, our results suggest that social support may act as a significant protective factor over maladaptive perfectionism and psychiatric symptoms, suggesting that optimising supports may be a useful part of an effective intervention plan.

The major limitation of our study is that we sampled a single population of postgraduate medical students on one occasion. The relatively small sample clearly impacted on the power and significance of our results, which may not be applicable to other university populations. In addition, and given the nature of the sample (future doctors) we believe there may have been

some reporting bias, despite the questionnaire itself being de-identified. Students, even those assured of anonymity, may have been reluctant to admit problems, given the possible implications of reporting self-harm and mental health problems.

In conclusion, our study of a population of medical students (of Australian and mixed cultural background) indicates they have concerning rates of self-injury, which appear to be associated with maladaptive perfectionism, depressive symptoms and perceived poor social supports. We believe this preliminary study highlights an urgent need for further investigation. In addition, it has implications for intervention to optimise the health of this particular population, considering that risks for poor mental health may impact on the individual, but also the community at large.

Declaration of Conflicting Interest

The Authors declare that there is no conflict of interest. There was no funding to support this study, and neither author received remuneration.

References

- Aktekin, M., Karaman, T., Senol, Y., Erdem, S., & Hakan, E. (2001). Anxiety, Depression and Stressful Life Events among Medical Students: a Prospective Study in Antalya, Turkey. *Medical Education*, 35(1), 12–17. DOI: 10.1111/j.1365-2923.2001.00726.x
- Allroggen, M., Kleinrahm, R., Rau, T., Weninger, L., Ludolph, A., & Plener, P. (2014). Nonsuicidal self-injury and its relation to personality traits in medical students. *Journal of Nervous and Mental Disorders*. 202(4), 300-4. doi: 10.1097/NMD.000000000000122.
- Baetens, I., Claes, L., Hasking, P., Smits, D., Grietens, H., Onghena, P., & Martin, G. (2013). The Relationship Between Parental Expressed Emotions and Non-suicidal Self-injury: The Mediating Roles of Self-criticism and Depression. *Journal of Child and Family Studies*. DOI: 10.1007/s10826-013-9861-8
- Caltabiano, G. & Martin, G. (2016). Mindless Suffering: The Relationship Between Mindfulness and Non-Suicidal Self-Injury. *Mindfulness*. 7(6). DOI 10.1007/s12671-016-0657-y
- Casey, D., Thomas, S., Hocking, D. & Kemp-Casey, A., 2016. Graduate-entry medical students: older and wiser but not less distressed. *Australasian Psychiatry*. 24(1), 88-92. doi: 10.1177/1039856215612991.

- Chapman, A., Gratz, K., & Brown, M. (2006). Solving the puzzle of deliberate self-harm: The experiential avoidance model. *Behaviour Research and Therapy*, 44, 371-394.
- Dahlin, M., & Runeson, B. (2007). Burnout and psychiatric morbidity among medical students entering clinical training: a three-year prospective questionnaire and interview-based study. *BMC Medical Education*, 7(6). doi:10.1186/1472-6920-7-6.
- Dyrbye, L., Thomas, M., & Shanafelt, T. (2005). Medical Student Distress: Causes, Consequences, and Proposed Solutions. *Mayo Clinical Process*, 80(12), 1613-1622.
- Dyrbye, L., Thomas, M., & Shanafelt, T. (2006). Systematic Review of Depression, Anxiety, and Other Indicators of Psychological Distress Among U.S. and Canadian Medical Students. *Academic Medicine*, 81(4), 354-373.
- Dyrbye, L., Thomas, M., Massie, F., Power, D., Eacker, A. Harper, W., Durning, S., Moutier, M., Szydlo, D., Novotny, P., Sloan, J., & Shanafelt, T. (2008). Burnout and Suicidal Ideation among U.S. Medical Students. *Annals of Internal Medicine*, 149, 334-341.
- Dyrbye, L., West, C., Satele, D., Boone, S., Tan, L., Sloan, J., & Shanafelt, T. (2014). Burnout among U.S. medical students, residents, and early career physicians relative to the general U.S. population. *Academic Medicine*, 89(3), 443-51. doi: 10.1097/ACM.000000000000134
- Enns, M., Cox, B., Sareen, J., & Freeman, P. (2001). Adaptive and maladaptive perfectionism in medical students: a longitudinal investigation. *Medical Education*, 35, 1034-1042.
- Firth, J. (1986). Levels and Sources of Stress in Medical Students. *British Medical Journal*, 292, 1177-1180.
- Flett, G., & Hewitt, P. (2006). Positive versus negative perfectionism in psychopathology: a comment on Slade and Owens's dual process model. *Behavior Modification*, 30(4), 472-495. doi: 10.1177/0145445506288026
- Frost, R., Marten, P., Laharte, C., & Rosenblate, R. (1990). The Dimensions of Perfectionism. *Cognitive Therapy and Research*, 14(5), 449-468.
- Givens, J. & Tjia, J. (2002). Depressed Medical Students' Use of Mental Health Services and Barriers to Use. *Academic Medicine*, 77(9), 918-921.
- Goldberg, D., & Hillier, V. (1979). A scaled version of the general health questionnaire. *Psychological Medicine*, 9, 139-145.
- Guthrie, E., Black, D., Bagalkote, H., et al. (1998). Psychological stress and burnout in medical students: a five-year prospective longitudinal study. *Journal of the Royal Society of Medicine*, 91, 237-243.
- Hasking, P., Coric, S., Swannell, S., Martin, G., Anderson, H., & Frost, A. (2010). Emotion regulation and coping as moderators in the relationship between personality and self-injury. *Journal of Adolescence*, 33, 767-773.
- Hewitt, P., Flett, G., Sherry, S., & Caelian, C. (2006). Trait Perfectionism Dimensions and Suicidal Behavior. (pp. 215-235). In Ellis, T. E. (Ed), *Cognition and suicide: Theory, research, and therapy*. Washington, DC, US: American Psychological Association, xviii, 409 pp.
- Hamza, C., Willoughby T., & Good, M. (2013). A preliminary examination of the specificity of the functions of nonsuicidal self-injury among a sample of university students. *Psychiatry Research*, 205, 172-175.
- Henning, M., Hawken, S., & Hill, A. (2009). The quality of life of New Zealand doctors and medical students: What can be done to avoid burnout? *New Zealand Medical Journal*, 122 (1307), 102-110.
- Horgan, M., & Martin, G., (2015). Differences between current and past self-injurers: How and why do people stop? *Archives of Suicide Research*, 20(1), In Press.
- Lievens F., Coetsier P., De Fruyt F., & De Maeseneer J. (2002). Medical students' personality characteristics and academic performance: a five-factor model perspective. *Medical Education* 36, 1050-1056.
- Lue, B-H., Chen, H-J., Wang, C-W., Cheng, Y., & Chen, M-C. (2010). Stress, personal characteristics and burnout among first postgraduate year residents: a nationwide study in Taiwan. *Medical Teacher* 32(5), 400-407. doi:10.3109/01421590903437188
- Martin, G., Swannell, S., Hazell, P., Harrison, J., & Taylor, A. (2010). Self-Injury In Australia: a community survey. *Medical Journal of Australia*, 193 (9), 506-510.
- McManus, I., Keeling, A., & Paice, E. (2004). Stress, burnout and doctors' attitudes to work are determined by personality and learning style: A twelve year longitudinal study of UK medical

- graduates *BMC Medicine*, 2, 29. doi:10.1186/1741-7015-2-29
- Nock, M., & Favazza, A. (2009). Non-suicidal self-injury: Definition and classification. In M. Nock (Ed.), *Understanding nonsuicidal self-injury: Origins, assessment, and treatment* (pp. 9–18). Washington, DC: American Psychological Association.
- O'Connor, R., Rasmussen, S., & Hawton, K. (2010). Predicting depression, anxiety and self-harm in adolescents: The role of perfectionism and acute life stress. *Behaviour Research and Therapy* 48(1), 52–59.
- Pitts, F., Winokur, G., Stewart, M. (1961). Psychotic syndromes, anxiety symptoms, and response to stress in medical students. *American Journal of Psychiatry* 118, 333-40.
- Rotenstein, L., Ramos, M., Torre, M., et al. (2016). Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation Among Medical Students: A Systematic Review and Meta-Analysis. *Journal of the American Medical Association*, 316(21), 2214-2236. doi:10.1001/jama.2016.17324.
- Rotolone, C., & Martin, G. (2012). Giving up Self-Injury: A Comparison of Everyday Social and Personal Resources in Past Versus Current Self-Injurers. *Archives of Suicide Research*, 16(2), 147-158.
- Saslow, G. (1956). Psychiatric Problems of Medical Students. *Journal of Medical Education*, 31, 27-33.
- Shaikh, B., Kahloon, A., Kazmi, M., Hamza, K., Nawaz, K., Khan, N. & Khan, S. (2004). Students, Stress and Coping Strategies: A Case of Pakistani Medical School. *Education for Health*, 17(3), 346 – 353.
- Stallman, H., & Hurst, C. (2011). The Factor Structure of the Frost Multidimensional Perfectionism Scale in University Students. *Australian Psychologist*, 46(4), 229–236. DOI: 10.1111/j.1742-9544.2010.00010.x
- Stöber, J. (1998). The Frost Multidimensional Perfectionism Scale: More perfect with four (instead of six) dimensions. *Personality and Individual Differences*, 24(4), 481-491.
- Swannell, S., Martin, G., Page, A., Hasking, P. & St. John, N. (2014). Prevalence of Nonsuicidal Self-Injury in Nonclinical Samples: Systematic Review, Meta-Analysis and Meta-Regression. *Suicide and Life Threatening Behavior*, 44(3), 273-303. DOI: 10.1111/sltb.12070
- Tysen R., Vaglum P., Gronvold N., & Ekeberg O. (2001). Factors in medical school that predict postgraduate mental health problems in need of treatment: a nationwide and longitudinal study. *Medical Education*, 35, 110-120.
- Tysen R., Hem E., Vaglum P., Gronvold N., & Ekeberg, O. (2004). The process of suicidal planning among medical doctors: predictors in a longitudinal Norwegian sample. *Journal of Affective Disorders* 80, 191-198.
- Tysen, R., Dolatowski, F., Røvik, J., Thorkildsen, R., Ekeberg, O., Hem, E., Gude, T., Grønvold, N., & Vaglum, P. (2007). Personality traits and types predict medical school stress: a six-year longitudinal and nationwide study. *Medical Education*, 41, 781–787. DOI: 10.1111/j.1365-2923.2007.02802.x
- Wagnild, G., & Young, H. (1993). Development and psychometric evaluation of the Resilience Scale. *Journal of Nursing Measurement*, 1, 165-178.
- Whitlock, J., Muehlenkamp, J., Purington, A., et al. (2011). Nonsuicidal Self-injury in a College Population: General Trends and Sex Differences. *Journal of American College Health*, 59(8), 691-698.
- Whitlock, J., Eells, G, Cummings, N., & Purington, A. (2009). Nonsuicidal Self-Injury in College Populations: Mental Health Provider Assessment of Prevalence and Need. *Journal of College Student Psychotherapy*, 23(3), 172-183.
- Zimet, G., Dahlem, N., Zimet, S., & Farley, G. (1988). The Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, 52, 30–41.
- Zivin, K., Eisenberg, D., Gollust, S., & Golberstein, E. (2009). Persistence of mental health problems and needs in a college student population. *Journal of Affective Disorders*, 117, 180–185.