

Validation of the short posttraumatic stress disorder rating interview (SPRINT-E) in a sample of people affected by F-27 Chilean earthquake and tsunami

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Título: Validación de la escala breve para diagnosticar estrés post-traumático (SPRINT-E) en una muestra de personas afectadas por el terremoto y tsunami del 27-F en Chile.

Resumen: El 27 de febrero de 2010 (27-F) se produjo un terremoto y un tsunami que ha causado alto impacto en la salud mental de la población chilena, específicamente en el aumento de los casos de estrés post-traumático (TEPT). Para contar con mejores instrumentos que midan el TEPT se aplicó, por primera vez desde que fue creada, la escala SPRINT-E en una población distinta a la estadounidense, específicamente en 291 personas que experimentaron el 27-F.

Los análisis de fiabilidad ($\alpha=.916$), validez concurrente (todos los ítems correlacionan significativamente con la escala DTS utilizada como criterio) y validez de constructo ($CMIN=2.237$, $RMSEA=.092$, $NFI=.901$, $CFI=.942$ y $PNFI=.704$ para el modelo de dos factores) indican que el SPRINT-E es una escala fiable y válida para medir TEPT en esa población.

Finalmente, se reflexiona respecto de la nueva estructura factorial descubierta en este análisis, la cual concuerda con el significado de los ítems y con modelos teóricos explicativos (estímulos encubiertos). También se reflexiona respecto de la utilidad de una escala breve, válida y de probadas muy buenas características psicométricas en una población de habla hispana propensa a catástrofes naturales como la chilena del 27-F, la japonesa del 11 de marzo de 2011, o la española del 11 de mayo de 2011.

Palabras clave: Trastorno por estrés post-traumático; análisis factorial exploratorio; análisis factorial confirmatorio; escala de diagnóstico breve; terremoto; tsunami.

Abstract: On February 27, 2010 (F-27) there was an earthquake and a tsunami in Chile that has caused a great impact on the mental health of the population of this country, specifically in the increase of cases of posttraumatic stress disorder (PTSD). In view of count better instruments to measure PTSD was applied for the first time since it was created, the SPRINT-E scale in a population other than the U.S., specifically in 291 people who experienced the F-27.

The analysis of reliability ($\alpha=.916$), concurrent validity (all items significantly correlated with the scale used as a criterion DTS) and construct validity ($CMIN=2.237$, $RMSEA=.092$, $NFI=.901$, $CFI=.942$ and $PNFI=.704$ for two-factor model) indicate that SPRINT-E is a valid and reliable scale to measure PTSD in this population.

Finally, some reflections about new factor structure discovered in this analysis, which is consistent with the meaning of items and with theoretical models such as covert stimuli. It also reflects on the usefulness of a brief scale, proven valid and very good psychometric characteristics in a Spanish-speaking population prone to natural disasters such as Chilean F-27, Japan (March 11, 2011) or Spain (May 11, 2011).

Key words: Posttraumatic stress disorder; exploratory factor analysis; confirmatory factor analysis; screening scale; earthquake; tsunami.

Introduction

On Saturday February 27th (F-27) at 03:34 (Chilean continental hour), an 8.8 Richter scale earthquake occurred. Its epicenter was located 35.909° south latitude and 72.733° west longitude, 335 kilometers to the southwest of Santiago de Chile (USGS, 2010). After the shake, a major tsunami devastated several cities and towns of at least 300 kilometers at central coast, such as Constitución or Talcahuano (Riquelme, 2010a).

This earthquake was one of the largest and intense in the history of the planet, being one of the six most powerful movements recorded since 1900 around the world (USGS, 2011). In Chile, the sum of the consequences from the earthquake and tsunami affected nearly 80% of the population (INE, 2003), five hundred thousand homes had severe damage and left about 2 million people affected (Riquelme, 2010b). The victims were 521 people and there are 56 persons still missing (Ministerio del Interior-Gobierno de Chile, 2010a, 2010b).

Based on information giving before, we can say that an earthquake and tsunami like the F-27 are events that cause a very high impact on people, regardless their ethnicity or so-

cial income. Several studies had been showed that these events have important negative effects on health of the inhabitants of central Chile (Figueroa, Gonzalez,& Torres, 2010; Leiva, 2010; Leiva,& Quintana, 2010; Mendez, Leiva, Bustos, Ramos,& Moyano, 2010; MIDEPLAN, 2011; ONEMI, 2010). It is clear, for instance, the need for valid diagnostic tools and effective methods to quantify these effects, especially with the most important disorder after a disaster: the post-traumatic stress disorder (PTSD; Rodríguez, Zaccarelli,& Perez, 2006; Solvason, Ernst,& Roth, 2003).

Specifically the PTSD is defined by the DSM IV as a kind of anxiety disorder characterized by symptoms following exposure either directly or indirectly (hear stories, see pictures or movies) to an extremely stressful and traumatic events (in this case, the F-27). The person responds with fear, helplessness or intense horror. The traumatic event is re-experienced through rumination, uncontrollable and distressing memories or dreams, accompanied by images, thoughts or perceptions. This produces an intense psychological distress associated with continual avoidance of the experienced, dullness (reluctantly), behavioral activation and physiological responses. These responses appear especially when the person is exposed to internal or external cues that symbolize or resemble an aspect of the traumatic event. Some of the symptoms of a PTSD are related to difficulties to falling or staying asleep, to focus attention, irritability, angry outbursts, hypervigilance and exaggerated startle re-

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sponse. These changes may last longer than 1 month and cause clinically significant distress or impairment in social, occupational or other important areas of functioning (Lopez-Ibor, & Valdes, 2008). Note that these symptoms do not always occur immediately after a disaster. Some people affected by PTSD improve their health with time, while others may maintain the disorder for 4 years or more (Goenjian et al., 2000). In fact, in PTSD, the symptoms may appear after 6 months (Priebe et al., 2009).

In a disaster like F-27, the prevalence of the disorder in the population could be between 10% and 30% approximately (Bland et al., 2005; Bulut, 2006; Cairo, Dutta, & Nawaz, 2010; Lai, Chang, Connor, Lee, & Davidson, 2004; Sharan, Chaudhary, Kavathekar, & Saxena, 1996), same as after a political violence event (Goenjian et al., 2000). In Chile, after the F-27 the prevalence of PTSD is 12%, 6.4% for men and 14.8% for women (MIDEPLAN, 2011). In cities affected directly for the earthquake and tsunami the prevalence is around 35% (Leiva-Bianchi, 2011). Furthermore, it is expected that between 10% and 20% of health care personnel will have symptoms of PTSD and between 30% and 40% in camps of people that lost their homes after F-27 (Figueroa, Gonzalez, et al., 2010).

Davidson and colleagues (Davidson et al., 1997) proposed a scale to measure the prevalence of PTSD called "Davidson Trauma Scale" (DTS). The DTS has 17 items, related to groups of symptoms collected in the DSM-IV. For each item, people have to give two types of responses regarding frequency and intensity of these symptoms in two 5 option Likert scales. Although the DTS is widely used after traumatic events (Chen, Lin, Tang, Shen, & Lu, 2001; Davidson et al., 1997; Villafañe, Milanese, Marcellino, & Amodei, 2003), there are some problems related to the extension of the scale and the two forms of answer to each items, which could cause confusion and fatigue in people who could present PTSD.

In order to give a solution to this problem, there are screening scales that have less items and with direct method of answer. That is the case of the "Short Posttraumatic Stress Disorder Rating Interview" (SPRINT-E) an instrument with 12 items, which measures the 3 groups of DSM-IV symptoms (items 1 to 4), reactions related to PTSD (5 to 11, depression, healthy behavior, stress tolerance, performance in their daily work and social functioning), the perception that each person has on needed help and suicidal intention (item 12). This last item is not included in the score but was included as a precaution: when this question is answered affirmatively, the health professionals may call for immediate referral to psychiatric services (Norris, Hamblen, Brown, & Schinka, 2008).

Respect of the measuring scale, each SPRINT-E item is evaluated as experienced by the person during the last month, through a Likert scale from 0 (none) to 4 (very much) points. It is considered that a symptom is intense if this has a score of 3 or 4 (Norris et al., 2008). With the total of intense symptoms, it is used the "rule of 3/7" which

states that 3 or more intense symptoms by person is very probably that he or she suffers PTSD; but with 7 or more responses the probability of a false positive (to diagnose PTSD when a person have not this disease) is very low (Norris et al., 2008).

Regarding the reliability and validity of the SPRINT-E, has been proven its predictive validity (it predicts the decrease of PTSD symptoms after treatment), concurrent validity (it is strongly correlated with the scales of Posttraumatic Stress Disorder Checklist -PCL- and the total score of the Iowa Depression Inventory) and construct validity (has only one general factor for PTSD that includes all items, except item 12; Norris et al., 2006; Norris et al., 2008). However, never before the validity of this scale (in any of its forms) has been tested in a Latin American sample, in Spanish language version, nor in people who experienced an earthquake and a tsunami. These three features constitute the main relevance of this work.

Method

Sample and procedure

The sample included 291 people, all adults of both sexes from eight different populations that lived through the F-27: 16 teachers of primary school of Constitucion city (city affected by earthquake and tsunami), 107 attorneys from the same school, 77 family health attention center workers of Constitucion city; 10 teachers of a high school of Santiago city (capitol of Chile, city affected by earthquake), 29 Education university students of a private university, 22 Education university students of a public university (both from Santiago city), and 30 Psychology university students of a University of Talca (city affected by earthquake). All these people were selected through a non-probabilistic and convenience sampling (Leon, & Montero, 2004). This is because the interest was to choose groups of people belonging to three cities affected by the F-27, although in different degrees. In addition, samples of teachers, attorneys and university students represent the general population and CESFAM staff represents a vulnerable group (Figueroa, Marin et al., 2010; Figueroa, Marin & Gonzalez, 2010).

Instruments

Short Posttraumatic Stress Disorder Rating Interview (SPRINT-E): is composed by 12 items. Items 1 to 4 refer to each of the 3 groups of DSM-IV symptoms: item 1 measure the Criterion B "intrusive re-experiencing"; items 2 and 3 measure the Criterion C "Avoidance and numbing"; and item 4 measure the Criterion D "Hyperactivity". Items 5 and 7 assess other important reactions related to PTSD, such as depression and healthy behavior. Items 6, 9 and 10 refer to the functional impairment of the person, resulting in questions about stress tolerance, performance in their daily work and social functioning, respectively. Items 8 and 11 assess that

each person has on need help (Norris et al., 2008) and item 12 which assess suicidal intention.

Respect of the measuring scale, each item of SPRINT-E is evaluated using a Likert scale from 0 (none) to 4 (very much) points, with the exception of item 12 (intention suicide) which is dichotomous (0 is "no" and 1 is "yes"); for this reason, item 12 was removed to the analysis. As mentioned before, the authors use it only as a criterion of gravity for the diagnosis (Norris et al., 2008).

Davidson Trauma Scale (DTS): to check concurrent validity of the SPRINT-E, DTS was applied to the same sample and at the same time as SPRINT-E. It was used an adaptation of the DTS validated for Spanish population which has good reliability index (Cronbach's Alpha over .7) and a good convergent validity (Bobes et al., 2000).

Data analysis

First, the reliability of the instrument was tested by Cronbach's Alpha for the 11 items of the SPRINT-E measured with Likert scale. For this test, a value above .9 is considered excellent (Pardo & San Martin, 1998).

Second, to determine concurrent validity Pearson correlations were conducted between the 11 items of the SPRINT-E and the 17 items of the DTS. While more items of a scale are related to each other, better will be the criterion validity of the SPRINT-E. All this correlations must be significant statistically ($p < .05$).

To assess construct validity, we performed an exploratory factor analysis (EFA) by the method of ungeneralized least squares extraction, varimax rotation and free numbers of factors. The EFA was performed among 144 randomly

selected participants from the 291 original sample. The model has a good fit and it is relevant to perform the analysis if the following tests show values within the limits: $KMO > .51$; Bartlett Sphericity Test with $p < .01$, X^2 with $p > .05$ (Ximenez & San Martin, 2004).

Finally, to confirm the existence of the pattern obtained from the EFA, we conducted a confirmatory factor analysis (CFA) through a structural equation model with the 11 items of the SPRINT-E. CFA was performed in the sample of participants that were not used in the EFA ($n=147$). A model has an appropriate adjustment if the following indicators have values within the limits: $CMIN < 3$, $RMSEA < .05$, $NFI > .9$, $CFI > .9$ and $PNF > .05$ (Barret, 2007; Hair, Anderson, Tatham, & Black, 2004).

Both, the analysis of reliability and EFA, were performed using SPSS version 15. CFA was performed using AMOS version 16.

Results

Reliability and concurrent validity

Regarding the reliability of the SPRINT-E, the test had a Cronbach Alpha value of .916 for the 11 items measured with Likert scale. Furthermore, when analyzing the values of this test if any item is deleted, the Cronbach Alpha decreases.

In relation with the concurrent validity, Pearson correlations between DTS and SPRINT-E items show that they are all highly and significantly correlated ($p < .01$, Table 1).

Table 1. Correlations between SPRINT-E and DTS items.

DTS item	SPRINT-E item										
	1	2	3	4	5	6	7	8	9	10	11
1	.455	.501	.371	.492	.517	.373	.433	.468	.482	.434	.379
2	.410	.475	.351	.463	.433	.435	.325	.434	.414	.399	.331
3	.310	.417	.230	.490	.413	.335	.330	.480	.430	.435	.322
4	.270	.351	.198	.393	.336	.221	.376	.370	.324	.339	.218
5	.457	.591	.398	.439	.418	.381	.414	.426	.362	.408	.455
6	.413	.541	.379	.460	.425	.429	.440	.444	.425	.391	.449
7	.244	.367	.266	.323	.326	.245	.265	.342	.236	.272	.271
8	.340	.449	.451	.497	.479	.415	.457	.547	.459	.499	.370
9	.199	.274	.387	.341	.414	.343	.390	.424	.430	.498	.308
10	.208	.257	.409	.202	.233	.259	.265	.302	.246	.331	.155
11	.270	.374	.390	.347	.346	.397	.315	.380	.282	.328	.327
12	.318	.388	.263	.553	.510	.288	.396	.496	.470	.365	.350
13	.284	.350	.353	.518	.523	.419	.504	.612	.529	.532	.377
14	.349	.389	.367	.560	.556	.431	.559	.617	.584	.532	.395
15	.360	.445	.323	.583	.506	.353	.465	.590	.516	.497	.435
16	.396	.461	.317	.552	.520	.428	.476	.603	.557	.484	.409
17	.406	.499	.377	.534	.424	.363	.405	.503	.483	.504	.347

Construct validity: exploratory factor analysis

To analyze the construct validity of the instrument was performed the exploratory factor analysis (EFA). The first

step was to analyze the relevance of the factor solution and if there is a structure of relations among the items suitable for extracting factors. In this regard, the Kaiser-Meyer-Olkin ($KMO = .917$) and Bartlett's sphericity ($X^2=830.455$,

$p < .01$) tests indicate that the structure of correlations was adequate and that it is appropriate to continue with the analysis.

The factor structure of the founded solution was analyzed. In this regard, we obtained a solution of 2 factors that explained 56.79% of the total variance. But this structure is different to that found by the authors of SPRINT-E above (Norris et al., 2006; Norris et al., 2008). For this reason, an EFA was performed with a single factor solution. This solution explained 48.53% of the total variance. In consequence, the evidence indicates that there are two possible models: the single general factor (Model 1) and the 2 factors model (Model 2).

Rotated factor matrix to identify which items should load on which factors was analyzed, to elucidate in part this

dilemma. Performing a reading of items, it is possible to group them at the same form that EFA do it: the first 4 items were related with the numbing, irritability and intrusive memories, while items 5 through 11, were related with the worry, stress and despair typical of PTSD reactions. This is consistent theoretically because is similar with the organization given by the authors of the scale (Norris et al., 2008). Therefore, the SPRINT-E would be measuring the intensity of PTSD symptoms grouped into two factors: first, related to DSM-IV symptoms of PTSD (intrusive memories, avoidance, emotional numbing and hyperarousal) and the second regarding reactions of PTSD and other health problems associated with this disorder (depression, impaired stress tolerance, impaired health behavior, bothered, impaired role functioning and impaired social functioning; see Table 2).

Table 2. Rotated factor matrix for two factors solutions (Model 2).

Label	Item	Factor	
		1	2
sprint1	"¿Cuánto le han molestado los recuerdos no deseados o pesadillas de lo que pasó?"	.221	.764
sprint2	"¿Cuánto esfuerzo ha hecho para evitar pensar o hablar sobre lo sucedido o realizar actos que le recuerden lo sucedido?"	.245	.761
sprint3	"¿Hasta qué punto ha perdido el placer por las cosas, se mantiene distante de la gente, o le ha sido difícil experimentar sentimientos a consecuencia de lo sucedido?"	.255	.631
sprint4	"¿Cuánto le han incomodado problemas de sueño, concentración, nerviosismo, irritabilidad o sentirse muy alerta de lo que le rodea a consecuencia de lo sucedido?"	.536	.570
sprint5	"¿Qué tan desanimado o deprimido se ha sentido a consecuencia de lo sucedido?"	.543	.538
sprint6	"¿Considera que su habilidad para manejar otras situaciones o eventos estresantes se ha visto dañada?"	.643	.339
sprint7	"¿Considera que sus reacciones interfieren con el cuidado de su salud física? Por ejemplo, ¿se alimenta poco, no descansa suficiente, fuma más, o se ha dado cuenta que ha incrementado el uso de alcohol y otras sustancias?"	.665	.220
sprint8	"¿Qué tan estresado o incómodo se siente con respecto a sus reacciones?"	.805	.261
sprint9	"¿Qué tanto han interferido sus reacciones con su habilidad para trabajar o llevar a cabo actividades diarias, como labores del hogar o académicas?"	.805	.264
sprint10	"Dadas sus reacciones ¿qué tan afectadas se han visto sus relaciones familiares o de amistad?, ¿qué tanto han interferido en sus actividades sociales, recreativas o comunitarias?"	.618	.239
sprint11	"¿Qué tan preocupado se ha sentido acerca de su habilidad para vencer problemas que podría enfrentar sin mayor asistencia?"	.491	.426

Note: Factorial loadings in bold letter where item belongs to a factor.

Item 12 ("¿Hay alguna posibilidad de que usted tenga deseos de herirse o suicidarse?") was not included in EFA because it is dichotomous.

Construct validity: confirmatory factor analysis (CFA)

Given the above results, we conducted a CFA to specify the adjustment of Model 2 (two factors) and compare the fit with Model 1 (single factor). In both cases, maximum likelihood estimation method was used. To begin, in Model 1, all factor loadings were significant ($p < .001$). However, it has a regular overall fit ($CMIN=2.535$ and $RMSEA=.103$) and incremental fit ($NFI=.885$ and $CFI=.926$), although it provided a good fit of parsimony ($PNFI=.708$; see Figure 1).

Regarding the two-factor model, all factor loadings were significant to ($p < .001$). This model also had a regular general fit, although slightly better than Model 1 ($CMIN=2.237$ and $RMSEA=.092$). However, both the incremental fit ($NFI=.901$ and $CFI=.942$) and the parsimony fit ($PNFI=.704$) are good and better than Model 1 (See Figure 2).

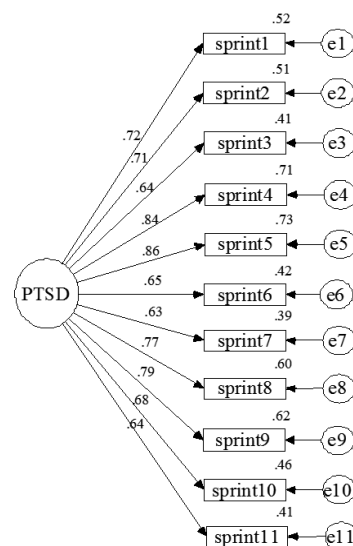


Figure 1. Standardized version of CFA for a single factor model (Model 1)

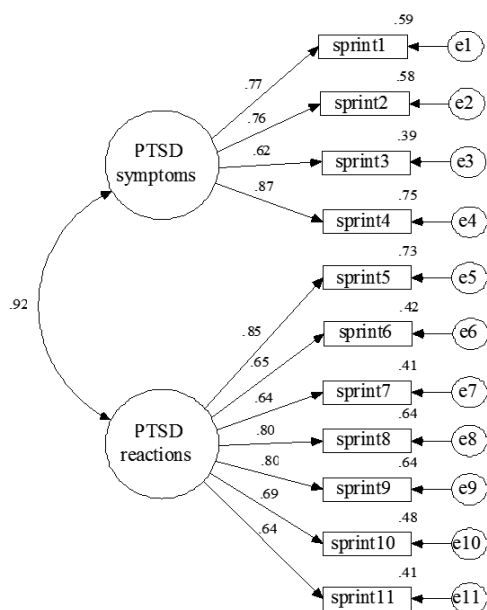


Figure 2. Standardized version of CFA for a two factors model (Model 2).

Discussion

Overall the SPRINT-E is a reliable and valid instrument for measuring the PTSD symptoms intensity. It has a very good index of internal consistency, high concurrent validity (high correlations with the DTS used as a criterion), and it has a factor structure that matches with the previous theory. It is also a brief and rapid scale that has fewer items than other scales such as the DTS. Therefore, the SPRINT-E is highly recommended to measure symptoms of PTSD in people who have experienced traumatic events as was the earthquake and tsunami of F-27 after which it was tested.

Regarding the construct validity of the SPRINT-E, the CFA shows that, although the original structure of a single factor is good, the fit is better for the two-factor model. This new model is consistent with the definition given by the authors (Norris et al., 2008) and items in this order have semantic coherence. Thus, the first 4 items are related with the PTSD symptoms (numbness, irritability and intrusive memories), while items 5 to 11 are related with responses or reactions linked to this disorder (discourage, difficulty in family and social relationships, substance abuse, difficulty solving problems and worry).

This new model can be explained from the theoretical perspective of covert conditioning, base of the therapeutic procedure known as systematic desensitization (Cautela & Kearney, 1986; Wolpe, 1958). From this perspective, PTSD is explained by covert stimulus (symptoms) that cause maladaptive responses (reactions). Therefore, the SPRINT-E is reproducing in its factor structure this fundamental theoretical organization. This increases its relevance as a diagnostic tool and complementary to the therapy of PTSD which, as

in the case of systematic desensitization should be based on cognitive-behavioral model to be effective (Figuroa et al., 2010).

A limitation of the results just presented might be the use of maximum likelihood as a method of extraction. While this method is the most used in the CFA and provides statistical tests for the estimated parameters of the model (Martinez, Hernandez,& Hernandez, 2006), may not be the most appropriate when variables are ordinal or when they do not meet normality assumption (Brown, 2006), such as the SPRINT-E items (see Table 3). Therefore, it is best to perform the analysis with another method, such as unweighted least square (Brown, 2006). Complementary to presented results, we performed the analysis of model 2 by the latter method. The procedure gives results that confirm the good fit of model: RMR close to 0 (0.073), GFI and NFI close to 1 (.994 and .992 respectively).

Table 3. Descriptive statistics for SPRINT-E items.

Item	Mean	Standard deviation	Skewness	Kurtosis
sprint1	1.52	1.38	0.48	-1.02
sprint2	1.27	1.38	0.71	-0.84
sprint3	0.85	1.14	1.14	0.17
sprint4	1.63	1.47	0.35	-1.28
sprint5	1.50	1.38	0.44	-1.11
sprint6	0.94	1.15	1.03	0.04
sprint7	0.92	1.31	1.26	0.28
sprint8	1.32	1.28	0.63	-0.74
sprint9	0.98	1.20	1.03	0.02
sprint10	0.94	1.18	1.12	0.32
sprint11	1.14	1.18	0.85	-0.16

Finally, the fact that the SPRINT-E has been validated for the first time in a different cultural context and after an earthquake and tsunami, is very important to implement improvements in diagnostic procedures of PTSD. Spanish version of the SPRINT-E will allow to mental health teams of the Spanish-speaking regions to have a useful and brief tool to mitigate the effects of traumatic events. For example, the SPRINT-E benefits directly to people that living in the American Pacific coast from California to Chile, susceptible population to suffer these catastrophic events, as was demonstrated after the earthquake and tsunami of Japan on March 11, 2011. The last catastrophic event not only affected the Japanese population, but also in countries such as Colombia, Ecuador, Peru and specially Chile, that suffered the effects of a massive tsunami again after just 13 months (USGS, 2011). In the Chilean case, the SPRINT-E might help to generate preventive and promotions actions for people's health, especially in coast cities, considering that the effects of a major catastrophe such as F-27 last even more than two years before occurred. Considering the situation after the earthquake of Lorca-Murcia (May 11, 2011) or others that might eventually happen in other Spanish-speaking places, can be used this scale for diagnoses and preventive purposes.

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