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BASIC RESEARCH ARTICLE

Posttraumatic anger: a confirmatory factor analysis of the Dimensions of Anger Reactions Scale-5 (DAR-5) – French adaptation

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ABSTRACT

Background: Research has shown that posttraumatic anger is common after a traumatic experience, represents a risk factor for post-trauma psychopathology, and can be screened for using the Dimensions of Anger Reactions Scale-5 (DAR-5), a concise five-item measure. However, a French version of the DAR-5 is not yet available.

Objective: We aimed to provide a French adaptation (DAR-5-F) and to replicate, in a French community sample, the psychometric properties of the original DAR-5.

Method: After translation using transcultural psychometric principles, the DAR-5-F was presented to 822 fluent French speakers alongside validated scales of anger (State-Trait Anger Expression Inventory-2), anxiety and depression (Hospital Anxiety and Depression Scale), alcohol misuse (Alcohol Use Disorders Identification Test-Consumption), and trauma exposure (Life Events Checklist-5).

Results: Confirmatory factor analyses confirmed that DAR-5-F scores fit a single-factor model as described with the English version of the scale. The scale showed noteworthy internal consistency and robust convergent validity with trait anger. The screening DAR-5-F cut-off of ≥12 successfully differentiated high from low scores of STAXI-2, anxiety, depression, and traumatic exposure.

Conclusions: The DAR-5 is a robust, psychometrically strong brief scale of anger useful for post-trauma screening, with the DAR-5-F now available for use in French-speaking populations. Future research that examines relationships between the DAR-5-F and variables such as trauma severity and posttraumatic stress symptoms will further improve our understanding of these phenomena.

HIGHLIGHTS
• Posttraumatic anger is common after traumatic exposure and represents a risk factor for posttraumatic psychopathology and poor treatment response.
• The DAR-5 is a concise and valid scale of anger useful for posttraumatic screening, with the DAR-5-F now available to Francophone researchers and clinical psychologists.
• he psychometric properties of the original DAR-5 were replicated with the current French sample suggesting that posttraumatic anger is not culture-specific.

Ira postraumatica: un analisis factorial confirmatorio de las Dimensiones de la Escala de Reacciones de Ira-5 (DAR-5) de la adaptacion francesa

Antecedentes: La investigación ha demostrado que la ira postraumática es común después de una experiencia traumática, representa un factor de riesgo para psicopatología post trauma, y puede ser tamizada usando las dimensiones de la Escala de Reacciones de Ira-5 (DAR-5 por sus siglas en inglés), una medida concisa de 5 items. Sin embargo, una versión francesa del DAR-5 no está aún disponible.

Objetivo: Nuestro objetivo fue proveer una adaptación francesa (DAR-5-F) y replicar, en una muestra de la comunidad francesa, las propiedades psicométricas de la DAR-5 original.

Método: Después de una traducción usando principios psicométricos transculturales, la DAR-5-F se presentó a 822 francoparlantes fluidos junto a escalas validadas de ira (Inventario de Expresión de Ira estado-rasgo, STAXI-2), ansiedad y depresión (Escala de Ansiedad y Depresión Hospitalaria, HAD), abuso de alcohol (Test de Identificación de Trastornos por consumo de alcohol, AUDIT- Consumo), y exposición a trauma (Lista de Chequeo de Eventos Vitales, LEC-5).

Resultados: El análisis factorial confirmatorio confirmó que el puntaje de DAR-5 F calza con un modelo de factor único como se describió en la versión inglesa de la escala. La escala mostró una consistencia interna notable y una validez convergente robusta con la ira-rasgo. El punto de corte del tamizaje de DAR-5 F igual o mayor a 12 diferenció exitosamente los puntajes altos de los bajos de STAXI-2, ansiedad, depresión, y exposición traumática.

Conclusiones: La DAR-5 es una escala de ira breve robusta, psicométricamente fuerte útil para el tamizaje post trauma, con la DAR-5 F ahora disponible para su uso en población francoparlante. Investigaciones futuras que examinen la relación entre la DAR-5 F y variables tales como severidad del trauma y síntomas de estrés postraumático mejorarán aún más nuestra comprensión de este fenómeno.

创伤后愤怒：《愤怒反应量表5》(DAR-5) 的验证性因素分析-法语改编版

背景: 研究表明, 创伤后愤怒在创伤经历后很常见, 是创伤后精神病的风险因素, 可以使用简明五条目《愤怒反应量表5》 (DAR-5) 进行筛查 。但是, 尚无法语版本的DAR-5可用。

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目标: 我们旨在提供法语改编版 (DAR-5-F), 并在一个法国社区样本中重复测定原始DAR-5的心理测量学性质。

方法: 使用跨文化心理测量学原则进行翻译后, 将DAR-5-F与已验证的量表一同呈现给822名流利的法语使用者, 包括愤怒 (《状态-特质愤怒表达量表2》), 焦虑和抑郁 (《医院焦虑抑郁量表》), 酒精滥用 (《酒精使用障碍筛查量表》) 和创伤暴露 (《生活事件量表5》)。

结果: 验证性因素分析确认DAR-5-F得分符合该量表英文版中所述的单因素模型。量表显示出显著的内部一致性和与特质愤怒稳健的聚合效度。筛查出DAR-5-F划界分大于等于12时可成功将STAXI-2, 焦虑, 抑郁和创伤暴露的高低得分区别开来。

结论: DAR-5是一种稳健的, 心理测量学上有力简要的愤怒量表, 可用于创伤后筛查, 现在DAR-5-F可用于法语使用者。未来考查DAR-5-F与变量 (例如创伤严重程度和创伤后应激症状) 之间关系的研究, 将进一步提高我们对这种现象的理解。

Anger is a common emotion, typically observed in response to an event that is appraised as unfair, harmful, or unacceptable by reference to personal values (Averill, 1983). It is associated with blame, and aggressive or hostile behaviours (Ellsworth & Scherer, 2003). Anger, in addition to anxiety and depression, is frequently observed in the aftermath of traumatic events (Orth & Wieland, 2006). It is a risk factor for the development of psychopathology after trauma (Jayasinghe, Giosan, Evans, Spielman, & Difede, 2008) and attenuates the effectiveness of treatment of posttraumatic stress disorder (PTSD; Galovski, Elwood, Blain, & Resick, 2014; Lloyd et al., 2014). Meta-analyses show that while the relationship between anger and anxiety disorders is strong, it is strongest for anger and PTSD (Olatunjii, Ciesielski, & Tolin, 2010). Moreover, anger predicts PTSD severity more than any other posttraumatic symptoms (Durham, Byllesbym, Lv, Elhai, & Wang, 2018). Similarly, recent symptom network analysis indicated that in the aftermath of trauma, anger produced the shortest path to all other PTSD symptoms (Sullivan, Smith, Lewis, & Jones, 2018). Despite these demonstrated relationships, the psychological processes underlying post-traumatic anger remain poorly understood (McHugh, Forbes, Bates, Hopwood, & Creamer, 2012). Nonetheless, it appears that anger is a critical component of the post-trauma response, indicating the clinical importance of properly assessing this construct.

There are several measures available to clinicians to assess anger. The most commonly used are the State-Trait-Anger-Expression Inventory 2 (STAXI-2; Spielberger, 1988), the Novaco Anger Scale and Provocation Inventory (Novaco, 2003), and the Dimensions of Anger Reactions Scale (DAR; Novaco, 1975). The latter has been validated in combat veterans by Forbes et al. (2004) against the STAXI. Despite their validity as self-report measures, these tools are far too long to be included in a routine mental health assessment, especially in the context of posttraumatic screening. To overcome this Forbes et al. (2014a, 2014b) developed a concise 5-item version of the DAR (i.e. DAR-5). The DAR-5 has been shown to have strong internal reliability and good convergent validity with the STAXI-2 (Forbes et al., 2014a). Research shows that a cut-off of 12 on the DAR-5 indicated good sensitivity and specificity, and successfully discriminated between high and low scores on the STAXI-2, and for individuals who were experiencing posttraumatic stress compared to those who were not. This result was observed in both community and trauma-exposed samples. Discriminant validity was also found between the DAR-5 and depression (as measured by the Hospital Anxiety and Depression Scale; HADS; Zigmond & Snaith, 1983; see Forbes et al., 2014a, 2014b), and alcohol abuse (as measured by the Alcohol Use Disorders Identification Test; AUDIT-C; Tuunanen, Aalto, & Seppa, 2007; see Forbes et al., 2015).

Confirmatory factor analysis (CFA) has indicated a single dimension underlying the DAR-5, both in trauma-exposed and non-trauma exposed Australian and US samples (Forbes et al., 2014a, 2014b). A replication of this one-factor structure in a French-speaking population would provide evidence for transcultural and French language generalization of the posttraumatic anger construct, and would indicate the DAR-5 is a valid tool for its assessment, as well as provide a French adaptation of the DAR-5. Such an undertaking is important considering there are 274 million French speakers worldwide, making it the fifth most widely spoken language on the planet, and French is also one of only two languages alongside English to be spoken on all five continents (International Organisation of La Francophonie, 2018).

The aim of the study was three-fold: first, we investigated whether anger, as measured by the DAR-5, conforms to a unitary construct in a different culture. Second, we sought to replicate and expand on the psychometric properties previously reported with the English version of the DAR-5 in a European French-speaking community with varying trauma exposure rates. Third, tested the French adaptation (DAR-5-F) with the goal of making it

available to French-speaking mental health practitioners and researchers as a screen for posttraumatic anger.

1. Method

1.1. Participants

Between December 2016 and May 2017, a snowball sampling method was used via two authors (GC & GS) who sent large-scale email invitations to potential participants (e.g. acquaintances, students, colleagues). The email invited each receiver to answer questions related to posttraumatic anger if they were 18 years of age or older, and fluent in French, and asked them to disseminate the invitation to other potential participants. The recruitment was carried out on a voluntary and anonymous basis. No personal relationship was established after the first email. The survey link was unique so a personal device could only be used to complete the study once. Fluent French-speaking adults ($N = 1195$) were recruited, with 372 non-completers (attrition rate = 31.13%). The non-completers were compared with the completers ($n = 822$) on all the measures. Completers and non-completers did not differ significantly on their respective scores of anger (either with the DAR-5-F – $M^c = 10.04$; $SD = 4.00$; $M^{nc} = 9.77$; $SD = 3.68$; t (911) = .65; $p = .51$ – or with the STAXI-2-F – e.g. for State Anger $M^c = 18.42$; $SD = 5.27$; $M^{nc} = 14.44$; $SD = 9.41$; $t(852) = -.59$; $p = .55$); nor depression, anxiety, and alcohol use ($t(719-852) = -.1.14-1.38$; $p = .17-.72$). However, completers self-reported a higher level of personal trauma exposure ($M = 4.17$; $SD = 3.07$) than non-completers ($M = 1.30$; $SD = 2.74$; $t(1192) = -15.44$; $p < .001$) as captured with the Life Events Checklist-5 (LEC-5-F; Weathers et al., 2013).

Of the completers, 600 were females, and the majority were either French ($n = 533$) or Swiss ($n = 246$). Respondents were 16–81 years old ($M = 37.04$; $SD = 15.83$). Although the email invited those 18 and older, 5 individuals completed the survey who were between 16 and 17 years of age and their responses were retained. The age histogram did not indicate outliers but showed a bimodal normal distribution with a group of young adults (16–31 years; $n = 412$) and a group of seniors (32–81 years; $n = 410$). Respondents education levels were as follows: tertiary (15+ years of formal education; $n = 469$), upper secondary (10–15 years of formal education; $n = 256$), below upper secondary (<10 years of formal education; $n = 97$).

As indicated in Table 1, the most commonly reported types of trauma were motor vehicle accident, physical assault, witnessing severe human suffering, life-threatening illness/injury, and natural

Table 1. Percentage of respondents who report a personal encounter with each given LEC-5-F trauma type.

	Overall	High trauma	Low trauma	$X^2(2)$
N	822	406	416	
3. Motor vehicle accident	61.6%	34.8%	26.8%	52.49***
6. Physical assault	43.5%	29.8%	13.7%	104.02***
13. Severe human suffering	38.6%	30.1%	13.3%	71.84***
12. Life-threatening illness/injury	38.7%	25.7%	13.0%	62.28***
1. Natural disaster	33.3%	20.8%	12.6%	36.87***
17. Any other trauma exposure	32.8%	22.3%	10.5%	70.29***
2. Fire or explosion	32.2%	25.3%	11.4%	38.96***
4. Serious accident	21.6%	15.7%	6.0%	53.38***
9. Unwanted sexual experience	15.8%	10.5%	5.3%	17.76***
15. Sudden accidental death	14.5%	8.2%	6.2%	3.46
8. Sexual assault	10.2%	7.5%	2.7%	22.88***
7. Armed assault	9.6%	7.7%	1.9%	33.68***
14. Sudden violent death	9.0%	5.7%	3.3%	7.58*
5. Exposure to toxic substance	8.5%	6.9%	1.6%	32.32***
10. Exposure to a war zone	3.4%	2.4%	0.6%	6.33*
16. Injury/death to someone else	2.8%	2.1%	0.7%	6.63*
11. Captivity	1.2%	1.0%	0.2%	3.79

Individuals who were considered to have had a 'personal encounter' with a trauma are those who reported either 'It happened to me' or 'I witnessed it' in reference to the trauma.
Percentages are given for the overall sample, and for the two subgroups, namely the high trauma and the low trauma exposure subsample.
LEC-5-F: French adaptation of the Life Events Checklist-5.
*$p < .05$; ***$p < .001$.

disaster. The incidence of each traumatic event was greater in the *high trauma* than in the *low trauma* subgroup (see below for further details).

1.2. Procedure and measures

The questionnaires, presented in a fixed order, were available online and took approximately 30 minutes to complete. The study was approved by the University of Geneva ethics committee.

1.2.1. French adaptation of the DAR-5
The DAR-5 (Forbes et al., 2014a) is a 5-item scale that measures anger experience over the past 4 weeks. In response to items such as 'When I got angry, I got really mad,' respondents rate their anger experience on a 5-point scale ranging from 1 ('None or almost none of the time') to 5 ('All or almost all of the time'). The five scores are summed, with a total DAR-5 score ranging from 5 to 25. Higher scores indicate more severe anger experiences. The DAR-5 was translated to French (DAR-5-F) in accordance with Hambleton, Merenda, and Spielberger (2004) rules for transcultural validation of psychometric instruments. The scale was first translated into French (by a native French bilingual expert) and then back-translated into English (by a native English bilingual expert). In a second round, experts were asked

to check the conformity of the two English versions and to revise the French version accordingly. All divergences were solved by discussion and amendments were reached by consensus. The DAR-5-F is provided in the Appendix.

The original English scale showed excellent internal validity (Cronbach's α .86 – .91) and was found to capture a single factor of anger experience constituted by five anger reactions (i.e. frequency, intensity, duration, interpersonal aggressiveness, and interference with interpersonal relationships; Forbes et al., 2014a). The DAR-5 showed good construct validity either with convergent or discriminant properties. Convergent validity was established with STAXI-2, particularly the subscale of trait anger (Forbes et al., 2014b, 2014a, 2004; Hawthorne, Mouthaan, Forbes, & Novaco, 2006). Discriminant validity was demonstrated with reference to depression (HADS; Forbes et al., 2014a, 2014b) and alcohol abuse (AUDIT-C; Forbes et al., 2015). In the current sample, the DAR-5-F showed good internal consistency (α = .80). The inter-item correlations were good (.31 < r(822) < .60; all p values were < .001), indicating that the five items measure the same construct without being repetitive.

1.2.2. State-trait anger, anger expression and anger control

The French adaptation of the STAXI-2-F (Borteyrou, Bruchon-Schweitzer, & Spielberger, 2008) was used to obtain a comprehensive anger profile. Participants were asked to respond to 57 items, using a 4-point scale ('Not at all' to 'Almost Always'), on State Anger (15 items assessing the intensity of anger when answering the questionnaire), Trait Anger (10 items assessing how often angry feelings are experienced over time), Anger Expression and Anger Control (32 items assessing four relatively independent anger-related traits of expression and control). High internal reliability is demonstrated for all subscales except for Trait Anger (α = .73–.76; Spielberger, 1988, 1999). STAXI-2-F has a test–retest stability over 2 months (e.g. .56 < r < .70; Borteyrou et al., 2008), and relationship with other measures of anger and hostility is in the expected direction (e.g. r = .65 with BDHI hostility; r = .58 with NEO PI-R score of anger; r = .66 with the Cook and Medley score of hostility), which establishes its convergent validity (Borteyrou et al., 2008). In the current sample, the internal consistency of the STAXI-2-F subscales ranged from α of .63 to .90.

1.2.3. Anxiety and depression

The 14-item HADS French version was used to assess anxiety and depression (Lépine, 1996; Zigmond & Snaith, 1983). The items are scored by referring to the previous week and ratings made on a 4-point scale ranging from 0 ('not at all') to 3 ('very much indeed'). Two subscales provide Anxiety and Depression scores. A recent review confirmed the two-factor solution of the HADS for the subscales of anxiety and depression. Cronbach's alpha for Anxiety varied from .68 to .93 and for Depression from .67 to .90. Correlations between HADS and other commonly used questionnaires of Anxiety and Depression were from .49 to .83 (Bjelland, Dahl, Tangen Haug, & Neckelmann, 2002). In the current sample, the reliability was good for anxiety and depression, with α of .75 and .71, respectively.

1.2.4. Alcohol use

The French adaptation of the concise version of the Alcohol Use Disorders Identification Test (AUDIT-C-F; Gache et al., 2005; Tuunanen et al., 2007) was used to measure alcohol misuse. The AUDIT-C-F consists of three items related to alcohol consumption. Areas under receiver operating characteristics curves (AUROCs) were used to assess the validity of the AUDIT-C in detecting alcohol misuse, abuse and dependence. The AUROCs ranged from .79 to .89, meaning the AUDIT-C is a valid screening test for these dimensions (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). In the current sample, its internal consistency was .66.

1.2.5. Trauma exposure

The LEC-5 (Weathers et al., 2013) assesses self-reported lifetime trauma exposure for 17 traumatic events (see Table 1). Participants report their exposure to each trauma by referring to six possible answers: 'It happened to me,' 'I witnessed it,' 'I learned about it,' 'It was part of my job,' 'I am not sure,' and 'This trauma doesn't apply to me.' The total LEC-5-F score sums all endorsements, except for 'This trauma doesn't apply to me'. An index of *personal trauma exposure* was calculated in the present study through endorsement of 'It happened to me' and/or 'I witnessed it' across traumas.

Of the total sample, 805 participants (97.9%) endorsed at least one trauma exposure (M = 9.98; SD = .20; *median* = 9 [of 85 possibly exposure types]). A median split allowed us to categorize participants into two trauma exposure groups: *High trauma* (LEC-5-F > 9; n = 406; 49.4%) and *low trauma* (LEC-5-F ≤ 9; n = 416; 50.6%).

1.3. Data analysis

CFA was performed with AMOS 24 software (Arbuckle, 2016) to test the one-factor validity of the DAR-5-F model with maximum likelihood estimation and uncorrelated error terms. The model was tested twice, once with the entire data matrix and subsequently with the trauma exposure subgroup. A Kolmogorov–Smirnov test on each DAR-5-F item indicated non-normal distributions, and data was subsequently square root transformed. Due to the

tendency for large sample sizes to produce statistically nonsignificant χ^2 (Byrne, 1994), we derived fit statistics that were less sensitive to sample size (Bollen, 1989). We report the root-mean-square error of approximation (*RMSEA*; a residual-based absolute fit sensitive to the misspecification of factor loadings) and the comparative fit index (*CFI*; an incremental relative fit measure; Schweizer, 2010). *RMSEA* values no greater than .05 indicate a good fit index (Hu & Bentler, 1999). *CFI* values between .95 and 1 indicate a good model fit, whereas values in the range of .90 and .95 indicate an acceptable fit. We also reported the goodness of fit index (*GFI*), an index that is analogous to the *R-square*, which performs better than any other absolute index of fit (Cole, 1987). The adjusted goodness of fit index (*AGFI*) corrects the GFI as a function of the number of indicators of each latent variable (Joreskog & Sorbum, 1984). The Tucker–Lewis index (*TLI rho2*; Tucker & Lewis, 1973) is a further index of model fit with values superior to the .95 cut-off and close to 1 indicate a very good model fit and negative TLI values or values greater than 1 may occur.

Cronbach's alphas were used as measures of internal consistency of each questionnaire (scale reliability). Alphas of 0.7 and above were considered to be indices of good reliability. When assumptions were met, *t-tests* were used to determine if means of two samples were significantly different from each other. The effect sizes were evaluated with *Cohen's d. Cohen's d* of .2, .5, and .8 are interpreted, respectively, as small, medium, and large.

A Receiver Operating Characteristics curve (ROC curve) was used to evaluate the various thresholds of DAR-5-F as a function of their sensitivity and specificity. The area under the curve (AUROC) was calculated to assess the performance of DAR-5-F in identifying individuals with post-traumatic anger. The AUROC varies between 0 and 1, with .5 representing chance performance (a non-informative classifier), while 1 represents perfect performance, and 0 represents the 'perverse' case of full information with DAR-5-F always incorrect.

2. Results

2.1. Concurrent validity

As expected, individuals with high-trauma levels reported stronger anger reactions on the DAR-5-F ($M = 10.21$; $SD = 3.71$), compared to individuals with lower trauma exposure ($M = 9.34$; $SD = 3.62$; $t(820) = -3.41$; $p < .001$; $d = .24$). A similar pattern of results was observed for trait and state anger, as well as alcohol misuse (Table 2). In contrast, trauma exposure was not significantly associated with individual's anger control or suppression. Consistent with prior research (e.g. Ceschi, Billieux, Hearn, Fürst, & Van der Linden, 2014), the high-trauma group tended to report more depression and anxiety than the low trauma group.

2.2. Convergent and discriminant validity

Table 3 reports the correlations obtained between the DAR-5-F and other measures. Correlation coefficients above .50 were considered to indicate convergence.

As expected, the DAR-5-F presented convergent validity with trait anger, as captured with the STAXI-2-F ($r(822) = .58$; $p < .001$). In addition, the STAXI-2-F state anger subscale tended to converge with the DAR-5-F ($r(822) = .46$; $p < .001$). This correlation was in particular driven by the subgroup of people who reported trauma exposure that was above the median ($r(406) = .52$; $p < .001$). The DAR-5-F did not correlate above .50 with depression, anxiety, and alcohol misuse, suggesting discriminant validity between the DAR-5-F and these constructs. The DAR-

Table 2. Mean scores, and standard deviation for all measures for the overall sample and for the two trauma exposure subgroups (high trauma *versus* low trauma).

	Overall	High Trauma	Low Trauma	t-test(820)	Cohen's d
N	822	406	416		
Posttraumatic anger a	9.77 (3.68)	10.21 (3.71)	9.34 (3.62)	-3.41***	.24
State Anger b	18.42 (5.27)	19.22 (5.93)	17.63 (4.39)	-4.35***	.30
Trait Anger b	19.59 (5.13)	20.21 (4.99)	19.00 (5.19)	-3.40**	.24
Anger Expression-In b	18.89 (4.33)	19.11 (4.33)	18.68 (4.32)	-1.44	.10
Anger Expression-Out b	15.18 (3.51)	15.46 (3.58)	14.91 (3.42)	-2.26*	.16
Anger Control-In b	22.04 (5.34)	21.97 (5.20)	22.10 (5.48)	0.33	-.02
Anger Control-Out b	22.92 (5.27)	22.65 (5.06)	23.18 (5.46)	1.46	-.10
Depression c	4.46 (3.14)	4.75 (3.15)	4.19 (3.11)	-2.58*	.18
Anxiety c	8.29 (3.84)	8.64 (3.81)	7.95 (3.84)	-2.58*	.18
Alcohol use d	3.62 (2.09)	3.89 (2.22)	3.35 (1.90)	-3.48**	.26
Personal trauma exposure e	4.17 (3.07)	5.72 (3.23)	2.65 (1.94)	-16.54***	1.15

The variables were derived from [a] the DAR-5-F – French adaptation of the Dimensions of Anger Reactions Scale-5; [b] the STAXI-2-F – French version of the State-Trait-Anger-Expression Inventory 2; [c] the HADS-F – French version of the Hospital Anxiety and Depression Scale; [d] the AUDIT-C-F – French adaptation of the short version of the Alcohol Use Disorders Identification Test; and [e] the LEC-5-F – French adaptation of the Life Events Checklist-5.
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 3. Correlations of DAR-5-F with the other constructs of the study for the overall sample and for the two subgroups of trauma exposure (high trauma *versus* low trauma).

	Overall	High trauma	Low trauma
N	822	406	416
State Anger[a]	.46***	.52***	.36***
Trait Anger[a]	.58***	.55***	.60***
Anger Expression-In[a]	.29***	.28***	.30***
Anger Expression-Out[a]	.39***	.36***	.42***
Anger Control-In[a]	−.36***	−.31***	−.41***
Anger Control-Out[a]	−.37***	−.34***	−.40***
Anxiety[b]	.42***	.37***	.45***
Depression[b]	.33***	.26***	.38***
Alcohol use[c]	.13**	.11*	.12*
Personal trauma exposure[d]	.16***	.12**	.11*

DAR-5-F: French adaptation of the Dimensions of Anger Reactions Scale-5. The other variables of the study were derived from [a] the STAXI-2-F – French version of the State-Trait-Anger-Expression Inventory 2; [b] the HADS-F – French version of the Hospital Anxiety and Depression Scale; [c] the AUDIT-C-F – French adaptation of the short version of the Alcohol Use Disorders Identification Test; and [d] the LEC-5-F – French adaptation of the Life Events Checklist-5.
*p < .05; **p < .01; ***p < .001.

5-F correlated more strongly with anxiety than with depression ($r(822)$ = .42 and .33, respectively, $ps < .001$; $z = 2.12$; $p < .05$). The correlation of the DAR-5-F with depression was lower than that with trait anger ($r(822)$ = .33 and, .58, respectively, $ps < .001$; $z = 5.09$; $p < .001$). The DAR-5-F was weakly correlated with alcohol misuse (r (822) = .13; $p < .01$).

2.3. DAR-5-F factorial structure

The CFA with a one-factor model indicated a good fit to the DAR-5-F data despite the large sample size (χ^2 (5, N = 822) = 7.82; $p = .167$). Robust indications of goodness of fit confirmed this observation (GFI = .996, AGFI = .988, TLI (rho2) = .995, CFI = .997, RMSEA = .026, and PCLOSE = .862). This single-factor solution was retested on the high-trauma group (N = 406; see Figure 1, with a standardized regression weigh of contribution for each item). The model was supported with traditional (χ^2(5, N = 406) = 3.36; $p = .644$) and more robust fit statistics (GFI = .997, AGFI = .990, TLI

(rho2) = 1.006, CFI = 1.000, RMSEA = .000, and PCLOSE = .924).

2.4. DAR-5-F cut-off

In the current sample, a DAR-5-F score of 12 or above placed the individual at the 75th percentile. Two subgroups were categorized using this criterion: *high anger* experience (DAR-5-F > 12; n = 166; 20.2%) and *low anger* experience (DAR-5-F ≤ 12; n = 656; 79.8%). Two subgroups were also created as a function of the STAXI-2 Trait anger cut-off of 21 (Spielberger, 1999): *high trait anger* (STAXI-2 trait anger > 21; n = 280; 34.1%) and *low trait anger* (STAXI-2 trait anger ≤ 21; n = 542; 65.9%). Interestingly, both classifications converge with sensitivity and specificity, respectively, of 69% and 75%. The correlation between the two classifications was significant, with r_{φ} = .37 ($\chi^2(1)$ = 114.84; N = 822; $p < .001$). A binomial proxy of 'clinical post-traumatic anger' was calculated by creating two groups of participants: 'posttraumatic anger' (high trauma AND STAXI-2-F trait anger above cut-off; n = 191), versus 'non-posttraumatic anger' (all the other participants; n = 631). The ROC curve suggested that the DAR-5-F could reasonably predict 'clinical posttraumatic anger' (Area Under the Curve (AUROC) = .749; $p < .000$). The cut-off of 12 reflected that predictive performance was characterized by sensitivity that was on the low side (.490) relative to specificity (.841).

As shown in Table 4, the two DAR-5-F subgroups differed with a medium to large effect size (Cohen's d from .50 to 1.21) on all measurements except for alcohol consumption ($d = .10$). Individuals with a high DAR-5-F score (>12) reported more trait anger, state anger, in- and outward anger expression, anxiety, depression, and trauma exposure. They also had lower scores for anger control. All effects were medium to large in size.

3. Discussion

The current findings suggest that DAR-5-F is a reliable and valid screening measure of anger in the context of trauma. The DAR-5-F uses only
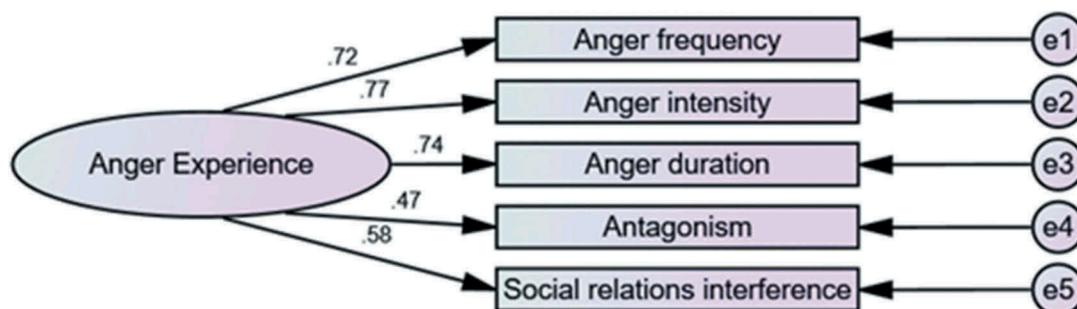

Figure 1. Path diagram illustrating the single-factor structure of the DAR-5-F for the Trauma subgroup with the standardized regression weight for each item (the model was supported with goodness of fit statistics: χ^2(5, N = 406) = 3.36; $p = .644$; GFI = .997, AGFI = .990, TLI (rho2) = 1.006, CFI = 1.000, RMSEA = .000, PCLOSE = .924).

Table 4. Mean value (SDs) of anger, anxiety depression, alcohol use, and trauma exposure for the participants with a high *versus* a low score on the DAR-5-F (cut-off = 12; 75th percentile).

	DAR-5-F			
	High	Low	t-test(820)	Cohen's d
Valid N	166	656		
State Anger[a]	22.51 (7.94)	17.38 (3.69)	−12.16***	.83
Trait Anger[a]	24.17 (4.99)	18.44 (4.47)	−14.39***	1.21
Anger Expression-In[a]	20.57 (4.08)	18.47 (4.29)	−5.70***	.50
Anger Expression-Out[a]	17.35 (3.98)	14.64 (3.15)	−9.36***	.75
Anger Control-In[a]	19.02 (4.95)	22.80 (5.16)	8.50***	−.75
Anger Control-Out[a]	19.91 (5.15)	23.68 (5.02)	8.59***	−.74
Anxiety[b]	10.67 (3.66)	7.69 (3.64)	−9.4***	.82
Depression[b]	6.06 (3.15)	4.06 (3.01)	−7.58***	.65
Alcohol use[c]	3.80 (2.50)	3.58 (1.97)	−1.12	.10
Personal trauma exposure[d]	4.90 (3.58)	3.98 (2.90)	−3.45**	.28

DAR-5-F: French adaptation of the Dimensions of Anger Reactions Scale-5.; The other variables of the study were derived from [a] the STAXI-2-F – French version of the State-Trait-Anger-Expression Inventory 2; [b] the HADS-F – French version of the Hospital Anxiety and Depression Scale; [c] the AUDIT-C-F – French adaptation of the short version of the Alcohol Use Disorders Identification Test; and [d] the LEC-5-F – French adaptation of the Life Events Checklist-5.
**$p < .01$; ***$p < .001$.

five items to index a single factor of anger experience and demonstrates good internal reliability (α = .80) and moderate inter-item correlations, which indicates that each item gauges a meaningfully different aspect of the anger construct. Convergent validity was indicated with strong correlations between the DAR-5-F and trait anger as measured with the STAXI-2-F, a widely accepted measure of anger. Furthermore, we showed that the DAR-5-F was correlated more strongly with this measure of trait anger than with depression. The discriminant validity shown with respect to alcohol misuse is a further index of DAR-5-F construct validity. Although a certain degree of covariance between 'anger experience' and 'alcohol misuse' was observed, the DAR-5-F is not expected to be a measure of addiction. In addition to the observed convergent validity, discriminant validity with supposed unrelated constructs is an important step in the establishment of the qualities of the current scale (Forbes et al., 2015).

As a whole, these results underline the good construct validity of this concise anger screening tool. Given the robust concordance of our results with those obtained with the original English version of the scale (Forbes et al., 2014a, 2014b), we provide support for the proposal that the anger experience, as indexed by the DAR-5, is not affected by language and culture. Further studies with other DAR-5 translations and samples should be conducted to support this cross-cultural perspective of posttraumatic anger.

Consistent with previous research, a cut-off score of 12 on DAR-5-F was used to reflect psychological distress and functional impairment, which corresponds to the 75th percentile of the current score distribution (Forbes et al., 2014b). The ROC curve analysis indicated that the DAR-5-F possesses reasonable predictive accuracy of 'clinical posttraumatic

anger' with a cut-off score set at 12 showing moderate sensitivity and good specificity. Knowing that the predictive value of a measure depends to some degree on the prevalence of the target problem, future studies using clinical samples with problematic anger are required to replicate the utility of this cut-off. That said, respondents with a DAR-5-F score above this clinical cut-off, compared with the rest of the sample, reported more anger (trait as well as state), poorer anger control, and more anxiety and depression. The clinical significance of the cut-off was shown with the large to medium effect sizes of these findings. Respondents who scored above the DAR-5-F cut-off also reported significantly greater exposure to traumatic events, although this difference was small. In contrast, alcohol misuse was not discriminated by the DAR-5-F cut-off. Once again, these findings were consistent with previous data obtained with the English version of the DAR-5 in community (Forbes et al., 2014a) and clinical samples alike (Forbes et al., 2014b). In addition, the current findings make available to French-speaking clinicians and researchers a valuable clinical and research anger screening tool, adapted and validated by using a sizable community sample.

These conclusions should be considered alongside the limitations of the study. First, nearly a third of the sample did not complete the study. This attrition rate is compatible with the mean dropout rate for internet surveys (Musch & Reips, 2000). Completers did not differ from non-completers on their DAR-5-F scores, but reported more traumatic events. Thus, we postulate that the dropout rate can be mainly attributed to participants who may have had less interest in trauma-related research. Unfortunately, given our procedure, we were not in a position to collect further information on trauma exposure from non-completers as well as from completers (e.g. trauma complexity or severity). Future research might reveal

differences on the DAR-5-F as a function of these variables.

Despite the possible skewed distribution of trauma endorsement, our findings indicate that the DAR-F-5 clearly distinguishes people on the basis of the frequency of their trauma exposure. This is consistent with previous data collected with the English version of the DAR-5 (Forbes et al., 2014a, 2014b). Research has found strong relationships between the severity of PTSD and lifetime number of different types of traumatic events (as opposed to single traumatic event; e.g. Briere, Agee, & Dietrich, 2016). While our definition of trauma exposure was based on the number of types of traumatic events as indicated by the LEC-5, there are other potential methods to indicate trauma exposure. In addition to using other methods to index the degree of traumatic experience (e.g. objective descriptions of traumatic situations, appraisals of overwhelming events, subjective severity ratings), broadening the study to include or assessment of PTSD or complex-PTSD symptoms in clinical samples will further our understanding of the role of anger in the development and maintenance of post-traumatic psychopathologies. Moreover, the cross-sectional nature of the study means we cannot draw conclusions about the causal relationship between anger and traumatic events.

Finally, our sample was mainly composed of Swiss and French citizens. Despite our efforts, we cannot exclude the possibility of minor regional discrepancies in French concepts. Thus, replications with other French samples (e.g. Canada; Belgium; French overseas territories, including North African countries) are needed to improve our knowledge and understanding of the potential generalization of our French adaptation of the scale to other French-speaking populations. This seems particularly crucial because cultural differences in the conceptualization of mental symptoms have already been described (Ventevogel, Jordans, Reis, & de Jonge, 2013). Nonetheless, these findings add important evidence in favour of a core construct of anger experience in the context of trauma that may be shared cross-culturally.

In conclusion, the current study indicates that the DAR-5-F has good psychometric properties and is an effective instrument to screen for problematic anger experience in trauma-exposed populations. The pattern of findings that we describe suggests that the French adaptation of the DAR-5-F, provided in the Appendix, behaves similarly to the original English version. This study succeeds in replicating the results obtained by Forbes et al. (2014a), providing support to the generalizability of the posttraumatic anger captured by the DAR-5.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author.

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Appendix.

French adaptation of the Dimension of Anger Reactions Scale-5 (DAR-5-F). Original instructions and items in brackets.

Veuillez cocher la case qui correspond le mieux à la quantité de temps pendant lequel vous vous êtes senti(e) de la façon décrite par chaque phrase. Référez-vous aux **4 DERNIERES SEMAINES**.

[Thinking over the past 4 weeks, circle the number under the option that best describes the amount of time you felt that way.]

		Jamais ou presque jamais	Pour un temps assez court	De temps en temps	La plupart du temps	Tout le temps ou presque tout le temps
1	Je me suis trouvé(e) en colère envers des gens ou des situations. [I found myself getting angry at people or situations.]	1	2	3	4	5
2	Quand je me suis mis(e) en colère, ça m'a vraiment mis(e) hors de moi. [When I got angry, I got really mad.]	1	2	3	4	5
3	Quand je me suis mis(e) en colère, je suis resté(e) en colère. [When I got angry, I stayed angry.]	1	2	3	4	5
4	Quand je me suis mis(e) en colère contre des gens j'aurais voulu les taper. [When I got angry at someone I wanted to hit them.]	1	2	3	4	5
5	Ma colère m'a empêché de m'entendre avec les gens aussi bien que je l'aurais souhaité. [My anger prevented me from getting along with people as well as I'd have liked to.]	1	2	3	4	5

The scale score is summative. There are no reversed items. The total DAR-5-F score ranges from 5 to 25. Higher scores indicate more severe symptoms.

Scale: [1 = None or almost none of the time; 2 = A little of the time; 3 = Some of the time; 4 = Most of the time; 5 = All or almost all of the time].