



Measurement Invariance of Three Brief Emotion Regulation Questionnaires in People With and Without a History of Non-Suicidal Self-Injury

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Abstract: In this study, we investigated the factor structure and measurement invariance of three brief emotion regulation questionnaires in samples of young adults (17–30 years) with and without a history of non-suicidal self-injury (NSSI; $n = 705–836$). Results revealed configural, full metric, and full scalar invariance for the Difficulties in Emotion Regulation Scale – Short Form (DERS-SF) and the Cognitive Emotion Regulation Questionnaire – Short (CERQ-S). In addition, the CERQ-S showed full residual error invariance. In contrast, the proposed factor structure of the Emotion Regulation Questionnaire (ERQ) was not confirmed in either sample. Further, we observed that some items function differently for people who self-injure and people who do not, which could result in artificial differences being reported in use of cognitive reappraisal. While the current findings offer confidence that observed differences using the DERS-SF and CERQ-S reflect reliable discrepancies in emotion regulation processes between people who self-injure and do not, the validity of statistical inferences using the ERQ could not be ensured and need further psychometric evaluation.

Keywords: non-suicidal self-injury, emotion regulation, measurement invariance

Non-suicidal self-injury (NSSI), the intentional destruction of one's body tissue with no intent to die (Nock and Favazza, 2009), is a major public health concern among young adults. International pooled prevalence rates estimate that 13.4% of young adults report engaging in any self-injury in their lifetime (Swannell, Martin, Page, Hasking, & St John, 2014), but estimates can vary widely across samples (8–32%; Hamza & Willoughby, 2016; Kiekens et al., 2016). NSSI can take many forms, but common behaviors include skin cutting, burning, and self-battery. Although engaged for a number of reasons, NSSI most often serves an emotion regulatory function, used in place of alternative emotion regulation strategies (Bentley, Nock, & Barlow, 2014). Emotion regulation is thus a central factor in almost all theoretical models of NSSI (see Hasking, Whitlock, Voon, & Rose, 2017). This has resulted in a substantial body of research seeking to understand the emotion

regulation processes proposed to underlie NSSI. Remarkably, however, no one has questioned whether measurement of emotion regulation works comparably in people who self-injure and those who do not. Of note, the very difficulties in emotion regulation thought to underlie NSSI may limit the validity of observed differences on self-report emotion regulation questionnaires. Yet, statistical comparisons of parameter estimates, like regression coefficients and means, are only meaningful when the instruments we use demonstrate measurement invariance (MI) across groups (Sass, 2011).

In this study, we used multigroup confirmatory factor analysis (MG-CFA) to investigate MI of three brief instruments commonly used to assess emotion regulation in individuals with and without a history of NSSI: the Difficulties in Emotion Regulation Scale – Short Form (DERS-SF; Kaufman et al., 2015), the Emotion Regulation

Questionnaire (ERQ; Gross & John, 2003), and the Cognitive Emotion Regulation Questionnaire – Short (CERQ-S; Garnefski & Kraaij, 2006). Given that length of questionnaires is inversely related to data quality (Galesic & Bosnjak, 2009), the need for brief instruments with sound psychometric properties is increasingly being recognized (e.g., Kaufman et al., 2015). However, when only a small number of items are used to operationalize emotion regulation processes, lack of MI can quickly become a major threat to the validity of the findings (Sass, 2011). We followed a stepwise bottom-up MI investigation and consecutively tested configural (i.e., implies same constructs are operationalized), metric (i.e., implies mean-corrected score comparability), scalar (i.e., implies full score comparability), and residual error (i.e., implies comparability of manifest scores) invariance across people who self-injure and those who do not.

Method

Participants and Procedure

Data for this study were aggregated from data collected for previous studies, broadly assessing emotion regulation as it relates to mental health outcomes. Participants were all undergraduate university students aged between 17 and 30 years who self-selected into the studies in response to advertisements posted on an online noticeboard; all received course credit for participation. After exclusion of duplicate responses on the same measure across different studies (which response to delete was chosen randomly), the dataset on the DERS-SF contained 836 respondents, the ERQ 705 respondents, and the CERQ-S 758 respondents. Table 1 presents an overview of the characteristics of the three samples. All studies from which data were drawn were approved by the University Human Research Ethics Committee. Participants were provided with information sheets about maintaining mental health, and provided contact details for local and national counseling services.

Measures

Inventory of Statements About Self-Injury (ISAS; Klonsky & Glenn, 2009)

All participants were asked if they had ever engaged in NSSI, defined as hurting themselves intentionally, and without suicidal intent. Participants reporting a history of NSSI then reported frequency of 12 self-injurious behaviors (e.g., cutting, burning, self-battery), age of onset, and frequency of NSSI in the last 12 months. The ISAS has

established test-retest reliability ($r = .85$; Klonsky & Olino, 2008) in samples of young adults.

The Difficulties in Emotion Regulation Scale – Short Form

The DERS was specifically designed to tap into six aspects of emotion regulation: nonacceptance of emotional response, difficulty in goal-directed behavior, impulse control, emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity (Gratz & Roemer, 2004). The DERS-SF reduced the 36-item DERS into an 18-item (i.e., three items for each scale) shortened version that showed a similar factor structure, correlated strongly with the factors of the original measure ($r \geq .90$), and had comparable, or better, psychometric properties (DERS-SF; Kaufman et al., 2015). Participants respond to each item on a 5-point scale (1 = *almost never*, 5 = *almost always*) regarding how often they use each strategy. In the current sample, Cronbach's α ranged from acceptable to excellent: Nonacceptance = .84, Goals = .88, Impulse Control = .91, Emotional Awareness = .79, Lack of Emotion Regulation Strategies = .83, and Emotional Clarity = .85.

The Emotion Regulation Questionnaire

The ERQ is a 10-item measure of emotion regulation, comprising independent, but correlated, factors of cognitive reappraisal (six items) and expressive suppression (four items; Gross & John, 2003). For each item, participants respond on a 7-point Likert scale indicating the degree to which they agree with the statement (1 = *strongly disagree*, 7 = *strongly agree*). Validation of the scale revealed adequate internal consistency for the two scales ($\alpha = .79$ for Cognitive Reappraisal and $\alpha = .73$ for Expressive Suppression) and good test-retest reliability ($r = .69$; Gross & John, 2003). In the current sample, Cronbach's α were acceptable for Expressive Suppression $\alpha = .78$, and excellent for Cognitive Reappraisal $\alpha = .91$.

Cognitive Emotion Regulation Questionnaire – Short

The CERQ was specifically designed to assess nine conceptually distinct cognitive emotion regulation strategies individuals may use in response to stress: self-blame, acceptance, rumination, positive refocus, refocus on planning, positive reappraisal, putting into perspective, catastrophizing, and blaming others (Garnefski, Kraaij, & Spinhoven, 2001). Garnefski and Kraaij reduced the 36-item CERQ into an 18-item questionnaire (i.e., two items for each scale) that showed a similar factor structure, and retained acceptable psychometric properties compared to the original measure (Garnefski & Kraaij, 2006; Ireland, Clough, & Day, 2017). For each item, participants indicate

Table 1. Demographic and scale characteristics across samples

	DERS-SF		ERQ		CERQ-S	
	<i>n</i> = 836		<i>n</i> = 705		<i>n</i> = 758	
	<i>n</i> / <i>M</i>	%/ <i>SD</i>	<i>n</i> / <i>M</i>	%/ <i>SD</i>	<i>n</i> / <i>M</i>	%/ <i>SD</i>
Female gender	630	75.36	516	73.19	558	73.61
Age	20.39	2.68	20.72	2.64	20.65	2.61
Full-time student	773	93.02	550	90.16	689	91.02
Lifetime history of NSSI	284	33.97	242	34.33	258	34.04
Age of onset NSSI	14.60	2.56	14.69	2.60	14.87	2.58
Emotion regulation subscales						
Non-Acceptance ^a	7.88	3.05	–	–	–	–
Goals ^a	8.17	2.86	–	–	–	–
Impulse control ^a	6.34	2.92	–	–	–	–
Emotional awareness ^a	6.99	2.44	–	–	–	–
Lack of strategies ^a	7.25	2.88	–	–	–	–
Emotional clarity ^a	7.21	2.60	–	–	–	–
Cognitive reappraisal ^b	–	–	24.06	7.78	–	–
Expressive suppression ^c	–	–	13.68	4.76	–	–
Self-blame ^d	–	–	–	–	6.02	1.98
Acceptance ^d	–	–	–	–	7.19	1.93
Rumination ^d	–	–	–	–	6.69	1.81
Positive refocus ^d	–	–	–	–	5.07	1.97
Refocus on planning ^d	–	–	–	–	6.56	1.83
Positive reappraisal ^d	–	–	–	–	6.83	2.09
Putting into perspective ^d	–	–	–	–	6.45	2.03
Catastrophizing ^d	–	–	–	–	5.49	2.11
Blaming others ^d	–	–	–	–	4.21	1.65

Notes. ^a3–15 range, ^b6–42 range, ^c4–28 range, ^d2–10 range. NSSI = Non-suicidal self-injury; DERS-SF = Difficulties in Emotion Regulation Scale – Short Form; ERQ = Emotion Regulation Questionnaire; CERQ-S = Cognitive Emotion Regulation Questionnaire – Short.

how much they use that strategy to cope with stressful events (1 = *almost never*, 5 = *almost always*). In the current sample, Cronbach's α generally ranged from acceptable to good: Self-Blame = .73, Acceptance = .81, Rumination = .60, Positive Refocus = .75, Refocus on Planning = .66, Positive Reappraisal = .76, Putting into Perspective = .74, Catastrophizing = .82, and Blaming Others = .80.

Data Analysis

MGCFA was used to test MI and model fit was assessed using maximum likelihood estimation with robust standard errors (MLR) in order to account for potential deviations of multivariate normality and incomplete data on emotion regulation items (less than 1.5% across datasets). The following fit indices were considered acceptable model fit: Standardized Root Mean Square Residual (SRMR) values close to 0.08 or below, Root Mean Square Error of Approximation (RMSEA) close to 0.08 or below, and a Comparative Fit Index (CFI) in the 0.90–0.95 range or higher

(Brown, 2015). Configural (i.e., equal form), full metric (i.e., equal factor loadings), full scalar (i.e., equal intercepts), and residual error invariance (i.e., equal item uniqueness) was supported if the configural model showed acceptable model fit and each of the subsequent models showed a nonsignificant MLR chi-square test statistic *and* an increase of CFI less than or equal to 0.02, or differences in McDonald's non-centrality index (NCI) below established cutoffs on the basis of the number of items and factors (Meade, Johnson, & Braddy, 2008). All analyses¹ were performed using MPlus v7.4 (Muthén & Muthén, 2012).

Results

Approximately one third of students reported a history of NSSI in each sample (Table 1). Among those who self-injured, about half reported NSSI in the last year (across samples: 45.87–46.51%). The three main forms reported were cutting oneself (44.69–47.58% range), severe

¹ Mplus output of all presented models can be found in the Electronic Supplementary Material, ESM 3.

Table 2. Model fit of baseline models between young adults with and without a history of non-suicidal self-injury

	χ^2	df	RMSEA [90% CI]	CFI	SRMR
DERS-SF					
No NSSI sample $n = 552$	261.47	120	0.046 [0.039, 0.054]	0.967	0.042
NSSI sample $n = 284$	203.09	120	0.049 [0.037, 0.061]	0.964	0.040
ERQ					
No NSSI sample $n = 463$	282.42	34	0.126 [0.112, 0.139]	0.876	0.063
NSSI sample $n = 242$	176.45	34	0.132 [0.113, 0.151]	0.842	0.072
Modified ERQ					
No NSSI sample $n = 463$	30.04	8	0.077 [0.049, 0.107]	0.978	0.029
NSSI sample $n = 242$	28.88	8	0.104 [0.065, 0.116]	0.951	0.034
CERQ-S					
No NSSI sample $n = 500$	335.26	99	0.069 [0.061, 0.077]	0.915	0.057
NSSI sample $n = 258$	221.33	99	0.069 [0.057, 0.081]	0.918	0.066

Note. NSSI = non-suicidal self-injury; DERS-SF = Difficulties in Emotion Regulation Scale – Short Form; ERQ = Emotion Regulation Questionnaire; CERQ-S = Cognitive Emotion Regulation Questionnaire – Short.

scratching (14.11–16.37% range), and self-battery (11.61–13.72% range).

DERS-SF

The baseline model was an acceptable fit to the data for both samples (Table 2). Configural (M1), full metric (M2), full scalar (M3), and partial residual error (M4.2) invariance was supported (Table 3). The results of latent mean analysis showed that young adults who self-injure score higher on nonacceptance of emotional response (unstandardized $M_{(NSSI)} = 0.45$, $Z = 6.29$, $p < .001$), difficulty in goal-directed behavior (unstandardized $M_{(NSSI)} = 0.42$, $Z = 6.13$, $p < .001$), impulse control difficulties (unstandardized $M_{(NSSI)} = 0.56$, $Z = 7.69$, $p < .001$), lack of emotional awareness (unstandardized $M_{(NSSI)} = 0.14$, $Z = 2.17$, $p = .030$), limited access to emotion regulation strategies (unstandardized $M_{(NSSI)} = 0.77$, $Z = 9.90$, $p < .001$), and lack of emotional clarity (unstandardized $M_{(NSSI)} = 0.41$, $Z = 6.43$, $p < .001$). Entering all latent subscales as predictors and gender and age as covariates in a logistic regression, only limited access to emotion regulation strategies ($\beta = 1.06$, $Z = 3.76$, $p < .001$) remained predictive of a lifetime history of NSSI.

ERQ

The baseline model was a poor fit to the data for both samples (Table 2). Modification indices suggested five residual variances be correlated to achieve an acceptable fit in both

samples. Given that these modifications could not be justified on theoretical grounds, items with the lowest factor loadings or large residual error covariances were removed until an acceptable fit was obtained. This resulted in the deletion of two items on each scale (see supplementary materials ESM 1).

Configural (M1) and full metric (M2) invariance was supported for the modified ERQ, but the MLR χ^2 test statistic and both ΔNCI and ΔCFI indicated full scalar (M3.1) invariance was rejected (Table 3). Irrespective of the score on the underlying latent factor cognitive reappraisal, there was a tendency for young adults who self-injured to disagree more with item 3 “When I want to feel less negative emotion (such as sadness or anger), I change what I’m thinking about” (Intercept_{(No NSSI)} = 4.24 vs. Intercept_{(NSSI)} = 3.91), and item 5 “When I’m faced with a stressful situation, I make myself think about it in a way that helps me stay calm” (Intercept_{(No NSSI)} = 3.84 vs. Intercept_{(NSSI)} = 3.59). Allowing these intercepts to vary between groups, partial scalar (M3.2) and full residual error (M4) invariance was supported (Table 3).}}}}

There were no mean differences on the latent factor for cognitive reappraisal (unstandardized $M_{(NSSI)} = -0.11$, $Z = 1.27$, $p = .203$) or expressive suppression (unstandardized $M_{(NSSI)} = 0.17$, $Z = 1.29$, $p = .196$). However, ignoring the differential functioning of item 3 and 5 would have resulted in the conclusion that young adults with NSSI score significantly lower on cognitive reappraisal (unstandardized $M_{(NSSI)} = -0.18$, $Z = 2.10$, $p = .036$) than peers without a history of NSSI².

² Focusing on the non-modified ERQ, and ignoring the lack of MI in our sample (see ESM 2), would have also led to an artificial difference (unstandardized $M_{(NSSI)} = -0.24$, $Z = 2.54$, $p = .011$) compared to the actual nonsignificant discrepancy on the latent factor cognitive reappraisal (unstandardized $M_{(NSSI)} = -0.11$, $Z = 1.09$, $p = .278$).

Table 3. Measurement invariance evaluation of emotion regulation measures between young adults with and without non-suicidal self-injury

	χ^2	df	NCI	CFI	Model comparison	p MLR $\Delta\chi^2$	Δ NCI	Δ CFI ^b
DERS-SF ^a								
M1: Configural invariance	465.05	240	0.8739	0.966	–	–	–	–
M2: Full metric invariance	480.08	252	0.8723	0.966	M1-M2	.290	0.0016	0.000
M3: Full scalar invariance	492.99	264	0.8719	0.966	M2-M3	.460	0.0005	0.000
M4.1: Full residual error invariance	540.28	282	0.8567	0.961	M3-M4.1	.001	0.0152	0.005
M4.2: Partial residual error invariance ^c	516.34	279	0.8675	0.964	M3-M4.2	.057	0.0043	0.002
Modified ERQ ^d								
M1: Configural invariance	59.04	16	0.9699	0.971	–	–	–	–
M2: Full metric invariance	67.60	20	0.9668	0.968	M1-M2	.087	0.0031	0.003
M3.1: Full scalar invariance	87.83	24	0.9557	0.957	M2-M3.1	< .001	0.0111	0.011
M3.2: Partial scalar invariance ^e	72.93	22	0.9645	0.966	M2-M3.2	.080	0.0023	0.002
M4: Full residual error invariance	77.17	28	0.9657	0.967	M3.2-M4	.581	–0.0012	–0.001
CERQ-S ^f								
M1: Configural invariance	561.21	198	–	0.916	–	–	–	–
M2: Full metric invariance	566.02	207	–	0.917	M1-M2	.368	–	0.001
M3: Full scalar invariance	575.07	216	–	0.917	M2-M3	.613	–	0.000
M4: Full residual error invariance	590.50	234	–	0.917	M3-M4	.221	–	0.000

Notes. ^aCutoff value for Δ CFI > 0.002, ^bcutoff value for Δ NCI > 0.0087, ^cresidual variance of item 8 ($p = .023$), 16 ($p = .023$), and 32 ($p = .026$) was higher in people who self-injure, ^dcutoff value for Δ NCI > 0.0062, ^eintercept of Item 3 ($p < .001$) and item 5 ($p = .016$) was lower in people who self-injure, ^fthere are no established Δ NCI cut-offs for models with 9 factors and 18 items.

CERQ-S

The baseline model was an acceptable fit to the data for both samples (Table 2). Configural (M1), full metric (M2), full scalar (M3), and full residual error (M4) invariance was supported (Table 3). The results of latent mean analysis show that young adults who self-injure score higher on self-blame (unstandardized $M_{(NSSI)} = 0.23$, $Z = 3.09$, $p = .002$), and catastrophizing (unstandardized $M_{(NSSI)} = 0.19$, $Z = 2.43$, $p = .015$). Conversely, young adults without a history of NSSI score higher on acceptance (unstandardized $M_{(No\ NSSI)} = 0.18$, $Z = 2.51$, $p = .012$), positive refocusing (unstandardized $M_{(No\ NSSI)} = 0.31$, $Z = 4.37$, $p < .001$), positive reappraisal (unstandardized $M_{(No\ NSSI)} = 0.24$, $Z = 2.86$, $p = .004$), and putting things into perspective (unstandardized $M_{(No\ NSSI)} = 0.21$, $Z = 2.64$, $p = .008$). There was no difference between groups on rumination (unstandardized $M_{(NSSI)} = 0.09$, $Z = 1.27$, $p = .203$), refocus on planning (unstandardized $M_{(NSSI)} = -0.11$, $Z = 1.73$, $p = .084$), and blaming others (unstandardized $M_{(NSSI)} = -0.09$, $Z = 1.30$, $p = .194$). Entering all latent subscales with significant mean differences as predictors, and gender and age as covariates, in a logistic regression, self-blame NSSI ($\beta = 0.54$, $Z = 2.92$, $p = .003$) and positive refocusing ($\beta = -0.41$, $Z = 2.59$, $p = .010$) remained predictive of a lifetime history of NSSI.

Conclusion

This is the first study to assess whether differences between young adults who self-injure and people who do not, that

are often observed with self-report measures of emotion regulation, reflect reliable differences in perceived emotion regulation or potential artifacts of measurement.

Overall, our findings offer confidence in using the DERS-SF and CERQ-S to assess discrepancies in emotion regulation processes, but reveal potential concern using the ERQ.

We found that inferences made using the DERS-SF and CERQ-S are reliable and likely a function of real group differences in emotion regulation. In line with recent studies (e.g., Kelada, Hasking, & Melvin, 2016; Zerkowitz, Cole, Han, & Tomarken, 2016), we found that perceived lack of emotion regulation strategies, self-blame and inability to refocus positively uniquely differentiate young adults who self-injure from those who do not. Surprisingly, however, we were not able to confirm the factor structure of the ERQ in either sample. While previous researchers have been able to confirm the proposed factor structure of the ERQ in an undergraduate university sample (Melka, Lancaster, Bryant, & Rodriguez, 2011), it should be noted that others have also failed to replicate the original factor structure in community samples and needed to make modifications in order to achieve acceptable model fit (Spaapen, Waters, Brummer, Stopa, & Bucks, 2014; Wiltink et al., 2011).

Further, while prior studies have revealed MI across age, gender, and education for the ERQ (Melka et al., 2011; Spaapen et al., 2014), it is worrying that we detected lack of MI between people who self-injure and do not in our data. In fact, if not taken into account, this measurement

artifact would have led to the erroneous conclusion that there is an apparent group difference in use of cognitive reappraisal. Although the current findings raise questions concerning the reliability of statistical comparisons between young adults with and without a history of NSSI using the ERQ, further MI evaluation of this measure is needed before definite conclusions can be made about potential lack of MI. Replication with larger samples that are not self-selected, and include young adults not enrolled in university would be informative for this purpose. Additional research is warranted exploring MI in samples of young adults who engage in current (as opposed to lifetime) NSSI or those that meet the proposed criteria for NSSI disorder (American Psychiatric Association, 2013).

Based on the above findings, we urge researchers to explore whether the emotion regulation measures selected introduce systematic bias before proceeding to group comparisons between participants who do and do not self-injure.

Acknowledgment

We thank Jessica Dawkins, Lana Glasson, Amy Peterson, Harmeen Puarr, Alyssa Rose, Erika Rutherford, Kassandra Shaw, and Ruth Tatnell for assistance with data collection.

Electronic Supplementary Materials

The electronic supplementary material is available with the online version of the article at <https://doi.org/10.1027/1015-5759/a000464>

ESM 1. Table (.doc)

Original and modified Emotion Regulation Questionnaire (ERQ).

ESM 2. Table (.doc)

Measurement invariance evaluation of non-modified Emotion Regulation Questionnaire between young adults with and without non-suicidal self-injury.

ESM 3. Data (.out)

Output data from MPlus.

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Received March 7, 2017
Revision received August 14, 2017
Accepted August 26, 2017
Published online March 28, 2018
EJPA Section/Category Clinical Psychology

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http://econtent.hogrefe.com/doi/pdf/10.1027/1015-5759/a000464 - Penelope Hasking <penelope.hasking@curtin.edu.au> - Tuesday, April 03, 2018 4:58:51 PM - IP Address: 134.7.248.199