Validation of the Dark Future Scale (DFS) for future anxiety on an Italian sample

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SUMMARY

Future anxiety (FA) is an attitude towards the future in which negative processes overcome positive ones, with fear of forthcoming threats being more powerful than hope. Since FA plays a pivotal role in many mental health conditions, we aimed to develop an Italian version of the Dark Future Scale (DFS) that allows measuring this construct.

We recruited 311 participants using a web-based survey. We investigated DFS internal reliability, convergent and divergent validities, as well as test repeatability over time. We conducted a receiver operating characteristic (ROC) analysis to find the best cut-off for FA. Finally, we performed a confirmatory factor analysis (CFA) based on a two-factor hypothesis. DFS showed excellent psychometric characteristics, with a high Cronbach's alpha, and test-retest reliability over 15 days. Significative correlation indices were seen between DFS and convergent and divergent measures. ROC analysis identified 17 on the overall score as the best cut-off for FA. The two-factor model on the CFA fitted the data reasonably well, showing good incremental and comparative fit indexes.

The Italian version of the DFS reported excellent psychometric properties and thus may be considered a reliable tool for both research and clinical settings.

Key words: future anxiety, depression, validation, ROC analysis, confirmatory factor analysis

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Introduction

Future-oriented thinking is defined as one's cognitive ability to daydream, mental time-travel, and make plans, aspirations, expectations, and predictions [1]. By means of future-oriented thinking, people have indeed the capability to imagine future scenarios and possible events, acting and behaving consequently.

Beck's cognitive triad of depression involves overwhelming negative thoughts about the self, the surrounding world, and the future [2]. According to Beck's proposal, in fact, both depression and anxiety may have a distorted future thinking, with the first one being centered on self-depreciation and hopelessness, and the latter, instead, being centered on future harms or threats [3]. Thus, although these two constructs share negative visions of the future, Beck's cognition-based hypothesis allows differentiating depression and anxiety by themes that are specific to each disorder.

A recent theory introduces future anxiety (FA) as a construct that includes both cognitive and emotional processes in which negative processes overcome positive ones, with fear of future threats being more powerful than hope [4]. More specifically, a dark future time perspective, i.e. a specific inclination to think about the future with preoccupation and predict negative scenarios, is one of the most important features of future anxiety [4,5].

Natural disasters, terrorism, political processes, and viral pandemics may generate a consistent amount of future anxiety [6-9]. For instance, the re-

cent COVID-19 pandemic has significantly increased the level of preoccupation with personal health, economic incomes, and social stability among the general population, and healthcare workers [10-12]. A recent study has found that the COVID-19 pandemic has indeed produced a substantial intensification of future anxiety levels, with FA showing a strong association with perceived threats related to COVID-19 and with conspiracy beliefs [7].

Since FA holds a primary position in the routinary evaluation of mental health, Zaleski and colleagues developed a 29-item scale that allows to investigate one's propensity to see the future with uncertainty as well as dislike and fear [4]. However, despite its noteworthy diagnostic utility and its significant value for research purposes, the Future Anxiety Scale (FAS) suffered from being too long and time-consuming. As this might have impacted the overloaded routine of the clinical practice as well as of research settings (especially if coupled with other measures), the Authors developed a 5-item, shorter form of the FAS, named the Dark Future Scale (DFS) [13]. The DFS presented excellent psychometric properties, ascribing it as a reliable and easy-to-use tool.

Since no homologous instrument exists at the moment, in this study we aimed to develop an Italian version of the Dark Future Scale. To test the psychometric properties, we measured the internal consistency, test-retest validity, and convergent and divergent validity. We also implemented a Receiving Operator Characteristic (ROC) analysis to identify a cut-off value. Finally, a confirmatory factor analysis (CFA) was performed to examine a bi-factorial model of FA, made up of internal and external features that may characterize FA.

Materials and methods

Study design

We conducted a cross-sectional web-based survey. Inclusion criteria were age range 18-35 years old and proficiency in Italian. As evidence has highlighted that younger adults are mostly associated with higher levels of anxiety compared to their older counterparts, we decided to select this age range [10]. The recruitment was conducted by means of a web-based survey administration software and with the help of social network applications using a snowball sampling, between June and July 2021. The survey was developed using the free software Google Forms®. On-line consent was obtained from the participants. Participants were allowed to terminate the survey at any time they desired. The survey was anonymous, and confidentiality of information was assured. The study was approved by the local ethics committee.

Measures

We prepared an online web-based survey composed of the first part with questions about gender, age, nationality, marital status, occupation, and education, and the second part with six different psychometric measures.

The Italian version of the Dark Future Scale

The DFS consists of five items (e.g., 'I am afraid that in the future my life will change for the worse'), rated with a seven-point Likert scale (from 0 = 'decidedly false' to 6 = 'decidedly true'). The resulting range goes from 0 to 30, with higher scores reflecting higher levels of FA [13].

Two proficient bilingual translators carried out the forward translation from English to Italian. Each item of the Italian version was then carefully evaluated by two independent psychiatrists and clinical psychologists. Finally, a third proficient bilingual translator performed the back translation to Italian to English. All the Authors of the current manuscript supervised the whole translation process and approved the final DFS Italian version.

The Italian version of the Beck's Depression Inventory

The Beck's Depression Inventory (BDI)-II is a 21-question self-report inventory that measures depression severity. Each question is rated with a four-point Likert scale, ranging from 0 to 3. Scores range from 0 to 63, with the following depression levels: minimal (≤ 13), mild (14-19); moderate (20-28), and severe (29-63) [14]. Cognitive, affective, and somatic symptoms of BDI-II were analyzed, based on Buckley's three-factor model, with items 1, 2, 3, 5, 6, 7, 8, 9, and 14 loading on the "Cognitive" factor, items 4, 10, 12, and 13 loading on the "Affective" factor, and items 11, 15, 16, 17, 18, 19, 20, and 21 loading on the "Somatic" factor [15].

The Italian version of the Beck's Anxiety Inventory

The Beck's Anxiety Inventory (BAI) is a 21-question self-report inventory for measuring anxiety severity. Each question is rated with a four-point Likert scale, from 0 to 3. Higher scores indicate higher anxiety levels, with the following standardized cut-offs: minimal (≤ 7), mild (8-15); moderate (16-25), and severe (26-63) [16].

The Italian version of the Beck Hopelessness Scale

The Beck Hopelessness Scale (BHS) is a 20-item true-false self-report inventory that measures three major aspects of hopelessness: feelings about the future, loss of motivation, and future expectations. Higher scores indicate higher levels of hopelessness [17]. According to Beck and Weissman, three factors were also analyzed: "Feelings about the Future", consisting of items 1, 6, 13, 15, and 19; "Loss of Motivation", consisting of items 2, 3, 9, 11, 12, 16,17, and 20; "Future Expectations", consisting of items 4, 7, 8, 14, and 18.

The Italian version of the Neuroticism-Extraversion-Openness Five-Factor Inventory

The Neuroticism-Extraversion-Openness Five-Factor Inventory (NEO-FFI) is a personality inventory that examines a person's Big Five personality traits (openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism), consisting of 60 items. Each item is rated by means of a five-point Likert scale (0 = 'strongly disagree' – 4 = 'strongly agree'). Each personality domain is represented by a single factor, that is composed of 12 items, with "neuroticism" consisting of items 1, 6, 11, 16, 21, 26, 311, 36, 41, 46, 51, and 56, "extraversion" consisting of items 2, 7 ,12, 17, 22, 27, 32, 37, 42, 47, 52, and 57, "openness" consisting of items 3, 8, 13, 18, 23, 28, 33, 38, 43, 48, 53, and 58, agreeableness consisting of items 4, 9, 14, 19, 24, 29, 34, 39, 44, 49, 54, and 59, and finally "conscientiousness" consisting of items 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60. The total score for each personality domain is the sum of the scores earned for the 12 items of that domain.

The Italian version of the Temperament Evaluation in Memphis, Pisa and San Diego, short form

The short version of the Temperament Evaluation in Memphis, Pisa and San Diego (s-TEMPS) scale consists of 35 items on a five-point Likert scale ranging from 1 to 5 (1 = "not at all"; 2 = "a little"; 3 = "moderately"; 4 = "much"; 5 "very much"). The items assess five different temperaments: depressive, composed of items 1-7, cyclotomic, composed of items 8-14, hyperthymic, composed of items 15-21, irritable, composed of items 22-28, and anxious, composed of items 28-35 [18].

Data analysis

Continuous variables were represented as mean and standard deviation (mean ± SD). Categorical variables were represented as absolute counts and percentage. The Kolmogorov-Smirnov test for the goodness of fit was performed to assess the normality of the distribution of all the tested variables.

Mann-Whitney U test for unpaired samples was used to compare the five items and the total score of DFS between females and males.

The internal consistency of DFS was assessed by means of Cronbach's coefficient alpha (α). Internal consistency is considered good when $\alpha \geq 0.8$. Spearman's correlation was carried out for the convergent and divergent validities and the test-retest reliability, calculated on 146 individuals with two administrations, first at the baseline and then after 15 days.

The receiver operating characteristic (ROC) curve was calculated to illustrate the relationship between sensitivity and specificity of the DFS in order to select the best cut-off value. This would discriminate between subjects with a high probability of having future preoccupations (above the cut-off value) and subjects without (under the cut-off value). To do so, we dummy coded the BDI overall score into a binary 1/0 variable, with 20 or above being considered as predictive of depression. We used a measure of depression as a gold standard as we considered FA as a cognitive expression of depression rather than anxiety.

Confirmatory Factor Analysis (CFA) of DFS was performed on two hypothesis-driven models: a one-factorial solution, with the five items loading on a single first-order latent variable, and a two-factorial solution, with items 1, 2, and 4 loading on the '*Externals*' factor, and items 3 and 5 loading on the '*Internals*' factor. Goodness-of-fit indices were assessed by the following [19]: the Root Mean Square Error of Approximation (RMSEA) evaluating the fitting of the model to the general population, with values ranging from 0.05 and 0.08 being indicative of an adequate fit [20]; the Comparative Fit Index (CFI) display scores between 0 and 1 (a value over 0.95 is considered excellent and a value between 0.90 and 0.95 considerate a good index) [21] and the (Standardized) Root Mean Square Residual (SRMR) indicates the difference between the residuals of the sample covariance matrix and the hypothesized model, with less than 0.08 indicating an acceptable value; relative fit indices [22] were Aikake's Information Criteria (AIC) [23] and Bayesian Information Criteria (BIC) that allow goodness-of-fit comparison between models [24].

Statistical analyses were conducted using *jamovi* v1.6 (The *jamovi* Project 2021) for MacOS for the CFA and the *Statistical Package for Social Science* (SPSS) v27 for MacOS for all the remaining analyses.

Results

Three hundred and nineteen subjects completed the online questionnaire (229 females and 90 males). Eight participants (3 females and 5 males) were excluded from the study because they did not meet the inclusion criteria of age. The remaining three hundred and eleven participants were 266 females (72.7%) and 85 (27.3%) males, with the age of 24.5 ± 4.70. Sociodemographic characteristics are summarized in Table I. According to the Kolmogorov-Smirnov test, all variables presented a non-normal distribution.

The scores for BDI were: total, 14.0 ± 9.01; cognitive, 3.87 ± 3.18; affective, 2.29 ± 1.99; somatic, 3.47 ± 2.42. The score for BAI was 18.2 ± 10.3. The scores for BHS were: total, 6.44 ± 4.66; feelings about the future, 1.50 ± 1.40; loss of motivation, 1.50 ± 1.96; future expectations, 2.93 ± 1.86. The scores for TEMPS were: depressive, 21.2 ± 6.66; cyclothymic, 20.7 ± 7.81; hyperthymic, 21.3 ± 5.79; irritable, 15.3 ± 5.42; anxious, 20.95 ± 6.93. The scores for NEO-FFI were: neuroticism, 24.7 ± 6.89; openness, 29.7 ± 6.35; agreeableness, 29.8 ± 5.09; conscientiousness, 30.3 ± 8.28).

TABLE I. *Socio-demographic characteristics of the whole sample.*

Variables	Mean (± SD)/N (%)
Age	24.5 (± 4.70)
Gender	
Female	226 (72.7%)
Male	85 (27.3%)
Nationality	
Italian	306 (98.4%)
Other	5 (1.6%)
Marital status	
Single	137 (44.1%)
Engaged (not cohabiting)	136 (43.7%)
Cohabitants/life partners	25 (8.0%)
Married	13 (4.2%)
Education	
Post-graduation degree (medical specialization, PhD, etc.)	37 (11.9%)
Graduation degree	52 (16.7%)
High School diploma	221 (71.1%)
Secondary school diploma	1 (0.3%)
Occupation	
Student	233 (74.9%)
Self-employed	21 (6.8%)
Employee	54 (17.4%)
Unemployed	3 (1.0%)

The score of the single-five items and the total score of DFS for the total sample and by gender are shown In Table II. For each DFS score, females scored significantly higher than males.

The analysis of internal consistency showed an overall Cronbach's α coefficient of 0.85. In the two subscales, the Cronbach's α was 0.728 for "Externals" and 0.738 for "Internals".

For the test-retest reliability, we assessed 146 of the initial 311 subjects and analyzed Spearman's rank-order correlation coefficient related to the total score and the two subscales. Our test-retest analysis had two administrations, one at the baseline and one after 15 days. We found a significant and positive correlation between baseline and follow-up scores (see Table III for details). Convergent and divergent validities were explored by means of Spearman's coefficient. DFS reported a significant positive correlation with all psychometric measures for depression and anxiety, with cyclothymic, irritable, and anxious temperament measures, as well as with neuroticism personality trait (see Table IV). On the other hand, DFS was negatively correlated with hyperthymic temperament, with extraversive, agreeable, and conscientious personality traits (Tab. IV).

The ROC analysis was performed on the DFS total score at baseline in order to evaluate the questionnaire's discriminative ability. BDI was used as the gold standard measure, with scores of 20 or above being considered diagnostic for depression. Although the best-balanced sensitivity (83.3%) and specificity (53.1%) were reached with a score of 16.50, and since DFS accepts only integers as overall scores, we decided to choose 17 as a cut-off for discriminating patient's FA (Fig. 1).

CFA was estimated to assess the factorial validity of two hypothesis-driven models, with the first one having only one latent first-order factor, and the second one having two latent first-order factors, i.e., Externals and Internals. Fit indexes are summarized in Table V. Overall, the two-factor model (Fig. 2) fitted the data reasonably well, showing good comparative and incremental fit indexes (RMSEA = 0.0998 [0.046 – 0.161]; SRMR = 0.0189; CFI = 0.986; AIC = 5598; BIC = 5661) (Tab. V).

Discussion

The present article provides a validation of the DFS on an Italian sample of 311 individuals. DFS, being a fast, handy, and therefore time-saving instrument, might be a crucial psychometric tool in every clinical or research setting, where FA plays a key role, i.e., after major life events, such as natural calamities, pandemics, or wars [7,25].

TABLE II. *Descriptive and univariate statistics of the Dark Future Scale (DFS) scoring in females and males.*

Item	Females (n = 226)	Males (n = 85)	U-values	P-values
1	3.64 ± 1.74	3.00 ± 1.59	7371	0.001
2	3.25 ± 1.79	2.58 ± 1.71	7585	0.004
3	2.84 ± 1.80	2.29 ± 1.62	7973	0.019
4	3.37 ± 1.76	2.69 ± 1.73	7534	0.003
5	3.94 ± 1.91	3.45 ± 1.76	7911	0.015
Total	18.4 ± 8.16	16.3 ± 9.27	7807	0.011

TABLE III. *Test-retest reliability of the Dark Future Scale (DFS).*

DFS item/domain	Spearman's coefficient
1	0.518***
2	0.689***
3	0.619***
4	0.727***
5	0.703***
Total score	0.795***
Externals	0.749***
Internals	0.744***

*Note: * p < 0.05, ** p < 0.01, *** p < 0.001; DFS: Dark Future Scale*

TABLE IV. *Convergent and divergent validity of the Dark Future Scale (DFS).*

Psychometric measures	Spearman's coefficient
BDI	
Total	0.479***
Cognitive	0.472***
Affective	0.377***
Somatic	0.242***
BAI	0.340***
BHS	
Total	0.500***
"Feelings about the Future"	0.312***
"Loss of motivation"	0.504***
"Future expectations"	0.448***
s-TEMPS	
Depressive	0.468***
Cyclothymic	0.402***
Hyperthymic	-0.383***
Irritable	0.135*
Anxious	0.314***
NEO-FFI	
Neuroticism	0.536***
Extraversion	-0.316***
Openness	0.012
Agreeableness	-0.114*
Conscientiousness	-0.317***

*Note: * p < 0.05, ** p < 0.01, *** p < 0.001; BAI: Beck's Anxiety Inventory; BDI: Beck's Depression Anxiety; BHS: Beck's Hopelessness Scale; NEO-FFI: Neuroticism-Extraversion-Openness Five Factor Inventory; s-TEMPS: Temperament Evaluation in Memphis, Pisa and San Diego scale (short version).*

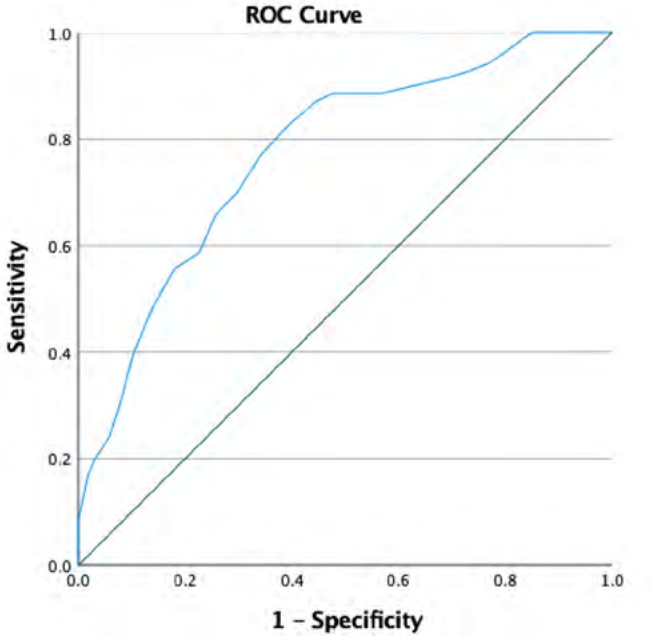

FIGURE 1. *Receiver operation characteristic (ROC) curve of the Dark Future Scale total score at baseline.*

Overall, the Italian version of the DFS presented good psychometric properties, with internal consistency showing an α of 0.85. Moreover, the test-retest reliability demonstrated significant Spearman's correlation indices between each item of the scale after 15 days, showing a high degree of repeatability over time (Tab. III).

The scores for FA were significantly higher among females than among males (Tab. II). This finding is consistent with the evidence that affective disorders, particularly anxiety, are more prevalent in women than in men [26].

Convergent validity analyses reported that DFS was positively correlated with multiple psychometric measures (Tab. IV). In particular, significant correlations were seen between DFS and BDI scores, with BDI total and cognitive subscale presenting the higher effect sizes (r = 0.479 and r = 0.472 respectively) compared to BAI (r = 0.340).

Although FA refers to a construct that most certainly resembles anxiety and thus may be defined as an emotion that features feelings of tension, and worried thoughts, as previously mentioned, the fear of future events is also what characterizes the so-called Beck's cognitive triad of depression [2]. Moreover, Zaleski's definition specifies that FA is a negative cognitive process that implies facilitation to outweigh negative thoughts or events with respect to positive ones [4]. To this end, we may conclude that FA might be ascribed to a cognitive rather than an affective construct.

TABLE V. *Confirmatory fit indices of the two hypothesis-driven models.*

Model	RMSEA [95% CI]	SRMR	CFI	AIC	BIC
One-factor	0.127 [0.085-0.172]	0.0334	0.962	5611	5667
Two-factor	0.0998 [0.046-0.161]	0.0189	0.986	5598	5661

AIC: Aikake's Information Criteria; BIC: Bayesian Information Criteria; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; SRMR: (Standardized) Root Mean Square Residual; 95% CI: 95% Confidence Interval

BHS total and BHS subscale scores also presented significant positive correlations with DFS total scores. In particular, the "Loss of Motivation" and "Future Expectations" subscales reported the highest effect sizes (r = 0.504 and r = 0.448, respectively). This reinforces the hypothesis of FA mostly depending on cognition, as hopelessness refers to a particular negative mindset, that features poor expectations of one's self and future [17]. Hence, we might speculate that FA holds two of the most important features of the pessimistic view of the future, i.e., having dark expectations of what is forthcoming and, consequently, giving up quite easily on future plans.

A high correlation was also seen with the NEO-FFI domain neuroticism. This construct is defined as one's tendency to experience negative emotions and vulnerability to stress or aversive stimuli [27]. Neuroticism is long established in the literature to be predictive of future depression and anxiety. Indeed, people having a high degree of neuroticism tend to be emotionally upset, afraid of future events, and generally have a negative attitude towards what is to come [28].

On the other hand, divergent validity analyses showed a significant negative correlation with extraversion and conscientiousness personality domains. This may be explained by the fact that persons who score high in extraversion tend to generally be enthusiastic, action-oriented, and with an optimistic view of the future as well as they are protected against anxiety and depressive disorders [29]. Similarly, as conscientiousness is the tendency to achieve goals against measures or outside expectations, which implies being stubborn and future-oriented, people scoring high in this factor tend to report low depressive and anxious symptoms [30].

The ROC curve shown in Figure 1 allows to set 17 as a cut-off point in order to discriminate people with a higher probability of having FA. Besides helping clinical scientists in research settings, this cut-off value may also concur to better characterize people with depressive disorders in the routinary clinical practice, especially if they have borderline psychometric scores for major depression. The reason why BDI scores have been used as a reference gold standard measure for the ROC analysis is based on the fact that FA has been intended mainly as a core feature of depressive rather than anxiety disorders.

CFA highlighted the presence of two latent factors that would help to better describe people with FA. This hypothesis-driven model revealed superior fit indices than the one-factor model, contrarily to what has been previously shown by Zaleski et al. [13]. The first factor, *Externals*, consisting of items 1,2, and 4, might be defined as those external issues related to the surrounding world that could contribute to enhance a pessimistic view of future events (e.g., health issues, financial crises, natural calamities, etc.). On the other hand, *Internals*, consisting of items 3 and 5, may be defined as those hurdles that are more related to one's own mood or mindset (i.e., the feeling that one could not be able to achieve any preset target).

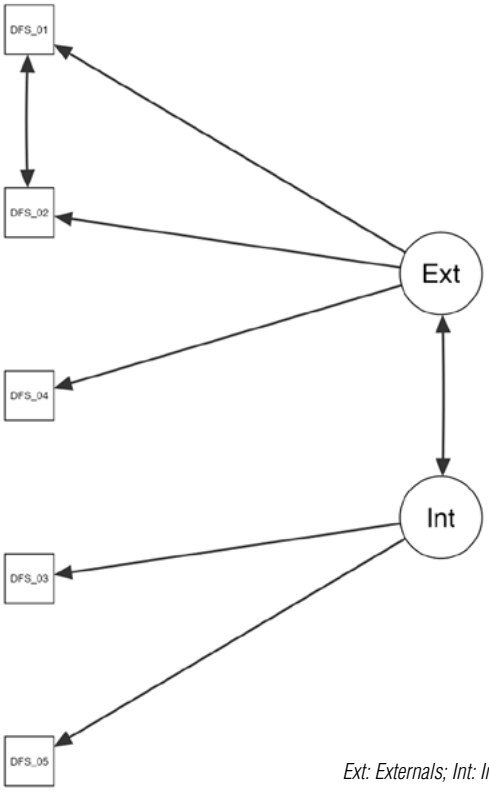

FIGURE 2. *Confirmatory factor analysis (CFA) of the Dark Future Scale showing the two-factor model. Ext: externals; Int: internals*

Despite the success demonstrated, being DFS a handy and reliable instrument, one limitation is represented by the fact that a brief measure could lead to lose data details, thus enhancing the risk of measurement errors. Future studies should compare results from the short and the long-form, using larger datasets with balanced representatives of both sexes, in order to avoid inaccurate scores to be computed and thus reduce the validity claims.

Conclusions

In conclusion, the Italian validation of the DFS reported good psychometric properties, showing an excellent internal validity and reliable convergent and divergent validities. For these reasons, the Italian version of the DFS may be considered a reliable tool for both research and clinical settings. In both cases, the DFS acts as a short and time-saving instrument that may be crucial when trying to assess and, consequently, treat people with depressive or anxious disorders.

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Conflict of Interest

The Authors declare no conflict of interest.

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Authors' contribution

TBJ: data collection, data analysis, manuscript drafting; RR: conceptualization, literature review; VS: scale translation, literature review; GDL: conceptualization, supervision;

Ethical consideration

This study was performed in accordance with the ethical standards as outlined in the 1964 Declaration of Helsinki and its later amendments.

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Appendices

Italian translation of the Dark Future Scale

Le affermazioni che seguono riguardano il tuo atteggiamento verso il futuro. Se un'affermazione descrive accuratamente il tuo atteggiamento, indica il numero '6' sulla scala allegata. Se un'affermazione non descrive il tuo atteggiamento, indica '0'. Ciascuna affermazione può riflettere il tuo atteggiamento in misura diversa. Indica il numero che definisce più accuratamente il tuo punto di vista.

0: Decisamente falso; 1: Falso; 2: Abbastanza falso; 3: Difficile a dirsi; 4: Abbastanza vero; 5: Vero; 6: Decisamente vero

1. Ho paura che i problemi che mi affliggono ora persisteranno per molto tempo	0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑
2. Sono terrorizzato dal pensiero che in futuro potrei affrontare crisi e difficoltà della vita	0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑
3. Ho paura che in futuro la mia vita cambierà in peggio	0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑
4. Ho paura che i cambiamenti delle condizioni economiche e politiche minacceranno il mio futuro	0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑
5. Sono turbato dal pensiero che in futuro non riuscirò a realizzare i miei obiettivi	0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑