

32 Introduction

33 Non-suicidal self-injury (NSSI) and suicidal ideation (SI) have each been shown to confer
34 risk for suicidal attempts (SA; Ribeiro *et al.* 2016). NSSI, SI and SA are each also
35 characterised by many of the same underlying risk factors e.g. depression, anxiety and
36 substance abuse (Andover *et al.* 2012; Mars *et al.* 2014; Grandclerc *et al.* 2016; May &
37 Klonsky, 2016). Moreover, these experiences seem to be temporally associated. De Leo *et al.*
38 (2005) for example, showed that over 99% of suicide attempters planned their attempt or
39 experienced SI before their attempt and that over 50% of individuals who reported suicidal
40 ideation or behaviour experienced all levels of ‘less severe’ suicidal thoughts and behaviours
41 preceding their most severe experience (e.g. life not worth living, seriously considering
42 suicide). NSSI has also been found to prospectively predict elevated SI (Guan *et al.* 2012).
43 Kessler *et al.* (1999), analysing data from the National Comorbidity Survey, showed that
44 transition rates from ideator to planner, planner to attempter and ideator to unplanned
45 attempter were 34%, 72% and 26% respectively. Similar transition rates have also been
46 observed more recently in a large metropolitan Chinese sample (Lee *et al.* 2007). Cessation
47 of self-harm (SH) (regardless of intent) has also been shown to reduce risk for later suicidal
48 thoughts and behaviours (Koenig *et al.* 2017). Importantly however, these phenomena can be
49 distinct, they do not always precede or co-occur with one another. For example, SA has been
50 shown to occur in the absence of SI or suicide planning (Bertolote *et al.* 2005). It has been
51 suggested by some therefore that self-injurious thoughts and behaviours may exist on a
52 continuum of ‘suicidality’, anchored at one end by less severe experiences and the other by
53 SA (Stanley *et al.* 1992; Svetcic & De Leo, 2012). In general, a skewed distribution, of
54 related phenomena that decrease in frequency (SA occurs less frequently than SI) but
55 increase in severity (SA behaviours are associated with more extreme outcomes than SI), has
56 now been well established in a diverse range of samples (Scocco & De Leo, 2002; Bertolote
57 *et al.* 2005; Nock *et al.* 2008; Ghazinour *et al.* 2010).

58 Little known research however has considered a suicide continuum that extends
59 beyond these extreme thoughts and behaviours, to incorporate a much wider array of
60 ‘overlooked’ phenomena that may vary in severity, but may constitute risk for SH at lower
61 levels. We suggest that a wider, more inclusive range of threatening thoughts, and beliefs,
62 referred to here as negative self-evaluation (NSE), can be meaningfully incorporated within
63 the extant suicidality continuum framework. Evidence would suggest that NSE can manifest
64 in various forms such as e.g. low self-esteem, feelings of inadequacy, self-criticism, shame,
65 submissive behaviour, self-disgust and guilt (Brown *et al.* 2001; Gilbert *et al.* 2004; Gilbert *et al.*
66 *et al.* 2010; Gilbert, 2015). These self-reflective emotions and cognitions, which in turn
67 underpin motivation and behaviour, are commonly reflected in people’s self-evaluations,
68 particularly regarding their e.g. sense of self-worth, value, ability, and belonging, as well as
69 their beliefs about how they are perceived by others (Leary, 2007). More importantly, these
70 NSE concepts are strongly related to one another (Cheung *et al.* 2004; Gilbert *et al.* 2004;
71 Gilbert *et al.* 2010), and are commonly identified features of many suicide-related psychiatric
72 phenomena e.g. depression, complex posttraumatic stress disorder (CPTSD), borderline
73 personality disorder (BPD) and psychosis (Beck *et al.* 1979; Garety *et al.* 2001; Rüsck *et al.*
74 2007; American Psychiatric Association, 2013; Maercker *et al.* 2013; Zahn *et al.* 2015;
75 World Health Organization, 2018). They have also been shown to characterise those at
76 greater risk for SI (Goodwin & Marusic, 2003; Creemers *et al.* 2012; Byran *et al.* 2013), and

77 SH and SA (Fazaa & Page, 2003; Goodwin & Marusic, 2003; O'Connor, 2007; Gilbert *et al.*
78 2010; Forrester *et al.* 2017).

79 We propose therefore that, if modelled together, NSE indicators and established
80 suicidality continuum indicators (SI, SH) will reveal an ordered, hierarchical, dimensional
81 structure that more accurately and broadly captures the spectrum of suicide risk that exists in
82 the general population. We also propose that this broader dimensional representation of risk
83 will manifest at lower or higher levels for distinct groups within the population and that the
84 'level' of suicidality expressed by these groups will in turn reveal variation in the proposed
85 underlying continuum. We propose too, that a range of established suicidality risk and
86 outcome variables will meaningfully validate this extended continuum. It is our expectation
87 that an NSE inclusive continuum will potentially afford greater and more valuable
88 opportunities for clinicians to identify suicide risk and intervene at the earliest possible time.
89 To the authors' knowledge, this is the first consideration and attempt to test an extended
90 suicidality continuum and we believe that exploitation of existing population data coupled
91 with sophisticated mixture modelling analysis affords a prudent framework to make an initial
92 investigatory step.

93

94

95 **Method**

96 *Sample*

97 The second British Psychiatric Morbidity Survey (BPMS) was a large-scale epidemiological
98 study conducted by the Office of National Statistics in 2000. The sample was designed to be
99 representative of the adult population, aged 16-74, living in private households in Britain and
100 its main aim was to estimate the prevalence and correlates of mental health problems. A
101 multistage, stratified sampling design was adopted using the small user Postcode Address
102 File (PAF), which yielded a total of 15,804 addresses. These addresses were visited by
103 interviewers to identify households with at least one adult age 16-74 and one adult within
104 each household was selected for interview using the Kish grid method.

105 Phase one assessment interviews were conducted which screened for the presence of
106 mental disorders, risk factors, service use and sociodemographic variables. These interviews
107 were successfully conducted with 8,580 adults (45% male, 55% female). Mean age was 45.37
108 ($SD = 15.61$) years. The majority of the sample were White (94%), with small proportions of
109 Black (2%), Indian/Pakistani/Bangladeshi (2%) and other ethnic group respondents (2%).
110 Details of the survey method are available (Singleton *et al.* 2001).

111 *Measures*

112 *Negative self-evaluation*

113 To examine whether a continuum of negative self-evaluation existed in the general
114 population, a pool of NSE items was generated. The BPMS was screened for appropriate
115 items and item selection was based on whether the item was considered to have a meaningful
116 negative self-evaluative component which could not be solely attributed to context or
117 situation. Appropriate items were located in the sections which screened for neurotic
118 disorders (assessed using the Clinical Interview Schedule-Revised, CIS-R; Lewis *et al.* 1992),
119 personality disorders (assessed using the self-completion version of the Structured Clinical

120 Interview for DSM-IV Axis 2, SCID-II; First *et al.* 1997) and deliberate self-harm. Only
 121 items which were available to the entire sample were utilised (i.e. screener linked items were
 122 not used).

123 In total, 14 items were identified on the basis of the criteria (see Table 1). One item
 124 was taken from the ‘Depression’ section of the questionnaire, four from the ‘Deliberate Self-
 125 Harm’ section and nine items were included from the ‘Personality Disorder’ section. All of
 126 these items were believed to reflect aspects such as negative self-concept, low self-esteem,
 127 subordination, worthlessness, SI and SH. All items were recoded as yes (1) or no (0).
 128 Responses of ‘does not apply’ relating to the personality disorder questions were recoded and
 129 treated as missing data.

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131 *Risk variables*

132 A number of variables were used to both predict class membership and to evaluate class
 133 membership outcomes.

134 *Sociodemographic:* Age, sex (male, female), ethnicity (white, non-white), annual income
 135 (<£5,199; £5,200-£15,599; £15,600-£33,799; >£33,800), employment (employed,
 136 unemployed), area (semi-rural/rural, urban) and relationship status (couple, not in couple).

137 *Substance use:* Drink problem and drug dependence.

138 *Adversities:* Several adverse and traumatic events were included as risk variables. These
 139 were: experiencing serious illness, injury or assault, separation or divorce, being sacked or
 140 made redundant, looking for work unsuccessfully for more than one month, having a major
 141 financial crisis, having a problem with the police involving a court appearance, being bullied,
 142 experiencing violence at work, violence at home, sexual abuse, running away from home and
 143 being homeless.

144 *Diagnostic variables:* A selection of psychiatric diagnoses were used as risk and outcome
 145 variables. Presence of panic disorder, generalised anxiety disorder (GAD), obsessive
 146 compulsive disorder (OCD), specific phobia and social phobia were determined on the basis
 147 of CIS-R responses. Individuals who screened positive for psychosis in the initial interview
 148 were invited for a follow-up clinical interview to determine presence of a clinical psychotic
 149 disorder. The majority of these individuals took part in the follow-up interview and this
 150 information was used to generate a psychotic disorder diagnosis variable. Individuals who did
 151 not screen positive for psychosis in the initial interview were not believed to have a psychotic
 152 disorder. Details on the selection process for the follow-up interview are available (Singleton
 153 *et al.* 2001). These diagnostic variables were combined to form an ‘Any Diagnosis’ variable.
 154 Diagnoses of depression and mixed depression and anxiety (MAD) were not accounted for
 155 given that a screener for depression was used as one of the NSE items.

156 *Suicide attempt:* Lifetime suicide attempt was used as an outcome variable.

157 *Analytic plan*

158 Latent variable modelling was conducted in four main stages. First, as there is no existing
 159 theoretical framework describing NSE in the context of the suicidality continuum,
 160 exploratory factor analysis (EFA) was first employed to explore and identify the dimensional
 161 structure of NSE using the selected items. The full BPMS dataset was randomly split into two
 162 sub-samples, each containing approximately 50% of the survey respondents. The fit of six

163 models (a 1-factor through a 6-factor model) was assessed using EFA (oblique rotation) on
164 one of the randomly generated subsamples. Second, confirmatory factor analysis (CFA) was
165 used to test the validity of the best EFA generated model on the remaining subsample. A
166 CFA model was then specified and estimated using the entire sample data to test whether the
167 model held for the full sample. Third, after establishing the underlying dimensional structure
168 of NSE using CFA, it was important to also test the best fitting model against a
169 unidimensional (all items loading on one factor) and a second-order factor model (established
170 factors loading onto a general higher-order factor), also using the full data to ensure that NSE
171 was modelled as accurately as possible. Finally, Factor Mixture Modelling (FMM) was used
172 to identify the fewest groups of individuals who shared the same profile of variation across
173 the established dimensions of NSE. FMMA is a sophisticated hybrid modelling technique
174 which combines latent class analysis with FA (Lubke & Muthén, 2007). In FMMA,
175 individuals are grouped into classes and once classified, variation within the class is able to
176 be modelled continuously (Clark *et al.* 2013). This can allow for better representation of the
177 dimensionality of a psychological structure (Clark *et al.* 2013). Eight models were specified
178 and tested. All models were specified and estimated using Mplus version 7.4 (Muthén &
179 Muthén, 1998-2015) with the appropriate weighting variable. Weighted least squares means
180 and variance adjusted (WLSMV) estimation was employed for the FAs and robust maximum
181 likelihood estimation (Yuan & Bentler, 2000) was used for the FMMA. In order to avoid
182 solutions based on local maxima, 100 random sets of starting values were initially used, with
183 10 final stage optimisations.

184 The goodness of fit of each model in the FAs was assessed using a series of fit
185 statistics: the chi-square statistic, the comparative fit index (CFI; Bentler, 1990) the Tucker-
186 Lewis index (TLI; Tucker & Lewis, 1973) and the root mean square error of approximation
187 (RMSEA; Steiger, 1990). Based on recommendations for parameters of acceptable model fit
188 (Hoyle & Panter, 1995; Hu & Bentler, 1999), a non-significant chi-square, values greater
189 than 0.95 for the CFI and TLI and a value of less than 0.05 for the RMSEA indicated good
190 model fit. Additionally, the standardized root mean square residual (SRMR; Joreskog &
191 Sorbom, 1981) and the weighted root mean residual (WRMR) were estimated. It is
192 recommended that the SRMR is close to or below 0.08 (Hu & Bentler, 1999) and for the
193 WRMR, values closer to 1 indicate better fit (Yu, 2002). The relative fit of the FMMA
194 models was compared by using three information theory-based fit statistics: the Akaike
195 information criterion (AIC; Akaike, 1987), the Bayesian information criterion (BIC; Schwarz,
196 1978) and the sample size-adjusted Bayesian information criterion (ssa-BIC; Sclove, 1987).
197 The model that produced the lowest values was judged to be the best fitting model. However,
198 the BIC is considered to be the best of the fit indices tests in for deciding the number of
199 classes in FMMA (Nylund *et al.* 2007). The Vuong-Lo-Mendell-Rubin likelihood ratio test
200 (LRT; Lo *et al.* 2001) can also be used to determine class enumeration. When the LRT
201 becomes non-significant it suggests the model with one less class is a better fit of the data. In
202 addition to the fit statistics, it is important to take into consideration the theoretical and
203 conceptual relevance of the factors and latent classes when interpreting the results.

204 A series of regression analyses was then conducted. First, a multinomial logistic
205 regression analysis was carried out to assess whether the sociodemographic, substance use,
206 adversities and diagnostic risk variables could discriminate between class memberships of the
207 best-fitting FMM. Next, multivariate logistic regression analyses were used to investigate
208 whether class membership predicted (i) individual diagnostic outcomes and (ii) SA history.

209

210 **Results**

211 The endorsement rates for these NSE items ranged from 42% (depression item) to 2% (NSSI
 212 item; see Table 1). All inter-item correlations were significant at the 0.01 level, ranging from
 213 0.046 to 0.721; as correlations were below +/- .90 multicollinearity and singularity were not
 214 considered issues.

215 [Table 1 near here]

216 *Preliminary factor analyses (EFA & CFA 50% of data)*

217 Based on the results of the EFA (50% of the data), the 1-, 2- and 3-factor models were
 218 rejected. Both the 4- and 5-factor models were judged to have good fit, although the 5-factor
 219 model had a slightly better fit based on the fit index guidelines (Hu & Bentler, 1999). CFA
 220 was then performed on the remaining 50% of the data in an attempt to validate the results of
 221 the EFA and to compare the 4- and 5- factor models. The 'Hurt' item substantially cross-
 222 loaded in both models and was therefore removed before conducting the CFA. The 4-factor
 223 model was deemed to be marginally better than the 5-factor model in the CFA. Furthermore,
 224 the extremely high correlation between factors 4 and 5 (.95) in the 5-factor model was a
 225 cause for concern, suggesting that these two dimensions should not be separate.

226 *Confirmatory factor analyses (100% of data)*

227 The best fitting CFA model (4-factor model) was then specified and estimated using 100% of
 228 the data. This model was tested against (i) the 5-factor model (ii) a unidimensional (all items
 229 loading on one factor) and (iii) a second-order factor model (established factors loading onto
 230 a general higher-order factor). Table 2 outlines the factor loadings and fit indices for the
 231 competing CFA models on the full data.

232 [Table 2 near here]

233 Similar to the preliminary findings, the 4-factor model provided the best-fitting, most
 234 parsimonious representation of the full data. Both the factor loadings and the fit statistics
 235 indicated excellent model fit. Factor correlations ranged between 0.47 and 0.71. In this
 236 model, 3 items loaded onto Factor 1 (F1) which seemed to reflect a traditional depression
 237 dimension; 2 items loaded onto Factor 2 (F2) which reflected SH behaviour; 5 items loaded
 238 onto Factor 3 (F3) which was interpreted as low self-worth and feelings of subordination and
 239 the final factor (F4) contained 3 items relating to suicidal thoughts/SI.

240 *Factor mixture modelling analyses*

241 The fit indices for the FMMs are shown in the online supplementary material (Table 1-OS).
 242 They indicated that the AIC, BIC and ssaBIC continued to decrease from the 2-Class model
 243 through to the 8-Class model. The LRT however became non-significant in the 8-class
 244 model, suggesting that the model with one fewer class should be accepted. Therefore, the 7-
 245 class solution, which had an acceptable entropy value (.734) was accepted as the best fitting
 246 model (Figure 1).

247 [Figure 1 near here]

248 Class 1 was the smallest class (1.7%) and had elevated probabilities across all four
 249 dimensions and was the only class to be characterised by SH; Class 2 (6.7%) had elevated
 250 probabilities on the low self-worth, depression and SI factors (F3, F1 and F4); Class 3 (9.7%)
 251 was characterised by depressed mood and SI (F1 and F4); Class 4 (4.0%) reflected a group of
 252 people high on the low self-worth and depression dimensions (F3 and F1); Class 5 (13.9%)

253 was the second largest class characterised only by low self-worth (F3); Class 6 (8.7%) was
 254 characterised by elevated probabilities on the depression dimension only (F1); and finally,
 255 Class 7 was the largest class made up of over half of the sample which represented a baseline
 256 class which was not characterised by NSE. Across all classes that showed an elevated
 257 probability on the low self-worth dimension, this was more pronounced for the items relating
 258 to worrying about criticism and feeling inferior to others compared to the other items in this
 259 dimension.

260 *Risk factors*

261 Odds ratios (ORs) for the sociodemographic, substance use, adversity and diagnosis variables
 262 predicting FMM class membership are shown in the online supplementary material (see
 263 Table 2-OS). In general, there was a tendency for the more severe classes (1, 2 and 3) to have
 264 higher ORs, although there was variability throughout. Of the sociodemographic variables,
 265 younger age had some of the strongest ORs, especially for the more severe classes (1 and 2).
 266 The trend for the substance use variables was somewhat more difficult to interpret as the
 267 more severe classes did not always necessarily seem to reflect greater risk, however, the
 268 highest ORs were associated with Class 1. Again, there was variability with the trauma and
 269 adversity variables. The highest ORs were associated with Class 1 and bullying was the only
 270 trauma variable to be consistently related to all classes. Similarly, the diagnosis variable was
 271 also significantly associated with all classes, however most notably with Class 1.

272 *Diagnostic and suicide attempt outcomes*

273 Multivariate logistic regression was then conducted using a range of diagnoses as outcome
 274 variables (Table 3). Significant associations emerged between all classes and diagnoses,
 275 except Class 5 with panic disorder and psychosis and Class 4 with psychosis. Again, higher
 276 ORs were evident for the more severe classes. Particularly strong ORs (>100) were observed
 277 for social phobia and Classes 1, 2 and 4; OCD and Classes 1 and 2; and Psychosis and Class
 278 1.

279 [Table 3 near here]

280 Compared to the baseline class, lifetime suicide attempt was associated with Classes
 281 1, 2, 3 and 6. ORs were extremely elevated for Class 1 compared to the other classes.
 282 However, Classes 2 and 3, which were characterised in part by suicidal ideation also had
 283 elevated ORs (Table 4).

284 [Table 4 near here]

285 **Discussion**

286 The purpose of this study was to integrate concepts of NSE into the existing suicidality
 287 continuum and to use a series of robust analytic techniques to investigate the viability of this
 288 extended construct. A series of factor analyses indicated that a correlated 4-factor model,
 289 encapsulating feelings of low self-worth and subordination, depression, SI and SH constituted
 290 the best representation of the population data. Factor correlations in this model ranged from
 291 0.47-0.71. The factors which were theorised to lie next to one another on the proposed
 292 continuum had the strongest relationships; the low self-worth factor correlated highly the
 293 depressive factor, as did the depression and SI factors, and the SI and SH factors. The results
 294 of the FMMA further supported an extended continuum framework, with 7 classes of graded

295 severity emerging from the data. Class composition suggested the presence of distinct groups
 296 that captured variation in ‘internal threat’ from less severe NSE experiences to the most
 297 severe suicidality related beliefs and behaviours. Furthermore, almost 45% of the sample
 298 were elevated on at least one NSE dimension, meaning that this was not just relevant to a
 299 small minority. Of note, only one class emerged which was characterised by SH; this class
 300 was the smallest but was also the Class with the highest endorsement probabilities across all
 301 NSE items.

302 A series of recent studies have highlighted the complex relationships between suicidal
 303 thoughts and behaviours. Zhang *et al.* (2017) investigated the pathways from negative
 304 emotion (e.g. depression and anxiety) to suicidal behaviours. They found negative emotion to
 305 be both directly linked to SI and indirectly through NSSI. Additionally, negative emotion was
 306 indirectly linked to a suicide attempt through both NSSI and SI. Similarly, NSSI has also
 307 been reported as a partial mediator between depression and suicidal risk, with depression also
 308 having a direct relationship to suicidal risk (Kang *et al.* 2018). These studies support a
 309 ‘graduation’ hypothesis from less to more severe experiences. Although the current study
 310 cannot infer temporal ordering, it similarly suggests that individuals in the classes
 311 characterised by experiences at the lower end of the continuum have the potential to
 312 transition or ‘graduate’ to increasingly severe experiences. Nevertheless, this is not a one-
 313 size-fits-all model. Not all individuals who die by suicide will have had this consecutive
 314 chain of experiences.

315 The findings reported here are preliminary and replication will be needed to further
 316 substantiate the model, however, the extended continuum that we have proposed does
 317 perform well against established criteria used to evidence the existence of continua in the
 318 population (see van Os *et al.* 2009 seminal systematic review and meta-analysis of the
 319 psychosis continuum). Consistent with van Os’ criteria, our results suggest that an extended
 320 suicidality continuum demonstrates (i) psychopathological validity: similar patterns of
 321 comorbidity among classes; (ii) demographic and aetiological validity: shared demography
 322 and risk among classes, and (iii) distributional validity: a half-normal distribution was
 323 present. Epidemiological validity was also partially supported; this refers to the distribution
 324 of the construct relevant to the underlying theory. A logical assumption of an extended
 325 suicidality continuum would be that NSE features, at the lower end, would be more prevalent
 326 than NSSI, SI features at the higher end of the continuum; feelings of sadness/depressed
 327 mood, worry about criticism and rejection and feelings inferiority in the current analyses
 328 were endorsed most frequently (over 25% of respondents) while, as expected, the most
 329 extreme SH items were rarer (2-3%). However, notably, the SI items were endorsed more
 330 frequently than some of the low self-worth items. Importantly, beyond the use of the SA
 331 variable, predictive validity could not be inferred; further prospective research will be needed
 332 to understand class transitions over time.

333 **Risk Factors**

334 Although not consistent across all variables, there was a general trend for risk factors to be
 335 most strongly associated with the SH class (Class 1), followed by the two classes
 336 characterised by SI (Classes 2 & 3). This incremental effect was suggestive of a continuum of
 337 experiences. Furthermore, differences between the SH class and the other classes appeared to
 338 be quantitative rather than qualitative in nature. This is similar to Nock *et al.* (2008) who

339 found that sociodemographic and mental disorder risk factors varied in magnitude rather than
340 type among suicide ideators, planners and attempters in their international study. Sexual
341 abuse and bullying were particularly relevant to NSE class membership in the current study.
342 Sexual abuse and bullying have both been found to be associated with SH and SI (Holt *et al.*
343 2015; Mossige *et al.* 2016) and it has been suggested that SH may be a maladaptive coping
344 mechanism used to alleviate distress (Zlotnick *et al.* 1996; Klonsky, 2007). Less severe NSE
345 experiences such as feelings of worthlessness are also influential in trauma-suicidal
346 behaviour (Jeon *et al.* 2014). Moreover, consistent with the broader literature, interpersonal
347 traumas (such as sexual abuse and bullying), compared to non-interpersonal traumas are more
348 associated with BPD (Westphal *et al.* 2013) and CPTSD (Cloitre *et al.* 2013) which are both
349 characterised by NSE and SH features.

350 ***Psychiatric Diagnoses and SA***

351 Strong associations were observed between the NSE classes and the psychiatric diagnoses.
352 Even classes characterised by the milder manifestations of internal threat only (e.g. Class 4)
353 presented risk of a psychiatric disorder on par with some of the more severe classes (e.g.
354 Class 2). These findings also support the literature showing that negative self-concepts are
355 not specific to depression, BPD or CPTSD, where they are often central to diagnostic
356 formulation. Rather, they are present across a spectrum of psychopathology and are seen in a
357 range of mental health problems including eating disorders (Cooper & Turner, 2000; Stein &
358 Corte, 2007), social anxiety (Clark, 2001) and psychosis (Bentall *et al.* 1994; Garety *et al.*
359 2001). NSE therefore is unlikely to be diagnostic specific but may instead be transdiagnostic,
360 a relevant construct for psychopathology more generally.

361 SA acted, in part, as a validator for the proposed extended continuum as it represented
362 the most extreme and severe outcome that could be considered for internal threat behaviour.
363 Its association (or lack thereof), with each of the classes, indicated that while SA may be
364 strongly associated with the most severe profiles of NSE, it is not likely to be an outcome for
365 all who occupy positions on the proposed continuum. There seemed to be a notable risk that
366 was specifically relevant for those who were/had actively engaged in SH behaviour. Those
367 who entertained thoughts of suicide but who did not SH also exhibited significantly elevated
368 risk of SA. Moreover, significant risk was also present for Class 6 (depression only); this was
369 an interesting finding as Class 4 (low self-worth and depression) did not exhibit risk of SA.

370 **Limitations**

371 Despite the large general population sample and robust analytic methodology, some
372 limitations must be acknowledged. First and foremost, the use of cross-sectional data did not
373 afford opportunities to test the temporal and transitional assumptions that were proposed.
374 This study was preliminary in nature, assessing whether the existence of such a continuum
375 was conceivable; as aforementioned, future research using prospective data will be needed to
376 demonstrate that individuals who occupy the lower end of the proposed continuum are also at
377 risk of transitioning through the continuum. Moreover, the current models were tested on a
378 single sample, and will require replication. Due to the constraints of working with secondary
379 data, only NSE-related items which were available in the dataset were utilised. Therefore,
380 incorporation of a broader selection of negative self-evaluative concepts, to more accurately
381 model the extended continuum and understand its associated risks and outcomes over time, is
382 also advised. The diagnoses of depression and MAD were not included as part of the

383 combined diagnosis variable or as individual diagnostic outcomes given that the NSE items
384 contained a screener question for depression. This meant that these relationships could not be
385 analysed. As previously stated, the suicidality continuum model does not align with every
386 individuals' experiences and not all research corroborates this continuum hypothesis (e.g. De
387 Leo *et al.* 2005; Dhingra *et al.* 2016). Likewise, we do not posit that the extended continuum
388 is experienced universally.

389 **Conclusion**

390 Low self-worth and subordination, and depression, while representative of distinct groups in
391 the population, are also highly prevalent in those who entertain suicidal thoughts and engage
392 in SH behaviour. A suicidality continuum therefore may extend beyond the most extreme
393 thoughts and behaviours and incorporate a much wider array of phenomena that may vary in
394 severity, and may constitute a broader NSE spectrum. Challenging NSE therefore may be a
395 fruitful avenue for therapeutic interventions that aim to reduce psychological distress, limit
396 suicidal ideation, and prevent self-harming behaviour and death by suicide.

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398 **Declaration of Interest**

399 None.

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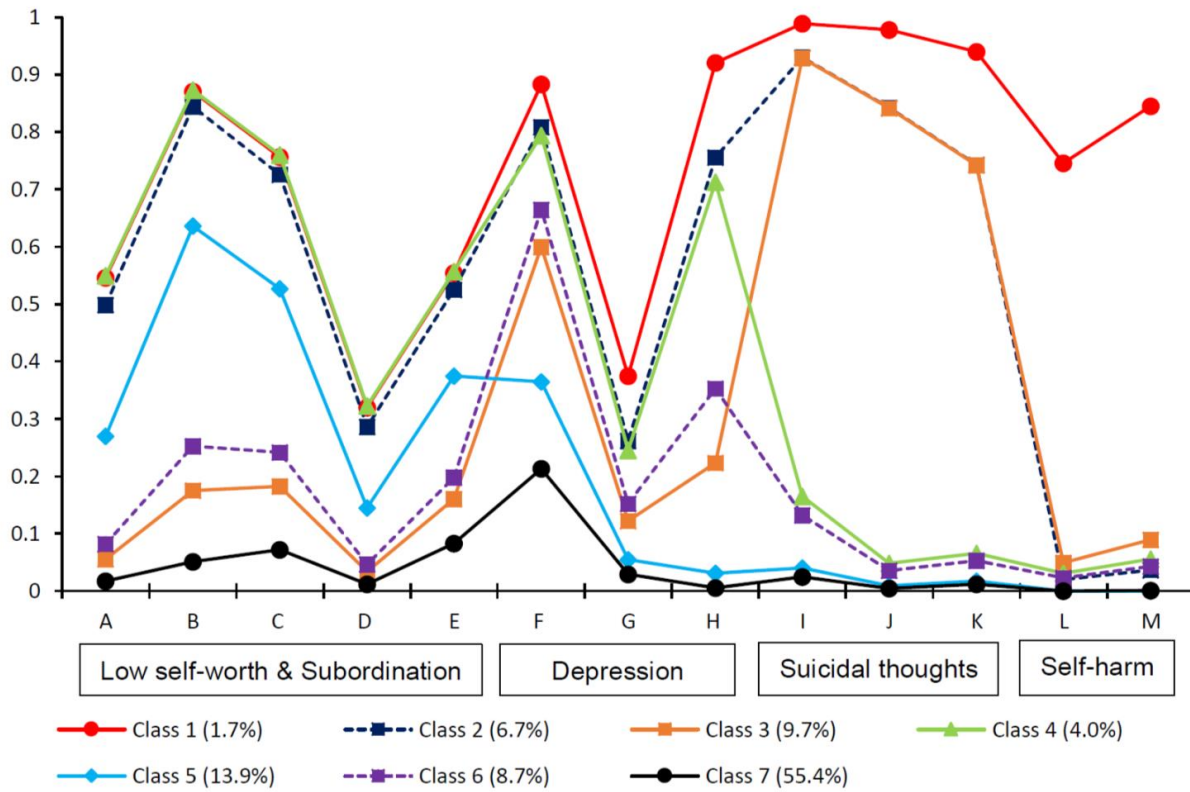
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634 **Figure 1.** FMMA 7-class model profile plot displaying class response probabilities to NSE items

635 A Involvement; B Criticism; C Inferior; D Reassurance; E Disagree; F Depressed; G Uncomfortable; H Empty;

636 I Not worth living; J Wish dead; K Suicidal ideation; L Non-suicidal self-injury; M Self-harm

637 *Note:* For a colour version, see this figure online.

Table 1. Frequency of negative self-evaluation items in the BPMS ($N = 8,580$)

Item	Label	N (%)
Have you had a spell of feeling sad, miserable or depressed in the past month?	Depressed	3581 (41.7)
Do you often worry about being criticised or rejected in social situations?	Criticism	2329 (27.1)
Do you believe that you're not as good, smart, or as attractive as most other people?	Inferior	2179 (25.4)
Have you ever felt that life was not worth living?	Not worth living	1911 (22.3)
Do you find it hard to disagree with people even when you think they are wrong?	Disagree	1754 (20.4)
Do you often feel empty inside?	Empty	1506 (17.6)
Have you ever wished that you were dead?	Wish dead	1465 (17.1)
Have you ever thought of taking your life, even if you would not really do it?	SI	1380 (16.1)
Do you avoid getting involved with people unless you are certain they will like you?	Involvement	1102 (12.8)
Do you usually feel uncomfortable when you are by yourself?	Uncomfortable	742 (8.6)
Have you tried to hurt or kill yourself or threatened to do so?	Hurt	685 (8.0)
Do you need a lot of advice or reassurance from others before you can make everyday decisions?	Reassurance	613 (7.1)
Have you ever cut, burned, or scratched yourself on purpose?	SH	271 (3.2)
Have you ever deliberately harmed yourself in any way but not with the intention of killing yourself?	NSSI	200 (2.3)

SI Suicidal ideation; *SH* Self-harm; *NSSI* Non-suicidal self-injury

Table 2. Factor loadings, factor correlations and fit indices for the unidimensional, 4-factor, 5-factor and second-order models in the CFA ($N = 8,580$)

Item	1-Factor	4-Factor				5-Factor					Second-Order			
	F1	F1	F2	F3	F4	F1	F2	F3	F4	F5	F1	F2	F3	F4
Depressed	.538	.628					.637				.633			
Uncomfortable	.454	.529								.565	.526			
Empty	.742	.919					.936				.916			
NSSI	.826		.958					.958				.962		
SH	.796		.934					.934				.930		
Involvement	.588			.748						.757			.748	
Criticism	.619			.812					.820				.813	
Inferior	.564			.726					.732				.726	
Reassurance	.495			.642						.648			.640	
Disagree	.398			.528						.531			.526	
Not worth living	.942				.960	.960								.960
Wished dead	.963				.974	.974								.975
SI	.907				.933	.933								.933
Second-order factor loadings												F1=.960; F2=.801		
												F3=.669; F4=.751		
Fit indices														
χ^2	3450.326		236.964				261.217					428.677		
Df	65		59				55					61		
P	0.000		0.000				0.000					0.000		
CFI	0.942		0.997				0.996					0.994		
TLI	0.930		0.996				0.995					0.992		
RMSEA	0.078		0.019				0.021					0.027		
WRMR	5.865		1.352				1.396					1.906		
4-Factor model correlations			F2	F3	F4									
		F1	0.62	0.71	0.71									
		F2		0.47	0.70									
		F3			0.47									

SI Suicidal ideation; SH Self-harm; NSSI Non-suicidal self-injury; χ^2 Likelihood ratio chi-square; CFI Comparative fit index; TLI Tucker Lewis Index; RMSEA Root mean standard error of approximation; WRMR Weighted root mean square residual.
 Note: all factor loadings and factor correlations are statistically significant ($p < 0.001$)

Table 3. Multivariate logistic regression with diagnoses as outcomes ($N = 8,580$)

Class	OR (95% CI)					
	Panic disorder	GAD	OCD	Psychosis	Specific phobia	Social phobia
1	9.10 (2.64-31.41)***	28.00 (17.09-45.89)***	107.62 (35.24-328.66)***	121.35 (22.84-644.76)***	67.04 (25.32-177.48)***	573.01 (127.15-2582.32)***
2	11.53 (4.91-27.07)***	24.45 (17.04-35.08)***	115.29 (42.97-309.37)***	31.86 (5.66-179.47)***	32.98 (13.84-78.63)***	217.97 (50.82-934.97)***
3	7.05 (2.82-17.63)***	8.02 (5.41-11.87)***	24.36 (8.07-73.55)***	25.98 (5.15-131.15)***	10.39 (3.88-27.82)***	28.82 (5.34-155.45)***
4	11.28 (4.22-30.17)***	14.08 (9.17-21.62)***	45.13 (14.86-137.09)***	8.69 (0.75-100.41)	22.71 (8.33-61.94)***	111.78 (24.31-514.04)***
5	2.50 (0.94-6.63)	3.07 (1.97-4.78)***	3.89 (1.04-14.49)*	2.59 (0.22-29.87)	5.30 (1.86-15.13)**	9.72 (1.34-70.46)*
6	6.14 (2.42-15.59)***	7.92 (5.31-11.81)***	24.27 (8.15-72.27)***	9.20 (1.23-69.06)*	4.10 (1.23-13.72)*	26.57 (4.73-149.40)***

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

Table 4. Multivariate logistic regression with suicide attempt as outcome ($N = 8,580$)

Class	OR (95% CI)
1	2743.87 (968.94-7770.15)***
2	346.51 (127.49-941.75)***
3	326.95 (120.97-883.67)***
4	3.50 (0.39-31.42)
5	2.99 (0.67-13.39)
6	16.15 (5.05-51.64)***

*** $p < .001$

Online Supplement (OS): Table 1-OS Fit indices for factor mixture models (FMMs) ($N = 8,580$)

Model	Log-likelihood	Par.	AIC	BIC	ssaBIC	LRT (p)	Entropy
2	-39160.802	27	78375.603	78566.147	78480.346	-45144.722 (0.0000)	.895
3	-37930.012	32	75924.023	76149.853	76048.163	-39160.802 (0.0000)	.798
4	-37269.243	37	74612.486	74873.602	74756.022	-37930.012 (0.0000)	.813
5	-37138.709	42	74361.148	74657.820	74524.351	-37269.243 (0.0000)	.827
6	-37030.889	47	74155.777	74487.465	74338.108	-37154.287 (0.0000)	.790
7	-36926.200	52	73956.400	74323.374	74158.127	-37030.889 (0.0001)	.734
8	-36846.718	57	73807.436	74209.696	74028.560	-36926.200 (0.5031)	.746

Par., Number of free parameters; AIC, Akaike information criterion; BIC, Bayesian information criterion; ssaBIC, Sample size adjusted BIC; LRT, Vuong-Lo-Mendell-Rubin likelihood ratio test

OS: Table 2-OS Predictors of NSE class membership (Class 7 reference class (baseline NSE)) (*N* = 8,580)

Predictors	OR (95% CI)					
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
Sociodemographic						
Female	2.60 (1.62-4.16)***	2.44 (1.91-3.11)***	2.39 (1.96-2.92)***	1.96 (1.48-2.60)***	1.77 (1.51-2.08)***	1.34 (1.11-1.63)**
Age ^a <24	15.88 (5.09-49.57)***	3.50 (2.10-5.83)***	1.00 (0.65-1.55)	2.57 (1.52-4.36)***	1.50 (1.09-2.05)*	0.95 (0.65-1.39)
25-34	10.54 (3.53-31.43)***	3.74 (2.39-5.87)***	1.45 (1.03-2.04)*	1.42 (0.86-2.34)	1.38 (1.06-1.80)*	1.07 (0.78-1.47)
35-44	5.27 (1.72-16.15)**	3.97 (2.54-6.21)***	1.78 (1.28-2.48)***	1.99 (1.23-3.22)**	1.52 (1.17-1.97)**	1.11 (0.81-1.52)
45-54	2.35 (0.72-7.67)	3.00 (1.90-4.73)***	1.93 (1.39-2.69)***	1.67 (1.02-2.74)*	1.36 (1.04-1.78)*	1.05 (0.76-1.45)
55-64	0.80 (0.19-3.32)	2.49 (1.59-3.88)***	1.51 (1.10-2.08)*	1.57 (0.98-2.51)	0.91 (0.70-1.18)	1.10 (0.82-1.47)
Non-white ethnicity	0.31 (0.11-0.84)*	0.57 (0.35-0.92)*	1.07 (0.76-1.52)	1.59 (1.04-2.43)*	1.09 (0.82-1.45)	1.24 (0.88-1.74)
Income ^b <£5,199	1.87 (0.52-6.73)	3.05 (1.63-5.71)***	0.98 (0.66-1.45)	2.47 (1.21-5.02)*	2.30 (1.62-3.27)***	2.16 (1.37-3.40)***
£5,200-£15,599	2.04 (0.60-6.96)	2.50 (1.37-4.57)**	1.14 (0.80-1.63)	2.14 (1.09-4.22)*	1.82 (1.31-2.53)***	1.89 (1.24-2.88)**
£15,600-£33,799	0.65 (0.17-2.52)	1.63 (0.88-3.02)	1.02 (0.71-1.47)	1.42 (0.71-2.86)	1.52 (1.09-2.12)*	1.53 (1.00-2.35)
Unemployed	1.89 (1.19-3.00)**	1.28 (1.00-1.64)	1.28 (1.03-1.60)*	1.26 (0.93-1.69)	0.85 (0.71-1.03)	1.03 (0.82-1.29)
Rural area	1.04 (0.67-1.59)	1.11 (0.90-1.36)	1.02 (0.86-1.22)	1.05 (0.82-1.35)	0.99 (0.86-1.14)	0.96 (0.81-1.15)
Not in a couple	1.61 (1.06-2.45)*	1.79 (1.45-2.22)***	1.63 (1.36-1.94)***	1.38 (1.06-1.78)*	0.97 (0.83-1.13)	1.71 (1.43-2.04)***
Substance use						
Drink problem	1.78 (1.18-2.69)**	1.08 (0.85-1.37)	1.29 (1.06-1.57)*	1.55 (1.18-2.03)**	1.04 (0.88-1.23)	1.16 (0.95-1.42)
Drug dependence	3.11 (1.71-5.65)***	1.60 (0.97-2.63)	2.34 (1.54-3.57)***	1.47 (0.80-2.68)	0.82 (0.48-1.40)	2.13 (1.36-3.33)***
Adversities						
Illness, injury or assault	2.73 (1.81-4.11)**	1.52 (1.23-1.89)***	1.49 (1.24-1.78)***	1.04 (0.79-1.37)	1.07 (0.91-1.26)	1.23 (1.02-1.48)*
Divorce or separation	1.58 (1.04-2.42)*	1.36 (1.10-1.70)**	1.75 (1.47-2.10)***	1.19 (0.91-1.55)	0.99 (0.84-1.16)	1.37 (1.14-1.65)***
Sacked or made redundant	1.31 (0.84-2.03)	1.20 (0.95-1.51)	1.27 (1.05-1.53)*	0.90 (0.68-1.20)	1.09 (0.92-1.28)	0.88 (0.72-1.08)
Out of work >1 month	2.12 (1.38-3.25)***	1.25 (0.98-1.59)	1.41 (1.15-1.73)***	1.26 (0.94-1.69)	1.15 (0.96-1.38)	1.03 (0.83-1.28)
Major financial crisis	1.37 (0.84-2.25)	1.86 (1.42-2.44)***	1.56 (1.23-1.96)***	1.27 (0.89-1.82)	0.96 (0.76-1.23)	1.28 (0.98-1.67)
Problems with the law	1.09 (0.64-1.85)	1.16 (0.83-1.61)	1.15 (0.87-1.51)	1.00 (0.65-1.54)	0.99 (0.75-1.31)	0.93 (0.68-1.28)
Bullying	2.54 (1.68-3.84)***	2.23 (1.76-2.82)***	2.37 (1.94-2.90)***	2.33 (1.75-3.09)***	1.54 (1.28-1.86)***	1.71 (1.37-2.13)***
Violence at work	0.61 (0.27-1.40)	0.85 (0.53-1.37)	1.08 (0.74-1.57)	0.93 (0.52-1.66)	0.71 (0.47-1.08)	1.16 (0.77-1.74)
Violence at home	1.57 (0.97-2.54)	1.80 (1.33-2.43)***	1.39 (1.05-1.83)*	1.95 (1.33-2.84)***	0.99 (0.72-1.36)	1.21 (0.87-1.68)
Sexual abuse	5.39 (3.06-9.50)***	4.28 (2.86-6.41)***	2.93 (1.98-4.34)***	1.64 (0.91-2.94)	1.58 (1.00-2.50)*	1.61 (0.97-2.67)
Runaway from home	3.27 (2.00-5.32)**	1.94 (1.35-2.79)***	1.82 (1.30-2.54)***	1.27 (0.78-2.07)	1.10 (0.75-1.61)	1.24 (0.82-1.88)
Homeless	2.16 (1.23-3.79)**	1.52 (1.02-2.29)*	1.80 (1.26-2.58)***	1.56 (0.93-2.63)	0.97 (0.61-1.53)	0.91 (0.56-1.48)
Psychiatric Diagnoses						
Any disorder ^c	26.27 (16.44-41.99)***	13.72 (9.99-18.84)***	4.54 (3.25-6.34)***	13.55 (9.48-19.37)***	2.65 (1.84-3.80)***	6.48 (4.66-9.03)***

Note. * *p* < .05, ** *p* < .01, *** *p* < .001. Reference categories: ^a>65, ^b>£33,800. ^cAny disorder variable includes panic disorder, GAD, OCD, specific phobia, social phobia or psychosis.