Measuring COVID-19 Related Anxiety in Parents: Psychometric Comparison of Four Different Inventories

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Measuring COVID-19 Related Anxiety in Parents: Psychometric Comparison of Four Different Inventories

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Abstract

Background: The novel coronavirus disease (COVID-19) outbreak and measures to contain the global pandemic can have an impact on individual's well-being and mental health status. Parents of young children are particularly at risk for high levels of parental stress due to the current public health crisis, which can impact parenting behaviors and children's well-being. Although different initial scales have been developed to measure COVID-19 related anxiety, they have not yet been tested sufficiently in parent samples. A brief measure of COVID-19-related anxiety is necessary for both quick assessment in practice and in larger epidemiological studies of parents.

Objective: To compare the distributions, validities and reliabilities of four different COVID-19 anxiety scales: Fear of COVID-19 Scale (FCV19-S), Coronavirus Anxiety Scale (CAS), Pandemic Anxiety Scale (PAS) and one subscale of the COVID-19 Stress Scale (CSS). Based on the psychometric properties, the purpose of this study is to provide recommendations for a brief unidimensional inventory to assess Covid-19 related anxiety among parents.

Methods: A cross-sectional online survey on 515 German-speaking parents (90.3% mothers) with a child aged 0 to 6 years was conducted during a six-week period (June 29 to August 9, 2020). Half of the parents were recruited via Facebook parenting groups while the other half were recruited through childcare centers. Twenty-five items on Covid-19 related anxiety were psychometrically tested, including item analysis, correlational analysis with family variables and explorative factor analysis (EFA).

Results: Based on the psychometric properties, five items were identified as single unidimensional factor. The brief COVID-19 scale had strong factor loadings on a single factor (.61 to .89), demonstrated good internal consistency (? = .86), high positive inter-correlation with three other COVID-19 anxiety scales, and a small positive association with parenting stress. Mothers and fathers did not differ in total scores, t(513)= .439, p = .66.

Conclusions: Factor analysis suggests that existing COVID-19 related anxiety scales are measuring different latent constructs of anxiety. However, all scales showed only small to moderate correlations with trait health anxiety, suggesting COVID-19 related anxiety is distinct from general health anxiety. The 5-item scale, derived from the larger item pool, is an economical measure for assessing COVID-19 anxiety in parents. Directions for future research are outlined.

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We have no conflict of interest to disclose.

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Abstract

Background: The novel coronavirus disease (COVID-19) outbreak and measures to contain the global pandemic can have an impact on individual's well-being and mental health status. Parents of young children are particularly at risk for high levels of parental stress due to the current public health crisis, which can impact parenting behaviors and children's well-being. Although different initial scales have been developed to measure COVID-19 related anxiety, they have not yet been tested sufficiently in parent samples. A brief measure of COVID-19-related anxiety is necessary for both quick assessment in practice and in larger epidemiological studies of parents.

Objectives: To compare the distributions, validities and reliabilities of four different COVID-19 anxiety scales: Fear of COVID-19 Scale (FCV19-S), Coronavirus Anxiety Scale (CAS), Pandemic Anxiety Scale (PAS) and one subscale of the COVID-19 Stress Scale (CSS). Based on the psychometric properties, the purpose of this study is to provide recommendations for a brief unidimensional inventory to assess Covid-19 related anxiety among parents.

Methods: A cross-sectional online survey on 515 German-speaking parents (90.3% mothers) with a child aged 0 to 6 years was conducted during a six-week period (June 29 to August 9, 2020). Half of the parents were recruited via *Facebook* parenting groups while the other half were recruited through childcare centers. Twenty-five items on Covid-19 related anxiety were psychometrically tested with the framework of Classical Test Theory (CTT), including item analysis, correlational analysis with family variables and explorative factor analysis (EFA). Moreover, an Item Response Theory (IRT) approach was applied to estimate item discriminations, item difficulties and test information functions.

Results: Based on the psychometric properties, three items of the Pandemic Anxiety Scale (PAS) were identified as a single unidimensional factor. The adapted scale demonstrated acceptable internal consistency (α = .79), moderate to high item discrimination, strong positive inter-correlation with

two other COVID-19 anxiety scales, and a small positive association with parenting stress. Mothers and fathers did not differ in total scores, $t(513)= -.79$, $p = .42$.

Discussion: Factor analysis suggests that existing COVID-19 related anxiety scales are measuring different latent constructs of anxiety. Furthermore, all scales showed only small to moderate correlations with trait health anxiety, suggesting COVID-19 related anxiety is distinct from general health anxiety. The adapted subscale “disease anxiety” of den Pandemic Anxiety Scale is an economical measure for assessing COVID-19 anxiety in parents. Directions for future research are outlined.

*Keywords***:** COVID-19; Coronavirus; anxiety; parents; parenting

Measuring COVID-19 Related Anxiety in Parents: Psychometric Comparison of Four Different Inventories

In December 2019 unusual cases of patients with pneumonia in Wuhan City, China, were initially reported [1] and later in January 2020 identified as being caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV2, [2]). Confirmed individual cases and cluster were subsequently observed in almost all countries of the world [3-4]. On March 11th, 2020, the World Health Organization [5] declared the rapidly spreading coronavirus disease 2019 (COVID-19) a global pandemic. Shortly afterwards, many countries around the globe went into lockdown with measures of closed borders, social distancing and quarantine orders to curb the spread of the novel coronavirus. To date (October 14th, 2020), over 38 million confirmed cases and 1,080,000 deaths have been reported by Johns-Hopkins University [4].

Despite the large discrepancies in infection and death rates within Europe, the socio-economic impact of the adopted measures for disease control has affected all countries more or less equally. Since then, notable effects on physical and mental health have been widely described, including symptoms of anxiety, stress and depression [6-8]. The danger of a global mental health crisis was discussed early on due to manifold restrictions and changes in daily living: confrontation with death, fear of catching the virus or transmitting it to others, isolation during quarantine, financial strain, job loss, anger against measures, closed public facilities and visitation bans to relatives [9,10]. Those severe life events can impair on already existing mental disorders as well as increasing risk of new incidences of stress-related disorders [11-12].

In particular, the pandemic outbreak has confronted families with unprecedented and immediate challenges in their daily routines. Psychosocial and economic changes have challenged family life. In the United States alone, the number of employed people decreased by 20 million between February and May [13]. Increased levels of stress and anxiety were found in parents [14-19] with substantial strains in compatibility of intensive childcare responsibilities and employment

during closed facilities [7]. As a result, other problems such as home schooling and crowded households have emerged and put additional strain on parents [7,20,21]. During the corona crisis, parents are may at increased risk for suffering from parental burnout [22] with growing evidence that mothers, children and immigrants from low SES households are most affected by negative mental and physical health sequela [23-27].

Perceived danger and fear of health consequences can be expected during pandemic outbreaks. Studies on the 2009 swine flu pandemic showed a significant increase in health-related fears [28-31]. Generally, health anxiety is characterized by excessive fears and worries about one's health of having, getting or developing a serious disease. Bleichhard & Hiller [32] found a point prevalence of about 6% in the German population suffering from health anxiety disorders, which is in line with results from other population samples [33,34]. Parents play a crucial role in transmitting health beliefs and related behavior to their children [35]. Contemporary research has provided some evidence of the interconnected anxiety of parents and their children during pandemics [17,36], which could prompt a parents-based intervention approach to simultaneously address fears and burden in the family.

In this context, less is known about the relationship between health anxiety and family variables (e.g., functioning, or intimate partner relationship distress). Although research on general anxiety provide evidence of associations with relational variables [37-40], they are rarely assessed together with health anxiety inventories. Anxiety-related psychopathologies often but not necessarily include worries about health [41]. Although a few studies have examined the connection between child's health anxiety and family functioning [42,43], less research has focused on health anxiety in parents, particularly in the general population. Understanding the contribution of family and couple functioning in relation to health anxiety in the general population is particularly relevant in the context of the current pandemic.

The current body of literature for measuring parental distress, burden or the quality of the

caregiver-child relationship is extensive with a long history of research [44,45]. However, there is a need to assess anxiety related to the pandemic among parents. To our knowledge, only one scale was developed for parenting during a pandemic [46], but was not yet validated among a parent sample. In terms of assessing Covid-19 related stress and anxiety, Ransing and colleagues [47] provide an overview of recently published scales. They identified five different scales through literature up until May 15th, 2020: the Fear of COVID-19 Scale (FCV-19S, [48]), the Coronavirus Anxiety Scale (CAS, [49]), the Obsession with COVID-19 Scale [50], the COVID Stress Scale (CSS, [51]) and Perception of Threat from COVID-19 [52]. Validation among parent samples has yet to be conducted as far as we are aware.

Stressors and needs within families of young children may differ than from other household types, where childcare obligations or home schooling can be serious challenges unique to parents [27,53]. Calls for initial measures for enhancing family-based interventions and sheltering of vulnerable groups has been noted [21,54,55]. From a public health perspective, valid measurements for early detection of COVID-19 anxiety among parents at risk may be useful for epidemiological studies as well as to identify parents in need of early intervention support through health care services or other social services [56,57].

Objectives

The objectives of the current study are twofold: 1) To compare the distribution, validity and reliability of four different COVID-19 anxiety and distress scales: Fear of COVID-19 Scale (FCV19-S), Coronavirus Anxiety Scale (CAS), Pandemic Anxiety Scale (PAS) and the *Danger* subscale of the COVID-19 Stress Scale (CSS); 2) To perform an explorative factor analysis (EFA) of all four scales to identify the most promising brief unidimensional scale that can be used efficiently for research and practice among parent samples. Included items should have sufficient variance in the sample, ability to detect symptoms in both mothers and fathers, moderate to high item discrimination and associations with related constructs. We hypothesized that the COVID-19 anxiety measures

would moderately correlate with trait health anxiety, show small to moderate correlations with other measures of family functioning (i.e., parental stress and general family functioning), and show weak associations with intimate partner relationship satisfaction in a cross-sectional sample based on past literature on anxiety and families reviewed above.

Methods

Participants

A total of 1526 individuals started the online survey, resulting in a final sample of 515 parents after data cleaning (see below). Participants were predominantly mothers (90.3%) with a university degree (59.6%). Most of the participants had a German (60.6%) or Austrian citizenship (34.4%). A share of 19.8% (n = 102) came from Carinthia. Parents were ages 18-58 (M = 34.95 years, SD = 5.39). The majority was employed (55.3%) or worked in the household (34.9%). In terms of family status, 27.4% were unmarried and 68.5% were married. At the time of the survey, 94.4% were in a partnership. Four participants (0.8%) stated that they had a confirmed Covid-19 infection. More detailed demographics are described in Table 1.

Table 1: *Sociodemographic Characteristics of Participants*

	Full sample	
	n	%
Gender		
Female	465	90.3
Male	50	9.7
Nationality		
Austria	177	34.4
Germany	312	60.6
Switzerland	6	1.2
Other	20	3.8
Marital status		
Unmarried	141	27.4
Married	353	68.5
Divorced	21	4.1
In a relationship [a]	486	94.4
Number of children		
1	206	40.0
2	239	46.4
3	55	10.7

4	10	1.9
5 or more	5	1.0
Current pregnancy [a]	22	4.3
Educational level		
Without a degree	1	0.2
Lower secondary	30	5.8
Higher secondary	68	13.2
High school	109	21.2
University	307	59.6
Employment		
Employed	285	55.3
Working in household	180	34.9
Other	50	9.8

Note. $N = 515$. Participants were on average 34.95 years old ($SD = 5.39$).

[a] Reflects the number and percentage of participants answering “yes” to this question.

Procedure

Participants were recruited online during a six-week period (June 29th to August 9th, 2020) mainly via social media in parenting or child-related *Facebook* groups and message boards. The evaluation of the Hypertext Transfer Protocol referrers showed that half of the final sample (50.48%) reached the survey through *Facebook*. In addition, more than 4000 kindergartens and parent-child centers in Germany, Austria and Switzerland were contacted electronically and asked to distribute the link of the online survey. Participants had to be 18 years or older, parents of at least one child between the ages of 0 and 6 years and were not allowed to have any chronic or acute diseases themselves or their children. This study was part of a larger study focused on understanding parental search behaviors for health information and the inclusionary criteria was required for purposes of the overall study. The survey took on average 22 minutes to complete. Participants were offered the chance to win ten vouchers in the amount of € 10 at the end of the survey. They were provided with a separate link to enter into the raffle that could not be connected with the data from the study, which was anonymous. The study was approved by the Institutional Review Board of the University of Klagenfurt. Informed consent was obtained before data were collected.

Data Cleaning

Prior to data analysis, the dataset of 1526 entries was cleaned in two waves. First, 978 (64.08%) participants failed to fill out the entire questionnaire. The majority of these participants ended the survey during or immediately after demographics (n = 544). Only five participants dropped out during the Covid-19 items which were presented on the last five pages. Second, 53 participants were excluded because they either stated that they had no child (n = 5), or their youngest child was older than six years (n = 48). This resulted in a final sample of 515 parents.

Translation

All COVID-19 scales were only available in English and thus translated into German by one author (CK) and an American studies student (AH) using the translation-back-translation procedure. To further ensure quality, two psychology doctoral students (JM and KP) subsequently checked the translations for their correctness independently. Based on this, some minor changes were made to make individual items to improve readability and precision. Some of the questionnaires used different spellings for the coronavirus (e.g. coronavirus-19, COVID-19, virus). We decided to use the term "Covid-19" consistently, which is common in Germany-speaking countries. All translated questionnaires are in the Multimedia Appendix 1.

Data Analytic Strategy

All descriptive and correlational analyses were performed using IBM SPSS version 25. A two-tailed probability value < .05 was considered statistically significant. We followed Cohen's [58] interpretation guidelines for Pearson correlations, with r = .10 considered as small correlation, r = .30 as medium correlation and r = .50 as a strong correlation. For the EFA model fit, Root Mean Square Error of Approximation (RMSEA) was calculated with JASP version 0.11.1 [59]. The RMSEA fit index was interpreted according to Browne & Cudeck [60].

In addition, we applied an Item Response Theory approach to provide measures for item

discriminability and difficulty. The Graded Response Model (GRM) by Samejima [116] was used. This model is an extension of the two-parameter logistic model (2PLM), but applicable for ordered polytomous variable data (e.g. Likert-scales). A sample size of $N = 500$ is recommended for accurate parameter estimation [121]. Marginal maximum likelihood estimation [119] was used for estimation of the parameters. We calculated item discrimination (*alpha*) and item difficulty (*beta*) for each scale separately based on the initial proposed unidimensional factor structures of Covid-19 related anxiety scales. As a result, the PAS was only considered with the subscale "disease anxiety" for the IRT analysis. All other scales were included in the analysis in its entirety since they were proposed to measure one factor. According to the guidelines of Baker and Kim [117], we interpret *alpha* values equal or smaller .64 as low item discrimination, values between .65 and 1.34 as moderate and values equal or more than 1.35 as high. The software used to estimate the parameters of the IRT models was IRTPRO [118].

Measures

One-Item Covid-Fear. The One-Item Covid-Fear scale (Covid-F) was developed for this study. The item assessed fear of the corona virus ("How do you rate your fear of the corona virus (Covid-19)?") answered on a 10-point Likert-scale (1–10) with higher scores indicating greater fear.

The Fear of COVID-19 Scale. The Fear of COVID-19 Scale (FCV19-S) by Ahorsu et al. [48] is a 7-item inventory using a five-point-Likert with scores between 7 and 35. The higher the score, the higher the fear of Covid-19. The scale showed good internal consistency ($\alpha = .82$). Moderate correlations with depression ($r = .42$) and anxiety ($r = .51$) were reported. Validation studies were done with samples from Russia and Belarus [61], Italy [62], Bangladesh [63], Turkey [64], Saudi Arabia [65], Israel [66], India [67], Greece [68], US [69], Spain [70], Japan [71], Cuba [72] and Mexico [73]. Overall, the FCV-19S has shown robust psychometric properties across validation studies. Findings support predominantly a unidimensional factor structure.

The Coronavirus Anxiety Scale. The Coronavirus Anxiety Scale (CAS) by Lee [49] is a

short 5-item screening instrument that assesses common physiological anxiety symptoms related to Covid-19 over the last two weeks: dizziness, sleep disturbance, tonic immobility, appetite loss and abdominal distress. Confirmatory factor analysis indicated a single factor structure of the coronavirus anxiety construct. The scale has shown excellent internal consistency (α = .93) in the initial validation study. Scores can range between 0 and 20. Associations were found with Covid-19 diagnosis, functional impairment and maladaptive coping strategies, but not with history of anxiety. The suggested cut-off (≥ 9) identified burden adults with 90% sensitivity and 85% specificity for dysfunctional levels of coronavirus related anxiety. Validation studies took place in Turkey [74] and Bangladesh [75].

The Pandemic Anxiety Scale. The Pandemic Anxiety Scale (PAS) by McElroy et al. [76] is a 7-item scale for assessing experienced anxiety during a pandemic. In the validation study, 4793 parents with children aged between 4 and 16 years were included. Total scores can range between 0 and 28. Exploratory factor analysis revealed a two-factor solution with four items regarding catching and transmitting the virus (disease-anxiety) and three items concerning worries about consequences of the pandemic (consequence-anxiety). This factor structure was verified with confirmatory factor analysis in the other half of the sample. Internal consistency across all items was acceptable (α = .70). Moderate correlation was found with a subset of items of the Depression, Anxiety and Stress Scale (DASS, [77]). The PAS was also tested in sample of medical students and residents in the UK [78].

The COVID-19 Stress Scale. The COVID-19 Stress Scale (CSS) by Taylor et al. [51] is a 36-item inventory that consists of five subscales: danger and contamination fears, socioeconomic consequences, xenophobia, traumatic stress symptoms and compulsive checking related to Covid-19. Initially, the scale was validated in a Canadian and US sample. The internal consistencies varied from α = .83 to α = .95 for the different subscales and the subscales were moderately to highly correlated.

In the initial six factor solution the subscales danger and contamination were divided into two subscales, but due to high cross loadings they were combined a posteriori. For our study we only used the six items of the danger subscale. This subscale includes relational items which seem highly relevant especially for parents (e.g. I am worried that I can't keep my family safe from the virus). Additional studies have conducted in another USA and Canadian sample [79] and in the Philippines [80].

Validity Measures

The Modified Short Health Anxiety Inventory. The Modified Short Health Anxiety Inventory (mSHAI) by Bailer et al. [81] is a 14-item test instrument for the measurement of trait health anxiety as a single construct. A meta-analysis has shown that the original Short Health Anxiety Inventory (SHAI) by Salkovskis et al. [82] is a valid, reliable and useful instrument for assessing health anxiety in clinical and non-clinical samples [83]. The mSHAI has in contrast to Salkovskis et al. [82] original inventory a simpler response format on a five-point Likert scale. Total scores ranged between 0 and 56. The mSHAI showed excellent internal consistency in our sample, $\alpha = .94$. We expected COVID anxiety scales to only weakly or moderately correlate with this measure of trait health anxiety due to the specificity of the pandemic impacting parents uniquely, who otherwise would have low levels of health anxiety.

The Couple Satisfaction Inventory. The Couple Satisfaction Inventory (CSI) by Funk & Rogge [84] is a widely used measurement in research and practice for relationship satisfaction. The German version of the CSI was used for this study [85]. The basic version contains 32 items (CSI-32), but the short version with 16 items (CSI-16) demonstrated strong psychometric properties and precision in detecting couple satisfaction compared to other measures. Total scores can range between 0 and 81. Scores below the recommended cut-off score of 51.5 indicate substantial relationship distress. In this sample, Cronbach's coefficient of the CSI-16 was excellent with $\alpha = .97$.

Parental Stress Scale. The Parental Stress Scale (PSS) by Berry and Jones [86] is an 18-item

scale for assessing child-related burden in mothers and fathers. Scores range from 18 to 90. A higher score indicates a higher level of parental stress. Factor analysis identified four dimensions: parental rewards, parental stressors, loss of control and parental satisfaction. Despite some discord in the literature about the initial factor structure [87], the PSS is a psychometrically robust and widely used measurement in both clinical and non-clinical samples. The internal consistency in the present sample was good, with Cronbach's α = .86.

General Functioning Scale – Family Assessment Device. The General Functioning Scale (GFS, [88]) is a 12-item subscale of the McMaster Family Assessment Device (FAD, [89]) to assess family functioning. On a 4-point Likert scale (1-4) parents evaluate statements about family life. The total score is then divided by 12 and gives the overall functional level. A score of 1.0 is indicating healthy family functioning, while 4.0 represents extremely poor family functioning. Byles et al. [88] recommended 2.17 as a cut-off to detect dysfunctional families. The measure is correlated with a variety of other measures of problems including with alcohol abuse, marital distress, partner violence and parental separation. In our sample, the GFS showed good internal consistency (α = .87).

Results

Sample Descriptive Statistics and Gender Differences

Overall, 27.4% scored below the distress cut-off of the CSI-16, indicating couple dissatisfaction. On the measure of family functioning, 17.5% were identified as reporting problematic family functioning. There was a significant difference in trait health anxiety (mSHAI) scores for mothers and fathers, $t(513) = 2.30$, $p = .02$, such that mothers had higher scores. However, there were no differences between mothers and fathers on Covid-19 related fear (Covid-F), $t(513) = .49$, $p = 62$. No significant gender differences were found for couple satisfaction, parenting stress or family functioning ($ps < .05$).

Table 2 shows the range, mean, standard deviation, score range, skewness and kurtosis for all scales.

With exception of PAS, all Covid-19 related scales were right skewed. None of the scales were normally distributed as assessed by Shapiro-Wilk-Test, $p = < .001$. In particular the CAS showed the least variance. More than three quarters of participants had zero variance (no endorsed symptoms) on this scale ($n = 402$).

Next, independent-samples t-test were conducted to compare total scores of Covid-19 scales among mothers and fathers. There were no significant differences in CAS ($t(513) = 1.03$, $p = .30$), PAS ($t(513) = -.28$, $p = .77$) or CSS-D ($t(513) = -.08$, $p = .93$). There was a significant difference in scoring for FCV-19S with higher scores among mothers than fathers, $t(513) = 2.98$, $p = .003$.

Table 2: *Descriptive Statistics*

Scale	Range of the Scale	Mean	SD	Score range	Skewness	Kurtosis	Shapiro-Wilk	p-Value Shapiro-Wilk
1. mSHAI [a]	0-56	13.99	10.66	0-56	1.12	1.47	.91	<.001
2. Covid-F [b]	1-10	4.10	2.25	1-10	.50	−.67	.93	<.001
3. FCV-19S [c]	7-35	13.39	4.96	7-35	.91	.80	.93	<.001
4. CAS [d]	0-20	0.67	1.80	0-15	3.96	18.89	.43	<.001
5. PAS [e]	0-28	10.63	5.29	0-25	.13	−.48	.98	<.001
6. CSS-D [f]	0-24	6.07	5.47	0-24	.86	.01	.90	<.001
7. CSI-16 [g]	0-81	58.81	17.12	3-81	−1.03	.50	.91	<.001
8. PSS [h]	18-90	39.21	8.99	18-73	.33	.06	.99	.003
9. GFS [i]	1-4	1.71	.52	1-3.75	.10	1.02	.92	<.001

Note. $N = 515$ for all scales, except CSI-16 with $n = 486$.

[a] mSHAI (modified Short Health Anxiety Inventory), [b] Covid-F (One-Item Covid-Fear), [c] FCV-19S (Fear of Covid-19 Scale), [d] CAS (Coronavirus Anxiety Scale), [e] PAS (Pandemic Anxiety Scale), [f] CSS-D (Corona Stress Scale: Subscale Danger), [g] CSI-16 (Couple Satisfaction Index), [h] PSS (Parenting Stress Scale), [i] GFS (General Functioning Scale)

Reliability

Internal consistencies for each of the four scales are presented in Table 3. All four scales showed at least acceptable unstandardized Cronbach's $\alpha > .70$ [90]. Inter-item average correlations

were between .30 to .63.

Table 3: *Reliability of Covid-19 related anxiety and distress scales*

Scale	Cronbach's α	McDonald's ω	Gutmann's λ6	Inter-item correlation
1. FCV-19S [a]	.87	.88	.89	.52
2. CAS [b]	.83	.84	.82	.51
3. PAS [c]	.73	.75	.78	.30
4. CSS-D [d]	.91	.91	.91	.63

Note. $N = 515$.

[a] FCV-19S (Fear of Covid-19 Scale), [b] CAS (Coronavirus Anxiety Scale), [c] PAS (Pandemic Anxiety Scale), [d] CSS-D (Corona Stress Scale: Subscale Danger)

Correlations with COVID-19 Anxiety Scales

Prior to analyzing validity, the correlations with demographic characteristics and COVID scales were examined. Parents' age, years in a relationship, age of the youngest child and number of children were not significantly ($p > .05$) correlated with FCV-19S, CAS, PAS or CSS-D.

For investigating convergent validity, we examined bivariate correlations between the four Covid-19 anxiety scales (Table 4). Moderate to high correlations of the four Covid-19 anxiety scales were found, ranging between $r = .36$ and $r = .65$. Except for the CAS, all scales had moderate correlations with the One-Item Covid-Fear scale, indicating convergent validity. Small to medium positive correlations were found between health anxiety as a trait (mSHAI) and the different Covid-19 scales, ranging from $r = .21$ and $r = .38$.

Table 4: *Pearson Correlations for Covid-19 Anxiety Scales and Other Measures of Anxiety and Family Variables*

Variable	1	2	3	4	5	6	7	8	9
1. mSHAI [a]	—								
2. Covid-F [b]	.19**	—							
3. FCV-19S [c]	.38**	.71**	—						
4. CAS [d]	.28**	.32**	.51**	—					

5. PAS [e]	.21**	.56**	.61**	.36**	—			
6. CSS-D [f]	.26**	.69**	.65**	.40**	.61**	—		
7. CSI-16 [g]	−.13**	−.03	−.07	−.12**	−.07	−.05	—	
8. PSS [h]	.19**	.09*	.17**	.15**	.25**	.19**	−.31**	—
9. GFS [i]	.15**	.05	.13**	.16**	.11**	.14**	−.80**	.35**	—

Note. $N = 515$ for all scales, except CSI-16 with $n = 486$. * $p < .05$, ** $p < .01$

[a] mSHAI (modified Short Health Anxiety Inventory), [b] Covid-F (One-Item Covid-Fear), [c] FCV-19S (Fear of Covid-19 Scale), [d] CAS (Coronavirus Anxiety Scale), [e] PAS (Pandemic Anxiety Scale), [f] CSS-D (Corona Stress Scale: Subscale Danger), [g] CSI-16 (Couple Satisfaction Index), [h] PSS (Parenting Stress Scale), [i] GFS (General Functioning Scale)

Validity Analyses with COVID-19 Anxiety Scales and Family Measures

As hypothesized, small positive correlations between the four Covid-19 scales were found with parenting stress ($r = .15$ to $r = .25$) and general family functioning ($r = .11$ to $r = .16$). No significant associations were found between the Covid-19 scales and couple satisfaction, except in the case of the CAS, which showed a small negative correlation with couple satisfaction. Among family measures, all scales correlated at least moderately.

Exploratory Factor Analysis (EFA) of all Covid-19 Anxiety Scales

We performed an additional Exploratory Factor Analysis (EFA) on all 25 items of the Covid-19 scales to examine the overall similarity of the construct (Table 5). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .93. Bartlett's test of Sphericity was significant ($p < .001$). Varimax (orthogonal) rotation was applied. Kaiser's criteria [91] and scree-plot resulted in retaining a five-component solution with initial eigenvalues of 8.49, 2.62, 1.83, 1.48, 1.01, which accounted for 67.10% of the total variance. The model showed acceptable fit, RMSEA = .068, 90% confidence interval [CI] = .061, .073, TLI = .909.

The first factor included in total eight items of the CSS (CSS-1, CSS-4), FCV-19S (FCV-1, FCV-2, FCV-5) and PAS (PAS-1, PAS-2, PAS-4) with loadings higher than .40, and accounted for

39.24% of the total variance. This factor represented Covid-19 related fear of infection. The second factor accounted for 10.5% of the total variance and was formed by the six items of the CSS-D. However, two items had cross loadings on the first factor. One item was nearly identical (CSS-1 and FCV1) and the other item relates to protecting one's family from the virus. Factor three explained 7.32% of the variance and contains six items without clear content focus, including fear of dying, nervousness about news on social media, physical symptoms of anxiety and insomnia. One item of the PAS on fear of leaving the house also loaded on this factor. Furthermore, the five items of the CAS all loaded uniquely on the fourth factor, representing physical symptoms of anxiety and explaining additional 5.94% of the variance. Surprisingly, these items did not load sufficient with those of the FCV-19S on physical anxiety symptoms. Finally, three items of the PAS (PAS5, PAS5, PAS7) formed the fifth factor regarding the socio-economic consequences of the coronavirus, explaining 4.07% of the total variance.

Table 5: Exploratory Factor Analysis on CAS, CSS, FCV-19S and PAS

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Uniqueness
CAS_CAS1	.	.	.	.666	.	.414
CAS_CAS2	.	.	.	.665	.	.449
CAS_CAS3	.	.	.	.787	.	.312
CAS_CAS4	.	.	.	.798	.	.324
CAS_CAS5	.	.	.	.766	.	.385
CSS_CSS1	.610	.436	.	.	.	.360
CSS_CSS2	.	.692	.	.	.	.312
CSS_CSS3	.	.843	.	.	.	.189
CSS_CSS4	.468	.694	.	.	.	.244
CSS_CSS5	.	.826	.	.	.	.206
CSS_CSS6	.	.711	.	.	.	.339
FCV19S_FCV1	.687	.	.	.	.	.262
FCV19S_FCV2	.727	.	.	.	.	.334
FCV19S_FCV3	.	.	.765	.	.	.347
FCV19S_FCV4	.	.	.591	.	.	.392
FCV19S_FCV5	.431	.	.557	.	.	.425
FCV19S_FCV6	.	.	.813	.	.	.220
FCV19S_FCV7	.	.	.818	.	.	.212
PAS_PAS1	.754	.	.	.	.	.225
PAS_PAS2	.715	.	.	.	.	.301
PAS_PAS3	.	.	.479	.	.	.525
PAS_PAS4	.648	.	.	.	.	.522
PAS_PAS5	.	.	.	.	.746	.354
PAS_PAS6	.	.	.	.	.864	.222
PAS_PAS7	.	.	.	.	.796	.350

Note. Applied rotation method is varimax. Factor loadings below .40 are omitted from the table to improve readability.

IRT Analysis

Based on the results of the exploratory factor analysis (EFA), the overall set of items did not appear to have a common unidimensional latent structure. In addition, the response format options were not identical for all questionnaires. Therefore, we conducted an analysis for each scale separately. Parameter estimation for item discrimination (i.e., slopes) and item difficulty (i.e., thresholds) can be found in Table 6. Individual item characteristic curves (ICC) are available in Multimedia Appendix 2.

Table 6: Graded Response Model Parameter Estimates for CAS, CSS-D, FCV-19S and PAS

	Discrimination		Difficulty			
Item	α	SE	β_1	β_2	β_3	β_4
CAS[a]						
CAS-1	3.01	0.39	1.49	2.18	2.86	
CAS-2	2.66	0.41	1.35	2.00	2.98	3.52
CAS-3	3.98	1.97	1.26	1.91	2.54	3.09
CAS-4	4.03	1.05	1.74	2.29	2.92	
CAS-5	3.35	0.56	1.82	2.30	2.72	3.02
CSS-D[b]						
CSS-D1	1.97	0.16	−0.34	0.72	1.75	3.04
CSS-D2	2.79	0.24	0.01	0.90	1.60	2.57
CSS-D3	3.86	0.35	0.08	0.75	1.32	2.36
CSS-D4	3.66	0.31	−0.62	0.26	0.88	1.88
CSS-D5	3.90	0.34	−0.34	0.42	0.96	1.77
CSS-D6	2.57	0.22	0.06	0.90	1.58	2.58
FCV[c]						
FCV-1	2.24	0.19	−0.83	0.12	1.21	2.52
FCV-2	1.91	0.16	−1.42	−0.60	0.22	1.83
FCV-3	2.68	0.27	0.65	1.75	2.86	3.60
FCV-4	2.48	0.23	0.29	1.05	1.83	2.70
FCV-5	2.26	0.19	−0.31	0.58	1.34	2.56
FCV-6	4.40	0.57	0.66	1.55	2.26	2.98
FCV-7	4.47	0.59	0.70	1.42	1.92	2.97
PAS[d]						
PAS-1	4.19	0.76	−0.72	−0.00	0.65	1.95
PAS-2	4.10	0.77	−1.20	−0.38	0.17	1.54
PAS-3	1.4	0.16	0.69	2.17	3.5	

PAS-4	9 1.30	0.12	−1.06	−0.11	1 0.74	2.67

Note. N = 515. β_4 could not be calculated for CAS-1, CAS-4 and PAS-3 due to the unused item response range.

[a] Difficulty parameters for responses on 5-point Likert scale: β_1 (from “not at all” to “rare, less than a day or two”), β_2 (from “rare, less than a day or two” to “several days”), β_3 (from “several days” to “more than 7 days”), and β_4 (from “more than 7 days” to “nearly every day over the last 2 weeks”).

[b] Difficulty parameters for responses on 5-point Likert scale: β_1 (from “Not at all” to “slightly”), β_2 (from “slightly” to “moderately”), β_3 (from “moderately” to “very”), and β_4 (from “very” to “extremely”).

[c] Difficulty parameters for responses on 5-point Likert scale: β_1 (from “strongly disagree” to “disagree”), β_2 (from “disagree” to “neither agree nor disagree”), β_3 (from “neither agree nor disagree” to “agree”), and β_4 (from “agree” to “strongly agree”).

[d] Difficulty parameters for responses on 5-point Likert scale: β_1 (from “strongly disagree” to “disagree”), β_2 (from “disagree” to “neither agree nor disagree”), β_3 (from “neither agree nor disagree” to “agree”), and β_4 (from “agree” to “strongly agree”).

Item discrimination was high for all items, except of the PAS-4 item on worriedness to transfer the infection to someone else with a moderate level of discrimination. High *alpha* values in all scales indicate that the items were able to discriminate parents with a high latent trait from those with a low latent trait. In respect to item difficulty, only the CAS provided exclusively positive threshold parameters, suggesting that these items perform best when measuring people with higher levels of the latent trait.

The test information function of each scale is presented in Figure 1. All scales have the tendency to provide more information between 0 and +2 SDs than 0 to −2 SDs. The CAS provides no sufficient information for parents with scores less than the mean. The PAS and CSS-D reached good accuracy between the mean and ± 1 SD. High values of the latent trait with + 3 SDs were measured accurate with CAS and FCV-19S, but less precise with PAS or CSS-D. Detailed item information function values at different *theta* levels can be found in Table 7.

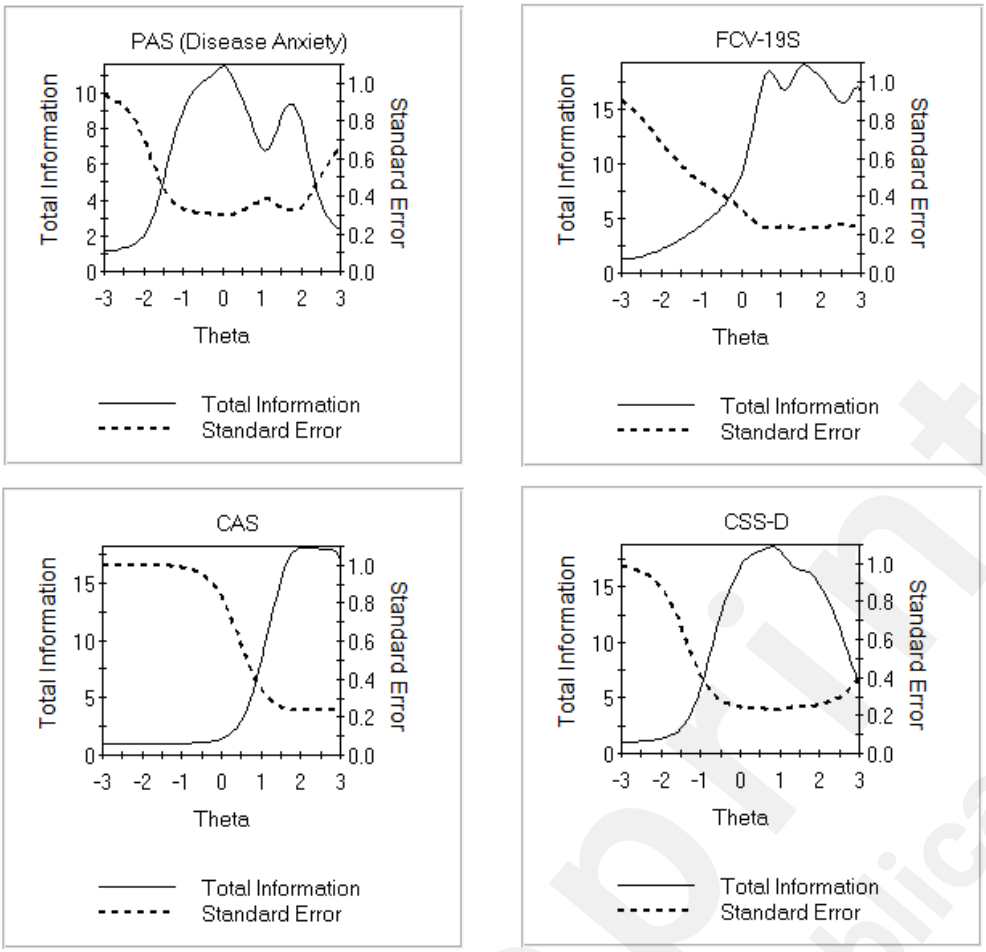

Figure 1: Total Information Functions for PAS, FCV-19S, CAS and CSS-D

Table 7: Item Information Function Values for Each Scale at θ Values between -2.4 to 2.4

	θ						
	−2.4	−1.6	−0.8	0.0	0.8	1.6	2.4
PAS	1.37	4.16	9.85	11.48	7.94	9.14	4.59
FCV-19S	1.62	2.91	5.02	9.07	18.34	19.13	15.85
CAS	1.00	1.00	1.04	1.43	5.54	16.21	17.99
CSS-D	1.11	1.94	8.46	16.73	18.64	16.42	12.28

Additional Analysis on Selected Items of the PAS subscale

We selected items for further investigation based on the analysis on distributions, variance in the sample, exploratory factor analysis and IRT analysis. This resulted in three items on infection worries regarding oneself (PAS-1) as well as family and friends (PAS-2), and to spread the virus to

someone else (PAS-4). These were all obtained from the PAS subscale on disease anxiety. We did not consider the other items on the first factor (Table 5), due to substantial cross loadings above .4 on other factors or gender-differences in scoring ($p < .05$).

Items of the other factors were not considered for the following reasons: The second factor (see Table 5) consists mainly of items regarding the role of the healthcare system and information provided on containment. Further, the third factor lacked coherence due to high variability of content with different cognitive and behavioral dimensions. Another issue were the different mean scores for mothers and fathers ($p < .01$) in some of these items (FCV-5, FCV-6, FCV-7), indicating gender specific differences. Moreover, although all items of the CAS loaded on an anxiety related fourth factor, they showed insufficient variance in the sample with 78.1% of participants not endorsing a single item. An additional IRT analysis revealed lack of sufficient test information for parents with scores equal or less than the mean. Finally, items of the fifth factor (PAS5, PAS6, PAS7) referred only to socio-economic consequences of the coronavirus without being related to anxiety.

Accordingly, we examined the psychometric properties of the 3 item PAS scale assessing disease anxiety. Scores can range between 0 and 12 ($M = 5.25$, $SD = 3.06$). They showed acceptable internal consistency ($\alpha = .79$). There was no significant scoring difference for mothers and fathers, $t(513) = -.799$, $p = .42$. Parents with elevated health anxiety had higher scores, $t(513) = -2.70$, $p = .007$. High correlations were found with the One-Item-Covid-Anxiety ($r = .69$), the FCV-19S ($r = .79$), the PAS ($r = .66$) and the CSS-D ($r = .70$). Small to moderate correlation was found with the CAS ($r = .28$), trait health anxiety ($r = .18$) and parenting stress ($r = .15$), all ps < .001. Non-significant correlations were found with age ($r = .04$, $p = .27$), length of partnership ($r = .00$, $p = .88$), age of youngest child ($rho = .01$, $p = .79$), couple satisfaction ($r = .00$, $p = .98$) and family functioning ($r = .05$, $p = .20$).

Discussion

Our aim was evaluate various existing scales for Covid-19 related anxiety and fear (i.e. basal

anxiety on the Covid-19 pandemic and infection itself, out of pre-existing scales). In our sample, all four scales (FCV-19S, PAS, CAS, CSS-D) had adequate psychometric properties. However, exploratory factor analysis revealed that different facets of anxiety and worries were measured across the scales. Based on our CTT and IRT analysis, the PAS subscale on disease anxiety for assessing COVID-19 related anxiety seems to be appropriate as a brief scale. However, factor analysis suggests using only the items PAS-1 (i.e. self-infection), PAS-2 (i.e. infection of family and friends) and PAS-4 (i.e. spreading of infection) for unidimensional assessment. We were able to show that these three items are psychometrically sound for covering general infection anxiety on COVID-19 in parents. Nonetheless, all investigated inventories had strengths, and the selection of which scale to use may be dependent on the sample in which they will be used (e.g., clinical vs. non-clinical, parent vs. non-parent or families with toddlers vs. families with older children).

Despite the CAS having a one-dimensional construct without cross loadings on other factors, floor effects were found for three-quarters of the participants (i.e., zero variance). This inventory assesses distressing bodily symptoms and may not capture general COVID-19 stress among community samples, but rather be suitable for clinical samples. In the DSM-5, the constructs somatic symptom disorder (F45.1) and illness anxiety disorder (F45.21) replaced hypochondria [92,93]. We suspect that the CAS may best detect whether parents report a somatic expression of Covid-19 related anxiety, but not necessarily those whose fear is predominantly cognitive. Interestingly, the FCV-19S has items on somatic symptoms of anxiety, such as clammy hands and tachycardia, which did not load (> .4) on the same factor as the CAS items.

The initial proposed two factor structure of the PAS was partially replicated with disease-anxiety and consequence-anxiety as two latent factors. The item assessing “worries to leave the house” no longer loaded on either factor and can be explained by timing of the data collection in the original study. McElroy et al. [76] collected data early during pandemic outbreak in April 2020, when lockdowns were in effect. This suggests that the influence of Covid-19 related anxiety items

may change when perception of risk situations changes over time in society. It may be important for longitudinal studies understanding COVID-related anxiety to include and test items that are relevant regardless of changes in lockdowns and public health measures.

Further, we observed in all items and scales lower means than in other studies on these measures [48,49,76]. It should be noted that the overall level of fear is probably strongly dependent on the time of the survey, the country of assessment, local closeness to infection clusters and media reporting. At the time of our survey period in July 2020, the number of infections in German-speaking countries was relatively stable with greater infection clusters in a subset of settings [115]. In contrast, the validation studies [48,49,51,76] all took place between March and April 2020 at the onset of the pandemic outbreak when there was a high level of uncertainty regarding the course.

In addition, small to moderate bivariate correlations between health anxiety as a trait (measured with mSHAI) and the instruments raised questions about Covid-19 related fear and its association with health anxiety. The One-Item Covid-Fear scale had a Pearson´s r = .19 with mSHAI. Correlations of mSHAI with the CAS, PAS and CSS-D ranged within rs = .20 to .28. This suggests that pandemic related health anxiety is distinct from trait health anxiety and should be assessed separately.

There may be several explanations for the small associations between COVID-19 related anxiety and health anxiety. Previous studies found different antecedents for Covid-19 related fears: fear about economic consequences, fear of new measures, fear of healthcare collapse, fear of illness, fear of death or fear of spreading the virus to risk groups [94-97]. We assume that these fears can appear independently from each other. Not all of them are health-related and therefore not necessarily linked to one´s own health anxiety [98].

In addition, the construct of trait health anxiety is based on relatively stable negative health-related cognitions and preoccupation with one's own health [92,99]. Covid-19 related anxiety may affect cognitions differently due to the public attention related to the virus in the media that places

the focus on a public health level rather than individual health level. Similarly, Covid-19 related anxiety may be perceived more as a threat to the family rather than only related to one's own health anxiety.

In our factor analysis, all items of the CSS danger subscale loaded on a common unique factor that had cross loadings with the general Covid-19 related anxiety factor (see Table 5). We suspect that this perceived fundamental threat occurs regardless of health anxieties and is represented in this factor. For example, an early study on H1N1 influenza pandemic from Jones and Salathé [29] found strong clustering of anxiety on swine flu with anxiety on trauma. The operationalization of Covid-19 related anxiety as related to threat and traumatic event perception rather than health anxiety has implications for prevention and treatment (see [12,100]). The use of a traumatic stress framework was already noted during the previous H1N1 pandemic for families [31], however, COVID-19-specific trauma research is needed [12].

A secondary goal of the study was to investigate the association between Covid-19 related anxiety and family variables (i.e. couple satisfaction, family functioning and parenting stress). We did not find significant associations between couple satisfaction and Covid-19 measures. Although there is some evidence of a link between couple distress and anxiety [37], findings related to general anxiety symptoms or disorders may not generalize to COVID-related anxiety, which is related to a population level public health crisis. In addition, we suspect that the relationship between Covid-19 related anxiety and couple satisfaction may be moderated by other variables that were not assessed such as social support or work stress [102].

As hypothesized, parenting stress and family functioning showed small correlations with COVID-19 anxiety among parents. Intriguingly, neither the one-item Covid-Fear Scale (Covid-F), nor the PAS subscale on disease anxiety correlated with family functioning, although all other tested Covid-19 scales did. Certain families experienced chronic stress and anxiety from the pandemic, which one would expect to impact family well-being and functioning over time and should therefore

be associated [103,104]. It is possible that the high education levels in our sample may have weakened the relationship between family functioning and COVID-19 related anxiety that might be seen among samples with a wider spectrum on socio-economic status [105-107]. In contrast, the Parental Stress Scale correlated consistently with all Covid-19 scales. Parenting stress may be a better indicator of COVID related impacts than a general family functioning measure, which may have a more distal relationship [103]. Especially some items of the parental stress scale were highly relevant during the time of recruitment with limited possibility of childcare offers (e.g. "Having child(ren) leaves little time and flexibility in my life"), and may have captured Covid-19 burden. It is possible that prolonged exposure to increased parental stress would have an effect on worsening family functioning over time. Prospective designs are needed to best understand the impacts of COVID-19 related anxiety on the parental relationship, parenting stress and family functioning.

Finally, more than one in four parents showed significant distress in their partner relationship and almost every fifth family has poor family functioning. Parental stress was substantial across mothers and fathers equally. High amounts of burdened parents during Covid-19 pandemic have been reported in other studies along with serious warnings on increased violence potential in families [14,22,108]. We encourage policymakers to focus on families as an important societal functional unit. Initial support for burden parents is urgently needed at all levels to mitigate the negative impact of Covid-19 on mental health in parents and children by providing public health education [109], offering positive parenting training and psychological support via telehealth [110,111], funding to mitigate economic hardship [112], strengthening of couple relationships [12], as well promoting general family functioning for building up resilience [114].

Limitations

The study is cross-sectional, thus we cannot make any statements about causalities. All measures were translated into German and tested in a German-speaking sample. It is conceivable that there are language or country-specific differences. We excluded those with self-reported acute

medical conditions, which means that results are only generalizable to a sample of parents without medical conditions. It may be that the relationship with health anxiety and COVID-19 related anxiety would be different in a sample of parents with acute or chronic medical conditions. Another possible limitation is that all parents were recruited online. Therefore, our results could be biased through self-selection [122] and overrepresentation of parents using social media. Further, more mothers participated than fathers, so further validation work with fathers is needed.

Conclusion

The current study highlights how some of the existing scales on Covid-19 related anxiety measure different facets of pandemic related anxiety among parents of young children. The differences across measures highlighted can serve as a guide for future selection of brief measures that assesses COVID-19 related anxiety among parents, which may be useful for future research. This study also highlights the associations between family variable and COVID-19 related anxiety, particularly in the case of parental stress. Future research should examine how anxiety may impact their family relationships over time to better understand the potential impacts of the pandemic on both mental health and family health. The results should also be replicated in other countries and cultures to best understand additional contextual factors.

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Conflict of Interest

None declared

Abbreviations

2PLM: Two-Parameter Logistic Model

CAS: Coronavirus Anxiety Scale

CFA: Confirmatory Factor Analysis

COVID-19: Coronavirus Disease 2019

CSS: COVID Stress Scale

CSS-D: COVID Stress Scale Subscale Danger

CSI: Couple Satisfaction Index

CTT: Classical Test Theory

EFA: Exploratory Factor Analysis

FAD: Family Assessment Device

FCV-19S: Fear of COVID-19 Scale

GFS: General Functioning Scale

GRM: Graded Response Model

IRT: Item Response Theory

KMO: Kaiser-Meyer-Olkin

M: Mean

PAS: Pandemic Anxiety Scale

PCA: Principal Component Analysis

PSS: Parenting Stress Scale

SD: Standard Deviation

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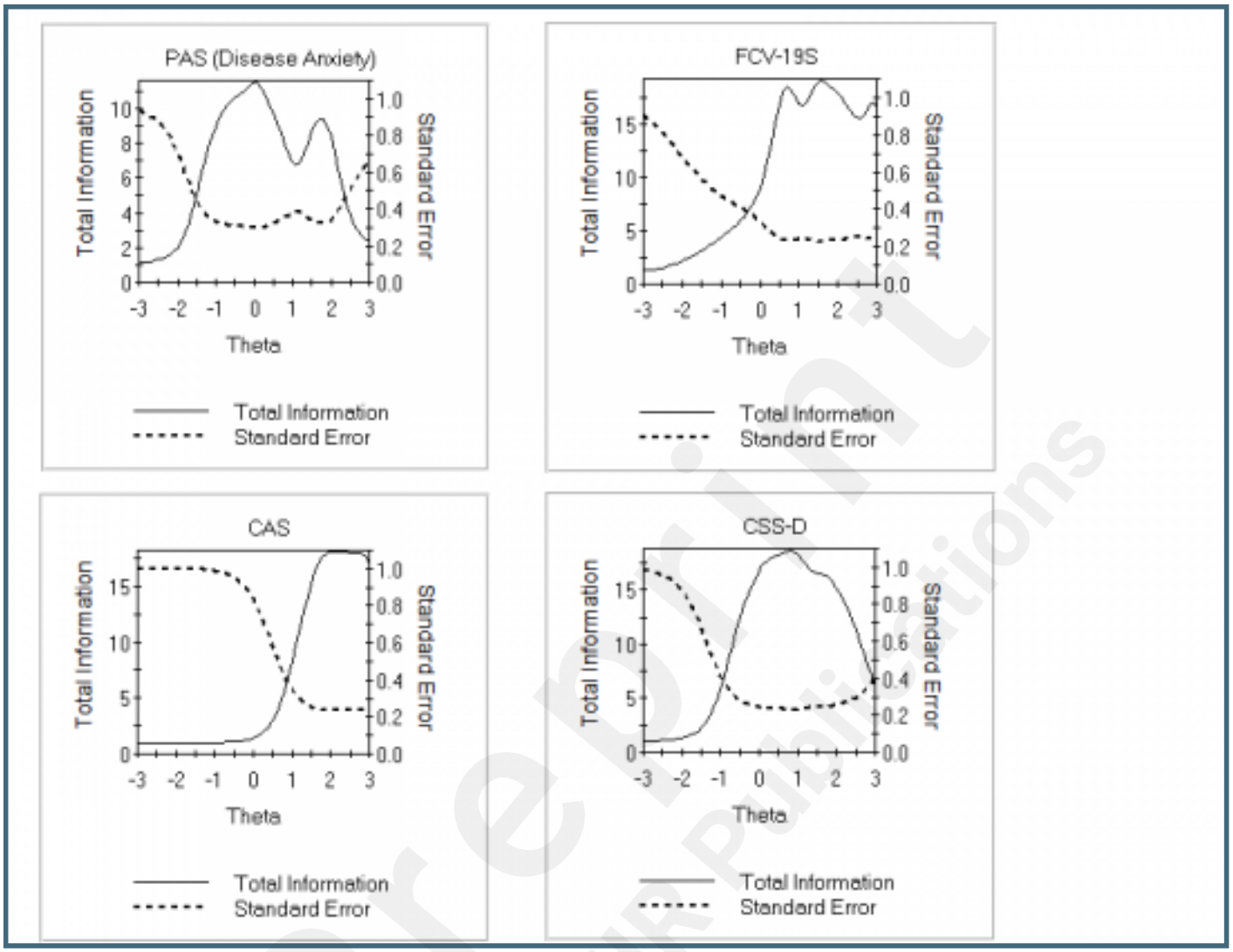
Supplementary Files

Figures

Total Information Functions for PAS, FCV-19S, CAS and CSS-D.



Multimedia Appendixes

Translations.
URL: https://asset.jmir.pub/assets/f10b1f5682c239265adff8b0f5f1c198.docx

IRT Analysis (ICC, TIC and TCC).
URL: https://asset.jmir.pub/assets/01ef435e9efb964beb6cc07a6a5b5228.pdf