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Validation of the Extreme Experiences Scale (EX^2) for Armed Conflict Contexts

L. S. Giraldo[1] · D. C. Aguirre-Acevedo[2] · S. Trujillo[1,3] · J. E. Ugarriza[3] · N. Trujillo[1,3]

Abstract

Psychological approaches to the study of armed conflict have focused on analyzing post-traumatic stress outcomes, and on evaluating the intensity of exposure to violent confrontation. Nevertheless, psychometrically valid tools required for measuring these traumatic experiences are scarce To validate the *Extreme Experiences scale (EX^2) for armed conflict contexts* for its use in Colombia, and to provide a framework for validation in conflict contexts around the world This Cross-sectional aims to validate the scale with 187 participants, study of validate with 187 participants, comprising population with high exposure to conflict (former combatants and a set of armed conflict victims) and low conflict-exposed individuals (control group). Structures of two domains and 18 items were confirmed: Direct Extreme Experiences (dEX^2) and Indirect Extreme Experiences (iEX^2); these dimensions were also validated by expert judgment, producing 14-item version. Good levels of internal consistency were found, with a KR-20 of 0.80 for the 18-item version, and 0.77 for the 14-item. The scale differentiates between population with 'high exposure to conflict' from population with 'low exposure' ($d_{np} > 0.5$ and area under the ROC >0.90). The scale scores have significant correlation with some mental health constructs. The EX^2 scale has good internal consistency, as well as structural validity with regard to exposed groups. This scale can be potentially validated for its use in countries with armed confrontation history. In future versions, the scale may include additional items in order to improve content validity.

Keywords Extreme experiences scale · Validation · War exposure · Armed conflict · Mental health · Victims · Ex-combatants · Colombia

✉ N. Trujillo
  natalia.trujillo@udea.edu.co

Extended author information available on the last page of the article

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Introduction

Psychometric strategies employed to measure individuals' exposure to armed conflicts require attention to both contexts and outcomes [5, 56–58]. Empirical efforts have typically favored the assessment of exposure by describing macro-level geographical and temporal distribution of violent events [10, 13, 67], and micro-level analysis of post-traumatic outcomes [44, 51, 55, 69].

However, once researchers attempts to combine these approaches in order to establish the psychological effects of conflict exposure they stumble upon the problems derived from ecological fallacy –attributing macro level effects to individual level traits- [56–58], and the lack of sensitivity of scales to capture a wide array of events in protracted, low-intensity conflicts such as the one in Colombian [9, 22, 23, 63].

When evaluating exposure to armed conflict, literature has offered a number of different approaches [10, 13, 36, 67, 69]. However, there are few instruments validated in Spanish that are used for this purpose [37]. Some studies have shown that the lack of valid instruments is a failure of the study of armed conflict, particularly in analyzing its actors' mental health [52, 56–58]. In this sense, a recent meta-analysis with 33 epidemiological studies on the impact of mental health due to the armed conflict indicates that future research should focus on the validity of instruments that facilitate the use of event characteristic of this context as a predictive variable [36]. In addition, Morina et al. [36] have reported that armed conflict exposure does not have a uniform effect on the population. Precisely instruments such as the one validated in this study attempts to capture the exposure to conflict more sensitively in comparison with spatial-temporal indicators [10, 13], thereby reducing the possibility of an ecological fallacy [47].

In the lack of a specialized instrument, the *Extreme Experiences scale* (EACA),[1] in Spanish version proposal, seems to be a useful tool to identify extreme experiences, included events of armed conflict. The EACA was used for the VIVO project (acronym Spanish Valoración del Impacto Vital) [46], tracks the occurrence of 24 extreme situations of trauma, loss, or crisis, and it has been used in the populations affected by traffic accidents [17, 45], labor incidents [45], and natural disasters [32], as well as experiences of cross-border displacement [42]. Besides being sensitive enough to identify events that can change among different places, the EACA allows us to differentiate between events and potential outcome effects, a crucial structural property for uses in psycho-social and policy intervention [36]. Psychometric properties of the original EACA scale have not been reported.

For purposes of applying such instrument (EACA) to the context of armed conflict, we adapted a reduced version incorporating 18 original items. For the adapted version, we defined 'extreme experience' as emotionally charged events, experienced at the individual level, and directly triggered by a violent armed conflict episode. Such events may or may not reach a clinical outcome, since the extreme experience itself is not defined by the occurrence of trauma [17, 32, 45, 46]. Our 18-item adaptation of the Extreme Experiences Scale, from here now referred to as EX^2, is composed of two dimensions: direct extreme experiences (dEX^2), and indirect extreme experiences (iEX^2). Through the first dimension, items aim to capture personal physical situations (i.e., death or illness); through the second

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[1] The ECAE scale has not been validated, its original authors have used it as a screening test to identify extreme experiences and subsequently with the VIVO instrument (Ontological Vital Impact Assessment) identify strategies and the ability of people to cope to difficult experiences in order to deepen the vital impact of extreme. The instrument can be found on the following page: http://www.psicosocial.info/cuestionario/cuestionario.php

one, the purpose is to capture situations where individuals may be witness o not to extreme events happening to third parties with whom they have an emotional bond, such as relatives or friends [7, 26, 56].

The EX^2 as formulated, represents progress. It asks about the age at which the event occurred, the duration of the event, the perceived threat, and the influence on life trajectory and on the way of seeing life (perspective) and dissociates from the measurement of traumatic outcomes that has traditionally been present in studies on the armed conflict [2, 8, 14, 27]. The EX^2 attempts to incorporate the main criteria that have been recommended as being necessary for the exploration of mental health disorders caused by the armed conflict. It has been recommended inquiring into the nature and intensity of the violent event, the nature of the impact suffered, the psychosocial characteristics of each person, how the person is associated with the violent act (victim, terrorist, combatant, etc.), and the secondary or indirect consequences of war on families, the economy, culture, and social life [12, 54, 56–58]. Psychometric properties of the 18-items adaptation have not been reported.

The Colombian context offers several advantages to validate this kind of instrument. First, Colombia has suffered more than six decades of an active armed conflict [66]. While armed confrontation with the largest group - Revolutionary Armed Forces of Colombia, FARC- ceased to exist after a peace deal was signed between the Government and the rebels in 2016, violent clashes continue with the smaller National Liberation Army –ELN- and smaller splinter guerrilla groups. Second, armed groups have applied various forms of violence, increasing the variation of conflict events. Official databases describe in some of cases of massacres, forced displacements, kidnappings, damages to civilian infrastructure and property, selective killings, and many other modalities of violence, attributed to main forces at conflict [66]. Third, intensity and magnitude of such armed conflict events has varied through time and place, posing a challenge to researchers in terms of measuring individuals' varying degrees of conflict exposure: military confrontation and violent events, while widespread in six decades of war, were not uniformly distributed across time a space.[2]

More than eight million people have been officially acknowledged as conflict victims by the Colombian State as of December 2018, out of which 7.4 million were victims of internal displacement –about 16 % of the total population that year.[3] According to the Colombian government, soldiers and civilians composed the largest number of people in the world killed or hurt by landmines, a weapon of choice for insurgents, with more than 10.500 victims recorded between 1982 and 2013 [66]. But armed conflict effects are visible not only among civilians, but also among combatants involved in the fighting. In particular, recent research has shown how former guerrilla and paramilitary illegal combatants tend to score lower on empathic concern and higher on post-traumatic stress and aggressive behavior, among other traits, when compared to non-combatant controls [48, 68].

The aim of this study was to determine the psychometric properties of our 18-item adaptation of the EX^2 in terms of content, structural, convergent and discriminant validity and internal consistency, using a sample of Colombian population that experienced some action of the armed conflict. This will facilitate its use in contexts of armed conflict around the world.

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[2] CERAC - Conflict Analysis Resource Center. Data on the armed conflict in Colombia, 2017: http://www.cerac. org.co/es/recursos/datosconflictoscolombia/
[3] Updated figures are available at https://cifras.unidadvictimas.gov.co/.

Methods

Study Design and Participants

In our study for the EX^2 scale evaluated its properties and validity for its use in both former combatants and civil population with varying levels of exposure of armed conflict. We applied the 18-item adapted scale to 187 participants between 2015 and 2017.

Our first pool we included participants with "high exposure to conflict" (former illegal combatants then enrolled in an official reintegration program led by the Reincorporation and Normalization Agency of Colombia -ARN-, and victims of conflict). For former combatants, during data collection researchers visited different facilities where gathered for their reintegration weekly workshop session, in order to invited to take part in the study. After signed informed consent, adult voluntary participants (18 years old and above) were included in our pool until a balanced 85–15 gender composition were reached (85.0% men and 15.0% women), following previous literature with about former combatants [43]. Following this procedure, we counted on a total of 67 registered former combatants. The victims were comprised of voluntary participants (18 years old and above) of one municipality (M1) from Colombia has a prolonged history of collective victimization between 1990 and 2013, having for that period one of the highest homicide rates in the country (125 homicides per 100,000 inhabitants) and a record of 3079 displaced people (about 10 % of the total population in 1990).

Our second pool was comprised of voluntary participants (18 years old and above) of another Municipality 2 (M2). Town M2 represents a sharp contrast with town M1, with a homicide rate closer to that reported at the national level (65.6 per 100,000 in habitants) and a displacement rate of 25.2 per 10,000 inhabitants (2622 in total), for the same period of 1990 and 2013 [11]. The creation of a civilian pool comprised of highly comparable heavily victimized individuals on the one hand, and less affected town dwellers on the other, would help us to ensure enough variation in terms of individuals' exposure to armed conflict.

A strategy was developed to meet the sample criteria needed for each type of validation in this study. The present study followed the parameter of 10 individuals per item for the validation of instruments [15, 59], considering 18 items in the EX^2 scale to assess structural validity. For internal consistency, the 117 records were used as a sample, considering a 95% confidence, with a $\propto = 0.05$ and a power of 0.8, and with the expectation of find an internal consistency of 0.7 [3, 15]. For content validity, we invited a total of 8 thematic experts in the field of armed conflict and the mental health, expecting a content validity index equal to or greater than 0.5823 in each of the evaluated categories [31, 33, 65]. To evaluate convergent and discriminant validity, the sample calculation formula was used to establish correlation coefficients between two variables [4]. A correlation of 0.5, a confidence level of 95.0%, a power of 80.0% and an amplitude of 0.3 was established as a hypothesis, obtaining a sample of 99 records. Finally, when having the retrospective information of 187 subjects, it was determined to take this number as the sample for all the analyzes. The sample calculation was exclusively to verify that the minimum recommended sample was in each validation. To evaluate the convergent and discriminant validity of the EX^2 scale with the IMA - Inventory of Motives for Aggression -, and with the ISCA - Inventory Situations and Aggressive Behaviors; a positive correlation and greater than of 0.4 was established as hypothesis, a confidence level of 95.0% and a power of 80.0%, obtaining a sample of 47 registre. To explore the discriminant validity of the EX^2 scale with the IRI - Inter-personality Reactivity Index-; a negative

correlation was established as a hypothesis and less than 0.4, a confidence level of 95.0% and a power of 80.0%, obtaining a sample of 85 records.

Application of our EX^2 instrument for both pools was made through individual sessions led by a group of four psychologists with clinical expertise. Protocols established a referral path to social service institutions when critical cases were identified, and explicitly pledged to protect participants' anonymity.

Instruments

Before application of the EX^2 scale, participants were asked to provide basic demographic data: gender, age, and educational level. Then, participants took the EX^2 scale, the Interpersonal Reactivity Index (IRI), Situation and Aggressive Behavior Inventory (ISCA: Spanish acronym), and the Inventory of Motives for Aggression (IMA: Spanish acronym). For the present study we will use the IRI to test divergent validity and the latters two to test convergent validity. Furthermore, the latter instruments were selected based on previous studies showing that exposure to armed conflict constitutes a risk factor for developing aggressive and violent behavior among former combatants, war veterans, and general population living in war zones [20, 62]. On the other hand, studies with former combatants using IRI have shown low scores in personal distress empathic disposition [64] and an ability for the scale to identify differences in emotional Processing between ex-combatants and civilians who were not directly exposed to the armed conflict [53].

The EX^2 Scale

The EX^2 questionnaire adapts 18 items of the framing of the 24 items originally included in the *Extreme Experiences* scale [46] in order to make them fit in an armed conflict framework, but still keeping the original dichotomous response options (yes/no). Items were pre-classified in two main dimensions: direct extreme experiences (dEX^2: items 1, 2, 4, 5, 6, 7, 8, 9, 10, 14, 16 and 18), and indirect extreme experiences (iEX^2: items 3, 11, 12, 13, 15 and 17). The initial statement of the scale reads "Most people have experienced situations that could affected them in a positive or negative sense. On this context, we will list experiences that might occur during an armed conflict, in order to ask if any of these situations had occurred you".

The dimension dEX^2 asks questions such as: "Sufrir amenazas de muerte, agresiones o palizas" [to suffer death threatening, aggressions or beating], "Ser personalmente víctima de secuestro" [to be a kidnapping victim], among others. Dimension iEX^2 items ask questions such as: "Secuestro de un familiar o amigo" [to have a close relative or friend as kidnapping victim], "Desaparición forzada de alguna persona cercana" [to suffer from a forced disappearance of someone close to you], among others.

EX^2 scores, as well as those for dimensions dEX^2 as iEX^2, represent the summation of affirmative responses per item. Details of items in use for each dimension are available in the Table 1 of Supplementary Material. In addition to the dichotomous response, participants were also asked to report the age at which the item-related event occurred, its duration, the perceived level of threat and the subjective impact of such experience.

The scale was designed to be applied in clinical settings by professionals with expertise in the management of psychological crisis. Since 2015 the scale has been applied inside a comprehensive mental health protocol for ex-combatant and civil population in Colombia. This is the first study that explores the psychometric properties of the EX^2 scale.

Inter-Personality Reactivity Index (IRI) – Empathy Scale

A Spanish version of the IRI was used to evaluate empathy [18], by means of 28 items issued in four subscales: 1) Fantasy (FS), 2) Perspective Taking (PT), 3) Empathic Concern (EC), and 4) Personal Distress (PD). The scale has response options that range from 1 to 5, with 1 being "does not describe me well" and 5 being "do describe me very well". The score is obtained by sum the answers in each of the items, previously inverting items 3, 4, 7, 12, 13, 14, 15, 18 and 19. PT evaluates the ability to consider other's points of view. EC assesses the response to feelings of compassion or sympathy through recognizing others' misfortunes. FS explores the ability to self-identify as a fictional character in a story such as movie, book or novel. PD measures self-oriented negative arousal in response to stressors, attitudes and experiences of other people [18]. The reliability of the scale ranges from 0.70 to 0.77 [18]. Cronbach's alpha values for this scale were 0.70 for FS, 0.56 for PT, 0.65 for EC, and 0.64 for PD [18]. The instrument was standardized and subjected to exploratory and confirmatory factor analyses among Colombian former combatants' population [21, 48]. Previous works have shown this instrument has convergent validity with pro-social reasoning and behavior, as well as, it has been negatively correlated with aggressive behavior and emotional instability [18].

Inventory of Situation and Aggressive Behavior (ISCA: Spanish Acronym)

This 22-item scale was originally developed in Spanish by Juarez [25] as *Inventario de Situaciones y Comportamientos Agresivos (ISCA).* The instrument assesses the expression of violent behaviors triggered by different situations during the last 4 weeks prior to the evaluation. This inventory consists of two subscales: a) aggressive behavior (9 items, alpha = 0.81), and b) events of aggression (13 items, alpha = 0.79). All items have three response options (almost never/never, sometimes, and often) and received a separate score for each subscale and a global score. Application of this scale yielded an overall Cronbach's alpha of 0.79 for the global score.

Inventory of Motives for Aggression (IMA- Spanish Acronym)

This inventory consists of 26 items aimed to gauge the frequency of alleged reasons to act aggressively [25]. This questionnaire is based on the concept that violent behaviors vary as a function of the intensity of their drivers. It uses 'almost never/never', 'sometimes', and 'often' as response options that indicates the frequency of each motive leading to aggressive behaviors. A score is obtained by calculating the sum of items responses. A previous study has reported an alpha of Cronbach of 0.91 for the global score [25].

Procedures and Analysis

We developed a six-step process in order to ensure a systematic examination of EX²'s psychometric properties.

First, once the EX² and complementary scales were applied, we proceeded to consolidate a database, after identifying and controlling for missing information, duplicate records, atypical data, and the floor or ceiling effect. As a result, we estimate a data loss of approximately 5.0%. In the Table 2 of Supplementary Material provides detail on descriptive statistics of our sample.

Second, we proceeded to analyze the structure validity by means of Confirmatory Factorial Analysis (CFA) for two dimensions according to the adapted version and experts' judgment: dEX^2 and iEX^2. Two models were built by estimating structural equation models of the Mplus 7.31 package [41]. We used the Diagonal Weighted Least Squares (WLSMV) method as an estimator to extract the factors for dichotomous qualitative variables [40]. The first model evaluated the two-dimensional structure with the 18 items from the questionnaire. The second model validated the structure resulting from the more restricted version derived from the experts 'content validity. An oblique Geomin rotation was used due to correlation between the factors was expected [6, 40]. In order to test goodness-to-fit for the models, we relied on chi-square test, comparative fit indexes (CFI), the Tucker–Lewis index (TLI), and the Root Mean Square Error of Approximation (RMSEA). Guidelines proposed [24] suggest that models with CFI and TLI close to 0.90 or higher, RMSEA between 0.05 and 0.08 are representative of good-fitting models.

In parallel, our pool of experts was asked to assess levels of content validity for both dimensions. Experts' output enabled us later to extract a more restrictive set of items, and an additional CFA was conducted on such content-validated version of the scale.

For this procedure, a panel of eight subject-matter experts was formed, with five having obtained doctoral degrees in Psychology, Engineering, Epidemiology, Education, and Social Sciences, and with three having obtained master's degrees in Psychology, Mental Health, and Public Health with an emphasis in Mental Health. In the Table 3 of Supplementary Material details the experts' background experience. Prior to the analysis, a conceptual review, a set of instructions, and a registration template were made available online. On the format experts rated the a) clarity (semantic and syntactic ease of understanding the item); b) coherence (logical relationship with the dimension or indicator that it is measuring); c) sufficiency (suitability of the number of items to estimate each of the dimensions being studied); d) relevance (importance of including the item in the instrument); and the e) pertinence of the response options (dichotomous YES/NO option).

Following standard rating schemes [15, 60], experts were asked to rate each aspect from 1 to 4, being 1 = Does not meet the criteria (the item can be eliminated); 2 = Low level (the item requires many modifications); 3 = Moderate level (the item requires specific modifications); and 4 = High level (the item does not require modification). The experts could include observations and recommendations for each item. Then, in order to estimate the Modified Content Validity Rate (CVR') [31, 33, 65], answer options were categorized as *Essential* (ratings 3 and 4) and 2) *not essential* (ratings 1 and 2). The modified CVR' was used because it allows to establish the content validity ratio based on a reference value (0.5823) that is not subject to the number of experts that validate the content of a scale.

Once each individual item's CVR' was calculated, the Content Validity Index (CVI) proposed by Lawshe was determined [31] as an average of the acceptable items. The minimum index value acceptable for CVR' and CVI remains constant at 0.5823 [33, 65].

In a third step, we evaluated different scoring options for answers provided by participants in our sample. Due to lack of an a priori scoring formula, we tried different alternatives. The scores were initially estimated by either 1) summation of items, 2) factor loadings, and 3) versions of those alternatives (1 and 2) weighted by the following variables: duration of the event, perceived threat, influence on life trajectory, and life perspective. In the Table 4 of Supplementary Material details the procedure for calculating weighted load.

In the fourth step, we evaluated the internal consistency for the full scale and for each dimension of the two derived models (18-item model and the expert-validated model)

independently. The Kuder–Richardson coefficient (KR-20) was calculated [29]. The recommendations of a KR-20 are between 0.7 and 0.9 as a reference measure to accept good internal consistency [15, 60].

In the fifth phase, we evaluated the construct validity. We evaluated two groups (High exposure vs low exposure to conflict). We expected to find higher scores in participants with high exposure to armed conflict. Also, we evaluated construct validty comparing by gender. We expected to find higher scores in men than woman because men had more risk of exposure to armed conflict. This was evaluated by testing the difference in means of the EX^2 between the groups of interest. To evaluate differences in the questionnaire global score and its dimensions, by sex and exposure to conflict (high exposure vs. low exposure), we used the U Mann-Whitney test [28]. In addition, the nonparametric effect size was calculated, having $d_{np} > 0.5$ as reference [19].

Aditional, we performed a sensitivity analysis to explore the discriminant capacity of the EX^2 scale to determine exposure to conflict (either highly or lowly exposed). Although there is not an available gold test to confirm high or low exposition group membership, this approach will allow us to recognize the discriminant utility of the instrument by to explore such binary distinction. In order to estimate cut-off points of the EX^2 scale questionnaire so as to determine exposure to the conflict, a sensitivity and specificity analysis was conducted, and the Receiver Operating Characteristic (ROC) was calculated [30]. The sensitivity and specificity values and the likelihood ratios (LR) were calculated according to each cut-off point. The optimal cut-off point was determined for the value at which the minimum level of specificity and sensibility was 80.0%, in addition to having the best score in the Youden index [30], which seeks to maximize the correct classification rate with exposure to high or low conflict.

Finally, in the sixth phase, we performed convergent validity and discriminant analyses. The convergent validity test [15, 34] was applied to the Inventory of Motives for Aggression (IMA), and the Inventory Situation and Aggressive Behavior (ISCA: Spanish acronym; see [25]). The discriminant validity test [15, 34] was assessed on the IRI [18].

In order evaluate convergent validity we used a Spearman correlation analysis between EX^2 scale score, IMA and ISCA, being all measures of theoretically similar domains. We expected a "moderate" and "positive" correlation (spearman correlation) ranged from 0.40 to 0.70, given previous literature pointing out that exposure to armed conflict increases the risk of developing aggressive and violent behavior [20, 62]. In the case of the discriminant validity test, we also used Spearman correlation analysis for the EX^2 scale score, and IRI, measures of theoretically different domains. We expected a "weak" and "negative" correlation <0.40, since studies have shown low scores on some dimensions of empathy, such as personal distress among former combatants [21, 64].

We used IBM SPSS software version 24 for the previous calculations and for CFA models Mplus version 7.31 [41].

Results

Characteristics of the Study Sample

We obtained 187 records of former combatants (35.8%), victims (36.9%), and control group members (27.3%), 66.3% of whom were women. We observed age median between 31 and 40 years in all three groups, and with a median of 11.0 years of education all groups (see Table 1).

Table 1 Demographic characteristic of the participants of the validation study of the Extreme Experiences scale (EX^2) in exposed population to armed conflict in Colombia. 2015–2017

Characteristic	Former combatants $n = 67$ (35.8%)	Victims $n = 69$ (36.9%)	Controls $n = 51$ (27.3%)	Total $n = 187$ (100%)
Gender, frequency (%)				
Male	41 (61.2)	11 (15.9)	11 (21.6)	63 (33.7)
Female	26 (38.8)	58 (84.1)	40 (78.4)	124 (66.3)
School level years				
Mean (SD)	9.1 (3.4)	10.9 (2.8)	10.7 (3.9)	10.2 (3.4)
Median (IR)	11.0 (5.8–11.0)	11.0 (11.0–12.5)	11.0 (9.0–13.0)	11.0 (8.0–12.0)
Age in years				
Mean (SD)	34.2 (8.1)	40.0 (14.5)	36.4 (16.3)	36.9 (13.3)
Median (IR)	34.0 (29.0–39.0)	40.0 (27.0–51.0)	31.0 (24.0–51.0)	34.0 (27.0–46.0)

SD Standard Deviation

IR Interquartile range

Content Validity by expert's Judgment and Structure Validity Test

Results from expert judgment validated a total of 14 items from the original the EX^2 scale. They reported sufficiency, clarity, coherence, relevance, and utility of the response options (Yes/No) for EX^2 scale. For all this category, the CVR' were above of 0.5823, accepted cut-off point for this validation. Four items fell below the accepted cut-off point (CVR' > = 0.5823). These items were left out (item 4, item 8, ítem 10 e item 16), leaving eight items for the dEX^2 dimension and six items for the iEX^2 (see Table 2).

According to evaluations, in category sufficiency, we observed CVR' of 0.88 for each the dimensions (dEX^2 and iEX^2). We found that 14 items in the EX^2 scale are sufficient to measurement the two dimensions (see Table 2). authors recommended a future inclusion of other conflict-related events such as displacement, forced recruitment by armed groups, extortion, to live in a shelter or to be an asylum seeker, and those related to gender violence. In Table 5 of Supplementary Material there are presented the assesment of the individual items by experts for the category's sufficiency.

Although a good CVR indicator was found (0.80) for the category of clarity, this was the category with acute recommendations. General observations from the experts, were related to the need of improving wording of some items, so as to ensure that lack of clarity would not disrupt the coherence, relevance, and adequacy. In particular, experts recommended removing redundant wording and ambiguous formulations in the case of terms "sufrir" [to suffer] and "paliza" [beating(item 1); "personalmente víctima" [personal victim] (item 2); "acciones de conflicto" [conflict actions](item 6); "represión política" [political represion], "víctima directa o indirecta" [direct or indirect victim] (item 7); "conflicto armado" [armed conflict] and "grupos armados" [armed group] (item 8); "muy grave" [very serious], "enfermedad crónica" [chronic disease] (item 11); "muerte por causa natural" [natural death] and "por una situación dolorosa" [for a painful situation] (item 17); "hundir completamente" [sink completely], "and "proyecto de vida" [life project] (item 18). Also, according to most experts, the term "marco del conflicto armado" in the heading of the test needed to be better explained, in order to avoid misinterpretations. In the Table 5 of Supplementary Material there are the assessment by item and experts for the category's clarity.

A good coherence index (CVR '=0.86) was found, indicated an adequate logical relationship of the items with each dimension. A CVR' 0.90 was also reported for the relevance

Table 2 Content Validity of the Extreme Experiences scale (EX^2)) in exposed population to armed conflict in Colombia. 2015–2017

ITEM	Clarity		Coherence		Relevance	
	Essential	CVR'	Essential	CVR'	Essential	CVR'
1. To suffering death threatening, aggressions or beats	8	1.00	7	0.88	8	1.00
2. To be a kidnapping victim	5	0.63	8	1.00	8	1.00
3. To have a close relative or friend as a kidnapping victim	8	1.00	8	1.00	8	1.00
4. To suffer from domestic violence in the context of the armed conflict	4	0.50	7	0.88	6	0.75
5. To be a victim of sexual abuse	6	0.75	8	1.00	7	0.88
6. To be a direct victim of armed conflict	5	0.63	7	0.88	4	0.50
7. To be a victim of armed conflict actions (landmines, explosions, massacre)	5	0.63	6	0.75	7	0.88
8. To be a victim of political repression	4	0.50	5	0.63	7	0.88
9. To be a victim of an assault by an armed group actor	7	0.88	7	0.88	8	1.00
10. To suffer from other threat to your wellbeing	4	0.50	5	0.63	4	0.50
11. To suffer the "natural death" of a family member or a friend due to armed conflict events	7	0.88	7	0.88	6	0.75
12. To suffer from a forced disappearance from someone close to you	8	1.00	8	1.00	8	1.00
13. To suffer from the homicide of someone close to you	7	0.88	8	1.00	8	1.00
14. To suffer from a chronic or invalidating disease in the context of the armed conflict	6	0.75	6	0.75	7	0.88
15. To suffer by the chronic or invalidating disease of someone close to you	6	0.75	7	0.88	7	0.88
16. To suffer a loving break in the context of the armed conflict	2	0.25	6	0.75	6	0.75
17. To suffer the loving break of your parents in the context of the armed conflict	6	0.75	8	1.00	7	0.88
18. To feel a loss of your life project in the context of armed conflict	6	0.75	6	0.75	7	0.88
CVI - Essential		**0.80**		**0.86**		**0.90**
CVI- all items		**0.72**		**0.86**		**0.85**
CVR' sufficiency dEX^2: 0.88						
CVR' sufficiency iEX^2: 0.88						

CVR' Content Validity Ratio Adjusted

CVI Content Validity Index

CVR' recommended > =0,5823

Essential number of experts who scored 3 or 4 on the item

CVI-Essential Content Validity Index for item with score 3 or 4

CVI-all items Content Validity Index for all item independent of the score

Values of Content Validity Ratio (CVR) were expresed for each item in order to clarity, coherence and relevance

dE 2 Direct Extrem Experience

iEX2 Indirect:Extrem Experience

category, showed the importance of including most items on the EX^2 scale (see Table 2). In the Tables 6 and 7 of Supplementary Material there are the assessment by item and experts for the category's coherence and relevance, respectively.

In contrast to the questionnaire's response scale (dichotomous YES/NO), a consensus of five experts agreed with the use dichotomous response informing a CVR' of 0.63, confirming that this response scale is consistent with the dimensions and the questionnaire used.

The confirmatory analysis for both models: 1)18 items model, 2) 14 items model (see Figs. 1 and 2) reported a good fit of the empirical data with the theoretical two-dimensional model (dEX^2 and iEX^2). For both models, the CFI and TLI indicators were around 0.9, X2 was <0.01, WRMR were above 1.0, and the RMSEA was between 0.05 and 0.07 (see Table 3).

Examining Participants' Scores

When examining scores obtained after coding for participant's responses, we report consistent figures among different aggregation strategies: summation, factor loading, and weighted versions of both. In the Table 8 of Supplementary Material shown the weighted scores separated by threat, by duration and by influence on the life trajectory and in the way of seeing life for the 18-item version. The summation scoring scale for the original 18-item version oscillated between 0 and 14 points. In the sample analyzed, the raw mean score was 4.3 with a standard deviation of 3.3, reaching a maximum of 14. For the dEX^2 dimension, the mean score was 2.8 (SD: 2.5) with range scoring between 0 and 11 points, and for the iEX^2
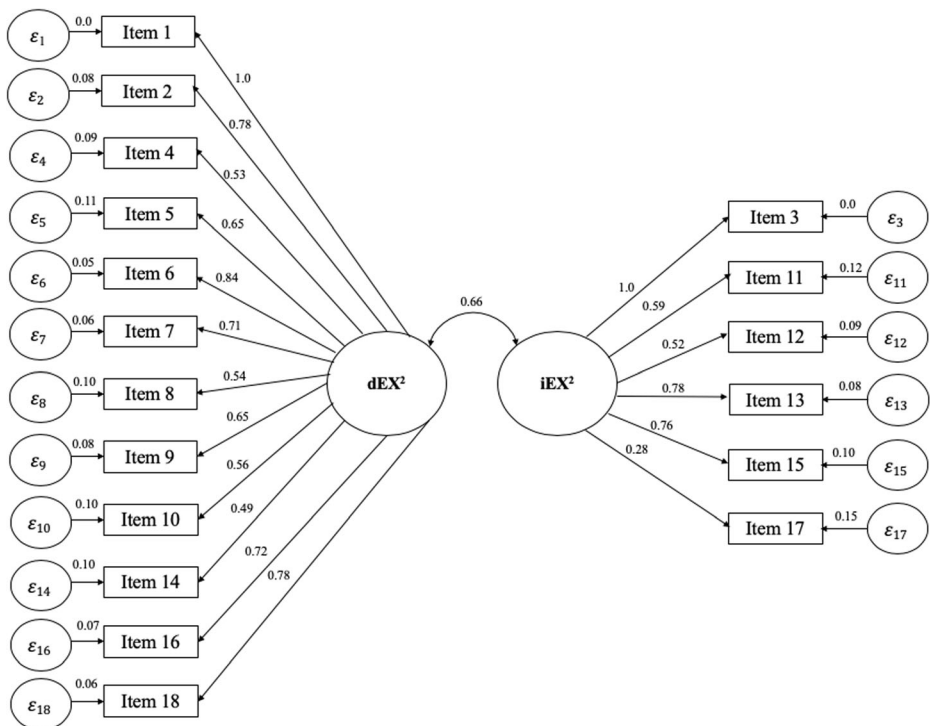
Fig. 1 Factorial structure of the Extreme Experiences scale (EX^2) of 18 items. Validation study of EX^2 Scale in exposed population to armed conflict in Colombia. 2015–2017
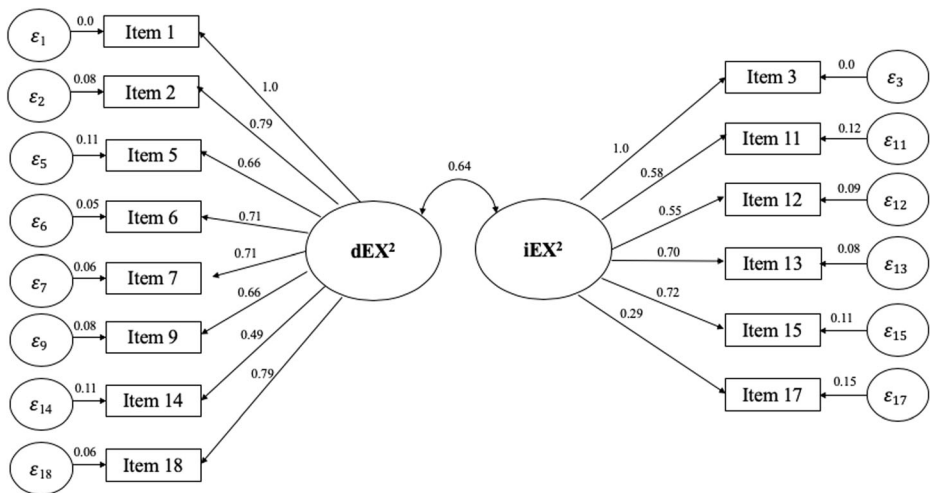
Fig. 2 Factor structure of the Extreme Experiences scale (EX^2) validated by expert judgment (14 items). Validation study of the Extreme Experiences scale (EX^2) in exposed population to armed conflict in Colombia. 2015–2017

dimension, it was 1.5 with a standard deviation of 1.2, with range scoring between 0 and 5 points. The weighted scores showed similar figures (see Table 4). In the Table 9 of Supplementary Material contains the Z, T, and percentile scores for the 18-item version.

Table 3 Data analysis of construct validity and Confirmatory Factor Analysis derivated from validation study of the Extreme Experiences scale (EX^2) in exposed population to armed conflict in Colombia. 2015–2017

Indicators	Model 18 Items	Model of experts' judgment
Adjustment indicators CFA		
X^2	209.76*	143.49*
CFI	0.91	0.90
TLI	0.90	0.89
RMSEA	0.05 (CI 90% 0.04–0.07)	0.07 (CI 90% 0.05–0.08)
WRMR	1.10	1.14
Internal Consistency Validity (K-R 20)		
Total Scale	0.80 (18 items)	0.77 (14 items)
dEX^2	0.78 (12 items)	0.75 (8 items)
iEX^2	0.48 (6 items)	0.48 (6 items)

X2 Chi-Square Test of Model Fit

CFI comparative fit index

TLI Tucker-Lewis

RMSEA Root Mean Square Error of Approximation

WRMR Weighted Root Mean Square Residual

K-20 Kuder-Richardson Formula 20

dEX2 Direct Extreme Experiences

iEX2 Indirect Extreme Experience

*p value < 0.01

CI confidence interval

Table 4 Descriptive statistics of the total score and dimensions of the 18-item version derived from validation study of the Extreme Experiences scale (EX^2)) in exposed population to armed conflict in Colombia. 2015–2017.

Statistic	Score by sum items			Score by factorial loading		
	EX^2	dEX^2	iEX^2	EX^2	dEX^2	iEX^2
Raw Score						
Possible range	0.0–18.0	0.0–12.0	0.0–6.0	0.0–18.0	0.0–12.0	0.0–6.0
Range observed	0.0–14.0	0.0–11.0	0.0–5.0	0.0–10.3	0.0–7.8	0.0–3.6
Median	4.0	3.0	1.0	2.6	2.0	0.8
Interquartile range	2.0–7.0	1.0–5.0	1.0–2.0	1.2–5.0	0.6–3.6	0.7–1.5
Mean	4.3	2.8	1.5	3.2	2.1	1.0
Standard Deviation	3.3	2.5	1.2	2.4	1.9	0.9
Weight Score*						
Possible range	0.0–18.0	0.0–12.0	0.0–6.0	0.0–18.0	0.0–12.0	0.0–6.0
Range observed	0.0–12.0	0.0–11.0	0.0–3.0	0.0–8.5	0.0–7.8	0.0–2.2
Median	2.5	1.1	0.3	1.1	0.9	0.2
Interquartile range	0.4–3.6	0.1–2.7	0.1–0.9	0.3–2.7	0.0–2.1	0.0–0.6
Mean	2.3	1.7	0.6	1.7	1.3	0.4
Standard Deviation	2.3	1.9	0.6	1.7	1.4	0.5

EX2 Extreme Experiences scale

dEX2 Direct Extreme Experience

iEX2 Indirect Extreme Experience

*Weighted by the following variables: duration of the event, perceived threat, influence on life trajectory, and life perspective

Table 5 Descriptive statistics of the score of the 14-item version validated by experts derivated from validation study of the Extreme Experiences scale (EX^2)) in exposed population to armed conflict in Colombia. 2015–2017

Statistic	Score sum items			Score factorial loading		
	EX^2	dEX^2	iEX^2	EX^2	dEX^2	iEX^2
Raw Score						
Possible range	0.0–18.0	0.0–12.0	0.0–6.0	0.0–18.0	0.0–12.0	0.0–6.0
Range observed	0.0–12.0	0.0–7.0	0.0–5.0	0.0–9.0	0.0–5.5	0.0–3.5
Median	3.0	2.0	1.0	2.5	1.7	0.7
Interquartile range	1.0–6.0	0.0–4.0	1.0–2.0	1.0–4.5	0.0–3.2	0.3–1.4
Mean	3.8	2.3	1.5	2.8	1.8	1.0
SD	2.8	2.0	1.2	2.1	1.6	0.9
Weight Score*						
Possible range	0.0 - 18.0	0.0–12.0	0.0–6.0	0.0–18.0	0.0–12.0	0.0–6.0
Range observed	0.0–9.3	0.0–7.0	0.0–3.0	0.0–7.0	0.0–5.5	0.0–2.1
Median	1.3	1.0	0.3	1.0	0.8	0.2
Interquartile range	0.4–3.1	0.0–2.3	0.1–0.9	0.2–2.4	0.0–1.8	0.0–0.6
Mean	2.0	1.4	0.6	1.5	1.1	0.4
SD	2.0	1.5	0.6	1.5	1.2	0.4

S.D Standard Deviation

EX2 Extreme Experiences scale

dEX2 Direct Extreme Experience

iEX2 Indirect Extreme Experience

*Weighted by the following variables: duration of the event, perceived threat, influence on life trajectory, and life perspective

For the version validated by the panel of experts, the total score was distributed between 0 and 12 points, with a median of 3 points (RI = 1.0–6.0). For this model, the factor loading score varied in the range 0–9 points (see Table 5). In the Table 10 Supplementary Material contains the Z, T, and percentile scores for the 14-item version validated by experts.

Internal Consistency Validity

As we saw in the Table 3, results indicated a KR-20 of 0.82 for the original 18-item EX^2 questionnaire - 0.78 for dEX^2, and 0.48 for iEX^2. For the 14-item expert validated version, we identified a consistency of 0.77 for the whole instrument – being 0.75 and 0.48 for dEX^2 and iEX^2 respectively. Results indicated good correlation between the full scale in both models (14 and 18 items) guaranteeing a good reliability to measure the extreme experience.

Construct Validity and Sub-Group Analysis

We did not find any significant differences in participant's scores in terms of gender, in either the 18-item version or 14-item expert-validated version, as Table 6 shows. However, significant differences were found when comparing sub-groups with varying levels of exposure to conflict: 1) High exposure (former combatants and victims) y 2) Low exposure (controls). As expected, the former tended systematically to have higher scores than the latter.

When using summation scores of either the 18-item version or 14 expert-validated version to differenciate between groups with high and low exposure to armed conflict (ex-combatants and victims on the one side, and controls on the other), we found (for both models 14 and 18 items) identical ROC values. For the EX^2 scale we observe a ROC of 0.93 (95% CI = 0.89–0.97). Furthermore, dEX^2 and iEX^2 scores were capable of differentiating these groups of exposition by 92% (ROC = 0.92 95% IC = 0.88–0.96) and 78% (ROC = 0.78 95% IC = 0.71–0.85) respectively. Similar results were found with the score calculated from factor loading in both models (see Fig. 3).

Table 7 shows for both models (14 and 18 items) different levels of sensitivity and specificity with cut-off points in EX^2 scores. They were used in order to classify individuals in highly conflict-exposed or lowly conflict-exposed sub-groups. For both models the cut-off points were equal. For both models on the full scale, the cut-off points of 2.5 showed a sensitivity of 85.3% and a specificity of 88.2%. A cut-off points of 3.5 reflects a sensitivity of 69.1%, while specificity increased to 96.1%. For the dEX^2 dimension, a sensitivity of 81.0% and a specificity of 92.0% were observed for cut-off point 1.5. The cut-off points of 1.5 for the iEX^2 dimension had a sensitivity of 52.0% and a.

Discriminant and Convergent Validity: Relationship between the EX^2 Scale and Other Mental Health Constructs

For both models (18 and 14 items), both in the population with low and high exposure to the conflict, positive and moderate correlations were observed with the score of motives for the aggression (r = 0.37, p value <0.01), however these correlations were not above 0.40, which was the initial hypothesis. On the other hand, within population with high exposure to conflict, an association was found between the EX^2 score and

Table 6 Construct validity by comparison of groups derived from validation study of the Extreme Experiences scale (EX²). 2015–2017. Version 18 items and 14 items

Characteristics	EX^2		dEX^2		iEX^2	
	Median (IR)	dip	Median (IR)	dip	Median (IR)	dip
Version 18 items– Score sum items						
Group						
High exposure	5.0 (3.0–7.8)	−0.663	4.0 (2.0–5.0)	−0.656	2.0 (1.0–2.8)	−0.448
Low exposure	1.0 (0.0–2.0)		0.0 (0.0–1.0)		0.0 (0.0–1.0)	
P value[a]	**p < 0.001**		**p < 0.001**		**p < 0.001**	
Gender						
Male	5.0 (2.0–7.0)	−0.114	3.0 (1.0–5.0)	−0.118	1.0 (0.0–2.0)	−0.089
Female	3.0 (1.0–6.8)		2.0 (0.0–4.8)		1.0 (0.0–2.0)	
P value[a]	0.071		0.064		0.045	
Figs.						
Figs.						
High exposure	3.9 (2.4–5.6)	−0.665	2.8 (1.6–4.0)	−0.656	1.2 (0.8–1.8)	−0.421
Low exposure	0.7 (0.0–1.3)		0.0 (0.0–0.7)		0.0 (0.0–0.8)	
P value[a]	**p < 0.001**		**p < 0.001**		**p < 0.001**	
Gender						
Male	3.7 (1.5–5.3)	−0.114	2.6 (0.7–3.7)	−0.133	0.8 (0.7–1.6)	−0.054
Female	2.4 (1.0–4.9)		1.6 (0.0–3.4)		0.8 (0.0–1.4)	
P value[a]	0.121		0.069		0.464	
Version 14 items – Score sum items						
Group						
High exposure	5.0 (3.0–6.0)	−0.660	3.0 (2.0–4.0)	−0.654	2.0 (1.0–2.8)	−0.448
Low exposure	1.0 (0.0–2.0)		0.0 (0.0–1.0)		0.0 (0.0–1.0)	
P value[a]	**p < 0.001**		**p < 0.001**		**p < 0.001**	
Gender						
Male	4.0 (2.0–6.0)	−0.129	3.0 (1.0–4.0)	−0.134	1.0 (1.0–2.0)	−0.089
Female	3.0 (1.0–6.0)		2.0 (0.0–4.0)		1.0 (0.0–2.0)	
P value[a]	**0.077**		**0.068**		**0.226**	
Version 14 items– Score factorial loading						
Group						
High exposure	3.5 (2.3–4.7)	−0.664	2.3 (1.5–3.3)	−0.651	1.1 (0.7–1.7)	−0.421
Low exposure	0.7 (0.0–1.3)		0,0 (0,0–0.7)		0.0 (0.0–0.7)	
P value[a]	**p < 0.001**		**P < 0.001**		**p < 0.001**	
Gender						
Male	3.0 (1.4–4.5)	−0.124	2.3 (0.7–3.2)	−0.146	0.7 (0.7–1.5)	−0.052
Female	2.2 (0.9–4.5)		1.5 (0.0–3.1)		0.7 (0.0–1.3)	
P value[a]	**0.090**		**0.048**		**0.476**	

a: U de Mann Whitney test

dnp Cohen's d from *t*-test

*High exposure (former combatants and victims)*

Low Exposure (Controls)

EX2 Extreme Experiences scale

dEX2 Direct Extreme Experience

iEX2 Indirect Extreme Experience

perspective taking score (r = −0.25 value $p < 0.05$), the established hypothesis; this was evident for 18 items model. Not association was found between other mental health constructs (fantasy, empathic concern, personal distress and Situation and Aggressive Behavior) and the EX² scale score in the exposure groups in analized models (see Table 8).
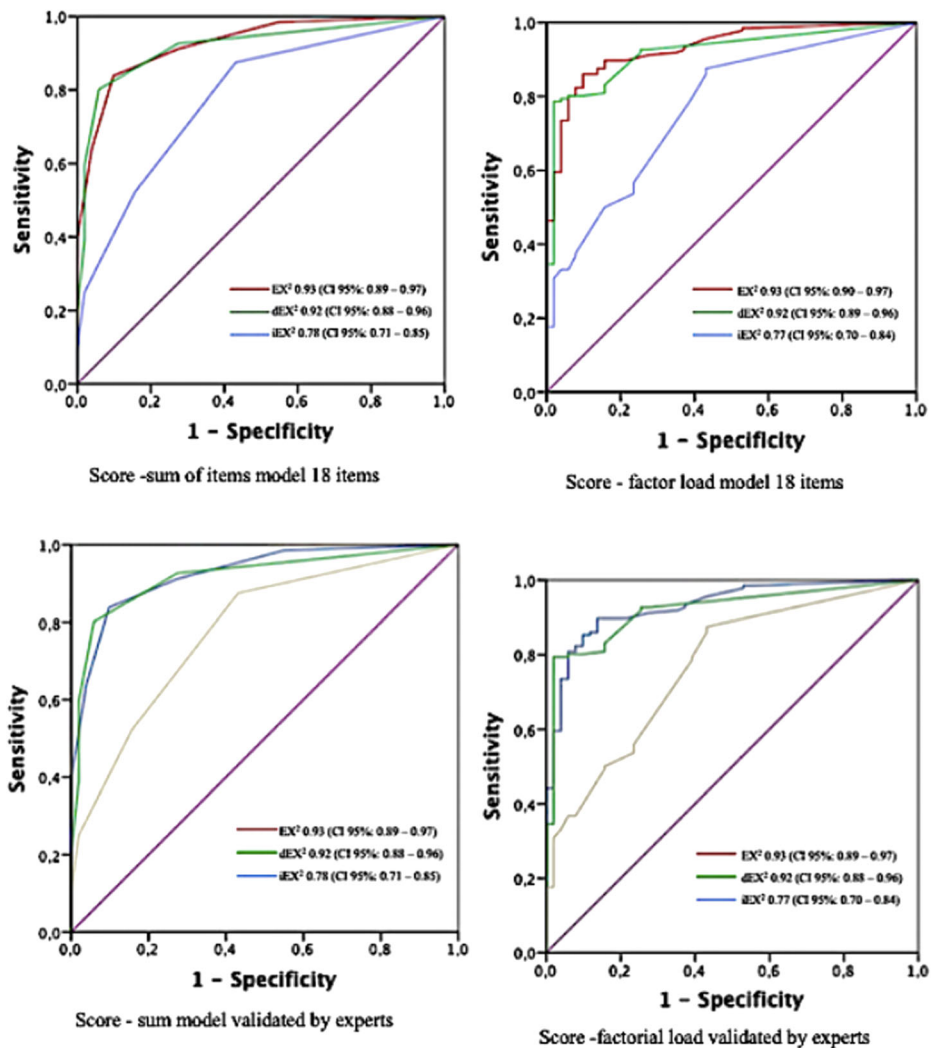
Fig. 3 Analysis of sensitivity and specificity of the *Extreme Experiences scale (EX²)* to discriminate population with high and low exposure to armed conflict. Validation study EX² Scale in exposed population to armed conflict in Colombia. 2015–2017

Discussion

The purpose of the study was to validate the *Extreme Experiences* scale within the framework of armed conflict (EX²) by means of analysis of its content validity, structural construct validity, internal consistency, comparative group construct validity, and convergent validity with other mental health constructs (i.e., empathy or aggression). Adequate CVI was observed for the questionnaire, items, and dimensions they represent. Experts recommended some edits to the wording of items. Factor structures of two dimensions for the EX² were confirmed, presenting adequate fit indexes for the models. In addition, this two-dimensional structure was validated by expert's judgment (14 items). Aggregation of item's responses by means of summation was also

Table 7 Cut-off points for the Extreme Experiences scale (EX^2) for discrimination of low and high exposure to conflict. Both models (version 18 items and model validated by experts). Validation study of the Extreme Experiences scale (EX^2)) in exposed population to armed conflict in Colombia. 2015–2017

Cut-off	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	LR+ (95% CI)	LR- (95% CI)	YI
EX^2							
2.50	85.3 (78.0–90.6)	88.2 (75.4–95.1)	95.1 (89.2–98.0)	69.2 (56.4–79.8)	7.3 (3.4–15.4)	0.2 (0.1–0.3)	0.74
3.50	69.1 (60.5–76.6)	96.1 (85.4–99.3)	97.9 (92.0–99.6)	53.9 (43.1–64.2)	17.6 (4.5–68.9)	0.3 (0.2–0.4)	0.65
dEX^2							
1.50	81.0 (73.1–86.9)	92.0 (80.3–97.5)	96.5 (90.7–98.9)	64.4 (52.2–75.0)	10.3 (4.0–26.5)	0.2 (0.1–0.3)	0.73
2.50	68.4 (59.8–75.9)	98.0 (88.2–99.9)	98.9 (93.4–99.9)	53.8 (43.2–64.1)	34.9 (5.0–243.7)	0.3 (0.2–0.4)	0.66
iEX^2							
0.50	87.5 (80.5–92.3)	56.9 (42.3–70.4)	84.4 (77.1–89.8)	63.0 (47.5–76.4)	2.0 (1.5–2.8)	0.2 (0.1–0.4)	0.44
1.50	52.0 (43.5–60.8)	84.0 (70.9–92.5)	89.9 (80.5–95.2)	39.8 (30.7–49.7)	3.3 (1.7–6.4)	0.6 (0.5–0.7)	0.37

IC Confidence interval

VPP Positive predictive value

VPN Negative predictive value

LR+ Positive Likelihood Ratio

LR- Negative Likelihood Ratio

YI Youden's Index

EX2 Extreme Experiences scale

dEX2 Direct Extreme Experience

iEX2 Indirect Extreme Experience

found appropriate to estimate a composite score of the EX^2 scale, given similar results found in both factorial load scores and the weighted scores. Both versions of the scale (the original full 18-item version, and the expert-validated 14-item scale) demonstrated to have adequate internal consistency in both full scale and the direct extreme experiences dimension (dEX^2). The indirect extreme experiences dimension (iEX^2) did not show enough consistency in any of the models.

Also, aggregated EX^2 scale (both models) facilitated the differentiation of groups of interest according to the level of exposure to the conflict. Participants with high exposure to conflict (former combatants and victims) tended to show higher scores than controls. We established a relationship between both EX^2 score and the dEX^2 dimension score with the empathic perspective score among the population with high exposure to armed conflict—but only for the 18-item version. In the sample with low exposure to conflict, and for both versions of the EX^2 scale, an association was found between the EX^2 score, the iEX^2 dimension, and the inventory of motives for aggression.

Faced with the questionnaire's content validity, although acceptable indicators were found, and only four items were left out, it is important to underline that original wording of some items may in some cases cause confusion [15, 60]. This observation was consistent among the eight experts.

Table 8 Correlations between the Extreme Experiences scale (EX^2) and empathy scale, inventory of situation and aggressive behavior and inventory of motives for aggression. Validation study of the Extreme Experiences scale (EX^2)) in exposed population to armed conflict in Colombia. 2015–2017

Mental health assessment	Model 18 items[a]		Model of experts' judgment [a]	
	High exposure	Low exposure	High exposure	Low exposure
EX^2				
Empathy				
Perspective Taking	−0.25*	0.08	−0.20	0.11
Fantasy	0.08	−0.03	0.10	−0.04
Empathic Concern	0.14	0.08	0.16	0.08
Personal Distress	−0.04	−0.14	−0.04	−0.15
Inventory ot motives for aggression	0.10	0.31*	0.09	0.30*
Inventory of Situation and aggressive Behavior				
Aggressive Behaviors	0.06	0.19	0.07	0.22
Aggressive Situations	0.10	0.03	0.09	0.06
dEX^2				
Empathy				
Perspective Taking	−0.26*	−0.00	−0.19	0.06
Fantasy	0.05	−0.03	0.06	−0.02
Empathic Concern	0.09	0.09	0.13	0.06
Personal Distress	−0.02	0.02	−0.03	0.03
Inventory ot motives for aggression	0.10	0.06	0.09	0.01
Inventory of Situation and aggressive Behavior				
Aggressive Behaviors	0.06	−0.03	0.06	0.06
Aggressive Situations	0.11	−0.13	0.09	−0.10
iEX^2				
Empathy				
Perspective Taking	−0.09	0.13	−0.09	0.13
Fantasy	0.10	−0.04	0.10	−0.04
Empathic Concern	0.17	0.07	0.17	0.07
Personal Distress	−0.05	−0.19	−0.05	−0.19
Inventory ot motives for aggression	0.08	0.37**	0.08	0.37**
Inventory of Situation and aggressive Behavior				
Aggressive Behaviors	0.07	0.26	0.07	0.26
Aggressive Situations	0.09	0.16	0.04	0.16

a: Spearman correlation

* p value < 0.05

** p value < 0.01

EX2 Extreme Experiences scale

dEX2 Direct Extreme Experience

iEX2 Indirect Extreme Experience

Also, experts point out than the adjusted content of the EX^2 questionnaire still lacks some categories that are considered to be key to describing exposure to armed conflict in Colombia. Some institutions such as the National Historical Memory Commission [49] have stipulated the typologies of victimizing armed conflict events, which, although proposed for victims, are worthy of a revision to include some of

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[0] The National Historical Memory Commission, for instance, suggests the systematic measure of the following categories: 1) displacement of population; 2) land eviction; 3) kidnapping; 4) extortion; 5) illicit recruitment of children; 6) torture; 7) homicide of protected persons, selective assassination, and massacre; 8) threats; 9) crimes against freedom and sexual integrity; 10) forced disappearance; 11) antipersonnel mines, unexploded munitions, and improvised explosive devices; 12) attacks on and losses of civil property; and 13) attacks on public property.

these in future validation processes of an expanded EX^2 questionnaire for the Colombian context.[4]

Descriptive spatial-temporal indicators of conflict-related events has been the traditional way to account for the effects of war on both combatant and non-combatants population in Colombia [22, 52]. Some authors who work at this level of analysis have tried to build lists of events to map out the effects of conflict on population and have incorporated most of the items that are part of the EX^2 scale. Events coded in these research studies include been getting caught in the crossfire in combat, receiving threats, suffering the murder of a family member, suffering a violent attack, and experiencing and surviving a massacre [38]; kidnapping; forced disappearance; torture or threat against life and integrity; being a victim of antipersonnel mines or grenades; living in the same place as armed actors; being a witness to torture or massacres; being a former combatant or having belonged to an armed group; and finally, having a close relative or significant person who has faced one of the following situations: kidnapping, child recruitment, forced disappearance, or torture [61]. This last classification attempt allows for a more accurate glimpse of the two dimensions in the EX^2 scale by separating the events directly experienced by the person from the events that happen to someone close, which are classified as iEX^2 in the EX^2 scale.

According to the CFA, it is appropriate to describe exposure to armed conflict-relates extreme experiences in a two-factor structure, namely direct and indirect experiences. This result was consistent in the two models analyzed (the full 18-item and the expert validated 14-items). Authors of the original questionnaire [46] have not reported such structural analysis, and it is therefore not possible to compare it with any previously proposed structure. Eiroa [17] made use the original scale among population affected by traffic accidents, while Loarche [32] used the scale in a railroad accident, and neither there we found reports of a structural analysis. Both authors classified the events from the *Extreme Experiences* scale in four groups: threats to integrity, losses, crises, and positive elements. This format was not explored in the present research study since context of experience was not comparable, and the fact that the version of the scale emerged from the content validity analysis was given priority. On the other hand, it seems the two dimensions confirmed in this study goes in line with the way events tend to be classified in conflict literature [7, 26, 38, 50, 56]. There we find classifications of groups of events such as personal exposure and extreme personal exposure [56]; direct and indirect impact of violence [26]; moderate and severe violence [38]; direct and indirect effects of the conflict [7]; and direct and indirect combat exposure [50]. However, dimensions of the EX^2 scale are not fully represented in several of them. Slone's proposal [56] defines personal exposure in terms of listening to bombings, living in shelters, seeing the wounded, kidnapping or disappearance of parents, violent home raids, witnessing assault on parents. This work also defines severe personal exposure as follows: being present at the death of a close relative, loss of one or more family members or being present during a terrorist attack. We can note that a few events from this classification are shared with the EX^2 scale.

Although some authors have used extreme experiences scale in their original formulation, only one of them [17] states the way they calculated a summary score (sum of individual items' score). However, the original authors [46] not showed summary score. We explored

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[4] The National Historical Memory Commission, for instance, suggests the systematic measure of the following categories: 1) displacement of population; 2) land eviction; 3) kidnapping; 4) extortion; 5) illicit recruitment of children; 6) torture; 7) homicide of protected persons, selective assassination, and massacre; 8) threats; 9) crimes against freedom and sexual integrity; 10) forced disappearance; 11) antipersonnel mines, unexploded munitions, and improvised explosive devices; 12) attacks on and losses of civil property; and 13) attacks on public property.

three forms of aggregation: 1) summation of items, 2) factorial load and 3) alternative summation and factorial aggregation procedures using individual item's scores weighted by variables of interest (duration of the event, perceived threat, influence on life trajectory and life perspective).

We found similarities in the scores and their capacity to discriminate groups of interest according to level of exposure to armed conflict. In light of results above, we recommend continuing using a summation-aggregated measure. This form helps to reduce the possible biases presented by the factorial and weighted load scores, since these are calculated according to the responses of the validation study participant and assume that other populations will have similar responses [15]. Also, we expect results from this method of aggregation to yield results that are more comparable with applications the EX^2 scale in other contexts around the world. Eiroa [17], the only author who has published as an original extreme scale score [46] has suggested doing so by adding items.

The internal consistency analysis of the EX^2 scale and its dimensions were adequate in the two models analyzed, even though the iEX^2 dimension did not match stringent criteria for instrument validation [15, 60]. Although it is not possible to compare KR-20 values with other questionnaires and populations because not founded preview validation, it is important to mention that the KR-20 values found in this study are consistent those found in measurements of conflict events elsewhere [27, 50]. Among these measurements, we can cite combat exposure measurement among war veterans by means of 5 and 13 items (Cronbach's $\alpha =$ 0.79 and 0.87 respectively [50]; also, the Combat Exposure Scale (CES) among war veterans with 7 items reported a Cronbach of 0.85 [27]. Other scales in Spanish about stressful life events also showed internal consistency values between 0.50 and 0.83 [37]. On the other hand, the internal consistency coefficient must be interpreted with care. Several studies [35, 60] have shown that this measure is not always relevant to the assessment of psychometric properties of life events checklists. In this type of questionnaire, such as with the EX^2 scale, construct items do not necessarily have to be correlated [60]. This situation may explain the low KR-20 value for the iEX^2.

As in similar study [17], the highest extreme experience-related scores were observed, as expected, among population with the most involvement in the event. The EX^2 score showed greater effects ($d_{np} > 0.5$) in the population with higher exposure to conflict. Former combatants and victims share common symptoms and trauma patterns. Previous research studies [16] have shown that former combatants who claim to have been recruited against their will develop trauma. In fact, 72.8% of our sample within the high exposure sub-group reported to consider themselves war victims.

The convergent and discriminant validity of the EX^2 scale against other mental health scales showed that, among people with low exposure to conflict, there is a relationship between high EX^2 scores and inventory of motives for aggression scores, and between high EX^2 and low empathic perspective at least among the high exposure sub-group. In other studies, with war veterans, exposure to armed conflict constitutes a risk factor for developing aggressive and violent behavior [20, 62] in contrast with the findings of this study.

Other studies with former combatants had already shown lower scores with respect to personal distress than our sample; however, they did not show significant differences when compared with indicators of low levels of perspective taking, fantasy, and empathic concern [64]. According to the present study, in the face of high EX^2 scores in former combatants and victims, the score of perspective taking, understood as the capacity to put oneself in another's situation, was low. This characteristic has been described as emotional insensitivity syndrome,

which also has high prevalence in populations of war veterans and other populations exposed to traumatic situations [39]. The negative relationship between perspective taking and EX^2 should be interpreted with care. In the present study, when the model went from 18 to 14 items, the relationship between perspective taking and EX^2 disappeared.

Finally, most research on how to better measure effects of armed conflict exposure is relatively recent. The results of this study shall contribute to their consolidation, allowing comparison with similar populations around the world.

A standard measure, such as the one generated in this study, should facilitate decision-making in allocating resources for victim assistance programs, reincorporation programs, and historical memory programs, among others. In addition, it is a useful tool for research in disciplines such as mental health, psychology, public health in active conflicts, and post-conflict contexts. In that sense, it would be advantageous for decision-makers to incorporate within sets of instruments to characterize victims and former combatants, and other armed conflict-exposed population, and therefore serve to guide intervention programs and to facilitate the consolidation of post-conflict and peace-building programs.

Limitations

We recommend the consolidation of larger samples in this type of research. This could contribute to finding more precise estimates when exploring mental health outcomes. It is also important to bear in mind that the scores were obtained in a population exposed to the conflict (former combatants and victims) and a control population with low exposure. Therefore, they are not reference points for a population without exposure to armed conflict. Although the selected participants represent a wide variability of exposure to the armed conflict in Colombia, for this sample we do not have the participation of other armed groups active as military or guerrillas. Added to this, the selection bias could also be presented when taking only ex-combatants from the ARN program, however, to access ex-combatants not registered in this program there are difficulties related to the high anonymity in which this population remains and the security implications for the research team.

The category of low or high exposure to the armed conflict emerged by the authors' criteria, however, it was conceptualized from what was observed in different studies where they affirm that each person may experience a conflict differently, leading to different types of exposure [7]. Additionally, several studies have shown that higher levels of exposure to armed conflict actions cause greater adverse reactions in mental health [5].

The construct of "Extreme Experience", is in development, was initially proposed for several extreme events (for example, natural disasters, accidents, conflict), this investigation proposed this construct for its exclusive use in the field of conflict armed. Although the theory behind this construct is recent, it allows us to overcome the constant obstacles that arise in the study of armed conflict that have presented a great variety of concepts of experience, exposure or event of armed conflict [36, 37], a situation that hinders the possibility of compare the studies in this field.

The internal consistency in both models (14 and 18 items) was weak for the indirect dimension, limiting the findings of this study. This evidences the need to include new items, some proposed by expert's judgment (for example, displacement, illicit recruitment or forced disappearance of relatives) that were not taken into account because the most data was taken in a retrospective way.

In line with the above, it is possible that the structure of the construct is not consolidated, and it is necessary to explore other structures such one-dimensional or more than 2

dimensions. This exploration must respond to the advances in the theoretical construction. We continue considering the structure of two dimensions; however, we agree with the participants of the expert judgment that more items should be incorporated into the instrument.

An additional disadvantage to the retrospective sample was related to the choice of constructs and instruments for convergent and discriminant validation. Although the study protocol was theoretically based on aspects of the armed conflict, it was not possible to incorporate instruments that assess life stressors or trauma that may possibly be more correlated with this construct of interest. With respect to the mental health instruments used, the scales of Inventory of Motives for Aggression and Aggressive Situations and Behaviors were validated specifically for the students from Colombia [25] but not validated with former combatants or victims. But they have been used to evaluate violent behavior in demobilized persons [1]. Not all hypotheses proposed for convergent and discriminant validity were verified, they were not affected by a homogenous sample, coefficients of variation higher than 24.0% were found in the selected instruments.

Conclusions

The EX^2 is a concise, easy-to-apply tool, which is shown as a reliable and valid measure of exposure to extreme experiences in contexts of armed conflict. The internal consistency was favorable for the full scale, and for one of its dimensions (dEX^2). This study confirms the importance of having tools adapted and validated for use in such particular populations. Future research shall be able to compare the findings in different cultural, historical and social environments. We expect the validated EX^2 become a useful instrument for academic and policy programs on mental and public health, reintegration of ex-combatants, assistance to war victims, and epidemiological surveillance of armed conflict effects.

Compliance and Ethical Standards

Conflict of Interest The authors declare no conflict of interest.

Ethical Approval The research ethics committee of the National School of Public Health at the University of Antioquia, with certificate CI 00236–2018 given in Medellín. gave ethical approval for the study.

Informed Consent Both, participants and experts were informed about the aims of the study and gave their informed consent, guaranteed the appropriate conditions of archiving, confidentiality, storage, and manipulation of information.

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Luz Stella Giraldo holds a M.Sc. in Epidemiology, and a Researcher from the Group of Mental Health at Public Health Department at the University of Antioquia. Her interest includes data management, psychometric validations and implementation of multivariate models.

Daniel C. Aguirre-Acevedo holds a Ph.D. in Epidemiology. He is an Associate Professor at Medical Research Institute at the University of Antioquia Colombia. His research interests include Epidemiology, and Statistics applied to neuropsychological research.

Sandra P. Trujillo is a Candidate of Ph. D. in Psychology at the University of Granada, Spain and a Researcher from the Group of Mental Health at Public Health Department at the University of Antioquia. Her research interest includes social neurosciences, conflict resolution, and peace-building.

Juan E. Ugarriza holds a Ph.D. in Political Sciences. He is an Associate Professor at the Law School at Rosario University, Colombia. His research interests include political deliberation, post-conflict, and social reintegration.

Natalia Trujillo holds a Ph.D. in Neuroscience. She is an Associate Professor at the Public Health Department at the University of Antioquia, Colombia. Her research interest includes cognitive and social neuroscience, post-conflict and translational mental health.

Affiliations

L. S. Giraldo[1] · **D. C. Aguirre-Acevedo**[2] · **S. Trujillo**[1,3] · **J. E. Ugarriza**[3] · **N. Trujillo**[1,3]

L. S. Giraldo
lstella.giraldo@udea.edu.co

D. C. Aguirre-Acevedo
daniel.aguirre@udea.edu.co

S. Trujillo
sandra.trujillo@udea.edu.co

J. E. Ugarriza
juan.ugarriza@urosario.edu.co

[1]   School of Public Health, Universidad de Antioquia, Calle 70 No. 52-21, Medellín, Colombia

[2]   Institute of Medical Research, Facultad de Medicina, Universidad de Antioquia, Carrera 51 D No. 62-29, Medellín, Colombia

[3]   Faculty of Law, Universidad del Rosario, Carrera 6 # 15-18, Bogotá, Colombia