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The development of a new computer-adaptive test to evaluate strain in caregivers of individuals with traumatic brain injury: TBI-CareQOL Caregiver Strain

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Abstract

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Objective—To develop a new measure of caregiver strain for use in caregivers of individuals with TBI, TBI-CareQOL Caregiver Strain.

Design—Qualitative data, literature reviews, and cross-sectional survey study.

Setting—Three TBI Model Systems rehabilitation hospitals, an academic medical center, and a military medical treatment facility.

Participants—Five-hundred-sixty caregivers of civilians (n=344) or service members/veterans (SMVs) with TBI (n=216).

Interventions—Not applicable.

Main Outcome Measure—TBI-CareQOL Caregiver Strain Item Bank

Results—Exploratory and confirmatory factor analyses, a graded response model (GRM) and differential item functioning supported the retention of 33 items in the final measure. GRM calibration data was used to inform the selection of a 6-item static short form, and to program the TBI-CareQOL Caregiver Strain computer-adaptive test (CAT). CAT simulation analyses indicated a 0.97 correlation between the CAT scores and the full item-bank. Three-week test-retest reliability was strong ($r = 0.83$).

Conclusions—The new TBI-CareQOL Caregiver Strain CAT and corresponding 6-item short form were developed using established rigorous measurement development standards; this is the first self-reported measure developed to evaluate caregiver strain in caregivers of individuals with TBI.

Keywords

Health-related quality of life; PROMIS; TBI-CareQOL; traumatic brain injury; caregiver; caregiver strain; caregiver burden; patient reported outcome

Over the past 30 years, many studies have documented significant distress for caregivers of persons with traumatic brain injury (TBI). Caregivers may experience emotional distress, including depression and anxiety, from as early as three months to as long as seven years after injury and beyond.¹⁻⁹ While this has been mostly described in those caring for individuals with more severe TBI, it can also occur in those caring for individuals with mild or moderate TBI, especially in the context of significant comorbid physical injuries or emotional trauma.¹⁰⁻¹⁵ Caregiver distress often increases over time, as caregivers are faced with persistent impairments in the person with injury.^{16,17} Pre-existing emotional distress is present in about a third of caregivers of persons with TBI and can predispose them to difficulty coping with the effects of injury.^{18,19}

Strain on caregivers may be attributed to the fact that they are often the primary source of assistance for financial, functional, and social components of daily living.²⁰ About one-third of persons with more severe TBI require supervision at one year post-injury in both civilian²¹ and service member/veteran (SMV)²² samples; over one-fourth still require assistance at 2-9 years post-injury.²³ Unemployment is a major problem for individuals with TBI, with 30-40% of civilians returning to work²⁴⁻²⁶ and only 20.5% of SMVs working at one year post-injury.²⁷ Reduced independence and community participation in the person

with TBI contributes substantially to distress in family caregivers.⁹ Caregivers often feel isolated and perceive discrimination and stigma associated with the caregiving role,²⁸ and they report a variety of unmet emotional and instrumental/practical needs for at least two years post-injury.^{29–31} Loneliness and less contact with friends contribute to caregivers' feelings of stress.^{32,33}

Caregiver stress has historically been conceptualized under the term “burden”, which refers to stress directly associated with injury-related changes.³⁴ The concept of caregiver burden is not well-conceptualized, nor is there a clear consensus definition of this term.^{35,36} Early research distinguished between objective burden (perceived changes in the person with injury) and subjective burden (distress experienced by caregivers as a result of injury-related changes).³⁷ Initially, subjective burden was rated on a single, 7-point Likert scale to assess stress resulting from the TBI.^{2,3,38} Over time, the multidimensional nature of caregiver burden³⁹ was recognized, and attempts were made to assess it, often via homegrown questionnaires with unknown psychometric properties.⁴⁰ Others adapted existing measures other disorders, including dementia and multiple sclerosis (Caregiver Burden Inventory,⁴¹ Caregiver Burden Scale,⁴² Zarit Burden Interview,⁴³ Caregiver Appraisal Scale^{44,45}). While these measures have shown utility for investigating some aspects of the caregiving role following TBI, other issues specific to TBI caregivers are neglected. For example, the young age of many persons with TBI means they will need care for a longer period of time compared to persons with dementia.^{46–49} Cognitive and behavioral changes also differ between severe TBI and dementia or multiple sclerosis.^{50,51} Therefore, a measure of stress or burden specific to TBI caregivers is warranted.

Recent efforts have been devoted to developing patient-reported outcome (PRO) assessments through the Patient-Report Outcomes Measurement Information System (PROMIS).^{52,53} PROMIS is a dynamic measurement system for physical, mental, and social well-being offering several advantages: measures are brief, administration can include a computer-adaptive test (CAT; a smart test in which items are selected based on the respondents' previous response—therefore, only the most relevant items in the bank are administered to each respondent) or fixed-length short form (SF), and measures are available across multiple domains of functioning. However, PROMIS does not include any caregiver-specific content or content that is specific to caring for someone with a TBI. To address this need, the TBI-CareQOL measurement system was developed using the established PROMIS methodology.^{54–57} This paper describes the development of a PRO measure of caregiver-reported HRQOL; TBI-CareQOL Caregiver Strain is designed to capture feelings of being overwhelmed or stressed by the caregiver role.

Methods

Study Participants

A total of 560 caregivers of individuals with TBI participated in this study (n=344 caregivers of civilians and n=216 caregivers of SMVs); some (56 civilian, 89 SMV) also completed a retest approximately 3 weeks after the initial visit. A detailed study description is reported elsewhere in this issue (Carlozzi et al., Under Review⁵⁸). Briefly, recruitment targeted existing hospital- and community-based initiatives, TBI caregiver databases, and medical

record data capture systems (MiChart and the Electronic Medical Record Search Engine⁵⁹). Participants were recruited through University of Michigan, TIRR Memorial Hermann, Rehabilitation Institute of Michigan, Kessler Foundation, and Walter Reed National Military Medical Center; retest participants were recruited solely through the University of Michigan. Caregivers were 18 years of age and able to read/understand English. For the civilian sample, caregivers were caring for an individual with a medically documented complicated mild, moderate, or severe TBI (according to TBI Model System criteria⁶⁰). For the SMV sample, caregivers were caring for an individual with a TBI that was documented by a Department of Defense or Veteran Affairs treatment facility. For both groups, the person with the TBI was 16 years of age at the time of injury and 1 year post injury. All caregivers were required to indicate that they provided physical assistance, financial assistance, or emotional support to an individual with a TBI. Data were collected with local institutional review boards; all participants provided consent prior to study participation.

Study Measures

The TBI-CareQOL Caregiver Strain Item Pool—An initial pool of 75 questions was designed to evaluate caregiver strain, using the PROMIS methodology.^{54,61} Specific item content was based on focus group discussions nine groups each with caregivers of civilians and nine groups with caregivers of SMVs with TBI.^{62,63} Items were further refined by expert review (n=11 Ph.D. and n=3 masters'-level investigators with expertise in TBI, caregivers of TBI, and measurement development), evaluation of item literacy level (to ensure 6th grade reading level), and participant cognitive review to ensure adequate content coverage and appropriate reading and comprehension levels. The final item pool was comprised of 66 items that examined feelings of being overwhelmed, stressed, self-defeated, down trodden, or beat down as a consequence of undertaking the role of caregiver for a person with TBI.

Statistical Analyses

Sample size considerations are reported elsewhere this special issue (Carlozzi et al., Under Review).⁵⁸

Overview—New measurement development included classical test theory and item response theory (IRT) analyses. First, an essentially unidimensional set of items (using classical test theory approaches described below) were identified, and second, IRT⁶⁴ analysis was conducted to estimate the item parameters (slopes and thresholds) necessary for CAT administration of the measure. Given that CAT administration includes only the most relevant and informative items for a specific respondent, CATs have the advantage of brevity (typically 4 to 12 items in length), as well as better precision and lower standard errors than more traditional static measures, even when the number of items for a CAT and a static form are identical.⁶⁵ Initial analyses began with the full 66-item Caregiver Strain item pool. All statistical analyses were conducted in accordance with PROMIS measurement development guidelines.⁶¹

Exploratory Factor Analysis (EFA)/Confirmatory Factor Analysis (CFA) Modeling, Initial Item Performance Assessments—Full-sample EFA and CFA was

used to examine and then assess the dimensionality of the item pool (using Mplus version 7.4⁶⁶). EFA was employed to determine if the data supported potential unidimensionality. This was done by examining the eigenvalues, a measure of the amount of the variance that is accounted for by each individual factor (the ratio of eigenvalue 1 to eigenvalue 2 >4 and the proportion of variance accounted for by eigenvalue 1 >.40). Next, items were excluded if they had sparse cells (i.e., a response category with n <10 respondents), if their item-adjusted total score correlation was low (<0.40), or if their observed responses were non-monotonic (according to item-rest plots and expected score by latent trait plots obtained from a non-parametric IRT model conducted using Testgraf⁶⁷). CFA was then used to screen out items with low factor loadings ($\lambda < 0.50$) and items demonstrating evidence of local dependence (residual correlation >0.20; correlated error modification index = 100).^{68–70} An iterative process was employed for both the EFA and CFA analyses, with clinical input elicited at item content decision points.^{68–70}

IRT Modeling, Final Item Performance Assessments, Differential Item Functioning (DIF) Studies, Final CFA Modeling—After an essentially unidimensional item set was identified and refined, item parameters were estimated with Samejima's graded response model (GRM),⁷¹ using IRTPRO (version 3.1.2).⁷² Items demonstrating good model fit ($S-X^2$, $p > .01$) were retained, while items displaying significant misfit ($S-X^2$, $p < 0.01$) were excluded. The retained items were assessed for DIF (response bias for a certain group) using a hybrid IRT ability score-ordinal logistic regression framework⁷³ (implemented in the R package LORDIF Version 0.3-2^{74,75}). Items were considered to have impactful DIF if: 1) they were flagged for potential DIF, using a flagging criterion of Nagelkerke pseudo-R² change = 0.20; and 2) more than 2% of DIF-corrected vs. uncorrected total score differences exceeded uncorrected total score standard errors. Items were removed due to impactful DIF for age, education, or caregiver status (civilian or SMV). Following DIF-based item exclusions, a final CFA model was run to assess overall model fit to the item response data, using standard fit criteria: comparative fit index (CFI) = 0.95, Tucker-Lewis index (TLI) = 0.95, and root mean square error of approximation (RMSEA) <0.15.^{76–79}

CAT Simulation, Short Form Development—A CAT simulation (using Firestar software⁸⁰) was run to estimate scores based on a CAT administration of the Caregiver Strain item bank and examine item usage frequencies and patterns. A 6-item short form was then developed, using item calibration and calibration-related statistics (e.g., item slope, thresholds, average item difficulty, and item information), in combination with input from clinical experts (n=7 Ph.D.– level investigators with expertise in TBI and/or caregivers of persons with TBI) on item content and its range of coverage. Thus, psychometric and clinical considerations were balanced in order to attain item bank representativeness in the short form items.

Results

Study Participants

Detailed descriptive data is provided in Carlozzi et al.⁵⁸ Briefly, 344 caregivers of civilians with TBI and 216 caregivers of SMVs with TBI participated in this study. Caregivers were

primarily female, Caucasian, married, and caring for their spouse. Caregivers of civilians were significantly older than caregivers of SMVs, and were caring for persons who were significantly older. A greater percentage of caregivers of civilians with TBI had a high school education compared to those caring for SMVs. Caregivers of civilians were much more likely to be unmarried than military caregivers.

Unidimensional Modeling and Analyses

EFA/CFA Modeling, Initial Item Performance Assessments—After field testing 66 Caregiver Strain items, EFA, CFA, and supporting analyses identified 40 essentially unidimensional items (Table 1).

IRT Modeling, Final Item Performance Assessments, DIF Studies, Final CFA Modeling—Next, an IRT model (GRM) indicated seven items with significant misfit ($S-X^2$, $p < 0.01$; Table 1). After assessing the remaining items, no items were flagged for age or education-related DIF; three items (“I feel like I am the only one who can care for the person with the injury,” “I feel stressed about the medical care the person I care for is receiving,” “I feel frustrated with my situation”) were flagged for potential civilian vs. military DIF. However, since these items did not exhibit impactful DIF (i.e., $< 2\%$ of DIF-corrected vs. uncorrected score differences exceeded uncorrected score standard errors) and were retained (see Table 2). A final CFA model was run; results suggest good overall model fit to the item response data (Table 2). The final item bank item parameters are reported in Table 3. On a measurement continuum from $\theta = -2.8$ (T-score=22) to $+2.8$ (T-score=78), score-level information was excellent from $\theta = -2.0$ to $+2.8$, with expected score-level reliability $\approx .90$; score-level reliability at $\theta = -2.4$ was also very good ($\approx .80$; Figure 1).

CAT Simulation, Short Form Development—The correlation between full item bank and CAT scores was 0.97. The standard deviation of the differences between these scores was 0.26, while the root mean square deviation (RMSD) of the two scores was also 0.26 (both statistics in the θ metric). The four most common CAT lengths were four items ($n=349$, 62.3%), five items ($n=93$, 16.6%), six items ($n=48$, 8.6%), and 12 items ($n=47$, 8.4%); CATs 7 to 11 items long occurred infrequently ($n=23$, 4.1%). The mean CAT length was 5.2 items. For 4-item CATs, observed θ s ranged from -1.05 to $+1.67$; θ ranges for 5- and 6-item CATs were similar to those observed for 4-item CATs, though slightly wider (5 items: -1.23 to $+1.82$; 6 items: -1.33 to $+2.05$). Observed θ s for 12-item CATs were bimodal: Low θ s ranged from -2.30 to -1.34 , while high θ s ranged from 2.68 to 2.77. Thus, 12-item CATs occurred when extreme low and extreme high levels of Caregiver Strain were measured. Overall, fewer items were required to estimate scores for the majority of individuals, whose caregiver strain levels ranged from moderately low to moderately high; individuals with either very low or very high levels of caregiver strain required the administration of additional items. The average administration time for a 6-item version was 42 seconds.

Figure 2 shows the number of CAT items used for different scale scores at standard deviation units: at < -1.4 SD units, the CAT tended to use the maximum of 12 items from the item bank; from -1.1 to $+1.7$ SD units, the CAT tended to use the minimum number of four

items from the item bank, with some longer-length CATs occurring, though considerably less frequently than 4-item CATs; and at >2.0 SD units the CAT tended to use the maximum of 12 items from the item bank.

Clinical experts approved the Caregiver Strain 6-item short form item content, its representativeness, and its range of coverage. On a measurement continuum from $\theta = -2.8$ (T-score=22) to $+2.8$ (T-score=78), score-level information was excellent in the θ range from -0.8 to $+1.6$, with expected score-level reliability $.90$; in the extended θ range from -1.6 to $+2.4$, score-level reliability was very good or excellent (i.e., $.80$), while in the further extended θ range from -1.6 to $+2.8$, score-level reliability was good, very good, or excellent (i.e., $.70$). Three-week test-retest for this short form was very good ($r=0.83$). Table 4 provides a summed score to t score conversion.

Discussion

This study developed a new PRO to evaluate the caregiver strain component of HRQOL in caregivers of individuals with TBI (the Caregiver Strain item bank and corresponding short form are available at www.assessmentcenter.net). The TBI-CareQOL Caregiver Strain item bank is the first measure to focus on a single, unidimensional and well-defined aspect of caregiver HRQOL—feelings of being overwhelmed, stressed, self-defeated, down trodden, or beat down as a consequence of undertaking the role of caregiver for a person with TBI. This item bank was developed using a well-established, mixed methodology that included critical input from the caregivers themselves, qualitative methods, classical test theory approaches, and item response theory.⁶¹ Items are devoid of bias (age, gender, and education) and are equally relevant to civilian- and military-TBI caregivers. This homogenous item set also exhibits excellent reliability that meets or exceeds established measurement development standards.⁶¹ This is also the first time that a CAT administration format has been available for use in caregivers. CAT has the advantages of efficiency (only the most relevant items are administered) and sensitivity (predetermined stopping rules for maximal acceptable standard error are implemented). Furthermore, the calibrated short form includes items selected using IRT, and thus scores can be generated, theoretically, from a single item. As a result, missing data are less problematic compared to a measure developed solely using classical test theory. Furthermore, as seen in Figure 2, the CAT administration typically requires fewer than 12 items for most participants, highlighting both test brevity and precision of this measure.

Caregiver Strain is scored using a T metric that indicates how a caregiver is functioning relative to other caregivers of individuals with TBI; higher scores indicate more self-reported strain. Such standardized scores have the advantage of aiding in score interpretation. For example, T scores that are one standard deviation above the mean (i.e., T scores ≥ 60) suggest clinically significant levels of strain since this is worse than 84% of the larger caregiver population. Scores ≥ 70 or above indicate extremely significant problems with strain (i.e., their concerns exceed 95.45% of caregivers). This scoring approach can help guide clinical decision making and referrals.

Study Limitations

While this calibration sample included a diverse caregiver cohort, there were not enough parents to assess item bias relative to spouses. Furthermore, there were not enough male caregivers ($n=81$) to examine item bias by sex (DIF analysis requires ~200 per group⁸¹). While all participants required medical record documentation to be included in this study, TBI severity data were lacking for individuals with TBI in the military sample (these data were missing for 60.3% of the military sample). However, these individuals were recruited from the community, and based on existing prevalence rates of TBI severity in the military,⁸² it can be reasonably assumed that most of this sample (i.e., >80%) falls in the mild TBI classification. Additional work is needed to establish test-retest reliability, validity, and responsiveness to change data for this measure. Preliminary support for reliability and validity are reported elsewhere in this special issue.⁵⁸

Conclusions

The Caregiver Strain item bank is the first computer adaptive test of caregiver strain to be developed that is relevant to caregivers of both civilians and SMVs with TBI. Since this measure was developed explicitly for use in caregivers of TBI, it should be more sensitive than existing generic measures of caregiver burden. This type of brief measure (taking less than one minute to complete), could potentially be integrated into outpatient visits where patients are often accompanied by caregivers, helping to generate appropriate referrals for caregivers in greatest need of additional services/support. This is especially important given that improvements in caregiver HRQOL have the potential benefit of improving the HRQOL of the person with the TBI (which would be consistent with research that links caregiver and care-recipient outcomes^{83–90}). Finally, while this measure was developed for use in caregivers of individuals with TBI, it may be relevant and clinically useful in other trauma or neurological caregiver populations.

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List of Abbreviations

CAT	Computer Adaptive Test
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CFA	Confirmatory Factor Analysis
CFI	Confirmatory Fit Index
DIF	Differential Item Functioning
EFA	Exploratory Factor Analysis
GRM	Graded Response Model
HRQOL	Health-Related Quality of Life
PRO	Patient-Reported Outcome
PROMIS	Patient-Reported Outcomes Measurement Information System
RMSD	Root Mean Square Deviation
RMSEA	Root Mean Squared Error of Approximation
SE	Standard Error
SF	Short Form
SMV	Service Member/Veteran
TBI	Traumatic Brain Injury
TBI-CareQOL	Traumatic Brain Injury Caregiver Quality of Life
TLI	Tucker Lewis Index

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Highlights

- The TBI-CareQOL measurement system includes new and existing self-report measures
- Measures were developed specific to caring for someone with traumatic brain injury
- Generic measures also evaluate important quality of life constructs for caregivers

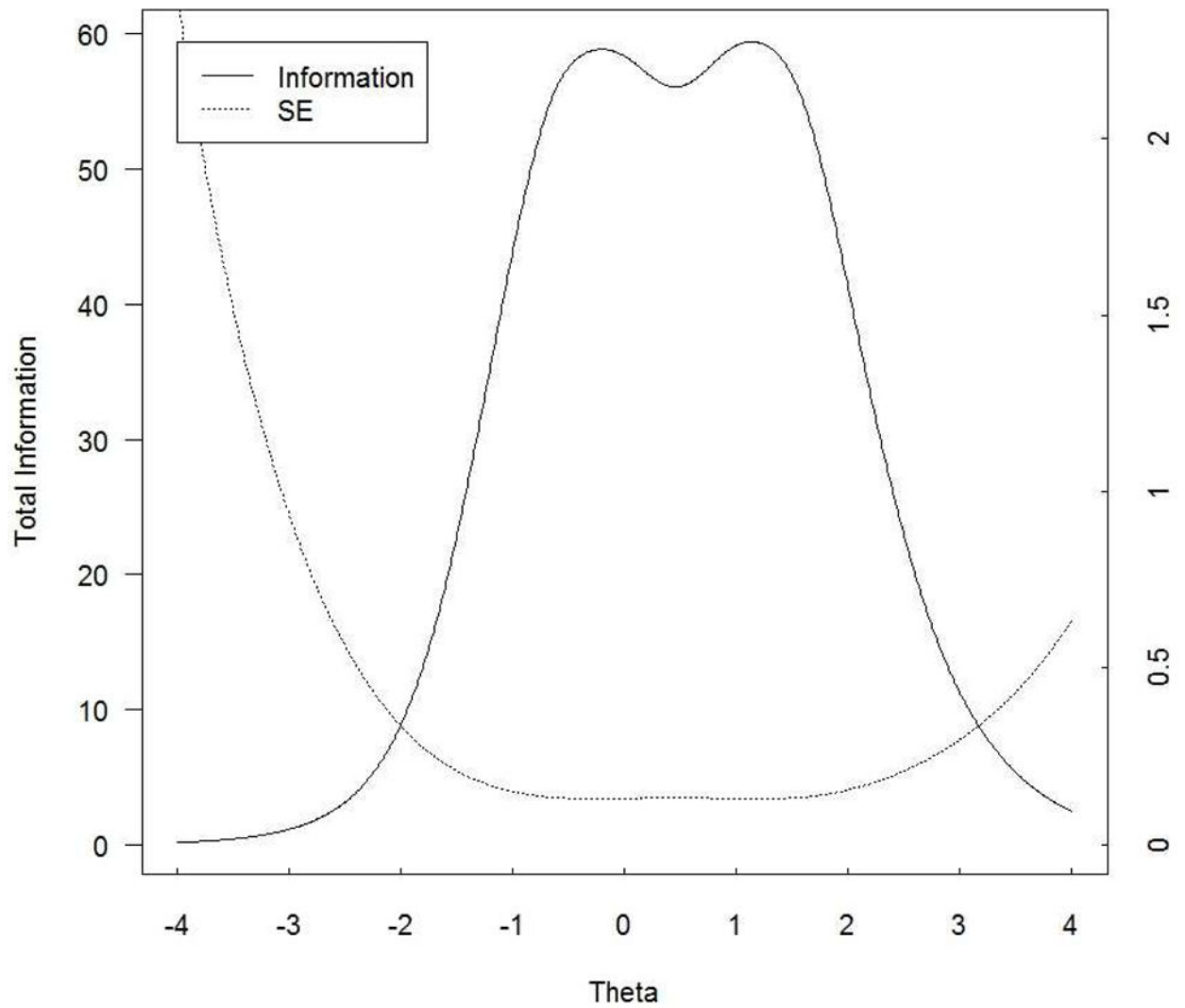


Figure 1. Caregiver Strain Test Information Plot

In general, total information should be 10.0 and the standard error should be 0.32 (this provides a reliability of 0.9). This figure shows excellent total information and standard errors for Caregiver Strain scale scores between -2.0 and $+2.8$.

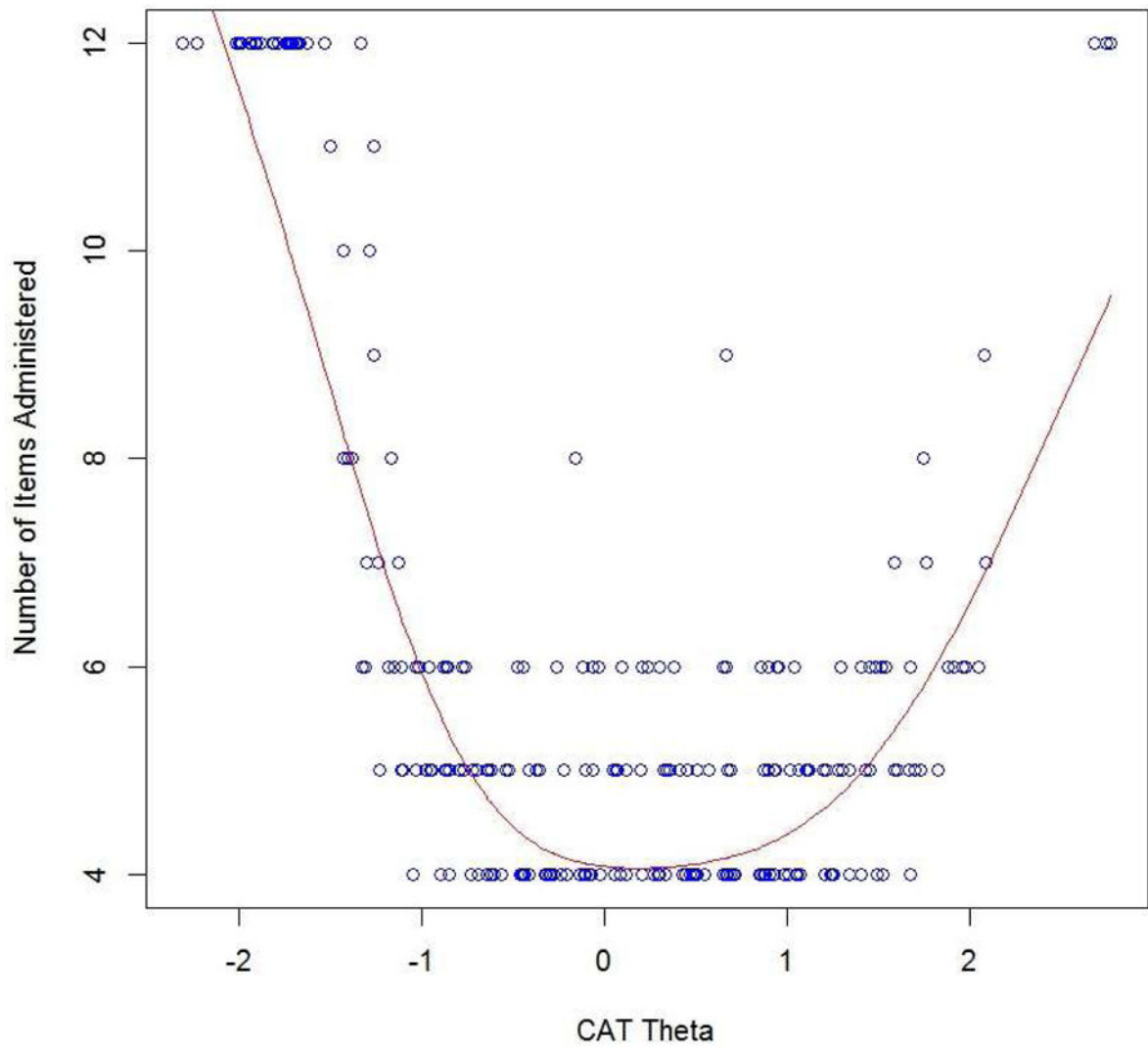


Figure 2. Caregiver Strain Number of CAT Items by CAT Theta

This figure shows the number of CAT items used for different scale scores in standard deviation units: at < -1.4 SD units, the CAT tended to use the maximum of 12 item bank items; from -1.1 to $+1.7$ SD units, the CAT tended to use the minimum number of 4 item bank items; and at $> +2.0$ units the CAT tended to use the maximum of 12 item bank items.

Unidimensional Modeling and Analyses

Table 1

Domain	Item pool	EFA E1/E2 ratio (criterion >4)	Proportion of variance for E1 (criterion >0.40)	Unidimensional Modeling					Initial Item Performance			IRT Modeling			Final item bank
				1-factor CFA loading (criterion <.50)	1-factor CFA residual correlation (criterion >.20)	1-factor CFA modification index (criterion >100)	Item-adjusted total score correlation (Criterion <.40) 1 1	Sparse cells (criterion<10)	Problems with monotonicity	IRT item misfit	DIF	IRT item misfit	DIF		
Caregiver Strain	66 items	8.99	0.51	0 items	3 items	9 items	1 item	13 items	0 items	7 items	0 items	0 items	0 items	0 items	33 items

Note. CFA = Confirmatory Factor Analysis; EFA = Exploratory Factor Analysis, IRT = Item Response Theory

Table 2

Caregiver Strain Final Item Parameters

Domain	Item Bank	CFI (criterion >.95)	TLI (criterion >.95)	CFI-based RMSEA (criterion <.15)	Alpha Reliability (criterion > .80)	IRT-based RMSEA (criterion < .15)	Response Pattern Reliability (criterion > .80)
Caregiver Strain	33 items	.95	.95	.096	.98	.08	.98

Note. CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, RMSEA: Root Mean Square Error of Approximation

Table 3

TBI-CareQOL Caregiver Strain Item Parameters

Item	Slope	Threshold 1	Threshold 2	Threshold 3	Threshold 4
I feel like there is no rest when it comes to providing care for the person with the injury.	2.14	-1.25	-0.36	0.65	1.51
I have trouble giving the same level of care that I did in the past.	1.52	-0.43	0.58	2.30	3.17
Small things stress me out more than they should when it comes to caring for the person with the injury.	1.92	-1.28	-0.31	1.08	2.06
I feel like I am the only one who can care for the person with the injury.	1.42	-1.32	-0.58	0.37	1.28
When it comes to caring for the person with the injury, I feel like there is no way out.	1.88	-0.24	0.42	1.59	2.27
I have trouble doing general household chores (i.e., taking out the trash) due to the responsibilities I have as a caregiver.	2.10	-0.19	0.63	1.71	2.38
I have too much to do because of the responsibilities I have as a caregiver.	3.07	-0.58	0.08	0.95	1.71
I wish I had help with the responsibilities I have as a caregiver.	2.37	-1.04	-0.28	1.05	1.71
I feel angry about the amount of help I get with the responsibilities I have as a caregiver.	2.66	-0.18	0.49	1.45	1.94
I am getting more and more tired of my caregiving responsibilities.	2.59	-0.25	0.55	1.52	2.16
I cannot handle any more responsibility when it comes to providing care for the person with the injury.	2.24	-0.32	0.61	1.44	2.39
I cannot do everything that needs to be done for the person I care for.	1.76	-0.54	0.46	1.72	2.73
I feel stressed when it comes to providing care for the person with the injury.	3.03	-1.09	-0.28	0.94	1.63
I feel so stressed that I am not taking care of myself.	2.83	-0.37	0.34	1.30	1.90
I feel drained by my responsibilities as a caregiver.	3.72	-0.69	0.02	1.04	1.60
I feel that stress makes me forget things more easily.	2.59	-0.85	-0.10	0.95	1.65
I feel that stress is making me age faster.	2.67	-0.81	-0.16	0.79	1.44
I feel like I am never going to stop feeling stressed.	3.14	-0.62	-0.09	0.83	1.46
I feel stressed about how the person I care for might act.	1.77	-1.02	-0.21	1.01	1.82
I feel stressed about the medical care the person I care for is receiving.	1.58	-0.76	0.05	1.03	1.80
I feel stressed out when interacting with the person I care for.	1.63	-0.74	0.20	1.94	2.78
I have to limit my social activity because I have too much to do.	2.43	-0.81	-0.15	0.74	1.41
I feel that stress makes it difficult to start anything new.	3.48	-0.64	-0.04	0.88	1.50
I feel that stress makes me feel tired.	3.40	-1.18	-0.63	0.42	1.10
I feel that there are not enough hours in the day to get everything done.	2.52	-1.24	-0.69	0.35	0.94
I feel that stress makes it more difficult to concentrate.	3.02	-1.16	-0.36	0.68	1.40
I feel like I am under too much pressure when it comes to providing care for the person with the injury.	2.87	-0.47	0.34	1.44	2.14

Item	Slope	Threshold 1	Threshold 2	Threshold 3	Threshold 4
I feel so stressed that I am not sure where to begin.	2.86	-0.64	0.15	1.28	1.98
I feel like I can never take a break from my caregiver responsibilities.	2.56	-0.79	-0.06	0.68	1.40
I feel alone in my caregiving duties.	2.59	-0.63	-0.05	0.71	1.36
I feel frustrated with my situation.	2.85	-0.77	-0.08	1.02	1.55
I feel so stressed that I want to remove myself from the situation.	1.64	0.03	0.84	2.17	2.98
I feel burdened with the responsibility of caring for the person with the injury.	2.10	-0.21	0.55	1.75	2.54

Note. Items that are indicated in bold were selected for inclusion on the 6-item Caregiver Strain short form

Table 4Caregiver Strain Short Form Summed Score to *t* Score Conversion Table

Raw Score	T-score	SE *
6	32.13	5.08
7	36.93	3.71
8	39.21	3.46
9	41.34	3.11
10	43.14	2.94
11	44.78	2.83
12	46.31	2.78
13	47.78	2.78
14	49.23	2.80
15	50.67	2.82
16	52.09	2.84
17	53.48	2.85
18	54.85	2.85
19	56.22	2.84
20	57.61	2.83
21	59.01	2.80
22	60.40	2.78
23	61.81	2.78
24	63.25	2.81
25	64.76	2.90
26	66.40	3.04
27	68.22	3.24
28	70.26	3.53
29	72.57	3.87
30	76.12	4.62

* SE = Standard error