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Normative data for the LPFS-BF 2.0 derived from the Danish general population and relationship with psychosocial impairment

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Abstract

The Level of Personality Functioning Scale–Brief Form 2.0 is a frequently used self-report inventory that may be used to screen for self- and interpersonal dysfunction according to the DSM-5 Alternative Model for Personality Disorders (AMPD) and the ICD-11 Classification of Personality Disorders. Nevertheless, reliable norms and cut-off scores to aid interpretation and clinical decision making are still lacking. The LPFS-BF and relevant impairment measures were administered to a sociodemographically stratified sample of 2,002 adults from the general Danish population of whom 713 individuals eventually delivered data for inclusion in the present study. The unidimensionality of the LPFS-BF scores was established using Confirmatory Factor Analysis (CFA). Item-Response Theory (IRT) analysis indicated satisfactory item functioning for all 12 items and suggested normative observed score thresholds at different latent severity levels. Meaningful associations were found between the LPFS-BF norm-based cut-off scores, quality of life, and social and occupational functioning. This study presented the first normative data for LPFS-BF, which specifically applies to Denmark but likely also other socioeconomically comparable Nordic and Western societies. These results allow for interpretation of LPFS-BF scores and clinical decision-making. Future research should corroborate these findings and compare them to scores obtained in other general population samples.

INTRODUCTION

DSM-5 introduced an alternative model for the classification of personality disorders: The Alternative Model for Personality Disorders (AMPD; American Psychiatric Association, APA, 2013). The AMPD model defines personality disorders as impairments in self and interpersonal functioning (Criterion A) and the presence of one or more pathological personality trait (Criterion B). Although originally intended to replace the categorical

DSM-IV-TR personality disorder model, it was placed in Section III ‘Emerging measures and models’ and the categorical model was retained in Section II. The AMPD model was deemed too disruptive for clinical practice and lacking in empirical evidence but included in Section III to stimulate further research (Clarkin & Huprich, 2011; Frances, 2012). The research base for the AMPD model has grown substantially over the last decade (Zimmermann et al., 2019); however, implementation of the model in clinical practice is still in its infancy for

several reasons. Although the APA workgroup developed the Personality Inventory DSM-5 for the assessment of Criterion B (Krueger et al., 2012), no measures were available for Criterion A upon publication of the DSM-5. Moreover, the lack of norms and cut-off scores for such measures makes interpretation of individual test scores difficult for clinicians.

In recent years several questionnaires and interview schedules were developed to reliably assess Criterion A (First et al., 2018; Gamache et al., 2019; Goth et al., 2018; Huprich et al., 2018; Hutsebaut et al., 2017; Morey, 2017; Weekers et al., 2018). The choice of instrument depends on the purpose of the assessment (e.g., quick screening or in-depth assessment of impairments). The Level of Personality Functioning Scale Brief Form 2.0 (LPFS-BF 2.0; Weekers et al., 2018) is a short 12-item self-report questionnaire that provides a first impression of impairments in personality functioning. The LPFS-BF 2.0 has been studied in a variety of samples (e.g., Bach & Hutsebaut, 2018; Lakuta et al., 2022; Spitzer et al., 2021; Stone et al., 2021). Most studies support a two-factor structure (self and interpersonal functioning), with the two factors highly correlated in line with the theoretical notion of a general dimension of severity (APA, 2013). Construct validity of the LPFS-BF has been supported by associations with personality disorder severity, symptom severity, pathological personality traits, well-being and dysfunctional schema modes (Bach & Hutsebaut, 2018; Lakuta et al., 2022; Spitzer et al., 2021; Stone et al., 2021). Furthermore, a high sensitivity to change was demonstrated after a 3-month inpatient treatment (Weekers et al., 2018). Recently, the ICHOM endorsed the use of the LPFS-BF 2.0 in their standard set of outcome measures for personality disorders, which was presented to consolidate outcome measures used in the field of personality disorders according to ICD-11 (Prevolnik Rupel et al., 2021). Summarizing, psychometric properties of the LPFS-BF 2.0 are adequate and the brevity of the measure and ability to assess changes in personality functioning during treatment makes it a convenient instrument to use in clinical practice, however clear norms to aid clinical decision making are still lacking.

The current study was designed to generate normative data for LPFS-BF 2.0 scale scores derived from the Danish general population, which are expected to be generalizable to most Nordic and Western societies of comparable socioeconomic status (Arnfred et al., 2019). To our knowledge, these are the first published normative scores for the LPFS-BF 2.0. Unlike traditional classical test theory approaches that assume equal reliability across scale scores, and normal

distribution for calculating standardized scores against representative norms, we relied on item response theory (IRT) for psychometric evaluation and to determine normative cut scores against latent thresholds. Furthermore, associations of LPFS-BF 2.0 scores with quality of life and overall functioning were assessed and evaluated according to our preliminary normative cut-scores.

METHOD

Participants and procedures

The participants included in the current study were derived from a representative general population sample ($N = 2,002$) of which 713 individuals eventually delivered complete data. In order to ensure that data had true normative qualities, we used a data-collection approach based on the Danish Civil Population Register (CPR). More specifically, at birth or time of immigration, all Danish citizens are given a unique personal identification number registered in the Danish Civil Population Register (CPR). In the present study, CPR-numbers for a representative sample of the general Danish population were extracted by means of Statistics Denmark's Research Services.

First, a representative sample of 2,002 citizens was drawn randomly from the CPR-register of Danish citizens aged 18–80, which corresponded to at least 16 men and 16 women for each age. This sample was stratified for sociodemographic factors including age, gender, ethnic origin, relationship status (e.g., single or in a relationship), family type (e.g., with or without children), educational level, occupational status, household income, and degree of urbanization (e.g., composition of citizens living in cities, towns, or in rural areas). In this way, the sample characteristics were approximately matched with the actual composition of the general population (see Table 1).

Next, an electronic version of the LPFS-BF 2.0 along with external criterion measures (see Section 2.2) were sent to individuals from the aforementioned derivation sample. This procedure was carried out by means of digital post (“E-boks”), which is securely linked to CPR-numbers and must be used by all Danish citizens. Non-responders received a reminder twice, and after the second reminder, their information was destroyed. According to estimations from Statistics Denmark, approximately 8% of the adult general population are not reading their digital post (typically recipients above 70 years old). The study questionnaire was therefore sent by regular letter to participants that

TABLE 1 Socio-demographics for respondents and population

	Respondents	Population
Total	713	4.437.668
Sex		
Male	45.6	49.9
Female	54.4	50.1
Age group		
18–29	21.9	22.5
30–39	8.68	15.4
40–49	15.6	17.1
50–59	20.1	17.9
60–69	19.4	14.8
70+	13.7	12.3
Highest completed education		
Primary school or none	24.5	26.7
High school	39.9	41.0
Lower level education	22.1	19.8
At least bachelor level	13.5	12.5
Family type		
Single without children	23.9	30.1
Single with children	6.1	5.7
Couple without children	41.9	33.7
Couple with children	28.1	30.5
Ethnic origin		
Danish	93.0	85.5
Immigrant	7.0	14.5
Occupational status		
Employed	54.7	56.3
Retired	25.1	22.0
Unemployed	20.2	21.7
Family income (1,000 DKK)		
100–150	13.2	21.9
150–250	29.4	31.5
250–350	29.0	25.5
350–500	20.5	15.2
+500	7.9	5.9
Degree of urbanization		
Most densely populated area	32.7	36.1
Medium populated area	33.5	31.6
Sparsely populated area	33.8	32.4

were not expected to read their digital post, including two reminders. All data collection took place from June 2 until September 2, 2020.

Finally, a total representative sample of 713 individuals (35.6% response rate) provided data that were analyzed in the present study. The study was approved by The Danish Data Agency (REG-063-2018), and all data were anonymized before being analyzed so that no participant could be identified. Ethical approval was not required according to Danish law due to the nature of the study, and participants did not receive any incitement for their participation.

Measures

The Level of Personality Functioning Scale Brief Form 2.0

The LPFS-BF 2.0 is a 12-item self-report questionnaire assessing impairment in self and interpersonal functioning (Weekers et al., 2018). The items correspond to the 12 facets of the LPFS as described in Section III of DSM-5 (APA, 2013). Respondents are asked to rate each item on a scale from 1 (*completely untrue*) to 4 (*completely true*).

The EuroQol 5D (EQ-5D)

The EQ-5D is a self-report measure to assess health-related quality of life (EuroQol Group, 1990). The respondents are asked to indicate their health state in five domains: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension has three impairment levels: no problems, some problems, and extreme problems.

The EuroQol Visual Analogue Scale

The EQ-VAS presents the respondent's self-rated health on a visual analog scale ranging from 0 *best imaginable health state* to 100 *worst imaginable health state* (EuroQol Group, 1990).

The Work and Social Adjustment Scale

The Work and Social Adjustment Scale (WSAS) is a five-item self-report questionnaire assessing impairments in social and occupational functioning (Mundt et al., 2002). The questionnaire assesses the impact of mental health problems on the ability to function in terms of work, home management, social and private leisure, and close relationships.

Statistical analysis

First, to examine whether the LPFS-BF 2.0 scores reflect a unidimensional severity index, which would be necessary to support the interpretation of total scores, we evaluated the internal structure by estimating a one-factor confirmatory factor analysis (CFA) model. Because items are ordered categorically, we used a diagonally weighted least squares estimator. We used conventional model fit indices to evaluate global model fit (i.e., Comparative Fit Index [CFI] and Tucker-Lewis Index [TLI] > .90, root mean square error of approximation [RMSEA]) and individual item parameters to evaluate local fit. Based on this CFA model, we also calculated McDonald's ω to evaluate internal consistency reliability. In addition, we estimated item response theory parameters based on Samejima's graded response model to evaluate item difficulty and item discrimination parameters as well as overall test information. This information was used to estimate a test characteristic curve (TCC) to show the expected observed scores across the range of theta. In other words, the TCC was used to establish normative observed score thresholds at different latent severity levels. Well-established inventories such as the MMPI-3 and PAI use clinical thresholds of 65 and 70 T, respectively, which would correspond to theta values of 1.5 and 2.0.

Furthermore, using the resulting LPFS-BF normative cut-scores to divide into groups (theta = <1.0, 1.0, 1.5, and >2.0), a one-way ANOVA with planned polynomial contrast was conducted for quality of life (EQ-5D & EQ-VAS) and social and occupational functioning (WSAS). Chi-square tests were conducted to assess convergence between the LPFS-BF normative cut-score groups and the WSAS severity groups suggested by Mundt et al. (2002) (subclinical, significant, and severe) and Mataix-Cols et al. (2005) (mild, moderate, and severe). Fourteen participants had missing data; the ANOVA and Chi-square tests were conducted on the 699 participants with complete data.

RESULTS

Factor structure and norm values

The one-factor CFA model demonstrated adequate model fit, $\chi^2 = 202.88$, $df = 54$, $p < .001$, CFA = .99, TLI = .99, and RMSEA = .063. Table 2 lists the factor loadings for the individual items, which ranged from .65 (item 8) to .87 (item 6), with a median loading of .73. In terms of reliability, McDonald's ω was .90 (95% CI: .89–.91). Table 2 also lists the IRT parameters for the 12 items of the LPFS-BF 2.0. As evident from this table, all items had

TABLE 2 Factor loadings, item discrimination, and item difficulty parameters for the LPFS-BF 2.0 items

	Factor Loading	IRT parameters			
		a	b_1	b_2	b_3
1	0.79	2.51	0.89	1.56	2.34
2	0.82	2.48	−0.01	0.82	1.94
3	0.83	2.61	0.32	1.08	2.20
4	0.79	2.33	0.39	1.17	2.04
5	0.87	3.32	0.43	1.21	2.13
6	0.71	1.78	−0.16	1.08	2.94
7	0.66	1.43	0.32	1.75	3.17
8	0.65	1.50	0.02	1.49	2.99
9	0.67	1.52	0.29	1.59	3.78
10	0.65	1.52	1.11	2.14	3.23
11	0.73	1.79	0.08	1.09	2.11
12	0.73	1.99	0.70	1.69	2.73

Notes: $N = 713$; factor loadings are from a Confirmatory Factor Analysis (CFA) model.

Abbreviation: IRT, item response theory.

acceptable discrimination parameters, which are directly corresponding to their CFA factor loadings. As expected, difficulty parameters were very high (all but one >1.00), particularly for endorsing “3” values on items, and extremely high levels for “4” levels, indicating substantial severity levels to endorse these items in an affirmative manner. Figure 1a shows the test information curve, with associated standard error of measurement estimates, which indicates that virtually all reliable scores fall in the theta range of 0 to 3. This finding is appropriate for a community normative sample. The test characteristic curve (see Figure 1b) shows the expected observed scores across the range of theta, and indicates that an observed score of 25.9 would be associated with a theta level of 1.0 corresponding to the 84th percentile and typical of subclinical dysfunction, 31 would be associated with a theta level of 1.5 and 36 with a theta level of 2.0; these correspond to the 92nd and 97th percentiles, respectively, and are typical to indicate clinical dysfunction. A score of 40.5 would be associated with a theta of 2.5, which would reflect a very severe range (>99th percentile).

Quality of life

There was a significant effect of the LPFS-BF 2.0 normative cut-scores on self-rated health (EQ-5D VAS; $F [3, 50.50] = 13.58$, $p < .001$). There was a significant linear trend ($F [1, 695] = 34.58$, $p < .001$), indicating

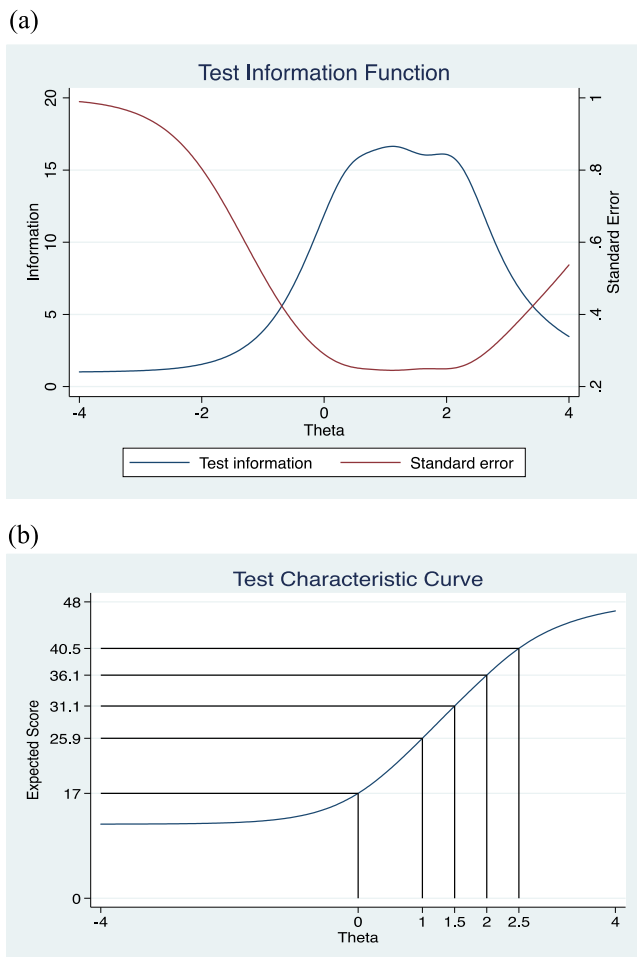


FIGURE 1 Test information function and characteristics for LPFS-BF 2.0

that as personality functioning was more severely impaired, self-rated health decreased proportionately. Table 3 shows descriptive statistics for the different cut-score groups. Planned contrasts revealed significant differences between the “healthy” group ($\theta < 1.0$) and the mild/subclinically impaired group (θ between 1.0 and 1.5), between the mild/subclinically impaired group and the moderately impaired group (θ between 1.5 and 2.0), but not between the moderately impaired- and severely impaired group ($\theta > 2.0$; see Table 3 for p values).

Furthermore, there was a significant effect of the LPFS-BF 2.0 normative cut-scores on health related quality of life (EQ-5D; $F [3, 49.97] = 15.29, p < .001$). There was a significant linear trend ($F [1, 695] = 38.57, p < .001$), indicating that as personality functioning was more severely impaired, health related quality of life decreased proportionately. Planned contrast showed significant differences between the “healthy” group ($\theta < 1.0$) and the mild/subclinically impaired group

(θ between 1.0 and 1.5). There were no significant differences between the mild/subclinically impaired group and the moderately impaired group (θ between 1.5 and 2.0) and between the moderately impaired group and the severely impaired group ($\theta > 2.0$; see Table 3 for p values).

Social- and occupational functioning

The LPFS-BF 2.0 normative cut-scores were also significantly related to social and occupational functioning (WSAS; $F [3, 50.19] = 18.25, p < .001$). There was a significant linear trend ($F [1, 695] = 52.32, p < .001$), indicating that as personality functioning was more severely impaired, social, and occupational functioning decreased. Descriptive statistics for the different cut-scores are presented in Table 3. Planned contrasts showed significant differences between the “healthy” group ($\theta < 1.0$) and the mild/subclinically impaired group (θ between 1.0 and 1.5), between the mild/subclinically impaired group and the moderately impaired group (θ between 1.5 and 2.0), but not between the moderately impaired- and severely impaired group ($\theta > 2.0$; see Table 3 for p -values). There were significant associations between the LPFS-BF normative cut-score groups and the WSAS severity groups according to Mundt and colleagues¹⁹ ($\chi^2 (6) = 85.77, p < .001$) and Mataix-Cols and colleagues²⁰ ($\chi^2 (6) = 80.02, p < .001$; see Table 4 for contingency table).

DISCUSSION

The present study first and foremost sought to provide normative data for the LPFS-BF 2.0 based on representative general population data that was characterized using IRT analysis. To our knowledge, these are the first published normative cut scores for the LPFS-BF 2.0, and they are anticipated to be generalizable to most Nordic and Western societies of comparable socioeconomic status (Arnfred et al., 2019). As a precondition for the analyses conducted in the present study, the unidimensionality of the total LPFS-BF score was supported in terms of factorial structure and item functioning. In other words, each of the LPFS-BF items generally contributed to a latent construct of global personality dysfunction, which supports the structure of the LPFS-BF severity dimension. Moreover, the LPFS-BF cut-off scores demonstrated meaningful associations with external criteria of impairment (i.e., EQ-5D, EQ-VAS, and WSAS). More severe impairments in personality functioning were associated

TABLE 3 EQ-5D and WSAS scores for the LPFS-BF 2.0 normative cut-score groups

	Healthy (N = 575)	Mild/ subclinical (N = 68)	Moderate (N = 39)	Severe (N = 17)	p value healthy subclinical	p value mild/ subclinical- moderate	p value moderate- severe
EQ-5D VASM (SD)	82.67 (14.85)	75.50 (17.46)	65.64 (22.29)	62.12 (24.72)	.002	.020	.618
EQ-5D sum score M (SD)	6.66 (2.19)	8.16 (3.13)	9.41 (3.54)	10.12 (4.21)	<.001	.071	.550
WSAS sum score M (SD)	4.66 (6.81)	8.76 (8.68)	14.03 (10.26)	16.65 (13.50)	<.001	.009	.481

Abbreviations: LPFS-BF, Level of Personality Functioning – Brief Form; EQ-5D, EuroQol health-related quality of life; EQ VAS, EuroQol Visual Analogue Scale; WSAS, Work and Social Adjustment Scale.

TABLE 4 Associations between LPFS-BF 2.0 normative cut-score groups and WSAS severity categories

	Mundt et al. (2002)			Mataix-Cols et al. (2005)		
	WSASsubclinical N (%)	WSASsignificant N (%)	WSASsevere N (%)	WSASmild N (%)	WSASmoderate N (%)	WSASsevere N (%)
LPFS-BF healthy	478 (83.1)	61 (10.6)	36 (6.3)	524 (91.1)	45 (7.8)	6 (1.0)
LPFS-BF mild/ subclinical	41 (60.3)	19 (27.9)	8 (11.8)	52 (76.5)	13 (19.1)	3 (4.4)
LPFS-BF moderate	17 (43.6)	10 (25.6)	12 (30.8)	24 (61.5)	13 (33.3)	2 (5.1)
LPFS-BF severe	6 (35.3)	3 (17.6)	8 (47.1)	9 (52.9)	4 (23.5)	4 (23.5)

Abbreviations: LPFS-BF, Level of Personality Functioning – Brief Form; WSAS, Work and Social Adjustment Scale.

with worse quality of life and lower social and occupational functioning. The LPFS-BF cut-off groups were also meaningfully related to the severity groups of the WSAS as suggested by Mundt et al. (2002) and Mataix-Cols et al. (2005). Pedersen et al. (2017) corroborated the severity groups suggested by Mataix-Cols and colleagues in a personality disorder sample. Our findings are consistent with previous research. For example, Christensen et al. (2020) found strong correlations between the LPFS (interview) and social-/occupational functioning. Bach and Hutsebaut (2018) showed correlations between the LPFS-BF 2.0, symptom severity, pathological personality traits, wellbeing, and dysfunctional schemas in a clinical and forensic sample. Associations with wellbeing were also found by Lakuta et al. (2022) in a Polish community sample.

Of note, there were significant differences in quality of life and overall functioning between the healthy, subclinical or mild, and moderate cut-off groups, but not between the moderate and severe cut-off groups, suggesting quality of life and functioning do not significantly decrease after a certain level of impairment in personality functioning is reached.

Tentative cut-off scores for significant impairment

Our unidimensional IRT model indicated that a LPFS-BF score of 36 corresponds to roughly 2 standard deviations above the latent mean (T-score of 70), which is a common benchmark for pronounced or severe clinical dysfunction on other well-established personality inventories (e.g. Morey, 2017). A score of 26 corresponds to 1.0 standard deviations above the latent mean (T-score of 60), which may indicate somewhat milder subclinical dysfunction. Likewise, a score of 31 corresponds to 1.5 standard deviations above the latent mean (T-score of 65), which may indicate a moderate level of dysfunction, and a score of 36 corresponds to 2.0 standard deviations above the latent mean (T-score of 70), which may indicate a severe level of dysfunction. Along these lines, a score of 41 corresponding to 2.5 standard deviations above the latent mean (T-score of 75) may potentially indicate somewhat extreme dysfunction if not a case of over-reporting (only two participants in the present study had a score above 40.5). Taken together, LPFS-BF scores of approximately

26, 31, 36, and 41 may tentatively be used to indicate subclinical or mild, moderate, severe, and perhaps extreme impairment, respectively. Nevertheless, such suggested cut-off scores for self-reported personality functioning do not necessarily correspond to the clinical thresholds for personality dysfunction according to the actual definitions in AMPD and ICD-11.

Limitations and future directions

The findings of the present study should be considered in the light of potential limitations and directions for future research. First, the study exclusively relied on self-reported personality functioning and external criterion measures, which increases the risk of artificially high associations among measures due to mono-method bias. Furthermore, it is unclear how well participants with more severe impairments in personality functioning can self-observe certain impairments (e.g., in the area of empathy). Future research should therefore also include informant or clinician ratings. Second, less than half of the derivation sample completed the LPFS-BF, which may have weakened the normative quality of data. Third, the utility of the suggested cut-scores may not ultimately mirror clinical impairment, and future studies should therefore further evaluate the LPFS-BF cut-off scores against clinician-rated personality dysfunction. Finally, the degree to which the norm-based LPFS-BF cut-off scores are appropriate for countries beyond Denmark and other comparable Nordic and Western countries also needs to be established.

CONFLICT OF INTEREST

The authors have no conflicts of interests to declare.

ETHICS STATEMENT

The study was conducted according to local ethical policies (see method section).

DATA AVAILABILITY STATEMENT

Dataset is available upon reasonable request.

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