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How am I doing compared to different standards? Comparative thinking and well-being following exposure to a vehicle-ramming attack

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ABSTRACT

Background: Exposure to potentially adverse events might intensify thinking about different comparison standards in relation to one's own well-being.

Objective: To examine how frequently survivors of a recent potentially traumatic event use different comparison standards to evaluate their current well-being.

Method: A survey with 223 participants directly or indirectly exposed to a vehicle-ramming attack was conducted. Symptoms of post-traumatic stress disorder (PTSD) and depression, quality of life, and the sum score of the frequency of different types of comparison standards were assessed. The latter consisted of temporal, counterfactual, social, dimensional, and criteria-based comparisons.

Results: In total, 98% of participants reported some form of comparative thinking during the last two weeks. The most frequent comparison types were temporal and dimensional comparisons, with 94 and 87% of participants reporting them, respectively. Notably, comparative thinking predicted unique variance in PTSD symptoms, over and above depressive symptoms.

Conclusion: The results suggest that comparative thinking may be a significant factor in understanding psychological distress following exposure to aversive events. Replication of the results in larger samples and using longitudinal and experimental designs is clearly necessary.

¿Cómo me está yendo según diferentes estándares valorativos? Pensamiento comparativo y bienestar luego de la exposición a un ataque por atropello deliberado

Antecedentes: La exposición a eventos potencialmente adversos puede aumentar el pensar en distintos estándares valorativos en relación con el propio bienestar.

Objetivos: Evaluar la frecuencia con la que los sobrevivientes de un evento potencialmente traumático emplean diferentes estándares valorativos para evaluar su propio bienestar.

Métodos: Se realizó una encuesta de 223 participantes que estuvieron directa o indirectamente expuestos a algún ataque por atropello deliberado. Se evaluaron los síntomas del trastorno de estrés postraumático (TEPT) y de la depresión, la calidad de vida y el puntaje final de la frecuencia de diferentes estándares valorativos. Estas incluían a comparaciones basadas en criterios temporales, contrafácticos, sociales y dimensionales.

Resultados: En total, el 98% de los participantes reportó algún tipo de pensamiento comparativo en las últimas dos semanas. Los tipos de comparación más frecuente fueron los temporales y los dimensionales, reportados en un 94% y en un 87%, respectivamente, por los participantes. El pensamiento comparativo predecía una varianza única en los síntomas del TEPT de una manera considerable y mucho mayor que los síntomas depresivos.

Conclusiones: Los resultados sugieren que el pensamiento comparativo podría ser un factor significativo para comprender el estrés psicológico luego de la exposición a eventos aversivos. Resulta claramente necesario el replicar los resultados en muestras más amplias y empleando diseños longitudinales y experimentales.

我的表现相较于不同标准怎么样？遭受撞车袭击后的比较思维和身心健康

背景: 暴露于潜在不良事件可能会加剧人们对自己身心健康相关的不同比较标准的思考。

目的: 考查最近一次潜在创伤事件的幸存者使用不同比较标准评估他们目前身心健康状况的频率。

方法: 对223名直接或间接遭受撞车袭击的参与者进行了调查。评估了创伤后应激障碍(PTSD)和抑郁症状,生活质量以及不同类型比较标准频率总分。后者包括时间,反事实,社会,维度和基于标准的比较。

结果: 在过去的两周中,总计98%的参与者报告了某种形式的比较思维。最频繁的比较类型是时间和维度比较,分别有94%和87%的参与者报告。值得注意的是,比较思维预测了除抑郁症状外,PTSD症状的独特变异。

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PALABRAS CLAVE

Estándares valorativos; pensamiento comparativo; contrafáctico; bienestar; TEPT; depresión

关键词

比较标准; 比较思维; 反事实; 身心健康; PTSD; 抑郁

HIGHLIGHTS

- Survivors of a vehicle-ramming attack frequently compared their current well-being to different comparison standards.
- The most frequently used comparisons were temporal and dimensional comparisons.
- Comparative thinking was a significant predictor of PTSD symptoms.

结论: 研究表明, 比较思维可能是理解暴露于厌恶事件后心理困扰的重要因素。在更大的样本中重复结果并使用纵向和实验设计显然是必要的。

1. Introduction

Most individuals experience at least one potentially traumatic event in the course of their lifetime (Benjet et al., 2016). A significant number of trauma survivors develop chronic symptoms of posttraumatic stress disorder (PTSD) or depression (Kessler et al., 2017). Furthermore, a significant number of individuals with PTSD have comorbid depression and research demonstrates that this co-occurrence is characterised by more general distress than either condition alone (Morina et al., 2013). Yet, the majority of survivors display a trajectory of resilience (Bonanno, Westphal, & Mancini, 2011). Cognitive factors play a crucial role in the development and maintenance of symptoms of PTSD and depression (LoSavio, Dillon, & Resick, 2017). However, surprisingly little is known about the role of comparative thinking in psychological adjustment following aversive experiences (Hoppen, Heinz-Fischer, & Morina, 2020). In general, comparative thinking can emerge either spontaneously or be instigated intentionally and serves key self-motives, including self-assessment, self-improvement, self-enhancement, and self-verification (Festinger, 1954; Morina, *in press*; Sedikides & Strube, 1997; Wood, 1996).

In relation to self-perception, comparative thinking is defined as thinking about different comparison standards that represent the benchmark against which the evaluator compares a characteristic of oneself (Morina, *in press*). Literature has identified several types of comparison that influence self-perception: social, temporal, criteria-based, dimensional, and counterfactual comparisons (Morina, *in press*). Social comparison is the most prominent type and relates to thinking about the social information in relation to the self (Gerber, Wheeler, & Suls, 2018; Wood, 1996). Temporal comparison relates to

comparing a present self-description with a self-description in the past or with envisioned prospective selves (Albert, 1977). Dimensional comparison occurs when an individual compares their attribute on one dimension with their attribute on another dimension (Möller & Marsh, 2013). Counterfactual comparison in relation to self-perception involves comparing the self to a hypothetical self that might or should have occurred but did not actually occur and is thus counter to the facts (Kahneman & Miller, 1986; Roese & Epstude, 2017). Finally, criteria-based comparisons can be done with socially shared or codified rules, requirements, and principles as well as with internalized principals, norms, or aspirations (Higgins, 1996; Lewin, 1951). Examples of temporal, counterfactual, social, criteria-based, and dimensional comparisons can be found in Table 1. Comparative thinking may play a significant role in the development of psychological distress following exposure to aversive events. Hoppen et al. (2020) recently conducted a systematic review and meta-analysis on the association of PTSD symptoms with counterfactual, social, and temporal comparative thinking. The authors concluded that only five and two studies have examined the relationship between social and temporal comparative thinking and PTSD, respectively. Hooberman, Rosenfeld, Rasmussen, and Keller (2010) found that PTSD symptom severity was significantly correlated with downward social comparison (i.e. individuals perceived to be 'worse off') but not with upward social comparison (i.e. individuals perceived to be 'better off'). Morris, Chambers, Campbell, Dwyer, and Dunn (2012) reported that upward identification in breast cancer survivors was somewhat negatively correlated with distress. Brown, Buckner, and Hirst (2011) and Troop and Hiskey

Table 1. Comparison standards related to current well-being following a vehicle-ramming attack.

Standard	Type of comparison		Items
		Direction	
			In the past two weeks when considering your wellbeing, how often did you:
Past temporal	<i>up/lateral/down</i>		think that you used to be doing <i>better/similar/worse</i> before the vehicle-ramming attack than currently
Prospective temporal	<i>up/lateral/down</i>		think that you will be doing <i>better/similar/worse</i> in the future than currently
Counterfactual self-focused	<i>up/down</i>		think that if you had behaved differently during the vehicle-ramming attack, you would be doing <i>worse/better</i> now
Counterfactual other-focused	<i>up/down</i>		think that if others had behaved differently during the vehicle-ramming attack, you would be doing <i>worse/better</i> now
Social	<i>up/lateral/down</i>		compare your well-being with other individuals affected by the vehicle-ramming attack who are doing <i>better/similar/worse</i> than you
Criteria-based	<i>up/down</i>		about how people your age and gender should be doing, and that you are doing <i>worse/better</i> than this
Dimensional	<i>up/down</i>		think that although you are not doing well at the moment, there are still <i>positive</i> aspects to your life think that you are doing well at the moment, but that there are still <i>negative</i> aspects to your life

Every item began with 'In the past two weeks when considering your wellbeing, how often did you'.

(2013) found that individuals with PTSD rated themselves significantly less favourably than individuals with a traumatic history who did not meet criteria for PTSD. Finally, Boals and Schuettler (2011) concluded that downward comparison is not correlated with symptoms of PTSD in undergraduate students.

With respect to temporal comparative thinking, Brown et al. (2011) found that veterans with PTSD rated their past selves more positive in comparison to their current and future selves. Furthermore, Roth, Steffens, Morina, and Stangier (2012) applied an Implicit Association Test using stimuli representing the self (i.e. present- vs. past-self) and stimulus attributes (i.e. positive vs. negative) and found that participants with PTSD reacted slower in both the present-self-positive and the past-self-positive condition relative to participants without PTSD. Hoppen et al. included in their meta-analysis 24 studies on the association between counterfactual thinking and PTSD symptoms and reported a strong pooled correlation between the two ($r = .46$). It is worth noting, however, that research on counterfactual thinking does not necessarily include a comparison to current well-being (Hoppen et al., 2020; Morina, *in press*). In fact, research on counterfactuals includes both episodic and semantic counterfactual thinking, with the former relating to alternatives to autobiographical events and the latter involving alternatives to general world knowledge (Roese & Epstude, 2017). With respect to episodic counterfactuals, this type of thinking involves a mental simulation of counterfactual alternatives to autobiographical past events ('If I had paid more attention, then X would not have died'). However, counterfactual thinking often might involve only low levels of cognitive elaboration and easily include cognitive processes not directly linked to comparative evaluations. For example, a car accident survivor may simply think that they (or somebody else) should have acted differently before or during the car accident, implying that things would be different now if they had acted differently then. However, this form of counterfactual thinking does not necessarily involve a focus on standings on specific self-relevant dimensions that may be different in the current situation than in a counterfactual world. Counterfactual comparison, on the other hand, requires thinking about the extent to which specific self-relevant dimensions (e.g. psychological or physical well-being or appearance) are different in the current situation than in a counterfactual world. From this it follows that counterfactual comparisons are a specific instance of counterfactual thinking and to measure them, we need not only to assess whether counterfactual thinking has occurred, but also whether a comparison of the current attributes relative to those in the counterfactual world has occurred (Morina, *in press*).

Current research suggests that comparative thinking plays a significant role in psychological distress following exposure to aversive events. The existing studies on temporal and social comparisons indicate that participants appraise their current selves less favourably than their pre-trauma selves and their situation as worse than other people's situation. However, they do not inform us how frequently survivors of traumatic events engage in temporal or social comparisons in relation to their well-being and whether this frequency is associated with psychological distress. In addition, we lack research on the frequency of different types of comparison in individuals with exposure to aversive events. Examining how often survivors of traumatic events make use of different comparison standards while evaluating their current well-being will inform us about the extent to which comparative thinking influences the development and maintenance of post-traumatic stress symptoms in this population. To this end, the goal of this study was to examine the frequency of social, temporal, criteria-based, dimensional, and counterfactual comparisons among individual with exposure to a recent aversive event. It was hypothesized that all five types of comparison will be significantly associated with symptoms of PTSD and that comparative thinking will predict PTSD symptoms over and above sociodemographic variables and depressive symptoms.

2. Methods

2.1. Participants

This survey was conducted in 2018 with individuals affected by a vehicle-ramming attack. On 7 April 2018, a man drove a camper van into people seated outside two restaurants in a pedestrianized square in Münster, Germany. As a result, four people died and more than 20 individuals were seriously injured. Inclusion criteria for this study were having been affected by the vehicle-ramming attack, being older than 17 years, and being fluent in German. Furthermore, current suicidality was regarded as an exclusion criterion. Participation in the study was promoted in a local newspaper, in local facebook groups, and through a press release by the University of Münster. As an incentive to participate, eight euros as well as the chance to win one of 30 vouchers for an online book store (worth 15 euros) was offered to every participant who filled out the survey.

Participants were informed thoroughly about the study before obtaining informed consent, which was obtained electronically. If a participant did not provide consent to the study or did not meet inclusion criteria, the survey ended automatically. In total, 311 potential participants started filling out the survey and 88 of them (28%) either discontinued it or were

excluded by the defined criteria. By definition, these participants did not provide final consent for data analysis at the end of the survey. Accordingly, 223 (148 female) participants were included in this study. They were 18 to 69 years old ($M = 27.35$, $SD = 8.60$) and 47 of them (21%) reported to having been affected directly by the vehicle-ramming attack by either having been victims of the attack themselves or having witnessed the attack directly or having a significant other who had been victim of the attack themselves or had witnessed the attack directly. The rest of the sample reported to having been indirectly affected by the attack, for example, because they had heard of a terrorist attack and worried about their own and/or their family's safety.

2.2. Material

The data were obtained through an online survey offered via Unipark (www.unipark.com) that was conducted between 30 July until 17 August 2018. The study was approved by the institutional review board of the University of Münster.

To assess the degree to which individuals report engaging in comparisons while evaluating their well-being, the *Comparison Standards Scale – Wellbeing* (CSS-W) was used. The CSS-W is based on the Comparison Standards Scale-Appearance (CSS-appearance), which was recently developed by a group of authors with expert knowledge in comparison research, clinical psychology and psychometrics to assess (McCarthy, Meyer, Back, & Morina, *submitted*). Similar to the CSS-appearance, the CSS-W assesses comparative thoughts that participants might have had during the last two weeks in relation to their current well-being. In line with the definition of social comparison by Wood (Wood, 1996) as thinking about the social information in relation to the self to enable a judgement about relative standing, the CSS-W assesses comparison as thinking about how one is doing in comparison to some type of standard, i.e. temporal, counterfactual, social, criteria-based, and dimensional standards.

Following an introduction to what comparative thinking is, participants were asked about the degree to which they engaged in comparisons regarding the dimension of well-being. Participants were asked if they considered to be doing better, similar, or worse than the specific comparison standard. They reported engaging in a specific comparison on a six-point Likert scale, from 'Not at all' (0) to 'Very often' (5). Overall, the CSS-W consists of 19 items that ask about the frequency of comparative thoughts in relation to five comparison standards (see Table 1). Temporal and counterfactual comparisons further consist of subcategories, i.e. past and prospective temporal comparisons and self-focused and other focused counterfactual comparisons. In addition, the scale differentiates between upward and

downward comparisons with respect to any type of comparison and also asks for lateral temporal and social comparisons. Lateral comparisons in relation to counterfactual, criteria-based, and dimensional comparisons were considered as irrelevant with respect to well-being following exposure to an aversive event. The authors of the CSS-appearance report an internal consistency of .82 and CSS-appearance was positively correlated with the anxiety, depression, and stress subscales of the Depression, Anxiety and Stress Scales (DASS-21; Lovibond & Lovibond, 1995; $r_s = .22-.33$), and negatively correlated with the Rosenberg Self-Esteem Scale (Rosenberg, 1965; $r = -.32$). In the current study, the internal consistency of the CSS-W was 0.77.

Symptoms of PTSD were assessed using Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) (Blevins, Weathers, Davis, Witte, & Domino, 2015). The PCL-5 is a 20 item self-report measure to assess the frequency and intensity of the 20 PTSD symptoms over the past four weeks with response options ranging from 0 ('not at all') to 4 ('extremely'). In this study, the items of the PCL-5 were anchored to the vehicle-ramming attack. Good reliability and validity data of the PCL-5 have been reported (Krüger-Gottschalk et al., 2017).

Symptoms of depression were assessed with the 9-item depression module of the Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 was developed for use in a self-administered format and several studies have revealed that it has good reliability and convergent/discriminant validity (Martin, Rief, Klaiberg, & Braehler, 2006).

Participant's subjective quality of life was measured with the Manchester Short Assessment of Quality of Life (MANSA) (Priebe, Huxley, Knight, & Evans, 1999). The MANSA contains 12 questions to assess global life satisfaction and facets including social relationships, family relationships, work, leisure, sex life, financial situation, living situation, personal safety, and physical and mental health. Subjective quality of life is assessed on a scale ranging from 1 ('couldn't be worse') to 7 ('couldn't be better').

2.3. Data analysis

Statistical analyses were conducted with IBM SPSS Statistics (version 25) for Windows. To supply basic information on sociodemographic and clinical variables, we calculated basic descriptive statistics (i.e. means, standard deviations, percentages). Data from the CSS-W, PCL-5, and PHQ were not normally distributed; thus, they were analysed using the Spearman correlation test. The CSS-W data used in the correlational and regression analyses represent the sum score of the frequency of temporal, counterfactual, social, criteria-based, and dimensional comparisons in the past two weeks. To analyse the factor

structure of the CSS-W, an explorative factor analysis with oblique rotation (direct oblimin) was conducted. Hierarchical regression analyses were conducted to analyse the relationship between the sum score of all types of comparison and PTSD symptoms while accounting for potentially confounding variables (i.e. age, gender, & depressive symptoms). Tests to check if the data met the assumptions of regression analysis indicated that the residuals of the regression line were not approximately normally distributed (Williams, Grajales, & Kurkiewicz, 2013). Normalization of the positively skewed distribution was achieved with a square root transformation to CSS-W scores. The frequencies of comparisons are further reported in Table 3 as dichotomous variables to indicate the number of participants reporting on the different types of comparison as well as a sum score. The alpha level was set at 0.05 (two-sided) for all analyses.

3. Results

An initial explorative factor analysis of the CSS-W resulted in five factors with eigen values greater than Kaiser's criterion of 1 and explaining 55.56% of variance. Examination of the scree plot indicated only two reliable factors to retain, thus the analysis was run again with a fixed number of two factors to extract. As can be seen in Table 2, 10 of the 17 items loaded on the first factor. This included upward and downward past temporal comparisons, all counterfactual comparisons, and all social comparisons. The seven items loading on the second factor were lateral past temporal comparison, all types of prospective temporal comparison, downward criteria-based comparison and upward and downward dimensional comparison. The two factors,

however, are not theoretically grounded. Consequently, the correlational and regression analyses were conducted first with the total score of the CSS-W (i.e. CSS-W total) and then repeated with the two CSS-W subscales (i.e. CSS-W factor 1 and CSS-W factor 2).

Sociodemographic data of the sample as well as the means of symptoms of depression and PTSD, quality of life, and frequency of comparisons can be found in Table 2.

The frequencies of comparison standards as dichotomous variables (i.e. absolute number of participants reporting any comparative thinking with respect to the specific type of comparisons) can be seen in Table 3. The most frequent comparisons were upward prospective temporal and downward dimensional comparisons (77.6% and 74.9%, respectively). The most frequent types of comparison standards were temporal and dimensional comparisons (94.2% and 87.4%, respectively). Finally, a total of 97.8% of participants reported to have compared their current well-being to at least one type of comparison standards.

The sum score of the frequency of comparisons as well as was significantly correlated with symptoms of PTSD and depression and with subjective quality of life (see Table 4). Findings were similar when scores of the subscales CSS-W factor 1 or CSS-W factor 2 were used instead. Results further revealed that all types of comparison standard (i.e. temporal, counterfactual, social, criteria-based, and dimensional) were significantly associated with the sum score of PTSD as well as with the single clusters of intrusion, avoidance, hyperarousal, and negative cognitions and emotions. With regard to depression, the frequency of temporal, criteria-based, and dimensional comparisons were significantly associated with depressive

Table 2. Sociodemographic variables, quality of life and symptoms of depression and PTSD.

Variable	N (%)	M (SD)	Observed Range
Sociodemographic variables			
Age		27.35 (28.6)	18–69
Gender			
Female	148 (66.4)		
Male	75 (33.6)		
Employment Situation			
Job-seeking/unemployed	5 (2.2)		
Employed	62 (27.8)		
Student	154 (69.1)		
Retired	1 (0.4)		
Unfit for work	1 (0.4)		
Scale-level descriptive characteristics			
PHQ Depression		13.2 (3.9)	9–30
PCL-5		26.7 (7.9)	20–66
PCL-5 intrusions		6.6 (2.3)	5–17
PCL-5 avoidance		2.8 (1.4)	2–9
PCL-5 neg. cognitions & emotions		8.8 (2.8)	7–23
PCL-5 hyperarousal		8.4 (3.0)	6–23
MANSAs		61.1(9.3)	27–78
CSS-W		16.1 (9.2)	0–48

CSS-W = Comparison Standards Scale – Well-being; PHQ = Patient Health Questionnaire; PCL = Posttraumatic Stress Disorder Checklist for DSM-5; MANSAs = Manchester Short Assessment of Quality of Life.

Table 3. Frequency and factor loading of comparative thoughts during the last two weeks.

Type of comparison		Absolute (%)	Mean (SD)	Rotated factor loading	
				1	2
Past temporal	Up	58 (26.0)	0.5 (0.9)	.619	-.091
	Down	27 (12.1)	0.2 (0.6)	.469	.100
	Lateral	117 (52.5)	1.8 (2.0)	-.169	.574
Prospective temporal	Up	173 (77.6)	2.3 (1.6)	-.057	.315
	Down	98 (44.0)	0.8 (1.1)	.071	.526
	Lateral	148 (66.4)	1.7 (1.5)	.063	.517
<i>Any temporal comparison</i>		210 (94.2)	13.2 (3.9)		
Counterfactual self-focused	Up	18 (8.1)	0.5 (1.1)	.477	.159
	Down	49 (22.0)	0.2 (0.6)	.544	-.061
Counterfactual other-focused	Up	66 (29.6)	1.5 (1.5)	.426	.140
	Down	46 (20.6)	0.7 (1.3)	.653	.016
<i>Any counterfactual comparison</i>		109 (48.9)	1.8 (2.7)		
Social	Up	19 (8.5)	0.2 (0.6)	.706	-.073
	Down	100 (44.8)	1.0 (1.4)	.645	-.049
	Lateral	46 (20.6)	0.4 (1.0)	.746	-.126
<i>Any social comparison</i>		110 (49.3)	4.6 (2.4)		
Criterion-based	Up	70 (31.4)	0.52 (0.8)	.426	.372
	Down	95 (42.6)	1.0 (1.3)	.300	.503
<i>Any criteria-based comparison</i>		116 (52.0)	3.5 (1.8)		
Dimensional	Up	158 (70.9)	2.3 (1.8)	.165	.442
	Down	167 (74.9)	1.8 (1.6)	-.065	.621
<i>Any dimensional comparison</i>		195 (87.4)	6.1 (2.6)		
<i>Any comparison</i>		217 (97.3)	16.1 (9.2)		

Absolute (%) indicates the absolute number and percentage of participants reporting any comparative thinking relative to those reporting no comparative thinking.

symptoms. Finally, only the frequency of dimensional comparisons was significantly correlated to quality of life.

To examine the contribution of the frequency of comparisons in predicting symptoms of PTSD, a hierarchical multiple regression analysis was conducted with the PCL-5 as the dependent variable and age, gender, depressive scores, and the sum score of all types of comparison as contributors (Table 5). Age and gender were entered in the first step and the PHQ-9 score was entered in step two. Finally, the CSS-W was entered in the third step. Age and gender did not significantly predict the dependent variable. When the PHQ-9 score was entered in the second step, the PHQ-9 significantly predicted scores of PTSD. In step 3, adding scores of the CSS-W into the equation accounted for additional significant variance above and beyond depressive scores (see Table 5). Here too, the results were similar when the subscales CSS-W factor 1 or CSS-W factor 2 rather than the CSS-W total score were entered in step 3 (see Table 5).

4. Discussion

This study aimed at assessing the association between comparative thinking and psychological distress among individuals directly or indirectly exposed to a vehicle-ramming attack. A total of 98% of participants reported comparative thoughts during the last two weeks. The frequency of comparative thoughts was significantly associated with PTSD symptoms and to a lesser degree with depression. The correlation with quality of life was rather weak. The frequency of comparative thoughts

predicted PTSD symptoms and accounted for additional significant variance beyond depressive symptoms.

The association between psychological distress and comparative thoughts found in the present sample is in line with the results of two recent meta-analyses that yielded a moderate to strong positive relationship between social, temporal, and counterfactual thoughts and PTSD, anxiety, and depression (Hoppen et al., 2020; McCarthy & Morina, 2020). However, the current study extends these findings by first specifically focusing on comparative thoughts as they related to current well-being, which is in line with the definition of social comparison by Wood (1996). Accordingly, the CSS-W assessed comparison as thinking about how one is doing in comparison to some type of upward, lateral, or downward standard. The current results are further relevant because they relate to five types of comparison standards likely to inform self-perception (Morina, *in press*). This aspect is crucial because the findings indicate that all five types of comparison are significantly related to PTSD. Whereas research on comparative thinking in PTSD has mostly focused on counterfactual thinking (Hoppen et al., 2020), the current findings demonstrate that in individuals with exposure to aversive events temporal and dimensional comparisons may occur even more frequently. Accordingly, more research is needed to understand the role of different types of comparison and their interaction in well-being following exposure to aversive events. Moreover, prospective research needs to further investigate the factor structure of the frequency of different comparison types. The current study suggested a two-factor solution, with upward and downward past temporal

Table 4. Correlations between mean scores of CSS-W and PHQ, PCL-5 and MANSA.

Comparison type		PCL-5					PHQ	MANSA
		Total	Int	Avo	NCE	Hyp		
Past temporal	Up	.43**	.44**	.37**	.31**	.40**	.12	-.15*
	Down	.25**	.25**	.19*	.20**	.17**	.08	-.19*
	Lateral	-.005	-.01	.004	.02	-.02	-.004	.09
Prospective temporal	Up	.17*	.06	.08	.14*	.17*	.22*	-.16*
	Down	.26**	.17*	.18*	.28**	.20**	.21**	-.33**
	Lateral	.08	.07	.05	.08	.03	-.01	.08
<i>Any temporal comparison</i>		.26**	.19**	.16**	.25**	.19**	.14*	-.12
Counterfactual self-focused	Up	.22**	.24**	.11	.18**	.21**	.005	-.09
	Down	.23**	.26**	.15*	.16*	.23**	.17**	-.12
Counterfactual other-focused	Up	.24**	.22**	.11	.14*	.25**	.05	-.05
	Down	.35**	.35**	.35**	.28**	.27**	.11	-.03
<i>Any counterfactual compar.</i>		.41**	.44**	.31**	.31**	.35**	.12	-.09
Social	Up	.26**	.24**	.21**	.20**	.19**	.15*	-.09
	Down	.22**	.30**	.18**	.18**	.15*	.11	-.05
	Lateral	.25**	.26**	.27**	.18**	.20**	.03	.04
<i>Any social comparison</i>		.28**	.36**	.34**	.22**	.20**	.09	-.03
Criteria-based	Up	.37**	.32**	.25**	.32**	.30**	.22**	-.17**
	Down	.27**	.23*	.25*	.24**	.21**	.08	-.02
<i>Any criteria-based comparis.</i>		.37**	.33**	.31**	.31**	.30**	.14*	-.10
Dimensional	Up	.38**	.26**	.30**	.35**	.31**	.29**	-.33**
	Down	.28**	.20**	.22**	.29**	.20**	.13	-.29**
<i>Any dimensional comparison</i>		.41**	.28**	.32**	.40**	.31**	.27**	-.40**
CSS-W total score		.50**	.44**	.37**	.45**	.39**	.24**	-.23**
CSS-W factor 1		.48**	.53**	.37**	.37**	.37**	.16*	-.11
CSS-W factor 2		.34**	.23**	.24**	.35**	.25**	.22**	-.22*

Avo = Avoidance; CSS-W = Comparison Standards Scale – Well-being; Hyp = Hyperarousal; Int = intrusions; MANSA = Manchester Short Assessment of Quality of Life; NCE = Negative Cognitions and Emotions; PCL = Posttraumatic Stress Disorder Checklist for DSM-5; PHQ = Patient Health Questionnaire.

* $p < .05$. ** $p < .01$.

Table 5. Hierarchical regression model with depression and comparative thoughts as predictors of post-traumatic stress symptoms.

Step	<i>b</i>	<i>SE_b</i>	<i>t</i>	ΔR^2	ΔF
Equation I					
1 age	.008	.010	.121	.001	1.121
gender	.100	.177	1.494		
2 depression	.203	.021	3.085**	.038	3.948**
3 depression	.076	.021	1.176	.177	12.936***
CSS-W total	.400	.011	6.157***		
Equation II					
1 age	.059	.010	.886	.007	1.755
gender	.111	.186	1.665		
2 depression	.113	.023	1.695	.015	2.138
3 depression	-.031	.022	-.484	.193	14.254***
CSS-W factor 1	.448	.011	7.014***		
Equation III					
1 age	.004	.045	-.053	-.003	.721
gender	.081	.085	1.199		
2 depression	.194	.098	2.932**	.031	3.363*
3 depression	.122	.101	1.788	.072	5.290***
CSS-W factor 2	.223	.051	3.260**		

* $p < .05$; ** $p < .01$; *** $p < .001$.

comparisons, all counterfactual comparisons, and all social comparisons loading on the first factor and the remaining seven items on the second factor. This, however, does not reflect an expected theoretical structure. For example, it remains unclear why lateral past temporal comparisons loaded on a different factor than upward and downward temporal comparisons and on the same factor as upward, downward, and lateral prospective temporal comparisons. From a theoretical perspective (e.g. Morina, *in press*), different factors would either comprise separate types of comparison standards (e.g. criteria-based comparisons would load on one factor) or separate types of motivational significance

(e.g. all aversive comparisons would load on one factor). Prospective studies with larger samples are needed to further examine this issue.

With respect to counterfactual thinking, some authors have suggested that following aversive life events people are more likely to engage in upward relative to downward counterfactuals (Kahneman & Miller, 1986; Roese, 1997). This is also in line with most current research on counterfactual thinking in individuals with symptoms of PTSD (Hoppen et al., 2020). However, the current findings do not support this view. In fact, more participants engaged in downward relative to upward self-focused counterfactual comparisons. The discrepancy might be explained by the fact that participants in the current study were specifically asked about comparing their current well-being to how they would be doing if something else had happened on the day of the attack. This suggests that general upward and downward counterfactual thoughts might manifest themselves differently than upward and downward counterfactual comparisons that relate to current perceptions of attributes of the self. The current data further indicate that the frequency of upward and downward comparisons might depend on the content of the event and the reference of the actor (e.g. self-focused vs. other focused). The findings are in line with the result of two studies by Blix et al. In one study (Blix et al., 2016), the authors reported that survivors of mass-trauma (i.e. 2011 Oslo bombings) engaged more often in downward rather than upward counterfactual thinking. In another study (Blix, Kantén, Birkeland, & Thoresen, 2018), survivors of a fire on a ferry reported higher frequency in

downward counterfactual thinking as compared to indirectly exposed individuals (i.e. bereaved individuals). It should be noted, however, that both frequencies in upward and downward counterfactual comparisons was significantly and similarly related to PTSD symptoms.

The study has also relevant implications with respect to social comparison. A recent systematic review of 145 publications on social comparison (Gerber et al., 2018) concluded that individuals generally tend to choose an upward rather than downward comparison standard and that threat leads to increased upward comparisons. The authors also reported that the choice of comparison standard became less differentiable when a lateral choice was also provided. The current findings, however, provide a different picture. In fact, participants reported more downward and lateral comparisons than upward comparisons. The discrepancy between the current findings and those in the systematic review by Gerber and colleague may be explained by the fact that Gerber et al. included studies applying the selection method approach. These studies have used different experimental paradigms to identify the conditions under which upward, lateral, or downward social standards are chosen. The current findings suggest that in daily life, survivors of aversive events may engage more frequently in downward and lateral comparisons than in upward comparisons when thinking about their current well-being. This may imply that upward (rather than downward and lateral comparisons) are less frequently used because they may lead to negative impact. Thinking often about survivors of the same event who are doing better may elevate negative affect and produce negative responses about the current and prospective self. On the other hand, engaging in lateral or even downward comparisons might reduce negative affect or increase positive affect and activate rather positive cognitions about oneself. These claims need to be investigated in future research.

Of the five types of comparison measures in this study, the assessment of dimensional comparison proved to be the most difficult one. Research in this area has been conducted mainly in the context of self-concept in educational psychology and has shown that dimensional comparisons affect self-evaluations of ability. In this line of research, students are, for example, asked about the extent to which they are better/worse in mathematics than in English. Yet, the assessment of dimensional comparisons with respect to well-being seems more difficult. While formulating the items to capture dimensional comparisons, we assumed that asking participants whether they think that their well-being is better/worse than other self-attributes might not be easy to understand. Accordingly, we introduced a new way of assessing dimensional comparisons by asking about the extent to which participants engaged in thinking 'that although you are not doing well at the moment, there are still positive aspects to your life' (see

Table 1). Our reasoning was that comparative dimensional thinking is represented by such examples as engaging in thinking that although one is not doing well in general, one can at least still work or take care of their children. Accordingly, in this example the dimension of well-being is being compared to the dimension of ability to work or that of functioning as a parent. However, the dimension of well-being constitutes a very broad and complex area and prospective research on dimensional comparison needs to consider and examine other ways of assessment.

The findings suggest that frequency of comparative thinking is positively associated with symptoms of PTSD and depression regardless of comparison type or direction. In fact, all of the significant correlations between comparison type and direction with PTSD and depression were positive. This seems surprising because comparison direction (i.e. upward, lateral, or downward) and comparison type (i.e. social, temporal, etc.) influence the motivational significance of the comparison process. In a general comparative processing model of self-evaluation, Morina (*in press*) suggests that the motivational significance of a comparison process can be perceived as either appetitive, neutral, or aversive. For example, comparing to an upward social or counterfactual comparison standard is likely to be perceived as aversive, whereas comparing to a downward social or counterfactual comparison standard is likely to be perceived as appetitive. Furthermore, the motivational significance of the comparison direction may depend on the type of comparison. Whereas upward social comparisons are mostly perceived as aversive, comparing to an upward prospective temporal standard (i.e. thinking that one will be doing better in the future) should mostly be perceived as appetitive. The current findings, however, suggest that both appetitive and aversive comparisons are positively associated with depression and PTSD symptoms. One explanation for this finding may lie in the fact that comparison standards are selected to meet different self-motives. For example, self-assessment motives serve the need to gain accurate information about our self-attributes, whereas self-enhancement motives serve the need to attain or maintain a positive self-view, which involves preferring favourable information over accurate but possibly unfavourable information. Sometimes a spontaneous comparison that is perceived as aversive may activate self-enhancement motives, which in turn may intentionally instigate new comparisons to attain a positive self-view or to decrease current negative mood (Morina, *in press*). Accordingly, the current data suggest that the study participants often engaged in appetitive comparisons for the sake of attaining a short-term positive self-view or decreasing state negative mood rather than for the purpose of self-assessment or self-improvement. Stated in other words, comparing to standards associated with appetitive outcomes, such as in the case of upward prospective

temporal standards, served short-term immediate mood rather than expected mood (Loewenstein, Weber, Hsee, & Welch, 2001).

This is the first study to assess five types of comparison standards related to well-being. The study used a novel self-report measure and therefore the current findings need to be treated as preliminary. Related to that, several potential limitations to this study need to be considered. Firstly, the use of a cross-sectional design does not allow any conclusions about temporal precedence of the measured variables. Accordingly, longitudinal and experimental designs are needed to assess causal conclusions. Related to this, frequency of comparisons was assessed retrospectively, which can be affected by memory bias and current emotional states (Conway & Loveday, 2015; Schwarz & Strack, 1999). Accordingly, future research should apply ecological momentary assessments and experimental designs to investigate the proximal antecedents and consequences of comparative thinking in their natural environments and under controlled conditions. While collecting data in real time and in the natural environment, ecological momentary assessments would maximize ecological validity and minimize recall bias and enable to investigate dynamic changes in comparative thinking and related processes across time. Experimental designs should assess contextual and personal factors that may have an impact on the comparison outcome and the engendered emotional, cognitive, and behavioural reactions (Morina, *in press*). A third limitation is that the majority of participants reported to having been indirectly affected by the vehicle-ramming attack. Accordingly, many of these study participants arguably did not meet DSM-5 Criterion A for PTSD. However, we need to consider the fact that on the day of the attack, city residents were confronted with rumours of imminent terrorist attacks for many hours, which is likely to have been perceived as extreme stress by all study participants. Another potential limitation relates to the aim of the study to assess all forms of comparison as long as they related to perceptions of current well-being and occurred during the last two weeks. To this end, the items of the CSS-W asked about different types of comparison ‘In the past two weeks when considering your wellbeing’. This raises the question whether the framing of the items might have led some participants to report only comparisons that occurred after one had engaged in reflecting about their well-being. This would indicate that some study participants might have ignored some relevant spontaneous comparisons that might have led to preoccupations with well-being. I think, however, that this is unlikely for two reasons. First, ‘considering’ (as in ‘when considering your well-being’) is a translation of the German word ‘befasst sein’ that does not necessarily indicate any temporal order of comparative thinking relative to engaging in thoughts about one’s well-being. Second, even if some participant

did assume that they needed to report only comparisons occurring following reflections on their well-being, it is unlikely that they would ignore spontaneous comparisons. Comparisons are best defined as a process and regardless of whether the process starts with a comparison standard (e.g. ‘I used to be doing better’) or the target (i.e. how one is doing currently), the entire process did start with considerations of one’s well-being. As such, even if the comparer thinks first that they used to be doing better than currently, they are likely to perceive this thought as comparison occurring when considering their well-being. However, these speculations need to be investigated in future research. Finally, the generalizability of our results to other samples with exposure to traumatic events needs to be tested in future research.

A number of preliminary conclusions can be derived from the current findings. They indicate that comparative thinking related to several types of comparison standards is associated with PTSD symptoms. However, due to several limitations, replication of the results in larger samples and using longitudinal and experimental designs is clearly necessary before any firm conclusions can be drawn.

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