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1 **Development and validation of the DISCUS scale: A reliable short measure for assessing**
2 **experienced discrimination in people with mental health problems on a global level**

3
4
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45 **ABSTRACT (249 words)**

46 **Background:** The Discrimination and Stigma Scale (DISC-12) was specifically developed to measure
47 experienced and anticipated discrimination reported by people with mental health problems.
48 However, the length of the DISC-12 may represent a disadvantage especially in country settings with
49 limited human capacity and infrastructure. The purpose of the study was to develop a short version
50 of DISC-12 (DISCUS) to address these limitations.

51

52 **Methods:** Data from 1087 participants with major depressive disorder and 732 patients with
53 schizophrenia were collected as part of two research network studies across 35 countries - Anti Stigma
54 Programme European Network (ASPEN) and International Study of Discrimination and Stigma
55 (INDIGO). We used a Meta Exploratory Factor Analysis (meta-EFA) and a Multiple Causes Multiple
56 Indicators (MIMIC) Model to reduce the number of items in the DISC-12 scale. The validity and
57 reliability of the reduced scale (DISCUS) was tested in 202 people with the full spectrum of mental
58 disorders recruited in a cross-sectional study conducted in South London. Psychometric validation for
59 the reduced scale used confirmatory factor analysis and measures of Cronbach's alpha and Pearson's
60 correlation coefficient.

61 **Results:** meta-EFA reduced twenty-one items to twelve items. An additional item was discarded with
62 the use of the MIMIC model. The 11-item DISCUS demonstrated excellent reliability (Cronbach's alpha
63 > 0.85), good fit (Tucker Lewis Index and Comparative Fit Index value>0.9) and weak to moderate
64 construct validity ($r>0.3$).

65 **Conclusions:** The DISCUS scale is a consistent and valid instrument to measure experienced and
66 anticipated discrimination predominantly in personal and social relationships in global settings.

67

68 **Keywords:** Discrimination; Stigma; Mental illness; Generalised Latent Variable Models; Meta
69 Exploratory Factor Analysis; Measure

70

71

- 72 **Abbreviations:**
- 73 Discrimination and Stigma Scale: DISC-12
- 74 short version of DISC-12 : DISCUS
- 75 Anti Stigma Programme European Network: ASPEN
- 76 International Study of Discrimination and Stigma: INDIGO
- 77 Meta Exploratory Factor Analysis: meta-EFA
- 78 Multiple Causes Multiple Indicators : MIMIC
- 79 No discrimination not applicable equal : NONE
- 80 Item median pro rating : IMAP
- 81 Brief Psychiatric Rating Scale: BPRS
- 82 Internalised Stigma of Mental Illness Scale: ISMI
- 83 Confirmatory item factor analysis: CFA
- 84 Comparative fit index: CFI
- 85 Tucker Lewis index: TLI
- 86 Root mean square error of approximation: RMSEA

87 **1. Introduction**

88 Stigma and discrimination have significant negative consequences for people with mental health
89 problems in terms of social exclusion from relationships with friends and family or intimate
90 relationships (Webber et al. 2014), barriers to participation in community activities and social life
91 (Angermeyer et al. 2014;Lasalvia et al. 2013) and discouraging help-seeking (Clement et al. 2015).
92 Moreover, there are significant measureable economic impacts in terms of employment, income,
93 health service use and social participation (Evans-Lacko et al. 2015; Wright et al. 2015). Although
94 evidence is growing in relation to effective interventions to reduce stigma and discrimination (Corrigan
95 et al. 2012; Thornicroft et al. 2016), mechanisms which explain the underlying processes and how
96 these could be improved are insufficiently developed (Evans-Lacko et al. 2014).

97

98 Inclusion of valid and reliable measures for assessing discrimination experienced by people with
99 mental health problems in large-scale studies could facilitate identification of key factors which
100 promote a reduction in discrimination, and identify mediators and moderators which mitigate the
101 negative consequences when it does occur. The complexity of mental health constructs are usually
102 captured with composite measurement scales based on a large number of items (Garratt et al. 2002).
103 However, the burden of long scales and the increasing need for multiple instruments in the same study
104 have created a need to reduce the number of scale items while retaining psychometric properties.
105 Given these issues which are prevalent across many large-scale studies, researchers should take
106 advantage of the robust methods and processes to facilitate briefer and more feasible assessment
107 instruments (Coste et al. 1997).

108

109 The Discrimination and Stigma Scale (DISC-12) is a psychometrically valid structured interview
110 specifically designed to assess the scope and content of experienced and anticipated discrimination in
111 people with mental health problems. In this context, discrimination is the behavioural element, where
112 stigma is considered to comprise problems related to knowledge, attitudes and behaviour (Thornicroft
113 et al. 2007). The DISC-12 has been tested across a number of social contexts such as the workplace,
114 healthcare and family settings; and among different populations including people with different types
115 of mental disorders, and across different geographical contexts (Lasalvia et al. 2013; Thornicroft et al.
116 2009; Corker et al. 2015; Oshodi et al. 2014; Milačić Vidojević et al. 2015; Brouwers et al. 2016). It was
117 developed using focus groups of people with a diagnosis of schizophrenia in 27 countries (Thornicroft
118 et al. 2009). Different versions of the scale have been developed over time, with the aim to
119 increasingly improve both content validity and usability. The current version, the DISC-12, comprises

120 22 items and its length can be a disadvantage, especially if implemented in low- and middle-income
121 country settings with few resources or when embedded in large-scale surveys.

122

123 To overcome this limitation, we conducted the present study aiming i) to develop and validate a short
124 version of the DISC-12 (DISCUS) scale with comparable reliability and validity to the original scale and
125 ii) to provide a methodology for item reduction of a mental health scale which could be used in a
126 global setting. The new developed scale would be consisted of items, which apply across the different
127 populations from which the data were derived (35 countries worldwide). To develop a short version
128 of the DISC-12 scale we applied two approaches; (i) a novel meta-analytic approach to Exploratory
129 Factor Analysis (meta-EFA) and (ii) a Multiple Indicators Multiple Causes (MIMIC) model. Validity and
130 reliability of the short version of the DISC-12 scale were also assessed.

131

132 **2. Methods**

133

134 2.1. Data

135 We analysed secondary data collected as part of the Anti Stigma Programme European Network
136 (ASPEN)/International Study of Discrimination and Stigma (INDIGO)-depression study and INDIGO-
137 schizophrenia study, previously described elsewhere (Lasalvia et al. 2013; Thornicroft et al. 2009).
138 Briefly, the EU-funded ASPEN study and the INDIGO-Depression research network recruited and
139 interviewed 1807 people with Major Depressive Disorders (from Jan 1 to Dec 31, 2010) in 35 countries
140 (39 sites) worldwide; the INDIGO schizophrenia recruited and interviewed 732 people with a clinical
141 diagnosis of schizophrenia (from Jan 1 to Dec 31, 2005) in 27 countries (28 sites) worldwide. Study
142 sites in both studies were identified through contact with members of the World Psychiatric
143 Association (WPA) Global Programme against Stigma and Discrimination. In both studies, directors at
144 each site were contacted and asked to identify participants who were, in their judgment, reasonably
145 representative (as a group) of all people with a clinical diagnosis of major depressive disorder
146 (ASPEN/INDIGO-depression) or schizophrenia (INDIGO-schizophrenia) in treatment with local
147 psychiatric services, including those in inpatient, day-patient, outpatient, and community settings
148 during the previous 12 months.

149 2.2. Discrimination and Stigma Scale (DISC-12)

150 We used here the most recent version of the DISC, the DISC-12, which contains 32 questions covering
151 aspects of everyday life including work, marriage, parenting, housing, leisure and religious activities.
152 Items 1-21 explore experienced discrimination (e.g. "Have you been treated unfairly in making or
153 keeping friends?"), items 22-25 assess anticipated discrimination (e.g. "Have you stopped yourself

154 from applying for work?”), items 28-32 explore coping strategies to overcome discrimination (e.g.
155 “Have you been able to use your personal skills or abilities in coping with stigma and discrimination?”),
156 items 26-27 explore positive treatment (e.g. “Have you been treated more positively by your family?”).
157 Ratings are given on a 4-point Likert scale (0=“no difference”, 1=“a little”, 2=“moderately”, 3=“a lot”).
158 Individuals may also indicate that a given item is ‘not applicable’ to them, usually because they had
159 not been in that situation (for example, experiencing discrimination in relation to having a child when
160 the participant did not have any children). We excluded the item ‘other’ as it did not contribute
161 specific information needed for the construction of latent constructs. A more detailed description of
162 the DISC-12 is provided elsewhere (Brohan et al. 2013). DISC-12 scale could be accessed upon request
163 (please see details on how to access the scale on the online supplementary material).

164

165 2.3. Meta Exploratory Factor Analysis (meta-EFA)

166 For the specific purposes of this study, only the 21 items of the DISC-12 covering the experienced
167 discrimination section were included in the analyses.

168

169 Because within country sample sizes were too small to analyse the data by individual countries, we
170 grouped countries into seven regions according to the United Nations statistics division geoscheme
171 (<http://unstats.un.org/unsd/methods/m49/m49regin.htm>).

172

173 We employed a meta-analytic approach to Exploratory Factor Analysis (meta-EFA) proposed by
174 Hedges and Olkin (Hedges 1985) and being previously applied in the field of psychiatry (Norton et al.
175 2013; Grube et al. 1998; Smith et al. 1998) and asthma epidemiology (Hooper et al. 2010) to determine
176 and confirm scale factor structures across different cultural contexts to the 1809 people with either
177 major depressive disorders (n= 1087) and schizophrenia (n= 732) living in 42 countries across seven
178 different regions. In each region, we evaluated the polychoric matrix of the 21 DISC-12 items and then
179 we derived a pooled correlation matrix from each of the different regions using a meta-analytical
180 approach. Exploratory factor analysis was applied to the matrix of pooled item correlation coefficients,
181 giving us underlying dimensions of experienced discrimination, which could be used, across all regions.

182

183 Specifically, in each region k for each DISC item i and DISC item j , we evaluated the polychoric matrix
184 using the polychoric correlation coefficient r_{kij} . Because the approximate distribution of r_{kij} depends
185 strongly on the value of the population correlation ρ_{kij} , each correlation coefficient was transformed
186 using a Fisher transformation

187 $z_{kij} = 0.5 \log\left(\frac{1+r_{kij}}{1-r_{kij}}\right)$, $k=1,..7$ $i=1,..21$ $j=1,..21$

188

189 to give it an approximately normal distribution with asymptotic variance $1/(n_j-3)$, where n_k is the
190 sample size for the country k . A weighted average of these values was then calculated

191
$$\sum_{k=1}^7 w_k z_{kij} = w_1 z_{1ij} + \dots + w_7 z_{7ij}, \quad i=1, \dots, 21 \quad j=1, \dots, 21$$

192 where the weights are
$$w_k = \frac{(n_k - 3)}{\sum_{l=1}^7 (n_l - 3)}$$

193 An inverse Fisher transformation was then applied to give a pooled polychoric correlation coefficient
194 matrix. Exploratory Factor analysis was applied to the matrix of pooled correlation coefficients, giving
195 us factor scores which could be used in all seven regions.

196

197 2.4. Multiple Indicator Multiple Cause (MIMIC) model

198 To explore the efficiency of item selection of the DISCUS, we also employed a MIMIC model to the
199 international sample of 1809 people with either major depressive disorders ($n=1087$) and
200 schizophrenia ($n= 732$) living in 42 countries across seven different regions. MIMIC models have been
201 used previously to explore scalar invariance (Joreskog and Goldberger 1975; Muthén 1989). Similarly
202 to factor analysis, factor loading estimates from the MIMIC model provide information on the strength
203 of the association with the latent construct. Information about the relationship between the items
204 and the validation metric is revealed through a regression parameter on the latent variable, which
205 assesses the association between the validation metric and the latent variable. An extension of this
206 model for categorical items assumes that ordinal items originate from underlying unobserved
207 continuous, normally distributed items and relates the observed items with the underlying
208 unobserved items through a series of threshold relationships (Muthén 1984). The MIMIC model
209 augments the original factor analysis model by introducing an external (exogenous) covariate. The
210 covariate can affect the item(s) directly (direct effects) and/or the latent trait (indirect effect). A
211 significant direct effect indicates that for the same values of the latent trait (that is, fixed to average
212 values) the probability of a certain response in the item varies (scalar invariance). In other words, two
213 individuals with the same (average) latent trait levels, have different probabilities of responding, for
214 instance, “a little” based on their values in the covariate. This introduces measurement bias and
215 therefore was considered as an item deletion criterion here. Significant indirect effects, on the
216 contrary, simply reflect latent score differences, often anticipated in relation to the covariate.

217

218 2.5. Missing data techniques for non-applicable and missing data

219 We employed two different approaches for handling the non-applicable and missing responses.
220 Firstly, we used a no discrimination not applicable equal (NONE) approach where all responses were
221 considered valid and where the categories “non-applicable” and “missing” were collapsed into the
222 category “not at all” (i.e., no experienced discrimination). Secondly, we used an imputation technique
223 whereby an estimated response for an individual is imputed into non applicable and missing items
224 conditional on the median response of all answered items for that individual item median pro rating
225 (IMAP). The score to be imputed in place of applicable responses is therefore conditional on the
226 responses of the applicable items.

227

228 2.6. Assessment of the reliability and validity of the DISCUS

229 We validated findings from the ASPEN/INDIGO-depression and INDIGO-schizophrenia data using data
230 collected as part of the Mental Illness-Related Investigations on Discrimination (MIRIAD) study (Evans-
231 Lacko et al. 2015;Farrelly et al. 2014). This was an ethnically diverse sample, which comprised 202
232 individuals using secondary mental health services in South London.

233

234 Cronbach’s coefficient alpha was employed to evaluate the reliability (internal consistency) of the
235 items of the DISCUS. It evaluates the extent to which items within a scale are inter-correlated with
236 one another and thus seem to measure the same concept. Its value ranges from 0 to 1 and internal
237 consistency reliability is suggested to be acceptable when Cronbach’s alpha (Cronbach 1951) is at least
238 0.70 (DeVellis 2016). Construct validity was further examined by estimating the correlation between
239 the DISCUS and the total scores of the Brief Psychiatric Rating Scale (BPRS) (Lukoff et al. 1986) and the
240 Internalised Stigma of Mental Illness Scale (ISMI) (Ritsher et al. 2003). A comparison of the DISCUS
241 with the Internalised Stigma of Mental Illness Scale (ISMI) as it can be considered a similar stigma-
242 related construct. Previous cross-country research shows that exposure to higher levels of stigma and
243 greater perceived discrimination is associated with higher internalised stigma (Evans-Lacko, et al.,
244 2012). We further examined the relationship between the DISCUS and the BPRS as severity is a
245 consistently identified determinant of experienced stigma (Livingston & Boyd, 2010).

246

247 Spearman’s correlation coefficients were calculated and were interpreted as follows: >0.80: very
248 strong relationship, 0.60-0.79: strong, 0.40-0.59: moderate, 0.20-0.39: weak, and <0.19: very weak.
249 Agreement was also established by calculating the total score of DISC-21 and DISCUS scale and
250 subsequently estimating the Pearson correlation coefficient ($\rho=0.95$) between the two total scores.

251

252 A confirmatory item factor analysis (CFA) model was fitted, with all DISCUS items loading onto a single
253 factor which we named as “Experienced Discrimination” (Figure 2). CFA was applied using the
254 weighted least square estimator with a mean- and variance-adjusted chi-squared method to handle
255 ordered categorical items (Muthen et al. 1997). Missing and non-applicable data across the DISCUS
256 were handled using full information maximum likelihood estimation. This method computes
257 parameter estimates on the basis of all available data, including the incomplete cases. The procedure
258 works under the assumption that the data are missing at random. To evaluate overall model fit, the
259 comparative fit index (CFI) (Bentler 1990), the Tucker Lewis index (TLI) (Tucker and Lewis 1973) and
260 the root mean square error of approximation (RMSEA) (Steiger 1980) were calculated. A CFI and TLI
261 value of greater than 0.90 indicates adequate fit to the data (Hu and Bentler 1999). A value of RMSEA
262 <0.05 indicates close fit, values between 0.05 and 0.08 suggest adequate model fit, and values >0.10
263 suggest poor model fit (Hu and Bentler 1999). Finally, due to the chi-square sensitivity to the sample
264 size, we used the relative chi-square (rel χ^2) (Kline 2011). According to Ullman (2001) (Ullman 2001)
265 the value of the relative chi-square should be close to 2 for adequate fit. Weighted Root Mean Square
266 Residual (WRMR) a “residual-based” fit index was also employed (Muthén BO 1998). The smaller the
267 residuals, the better the model functions to reproduce the relationships from the input covariance
268 matrix; consequently, a residual-based fit index is likely to report acceptable model–data fit in such
269 situations. Statistical analyses were conducted using STATA 14.1 (Stata Corporation, College Station,
270 Texas USA) and Mplus 7.4 (Muthén 1998).

271

272 3. Results

273 Our final sample included 1809 people with either major depressive disorders (n= 1087) and
274 schizophrenia (n= 732) living in 42 countries across seven different regions worldwide. Further
275 sociodemographic and DISC-12 item descriptive data are presented in Table 1 for the overall sample,
276 Table S1 for the validation sample and Table S2 per each different region.

277

278 3.1. Item reduction with the use of meta-EFA and MIMIC model

279 Meta Exploratory Factor Analysis (meta-EFA) was conducted to account for between country
280 heterogeneity with the use of IMAP for missing data. A varimax rotation was applied to improve the
281 interpretability of the factors obtained. We used three objective criteria to aid the choice of number
282 of patterns and provide empirical support for the selection: i) The scree plot ii) the criterion of
283 eigenvalues above 1 and iii) the percentage of total variance being explained by the factors retained
284 above 80%. The two-factor solution explained 96% of the variance (first factor explained 90% and
285 second factor explained 6%) of the variance in the original 21 items, however eigenvalues of the

286 second factor were not above 1, with scree plot confirming these findings (Figure S1 - see online
287 supplement). According to Table 2, in more than five regions, the first factor was characterized by
288 items relating to experiences of discrimination mainly in personal relationships and the second factor
289 was associated with experiences of discrimination mainly in health and social care settings and thus
290 factors were labelled accordingly, however these labels were not defining completely the two factors.
291 We choose to retain the first factor for our shorter version of DISC-21 as the factor was explaining the
292 biggest percentage of total variance, had eigenvalues >1 and gave a meaningful interpretation of
293 experience discrimination in personal, educational and work settings. Table 2 presents correlation
294 coefficients between individual DISC items (those which correlated ≥ 0.4 or ≤ 0.1) with the DISC latent
295 factors across the seven different regions. The meta-EFA reduced the original twenty-one items to
296 twelve items (we retained the items whose correlation coefficients were 0.40 or higher for one factor
297 and 0.10 or lower for the other factor; Table 2).

298 One more item was discarded by applying the MIMIC model which indicated that one-item non-
299 invariance was present and thus further shortened the reduced twelve item scale derived by the meta-
300 EFA to a 11-item scale (data available upon request). Factor loadings from the ordinal MIMIC model
301 indicated modest and strong relationships among the candidate items and the latent measure of
302 personal experience of stigma across the seven global regions. A graphical representation of the
303 MIMIC model for the DISCUS is presented in Figure 1. The within country Cronbach's coefficient alpha
304 value for the first factor ranged between 0.70 and 0.86 across the seven regions.

305

306 3.2. Psychometric properties of the DISCUS

307 A graphical representation of the one factor CFA model is presented in Figure 2. The one factor
308 solution for DISCUS had relatively good fit, as illustrated by the goodness-of-fit indices. The RMSEA
309 value of 0.07, and CFI and TLI values >0.9 and WRMR < 0.10 suggest adequate model fit. The reliability
310 of DISCUS items and the DISCUS total score was satisfactorily established, including internal
311 consistency and criterion-predictive validity. Cronbach's alpha coefficient for the eleven-item DISCUS
312 was 0.87. Pearson correlation coefficients with the total scores of the BPRS (Lukoff et al. 1986) and
313 the ISMI Scale (ISMI) (Ritsher et al. 2003) were 0.1 ($p < 0.001$) and 0.5 ($p < 0.001$) respectively. Excellent
314 agreement was also observed between Pearson correlation coefficient of total scores of DISC-21 with
315 the corresponding scores of DISCUS ($p = 0.95$). DISCUS could be accessed upon request (please see
316 details on how to access the scale on the technical note of the online supplementary material).

317

FIGURE 2 ABOUT HERE

318

319 4. Discussion

320 This paper describes the development of a short version of the DISC-12, the DISCUS scale, a reliable
321 measure which can be used in large-scale international surveys, involving a wide range of respondent
322 types. The DISCUS was designed to address the need for an international psychometrically validated
323 brief measure which considers the scope and content of experienced discrimination. For this purpose,
324 we utilise two statistical approaches, a novel meta-EFA and a MIMIC model, which led to a
325 recommendation for the 11-item subscale to be used as a stand-alone measure of experienced
326 discrimination. This subscale was psychometrically robust, meeting content, discriminant and
327 reliability criteria. It covers the key dimension of the experienced discrimination in terms of personal
328 and social relationships.

329 Our analysis supported the existence of an experienced discrimination dimension. The analysis of
330 convergent and discriminant validity reported here provides some preliminary information on how
331 this dimension relate to other factors. Experienced discrimination was moderately associated with
332 both the Brief Psychiatric Rating Scale and the Internalised Stigma of Mental Illness Scale, suggesting
333 that this dimension may capture both psychiatric symptoms and stigma dimensions. The short version
334 presented good agreement with the original scale. Further work is required to understand the
335 complex ways in which all of these dimensions are related to other constructs and operate together
336 and separately to influence outcomes.

337

338 4.1. Strengths, Limitations and further research

339 Goetz et al. 2013 (Goetz et al. 2013) proposed necessary conditions for valid item reduction which
340 were considered and met when developing the DISCUS. Specifically, the validity of the original scale
341 has well documented properties (Brohan et al. 2013) and DISCUS complies with the conceptual model
342 postulated in the original DISC-12 scale and aims to capture the latent trait of experienced
343 discrimination. Content validity is well documented in the original DISC-12 paper (Brohan et al. 2013).
344 and a group of mental health experts (physicians, psychologists, service users and methodologists). To
345 review the revised list of items in terms of conceptual content, we contacted individuals who were
346 involved in measurement development and testing as part of the Indigo anti-stigma network and thus
347 had some familiarity with the original DISC (<http://www.indigo-group.org/the-network/>). The group
348 included physicians (n=5), psychologists (n=4), service users (n=3) and methodologists (n=3) who
349 reviewed and discussed the revised instrument in relation to the original version. The group confirmed
350 that the eleven items of the DISCUS should be retained and had reasonable conceptual content. In
351 addition, we used meta-EFA and MIMIC models as appropriate statistical techniques to derive the
352 short scale. The DISCUS was also tested among an independent sample to document its construct
353 validity, internal reliability and discriminant validity - Confirmatory factor analysis, Cronbach's alpha

354 and Pearson correlation coefficients were employed to assess whether the initial model remained
355 intact when items were removed in an independent sample.

356

357 The study is limited by the existing small sample sizes within the 42 countries and 46 sites. Aggregating
358 the data into regions may be problematic in terms of the generalisability of the study as the people
359 that were sampled may not be representative of the overall populations within and across the
360 countries. Nevertheless, when we tested the DISCUS in an independent UK sample, the DISCUS scale
361 has excellent psychometric properties. In addition, our final dataset was a combination of two
362 different studies (ASPEN and INDIGO) where different sampling designs were used. We used two
363 different imputation techniques (NONE and IMAP) to impute values in the non-applicable cells of the
364 original DISC scale. These two different imputation techniques gave a slightly different factor structure
365 after a meta-EFA was applied to the data. Specifically, when we applied the IMAP technique meta-EFA
366 retained 12 items (Table 2) while when we applied the NONE technique meta-EFA retained 13 items
367 (Table S3). However, 10 items were overlapping with either using IMAP or NONE, and the 11 item that
368 were retained were retained by the additional application of the MIMIC model.

369

370 Further work will also be necessary to evaluate the psychometric properties of the DISCUS in
371 additional clinical populations or in cultural groups other than those included in this article and across
372 different contexts and cultural settings.

373

374 5. Conclusions

375 In conclusion, the 11-item DISCUS had strong psychometric properties and is a reliable, valid, precise,
376 acceptable, measure for use in assessing experienced discrimination predominantly in personal and
377 social relationships. As expected, the DISCUS showed moderate correlations with the BPRS and ISMI
378 scale. The use of this scale is recommended as an evaluation tool in a global setting to assess the
379 impact of discrimination predominantly in personal and social relationships upon people with
380 experience of mental ill health and future studies.

381

382 Contributors

383 Ioannis Bakolis (IB), Graham Thornicroft (GT) and Sara Evans-Lacko (SEL) designed the study and wrote
384 the protocol. IB, Chiara Bonnetta (CB), Nicolas Rüsçh (NR), Antonio Lasalvia (AL) and SEL managed data
385 collection and Ioannis Bakolis and Silia Vitoratou (SV) undertook the statistical analyses. IB and SEL
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387 manuscript.

388

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402

403 **Conflict of Interest**

404 None

405 **References**

- 406 Angermeyer, M.C., Matschinger, H., Schomerus, G., 2014. Attitudes of the German public to
407 restrictions on persons with mental illness in 1993 and 2011. *Epidemiol.Psychiatr.Sci.* 23 (3) 263-270.
- 408 Bentler, P.M., 1990. Comparative fit indexes in structural models. *Psychol.Bull.* 107 (2) 238.
- 409 Brohan, E., Clement, S., Rose, D., Sartorius, N., Slade, M., Thornicroft, G., 2013. Development and
410 psychometric evaluation of the Discrimination and Stigma Scale (DISC). *Psychiatry Res.* 208 (1) 33-40.
- 411 Brouwers, E.P., Mathijssen, J., Van Bortel, T., Knifton, L., Wahlbeck, K., Van Audenhove, C., Kadri, N.,
412 Chang, C., Goud, B.R., Ballester, D., Tofoli, L.F., Bello, R., Jorge-Monteiro, M.F., Zaska, H., Milacic, I.,
413 Ucok, A., Bonetto, C., Lasalvia, A., Thornicroft, G., Van Weeghel, J., ASPEN/INDIGO Study Group*,
414 2016. Discrimination in the workplace, reported by people with major depressive disorder: a cross-
415 sectional study in 35 countries. *BMJ Open.* 6 (2) e009961-2015-009961.
- 416 Clement, S., Schauman, O., Graham, T., Maggioni, F., Evans-Lacko, S., Bezborodovs, N., Morgan, C.,
417 Rusch, N., Brown, J.S., Thornicroft, G., 2015. What is the impact of mental health-related stigma on
418 help-seeking? A systematic review of quantitative and qualitative studies. *Psychol.Med.* 45 (1) 11-27.
- 419 Corker, E.A., Beldie, A., Brain, C., Jakovljevic, M., Jarema, M., Karamustafalioglu, O., Marksteiner, J.,
420 Mohr, P., Prelipceanu, D., Vasilache, A., 2015. Experience of stigma and discrimination reported by
421 people experiencing the first episode of schizophrenia and those with a first episode of depression:
422 The FEDORA project. *Int.J.Soc.Psychiatry.* 61 (5) 438-445.
- 423 Corrigan, P.W., Morris, S.B., Michaels, P.J., Rafacz, J.D., Rüsck, N., 2012. Challenging the public
424 stigma of mental illness: a meta-analysis of outcome studies. *Psychiatric services.* 63 (10) 963-973.
- 425 Coste, J., Guillemin, F., Pouchot, J., Fermanian, J., 1997. Methodological approaches to shortening
426 composite measurement scales. *J.Clin.Epidemiol.* 50 (3) 247-252.
- 427 Cronbach, L.J., 1951. Coefficient alpha and the internal structure of tests. *Psychometrika.* 16 (3) 297-
428 334.
- 429 DeVellis, R.F., 2016. *Scale development: Theory and applications*,. Sage publications.

430 Evans-Lacko, S., Clement, S., Corker, E., Brohan, E., Dockery, L., Farrelly, S., Hamilton, S., Pinfold, V.,
431 Rose, D., Henderson, C., Thornicroft, G., McCrone, P., 2015. How much does mental health
432 discrimination cost: valuing experienced discrimination in relation to healthcare care costs and
433 community participation. *Epidemiol.Psychiatr.Sci.* 24 (5) 423-434.

434 Evans-Lacko, S., Courtin, E., Fiorillo, A., Knapp, M., Luciano, M., Park, A.L., Brunn, M., Byford, S.,
435 Chevreur, K., Forsman, A.K., Gulacsi, L., Haro, J.M., Kennelly, B., Knappe, S., Lai, T., Lasalvia, A., Miret,
436 M., O'Sullivan, C., Obradors-Tarrago, C., Rusch, N., Sartorius, N., Svab, V., van Weeghel, J., Van
437 Audenhove, C., Wahlbeck, K., Zlati, A., ROAMER Consortium, McDaid, D., Thornicroft, G., 2014. The
438 state of the art in European research on reducing social exclusion and stigma related to mental
439 health: a systematic mapping of the literature. *Eur.Psychiatry.* 29 (6) 381-389.

440 Evans-Lacko S, Brohan E, Mojtabai, R*, Thornicroft G*. Association between public views of mental
441 illness and self-stigma among individuals with mental illness in 14 European countries. *Psychological
442 Medicine* 2012; 42(8):1741-1752.

443 Farrelly, S., Clement, S., Gabbidon, J., Jeffery, D., Dockery, L., Lassman, F., Brohan, E., Henderson,
444 R.C., Williams, P., Howard, L.M., Thornicroft, G., MIRIAD study group, 2014. Anticipated and
445 experienced discrimination amongst people with schizophrenia, bipolar disorder and major
446 depressive disorder: a cross sectional study. *BMC Psychiatry.* 14 157-244X-14-157.

447 Garratt, A., Schmidt, L., Mackintosh, A., Fitzpatrick, R., 2002. Quality of life measurement:
448 bibliographic study of patient assessed health outcome measures. *BMJ.* 324 (7351) 1417.

449 Goetz, C., Coste, J., Lemetayer, F., Rat, A.C., Montel, S., Recchia, S., Debouverie, M., Pouchot, J.,
450 Spitz, E., Guillemin, F., 2013. Item reduction based on rigorous methodological guidelines is
451 necessary to maintain validity when shortening composite measurement scales. *J.Clin.Epidemiol.* 66
452 (7) 710-718.

453 Grube, B.S., Bilder, R.M., Goldman, R.S., 1998. Meta-analysis of symptom factors in schizophrenia.
454 *Schizophr.Res.* 31 (2-3) 113-120.

455 Hedges, L.V., 1985. *Statistical methods for meta-analysis.*, Academic Press, Orlando.

456 Hooper, R., Heinrich, J., Omenaas, E., Sausenthaler, S., Garcia-Larsen, V., Bakolis, I., Burney, P., 2010.
457 Dietary patterns and risk of asthma: results from three countries in European Community
458 Respiratory Health Survey-II. *Br.J.Nutr.* 103 (9) 1354-1365.

459 Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis:
460 Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary
461 journal.* 6 (1) 1-55.

462 Joreskog, K.G., Goldberger, A.S., 1975. Estimation of a Model with Multiple Indicators and Multiple
463 Causes of a Single Latent Variable. *Journal of the American Statistical Association.* 70 (351) 631-639.

464 Kline, R., 2011. *Principles and Practice of Structural Equation Modeling*, 3rd edn Guilford Press. New
465 York.

466 Lasalvia, A., Zoppei, S., Van Bortel, T., Bonetto, C., Cristofalo, D., Wahlbeck, K., Bacle, S.V., Van
467 Audenhove, C., van Weeghel, J., Reneses, B., Germanavicius, A., Economou, M., Lanfredi, M., Ando,
468 S., Sartorius, N., Lopez-Ibor, J.J., Thornicroft, G., ASPEN/INDIGO Study Group, 2013. Global pattern of
469 experienced and anticipated discrimination reported by people with major depressive disorder: a
470 cross-sectional survey. *Lancet.* 381 (9860) 55-62.

471 Livingston JD, Boyd JE (2010). Correlates and consequences of internalized stigma for people living
472 with mental illness: A systematic review and meta-analysis. *Social Science and Medicine* 71, 2150-
473 2161.

474 Lukoff, D., Nuechterlein, K., Ventura, J., 1986. Manual for the expanded brief psychiatric rating scale.
475 *Schizophr.Bull.* 12 (4) 594-602.

476 Milačić Vidojević, I., Dragojević, N., Tošković, O., 2015. Experienced and anticipated discrimination
477 among people with major depressive disorder in Serbia. *Int.J.Soc.Psychiatry.* 61 (7) 638-644.

478 Muth6n, B., du Toit, S., Spisic, D., 1997. Robust inference using weighted least squares and quadratic
479 estimating equations in latent variable modeling with categorical and continuous outcomes.
480 *Psychometrika.* 75 (1) 40-45.

481 Muthén, B., 1984. A general structural equation model with dichotomous, ordered categorical, and
482 continuous latent variable indicators. *Psychometrika*. 49 (1) 115-132.

483 Muthén, B.O., 1989. Latent variable modeling in heterogeneous populations. *Psychometrika*. 54 (4)
484 557-585.

485 Muthén, B.O., 1998. Mplus technical appendices

486 Muthén, L.K., 1998. Mplus User's Guide 5th ed. Los Angeles, CA: Muthén & Muthén.

487 Norton, S., Cosco, T., Doyle, F., Done, J., Sacker, A., 2013. The Hospital Anxiety and Depression Scale:
488 a meta confirmatory factor analysis. *J.Psychosom.Res.* 74 (1) 74-81.

489 Oshodi, Y.O., Abdulmalik, J., Ola, B., James, B.O., Bonetto, C., Cristofalo, D., Van Bortel, T., Sartorius,
490 N., Thornicroft, G., 2014. Pattern of experienced and anticipated discrimination among people with
491 depression in Nigeria: a cross-sectional study. *Soc.Psychiatry Psychiatr.Epidemiol.* 49 (2) 259-266.

492 Ritsher, J.B., Otilingam, P.G., Grajales, M., 2003. Internalized stigma of mental illness: psychometric
493 properties of a new measure. *Psychiatry Res.* 121 (1) 31-49.

494 Smith, D.A., Mar, C.M., Turoff, B.K., 1998. The structure of schizophrenic symptoms: a meta-analytic
495 confirmatory factor analysis. *Schizophr.Res.* 31 (1) 57-70.

496 Steiger, J.H., 1980. Statistically based tests for the number of common factors.

497 Thornicroft, G., Mehta, N., Clement, S., Evans-Lacko, S., Doherty, M., Rose, D., Koschorke, M.,
498 Shidhaye, R., O'Reilly, C., Henderson, C., 2016. Evidence for effective interventions to reduce mental-
499 health-related stigma and discrimination. *The Lancet*. 387 (10023) 1123-1132.

500 Thornicroft, G., Brohan, E., Rose, D., Sartorius, N., Leese, M., INDIGO Study Group, 2009. Global
501 pattern of experienced and anticipated discrimination against people with schizophrenia: a cross-
502 sectional survey. *Lancet*. 373 (9661) 408-415.

503 Thornicroft, G., Rose, D., Kassam, A., Sartorius, N., 2007. Stigma: ignorance, prejudice or
504 discrimination? *Br.J.Psychiatry*. 190 192-193.

505 Tucker, L.R., Lewis, C., 1973. A reliability coefficient for maximum likelihood factor analysis.
506 *Psychometrika*. 38 (1) 1-10.

507 Ullman, S., 2001. In BG Tabachnick, & LS Fidell (Eds.), *Using multivariate statistics* (pp. 653–771 ed.,
508 p. 966).

509 Webber, M., Corker, E., Hamilton, S., Weeks, C., Pinfold, V., Rose, D., Thornicroft, G., Henderson, C.,
510 2014. Discrimination against people with severe mental illness and their access to social capital:
511 findings from the Viewpoint survey. *Epidemiol.Psychiatr.Sci.* 23 (2) 155-165.

512 Wright, S., Henderson, C., Thornicroft, G., Sharac, J., McCrone, P., 2015. Measuring the economic
513 costs of discrimination experienced by people with mental health problems: development of the
514 Costs of Discrimination Assessment (CODA). *Soc.Psychiatry Psychiatr.Epidemiol.* 50 (5) 787-795.

Table 1 Socio-demographic characteristics and item content, response frequencies and percentages of the DISC questionnaire (n=1809) . Data were collected from the Anti Stigma Programme European Network (ASPEN)/International Study of Discrimination and Stigma (INDIGO)-depression study and INDIGO-schizophrenia study.

Age years N=1809	Mean (SD)				
	42.5 (13.9)				
Female N=1809	n(%)				
	996 (54.7)				
Employment status N=1759	n(%)				
unemployed	513 (28.2)				
I work full-time (>30 hours per week)	547(30.0)				
I work part-time (<30 hours pr week)	93(5.1)				
I work as a volunteer (not paid)	15(0.8)				
work in a sheltered/supported employm	7(0.3)				
work in the home (looking after child	87(4.7)				
I am looking for a job	120(6.6)				
would like to work but I am afraid of	7(0.3)				
I am not able to work (disabled)	129(7.0)				
choose not to work	42(2.3)				
student	72(3.9)				
DISCUS items N=1809	n(%)	n(%)	n(%)	n(%)	n(%)
	Not at all	A little	Moderately	A lot	Not applicable
Have you been treated unfairly in making or keeping friends?	984(56.5)	251(14.4)	218(12.5)	229(13.2)	59(3.4)
Have you been treated unfairly by the people in your neighbourhood?	1229(71.7)	169(9.9)	126(7.4)	105(6.1)	85(5.0)
Have you been treated unfairly in dating or intimate relationships?	858(51.0)	141(8.4)	159(9.4)	201(11.9)	324(19.3)
Have you been treated unfairly in housing?	969(62.4)	75(4.8)	64(4.1)	106(6.8)	340(21.9)
Have you been treated unfairly in your education?	744(51.5)	92(6.4)	77(5.3)	101(7.0)	432(29.9)
Have you been treated unfairly in marriage or divorce?	598(46.8)	93(7.3)	82(6.4)	174(13.6)	331(25.9)
Have you been treated unfairly by your family?	863(53.0)	273(16.8)	222(13.6)	251(15.4)	20(1.2)
Have you been treated unfairly in finding a job?	729(47.4)	93(6.0)	105(6.8)	156(10.1)	456(29.6)
Have you been treated unfairly in keeping a job?	752(48.5)	117(7.6)	132(8.5)	196(12.7)	352(22.7)
Have you been treated unfairly when using public transport?	1334(79.0)	56(3.3)	43(2.5)	38(2.3)	217(12.9)
Have you been treated unfairly in getting welfare benefits or disability pensions?	744(49.3)	69(4.6)	45(3.0)	64(4.2)	586(38.9)
Have you been treated unfairly in your religious practices?	1141(73.0)	37(2.4)	38(2.4)	53(3.4)	293(18.8)
Have you been treated unfairly in your social life?	1250(74.9)	145(8.7)	87(5.2)	73(4.4)	113(6.8)
Have you been treated unfairly by the police?	1015(65.2)	54(3.5)	62(4.0)	71(4.6)	354(22.7)
Have you been treated unfairly when getting help for physical health problems?	1351(79.5)	124(7.3)	73(4.3)	98(5.8)	53(3.1)
Have you been treated unfairly by mental health staff?	1192(79.9)	115(7.7)	68(4.6)	66(4.4)	25(1.7)
Have you been treated unfairly in your levels of privacy?	1363(77.6)	137(7.8)	96(5.5)	120(6.8)	40(2.3)
Have you been treated unfairly in your personal safety and security?	1248(72.7)	144(8.4)	118(6.9)	159(9.3)	48(2.8)
Have you been treated unfairly in starting a family or having children?	652(45.7)	77(5.4)	70(4.9)	82(5.7)	546(38.3)
Have you been treated unfairly in your role as a parent to your children?	631(49.3)	75(5.9)	58(4.5)	93(7.3)	421(32.9)
Have you been avoided or shunned by people who know that you have a mental health problem?	950(60.9)	221(14.2)	172(11.0)	183(11.7)	31(2.0)

Table 2

How correlation coefficients of DISC items with identified DISC latent factors vary between regions* (Items in bold characters represent the factors that retained from meta-EFA)

	Australasia/Eastern/South East Asia (n=318)		Eastern Europe (n=225)		North/South America (n=146)		Northern Europe (n=230)		Northern and Western Africa (n=188)		Southern Europe (n=422)		Western Europe (n=290)	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II
Have you been treated unfairly in making or keeping friends?	0.76		0.73		0.70		0.70		0.71		0.70		0.65	
Have you been treated unfairly by the people in your neighbourhood?	0.69		0.53		0.65		0.62		0.59		0.67		0.55	
Have you been treated unfairly in dating or intimate relationships?	0.63		0.58		0.59		0.68		0.62		0.63		0.56	
Have you been treated unfairly in housing?	0.61		0.56		0.58		0.61		0.60		0.63		0.51	
Have you been treated unfairly in your education?	0.59		0.50		0.51		0.59				0.48			
Have you been treated unfairly in marriage or divorce?		0.54				0.55	0.52	0.52	0.50			0.59		0.51
Have you been treated unfairly by your family?		0.55				0.52	0.42	0.42	0.50			0.59		0.51
Have you been treated unfairly in finding a job?	0.67		0.48		0.58		0.63		0.60		0.56			
Have you been treated unfairly in keeping a job?	0.51		0.43				0.54		0.52		0.50			
Have you been treated unfairly when using public transport?		0.65		0.50		0.47		0.48		0.56		0.55		0.45
Have you been treated unfairly in getting welfare benefits or disability pensions?		0.75		0.73		0.58		0.72		0.76		0.68		0.63
Have you been treated unfairly in your religious practices?		0.61		0.43				0.60		0.48		0.46		
Have you been treated unfairly in your social life?	0.60		0.46		0.47		0.50		0.44		0.47			
Have you been treated unfairly by the police?		0.55						0.56	0.60		0.48		0.48	0.47
Have you been treated unfairly when getting help for physical health problems?		0.63						0.63	0.56		0.51		0.50	
Have you been treated unfairly by mental health staff?		0.57		0.40				0.55	0.48		0.57		0.46	
Have you been treated unfairly in your levels of privacy?	0.49		0.45		0.50		0.41		0.44		0.53			
Have you been treated unfairly in your personal safety and security?	0.56		0.58		0.50		0.66		0.49		0.53		0.50	
Have you been treated unfairly in starting a family or having children?	0.59		0.60		0.42		0.63		0.49		0.55			
Have you been treated unfairly in your role as a parent to your children?		0.65		0.53		0.48		0.71	0.52		0.57		0.61	
Have you been avoided or shunned by people who know that you have a mental health problem?	0.55		0.50				0.54	0.43	0.60		0.49			

* Values are Spearman Correlation Coefficients between a DISC item and an identified latent factor. For clarity only food items that were correlated >0.40 or <-0.1 with a latent factor for each region were included in the table ** I: Personal Experience *** II: Service use experience **** Item Median Pro-rating (IMP) method.

