

UNIVERSIDADE FEDERAL DE MINAS GERAIS
Faculdade de Medicina
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Sabrina de Sousa Magalhães

**DESASTRES DECORRENTES DE EVENTOS CLIMÁTICOS EXTREMOS:
impacto na saúde mental e acompanhamento prospectivo de sintomas em crianças
e adolescentes**

BELO HORIZONTE
2019

Sabrina de Sousa Magalhães

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impacto na saúde mental e acompanhamento prospectivo de sintomas em crianças e
adolescentes

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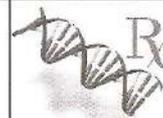
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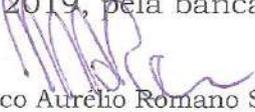
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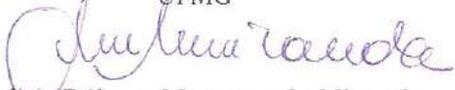
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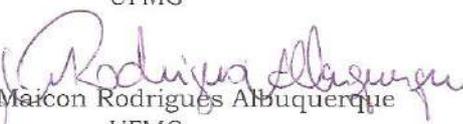
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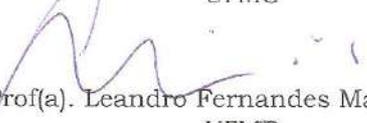
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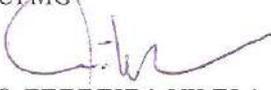
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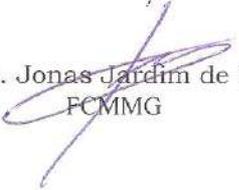

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*Caminante, son tus huellas
el camino, y nada más;
caminante, no hay camino:
se hace camino al andar.*

*Al andar se hace camino,
y al volver la vista atrás
se ve la senda que nunca
se ha de volver a pisar.*

*Caminante, no hay camino,
sino estelas en la mar.*

Antônio Machado

Climate change is a future problem. But it is also a past problem and a present problem. It is better thought of as a developing process of long-term deterioration, called, by some psychologists, a “creeping problem.” The lack of a definite beginning, end, or deadline requires that we create our own timeline. Not surprisingly, we do so in ways that remove the compulsion to act. We allow just enough history to make it seem familiar but not enough to create a responsibility for our past emissions. We make it just current enough to accept that we need to do something about it but put it just too far in the future to require immediate action.

George Marshall

[...] that sense of immersion in the moment and solidarity with others caused by the rupture in everyday life, an emotion graver than happiness but deeply positive. We don't even have a language for this emotion, in which the wonderful comes wrapped in the terrible, joy in sorrow, courage in fear. We cannot welcome disaster, but we can value the responses, both practical and psychological.

Rebecca Solnit

RESUMO

Secas e inundações representam os desastres naturais mais frequentes em todo mundo. Evidências indicam que a incidência e intensidades destes desastres irão aumentar ao longo do tempo. Estes eventos podem afetar a saúde mental dos envolvidos, especialmente crianças e adolescentes que apresentam risco maior de desenvolverem respostas adversas depois de um desastre. Os objetivos da tese foram traduzir e adaptar a escala CRIES-8 de rastreio para sintomas de transtorno de estresse pós-traumático (TEPT) para a população infantil brasileira (estudo 1); avaliar as propriedades psicométricas da versão brasileira da escala (estudo 1); descrever o impacto na saúde mental de crianças e adolescentes expostos aos desastres naturais da seca e inundação (estudo 2); e, realizar acompanhamento prospectivo dos sintomas após um período de, aproximadamente, 15 meses (estudo 2). Crianças e adolescentes (6 a 18 anos) provenientes de quatro condições e cidades distintas foram recrutadas para a pesquisa. De forma geral, a amostra foi dividida em quatro grupos: i) Controle sem vulnerabilidade sócio-econômica; ii) Controle com vulnerabilidade sócio-econômica; iii) Inundação; iv) Seca. O protocolo de avaliação incluiu rastreio de sintomas de TEPT e investigação de problemas comportamentais em geral. O estudo 1 validou a ferramenta CRIES para uso na população infantil brasileira vítima de algum tipo de evento traumático. A escala apresentou adequadas validade e fidedignidade de suas medidas. O estudo 2 investigou a saúde mental das crianças e adolescentes e verificou que os problemas gerais de comportamento tendem a diminuir ao longo do tempo e não foram sensíveis para diferenciar os grupos, ao contrário dos sintomas de TEPT. O grupo Inundação apresentou padrão de recuperação e resiliência dos sintomas de TEPT, enquanto o grupo Seca apresentou persistência e estabilidade de sintomas e agravamento dos mesmos. O rastreio para sintomas de TEPT entre crianças e adolescentes que vivenciam eventos traumáticos é fundamental para identificação e intervenção de crianças em situação de risco de desenvolvimento de respostas adversas. Além disso, variáveis relativas ao contexto sócio-econômico e à resiliência podem influenciar os desfechos psicológicos e, portanto, precisam ser consideradas em pesquisas desta natureza.

Palavras chave: CRIES, desastres naturais, inundação, mudança climática, saúde mental, seca, transtorno de estresse pós-traumático

ABSTRACT

Floods and drought are the most frequent extreme climate-related disasters. Evidence have been indicating those events will increase and intensify. These extreme climate-related events may affect individuals' mental health, specially children and adolescents whom present a higher risk to develop psychological distress after any disaster. The present dissertation aimed to translate and transcultural adaptation of CRIES-8 to Brazilian Portuguese (study 1); to evaluate the psychometric properties of the Portuguese version of CRIES-8 (study 1); to describe mental health impact on youth exposed to the natural hazards of flood or drought (study 2); and to provide a prospective follow up of symptoms, after a time lapse of 15 months, approximately (study 2). Children and adolescents (6 to 18 years old) from four distinct condition and cities were recruited for the purpose of the study. Generally, the sample was splitted into four subgroups: i) Control without socio disadvantages (SD); ii) Control with SD; iii) Flood group; iv) Drought group. Protocol included evaluation of posttraumatic stress symptoms (PTSS) and general behavior problems. Study 1 validated CRIES for use in youth Brazilian population victim of some sort of traumatic event. The Portuguese version presented adequate indices of validity and reliability of its measures. The study 2 investigated the children's mental health and found that behavioral problems presented a tendency to remission over time and did not significantly differentiate the groups, instead of PTSS. Flood youth group presented a general pattern of recovery and resilience, about PTSS, whereas the Drought youth group displayed a persistence and stability pattern of PTSS and an aggravation of PTSS. The screening for PTSS among children and adolescents who face traumatic events is of paramount importance to provide identification and intervention to children at risk of psychological distress. Furthermore, variables concerning socioeconomic status and resilience may influence the psychological answers, thus must be considered in the field.

Keywords: climate change, CRIES drought, flood, mental health, natural disasters, post-traumatic stress disorder

LISTA DE FIGURAS

Figura 1. Mapa com localização da cidade de Rio Branco, estado do Acre, Brasil	22
Figura 2. Mapa com localização da cidade de Francisco Sá, estado de Minas Gerais, Brasil	22
Figura 3. Mapa com localização da cidade de Belo Horizonte, estado de Minas Gerais, Brasil	23
Figura 4. Mapa com localização da cidade de Paraopeba, estado de Minas Gerais, Brasil	24
Figure 1. Flow chart with methodological steps to Translation and Cultural Adaptation process, according to ISPOR Translation and Cultural Adaptation Task Force.....	34
Figure 1. Comparative differences in CBCL t scores between groups, for children subjects. (<i>Note:</i> SD: social disadvantage, * $p < 0,05$, ** $p < 0,01$)	56
Figure 2. Comparative differences in CBCL t scores between groups, for adolescents subjects. (<i>Note:</i> SD: social disadvantage, ADHD: Attention Deficit Hyperactivity, * $p < 0,05$, ** $p < 0,01$)	59
Figure 3. Comparative differences in CRIES scores between groups. Upper panel exhibits data for children subjects, and low panel for adolescents participants. (<i>Note:</i> SD: social disadvantage, * $p < 0,05$, ** $p < 0,01$)	61
Figure 4. Significant differences in CBCL scores for Flood group, according to age group, and with 14 months of interval between evaluations. (For p value, consult Table 8)	64
Figure 5. CRIES scores between the two time points evaluations for both natural hazards groups and age groups. (<i>Note:</i> * $p < 0,05$, ** $p < 0,01$)	67

LISTA DE TABELAS

Table 1. Versions of CRIES accordingly to the translations and adaptation process	37
Table 2. Reliability analysis for children exposed and non-exposed to an adverse condition related to natural hazard, according to different methods (N=235)	36
Table 3. Principal components analysis of Portuguese CRIES-8 version, with <i>promax</i> rotation	38
Table 4. Comparison between CRIES and CBCL indices for children exposed to adverse weather event (drought or flood) and non-exposed children	39
Table1. Demographic characterization of the study children sample, and data about the equivalence between groups according to age and gender (n=184) .	51
Table2. Demographic characterization of the adolescent sample, and data on the equivalence between groups according to gender (n=128)	52
Table 3. CBCL t scores for children, according to the group, and analysis of differences between them	57
Table 4. CBCL t score for adolescents, according to the group, and analysis of differences between them	58
Table 5. Posttraumatic Stress Symptoms in children, according to CRIES, and differences between groups	60
Table 6. Posttraumatic Stress Symptoms in adolescents, according to CRIES, and differences between groups	61
Table 7. CBCL scores at the prospective follow up for the Flood group (children and adolescents), after 14 months, and the comparison between times points 1 and 2	63
Table 8. CRIES scores at the prospective follow up for the Flood group (children and adolescents), and the comparison between times points 1 and 2	65
Table 9. CBCL scores at the prospective follow up for the Drought group (children and adolescents), after 17 months, and the comparison between times points 1 and 2	66
Table 10. CRIES scores at the prospective follow up for the Drought group (children and adolescents), and the comparison between times points 1 and 2	65
Table S1. CRIES scores according to group, age, and sex, and the comparison between female and male scores	95

LISTA DE ABREVIACOES

ADH: attention deficit/hyperactivity

CBCL: *Child Behavior Checklist*, Inventrio de Comportamentos da Infncia e Adolescncia

CCEB: Critrio de Classificao Econmica Brasil

CFI: Comparative Fit Index

COMDEC: Coordenadoria Municipal da Defesa Civil

CRED: *Centre for Research on the Epidemiology of Disasters*

CRIES: *Children's Revised Impact of Event Scale*

HPA: hipfise-pituitria-adrenal

IES: Impact of Event Scale

KMO: teste Kaiser-Meyer-Olkin

PTS: posttraumatic stress

PTSD: posttraumatic stress disorder

PTSS: posttraumatic stress symptoms

RMSEA: Root Mean Square Error of Approximation

SD: socio disadvantages

SES: socioeconomic status

SEHAB: Secretaria de Habitao e de Interesse Social do Estado do Acre

SPSS: Statistical Package for the Social Sciences

TA: Termo de Assentimento Livre e Esclarecido

TCLE: Termo de Consentimento Livre e Esclarecido

TEPT: transtorno de estresse ps-traumtico

TLI: Tucker-Lewis Index

SUMÁRIO

APRESENTAÇÃO	15
1. INTRODUÇÃO	16
1.1 Objetivo geral	20
1.2 Objetivos específicos	20
2. MÉTODO	21
2.1 Participantes	21
2.2 Local	21
2.3 Instrumentos	24
2.4 Procedimentos	25
3. RESULTADOS	29
3.1 Psychometric properties of a Brazilian Portuguese version of the Children's Revised Impact of Event Scale (CRIES-8)	29
Abstract	29
Introduction	30
Methods	31
<i>Participants</i>	31
<i>Assessment</i>	32
CRIES	32
CBCL	32
<i>Study design</i>	32
Results	35
Discussion	39
References	42
Acknowledgment	44
3.2 Extreme Climate Related Disasters: impact in youth mental health and a prospective follow up of symptoms	45
Abstract	45
1. Introduction	45
2. Method	50
2.1 Participants	50
2.2 Assessment	52
2.2.1 CRIES	52
2.2.2 CBCL	53

2.2.3 CCEB	53
2.3 Statistical analysis	53
2.4 Procedures	54
3. Results	54
3.1 Disaster experience	54
3.2 Mental health at time point 1	55
3.3 Mental health at time point 2	62
3.4 CRIES scores according to condition, age and sex	67
4. Discussion	68
4.1 Disaster experience	68
4.2 Mental health at time point 1	69
4.3 Mental health at time point 2	75
4.4 Limitations	79
4.5 Strengths	81
4.6 Conclusion	81
References	83
Supplementary material	93
4. DISCUSSÃO E CONSIDERAÇÕES FINAIS	95
5. REFERÊNCIAS BIBLIOGRÁFICAS	98
ANEXOS	109

APRESENTAÇÃO

A presente tese foi organizada no formato de artigos. Dois estudos, um já publicado e outro em fase de submissão, compõem os resultados e, para contextualizá-los, uma introdução e método gerais são inicialmente apresentados. Posteriormente, as considerações finais buscam alinhar os resultados específicos de cada artigo no corpo de conhecimento mais amplo que compõe a tese.

O primeiro artigo trata dos processos de tradução, adaptação, validação e análise de propriedades psicométricas da escala CRIES (*Children's Revised Impact of Event Scale*) de rastreio para transtorno de estresse pós-traumático. Neste artigo serão apresentados alguns dados de saúde mental que subsidiaram a validação da escala.

O segundo artigo refere-se aos dados de saúde mental de crianças e adolescentes que vivenciaram os desastres de seca ou inundação, assim como de grupos controles provenientes de contextos com e sem adversidade sócio-econômica.

Ao final, constam as referências bibliográficas de todo trabalho e os anexos apresentam os documentos de consentimento livre e esclarecido para participação na pesquisa.

1. INTRODUÇÃO

Ao redor do mundo, observa-se crescente aumento do número de desastres naturais, relacionados ao desequilíbrio climático. Eventos tais como inundações, tempestades, ciclones tropicais, temperaturas extremas e secas se tornarão mais intensos e mais freqüentes e, conseqüentemente, um número cada vez maior de pessoas será afetado por esses eventos (Guha-Sapir, Hoyois, Below, 2016). Estima-se que, em média, ocorra por dia, um desastre no mundo – seja ele natural ou tecnológico (Saunders & Adams, 2014).

Desastre pode ser definido, segundo o CRED (*Centre for Research on the Epidemiology of Disasters*), como uma situação ou evento imprevisível, frequentemente repentino, que ultrapassa a capacidade local de resposta, pois causa grandes danos, destruição e sofrimento humano e, desse modo, requer assistência externa seja a nível nacional ou internacional (Guha-Sapir, Hoyois & Below, 2016). Em geral, os desastres são classificados em naturais ou tecnológicos. Os desastres naturais são provocados por fenômenos e desequilíbrios da natureza que atuam independentemente da ação humana (embora possa ser potencializada por ela). Incluem nessa categoria, por exemplo, os terremotos, atividade vulcânica, inundação, tempestades, seca, incêndios florestais, infestação de inseto, epidemias, impactos de origem extra-terrestre (Guha-Sapir, Hoyous, Below, 2016). Já os desastres tecnológicos ou desastres humanos decorrem da ação ou omissão humana. Enquadram-se nessa categoria incêndios urbanos, explosões, ataques terroristas, desastres em plantas e distritos industriais, parques e armazenamentos com extravasamento de produtos perigosos, rompimento de barragens.

No Brasil, secas/estiagens e inundações são os desastres naturais mais freqüentes, com maiores danos humanos registrados. Somente a seca/estiagem responde por 64,41% do número de pessoas afetadas por desastre no Brasil, em 2013 (Anuário, 2014). Esse mesmo padrão é observado mundialmente, visto que os maiores desastres em 2017, ao redor do mundo, foram decorrentes de inundações (em torno de 60% de pessoas afetadas por desastres). No mesmo ano de 2017, inundações foram responsáveis pelo maior número de mortes e a seca respondeu por oito dos dez desastres naturais que afetaram o maior número de pessoas (CRED, 2018).

Desastres naturais causam uma série de adversidades nas sociedades humanas, nos campos econômicos, sociais, ambientais e de saúde, sobretudo na saúde mental dos

envolvidos, visto estes efeitos sobrepujarem os danos físicos em uma proporção de 40:1 (Hayes et al., 2018) e, apesar disso, ainda serem relativamente pouco estudados (Hayes & Poland, 2018). Embora a maioria das pessoas expresse resiliência e consiga se recuperar após o evento, muitos apresentam importantes prejuízos e queixas, e alguns cumprirão critérios diagnósticos para transtornos mentais (Goldmann & Galea, 2014).

Embora a definição de saúde mental seja mais ampla do que adoecimento psíquico, doença mental ou transtornos mentais, já que inclui estados de bem estar psíquico, resiliência emocional e bem estar psicossocial (Hayes et al., 2018), o escopo da presente tese limita-se a problemas de saúde mental em decorrência da exposição a desastres naturais. Uma possível definição de saúde mental, a despeito da falta de consenso, considera que seja o “estado de organização psíquica que atende as necessidades de relacionamento do sujeito com o mundo à sua volta, resguardando a sua autonomia. Estado que permite trocas afetivas com os demais, preserva a tomada de decisões e a capacidade produtiva” (Lopes, 2010).

O transtorno de estresse pós-traumático (TEPT) é uma das mais severas condições diretamente associadas aos desastres naturais e é a resposta pós-desastre mais comum (Hayes et al., 2018; Silove & Steel, 2006; Zhong et al., 2018). Junto com os sintomas de TEPT, são as medidas mais utilizadas no estudo envolvendo crianças no contexto de desastres, devido a sua alta frequência e impacto psicológico (Galea, Nandi & Vlahov, 2005; Pfefferbaum et al., 2013).

O TEPT ocorre em decorrência da exposição a episódio concreto de ameaça de morte ou lesão grave, testemunho direto de acontecimento traumático com outras pessoas, ou através do conhecimento de que o evento ocorreu com familiar ou pessoa próxima. O quadro pode interferir no funcionamento social e educacional e caracteriza-se pela presença de quatro grandes categorias de sintomas: a) intrusão de lembranças angustiantes, recorrentes e involuntárias do evento traumático; b) evitação persistente a estímulos associados ao evento traumático, cujo início se dá após a ocorrência do fato traumático; d) alterações negativas em cognições e no humor associadas ao evento traumático; e) alterações marcantes na excitação e reatividades associados ao episódio (American Psychiatric Association, 2013).

A escala CRIES é uma escala internacionalmente utilizada para rastreamento de sintomas de TEPT. Consiste em oito questões que representam os domínios de intrusão e evitação do TEPT. Na ausência de instrumentos de rastreamento rápido, acessíveis e

adaptados para a cultura brasileira, verificou-se a necessidade de adaptar e validar a CRIES para o contexto brasileiro.

Estima-se que em torno de 13,9% de crianças são expostas a algum tipo de desastre (Becker-Blease, Turner, & Finkelhor, 2010) e, em decorrência, apresentam maior risco de respostas psicológicas adversas (Zhong et al., 2018; Burke, Sanson, & Hoorn, 2018). Fatores para maior vulnerabilidade deste segmento referem-se a imaturidade fisiológica e cognitiva, habilidades físicas limitadas, dependência de outros para cuidado, proteção, segurança e provisão, dentre outros (Bennett & Friel, 2014; De Young, Kenardy, & Cobham, 2011; Garcia & Sheehan, 2016).

Crianças e adolescentes formam população vulnerável (Bartlett, 2008) e compreender o impacto de estressores ambientais em seu desenvolvimento torna-se fundamental. Evidências indicam que experiências adversas na infância provocam alterações duradouras na função e neuroplasticidade do eixo HPA (hipófise-pituitária-adrenal), induzindo comportamentos mal adaptativos e aumento de risco para desenvolvimento futuro de psicopatologias (Rincón-Cortés & Sullivan, 2014). Estudos longitudinais revelam que a vivência de desastre na infância afeta significativamente a pessoa, quando na vida adulta, sobretudo pela apresentação de sintomas e transtornos de ansiedade (Chu et al., 2013; Maclean, Popovici, & French, 2016; Najarian et al., 2011), embora a associação com outros traumas, funcionamento psicológico prévio e contextos de vida também precise ser considerado (McFarlane & Van Hooff, 2009).

De fato, crianças apresentam uma resposta paradoxal frente a desastre. Por um lado, apresentam capacidade de adaptação já que ainda se encontram em desenvolvimento. No entanto, essas habilidades de enfrentamento dependem de fatores tais como características do evento e condições de proteção e segurança garantidas pela família e/ou comunidade (Nieto, 2006).

Dentre os fatores que aumentam a vulnerabilidade da população infantil em situações adversas encontram-se a pobreza, visto os impactos mais adversos de desastres decorrentes das mudanças climáticas ocorrerem nas populações mais pobres, vulneráveis e marginalizadas (Bennett & Friel, 2014; Hayes et al., 2018).

La Greca et al. (2013) afirmam que a presença de altos níveis de ansiedade nos meses subsequentes ao desastre estão relacionados ao padrão de resposta que a criança irá apresentar. Dessa forma, o rastreio de sintomas relacionados ao TEPT pode ser

fundamental para auxiliar na identificação precoce de crianças com maior risco de respostas adversas ao longo do tempo.

1.1 Objetivo geral

Avaliar a saúde mental de crianças e adolescentes expostos aos desastres naturais de seca e inundação.

1.2 Objetivos específicos

Traduzir, adaptar e validar a escala CRIES de rastreio de sintomas de transtorno de estresse pós-traumático (TEPT) para a população infantil brasileira (Artigo 1).

Avaliar as propriedades psicométricas da versão brasileira da escala CRIES (Artigo 1).

Descrever o impacto na saúde mental de crianças e adolescentes expostos aos desastres naturais da seca e inundação (Artigo 2).

Realizar acompanhamento prospectivo dos sintomas após um período de, aproximadamente, 15 meses (Artigo 2).

2. MÉTODO

2.1 Participantes

A amostra da pesquisa foi formada por estudantes, com idade entre 6 e 18 anos, agrupados de acordo com a idade – crianças (6 a 11 anos) e adolescentes (12 a 18 anos de idade) – e local de origem. Os estudantes foram recrutados em escolas públicas das cidades alvo ou eram de serviços sociais atendidos pelo poder público da localidade. Os critérios de inclusão para a pesquisa foram: i) apresentar idade entre 6 e 18 anos; ii) residir na área urbana ou rural das cidades selecionadas; iii) estar regularmente matriculado em escola; iv) fornecimento de consentimento formal do responsável e assentimento das crianças e adolescentes para participação na pesquisa. O critério de exclusão foi a presença de diagnóstico de epilepsia e sintomas correlatos. Ao total, seis crianças foram excluídas da amostra final. O tamanho da amostra variou de acordo com os estudos e a presença de dados completos para as análises selecionadas.

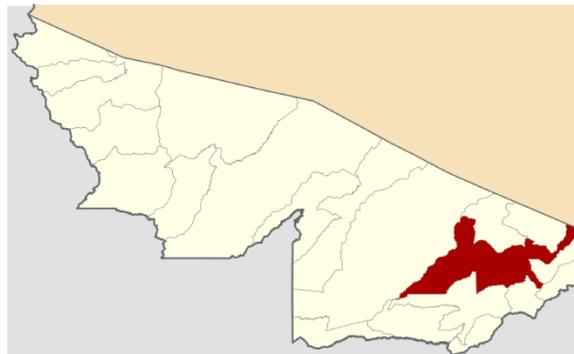
2.2 Local

Para representar o grupo que vivenciou Inundação, foram recrutados participantes da cidade de Rio Branco, Acre, Brasil (Figura 1). O estado do Acre situa-se no norte do país, apresenta clima equatorial chuvoso, praticamente sem estação seca e com o maior nível pluviométrico anual em todo o país (Anuário, 2014).

Os demais locais de coleta de dados da pesquisa concentraram-se na região Sudeste do país. A cidade de Francisco Sá, selecionada para a coleta de dados do grupo Seca, localiza-se no norte de Minas Gerais e apresenta clima semiárido e os totais pluviométricos anuais são inferiores a 1.000mm, desse modo, é bastante freqüente os desastres hidrológicos (Figura 2). É uma região de grande vulnerabilidade social e menor desenvolvimento econômico (Anuário, 2014).



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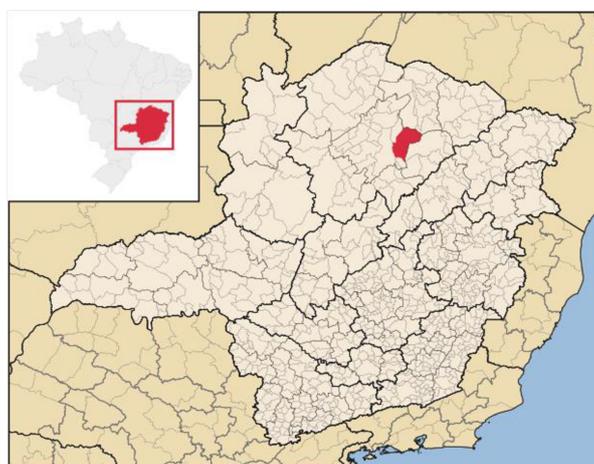
Crédito da imagem: Alice Hunter, CC BY-SA 4.0^c
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Figura 1. Mapa com localização da cidade de Rio Branco, estado do Acre, Brasil.

^a O autor não foi fornecido de forma legível por computadores. Presume-se que seja Joao Xavier (com base nos direitos de autor reivindicados).

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Figura 2. Mapa com localização da cidade de Francisco Sá, estado de Minas Gerais, Brasil.

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A cidade de Belo Horizonte, capital do estado de Minas Gerais, e a cidade de Paraopeba, localizada a 70km aproximadamente da capital mineira, possuem clima tropical e totais pluviométricos entre 1.250 a 1.400mm (Figura 3 e Figura 4). Os participantes da cidade de Belo Horizonte foram recrutados em escolas públicas da cidade e cujas famílias não apresentavam vulnerabilidade sócio-econômica, segundo a medida utilizada para esta inferência.



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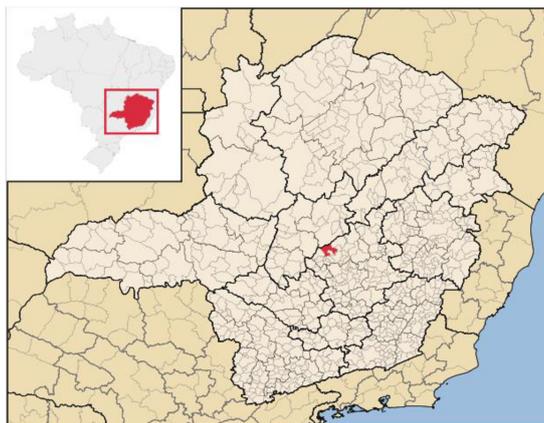
Figura 3. Mapa com localização da cidade de Belo Horizonte, estado de Minas Gerais, Brasil.

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Já as crianças e adolescentes residentes na cidade de Paraopeba, foram oriundos de bairro de periferia da cidade no qual a vulnerabilidade sócio-econômica e a escassez de recursos estiveram presentes. Dessa forma, apesar de não ser atingida por desastre natural, seja seca ou inundação, estiveram presentes fatores estressores de ordem social e econômica.

A escolha das cidades e escolas das respectivas localidades baseou-se em critérios de conveniência para os pesquisadores.



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Figura 4. Mapa com localização da cidade de Paraopeba, estado de Minas Gerais, Brasil.

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2.3 Instrumentos

O Termo de Consentimento Livre e Esclarecido (TCLE, Anexos I e II) foi previamente aprovado pelo Comitê de Ética em Pesquisa da UFMG (registro CAAE: 26886814.9.0000.5149) e apresentado a todo responsável participante. O termo foi discutido e assinado em duas vias. O TCLE visa assegurar à família participante a condição de voluntários na pesquisa, a confidencialidade das informações colhidas e seus direitos éticos. O Termo de Assentimento Livre e Esclarecido (TA, Anexos III, IV) é um instrumento equivalente, mas direcionado às crianças e adolescentes que indicavam, através da assinatura do termo, em duas vias, se concordavam com a participação na pesquisa. Neste momento, era explicado que o responsável já havia assinado, mas que ele(a) tinha liberdade para decidir aderir ou não, e também era esclarecido o que seria realizado. Inclusive, deixava-se claro que não havia obrigação de participar de todas as etapas (sobretudo, a que se referia à coleta de material biológico) e que ele(a) poderia desistir a qualquer momento. Todos os estudantes assinaram o Termo de Assentimento para poder dar início à coleta de dados da pesquisa.

O Critério de Classificação Econômica Brasil (CCEB) é um instrumento de segmentação econômica que utiliza o levantamento de características domiciliares (presença e quantidade de alguns itens domiciliares de conforto e grau escolaridade do chefe de família) para diferenciar a população. O critério atribui pontos em função de

cada característica domiciliar e realiza a soma destes pontos. É feita, então, uma correspondência entre faixas de pontuação do critério e estratos de classificação econômica definidos por A1, A2, B1, B2, C1, C2, D e E (Mazzon & Kamakura, 2016).

O *Child Behavior Checklist* (CBCL, Inventário de Comportamentos da Infância e Adolescência) é um questionário composto por 138 itens que deve ser respondido pelo responsável por crianças na faixa etária de 6 a 18 anos. O inventário é estruturado por 118 questões relativas à avaliação de problemas de comportamento. O instrumento inclui oito escalas de síndromes: isolamento, queixas somáticas, ansiedade/depressão, problemas sociais, problemas do pensamento, problemas de atenção, problemas sexuais, comportamento de quebrar regras e comportamento agressivo, podendo ser utilizado para avaliação de indicadores de distúrbio que correspondam a qualquer uma dessas oito escalas (Bordin, Mari & Caeiro, 1995).

A CRIES (*Children Revised Impact of Event Scale*) é uma escala de 8 itens para rastreio de sintomas de TEPT em crianças e adolescentes e é composto pela subescalas de intrusão e evitação. Quanto maior a pontuação na escala, maior frequência de queixas relativas ao evento traumático (Chen et al, 2012; Magalhães et al., 2018; Perrin, Meiser-Stedman & Smith, 2005).

Os instrumentos aqui descritos referem-se apenas aos utilizados nas análises da presente tese. A coleta de dados do projeto de pesquisa abrangeu outros domínios de análise e a utilização de vários outros instrumentos não especificados neste momento.

2.4 Procedimentos

O projeto de pesquisa foi submetido e aprovado pelo Comitê de Ética em Pesquisa da UFMG (registro CAAE: 26886814.9.0000.5149) e, dessa forma, todos os procedimentos foram executados de modo a respeitar e cuidar da integridade física e emocional dos participantes.

Os procedimentos para recrutar os participantes foram dispendiosos e exigiram vários cuidados técnicos e burocráticos por parte dos pesquisadores. Foram realizados contatos com poder público local e escolar de cidades dos estados de Acre, Minas Gerais, Paraná, Rio Grande do Sul e São Paulo. No entanto, foram bem sucedidos apenas os contatos nos estados do Acre e Minas Gerais.

Como os participantes foram oriundos de escolas públicas, de modo geral, a primeira forma de acesso às escolas participantes foi através da Secretaria Municipal de Educação (ou outra Secretaria que pudesse intermediar o acesso à população atingida) e da diretoria de alguma escola local. O segundo passo era convidar os pais para a participação na pesquisa, explicar todos os procedimentos, esclarecer eventuais dúvidas e recolher a assinatura do TCLE. Com esta autorização, os alunos eram convidados a participar da pesquisa, durante o horário de aula, reservando a eles o direito de recusa, a despeito da autorização prévia dos pais ou responsável. Nenhum aluno começava a pesquisa sem o TCLE assinado pelos pais e sem assinar ele próprio o TA. Em todas as cidades, houve sempre o cuidado de pedir autorização ao professor para que ele(a) liberasse o(a) aluno(a) para participação na pesquisa durante sua aula. Desse modo, evitava-se comprometer o acompanhamento do aluno(a) nos conteúdos escolares e respeitava-se a dinâmica e rotina escolar.

Em Rio Branco, Acre, o contato foi, no primeiro momento, direcionado à Secretaria de Habitação e de Interesse Social do Estado do Acre (SEHAB) e da Coordenadoria Municipal da Defesa Civil (COMDEC), pois foi indicado esse caminho através de uma psicóloga parceira que trabalhava na Secretaria de Assistência Social e desenvolvia intervenções com as famílias atingidas pelas inundações. Ofícios descrevendo o projeto de pesquisa, seus objetivos e procedimentos e apresentando os pesquisadores responsáveis foram enviados, via email, para os representantes das deferidas instâncias. Após consolidação inicial da parceria, foram ajustados a cessão de espaços para as entrevistas e quais famílias seriam inicialmente acessadas. Utilizou-se o cadastro da SEHAB para identificar as famílias que residiam no conjunto habitacional da Cidade do Povo que haviam vivenciado a inundação e que tinham sido contempladas com uma moradia no local. Uma equipe da pesquisa deslocou-se até a cidade de Rio Branco e treinou uma equipe local de quatro psicólogas para auxiliar nas entrevistas e aplicação de instrumentos. Em primeiro momento, as famílias foram contatadas por telefone e convidadas para uma reunião com a equipe de pesquisa na qual foram apresentadas os objetivos e procedimentos da coleta de dados da pesquisa. Também foram realizados convites pessoalmente nas residências de algumas famílias. Devido a baixa adesão das famílias no contexto da Cidade do Povo, foi acionada a Secretaria de Estado de Educação, Cultura e Esportes para auxiliar com indicação de uma escola na qual fosse possível dar continuidade à coleta de dados. Conseguiu-se uma nova parceria

em uma escola estadual, que ficava em bairro atingido pela inundação, para recrutar mais famílias. Com o apoio da diretoria da escola, os responsáveis por alunos foram convidados a participar e procedeu-se à assinatura do TCLE, entrevistas e aplicação dos demais instrumentos.

Para a coleta de dados em Francisco Sá, o contato inicial foi através de conversas telefônicas e ofícios encaminhados à Secretaria Municipal de Educação da cidade que, no segundo momento, indicou duas escolas (uma urbana, com alunos a partir dos anos finais do Ensino Fundamental (6º ao 9º ano) e Ensino Médio, e outra escola sediada no ambiente rural que atendia aos primeiros anos do Ensino Fundamental) para realização da pesquisa. As diretoras da escola foram contatadas por telefone e foram enviados ofícios de apresentação da pesquisa. Posteriormente, foi agendada uma visita técnica da representante da pesquisa para conversar pessoalmente com as autoridades locais (secretária municipal de educação e diretorias das escolas). Na oportunidade, foi possível apresentar pessoalmente a proposta da pesquisa, escopo de atuação, acordar a infraestrutura necessária para a realização da coleta de dados e qual seria a contrapartida para os participantes, escola e Secretaria Municipal de Educação. A infraestrutura solicitada consistia em uma sala reservada para os fins da pesquisa, com mesas e cadeiras disponíveis; e, transporte para a escola rural. No acompanhamento prospectivo, foi solicitada também uma equipe apta de agentes de saúde para a coleta de material biológico (amostras de sangue e cabelo), embora todo o instrumental, equipamentos de proteção individual e coletor rígido para material perfurocortante descartável (Descarpack) fossem fornecidos pela pesquisa. A contrapartida oferecida para participação na pesquisa era a entrega de um relatório com a síntese dos dados obtidos.

Para seleção de escolas em Belo Horizonte aproveitou-se locais onde o grupo de pesquisa já tinha um contato anterior ou estava com algum projeto ativo de pesquisa sendo desenvolvido no local. De todo modo, foram realizadas reuniões com a direção da escola, apresentados os objetivos e procedimentos da pesquisa. Em uma das escolas, a direção solicitou o envio do projeto de pesquisa para que fosse analisado por comitê próprio e também recomendou que a pesquisadora responsável participasse de uma reunião com os professores das séries selecionadas para estudo. Nessas escolas, foram enviadas cartas convite aos pais, explicando o funcionamento da pesquisa, e solicitando que eles assinassem o TCLE caso concordassem em participar. Em caso afirmativo, eles

também respondiam os questionários de dados sócio-demográficos, CCEB, CBCL, Escala de Depressão de Beck (BDI; os dados deste instrumento não foram utilizados nas análises contidas nesta tese) e Escala de Impulsividade de Barrat (BIS 11; os dados deste instrumento não foram utilizados nas análises contidas nesta tese). Com o TCLE assinado pelos pais, convidava-se a criança ou adolescente durante o horário de aula para participar da pesquisa. A primeira etapa era a assinatura do TA e, posteriormente, procedia-se à aplicação dos demais instrumentos.

Em Paraopeba, o primeiro contato foi com a Secretaria Municipal de Educação, Cultura, Esporte e Lazer e diretoria da escola através de conversa telefônica e posterior envio de ofício, via email, com apresentação da pesquisa. Houve anuência de ambas as instâncias. No entanto, houve mudança de gestores durante o processo. Deste modo, foi necessário repetir o procedimento com o novo secretário e nova diretora da escola, inclusive, com agendamento de encontro presencial. Novamente, obteve-se o consentimento de ambos. A diretora da escola cedeu espaço em duas reuniões de pais para que pudéssemos apresentar a pesquisa, tirar dúvidas e colher a assinatura do TCLE. A partir do TCLE assinado, agendava-se a entrevista com os pais (ou responsáveis) em horário mais conveniente para eles e procedia-se ao convite para que os alunos também participassem. Nesta cidade, também foi promovido, a título de contrapartida, uma palestra para professores e equipe pedagógica com temas pertinentes ao cotidiano escolar.

Cada família participante recebia no acompanhamento prospectivo um relatório com o desempenho do(s) filho(s) participante(s) nos testes neuropsicológicos e na escala de problemas de comportamento respondido pelo responsável, com as interpretações condizentes, segundo normas para idade e sexo. A escola participante também obtinha um relatório com a síntese de desempenho do grupo de alunos participantes. Para não violar o sigilo, os dados foram apresentados para as escolas na forma de médias e desvio padrão e não os resultados individuais de cada aluno. As secretarias municipais de educação de Francisco Sá e Paraopeba igualmente receberam um relatório síntese de desempenho das escolas participantes.

Para o acompanhamento prospectivo, a segunda avaliação ocorreu após 14 meses para o grupo Inundação e após 17 meses para o grupo Seca. Não foi realizado o acompanhamento longitudinal com os grupos controle devido a limitações financeiras do projeto de pesquisa e restrições de equipe para tal empreendimento.

3. RESULTADOS

3.1 Psychometric properties of a Brazilian Portuguese version of the Children's Revised Impact of Event Scale (CRIES-8)¹

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Abstract

Background: Children and adolescents are considered a population at risk for developing posttraumatic stress disorder (PTSD) after a traumatic event. The Children's Revised Impact Scale (CRIES-8) is a self-report scale with 8 items that investigates avoidance and intrusion behaviors related to posttraumatic stress symptoms. **Objective:** The study consisted of translation and transcultural adaptation of CRIES-8 to Brazilian Portuguese and evaluation of its psychometric properties. **Methods:** A sample of 235 Brazilian children and adolescents exposed to natural hazards (drought or flood) and non-exposed children participated in the study. The methodological procedure for translation and cultural adaptation were in accordance with the principles described by ISPOR Task Force for Translation and Cultural Adaptation. We also evaluated test reliability and validity based on test content, the relations to other variables, and internal structure. **Results:** The procedures lead to a final Portuguese version proofread and cultural-adapted. Empirical evidence supports CRIES-8's division in two latent constructs (Intrusion and Avoidance), as well convergence correlations with other measures of child mental health and high reliability. **Discussion:** A Brazilian-Portuguese version of CRIES-8 is an important tool for a better screening of PTSD among youth who face traumatic events, being a potential informative instrument to identify children at risk.

Keywords: post-traumatic stress disorders, child, psychological trauma, natural disasters, CRIES-8

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Introduction

From natural to human-made/technological events, disasters are potentially traumatic events. Virtually all people affected by a traumatic event exhibit posttraumatic stress (PTS) symptoms in some level, even though the full diagnostic criteria for posttraumatic stress disorder (PTSD) may not be fully reached¹. The acute traumatic stress is the more common response after a disaster and it is associated with symptoms that show a tendency to disappear after safety conditions are restored²⁻⁵.

Children and adolescents are usually more affected than adults after a traumatic event. Along with other vulnerable population, they are at a higher risk of developing PTSD after a stressful event, especially the youngest ones⁶. Circumstances of life-threatening, a probability of being apart from family, less efficient coping strategies, and disturbances in social support all account for the anxiety-like response after disasters^{6,7}.

PTSD can be defined as an anxiety disorder triggered by severe traumatic life stress. It was not until 1987 that childhood PTSD has been recognized as different from adult trauma. Rather than responding to a traumatic situation with helplessness or fear, children may exhibit an agitated or disorganized behavior, as well as physical symptoms, such as headaches. Therefore, when assessing children's PTSD it is crucial to be prepared to deal with their peculiarities related to the developmental level⁸.

For children older than 6 years, the DSM-5 diagnostic criteria for PTSD are: the need of exposure to an actual or threatened death, serious injury, or sexual violence through directly experiencing the traumatic event, witnessing it, having awareness that it happened to a family member or friend or by re-experiencing the traumatic event. PTSD symptoms can be divided into four main clusters. The first one comprises reliving the traumatic event through intrusive memories and nightmares or physiological and psychological suffering when the trauma is recollected. The second cluster is related to persistent avoidance behavior and include the following symptoms: attempts to avoid feelings and thoughts associated with the event, and to avoid external reminders (people or activities) that are related to re-experiencing the trauma. The third cluster consists of negative alteration in cognitions and mood following the traumatic event. The last cluster is related to arousal symptoms and is marked by irritability, aggressive behavior, hypervigilance, sleep disturbances and difficulty to concentrate.

The symptoms should persist for at least one month after the traumatic event and result in impairment to one's functioning^{8,9}.

Screening tools are regarded as important instruments to evaluate effects following a distress, being considered reliable and cost-effective. Horowitz et al¹⁰ first developed the Impact of Event Scale (IES) to assess the effect of traumatic events experienced. This original version counted with 15 items, and two clusters of symptoms Intrusion and Avoidance, but it is applied solely in adults. The next step was to produce a shortened version of the scale to be used among children and adolescents. For this purpose, seven items were excluded, and the remaining eight were adapted to a younger population¹¹. The new version, Children's Revised Impact of Event Scale (CRIES- 8), consists of 4 items measuring Intrusion and 4 items measuring Avoidance, becoming one of the most widely used screening tools for evaluating PTSD among children and adolescents⁵. Studies investigating the reliability and consistency of the scale have shown that PTSD is not culture bound and its factor structure has been proven to be stable across gender, age and different types of trauma¹²⁻¹⁴.

The main aim of this study is to describe the process of translation and cultural adaptation of CRIES-8 to a Portuguese version. Secondly, we aim to investigate the psychometric properties of the Brazilian version of CRIES-8, which includes validity and reliability, in a sample of children affected by flood or drought. Among the numerous events that could result in trauma, we selected a sample from those exposed to natural disaster. At present, the world is facing a substantial growth of these extreme events due to environmental changes related to global warming¹⁵. In Brazil, flood and drought are the most common natural adversities and the main cause of human damage and a similar pattern is also observed worldwide^{16,17}.

Methods

Participants

Different samples were used according to the specific methods of the study. For the psychometric properties analysis, the sample consists of Brazilian children exposed to an adverse climate condition, especially drought or flood (n=146), and a control group not exposed to the specific climate stressor considered. Children from the drought

subgroup lived at Rio Pardo de Minas or Francisco Sá, both cities at the semi-arid zone of Minas Gerais state, Brazil. For the flood subgroup, children from Rio Branco, state of Acre, were recruited. This city is located in the north of Brazil and in 2015 it faced the worst flood incident of its history. The survey in Rio Branco was conducted up to 40 days after the peak of the disaster. The mean age for the exposed group was 11.17 (± 3.30) and 77 were female. For the non-exposed group, students from two public schools at Belo Horizonte, capital state of Minas Gerais, were recruited ($n=89$). The mean age was 11.06 (± 2.74) and 56 were female.

Assessment

CRIES

CRIES-8 is a screening tool for PTS symptoms in children, aged 8 and above and which reading abilities are sufficiently developed to understand and interpret the items. The scale is self-administrated and consists of 8 items, 4 measuring Intrusion (items 1, 3, 6, and 7) and 4 measuring Avoidance (items 2, 4, 5, 8). The items are scored on a four-point scale: “not at all” receives 0 scores, “rarely” sums 1 point, “sometimes” adds 3 points, and “often” computes 5 points. The Intrusion and Avoidance subscales are obtained counting the respective point for the appropriate subscale item. CRIES has more than 25 translations in different languages. All of it is available free of charge on the website of Children and War Foundation (<http://www.childrenandwar.org>).

CBCL

The Child Behavior Checklist (CBCL) consists of a questionnaire, answered by a caregiver, to identify behavior problem in school-aged children from 6 to 18 years old¹⁸. In this study, we used the Internalizing Problems category, which is composed by the sum of the anxious/depressed, withdrawn-depressed, somatic complaints, social problems, thought problems, and attention problems raw scores; the Externalizing Problems category that resides on rule-breaking behavior and aggressive behavior raw scores; and the Total Problems raw score. Higher scores indicate greater problems.

Study design

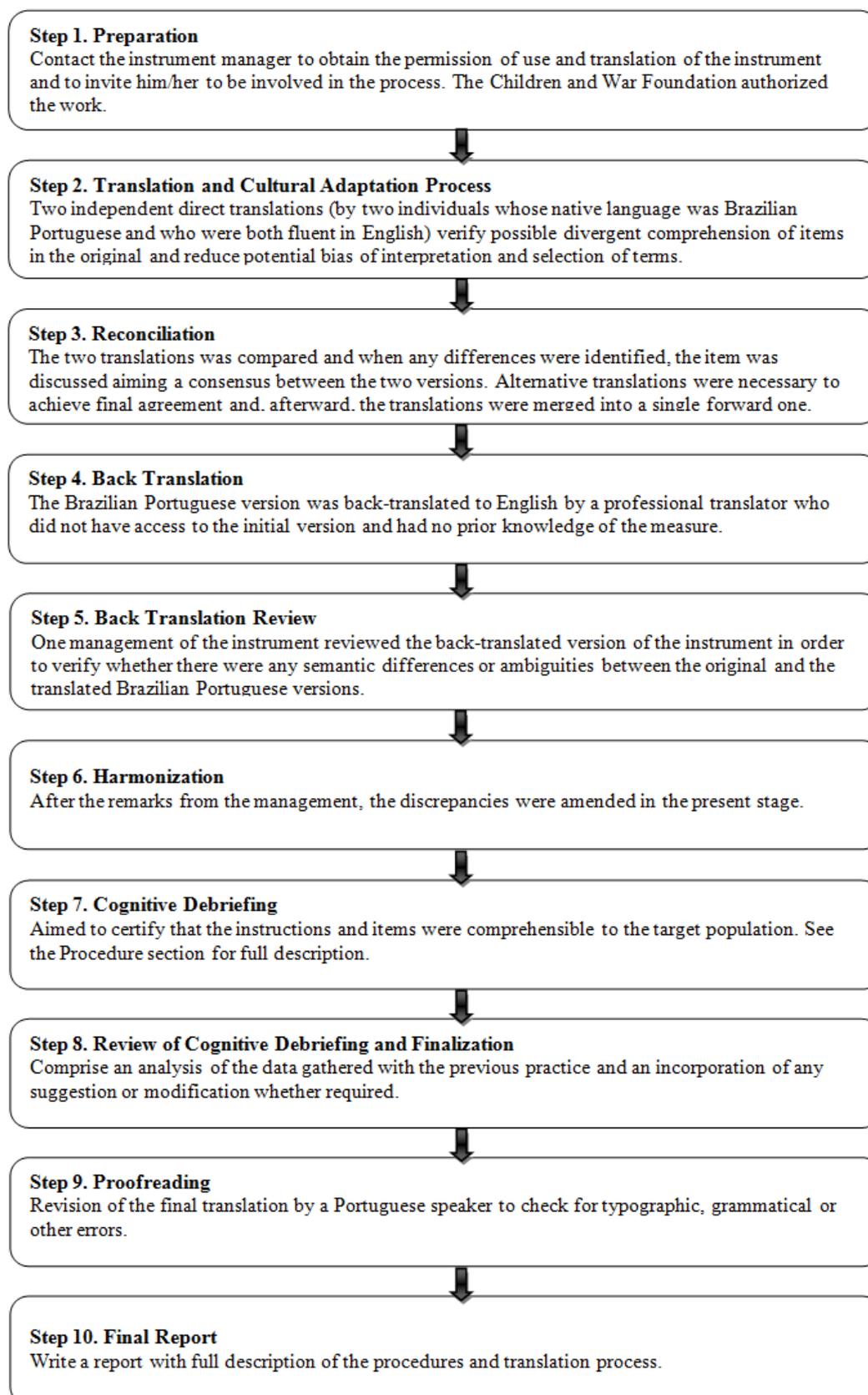
The translation and cultural adaptation of CRIES-8 are part of a broader project to study the impact of extreme natural events on children mental health conducted by

our research group, which was approved by the local Ethics Committee. The procedure of transcultural adaptation was conducted following the practices described by Wild et al¹⁹ which comprises ten steps described in Figure 1.

The seventh step for Translation and Cultural Adaptation process, namely the Cognitive Debriefing, was performed by five young boys from Rio Pardo de Minas, and by four young children from Sabará, a city at the center of Minas Gerais state that faced flood consequences. Their age ranged from 6 to 13 years old (mean age $8,67 \pm 2,45$ years) and they were all primary students of public schools. A five-point verbal numerical scale²⁰ was used to assess the comprehensibility of the CRIES. The guide question was: “Do you understand what has been asked?”. The participant should choose between the minimum value 0 (“I don’t understand anything”) to the maximum value 5 (“I understand perfectly, and I do not have any doubts about it”). The correspondent meaning of the extreme values was displaced above the numbers. The question must reach at least three points to be considered with satisfactory comprehension. For all the items, the participants had the option to suggest any modifications to improve understanding.

After transcultural adaption procedures, we investigated CRIES-8 psychometric properties. We evaluated the reliability by computing internal consistency using Cronbach’s Alpha and Split-Half methods. Validity was investigated focusing on test content (assessment by different judges during transcultural adaptation), its association with other variables (correlations with CBCL scores and comparison of youths exposed and non-exposed to natural disasters) and by assessment of internal structure (exploratory and confirmatory factor analysis). The latter procedure involved a principal component analysis with oblique rotation and confirmatory factor analysis using a diagonally weighted least squares method, commonly adopted to analyze ordinal data. Fit indexes commonly adopted in psychometric studies were computed, including Comparative Fit Index (CFI); Tucker-Lewis Index (TLI); Root Mean Square Error of Approximation (RMSEA).

Figure 1. Flow chart with methodological steps to Translation and Cultural Adaptation process, according to ISPOR Translation and Cultural Adaptation Task Force¹⁹.



Results

The process of transcultural adaptation of CRIES-8 began with an initial translation which was back-translated to the original language, English (see Table 1), then members of the Children and War Foundation reviewed it. Any discrepancies, semantic differences or conceptual nonequivalence were investigated and highlighted. Five items received a critical observation (question 2, 3, 4, 6, and 7) because they did not adequately correspond to the concept depicted in the original version. Subtle lexical and grammar differences were identified between the meaning of original terms in English and the supposed equivalent words chosen in Portuguese. For question 2, was identified a different meaning between *remove* and *think in erasing*, one being more permanent than the other. Due to the failed first attempt to proper translate the expression *waves of strong feelings* depicted in question 3, the reviewers emphasized the importance of stressing that the moment when an emotion affects someone is in a suddenly and profoundly manner. Lastly, the question 7 received a syntactic critic because of its construction. If the auxiliary *do* was used, the intention was to only ask whether the action occurs; on the other hand, the verb *to be* implied an interest in what other things trigger memories of the traumatic event. Another harmonization process was conducted to overcome these discrepancies and to ensure the equivalence between the versions.

Only one item remained the same, despite the back-translation review. The original item, question 6, “Do pictures about it pop into your mind?” was back-translated to “Do images from the event suddenly pop up in your head?”. The replacement of mind to head was a matter of cultural adaptation. In Brazil, we often assign to head instead of mind to refer to daily cognitive activity.

For cognitive debriefing process, nine children classified the instructions and all the eight items of CRIES, accordingly to their understanding. They did not present any suggestions to improve the comprehension of the items. Only for the first question, a participant claimed not to understand it at all, probably due to his initial difficulty to understand what had been proposed with the task, as his original tendency was to answer the CRIES questions themselves. The question 2 also received a critical minimum rate. Further investigations at the moment of the evaluation revealed that some children recognize two different meaning for a keyword of the question. In

Portuguese, the word *lembrança* is equivalent to memory, as well it can mean a gift someone gives to another. Nonetheless, because the meaning of retaining and recalling something was also recognized we decided to keep the word. Thus, the scale obtained suitable rates and therefore gathered its first evidence of validity.

The final proofreading checked for grammatical errors, the plausibility of comprehension by children population due to the concrete thinking they exhibit, and for theoretical consistency, to ensure the validity of test content. Table 1 presents the original CRIES version, the back-translated Portuguese version and the final Portuguese version.

For investigation of other psychometric properties of CRIES and the internal structure of the Portuguese CRIES-8 version, we evaluated a sample of 146 children affected by flood or drought and 89 children for control group. All indices of CRIES significant correlated with each other (data not show). Reliability analysis accessed through Cronbach's Alpha and Split Half methods achieved an index of 0.79 and 0.83, respectively, for total sample ($N=235$). The scales achieve a Cronbach's Alpha at 0.79 for Intrusion and 0.77 for Avoidance subscales, for total sample. Table 2 exhibits reliability analysis for the subgroups according to different methods.

Table 2. Reliability analysis for children exposed and non-exposed to an adverse condition related to natural hazard, according to different methods ($N=235$).

	Exposed (n = 146)			Non-exposed (n = 89)		
	CRIES	Intrusion subscale	Avoidance subscale	CRIES	Intrusion subscale	Avoidance subscale
Cronbach's Alpha	0.80	0.73	0.73	0.89	0.86	0.80
Split Half	0.84	0.77	0.70	0.89	0.85	0.81

Table 1. Versions of CRIES accordingly to the translations and adaptation process

Original CRIES version	Back-translated Brazilian Portuguese version	Final Brazilian Portuguese version
Below is a list of comments made by people after stressful life events. Please tick each item showing how frequently these comments were true for you during the past seven days. If they did not occur during that time please tick the 'not at all' box.	Below there is a list of comments made by people after stressful events. Please, mark the item that corresponds to the frequency these comments were true for you during the last seven days. If they did not happen during this time choose the option "not at all".	Abaixo se encontra uma lista de comentários feitos por pessoas após eventos estressantes. Por favor, marque o item que apresenta com qual frequência esses comentários foram verdadeiros para você durante os últimos sete dias. Se eles não aconteceram durante esse período, marque a opção "Nenhum pouco".
1. Do you think about it even when you don't mean to?	1. Do you think about it even when you do not want to?	1. Você pensa nisso mesmo quando não quer?
2. Do you try to remove it from your memory	2. Do you think in erasing it out of your memory?	2. Você tenta afastar isso da sua lembrança?
3. Do you have waves of strong feelings about it	3. Do you have moments with strong feelings about what has happened?	3. Você tem momentos em que sentimentos fortes sobre o que aconteceu invadem seus pensamentos?
4. Do you stay away from reminders of it (e.g. places or situations)	4. Do you stay away from stuff, places or situations that make you remember what has happened?	4. Você fica longe de lugares ou situações que lhe fazem lembrar o que aconteceu?
5. Do you try not talk about it	5. Do you try not to talk about it?	5. Você tenta não falar sobre isso?
6. Do pictures about it pop into your mind?	6. Do images from the event suddenly pop up in your head?	6. Imagens do acontecimento surgem de repente na sua cabeça?
7. Do other things keep making you think about it?	7. Are there other things that make you keep on thinking about what has happened?	7. Outras coisas fazem você ficar pensando sobre o que aconteceu?
8. Do you try not to think about it?	8. Do you try not to think about it?	8. Você tenta não pensar sobre isso?
Not at all	Not at all	Nenhum pouco
Rarely	Rarely	Raramente
Sometimes	Sometimes	De vez em quando
Often	A lot	Muitas vezes

A principal component analysis, with *promax* rotation, exhibited a solution with 2 factors and it explained 55.37% of the variance (Table 3). The Bartlett's Test of Sphericity was significant ($p < 0.001$) and the KMO was 0.82, which indicate the

adequacy of the sample. A confirmatory factor analysis tested the original two-factor solution (Intrusion and Avoidance). The final model sustained the original two-factor solution, with adequate fit-indexes ($\chi^2=39.98$, $df=10$, $\chi^2/df=2.05$, $CFI=0.98$, $TLI=0.98$, $RMSEA=0.067$).

Table 3. Principal components analysis of Portuguese CRIES-8 version, with *promax* rotation

	Loading	
	Factor 1 Intrusion	Factor 2 Avoidance
6. Do pictures about it pop into your mind?	0.76	
7. Do other things keep making you think about it?	0.73	
1. Do you think about it even when you don't mean to?	0.73	
3. Do you have waves of strong feelings about it?	0.70	0.40
4. Do you stay away from reminders of it (e.g. places or situations)	0.52	0.50
8. Do you try not to think about it?	0.41	0.84
5. Do you try not talk about it?		0.83
2. Do you try to remove it from your memory?		0.72

Another question addressed was whether CRIES-8 could be related to a screening tool for children behavioral problems (validity based on association with other measures). We recruited another sample of 89 healthy children, non-exposed to any specific stressful event, as a comparison group. There were no significant differences between the groups concerning age, years of formal schooling and sex ($p=0.85$, $p=0.79$, and $p=0.18$, respectively). All CRIES scores indicated that those who experienced an adverse condition reported more symptoms of intrusion and avoidance related to the event, compared to those non-exposed to stressful condition. However, if we considered the cut-off score of 17 reported by Perrin, Meiser-Stedman, and Smith²¹ to positive screening for PTSD, both groups did not reach this threshold. The Cohen's *d* effects sizes were moderate. There were no significant differences between groups in any kind of behavior problems described by the parent and both groups did not show any significant clinical problem in average accessed by the CBCL (Table 4).

Table 4. Comparison between CRIES and CBCL indices for children exposed to adverse weather event (drought or flood) and non-exposed children.

	Exposed ¹		Non-exposed ²		Statistics	
	Mean	SD	Mean	SD	F	d
CRIES total score	15.90	10.25	9.26	10.65	22.74*	0.63
CRIES intrusion	7.44	5.73	4.09	5.70	18.95*	0.59
CRIES avoidance	8.49	6.06	5.17	5.86	17.09*	0.56
CBCL Total Problems	37.19	20.17	33.06	20.17	1.75	0.20
CBCL Internalizing Problems	12.55	7.76	11.58	8.02	0.63	0.12
CBCL Externalizing Problems	9.09	6.82	8.30	6.08	0.61	0.12

¹n= 146 for CRIES scores, and n=111 for CBCL scores; ² n=89 for CRIES scores, and n=67 for CBCL scores; * p < 0.001

To further evaluate its validity by its association with other measures we correlated CRIES total score with CBCL. We found significant correlations with CBCL internalizing problems ($r=0,16$, $p=0,05$) and CBCL total problems score ($r=0,16$, $p=0,05$). The avoidance index of CRIES is associated with the CBCL total problems ($r=0,18$, $p=0,05$) and the intrusion index is not correlated with any CBCL measures.

Discussion

Our study resulted in a transcultural adaptation of CRIES-8 for Brazilian-Portuguese. This version succeeds in reaching meticulous methodological steps to establish language adequacy, cultural adjustment, and language standards. Besides the translation procedures, we found evidences of validity and reliability for the adapted version, including moderate to high internal consistency, a two-components latent structure, significant score differences by children exposed and non-exposed to natural disasters and weak but significant correlations with other measures of behavioral problems.

After a trauma, most children do not develop PTSD²². Nevertheless, subclinical levels of PTS symptoms can significant impair social and educational functioning, and could impact psychological and developmental process. Age and the stage of development can lead to a greater recognition and memories of the event, jeopardizing mental health²¹. CRIES-8 is highly regarded as an important tool for screening children at risk for PTSD. The instrument is widely used in a variety of cultures, since

posttraumatic stress symptoms in children have more similarities than differences from one place to the other²¹. As these versions enhance the worldwide comparability of research of the effects of disasters on children, it will be important and useful to introduce CRIES-8 in Brazil. In fact, it promptly covers a lack of valid and adapted instruments for these purposes in Brazil. To our knowledge, this is the first free PTSD screening tool adapted for Brazilian children and adolescents.

Reliability indices were moderate; however, the two distinct methods provide convergent results. Moderate values are expected in screening tests or scales, since the low number of items may influence the internal reliability. In this sense, lower internal consistency values are usually accepted for those measures²³. The values obtained were coherent with international literature. Studies with distinguished disaster events usually report a Cronbach's alpha varying between 0.70 to 0.86 for the total score of CRIES-8^{2,11,13,24}. For the intrusion items, the Cronbach's alpha was reported at 0.60 to 0.88^{2,11,13,14,24,25}. Finally, for the avoidance subscale, Cronbach's alpha was 0.58 to 0.85^{2,11,13,14,24,25}.

In exploratory principal component analysis, the underlying latent structure was similar to other versions of CRIES-8^{13,14,21,25}, with exception for the Question 4 that was supposed to count for Factor 2, Avoidance, although in our study it loads slightly more on Factor 1, Intrusion. Due to specificities of the trauma studied, children from both conditions (drought or flood) not always have the actual power to avoid places or situations that remind them of the disaster. The analysis of another sample exposed to a different traumatic event will help to elucidate this finding. However, a confirmatory factor analysis still corroborated the original items structure. Three of the four fit indexes showed optimal parameters ($\chi^2/df < 3$, CFI > 0.95, TLI > .95) and one showed marginal results (RMSEA < 0.06). Our results corroborate the internal structure validity of CRIES-8.

We verified a significant difference in CRIES scores between the exposed and non-exposed group, with moderate effect sizes. Although no differences were found on CBCL between groups, CRIES-8 better discriminated between groups of exposed and non-exposed. Thus, it was sensible to disclose distress symptoms that children probably were experiencing in consequence to the disaster.

PTSD is mainly an internal phenomena since it is characterized by a phenomenology of recollections, therefore not always clearly evident to others. This

highlights the importance of self-report, especially child self-report data. We found a significant difference, with moderate size effects, between CRIES and CBCL scores. The apparent divergence between CRIES scores and the CBCL scores may be under the assumption that parents in a context of adversities may not be able in providing a suitable care for their kids, and their report could not be the most reliable concerning the experience of their children after an adverse experience. Furthermore, children and adolescents could exhibit a tendency to hide stress feelings and thoughts from their parents in order to preserve them from another source of distress. Therefore, the study suggests that child self-reports are the preferred source of information in the evaluation of youth PTSD.

In general, the significant correlations between CRIES and CBCL were few and modest. One hypothesis to explain the data may be due to differences in self-reports and parental reports, as previously discussed. A second one could be due to the time period that the investigation occurs. Accordingly to DSM-5, PTSD symptoms usually appear within the first 3 months after the event⁹. For flood affected children, the acme of the rainy period occurred about one month previously to the data collection. On the other hand, CBCL requires parents to report the pattern of child behavior during the last 6 months. So the time lapse was before the peak of the disaster for the flood group and it could also include a different season with no rain/flood incidents.

This study has two important limitations. First, the original CRIES version was designed for children aged 8 or older, but we included children with 6 and 7 years of age (n=31, 13,2% of total sample). The original authors of CRIES argue that children young as 6 years old may not have the proper reading and comprehension skills to answer the scale and they do not recommend 6 years old children answering the scale. Regarding this, experimenters were instructed to help young children achieve a better comprehension of the items. The decision to maintain this young age group was due to our plan to follow-up this population for future symptoms.

The second limitation refers to the type of stressful event chosen to validate the scale. Children reactions to different types of disasters may be very specific to the event. Research with different traumatic contexts is highly desired to consolidate CRIES for a screening tool for PTSD in the Brazilian population. After all, some studies found a lower prevalence of PTSD after natural disasters than after human-made/technological events²⁶.

Areas in need of research include the factors that might modulate and mediate PTSD symptoms (e.g. disaster-related media exposure, prior trauma, social support), the assessment of the long-term impact of disasters, as well as how PTSD symptoms relate to measures of daily functioning. Resilience should also be put in perspective, as it is often neglected by post-disaster studies. Future proceedings must include studies of validity evidence based on consequences of testing of CRIES-8 for the diagnoses of PTSD and to verify a suitable cut off of CRIES-8 for the Brazilian population.

Children and adolescents are a population deemed to be at risk following a disaster, especially because they are still in development and less prepared to deal with stress and drastic changes. Screening tools are especially useful in the context of experiencing stressful events, as they optimize the evaluation process, and objectively identifying potential impairments in one's life. The translation and cultural adaptation of CRIES-8 to a Brazilian Portuguese version were conducted following gold standard guidelines to ensure the quality of the process¹⁹. The extensive revisions lead to a version that is intended to be comprehensible for even young children, it is theoretical representative of the two major factors of the scale (intrusion and avoidance), it is semantic equivalent to the original version, and empirical evidence supports its validity evidence based on test content, relations to other variables, internal structure, and the reliability of its measures. A further strength of the current study was the work definition of PTSD as a heterogeneous construct, which includes Intrusion and Avoidance symptoms.

References

1. Hughes V. The roots of resilience. *Nature*. 2012; 490:165-167.
2. Chen Z, Zhang Y, Liu Z, Liu Y, Dyregrov A. Structure of the Children's Revised Impact of Event Scale (CRIES) with children and adolescents exposed to Debris Flood. *Plos One*. 2012; 7(8): 1- 6.
3. Furr JM, Comer JS, Edmunds JM, Kendall PC. Disasters and youth: a meta- analytic examination of posttraumatic stress. *J Consult Clin Psych*. 2010; 78(6): 765- 780.
4. Green BL, Korok, M, Grace, MC, Vary MG, Leonard AC, Gleser GC, Smitson-Cohen S. Children and disaster: age, gender, and parental effects on PTSD symptoms. *J Am Acad Child Psy*. 1991; 30(6): 945-951.

5. Trickey, D, Siddaway AP, Meiser-Stedman R, Serpell L, Field AP. A meta-analysis of risk factors for post-traumatic stress disorder in children and adolescents. *Clin Psychol Rev.* 2012; 32:122-138.
6. Masten A, Osofsky J. Disasters and their impact on child development: Introduction to the special section. *Child Dev.* 2010; 81(4): 1029- 1039.
7. McDermott BM et al. Vulnerability factors for disaster-induced child post-traumatic stress disorder: the case for low family resilience and previous mental illness. *Aust NZ J Psychiat.* 2010; 44(4): 384-389.
8. Salmon K, Bryant R A. Posttraumatic stress disorder in children: the influence of developmental factors. *Clin Psychol Rev.* 2002; 22(2): 163- 188.
9. American Psychiatric Association Diagnostic and statistical manual of mental disorders. 5th ed. Washington, DC: American Psychiatric Association; 2013.
10. Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: A measure of subjective stress. *Psychosom Med.* 1979; 41(3): 209- 218.
11. Verlinden E, et al. Characteristics of the Children's Revised Impact of Event Scale in a clinically referred Dutch sample. *J Trauma Stress.* 2014; 27:338–344.
12. Beck J, Grant D, Read J, Clapp, J, Coffey S, Miller L. The Impact of Event Scale-Revised: Psychometric properties in a sample of motor vehicle accident survivors. *J Anxiety Disord.* 2008; 22(2):187- 198.
13. Deeba F, Rapee RM, Prvan T. Psychometric properties of the Children's Revised Impact of Events Scale (CRIES) with Bangladeshi children and adolescents. *PeerJ.* 2014; 2:e536.
14. Giannopoulou I, Smith P, Ecker C, Strouthos M, Dikajakou A, Yule W. Factor structure of the Children's Revised Impact of Event Scale (CRIES) with children exposed to earthquake. *Pers Individ Differ.* 2006; 40(5): 1027- 1037.
15. Intergovernmental Panel on Climate. *Climate Change 2014: Synthesis Report.* Available online at <http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_LONGERREPORT_Corr2.pdf>.
16. Anuário brasileiro de desastres naturais : 2013 / Ministério da Integração Nacional. Secretaria Nacional de Proteção e Defesa Civil. Centro Nacional de Gerenciamento de Riscos e Desastres. – Brasília: CENAD; 2014.
17. Guha-Sapir D, Hoyois Ph, Below R. *Annual Disaster Statistical Review 2015: The Numbers and Trends.* Brussels: CRED; 2016.
18. Bordin IAS, Mari JJ, Caeiro MF. Validação da versão brasileira do “Child Behavior Checklist (CBCL) (Inventário de Comportamentos da Infância e Adolescência): dados preliminares. *Rev ABPAPAL.* 1995; 2(17): 55-66.
19. Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee- Lorenz A, et al. Principles of good practice for the translation and cultural adaptation process for patient- reported outcomes (PRO) measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. *Value Health.* 2005; 8(2): 94- 104.
20. Grassi-Oliveira R, Stein L M, Pezzi JC. Tradução e validação de conteúdo da versão em português do Childhood Trauma Questionnaire. *Rev Saude Publ.* 2006; 40(2): 249-255.

21. Perrin S, Meiser- Stedman R, Smith P. The Children´s Revised Impact of Event Scale (CRIES): Validity as a Screening Instrument for PTSD. *Behav Cogn Psychoth.* 2005; 33: 487- 498.
22. Alisic E, Jongmans MJ, Wesel FV, Kleber RJ. Building child trauma theory from longitudinal studies: a meta-analysis. *Clin Psychol Rev.* 2011; 31:736-747.
23. Mitrushina M, Boone KB, Razani J, Delia LF. *Handbook of normative data for neuropsychological assessment.* Oxford University Press; 2005
24. Lau JTF, Yeung NCY, Yu X, Zhang J, Mak WWS, Lui WWS, Zhang J. Validation of the Chinese version of the Children´s Revised Impact of Event Scale (CRIES) among Chinese adolescents in the aftermath of the Sichuan Earthquake in 2008. *Compr Psychiat.* 2013; 54: 83-90.
25. Oh EA, Park EJ, Lee SH, Bae SM. Validation of the Korean version of the Children´s Revised Impact of Event Scale. *Clin Psychopharm Neu.* 2014; 12(2):149-156.
26. Galea S, Nandi A, Vlahov D. The epidemiology of post-traumatic stress disorder after disasters. *Epidemiol Rev.* 2005; 27, 78-91.

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3.2 Extreme Climate Related Disasters: impact in youth mental health and a prospective follow up of symptoms²

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Abstract

Floods and drought are the most frequent extreme climate-related disasters. Evidence have been indicating those events will increase and intensify. These extreme climate-related events may affect individuals' mental health, specially children and adolescents whom present a higher risk to develop psychological distress after any disaster. The present study aimed to describe mental health impact on youth exposed to the natural hazards of flood or drought (time 1) and to provide a prospective follow up of symptoms (time 2), after a time lapse of 15 months, approximately. Protocol included evaluation of posttraumatic stress symptoms (PTSS) and general behavior problems. Sociodemographic data from 312 children and adolescents (6 to 18 years old) were described and analyzed. Sample was splitted into four subgroups: i) Control without socio disadvantages (SD); ii) Control with SD; iii) Flood group; iv) Drought group. At time point 1, children from all groups did not substantially differ in their pattern of behavioral problems reported by parents and measured with the CBCL, but PTSS scores significantly differentiate the groups. The prevalence rate of probable PTSD varied between 6,0% to 94,74% in all case groups. At time point 2, the Flood youth group presented a general pattern of recovery and resilience, about PTSS. Also, for the Drought youth group a persistence and stability pattern of PTSS was verified and an aggravation of PTSS. Post-disaster longitudinal studies are unfortunately rare, however, they are essential to elucidate how patterns of psychological distress progress over time and under variable socioeconomic status and to understand the relationship between mental health and exposure to trauma.

Keywords: climate change; mental health; drought; flood; youth.

1. Introduction

Every day a natural or technological disaster occurs on the globe (Saunders & Adams, 2014). In 2018, the Centre for Research on the Epidemiology of Disasters (CRED) reported the majority of worldwide natural disasters in the previous year were floods and landslides (CRED, 2018). Fernandez et al. (2015) appointed floods as the most common type of natural disaster worldwide, responding to almost 53,000 deaths in the past decade. Additionally, of the ten natural disasters that affected a large number of

² Trabalho em vias de submissão.

people, eight were drought events (Fernandez et al., 2015). There is medium confidence that both floods and droughts will increase in some areas (Ebi & Bowen, 2015). In developing countries, floods and droughts were the most common and critical disasters (Rataj, Kunzweiler, and Garthus-Niegel, 2016).

Droughts are costly, slow-onset and longlasting events resulting from a severe hydrological imbalance. Drought can be classified through meteorological, hydrological, agricultural and socioeconomic types (Vins et al., 2015). Here we use the agricultural definition of drought which is defined by a period of below-average precipitations and/or above-normal evaporation, with consequences for the soils (dryness), plant growth (reduction) and crop production (Below, Wirtz, & Guha-Sapir, 2009).

Flood is “a significant rise of water level in a stream, lake, reservoir or coastal region” (Below, Wirtz, & Guha-Sapir, 2009) and can be classified in three periods: i) the immediate period: lasting days or weeks when protection and rescue activities are present; ii) the medium-term period: lasting weeks or months and characterized by recovery and restorations of community functionality; iii) the long-term period: that can last months or years, and the focus is the post-flood reconstruction (Zhong et al., 2018). The individual response and potential health problems are different in each phase. In the context of disaster: i) the acute period constitutes the first two to six months after the disaster onset; ii) the intermediate period occurs 12 to 18 months post event; and iii) the long-term phase comprises two to three years post event (Pfefferbaum et al., 2012).

The interface of mental health area and climate change is of increasingly concern since evidence shows that psychological consequences exceed physical injury by 40:1, and the incidence of extreme weather events has grown by 46% since 2000 (Hayes et al., 2018). Extreme climate events may affect individuals' mental health directly and/or indirectly. Direct effects involve the psychological trauma that followed the adverse experience, the destruction of landscapes which disturb the sense of belonging and solace with the land (Barry, Bowen, & Kjellstrom, 2010). Posttraumatic stress disorder (PTSD) is one of the most severe mental health condition directly associated to natural disasters (Hayes et al., 2018, Zhong et al., 2018). Together with posttraumatic stress symptoms (PTSS), they are the outcome measured in disaster studies on affected children (Pfefferbaum et al., 2013) even in the long-term (Dai et al., 2016), due to its high frequency and psychological debility (Galea, Nandi & Vlahov, 2005). The indirect climate change effect on mental health occur by affecting physical

health, aggravation of previous mental health problems, disturbing physical and social environment and infrastructure, providing caregiver burden which compromise the quality of care or protection, apart from others consequences (Barry, Bowen, & Kjellstrom, 2010; Hayes et al., 2018; Peek-Asa et al., 2012). The gamut of impact runs from physical trauma, injuries and wounds, to increased incidence of some illnesses and conditions (Clayton, Manning, & Hodge, 2014; Saulnier, Ribacke, & Schreeb, 2017; Zhong et al., 2018).

Children and adolescents present a higher risk than adults to develop psychological distress after a disaster (Zhong et al., 2018; Burke, Sanson, & Hoorn, 2018). Factors associated to this vulnerability are physiological and cognitive immaturity, limited physical skills, higher metabolic rate that increase the sensitivity to temperature changes, and dependence on others for care, protection, safety and provision (Bennett & Friel, 2014; De Young, Kenardy, & Cobham, 2011; Garcia & Sheehan, 2016). Children are particularly vulnerable to emotional trauma and distress after sudden changes in their daily lives, social interactions and sense of security (Bennett & Friel, 2014). Furthermore, children seem exceptionally vulnerable to long-term adverse outcomes (De Young, Kenardy, & Cobham, 2011).

In fact, children present a paradox background to disaster response. Nieto (2006) reinforce the positive capacity of adaptation of children as a result of their condition as in development beings. However, those coping behaviors depend on some factors, like age, characteristics of the event, protection and safety conditions provided by family or community. In general, children react in expected ways in response to a traumatic condition, i.e., with non-pathological behaviors. The probable psychological distress they first present naturally remits over time. Noteworthy is the importance of parents, school and health professionals to be able to identify and differentiate the typical responses from those that require immediate intervention.

The number of children affected by natural disasters is already high, and the projections indicate to be even higher as a consequence of climate change effects. Worldwide, children are estimated to bear almost 90% of disease due to climate change, and the burden is more significant if poverty conditions are present (Philipsborn & Chan, 2018). The epidemiological estimates indicate that 1 in 4 adolescents had faced a natural disaster in their lifetimes (Saunders & Adams, 2014).

Stress resulting from exposure to extreme events can act via two principal mechanisms in children, one via cumulative effects that impair body's ability to adapt and respond appropriately, and the second via acute effects that inflict a burden to the body's systems at a critical developmental stage. The latter is particularly crucial for children in the aftermath of a disaster, while the former may be more significant to chronic conditions or in association with socioeconomic vulnerabilities (Abramson et al., 2010).

Even though the majority of studies focus on the detection of PTSD, anxiety problems or depression, many other disorders could be verified, including externalizing problems like aggression (Marsee, 2008) or conduct problems (Crum et al., 2015), substance use, specially alcohol (Reijneveld et al., 2003), adjustment disorder (Demir et al., 2010), social isolation (Teasdale et al., 2013), existential anxiety (Weems et al., 2016), school problems (Lai et al., 2015; Sims et al., 2015), child abuse (Curtis, Miller, & Berry, 2000), and suicide (Castellanos et al., 2003). Comorbidities between PTSD, depression, and anxiety are significant frequent and can affect 39% of youth with a psychiatric diagnosis (Kar & Bastia, 2006; Lai et al., 2014; Zhong et al., 2018).

Most neuropsychiatric disorders emerge from a complex interaction of factors and compensatory mechanisms resulting from abnormal developmental trajectories, and the developmental timing of the trauma is related to the specific resultant disorder (Marín, 2016; Marshall, 2016). The prevalence of long-term psychological effects tends to be lower than the short-term outcome after a disaster (Zhong et al., 2018; Stoddard Jr, 2014). Longitudinal studies evidenced a peak of symptoms one year after the disaster and generally an improvement over time. However, there is the possibility of the remission of PTSS to be replaced by subclinical symptoms of anxiety leading to a continued impact over time (Jin, Liu, & Guan, 2015; Math et al., 2008; Tian et al., 2013), especially when associated with poor parental care, psychiatric comorbidities, and low resource environment (Zhong et al., 2018).

After a traumatic experience, four trajectories are commonly described: resistance, resilience, recovery, and chronic dysfunction (Goldmann & Galea, 2014). The pathways incorporating the concept of resilience and posttraumatic growth are five. To acute-onset traumatic experience, the following pathways were indicated: i) stress resistance in which no alteration is observed; ii) disturbance with recovery; iii) posttraumatic growth characterized by an improvement of behavioral responses; iv)

breakdown without recovery (in the time considered); and v) delayed breakdown without recovery (in the time considered) (Masten & Narayan, 2012). The first three patterns show forms of resilience and the others indicate maladaptive pathways. To chronic-onset extreme event, it was suggested the possibility of the subsequent pathways: i) previous maladaptive behaviors and recovery after conditions are improved; ii) previous normal functions with slight breakdown with recovery after conditions are restored or good conditions are established; iii) decline with no sign of recovery (in the time considered), despite more favorable conditions. To help predict and differentiate which children will present chronic distress or recovery pattern, the suggestion is to verify the presence of high levels of anxiety in the months immediately post-disaster (La Greca et al., 2013).

The challenge to disentangle the precise contribution of natural hazards in youth mental health to other social determinants is overt (Hayes et al., 2018). In general, youth living in poverty conditions have increased rates of the most chronic health problems and mental health problems, inadequate access to care, higher rates of exposure to adverse – potentially traumatic – life conditions (National Academies of Sciences, 2015). After all, the social vulnerability was found to strongly influence the perception of health risk in response to climate change (Akerlof et al., 2015).

Further, disasters contribute to exacerbate previous troublesome life conditions or to interact with previous traumatic events or augment prior existing inequalities. The most affected population segments are marginalized groups regarding socioeconomic status, culture, gender, race, employment, and education (Bennett & Friel, 2014; Hayes et al., 2018). Disadvantaged children will be disproportionately affected by the consequences of climate change (Bennett & Friel, 2014). In Sri Lanka, children and adolescents victims from a tsunami presented additional trauma to the previous civil war context they were exposed to (Catani et al., 2008). One in four American youth from a sample victim from the Hurricane Katrina and the Gulf oil spill had already, at least, one previous trauma (King et al., 2015).

The exposition to one or more traumatic experience was related to a higher prevalence of psychological symptoms, suicide ideation and attempt in adolescent survivors of an earthquake (Tanaka et al., 2016). Overstreet, Salloum, and Badour (2010) studied adolescents exposed to Hurricane Katrina, in the USA, and found that 92% of the sample lived a secondary stressor and that it was related to PTSD symptoms

and all three PTSD symptom clusters. Thus, cumulative trauma experience influences child mental health negatively.

Although the definition of mental health is broader than mental illness, mental problems or mental disorders, because it includes states of mental wellness, emotional resilience and psychosocial well-being (Hayes et al., 2018), the scope of this study is primarily limited to mental health problems in consequence of exposure to a natural hazard. This study aimed to describe mental health impact on youth exposed to the natural hazard of flood or drought and to provide a prospective follow up of symptoms, after a time lapse of about 15 months. PTSS and general behavior problems were evaluated, and age, sex, and socioeconomic status (SES) were factors analyzed together with mental health data.

2. Method

2.1 Participants

The sample of the present study was composed of four main groups, which were split according to age, resulting in eight subgroups. Subjects with 6 to 11 years old belonged to Children subgroup, and subjects with 12 to 18 years old took part in the Adolescent subgroup. First, 46 children and 42 adolescents (n=88) were recruited from two public schools at Belo Horizonte, southeast region in Brazil. This group called Control without socio disadvantages (SD) was characterized by the absence of major socio-economic deprivation and a common external stressor. The second group, Control with SD, had an important feature of socio-economic detriment, although not exposed to a common natural external stressor. Fifty children and 29 adolescents (n=79) belong to this group. They were from a public school at Paraopeba, southeast region in Brazil. The Flood group was formed by 61 children and 23 adolescents (n=84) from Rio Branco city, northwest of Brazil. In 2015, this city faced the worst flood incident of its history. According to local public help agencies, the river Acre rose 18,4 meters, affecting 87,000 people (21% of total population) and leaving 10,400 unsheltered after the incident. The time 1 survey was conducted 40 days after the peak of the disaster. The sample was from local public school and social services family users. The Drought group was composed of 27 children and 34 adolescents (n=61) from Francisco Sá, southeast region in Brazil. This city belongs to the Brazilian semi-arid zone which is the

area most affected by drought in Brazil and the total annual pluviometric indices for this region are inferior to 1.000 mm (Anuário, 2014). They were recruited from a rural public school and an urban public school. The two main features for the last groups are the facing with a natural hazard (flood or drought) and social disadvantages. The final sample size contained 312 participants. After the prospective follow-up, we did not collect data from the control groups. We specified the sample size in all analysis. Cities chosen to collect the control groups mimics the size, infrastructure and climate conditions, but do not had extreme climate events.

Table 1 presents the characteristics of children in the groups, and Table 2 shows demographic data for the adolescents. We tried to match the groups according to age, gender, and SES.

Table 1. Demographic characterization of the study children sample, and data about the equivalence between groups according to age and gender (n=184)

	Children	Gender (F/M)	Age - <i>M</i> (SD)	SES - <i>M</i> (SD)
Control without socio disadvantages I	n=46	25/21	8,80 (1,59)	34,29 (11,64)
Control with socio disadvantages II	n=50	24/26	8,86 (1,69)	18,64 (5,24) ^a
Flood group III	n=61	30/31	8,57 (1,30)	17,74 (5,43)
Drought group IV	n=27	15/12	8,63 (1,78)	12,52 (8,16) ^b
Statistics		$\chi^2 = 0,691,$ $p=0,875$	$F(3,180) = 0,39,$ $p=0,761$	$F(3,157) = 50,53, p<0,001$
Pos hoc		-	-	All were different from each other, except II=III

Note: F/M: female/male; *M*: mean; SD: standard deviation; SES: socioeconomic status. ^an=44, ^bn=21.

Inclusion criteria for the study were the written consent by the parent or a proper caregiver, the minimum age of six years old for the subjects, and the requirement to belong to the public school. Exclusion criteria were any actual or previous diagnosis of epilepsy. Six children were excluded from the study, one from the Control without SD group, three from Control with SD group, and two from Drought group.

Table 2. Demographic characterization of the adolescent sample, and data on the equivalence between groups according to gender (n=128).

	Adolescents	Gender (F/M)	Age - <i>M</i> (SD)	SES
Control without socio disadvantages I	n=42	30/12	13,55 (1,11)	31,71 (7,43) ^a
Control with socio disadvantages II	n=29	15/14	13,10 (1,11)	17,74 (5,69) ^b
Flood group III	n=23	11/12	14,52 (2,13)	13,91 (4,41)
Drought group IV	n=34	19/15	14,64 (1,69)	21,64 (7,49) ^c
Statistics		$\chi^2 = 4,618,$ $p=0,202$	F(3,123) = 7,474, p<0,001	F(3,95) = 34,223, p<0,001
Pos hoc		-	I≠III; I≠IV; II≠III; II≠IV.	I≠II; I≠III; I≠IV; III≠IV

Note: F/M: female/male; *M*: mean; SD: standard deviation; SES: socioeconomic status. ^an=24, ^bn=27, ^cn=25.

We included children with psychiatric diagnosis, e.g., depression or attention deficit hyperactivity disorder (ADHD), or in use or past use of psychoactive medication, because we planned to form a realistic sample of children exposed to natural disasters and to not exclude commonly present psychiatry disorders. A total of 17 children (5,5% of total sample) presented some health issue informed by parents, regardless of the group. Furthermore, unfortunately, as we are dealing mostly with family with low SES, it was not uncommon that parents ignored their children's diagnosis.

2.2 Assessment

2.2.1 CRIES

The Children's Revised Impact Scale (CRIES-8) is a screening tool for posttraumatic stress symptoms in children and adolescences during the last week. The scale consists of eight items, which half of them measure intrusion complaints about the stressful event, and the other half measure avoidance behavior related to the traumatic event. The Intrusion and Avoidance subscales are obtained through the sum of the respective items. The Brazilian version of CRIES was developed by Magalhães et al. (2018).

2.2.2 CBCL

The Child Behavior Checklist (CBCL) consists of 118 screening questions about behavior problem in school-aged children, from 6 to 18 years old, answered by the parent or caregiver. It comprehends the past six month's period. CBCL provides the following subscales grouped according to a superordinate category: I) internalizing problems: anxious/depressed, withdrawn-depressed, somatic complaints, social problems, thought problems, and attention problems; II) externalizing problems: rule-breaking behavior and aggressive behavior; III) total problems; IV) subscales based on DSM-IV: affective problems, anxiety problems, somatic problems, attention deficit/hyperactivity (ADH) problems, oppositional defiant problems, and conduct problems. The answers were transformed to T scores to indicate the performance of the individual in reference to normative data concerning culture (i.e., Brazilian), age and gender (Bordin, Mari, & Caeiro, 1995).

2.2.3 CCEB

The Brasil Economic Classification Criteria (CCEB) is a Brazilian tool to access and classify SES through investigation of some domestic features, like the existence and quantity of some well-being domestic items and the years of education of the family representative member. Each answer has attributed points and the final score is the sum of those values. Higher values indicate higher SES (Kamakura & Mazzon, 2013).

2.3 Statistical analysis

The Statistical Package for the Social Sciences 20.0 (SPSS) platform was used to perform statistical analysis, and the Sigma Plot 14.0 was used for graphs construction. Descriptive analysis indicated the demographic profile of the sample and the performance on mental health scales. The vast majority of data presented a normal distribution (yet 13,6% of variables had a non-normal distribution). Then, we used ANOVA, as an inferential analysis, to verify differences between groups. The differences were pointed out by Bonferroni post hoc test, and the effect size value estimated the magnitude of it through Eta Squared indices.

2.4 Procedures

The typical procedure for the beginning of the data collection was local contact, sometimes with public authority like the municipal secretary of education and school principal, to explain the research, its aims, and procedures. After the formal contact with the school or social service, we invited parents to engage in our study. As we were enrolling minors, both parents and children/adolescence read the term of participation and adults gave written informed consent and youth assigned the assent term.

The local ethics committee approved all procedures of this study under the registration number CAAE: 26886814.9.0000.5149. We interviewed parents at one time and then separately the child. Both interviews occurred in one meeting that lasted around 90 minutes because other measures beyond those described and analyzed here were also obtained. At the prospective follow-up, we re-evaluated the child's mental health. The follow-up to flood condition was after 14 months, and to drought condition was after 17 months. However, the control groups did not have a second evaluation due to the project's budget constraints and staff restrictions.

3. Results

3.1 Disaster experience

All family participants in the Flood group declared to be affected by the 2015 flood. Nearly 60% of the families were displaced from their home, and more than half were unsheltered. A third had definitive property losses, 20% had any physical injury (e.g., cuts on inferior members, leptospirosis, dengue fever, virosis). No families lost relatives, although pets and chickens or other domestic animals were lost or dead. Approximately 14% reported a loss of material income or means of income. Almost half did not have access to public health services in the aftermath, and many disclaimed the lack of access for proper medication, hygiene items, clean water provision, food, public transportation, waste management, light and water supplies. The vast majority of families need to evacuate from their home, although not all of them had time to pack their things properly. They reported feeling scared and in danger. Social support was not the central assistance provided, in contrast to public assistance that provides shelter, transport to mobile and home appliances, food, and cleaning kit. For more than 80% of the Flood group's families, a flood incident had already occurred before. Youth from

Flood group reported being scared (73%), believe to be in risk of death (79%), and a third witnessed injured people as consequence of flood. Most children had suspended classes in school and almost all watched televised coverage of the disaster.

Families from the Drought group had water supplied by general public services and/or artesian well – it is not uncommon that a family had more than one water source. The city had implemented a water rationing program that provided water day on-day off for the community, although just about 72% of families declared being affected by the drought. More than a third of the interviewees reported facing health problems due to drought-related conditions (e.g., kidney stones, respiratory and allergic problems). The majority of families reported a loss of crops. Social support was less evident than public support to deal with the drought. Many families were enrolled for the minimal wage program and other public income programs to help overcome agriculture losses or to obtain facilitated public loan. The majority of families reported the feeling of being in danger due to drought conditions. The concern about drought and scarcity of water was reported for almost our entire youth sample, as well as the feeling of danger due to water scarcity. They valued water as having the utmost importance for their daily survival. More than half affirmed that the actual drought conditions interfered with their plans for the future, even the notion of future was attached to water.

The majority of the families from the Control with SD group did not have previous experience of flood or drought events, except 11% of them. However, almost half reported some stressful life experience like the traumatic death of a family member, domestic violence, parents' divorce. Data regarding previous adverse experience was not collected from the Control without SD group.

3.2 Mental health at time point 1

At first sight, the analysis did not indicate significant differences between groups according to mental health parameters complied with the CBCL answers. Table 3 represented the data for children and Table 4 for adolescents. For children, significant differences were achieved for the domain of anxiety problems, but only between the control groups, somatic problems differences were found in the Control with SD group and Flood's, and the domain of ADH problems was distinctive between Control with SD, Control without SD and Flood groups. All those differences exhibited small effect

sizes, and differences can be examined in Figure 1. We did not find any significant differences between gender within flood's and drought's children ($p > 0,05$) except for a difference in rule-breaking behavior for drought's female children who scored more in this domain ($F=10,06$, $p=0,005$).

However, more significant differences with medium effect sizes were observed for the adolescent groups. Control with SD group exhibits more complains of anxious/depressed, withdraw/depressed, attention problems, total problems, anxiety problems, and ADH problems behaviors (see Table 4). The significant differences between groups were plotted (see Fig. 2). For the adolescent Flood group, we found differences between genders in CBCL scores in the domains of internalizing problems ($F=10,00$, $p < 0,006$), externalizing problems ($F=15,93$, $p=0,001$), and oppositional defiant problems ($F=4,47$, $p=0,05$); female adolescents scored higher in all the domains. For drought's older group, significant sex-differences were found for internalizing problems ($F=4,993$, $p=0,39$) and externalizing problems ($F=4,743$, $p=0,044$), and female displayed higher scores.

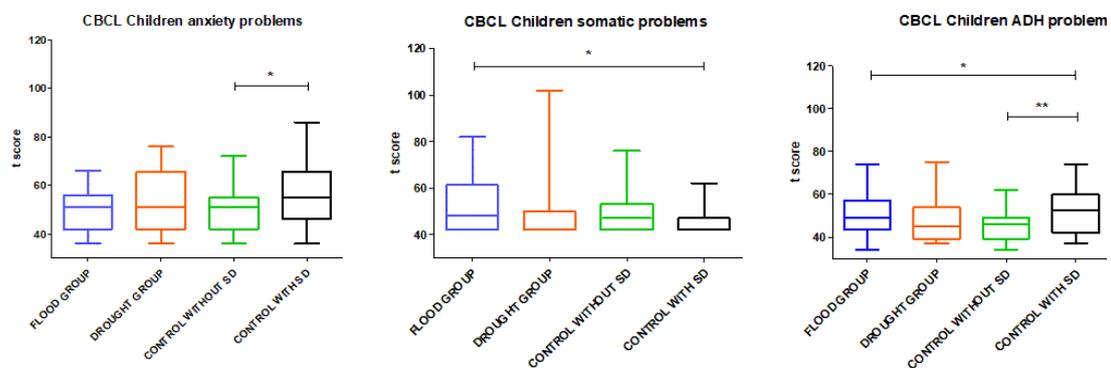


Figure 1.Comparative differences in CBCL t scores between groups, for children subjects. (Note: SD: social disadvantage, * $p < 0,05$, ** $p < 0,01$)

Table 3. CBCL t scores for children, according to the group, and analysis of differences between them.

CBCL	Control without socio disadvantages (I)	Control with socio disadvantages (II)	Flood group (III)	Drought group (IV)	Statistics	Pos hoc	Effect size
	Children (n=36)	Children (n=40)	Children (n=44)	Children (n=21)			
Anxious depressed	53,06 (10,43)	56,20 (11,82)	54,11 (9,86)	52,33 (11,94)	F (3,137) = 0,786, p=0,504	-	-
Withdraw depressed	43,92 (7,44)	49,40 (9,71)	47,02 (9,62)	47,33 (11,41)	F (3,137) = 2,152, p=0,097	-	-
Somatic complaints	48,64 (8,73)	47,48 (6,72)	51,45 (10,42)	47,43 (12,25)	F (3,137) = 1,566, p=1,566	-	-
Social problems	48,19 (7,62)	49,03 (9,53)	49,95 (8,20)	46,10 (10,73)	F (3,137) = 0,955, p=0,416	-	-
Thought problems	49,64 (10,08)	53,15 (12,16)	50,77 (11,07)	52,57 (14,29)	F (3,137) = 0,685, p=0,563	-	-
Attention problems	45,69 (7,96)	50,88 (10,78)	49,27 (9,89)	47,62 (11,07)	F (3,137) = 1,876, p=0,137	-	-
Rule-breaking behavior	45,06 (4,60)	45,38 (4,85)	46,68 (6,94)	45,19 (5,66)	F (3,137) = 0,699, p=0,554	-	-
Aggressive behavior	48,00 (6,90)	53,52 (10,11)	50,43 (10,51)	49,38 (9,70)	F (3,137) = 2,296, p=0,080	-	-
Internalizing problems	48,58 (8,35)	51,70 (9,74)	51,27 (8,80)	49,05 (12,67)	F (3,137) = 0,930, p=0,428	-	-
Externalizing problems	45,50 (6,74)	50,53 (9,63)	48,61 (11,41)	46,62 (7,81)	F (3,137) = 2,036, p=0,112	-	-
Total problems	47,06 (7,12)	51,73 (8,57)	50,23 (8,48)	47,81 (12,09)	F (3,137) = 2,129, p=0,099	-	-
Affective problems	46,91 (6,88)	47,08 (7,54)	48,61 (6,87)	45,43 (12,75)	F (3,137) = 0,798, p=0,497	-	-
Anxiety problems	48,86 (8,75)	55,70 (12,25)	49,82 (9,60)	53,05 (12,84)	F (3,137) = 3,249, p=0,024	I≠II	0,258 (small)
Somatic problems	48,92 (8,92)	44,95 (5,52)	51,82 (11,52)	47,86 (13,55)	F (3,137) = 3,430, p=0,019	II≠III	0,264 (small)
ADH problems	45,03 (6,61)	52,70 (10,38)	50,86 (10,27)	47,71 (11,42)	F (3,137) = 4,530, p=0,005	I≠II; I≠III	0,3 (medium)
Oppositional defiant problems	49,44 (8,50)	51,03 (10,89)	49,80 (12,08)	49,14 (11,06)	F (3,137) = 0,202, p=0,895	-	-
Conduct problems	45,31 (5,08)	46,55 (6,78)	47,80 (8,03)	45,62 (4,26)	F (3,137) = 1,109, p=0,348	-	-

Note: ADH: Attention Deficit Hyperactivity

Table 4. CBCL t score for adolescents, according to the group, and analysis of differences between them.

CBCL	Control without socio disadvantages (I)	Control with socio disadvantages (II)	Flood group (III)	Drought group (IV)	Statistics	Pos hoc	Effect size
	Adolescents (n=31)	Adolescents (n=27)	Adolescents (n=19)	Adolescents (n=19)			
Anxious depressed	55,06 (16,23)	65,33 (13,28)	55,21 (12,61)	55,26 (11,45)	F(3,92) = 3,479, p=0,019	I≠II	0,319 (medium)
Withdraw depressed	43,06 (9,16)	51,93 (12,41)	52,37 (15,46)	46,37 (10,37)	F(3,92) = 3,808, p=0,013	I≠II; I≠III	0,332 (medium)
Somatic complaints	49,00 (8,91)	47,11 (9,48)	47,84 (11,44)	45,42 (7,04)	F(3,92) = 0,609, p=0,611	-	-
Social problems	48,87 (9,11)	54,59 (13,95)	50,68 (8,75)	47,84 (9,01)	F(3,92) = 1,970, p=0,124	-	-
Thought problems	50,03 (8,08)	52,67 (12,22)	52,11 (10,59)	49,47 (7,93)	F(3,92) = 0,583, p=0,628	-	-
Attention problems	45,61 (8,41)	54,89 (11,43)	50,68 (9,36)	45,58 (8,36)	F(3,92) = 5,739, p=0,001	I≠II; II≠IV	0,397 (medium)
Rule-breaking behavior	47,32 (7,41)	45,96 (7,99)	44,89 (4,59)	43,74 (3,05)	F(3,92) = 1,343, p=0,265	-	-
Aggressive behavior	52,81 (13,71)	57,07 (10,49)	52,42 (10,82)	50,58 (8,85)	F(3,92) = 1,389, p=0,251	-	-
Internalizing problems	59,35 (14,00)	63,52 (10,25)	59,95 (16,47)	54,26 (11,57)	F(3,92) = 1,851, p=0,143	-	-
Externalizing problems	55,65 (14,53)	55,74 (13,16)	51,95 (12,07)	48,58 (9,59)	F(3,92) = 1,590, p=0,197	-	-
Total problems	49,19 (10,73)	55,85 (9,08)	51,26 (9,16)	47,63 (8,48)	F(3,92) = 3,470, p=0,019	II≠IV	0,319 (medium)
Affective problems	47,77 (10,31)	51,04 (11,00)	51,26 (13,19)	45,68 (9,69)	F(3,92) = 1,277, p=0,287	-	-
Anxiety problems	52,52 (14,51)	64,26 (13,40)	50,74 (11,18)	52,32 (10,70)	F(3,92) = 5,960, p=0,001	I≠II; II≠III; II≠IV	0,403 (medium)
Somatic problems	49,03 (8,98)	44,33 (7,40)	48,24 (11,85)	42,63 (6,33)	F(3,92) = 2,876, p=0,040	-	-
ADH problems	47,29 (9,30)	55,33 (11,96)	48,79 (9,80)	47,05 (8,57)	F(3,92) = 3,883, p=0,012	I≠II; II≠IV	0,335 (medium)
Oppositional defiant problems	52,74 (12,25)	55,74 (13,44)	52,26 (13,62)	48,16 (10,35)	F(3,92) = 1,365, p=0,258	-	-
Conduct problems	47,48 (9,50)	47,26 (10,43)	45,32 (7,77)	43,63 (4,32)	F(3,92) = 0,976, p=0,407	-	-

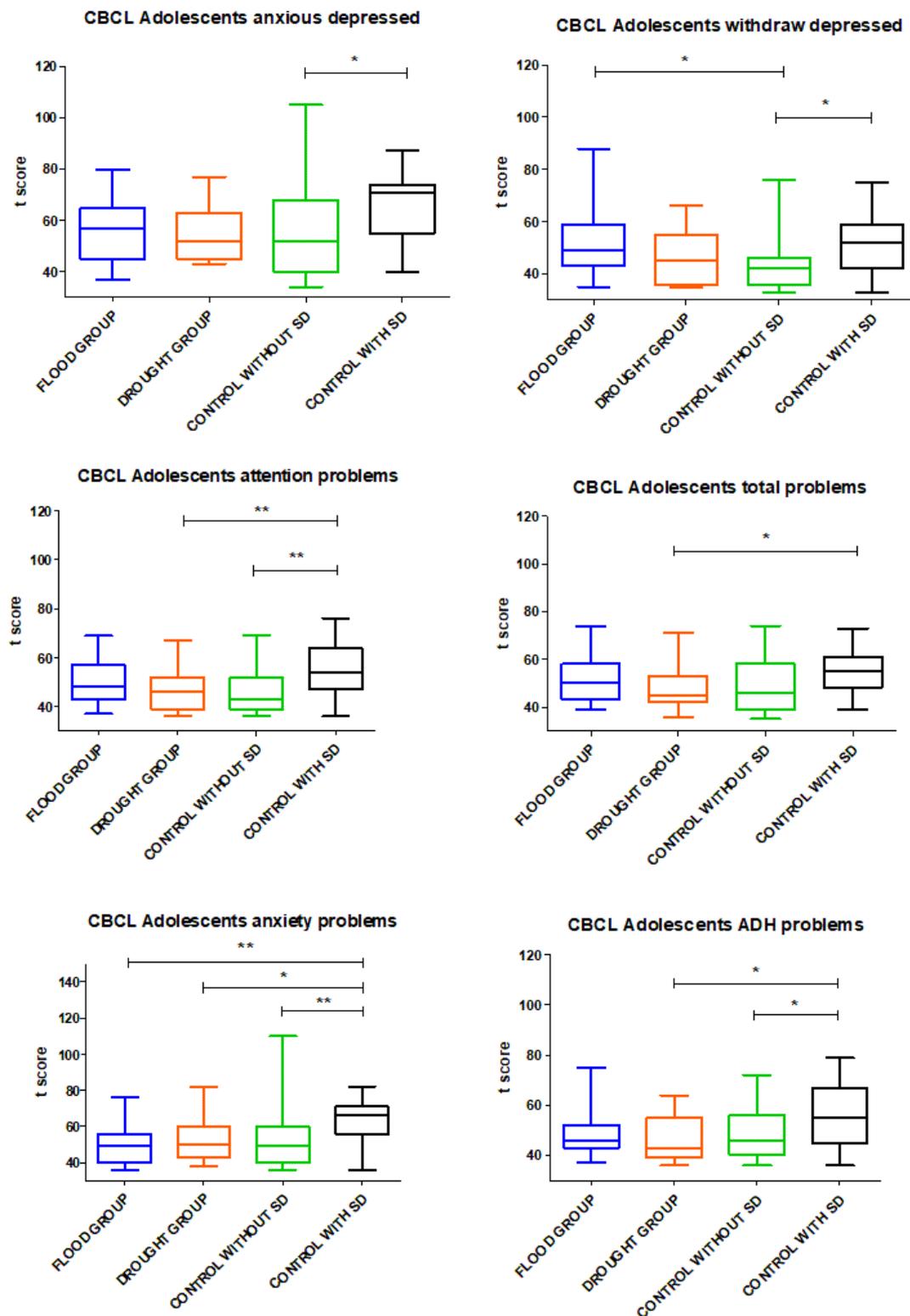


Figure 2. Comparative differences in CBCL t scores between groups, for adolescents subjects. (Note: SD: social disadvantage, ADH: Attention Deficit Hyperactivity, * $p < 0,05$, ** $p < 0,01$)

Additionally, CRIES scores provided significant differences related to PTSS. Table 5 displays the data for children and Table 7 for the adolescents' sample. Children from the Flood group presented the higher scores for intrusion and avoidance behavior related to the natural hazard and total score of CRIES. The same pattern can be observed for the older child. Youth from Drought group did not significantly differ from the control groups.

Table 5. Posttraumatic Stress Symptoms in children, according to CRIES, and differences between groups.

CRIES	Control without socio disadvantages I	Control with socio disadvantages II	Flood group III	Drought group IV	Statistics	Pos hoc	Effect size
	Children (n=46)	Children (n=50)	Children (n=54)	Children (n=25)			
Intrusion	3,85 (5,20)	2,32 (3,65)	7,28 (5,42)	3,56 (4,44)	F(3,171) = 10,164, p<0,001	III≠I; III≠II; III≠IV	0,389 (medium)
Avoidance	5,65 (5,95)	2,38 (3,31)	10,37 (5,19)	4,04 (4,95)	F(3,171) = 24,578, p<0,001	I≠II; III≠I; III≠II; III≠IV	0,549 (large)
Total	9,50 (10,30)	4,70 (6,65)	17,65 (9,27)	7,60 (8,47)	F(3,171) = 20,244, p<0,001	I≠II; II≠III; III≠I; III≠IV	0,512 (large)

The results provided by CRIES can also be seen in Figure 3. If we considered the cut-off score of 17 reported by Perrin et al. (2005) to positive screening for PTSD, we verified the following prevalence among individuals: 57,4% of children from Flood group; 94,7% of adolescents from Flood group; 16,0% of children from Drought; 23,5% of adolescents from Drought; 21,7% of children from Control without SD; 21,4% of adolescents from Control without SD; 6,0% of children from Control with SD; 17,9% of adolescents from Control with SD.

Table 6. Posttraumatic Stress Symptoms in adolescents, according to CRIES, and differences between groups.

CRIES	Control without socio disadvantages I	Control with socio disadvantages II	Flood group III	Drought group IV	Statistics	Pos hoc	Effect size
	Adolescents (n=42)	Adolescents (n=28)	Adolescents (n=19)	Adolescents (n=34)			
Intrusion	4,07 (6,05)	3,96 (4,80)	11,74 (4,29)	6,88 (5,12)	F(3,119) = 11,037, p<0,001	I≠III; II≠III; III≠IV	0,467 (medium)
Avoidance	4,52 (5,79)	3,96 (5,66)	12,11 (4,53)	5,53 (4,72)	F(3,119) = 10,912, p<0,001	I≠III; II≠III; III≠IV	0,464 (medium)
Total	8,60 (10,95)	7,93 (10,17)	23,84 (6,78)	12,41 (7,92)	F(3,119) = 13,530, p<0,001	I≠III; II≠III; III≠IV	0,504 (large)

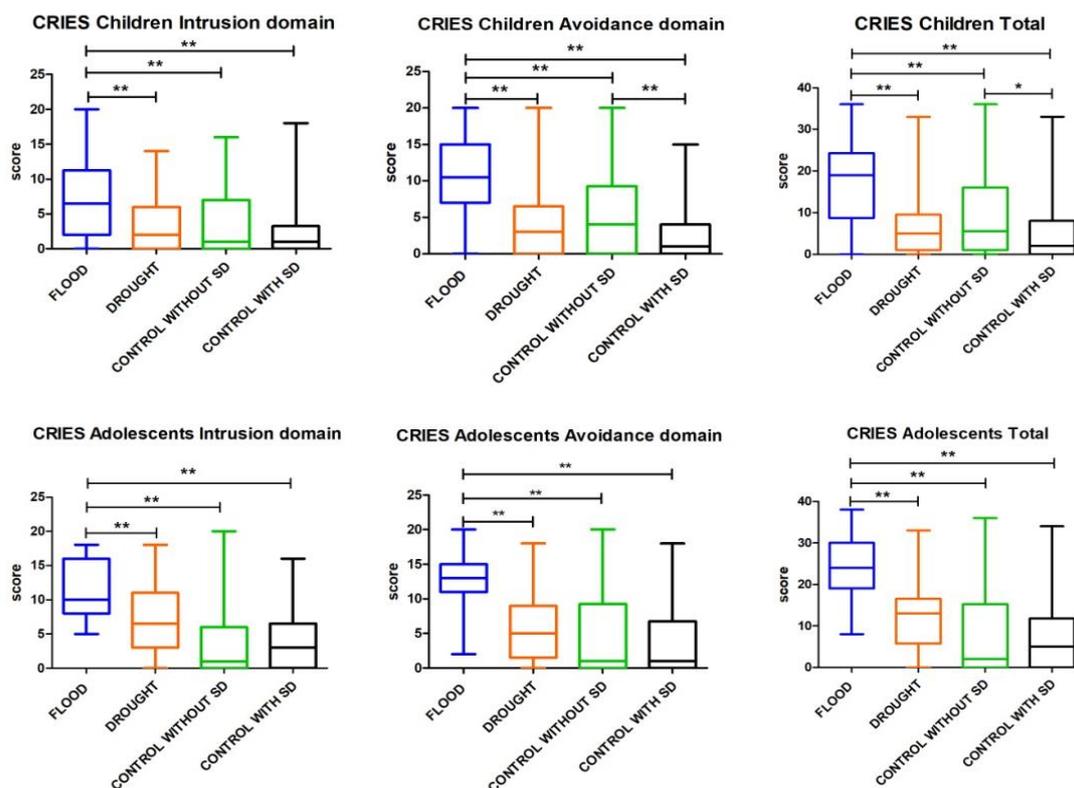


Figure 3. Comparative differences in CRIES scores between groups. Upper panel exhibits data for children subjects, and low panel for adolescents participants. (Note: SD: social disadvantage, * $p < 0,05$, ** $p < 0,01$).

To better characterize the experience of disaster, we correlate qualitative parameters with CRIES outcomes. For both natural hazards groups, the feeling of being

in danger did not correlate with any CRIES measures. On the other hand, for children from the Drought group, their concern about his/her own future significant correlate with the total score of CRIES ($r=0,41$, $p<0,05$). To adolescents from the same group, this distress correlates with the CRIES avoidance score ($r=0,37$, $p<0,05$).

3.3 Mental health at time point 2

After 14 months for Flood group and after 17 months for Drought group, we conducted a prospective follow-up. Parents answered the CBCL again for mental health screening during the past six months, and children responded the CRIES according to the natural hazard they were/are exposed.

Table 7 presents the results for CBCL scores in the Flood group and the comparison with data from time point 1. For children, we found significant differences in the following domains: somatic complaints, social problems, thought problems, attention problems, total problems, somatic problems, and ADH problems. All of it decreased over time and effect sizes were medium to large.

For adolescents in the Flood group, more CBCL domains were pronounced distinctive between time points, i.e., with large effect sizes. We found a decrease in behavior complaints in the following categories: anxious-depressed, attention problems, aggressive behavior, internalizing problems, externalizing problems, total problems, affective problems, ADH problems, and oppositional defiant problems. The results described above can be more easily visualized in Figure 4.

Table 7. CBCL scores at the prospective follow up for the Flood group (children and adolescents), after 14 months, and the comparison between times points 1 and 2.

CBCL	Flood group					
	Children (n=39)	Comparison with time 1	↔↑↓ Effect sizes	Adolescents (n=12)	Comparison with time 1	↔↑↓ Effect sizes
Anxious depressed	52,10 (10,44)	p=0,237	↔	45,37 (6,14)	p=0,030	↓ 0,6 (large)
Withdraw depressed	45,79 (7,41)	p=0,623	↔	45,31 (8,21)	p=0,091	↔
Somatic complaints	45,49 (7,90)	p=0,002	↓ 0,551 (large)	41,94 (8,43)	p=0,135	↔
Social problems	46,26 (6,05)	p=0,007	↓ 0,496 (medium)	45,31 (9,86)	p=0,276	↔
Thought problems	47,31 (5,88)	p= 0,043	↓ 0,385 (medium)	45,00 (6,95)	p=0,163	↔
Attention problems	46,56 (8,74)	p=0,020	↓ 0,436 (medium)	43,81 (7,99)	p=0,016	↓ 0,654 (large)
Rule- breaking behavior	44,36 (5,69)	p=0,065	↔	43,56 (3,74)	p=0,897	↔
Aggressive behavior	48,54 (8,48)	p=0,124	↔	44,13 (9,67)	p=0,018	↓ 0,643 (large)
Internalizing problems	48,36 (8,06)	p=0,055	↔	49,00 (10,51)	p=0,052	↓ 0,549 (large)
Externalizing problems	45,95 (8,71)	p=0,162	↔	44,06 (11,29)	p=0,049	↓ 0,555 (large)
Total problems	46,46 (7,00)	p=0,002	↓ 0,552 (large)	42,19 (7,19)	p=0,004	↓ 0,74 (large)
Affective problems	46,15 (6,62)	p=0,195	↔	41,19 (6,35)	p=0,009	↓ 0,688 (large)
Anxiety problems	49,44 (10,14)	p=0,585	↔	44,31 (9,99)	p=0,102	↔
Somatic problems	45,64 (8,07)	p=0,006	↓ 0,506 (large)	42,12 (9,20)	p=0,107	↔
ADH problems	47,46 (8,81)	p=0,016	↓ 0,451 (medium)	42,13 (7,64)	p=0,012	↓ 0,672 (large)
Oppositional defiant problems	47,69 (9,72)	p=0,111	↔	45,25 (12,17)	p=0,040	↓ 0,574 (large)
Conduct problems	45,36 (6,28)	p=0,111	↔	43,06 (3,68)	p=0,361	↔

Note: ↔: stability with no significant change; ↑: significant increase; ↓: significant decrease.

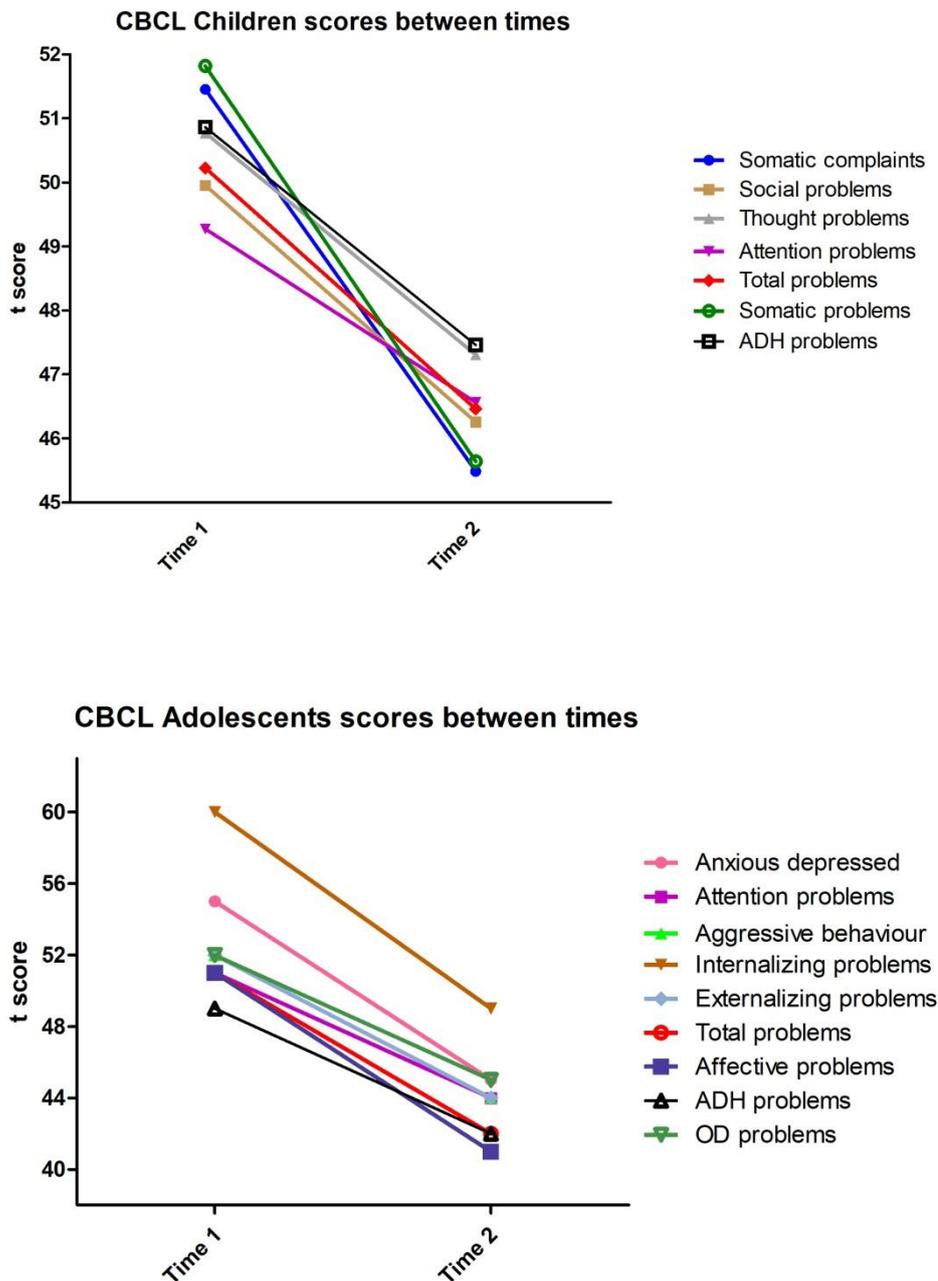


Figure 4. Significant differences in CBCL scores for Flood group, according to age group, and with 14 months of interval between evaluations. (For p value, consult Table 7).

About PTSS in the Flood group, CRIES scores for children did not statistically change over time. However, the mean score for the group is below the cut-off point of 17. For adolescents, we found a significant decrease in those symptoms. The results can be found in Table 8 and Figure 5. Considering the cut off value of 17 (Perrin et al., 2005), the prevalence at time point 2 of PTSD related to the natural disaster was the

following: 45,6% of children from Flood group; 36,3% of adolescents from Flood group; 23,8% of children from Drought group; and 39,1% of adolescents from Drought group.

Table 8. CRIES scores at the prospective follow up for the Flood group (children and adolescents), and the comparison between times points 1 and 2.

CRIES	Flood group					
	Children (n=46)	Comparison with time 1	↔↑↓ Effect size	Adolescents (n=11)	Comparison with time 1	↔↑↓ Effect size
Intrusion	6,72 (5,23)	p=0,244	↔	6,91 (6,49)	p=0,017	↓ 0,669 large
Avoidance	9,04 (5,29)	p=0,076	↔	8,36 (4,91)	p=0,047	↓ 0,583 large
Total	15,76 (8,88)	p=0,088	↔	15,27 (9,90)	p=0,002	↓ 0,787 large

Note: ↔: stability with no significant change; ↑: significant increase; ↓: significant decrease.

The results of the follow up for the Drought group are presented in Table 9 which shows data from CBCL scores and Table 10 which exhibits data for CRIES. For children subgroup, we did not find any significant difference between the CBCL scores at the two evaluations. For adolescents, we found a significant increase in anxiety problems complaints.

For PTSS, we found the stability of complaints for the adolescent Drought subgroup, and a significant increase pattern of complaints in avoidance domain and for the total score of CRIES for children, although none of the mean scores of groups reached the cut-off of 17 points (see Table 10 and Figure 5).

Table 10. CRIES scores at the prospective follow up for the Drought group (children and adolescents), and the comparison between times points 1 and 2.

CRIES	Drought group					
	Children (n=21)	Comparison with time 1	↔↑↓ Effect size	Adolescents (n=23)	Comparison with time 1	↔↑↓ Effect size
Intrusion	6,05 (5,74)	p=0,109	↔	8,04 (5,68)	p=0,948	↔
Avoidance	6,71 (4,16)	p=0,044	↑ 0,455 (medium)	6,43 (5,70)	p=0,623	↔
Total	12,76 (7,48)	p=0,033	↑ 0,479 (medium)	14,48 (8,89)	p=0,757	↔

Note: ↔: stability with no significant change; ↑: significant increase; ↓: significant decrease.

Table 9. CBCL scores at the prospective follow up for the Drought group (children and adolescents), after 17 months, and the comparison between times points 1 and 2.

CBCL	Drought group					
	Children (n=21)	Comparison with time 1	↔↑↓ Effect size	Adolescents (n=19)	Comparison with time 1	↔↑↓ Effect size
Anxious depressed	54,33 (13,00)	p=0,858	↔	59,58 (10,89)	p=0,092	↔
Withdraw depressed	49,62 (10,92)	p=0,393	↔	49,21 (11,57)	p=0,201	↔
Somatic complaints	44,71 (7,69)	p=0,116	↔	50,37 (20,04)	p=0,264	↔
Social problems	49,57 (13,87)	p=0,527	↔	49,95 (8,55)	p=0,575	↔
Thought problems	47,71 (6,99)	p=0,091	↔	49,84 (9,79)	p=0,814	↔
Attention problems	48,71 (12,20)	p=0,943	↔	47,00 (6,83)	p=0,936	↔
Rule-breaking behavior	43,33 (4,12)	p=0,193	↔	43,79 (3,39)	p=0,470	↔
Aggressive behavior	49,38 (11,92)	p=0,598	↔	50,05 (6,76)	p=0,245	↔
Internalizing problems	52,62 (16,23)	p=0,457	↔	61,00 (11,78)	p=0,071	↔
Externalizing problems	47,57 (11,67)	p=0,929	↔	49,16 (9,61)	p=0,261	↔
Total problems	47,90 (10,45)	p=0,496	↔	49,84 (6,78)	p=0,332	↔
Affective problems	46,38 (11,58)	p=0,723	↔	53,05 (20,17)	p=0,102	↔
Anxiety problems	54,00 (12,57)	p=0,743	↔	59,89 (11,93)	p=0,012	↑ 0,629 (large)
Somatic problems	44,71 (6,87)	p=0,154	↔	43,58 (7,62)	p=1,000	↔
ADH problems	50,00 (12,49)	p=0,657	↔	47,42 (6,97)	p=0,715	↔
Oppositional defiant problems	47,24 (12,01)	p=0,224	↔	50,74 (9,23)	p=0,799	↔
Conduct problems	44,95 (7,74)	p=0,826	↔	43,16 (3,58)	p=0,332	↔

Note: ↔: stability with no significant change; ↑: significant increase; ↓: significant decrease.

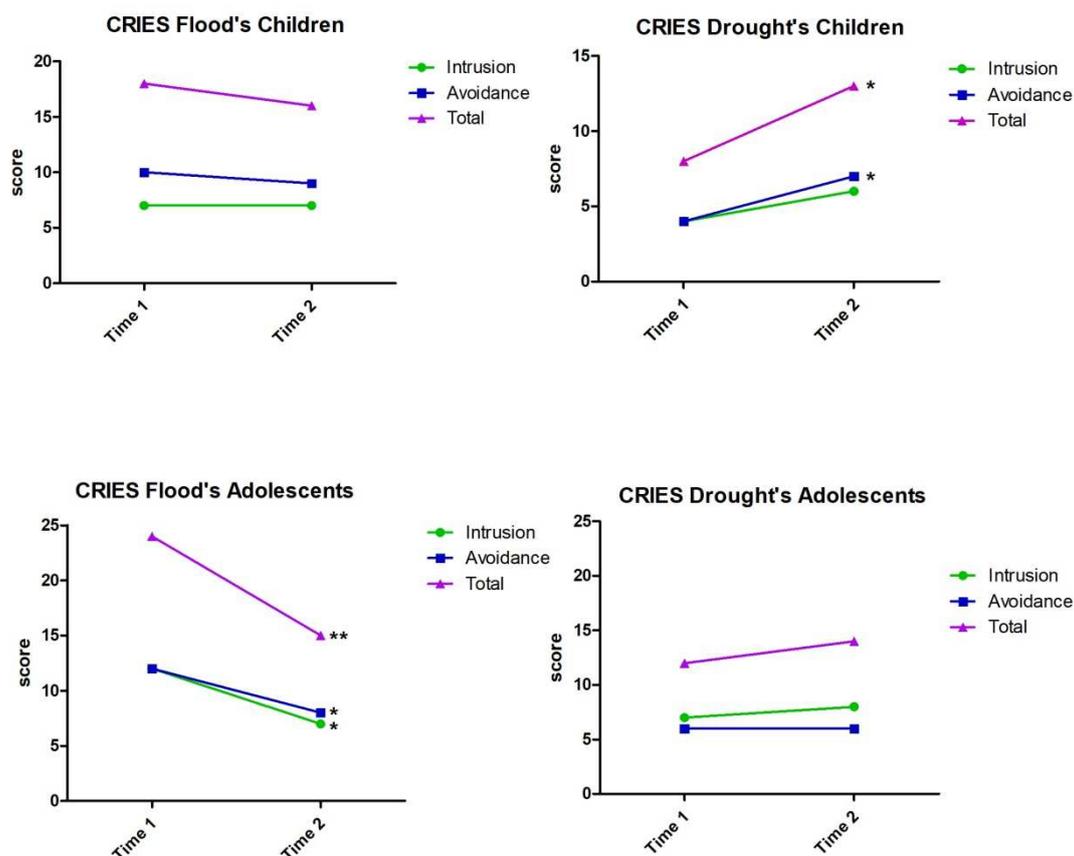


Figure 5. CRIES scores between the two time points evaluations for both natural hazards groups and age groups. (Note: * $p < 0,05$, ** $p < 0,01$)

3.4 CRIES scores according to condition, age and sex

Following literature reports of sex differences in PTSS, we compared the scores for female and male individuals in each group, at different ages, and the two time points. For Flood group, we only found significant differences in avoidance ($F(1,52) = 4,965$, $p=0,030$) and total score ($F(1,52) = 5,465$, $p=0,023$) for children in the first evaluation. Female children reported more symptoms than male children. In Drought group, differences were achieved only for adolescents in the second evaluation and all CRIES domains presented significant differences and female subjects had higher scores than male's (Intrusion: $F(1,21) = 8,013$, $p=0,010$; Avoidance: $F(1,21) = 4,637$, $p=0,043$; Total: $F(1,21) = 12,329$, $p=0,002$). No significant differences were observed for the control groups. Specific data about this analysis can be consulted at Supplementary material (Table S1).

4. Discussion

In this study, we addressed the mental health impact of climate change related disasters on youth through evaluation of general behavior problems and PTSS on children and adolescent exposed either to flood or drought conditions. We also followed up the trajectories of disaster related symptoms over a year after the first evaluation. All events happened in Brazil and the conditions were very similar to disasters elsewhere in middle-income developing countries (CRED, 2018).

Vulnerability represents the interaction between risk and protective factors that determine whether an individual exhibits adverse mental health outcome in response to an extreme event (Balbus & Malina, 2009). Youth is a vulnerable group to suffer adverse effects of extreme weather events. The rationale, as previously noted, include their initial developing coping capacity, limited capacity to independently mobilize resources to assist them, a higher dependency of a caregiver, developmental timing and sensitive period of development (Abramson et al., 2010).

In a developing country, climate change is a topic already familiar to most children and adolescents, indeed with different levels of knowledge. They expressed concern, interest, and some of them exhibited worry, fear, employment and economic concerns, and anxiety about their future lives in a climate-changing world, including the belief that the world may end soon. Such prospects led researchers to consider climate change as a “stressor” for youth, even when the impacts were not direct (Burke, Sanson, & Hoorn, 2018).

4.1 Disaster experience

All children from the Flood group were direct or indirect affected by the 2015 flood in Rio Branco city, and the vast majority of them had been previously exposed to a flood incident. Whereas not all families from the Drought group reported being affected by droughts, we do observe indirect impact in all of them, since water distribution by the public agency has already been rationed during all year due to the scarcity of this natural resource. In addition, physical drought-related health problems were already being reported by families. Other consequences like crops loss and the need for public social support was also observed (Alpino, Sena, & Freitas, 2016; Clayton, Manning, & Hodge, 2014; Zhong et al., 2018). Although impacted by drought,

families did not recognize it. Howe et al. (2014) described the need of at least 25 weeks of severe drought conditions in order to the majority of people report the experience of a drought event. Drought disaster and its impacts are so common that makes it difficult to reach proper allocation of needed resources and community engagement in preventive and mitigation actions.

4.2 Mental health at time point 1

Youth just exposed to disasters present a higher risk for developing an extensive set of responses, including PTSS, depression, anxiety, phobias, sleep disorders, attachment disorders, aggression, functional impairment, substance use, suicidal ideation and behaviors, risk-taking behaviors, physical health problems or other mental health disturbances (Burke, Sanson, & Hoorn, 2018; Castellanos et al., 2003; Kar, 2009; Kletter et al., 2013). Usually, internalizing symptoms are more common than externalizing ones (Felix et al., 2011). In consequence, a cascade of interference may disrupt children's emotion regulation, behavioral control, cognition, learning, language development, and academic performance which in turn can influence adverse mental health outcomes in adulthood (Burke, Sanson, & Hoorn, 2018; Stoddard Jr, 2014). The prevalence of mental health symptoms in children exposed to disaster can be 44 to 104% superior to pre-disaster baseline, up to two years after the incident (Roberts et al., 2010).

The contribution of age to the prevalence of mental health complaints after a disaster is also an ongoing debate. Younger age was reported as a predictor of a worse outcome by Bokszczanin (2007), Chen et al. (2002), McDermott et al. (2005), Lieber et al. (2017), Piyavhatku et al. (2008). Yet, old age was considered a negative predictor of mental health complaints (Adams et al. (2014), Carpenter et al. (2015), Fan et al. (2011), Green et al. (1991), Liu et al. (2016), Thienkrua et al. (2006), Tian et al. (2013), Zhang et al. (2015), Furr et al. (2010)). Last, the third scenario in which age was unrelated to the emotional and behavioral outcomes was reported by Wei et al. (2014) and Ziaaddini, Nakhaee and Behzadi (2009). Besides, Iwadare et al. (2014) working with children victim of earthquake and tsunami verified that younger children tend to improve symptoms over time, whereas older students did not.

For Masten (2014), younger children are somewhat protected by a lack of a deeper comprehension of the disaster and, they are more susceptible because of their emotional immaturity that prevent healthier responses, and sensitivity to parents' behavior in the aftermath of an extreme event (Masten & Narayan, 2012). At time point 1, children from all groups did not substantially differ in their pattern of behavioral problems. All significant differences found exhibited only small effect sizes, and the majority of them were due to a higher prevalence of anxiety and ADHD problems for those from the Control with SD group, except for the domain of somatic problems where Flood children had higher rates. However, it is highly possible that families reported any physical issues the children may exhibit regardless of the cause, overestimating this domain.

A similar configuration of results was verified for adolescents. Again, the Control with SD group scored significantly more on some CBCL domains than other groups, with medium to large effect sizes. This pattern was observed for the following domains: anxious-depressed, withdrawn depressed, attention problems, total problems, anxiety problems, and ADHD problems. However, adolescents from the Flood group rated more on withdrawn depressed problems than the Control without SD group, but did not differ from the Control with SD group. The occurrence of a non-desirable disturbance in parent monitoring could explain these findings (Poulsen et al., 2015; Stuber et al., 2005). Besides, resilient behaviors demonstrated by children also provide insights on the absence of behavioral problems measured by CBCL. Even externalizing problems, especially substance use disorder and conduct disorder, were not salient in our adolescent groups (Carliner et al., 2017).

A few studies did not find any youth mental health consequences after the experience of a disaster. For example, Thomson et al. (2016) studied children victims of an earthquake in New Zealand with data pre and 1-year post-event and verified that parents and teachers did not report any significant behavior and emotional problems in consequence of the disaster. One hypothesis to explain the absence of adverse impact is a possible change in parents and caregivers' perceptions about their children. Parent monitoring toward children after a disaster can raise (Henry, Tolan & Gor, 2004), be exacerbated in an unreal way (Bromet et al., 2000), decreased (Stuber et al., 2005) or even be distant in the sense that they do not express concern about the possible psychology consequences for children (Poulsen et al., 2015).

Another hypothesis resides on the influence of resilient behavior. After all, adverse experiences are not necessarily linked with adverse psychological responses. Most children exhibit minimal symptoms following disasters (Lai et al., 2015; La Greca et al., 2013) or even do not develop any psychopathology, instead they exhibit a continued capacity of functioning (Goldmann & Galea, 2014). Children can exhibit more resilience than adults and recover more quickly in some circumstances (Garcia & Sheehan, 2016). Resilience is the capacity of positive adaptation in the face of adversity and stressors that threaten the stability, viability, or development of a dynamic system; encompasses an effective response to maintain or regain mental health, recovering after adversity (Herrman et al., 2011; Masten & Narayan, 2012). Therefore, resilience does not implicate the absence of any initial psychological distress; instead, it refers to the ability of “bouncing back” (Goldmann & Galea, 2014). Posttraumatic growth is a concept emerged to explain positive changes and adaptive behaviors following a trauma, which includes a greater appreciation for life, improved relationship, spiritual growth, increased sense of personal strength (Pfefferbaum et al., 2012). Further, posttraumatic growth includes positive changes that occur in response to a crisis or a traumatic event, with subsequent improvement adaptation response in the context of adversity (Masten & Narayan, 2012; Yoshida et al., 2016). A child who exhibits resilience, posttraumatic growth or full recovery may show better personal resources if faced again with a future traumatic event (Noffsinger et al., 2012).

The Control with SD group exhibited the worse general mental health outcome, especially for the adolescents. Poverty and ongoing social adversity context probably account for the observed results. There is a direct relationship between drought and floods exposure and Human Development Index class (Ebi & Bowen, 2015). Poverty constitutes an essential factor in increased vulnerability to extreme events. In a context with more social vulnerabilities, a worse mental health outcome may overcome flood and drought disasters' impact, mainly because they were not an uncommon situation in both contexts. Since poverty and human development are both multifactorial, it imposes a challenge for researchers to isolate the underlying effects of them (Lipina & Colombo, 2009). Both had the potential to alter the children's socioemotional functioning and to lead to mental, emotional and behavioral problems.

The most adverse impact of disasters is circumscribed to the poorest and more vulnerable populations (World Health Organization, 2012). The more social vulnerable

a community is, the more devastating a natural hazard can become (Aitsi-Selmi & Murray, 2016). Most deaths associated with extreme weather events occur in low- and middle-income countries, and there resides the majority of the global youth population, about 85% of them (Burke, Sanson, & Hoorn, 2018; Garcia & Sheehan, 2016). As a sub-acute hazard, drought may impact youth to a greater extent in indirectly ways (Hayes et al., 2018), undetectable by screening tests like CBCL. Vins et al. (2015), indicated that the primary pathway connecting drought and mental health is via the economic impact of land degradation. Consequences in economic structure, such as availability of job offers, income insecurity, and disruption in physical and social infrastructure, influence mental health in the long term or with earlier subthreshold symptoms.

Improvement in family income is directly linked to reduced risk for child psychopathology, especially conduct and oppositional disorder (Costello et al., 2013). But emotional symptoms like anxiety and depression were unaffected by the increase of the family income. In our results, differently from stated above, adolescents from the Control with SD group had worse outcomes in the domain of emotional symptoms. We raise two possibilities to explain our findings. First, the pattern obtained was due to another factor beyond poverty or, second, psychological and social situations impact more in mental health than socioeconomic status. Indeed, a Brazilian study about mental health, well-being, and poverty with adults from a drought environment reported that income did not significantly influence the perceived well-being of the analyzed sample (Nepomuceno et al., 2016). However, this issue is still in need of deeper discussion.

Differences between male and female subjects were not observed among younger children, except for rule-breaking behavior which female children exhibited higher scores than males. However, those differences were found in older participants in both disaster-related groups. Differences were observed for internalizing and externalizing problems in both Flood and Drought groups, and also for oppositional defiant problems, although the last one was found only within the Flood group. In all domains, females scored higher than their counterpart males. Internalizing symptoms are usually more frequent in female subjects and externalizing problems in male adolescents (Liao et al., 2014). Our results indicated that female adolescents scored

higher than males in both disaster groups for any symptom. Therefore, females might share their distress or somehow made it more accessible for parents to perceive it.

Sex differences in PTSS are controversial. Some studies found no effect of gender (Demir et al., 2010; Jin, Liu, & Guan, 2015; Lau et al., 2010, Lieber, 2017), whereas others reported more symptoms in girls (Bokszczanin, 2007; Fan et al., 2011; Furr et al., 2010; Green et al., 1991; Kiliç, Özgüven, & Sayil, 2003; Liu et al., 2006; Overstreet et al., 2010; Ziaaddini et al., 2009). However, this is not a consensus; see Banon et al. (2009) or Ekşi et al. (2007) for a preponderance of PTSS in male subjects. In the absence of pre-disaster data, caution is needed for not to infer sex-effect on post-disaster symptomatology, as it may reflect a standard normative difference found in the healthy population (Masten & Narayan, 2012).

Sex differences in PTSS in the first evaluation were verified only in children from the Flood group. The intrusion domain did not differentiate the groups, only avoidance and total scores. Female children scored higher in latter domains. In the second evaluation, no differences between sexes were observed for PTSS from the Flood group. Though, differences for adolescents from the Drought group were observed with higher scores presented by females. PTSS is usually preponderant in female subjects and our data endorsed this finding (Bokszczanin, 2007; Fan et al., 2011; Furr et al., 2010; Green et al., 1991; Kiliç, Özgüven, & Sayil, 2003; Liu et al., 2006; Overstreet et al., 2010; Ziaaddini et al., 2009). To be a younger female conferred small to moderate risk factor to develop PTSD in a meta-analysis by Trickey et al. (2012).

Parents may not report concerns about their children mental health symptoms, even if the child is within the severe range for PTSS (Poulsen et al., 2015). Other possible explanation for the apparent divergence between CBCL symptoms prevalence and CRIES scores may be under the assumption that symptoms of PTSD may be more representative of the internalizing experience in face of a disaster. Parent condition and family functioning (Feo et al., 2014) promote biased circumstances related to children's observation. CRIES scores provided some interesting insights about youth reaction in response to the disaster.

As the preponderant response after an extreme event (Goldmann & Galea, 2014), PTSS scores differentiate the groups. A meta-analysis of risk factors for PTSD in youth conducted by Trickey et al. (2012) verified that PTSD outcome in children and adolescents is mostly a reaction to the specificities of the event, instead of previous

functioning or experience. The Flood group presented the higher rates of intrusion and avoidance symptoms, and also higher total CRIES score. Flood incidents seem to be more disturbing and to elicit more post-event PTSS than drought's, or even to other everyday stressors that a child can be exposed in a context of social disadvantage. Flood is considered an acute hazard and it is more related to direct mental health consequences (Hayes et al., 2018)

The prevalence of PTSD rates varies significantly among studies (De Young, Kenardy, & Cobham, 2011; Salmon & Bryant, 2002). It ranges from 5% to 30% (Burke, Sanson, & Hoorn, 2018; Salmon & Bryant, 2002), but can reach even 60,8% of exposed youth (Liu et al., 2010). Prevalence rate of probable PTSD in our study was significant higher for the Flood group (57,4% of children and 94,7% of adolescents), compared to the Drought group (16,0% of children and 23,5% of adolescents), the Control without SD (21,7% of children and 21,4% of adolescents), and Control with SD groups (6,0% of children and 17,9% of adolescents). Chen et al. (2012) evaluated PTSS on Chinese youth (aged 8-18 years) exposed to a flood event, using CRIES. They verified that 46,6% of participants presented probable PTSD and older children exhibited higher values on total CRIES score. Our results from the Flood group were compatible with those described for Chinese children.

An epidemiological study with Brazilian school-age children and adolescents found a prevalence of 0,1% (CI 0-0,3) of PTSD (Fleitlich-Bilyk & Goodman, 2004). For the control groups, the prevalence is higher than the national parameter. However, CRIES was not developed to provide a precise diagnostic of PTSD. As a screening tool, it was conceived to detect PTSS during the last seven days, and the DSM diagnostic criteria established that symptoms must last more than one month and have significant impact in everyday's life. Nonetheless, CRIES still is an essential tool to access emotional distress. Because it is cost-effective and with a fast application (Magalhães et al., 2018), it can reliably detect subthreshold cases that are very important to recognize in order to provide early specialized intervention (Copeland et al., 2015).

Qualitatively, most of the youth from the Flood group reported high rates of perceived life threat and internal fear in face of the disaster. However, contrary to our expectation, qualitative parameters about youth's experience of disaster did not significantly correlate with any CRIES measure for the Flood group. However, significant correlations were verified for the Drought's youth. In agreement with youth

from the Flood group, most of the Drought's children and adolescents also reported the feeling to be in danger in the climate context they lived. The concern about their own future significant correlated with the total CRIES score for children, while for adolescents it correlated with CRIES avoidance score. Their future is perceived to be threatened by the possibility of aggravation of the drought scenario. Adolescents from the Drought group reported fear about their future and their financial situation which correlated with avoidance scores. Droughts impose some constraints on employability in their hometown, the need to help family's income sometimes giving up plans or imposing the need of migration (Alpino, Sena, & Freitas, 2016). The correlation between fear of the future and avoidance score implies a tendency to cognitive avoidance and an attempt to avert the dealing with internal distress that the current context already provoked on them. Adolescence is a critical period of psychosocial development to make decisions about the course of life (Weems et al., 2016). Adverse events may intensify worrying thoughts and the need to deal with them. Also, traumatic experiences threaten the accomplishment of personal goals and one's place in the world, ultimately triggering anxiety or depression symptoms (Weems et al., 2016).

Risk and protective factors are usually described in studies about youth reaction to disaster as they interact in order to portray the adaptative response. Since extreme climate events can be considered a stressful event, there is a need to better understand how the risk factors can moderate and mediate the impact over children and adolescents to better drive public policies. Another interesting point is that children exposed to several stressors may be at an even higher risk for comorbidities and severe outcomes (Lai et al., 2015). So, it is important to mitigate the impact of any hazard and to avoid new stressful events.

4.3 Mental health at time point 2

The impact of one stressful event can be noted after three (Jin, Liu, & Guan, 2015) or even six years after a disaster (Tanaka et al., 2016). Prospective follow ups are still rare (Zhong et al., 2018). However, they are essential to identify the course of PTSD and other psychological outcomes in order to differentiate pathological and normative responses, onset and remission (North, 2016).

Dai et al. (2016) conducted a follow-up assessment of PTSD in flood victims after 13-14 years and approximately 16% of the subjects still had PTSD. Moreover, social support was significantly associated with the recovery from prior PTSD. Australian rural adolescents exposed to drought reported higher levels of emotional distress, behavioral difficulties, disturbance in family functioning and community dynamics, than adolescents from the same community evaluated three years earlier. Authors stated that the magnitude of the current drought might explain the adverse outcomes (Dean & Stain, 2010).

After more than one year, we observed a significant reduction of behavioral complaints in the Flood group. Conversely, there was the stability of symptoms for children living in a drought environment and an increase in anxiety problems for adolescents in the Drought group.

Regarding PTSS in the Flood groups, children did not exhibit symptom remission over time, although showing a tendency for decrease of them. For adolescents, we found a substantial decrease of symptoms, with the mean score below cut-off for PTSD screening (Perrin et al., 2005). At follow-up, children from the Drought group presented higher scores of PTSS, especially for the avoidance domain, although for adolescents no change was observed. The prevalence of positive screening for PTSD at time point 2 was still higher for children from the Flood group (45,7% of children from flood group and 23,8% from drought group) and adolescents from the Drought group (36,4% of adolescents from flood group and 39,1% from drought group).

After a natural disaster, prevalence of PTSD and PTSS can range from 14,0% three months post-event to 30,6% in children one year after (Liu et al, 2011, Kar et al.2007). Nevertheless, chronic PTSS rarely increase over 30% of the sample (Lai et al., 2015).

For the Flood group, that faced a typically acute-onset event, the PTSS trajectories are distinct for children and adolescents. Younger individuals exhibit disturbance in the first assessment, and a tendency to recover in the following evaluation, an indicative of resilience behavior. Adolescents presented a marked remission of PTSS, thus denoting recovery and resilience (Goldmann & Galea, 2014; Masten & Narayan, 2012). In the drought scenario, we could not apply the pathways to the chronic-onset extreme event indicated by Masten and Narayan (2012) as the adverse effects were still ongoing with lack of restored conditions, however, we did observe that

children with previous normal functions showed a tendency to a slight breakdown with the increase of persistent PTSS; it may be better characterized as a resistance pattern (Goldmann & Galea, 2014). For adolescents, PTSS remained stable, below cut-off, but slightly increased in the second evaluation.

Flood as typically a rapid-onset, short-duration extreme event tend to be short-lived, and it is usually associated with short-term PTSD symptoms; whereas drought, a slower-onset and chronic disaster that accumulate adversities and vulnerabilities, led to long term serious mental health outcomes (Burke, Sanson, & Hoorn, 2018). Noteworthy is the intensification of avoidance complaints in children from the Drought group. Trickey et al. (2012) validated thought suppression as one of the main risk factors to youth PTSD, and they concluded that the avoidance cluster was central to PTSD symptomatology. In the time considered in this study, children did not reach the threshold for positive PTSD. However, avoidance scores correlated with fear about the future in our sample.

An ongoing question on the field is about the effects of repeated disasters on an individual's mental health. In the North region city, flood events are unfortunately recurrent every rain season, and, in turn, drought events are a chronic condition in the semi-arid zone of Brazilian Northeast region. Previous exposure to extreme adversity can lead to a better response to a subsequent traumatic event, or worse response, indicating vulnerability-inducing effects (Masten & Narayan, 2012). In low-resource settings, cumulative adverse experiences may increase vulnerability to the following extreme event if there is not adequate means and time to recover (Ebi & Bowen, 2015). Our data suggested a protective effect on children exposed to recurrent flood, and a sensitizing model for drought youth.

Mental health complains evaluated by CBCL and CRIES pointed to stability or remission of symptoms in the Flood group. A remission pattern was reported by Chen and Wu (2006), Felix et al. (2011), Jensen, Dyb and Nygaard (2009). Therefore, the continuous exposure to an adverse event created a favorable circumstance for the development of preparedness and resilience behavior. Even if the flood was unusually severe, youth overcame initial distress caused by the hazard. This trend is also reported in other studies. In an unusual opportunity, Stough and North (2018) investigated a sample that repeatedly faced a series of disasters. Through multiple logistic regressions, they observed that disaster-related PTSD was uncommon. Disaster factors contributed

to worsening preexisting psychopathology, but not to produce new ones according to them. Another essential remark from that study was the observation that the survivors were remarkably resilient. Pollarck, Weiss, and Trung (2016) also verified that the frequency of exposure to natural disasters, in Vietnam, was unrelated to increased risk for mental health problems; however, a traumatic exposure was. Studies are beginning to report the influence of resilience and coping in the aftermath of the event (Pfefferbaum, Sconzo, et al., 2003). Resilience and emotional coping can explain up to 30% of the variance for PTSS, in a model validated with adolescents exposed to an earthquake (Stratta et al., 2014). To count with resilience repertoire does not mean that any adverse symptom will emerge. On the contrary, the stress level can interfere in resilience behaviors and lead to manifestations of PTSD, depression or other subclinical psychiatric symptoms (Adams et al., 2014; Fan et al., 2016). The resilience repertoire will become visible as the ability to bounce back to a previous healthier state and regain prior functionality (Goldmann & Galea, 2014).

In drought context, the prospect is different. Youth from drought scenario are continuously exposed and live within the secondary adversities imposed by drought. According to CBCL, children maintain the same pattern of behavioral problems, and adolescents had a significant increase in anxiety problems. For PTSS, children reported more symptoms than the previous assessment, and adolescents remained with the same pattern of results. Thus, we did not observe remission, on the contrary, we verified stability or enhancement of symptoms. Stability and persistence of complaints were described by Thienkrua et al. (2006), Osofsky et al. (2016) e Jia et al. (2013). A vulnerability-inducing effect, or sensitizing model, can account for this pattern of finding and the maintenance of problems related to drought effects contribute to it.

The social systems that directly interact with children exposed to disaster are essential contributors to children response. If dysfunctional, it may intensify stress experience. On the other hand, good quality of parental interaction, parental control, household functioning, neighborhood stability, community participation, and social cohesion support child's recovery (Abramson et al., 2010; Felix et al., 2013; McDermott, 2010; Yagi et al. (2016). Connectedness, also referred as social capital, is representative of social cohesion and community participation (McDermott, Berry, & Cobham, 2012). Connectedness was the primary factor that explained 60% of the variance of PTSD symptomatology in Australian children exposed to a cyclone.

The Brazilian flooded community was already engaged in dealing with flood events, and the municipality had initiated mitigation and preventive actions. The social preparedness for the disaster exhibited by them can partially explain the findings of mental health symptoms. In addition, resilience behaviors, positive adaptation, and protective effects have the potential to spread within individuals, families, communities, and across generations (Masten & Narayan, 2012). Therefore, to ensure familiar and social stability, and to strengthen these systems are a meaningful way to assist children after disasters and to confer resilience (Masten & Narayan, 2012; McDermott, Berry, & Cobham, 2012; Wu, 2014; Yagi et al., 2016).

Interventions delivered in the post-disaster period may attenuate short-term PTSS and impairment. Alleviating secondary stressors may be crucial in dealing with the long-term course of posttraumatic stress and in restoring functionality and quality of life (Cerdá et al., 2013).

4.4 Limitations

Methodological challenges in the context of disaster studies impose some constraints that may influence the results and limit the generalizability of findings (Goldmann & Galea, 2014). Both our disaster samples were very heterogeneous and included youth direct and indirectly affected by the extreme event, which *per se* may lead to lower estimates of the psychological burden. Further, we rely mostly on a convenience sample, and the representativeness of our sample can be questionable. Due to practical field conditions, we chose to collect data through school partnerships. Students from the same scholar setting form a “cluster” that may compromise the degree of representativeness stated above (Pfefferbaum et al., 2012).

The prospective methodology supports better the understanding of the disaster influence on youth mental health and trajectories of symptoms. Unfortunately, we lost some participants due to migration or impossibility to contact in the second assessment wave. The comparison with non affected communities provides useful insights, but some crucial differences between the groups cannot be suppressed. Thus, our methodological choices did not imply in causality. In addition, the lack of pre-disaster information is also a limitation.

Our data rely partially on parent reporting, and it may not be accurate in the aftermath of a disaster. They may underestimate internalizing symptoms in children.

Also the answers can be biased by the parents' own dysfunctional status at the assessment time point, or even overlooked the support required for their children (De Young, Kenardy, & Cobham, 2011; Noffsinger et al., 2012). Hence, parents report better externalizing symptoms, and children are a more reliable source to inform internalizing symptoms (Pfefferbaum et al., 2012). As we collected data from both parents and children, we attempted to approach this issue. The noticeable difference between CBCL scores and CRIES scores may be explained under this assumption. Nonetheless, the option for different informants required the reconciliation of possible discrepancies, also the deep consideration if these differences are meaningful or random (Pfefferbaum et al., 2013)

The child self-report itself is not free of bias and limitations that cannot be disregarded. Younger child did not have fully developed their self-introspective skills. So, they may have difficulty in exposing intrusive thoughts, for example. Along with avoidance, intrusion symptoms are a central part of PTSD. However, to be able to report those symptoms, children must be first aware of themselves, which require a specific ability of introspection. The lack of a complete maturation of those skills may bias the youth self-report (De Young, Kenardy, & Cobham, 2011). As youth can experience the disaster idiosyncratically, individual differences to interpret and report the distressing feeling may occur. Moreover, they could face stigma or prejudice against those feelings which, in turn, may again influence the youth self-report (Masten & Narayan, 2012). Therefore, the data collected can be biased for many variables that are out of the researcher control but cannot be ignored.

Families sometimes can identify altered behavior in children after a traumatic event (e.g., nightmares, anxiety about recurrence, general fear), however it is not uncommon for them not to consider those signs as mental health issues in need of specialized intervention, beyond family support. Krishna, Ronan, and Alisic (2018) considered that the lack of mental health awareness in the community, the stigmatization of mental health problems, and deficient public policies to target mental health issues are responsible for the family perceptions and actions in the context of disaster.

The extent of drought's impact is mediated by a multitude of factors due to its complexity, while interacting with economic, environmental, political, and social factors. The context imposes difficulty in attributing adverse mental health outcomes

directly from the natural event. Also, the onset and end of the drought event are sometimes hardly defined, and due to its chronicity, the effect can accumulate posing another challenge for researchers (Coelho et al., 2004; Ebi & Bowen, 2015).

4.5 Strengths

Youth population answer to a disaster is understudied. Stakeholders and the scientific community are beginning to show concern about the impact extreme events can impose on youth. Our study provides valuable insights into mitigation strategies and development of preparedness actions. For developing countries, it assumes the focus on youth from low- and middle-income countries whose vulnerability to the effects of climate change is higher than any other (Burke, Sanson, & Hoorn, 2018).

One challenge in the field of disaster is the difficulty in comparing outcomes, measurements, and covariates between studies (Goldmann & Galea, 2014). The option for CRIES and CBCL, both universal instruments that have been translated and adapted for several cultural backgrounds, contribute to overcoming this barrier. According to Pfefferbaum et al. (2013), CBCL is one of the most used instrument to assess anxiety, depression and behavior problems in the context of disasters outcomes. In turn, CRIES is a well know scale to evaluate PTSS (Magalhães et al., 2018). Another strength of the study was the investigation of symptoms beyond PTSS, which are the predominant focus in disaster research but may lead to oversimplification of the youth pattern response. Clinicians and mental health responders should assess a broad range of symptoms of distress, as well as potential stressors (Lai et al., 2015) and qualitative data (Fernandez et al., 2015).

In the absence of baseline assessment of exposed children, we sought to establish a proper comparison group to provide reliable means of comparability. Our normative sample was matched for sex, age, and SES. Also, we did a follow up after more than one year. So, the trend trajectories of symptoms were investigated and the impact of the disaster evaluated.

4.6 Conclusion

Effective screening about mental health in the aftermath of a disaster is crucial to help children deal with and recover from the event (Chen et al., 2012). Extreme climate events are stressful circumstances with different after-disaster findings in children and

adolescents, with long-term consequences of childhood trauma well established in the literature (Copeland et al., 2015). Chronic stress may alter the regular function of the stress response system, hence establishing a vulnerability condition to the onset of mental health problems.

The challenge to attribute symptoms and distress specifically to climate change persists (Hayes et al., 2018). However, if we consider that the number and intensity of disasters will probably increase and that a vast literature correlates natural disasters with adverse mental health outcome, then it is expected an increase in the number of mental health symptoms and disorders related to climate change extreme events (Clayton, Manning, & Hodge, 2014).

Public health must be prepared to deal with children's reaction to natural hazards, as the odds of an adverse outcome are high and the long-term consequences may be deleterious for their development. Besides, the number of children exposed to disaster is prone to increase each year. The occurrence of an extreme event may alter community and geographic vulnerability to future events (Ebi & Bowen, 2015). Previous social determinants interact with the characteristics of the disaster itself imposing a challenge to disentangle both influences (Hayes et al., 2018). Socioeconomically disadvantaged communities may present greater exposure and fewer resources for an adequate response, adaptation, and recovery (Akerlof et al., 2015).

Overall, general behavior symptoms remitted over time in both groups and in all age range. However, children from the Drought group presented an intensification of PTSS after more than one year, and adolescents from the same group had increased their measured anxiety problems. Chronicity, SES and poverty may have contributed to the outcome data, and its influence cannot be neglected. Health professionals must be aware of the presence of subclinical psychiatric symptoms and pursue not only the full diagnostic of a disorder but signs of distress that may interfere with one's life.

Longitudinal studies beyond one-year post-disaster are unfortunately rare; however, they are critical to elucidate how original patterns of psychological distress progress over time (Lai et al., 2015). Just a few will need specialized mental healthcare to meet their psychosocial needs (Stanke et al., 2016). However, it is critical to properly identify any mental disorder symptoms from disaster related emotional distress. The allocation of resources, development of public policies, treatment options, and adapted interventions rely on that outcome. Post-disaster psychological assessments must

evaluate multiple disorders through independently and varied sources of children's behaviors and complaints. The instruments must be age, developmentally, and culturally appropriated. Resilience factors and the influence of SES cannot be neglected (Balaban, 2006). Increasingly recognition of human capacity to adapt to stressor challenges the simplistic vision that an stressful event results in psychological outcomes. Our data provide empirical evidence for the resilience capacity of children to cope well in the midst of a disaster. Generally, symptoms remit over time, although subclinical complaints can persist.

References

- Abramson, D. M., Park, Y. S., Stehling-Ariza, T., & Redlener, I. (2010). Children as bellwethers of recovery: dysfunctional systems and the effects of parents, households, and neighborhoods on serious emotional disturbance in children after Hurricane Katrina. *Disaster Medicine and Public Health Preparedness*, 4(S1), S17-S27.
- Adams, Z. W., Sumner, J. A., Danielson, C. K., McCauley, J. L., Resnick, H. S., Grös, K., ... & Ruggiero, K. J. (2014). Prevalence and predictors of PTSD and depression among adolescent victims of the Spring 2011 tornado outbreak. *Journal of child psychology and psychiatry*, 55(9), 1047-1055.
- Aitsi-Selmi, A., & Murray, V. (2016). Protecting the health and well-being of populations from disasters: Health and health care in the Sendai framework for disaster risk reduction 2015-2030. *Prehospital and disaster medicine*, 31(1), 74-78.
- Akerlof, K., Delamater, P., Boules, C., Upperman, C., & Mitchell, C. (2015). Vulnerable populations perceive their health as at risk from climate change. *International journal of environmental research and public health*, 12(12), 15419-15433.
- Alpino, T. A., Sena, A. R. M. D., & Freitas, C. M. D. (2016). Desastres relacionados à seca e saúde coletiva—uma revisão da literatura científica. *Ciência & Saúde Coletiva*, 21, 809-820.
- Anuário brasileiro de desastres naturais : 2013 / Ministério da Integração Nacional. Secretaria Nacional de Proteção e Defesa Civil. Centro Nacional de Gerenciamento de Riscos e Desastres. – Brasília: CENAD; 2014.
- Balaban, V. (2006). Psychological assessment of children in disasters and emergencies. *Disasters*, 30(2), 178-198.
- Balbus, J. M., & Malina, C. (2009). Identifying vulnerable subpopulations for climate change health effects in the United States. *Journal of occupational and environmental medicine*, 51(1), 33-37.
- Bannon, W., DeVoe, E. R., Klein, T. P., & Miranda, C. (2009). Gender as a moderator of the relationship between child exposure to the World Trade Centre disaster and behavioural outcomes. *Child and Adolescent mental health*, 14(3), 121-126.

- Bennett, C. M. & Friel, S. Impacts of climate change on inequities in child health. *Children* 2014, 1, 461-473
- Berry, H. L., Bowen, K., & Kjellstrom, T. (2010). Climate change and mental health: a causal pathways framework. *International journal of public health*, 55(2), 123-132.
- Bokszczanin, A. (2007). PTSD symptoms in children and adolescents 28 months after a flood: Age and gender differences. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, 20(3), 347-351.
- Bordin IAS, Mari JJ, Caeiro MF. Validação da versão brasileira do “Child Behavior Checklist (CBCL) (Inventário de Comportamentos da Infância e Adolescência): dados preliminares. *Rev ABPAPAL*. 1995; 2(17): 55-66.
- Bromet, E. J., Goldgaber, D., Carlson, G., Panina, N., Golovakha, E., Gluzman, S. F., ... & Schwartz, J. E. (2000). Children's well-being 11 years after the Chornobyl catastrophe. *Archives of General Psychiatry*, 57(6), 563-571.
- Burke, S. E. L., Sanson, A. V. & Van Hoom, J. The psychological effects of climate change on children. *Current Psychiatry Reports* (2018) 20:35
- Carliner, H., Gary, D., McLaughlin, K. A., & Keyes, K. M. (2017). Trauma exposure and externalizing disorders in adolescents: results from the National Comorbidity Survey Adolescent Supplement. *Journal of the American Academy of Child & Adolescent Psychiatry*, 56(9), 755-764.
- Carpenter, A. L., Elkins, R. M., Kerns, C., Chou, T., Greif Green, J., & Comer, J. S. (2017). Event-related household discussions following the Boston Marathon bombing and associated posttraumatic stress among area youth. *Journal of Clinical Child & Adolescent Psychology*, 46(3), 331-342.
- Castellanos, D., Perez, M., Lewis, J., & Shaw, J. A. (2003). Youth suicide and Hurricane Andrew. *Journal of the American Academy of Child & Adolescent Psychiatry*, 42(2), 131.
- Catani, C., Jacob, N., Schauer, E., Kohila, M., & Neuner, F. (2008). Family violence, war, and natural disasters: A study of the effect of extreme stress on children's mental health in Sri Lanka. *BMC psychiatry*, 8(1), 33.
- Cerdá, M., Bordelois, P. M., Galea, S., Norris, F., Tracy, M., & Koenen, K. C. (2013). The course of posttraumatic stress symptoms and functional impairment following a disaster: what is the lasting influence of acute versus ongoing traumatic events and stressors?. *Social psychiatry and psychiatric epidemiology*, 48(3), 385-395.
- Chen Z, Zhang Y, Liu Z, Liu Y, Dyregrov A. (2012) Structure of the Children's Revised Impact of Event Scale (CRIES) with children and adolescents exposed to Debris Flood. *Plos One*, 7(8): 1- 6.
- Chen, S. H., & Wu, Y. C. (2006). Changes of PTSD symptoms and school reconstruction: A two-year prospective study of children and adolescents after the Taiwan 921 earthquake. *Natural Hazards*, 37(1-2), 225-244.
- Clayton, S., Manning, C. M., & Hodge, C. (2014). Beyond storms & droughts: The psychological impacts of climate change. Washington, DC: American Psychological Association and ecoAmerica.

- Coelho, A. E., Adair, J. G., & Mocellin, J. S. (2004). Psychological responses to drought in northeastern Brazil. *Interamerican Journal of Psychology*, 38(1), 95-103.
- CRED, Centre for Research on the Epidemiology of Disasters. (2018). *Natural Disasters 2017*. Brussels: CRED; 2018 EM-DAT file dated 02/07/2018. This document is available at: https://cred.be/sites/default/files/adsr_2017.pdf
- Crum, K. I., Cornacchio, D., Coxe, S., Green, J. G., & Comer, J. S. (2015). Conduct problems among Boston-area youth following the 2013 marathon bombing: the moderating role of prior violent crime exposure. *Journal of Clinical Child & Adolescent Psychology*, 1-10.
- Curtis, T., Miller, B. C., & Berry, E. H. (2000). Changes in reports and incidence of child abuse following natural disasters. *Child abuse & neglect*, 24(9), 1151-1162.
- Dai, W. et al. Predictors of recovery from post-traumatic stress disorder after the dongting lake flood in China: a 13–14 year follow-up study. *BMC Psychiatry* (2016) 16:382
- De Young, A. C., Kenardy, J. A., & Cobham, V. E. (2011). Trauma in early childhood: A neglected population. *Clinical child and family psychology review*, 14(3), 231.
- Dean, J. G., & Stain, H. J. (2010). Mental health impact for adolescents living with prolonged drought. *Australian Journal of Rural Health*, 18(1), 32-37.
- Demir, T., Demir, D. E., Alkas, L., Copur, M., Dogangun, B., & Kayaalp, L. (2010). Some clinical characteristics of children who survived the Marmara earthquakes. *European child & adolescent psychiatry*, 19(2), 125-133.
- Ebi, K. L. & Bowen, K. Extreme events as sources of health vulnerability: Drought as an example. *Weather and Climate Extremes*. (2015).
- Ekşi, A., Braun, K. L., Ertem-Vehid, H., Peykerli, G., Saydam, R., Toparlak, D., & Alyanak, B. (2007). Risk factors for the development of PTSD and depression among child and adolescent victims following a 7.4 magnitude earthquake. *International Journal of Psychiatry in Clinical Practice*, 11(3), 190-199.
- Fan, F., Zhang, Y., Yang, Y., Mo, L., & Liu, X. (2011). Symptoms of posttraumatic stress disorder, depression, and anxiety among adolescents following the 2008 Wenchuan earthquake in China. *Journal of traumatic stress*, 24(1), 44-53.
- Fan, W., Zhou, M., Cheung, F. M., Zhang, J., & Zhou, X. (2016). Contributions of resilience to mental health in Chinese secondary school students at different disaster stress levels. *The Asia-Pacific Education Researcher*, 25(3), 389-398.
- Felix, E., Hernández, L. A., Bravo, M., Ramirez, R., Cabiya, J., & Canino, G. (2011). Natural disaster and risk of psychiatric disorders in Puerto Rican children. *Journal of abnormal child psychology*, 39(4), 589-600.
- Felix, E., You, S., Vernberg, E., & Canino, G. (2013). Family influences on the long term post-disaster recovery of Puerto Rican youth. *Journal of abnormal child psychology*, 41(1), 111-124.

- Feo, P., Di Gioia, S., Carloni, E., Vitiello, B., Tozzi, A. E., & Vicari, S. (2014). Prevalence of psychiatric symptoms in children and adolescents one year after the 2009 L'Aquila earthquake. *BMC psychiatry*, *14*(1), 270.
- Fernandez, A. et al. Flooding and mental health: a systematic mapping review. *Plos One* *10*(4): e0119929. doi:10.1371/journal.pone.0119929 (2015).
- Fleitlich-Bilyk, B. & Goodman, R. (2004). Prevalence of child and adolescent psychiatric disorders in Southeast Brazil. *J. Am. Acad. Child Adolesc. Psychiatry*, *23*(6): 727-734.
- Furr, J. M., Comer, J. S., Edmunds, J. M., & Kendall, P. C. (2010). Disasters and youth: A meta-analytic examination of posttraumatic stress. *Journal of consulting and clinical psychology*, *78*(6), 765.
- Galea S, Nandi A, & Vlahov D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiol Rev.*; *27*, 78-91.
- Garcia, D. M., & Sheehan, M. C. (2016). Extreme weather-driven disasters and children's health. *International journal of health services*, *46*(1), 79-105.
- Goldmann, E., & Galea, S. (2014). Mental health consequences of disasters. *Annual review of public health*, *35*, 169-183.
- Green, B. L., Korol, M., Grace, M. C., Vary, M. G., Leonard, A. C., Gleser, G. C., & Smitson-Cohen, S. (1991). Children and disaster: Age, gender, and parental effects on PTSD symptoms. *Journal of the American Academy of Child & Adolescent Psychiatry*, *30*(6), 945-951.
- Hayes, K., Blashki, G., Wiseman, J., Burke, S. & Reifels, L. (2018). Climate change and mental health: risks, impacts and priority actions. *Int J Ment Health Syst*, *12*:28.
- Henry, D. B., Tolan, P. H., & Gorman-Smith, D. (2004). Have there been lasting effects associated with the September 11, 2001, terrorist attacks among inner-city parents and children?. *Professional Psychology: Research and Practice*, *35*(5), 542.
- Herrman, H., Stewart, D. E., Diaz-Granados, N., Berger, E. L., Jackson, B., & Yuen, T. (2011). What is resilience?. *The Canadian Journal of Psychiatry*, *56*(5), 258-265.
- Howe, P. D., Boudet, H., Leiserowitz, A., & Maibach, E. W. (2014). Mapping the shadow of experience of extreme weather events. *Climatic change*, *127*(2), 381-389.
- Iwadare, Y., Usami, M., Suzuki, Y., Ushijima, H., Tanaka, T., Watanabe, K., ... & Saito, K. (2014). Posttraumatic symptoms in elementary and junior high school children after the 2011 Japan earthquake and tsunami: symptom severity and recovery vary by age and sex. *The Journal of pediatrics*, *164*(4), 917-921.
- Jensen, T. K., Dyb, G., & Nygaard, E. (2009). A longitudinal study of posttraumatic stress reactions in Norwegian children and adolescents exposed to the 2004 tsunami. *Archives of Pediatrics & Adolescent Medicine*, *163*(9), 856-861.
- Jia, Z., Shi, L., Duan, G., Liu, W., Pan, X., Chen, Y., & Tian, W. (2013). Traumatic experiences and mental health consequences among child survivors of the 2008 Sichuan earthquake: a community-based follow-up study. *BMC public health*, *13*(1), 104.

- Jin, Y., Liu, D., & Guan, W. (2015) Symptoms of post-traumatic stress disorder and anxiety among adolescents following the 2010 Yushu earthquake. *African Journal of Psychiatry (South Africa)*, 18 (1), 1-6.
- Kar, N. (2009). Psychological impact of disasters on children: Review of assessment and interventions. *World Journal of Pediatrics*, 5(1), 5–11. Epub 2009 Jan 27.
- Kar, N., & Bastia, B. K. (2006). Post-traumatic stress disorder, depression and generalised anxiety disorder in adolescents after a natural disaster: a study of comorbidity. *Clinical Practice and Epidemiology in Mental Health*, 2(1), 17.
- Kar, N., Mohapatra, P. K., Nayak, K. C., Pattanaik, P., Swain, S. P., & Kar, H. C. (2007). Post-traumatic stress disorder in children and adolescents one year after a super-cyclone in Orissa, India: exploring cross-cultural validity and vulnerability factors. *BMC psychiatry*, 7(1), 8.
- Kiliç, E. Z., Özgüven, H. D., & Sayil, I. (2003). The psychological effects of parental mental health on children experiencing disaster: The experience of Bolu earthquake in Turkey. *Family process*, 42(4), 485-495.
- King, L. S., Osofsky, J. D., Osofsky, H. J., Weems, C. F., Hansel, T. C., & Fassnacht, G. M. (2015). Perceptions of trauma and loss among children and adolescents exposed to disasters a mixed-methods study. *Current Psychology*, 34(3), 524-536.
- Kletter, H., Rialon, R. A., Laor, N., Brom, D., Pat-Horenczyk, R., Shaheen, M., ... & Lieberman, A. (2013, August). Helping children exposed to war and violence: Perspectives from an international work group on interventions for youth and families. In *Child & Youth Care Forum* (Vol. 42, No. 4, pp. 371-388). Springer US.
- Krishna, R. N., Ronan, K. R., & Alisic, E. (2018). Children in the 2015 South Indian floods: Community members' views. *European journal of psychotraumatology*, 9(sup2), 1486122.
- La Greca, A. M., Lai, B. S., Llabre, M. M., Silverman, W. K., Vernberg, E. M., & Prinstein, M. J. (2013, August). Children's postdisaster trajectories of PTSD symptoms: Predicting chronic distress. In *Child & youth care forum* (Vol. 42, No. 4, pp. 351-369). Springer US.
- Lai, B. S., Auslander, B. A., Fitzpatrick, S. L., & Podkowirow, V. (2014) Disasters and depressive symptoms in children: a review. *Child Youth Care Forum*. 43(4): 489–504.
- Lai, B. S., Kelley, M. L., Harrison, K. M., Thompson, J. E., Self-Brown, S. (2015). Posttraumatic stress, anxiety, and depression symptoms among children after hurricane Katrina: a latent profile analysis. *J Child Fam Stud*. 24(5): 1262–1270.
- Lau, J. T., Yu, X., Zhang, J., Mak, W. W., Choi, K. C., Lui, W. W., & Chan, E. Y. (2010). Psychological distress among adolescents in Chengdu, Sichuan at 1 month after the 2008 Sichuan earthquake. *Journal of Urban Health*, 87(3), 504-523.
- Liao, T. L., Chen, Y. S., Chen, C. Y., & Chien, L. Y. (2014). Self-reported internalizing and externalizing behaviours among junior high school students at 2 and 4 years after the 921 earthquake in Taiwan. *Stress and Health*, 30(4), 265-271.

- Lieber, M. (2017). Assessing the mental health impact of the 2011 great Japan earthquake, tsunami, and radiation disaster on elementary and middle school children in the Fukushima prefecture of Japan. *PLoS one*, 12(1), e0170402.
- Lipina, S. J., & Colombo, J. A. (2009). *Poverty and brain development during childhood: An approach from cognitive psychology and neuroscience*. American Psychological Association.
- Liu, A., Tan, H., Zhou, J., Li, S., Yang, T., Wang, J., ... & Wen, S. W. (2006). An epidemiologic study of posttraumatic stress disorder in flood victims in Hunan China. *The Canadian Journal of Psychiatry*, 51(6), 350-354.
- Liu, D., Fu, L., Jing, Z., & Chen, C. (2016). Post-traumatic stress disorder and its predictors among Tibetan adolescents 3 years after the high-altitude earthquake in China. *Archives of psychiatric nursing*, 30(5), 593-599.
- Liu, M., Wang, L., Shi, Z., Zhang, Z., Zhang, K., & Shen, J. (2011). Mental health problems among children one-year after Sichuan earthquake in China: a follow-up study. *PloS one*, 6(2), e14706.
- Liu, X., Yang, Y., Yuan, P., Zhang, X., Han, Y., Cao, Y., & Xiong, G. (2010). A study of the relationship between mental health and menstrual abnormalities in female middle school students from post-earthquake Wenchuan. *Bioscience trends*, 4(1).
- Magalhães, S. D. S., Miranda, D. K., Paula, J. J. D., Miranda, D. M. D., Romano-Silva, M. A., & Malloy-Diniz, L. F. (2018). Psychometric properties of a Brazilian Portuguese version of the Children's Revised Impact of Event Scale (CRIES-8). *Archives of Clinical Psychiatry (São Paulo)*, 45(2), 27-32.
- Marin, O. (2016). Developmental timing and critical windows for the treatment of psychiatric disorders. *Nature medicine*, 22(11), 1229.
- Marsee, M. A. Reactive Aggression and Posttraumatic Stress in Adolescents Affected by Hurricane Katrina. *Journal of Clinical Child & Adolescent Psychology*, 37(3), 519–529, 2008
- Marshall, A. D. Developmental timing of trauma exposure relative to puberty and the nature of psychopathology among adolescent girls. *J Am Acad Child Adolesc Psychiatry* 2016;55(1):25–32.
- Masten, A. S. (2014). Global perspectives on resilience in children and youth. *Child development*, 85(1), 6-20.
- Masten, A. S., & Narayan, A. J. (2012). Child development in the context of disaster, war, and terrorism: Pathways of risk and resilience. *Annual review of psychology*, 63, 227-257.
- Math, S.B., Tandon, S., Girimaji, S.C., Benegal, V., Kumar, U., Hamza, A., Jangam, K., & Nagaraja, D. (2008) Psychological impact of the tsunami on children and adolescents from the Andaman and Nicobar islands. *Primary Care Companion to the Journal of Clinical Psychiatry*, 10(1), p. 31-37.
- Mazzon, J. A., & Kamakura, W. A. (2016). *Estratificação socioeconômica e consumo no Brasil*. Editora Blucher.
- McDermott, B. M., Cobham, V. E., Berry, H., & Stallman, H. M. (2010). Vulnerability factors for disaster-induced child post-traumatic stress disorder: the case for low

- family resilience and previous mental illness. *Australian & New Zealand Journal of Psychiatry*, 44(4), 384-389.
- McDermott, B. M., Lee, E. M., Judd, M., & Gibbon, P. (2005). Posttraumatic stress disorder and general psychopathology in children and adolescents following a wildfire disaster. *The Canadian Journal of Psychiatry*, 50(3), 137-143.
- McDermott, B., Berry, H., & Cobham, V. (2012). Social connectedness: A potential aetiological factor in the development of child post-traumatic stress disorder. *Australian & New Zealand Journal of Psychiatry*, 46(2), 109-117.
- National Academies of Sciences, Engineering, and Medicine. (2015). *Mental disorders and disabilities among low-income children*. National Academies Press.
- Nepomuceno, B. B., Cardoso, A. A. V., Ximenes, V. M., Barros, J. P. P., & Leite, J. F. (2016). Mental health, well-being, and poverty: A study in urban and rural communities in Northeastern Brazil. *Journal of prevention & intervention in the community*, 44(1), 63-75.
- Nieto (2006), G. C. Capítulo V – Atención psicosocial a la infancia y la adolescencia. p. 97 – 125. In Rodríguez, Jorge – ed Guía práctica de salud mental en situaciones de desastres Washington, D.C.: OPS, © 2006.
- Noffsinger, M. A., Pfefferbaum, B., Pfefferbaum, R. L., Sherrieb, K., & Norris, F. H. (2012). The burden of disaster: Part I. Challenges and opportunities within a child's social ecology. *International journal of emergency mental health*, 14(1), 3.
- North, C. S. (2016). Disaster mental health epidemiology: methodological review and interpretation of research findings. *Psychiatry*, 79(2), 130-146.
- Osofsky, J. D., Osofsky, H. J., Weems, C. F., Hansel, T. C., & King, L. S. (2014). Effects of stress related to the Gulf Oil Spill on child and adolescent mental health. *Journal of pediatric psychology*, 41(1), 65-72.
- Overstreet, S., Salloum, A., & Badour, C. (2010). A school-based assessment of secondary stressors and adolescent mental health 18 months post-Katrina. *Journal of school psychology*, 48(5), 413-431.
- Peek-Asa, C., Ramirez, M., Young, T., & Cao, Y. (2012). Flood-related work disruption and poor health outcomes among university students. *Prehospital and disaster medicine*, 27(6), 503-508.
- Perrin, S., Meiser-Stedman, R., & Smith, P. (2005). The Children's Revised Impact of Event Scale (CRIES): Validity as a screening instrument for PTSD. *Behavioural and Cognitive Psychotherapy*, 33(4), 487-498.
- Pfefferbaum, B. et al. (2013). Research methods in child disaster studies: a review of studies generated by the September 11, 2001, terrorist attacks; the 2004 Indian ocean tsunami; and hurricane Katrina. *Child Youth Care Forum*, 42:285–337
- Pfefferbaum, B., Noffsinger, M. A., Sherrieb, K. & Norris, F. H. (2012) Framework for research on children's reactions to disasters and terrorist events. *Prehosp Disaster Med.*; 27(6): 567–576.
- Pfefferbaum, B., Sconzo, G. M., Flynn, B. W., Kearns, L. J., Doughty, D. E., Gurwitch, R. H., ... & Nawaz, S. (2003). Case finding and mental health services for children

in the aftermath of the Oklahoma City bombing. *The Journal of Behavioral Health Services & Research*, 30(2), 215-227.

- Philipsborn, R. P., & Chan, K. (2018). Climate change and global child health. *Pediatrics*, 141, e20173774.
- Pollack, A. A., Weiss, B., & Trung, L. T. (2016). Mental health, life functioning and risk factors among people exposed to frequent natural disasters and chronic poverty in Vietnam. *BJPsych open*, 2(3), 221-232.
- Poulsen, K. M., McDermott, B. M., Wallis, J., & Cobham, V. E. (2015). School- Based Psychological Screening in the Aftermath of a Disaster: Are Parents Satisfied and Do Their Children Access Treatment?. *Journal of traumatic stress*, 28(1), 69-72.
- Reijneveld, S. A., Crone, M. R., Verhulst, F. C. & Verloove-Vanhorick, S. P. The effect of a severe disaster on the mental health of adolescents: a controlled study. *Lancet* 2003; 362: 691–96
- Roberts, Y. H., Mitchell, M. J., Witman, M., & Taffaro, C. (2010). Mental health symptoms in youth affected by Hurricane Katrina. *Professional Psychology: Research and Practice*, 41(1), 10.
- Salmon, K., & Bryant, R. A. (2002). Posttraumatic stress disorder in children: The influence of developmental factors. *Clinical psychology review*, 22(2), 163-188.
- Saulnier, D. D., Ribacke, K. B. & Schreeb, J. von. No calm after the storm: a systematic review of human health following flood and storm disasters. October 2017 Prehospital and Disaster Medicine
- Saunders, B. E. & Adams, Z. W. (2014). Epidemiology of traumatic experiences in childhood. *Child and Adolescent Psychiatric Clinics*, 23(2), 167-184.
- Sims, A. J., Boasso, A. M., Burch, B., Naser, S., & Overstreet, S. (2015, August). School dissatisfaction in a post-disaster environment: The mediating role of posttraumatic stress symptoms. In *Child & Youth Care Forum* (Vol. 44, No. 4, pp. 583-595). Springer US
- Stanke, C., Murray, V., Amlôt, R., Nurse, J., & Williams, R. (2012). The effects of flooding on mental health: Outcomes and recommendations from a review of the literature. *PLoS currents*, 4.
- Stoddard, F. J. (2014). Outcomes of traumatic exposure. *Child and Adolescent Psychiatric Clinics*, 23(2), 243-256.
- Stough, L. M., & North, C. S. (2018). The association of adverse mental health effects with repeated exposure to disasters.
- Stratta, P., Capanna, C., Dell’Osso, L., Carmassi, C., Patriarca, S., Di Emidio, G., ... & Rossi, A. (2015). Resilience and coping in trauma spectrum symptoms prediction: A structural equation modeling approach. *Personality and Individual Differences*, 77, 55-61.
- Stuber, J., Galea, S., Vandivere, S., Moore, K., Pfefferbaum, B., & Fairbrother, G. (2005). Behavior problems in New York City's children after the September 11, 2001, terrorist attacks. *American Journal of Orthopsychiatry*, 75(2), 190-200.
- Tanaka, E., Tsutsumi, A., Kawakami, N., Kameoka, S., Kato, H., & You, Y. (2016). Long-term psychological consequences among adolescent survivors of the

- Wenchuan earthquake in China: a cross-sectional survey six years after the disaster. *Journal of affective disorders*, 204, 255-261.
- Teasdale, B., Stephens, P. C., Sloboda, Z., Stephens, R. C., & Grey, S. F. (2013). The effect of Hurricane Katrina on adolescent feelings of social isolation. *Social Science Quarterly*, 94(2), 490-505.
- Thienkrua, W., Cardozo, B. L., Chakkraband, M. S., Guadamuz, T. E., Pengjuntr, W., Tantipiwatanaskul, P., ... & Tappero, J. W. (2006). Symptoms of posttraumatic stress disorder and depression among children in tsunami-affected areas in southern Thailand. *Jama*, 296(5), 549-559.
- Thomson, J., Seers, K., Frampton, C., Hider, P., & Moor, S. (2016). Sequential population study of the impact of earthquakes on the emotional and behavioural well being of 4 year olds in Canterbury, New Zealand. *Journal of paediatrics and child health*, 52(1), 18-24.
- Tian, W., Jia, Z., Duan, G., Liu, W., Pan, X., Guo, Q., ... & Zhang, X. (2013). Longitudinal study on health-related quality of life among child and adolescent survivors of the 2008 Sichuan earthquake. *Quality of Life Research*, 22(4), 745-752.
- Trickey, D., Siddaway, A. P., Meiser-Stedman, R., Serpell, L., & Field, A. P. (2012). A meta-analysis of risk factors for post-traumatic stress disorder in children and adolescents. *Clinical psychology review*, 32(2), 122-138.
- Vins, H., Bell, J., Saha, S. & Hess, J. J. The mental health outcomes of drought: a systematic review and causal process diagram. *Int. J. Environ. Res. Public Health* 2015, 12, 13251-13275; doi:10.3390/ijerph121013251
- Weems, C. F., Russell, J. D., Neill, E. L., Berman, S. L., & Scott, B. G. (2016). Existential anxiety among adolescents exposed to disaster: linkages among level of exposure, PTSD, and depression symptoms. *Journal of Traumatic Stress*, 29(5), 466-473.
- Wei, Y., Wang, L., Wang, R., Cao, C., Shi, Z., & Zhang, J. (2013). Prevalence and predictors of posttraumatic stress disorder among Chinese youths after an earthquake. *Social Behavior and Personality: an international journal*, 41(10), 1613-1623.
- World Health Organization. (2012). Atlas of health and climate.
- Wu, H. C. (2014). Protectors of indigenous adolescents' post-disaster adaptation in Taiwan. *Clinical Social Work Journal*, 42(4), 357-365.
- Yagi, J., Fujiwara, T., Yambe, T., Okuyama, M., Kawachi, I., & Sakai, A. (2016). Does social capital reduce child behavior problems? Results from the Great East Japan Earthquake follow-up for Children Study. *Social psychiatry and psychiatric epidemiology*, 51(8), 1117-1123.
- Yoshida, H., Kobayashi, N., Honda, N., Matsuoka, H., Yamaguchi, T., Homma, H., & Tomita, H. (2016). Post-traumatic growth of children affected by the Great East Japan Earthquake and their attitudes to memorial services and media coverage. *Psychiatry and clinical neurosciences*, 70(5), 193-201.

- Zhang, Y., Zhang, J., Zhu, S., Du, C., & Zhang, W. (2015). Prevalence and predictors of somatic symptoms among child and adolescents with probable posttraumatic stress disorder: a cross-sectional study conducted in 21 primary and secondary schools after an earthquake. *PloS one*, *10*(9), e0137101.
- Zhong, S. et al. The long-term physical and psychological health impacts of flooding: a systematic mapping. *Science of the Total Environment* *626* (2018) 165–194
- Ziaaddini, H., Nakhaee, N., & Behzadi, K. (2009). Prevalence and correlates of PTSD among high school students after the earthquake disaster in the city of Bam, Iran. *American Journal of Applied Sciences*, *6*(1), 130-132.

Supplementary material

Table S1. CRIES scores according to group, age, and sex, and the comparison between female and male scores.

CRIES	Control without socio disadvantages group					
	Children			Adolescents		
	Female (n= 25)	Male (n= 21)	Statistics	Female (n=30)	Male (n=12)	Statistics
Intrusion	3,60 (4,73)	4,14 (5,82)	$F(1,44) = 0,122,$ $p=0,728$	4,53 (6,12)	2,92 (6,98)	$F(1,40) = 0,605,$ $p=0,441$
Avoidance	4,68 (5,34)	6,81 (6,54)	$F(1,44) = 1,480,$ $p=0,230$	4,80 (5,96)	3,83 (5,54)	$F(1,40) = 0,234,$ $p=0,631$
Total	8,28 (9,12)	10,95 (11,61)	$F(1,44) = 0,764,$ $p=0,387$	9,33 (11,06)	6,75 (10,92)	$F(1,40) = 0,471,$ $p=0,496$
CRIES	Control with socio disadvantages group					
	Children			Adolescents		
	Female (n=24)	Male (n=26)	Statistics	Female (n=15)	Male (n=13)	Statistics
Intrusion	2,00 (3,15)	2,62 (4,10)	$F(1,48) = 0,350,$ $p=0,557$	3,53 (3,93)	4,46 (5,78)	$F(1,26) = 0,253,$ $p=0,619$
Avoidance	1,58 (2,23)	3,12 (3,97)	$F(1,48) = 2,765,$ $p=0,103$	3,67 (5,37)	4,31 (6,18)	$F(1,26) = 0,086,$ $p=0,771$
Total	3,58 (4,92)	5,73 (7,88)	$F(1,48) = 1,311,$ $p=0,258$	7,20 (9,07)	8,77 (11,63)	$F(1,26) = 0,161,$ $p=0,692$
CRIES	Flood group – Time 1					
	Children			Adolescents		
	Female (n=27)	Male (n=27)	Statistics	Female (n=10)	Male (n=9)	Statistics
Intrusion	8,59 (5,10)	5,96 (5,50)	$F(1,52) = 3,317,$ $p=0,074$	11,30 (3,62)	12,22 (5,12)	$F(1,17) = 0,209,$ $p=0,653$
Avoidance	11,89 (4,53)	8,85 (5,45)	$F(1,52) = 4,965,$ $p=0,030$	13,60 (3,10)	10,44 (5,43)	$F(1,17) = 2,485,$ $p=0,133$
Total	20,48 (7,32)	14,81 (10,25)	$F(1,52) = 5,465,$ $p=0,023$	24,90 (4,25)	22,67 (8,96)	$F(1,17) = 0,499,$ $p=0,490$
CRIES	Flood group – Time 2					
	Children			Adolescents		
	Female (n=25)	Male (n=21)	Statistics	Female (n=5)	Male (n=6)	Statistics
Intrusion	6,88 (4,94)	6,52 (5,67)	$F(1,44) = 0,052,$ $p=0,821$	5,00 (6,29)	8,50 (6,78)	$F(1,9) = 0,776,$ $p=0,401$
Avoidance	10,32 (5,64)	7,52 (4,50)	$F(1,44) = 3,360,$ $p=0,074$	6,40 (4,83)	10,00 (4,73)	$F(1,9) = 1,550,$ $p=0,245$
Total	17,20 (9,09)	14,05 (8,52)	$F(1,44) = 1,453,$ $p=0,235$	11,40 (9,76)	18,50 (9,61)	$F(1,9) = 1,468,$ $p=0,256$

(cont. Table S1)

Drought group – Time 1						
CRIS	Children		Statistics	Adolescents		Statistics
	Female (n= 15)	Male (n= 10)		Female (n=19)	Male (n=15)	
Intrusion	4,60 (5,15)	2,00 (2,58)	F(1,23) = 2,161, <i>p</i> =0,155	7,74 (6,02)	5,80 (3,59)	F(1,32) = 1,209, <i>p</i> =0,280
Avoidance	4,93 (5,09)	2,70 (4,67)	F(1,23) = 1,231, <i>p</i> =0,279	6,11 (5,27)	4,80 (3,97)	F(1,32) = 0,635, <i>p</i> =0,432
Total	9,53 (9,13)	4,70 (6,78)	F(1,23) = 2,038, <i>p</i> =0,167	13,84 (9,49)	10,60 (5,08)	F(1,32) = 1,421, <i>p</i> =0,242

Drought group – Time 2						
CRIS	Children		Statistics	Adolescents		Statistics
	Female (n= 11)	Male (n= 10)		Female (n=11)	Male (n=12)	
Intrusion	6,27 (5,95)	5,80 (5,81)	F(1,19) = 0,034, <i>p</i> =0,856	11,09 (4,21)	5,25(5,53)	F(1,21) = 8,013, <i>p</i>=0,010
Avoidance	7,64 (4,76)	5,70 (3,34)	F(1,19) = 1,142, <i>p</i> =0,299	8,91 (5,94)	4,17 (4,59)	F(1,21) = 4,637, <i>p</i>=0,043
Total	13,91 (7,33)	11,50 (7,82)	F(1,19) = 0,531, <i>p</i> =0,475	20,00 (6,25)	9,42 (8,01)	F(1,21) = 12,329, <i>p</i>=0,002

4. DISCUSSÃO E CONSIDERAÇÕES FINAIS

Compreender o impacto sobre a população infantil de eventos extremos decorrentes das mudanças climáticas é de grande relevância. Primeiro, as potenciais conseqüências adversas irão moldar o desenvolvimento infantil e se fazer presente durante todo o curso de vida deste indivíduo. Logo, torna-se imperioso buscar reduzir os efeitos e possibilitar um contexto protetor para o desenvolvimento posterior. Segundo, desta geração irão advir os futuros líderes das sociedades e as respostas emocionais que apresentam hoje irão influenciar as futuras tomadas de decisão. Por fim, será fundamental que essas crianças e adolescentes consigam desenvolver estratégias de adaptação, tanto psicológica quanto física, e construir habilidades de resiliência para lidar com as configurações de um novo mundo transformado pelas mudanças climáticas (Burke, Sanson, & Hoorn, 2018).

O desenvolvimento de pesquisas no contexto de desastres naturais é inerentemente desafiador. Dentre os motivos que dificultam o processo estão janela temporal de oportunidade, dificuldades para acessar a população afetada, condições de infraestrutura do local, processos de maturação da própria infância e adolescência além do contexto familiar e social (North, 2016; Pfefferbaum et al., 2012). Desafios de ordem metodológica também aumentam a sobrecarga da pesquisa, como obter uma amostra representativa de pessoas afetadas, desenvolver um delineamento experimental adequado, mensurar aspectos centrais no tempo e com a escassez de recursos disponíveis (Goldmann & Galea, 2014).

A utilização de instrumentos validados internacionalmente e utilizados em outras pesquisas acerca do impacto de desastres na saúde mental de crianças e adolescentes possibilita superar a dificuldade da ausência de uniformização de instrumentos. As medidas provenientes da presente pesquisa possibilitarão a comparação de resultados entre a comunidade científica e a integração de achados.

A CRIES demonstrou robustez em seu processo de validação para a população brasileira e as informações dela extraídas foram fundamentais para distinguir os grupos Inundação e Seca dos controles. Os sintomas de TEPT foram mais sensíveis para representar o possível impacto vivenciado pelos participantes em decorrência dos eventos ocorridos. Afinal, as crianças tiveram oportunidade de especificar as próprias reações e emoções pós-desastre, muitas das quais eram de desconhecimento dos pais ou

cuidador. Por isso, Balaban (2006) afirma que o autorrelato da criança não pode ser substituído pelo relato do cuidador. O ideal é trabalhar com múltiplas fontes de informação para alcançar uma visão global das respostas infantis. Observou-se que, em geral, os sintomas apresentaram remissão ao longo do tempo. Apenas no contexto de um desastre ambiental crônico, como a seca, houve manutenção e aumento de sintomas relativos ao TEPT e ansiedade.

O estudo da saúde mental em contextos de desastre impõe o desafio de atribuir os achados especificamente ao evento climático. Vários fatores contribuem para mediar as respostas ao desastre e torna-se inviável a avaliação de todos eles, devido a restrições de tempo (janela temporal pós-desastre, duração das entrevistas e coletas de dados) e instrumentos validados para a finalidade. Selecionou-se alguns problemas em saúde mental para levantamento de informações, mas outras importantes respostas como taxas de suicídio e ideação suicida não foram avaliadas. Além disso, evidências já identificaram que fatores socioeconômicos interagem com características do desastre em si, de modo a influenciar a vulnerabilidade da comunidade afetada (Ebi, 2011). Por exemplo, estes fatores podem aumentar a exposição a contextos de infecção e insalubridade, interagir com características individuais que correspondem à habilidade de adaptar e responder às adversidades, moldar o tipo de suporte social oferecido às populações vulneráveis na resposta pós-desastre. Por isso, a pesquisa contou com grupos controle que, sobretudo, apresentassem a variável sócio-econômica como diferenciador, para aumentar a confiabilidade ao correlacionar o desastre com as respostas obtidas. De todo modo, a utilização de amostras de conveniência e a ausência de manipulação de todas as variáveis intervenientes impossibilitaram a inferência de causalidade dos resultados. Portanto, os mesmos devem ser considerados com cautela.

Um evento extremo atinge as mais diferentes esferas, tais como escolas, sistema econômico, sistemas de comunicação, alimentação, moradia. Todos esses domínios são atingidos seja direta ou indiretamente por um desastre. Como o desenvolvimento infantil ocorre no contexto de grupos, sistemas e comunidades que se interconectam e se influenciam mutuamente, desde a família no microssistema até as estruturas sociais, políticas, econômicas e culturais no macrossistema (Noffsinger et al., 2012), a resposta de crianças e adolescentes frente a adversidade ocorrerá dentro desse ambiente, no qual todos os níveis enfrentam a sobrecarga do desastre. Um dos pontos chave para a compreensão da saúde mental infantil e também para a efetividade de uma intervenção é

considerar esses diferentes níveis de organização dos indivíduos, partindo-se da premissa subjacente que a resiliência em nível individual é dependente dos múltiplos níveis sociais.

A ausência de medidas diretas de resiliência e de comportamento adaptativo foi outro limitante da pesquisa. A inferência destes comportamentos deu-se como tentativa de explicação do corpo de dados. No entanto, futuros estudos devem incorporar essas medidas em seu delineamento de modo a abarcar a riqueza e variabilidade do comportamento humano.

A compreensão de que as mudanças climáticas são subjacentes à ação humana são fundamentais para o engajamento público e para subsidiar ações de resposta e mitigação frente aos desastres decorrentes destes fenômenos (Lee et al., 2015). Ampliar a conscientização acerca dos impactos das mudanças climáticas em várias esferas de vida dos indivíduos é fundamental para fomentar o desenvolvimento de estratégias de enfrentamento capazes de lidar com as adversas conseqüências psicossociais de um mundo em transformação (Akerlof et al., 2015). Ações de adaptação envolvem políticas públicas, intervenções comportamentais a nível individual e comunitário, treinamento específico do corpo técnico e profissional de centros de saúde, maior participação e envolvimento da comunidade científica. Inclusive, segundo o Marco de Sendai para a Redução de Risco de Desastres 2015-2030, é um dos atributos da comunidade científica adotar ações de prevenção, redução de riscos, promoção de resiliência, resposta, ajuda e recuperação após a ocorrência de desastres (Aitsi-Selmi & Murray, 2016).

Estudos pós-desastre sobre as variáveis de saúde mental deveriam ser realizados sempre que um desastre acontecer em qualquer parte do mundo. A integração de estratégias e diferentes conhecimentos científicos é fundamental para a preparação e recuperação (Masten & Narayan, 2012). Afinal, eventos traumáticos têm o potencial de continuar afetando as pessoas ao longo do tempo e intervenções precoces pós-desastre podem atuar prevenindo desfechos negativos.

5. REFERÊNCIAS BIBLIOGRÁFICAS

- Abramson, D. M., Park, Y. S., Stehling-Ariza, T., & Redlener, I. (2010). Children as bellwethers of recovery: dysfunctional systems and the effects of parents, households, and neighborhoods on serious emotional disturbance in children after Hurricane Katrina. *Disaster Medicine and Public Health Preparedness*, 4(S1), S17-S27.
- Adams, Z. W., Sumner, J. A., Danielson, C. K., McCauley, J. L., Resnick, H. S., Grös, K., ... & Ruggiero, K. J. (2014). Prevalence and predictors of PTSD and depression among adolescent victims of the Spring 2011 tornado outbreak. *Journal of child psychology and psychiatry*, 55(9), 1047-1055.
- Aitsi-Selmi, A., & Murray, V. (2016). Protecting the health and well-being of populations from disasters: Health and health care in the Sendai framework for disaster risk reduction 2015-2030. *Prehospital and disaster medicine*, 31(1), 74-78.
- Akerlof, K., Delamater, P., Boules, C., Upperman, C., & Mitchell, C. (2015). Vulnerable populations perceive their health as at risk from climate change. *International journal of environmental research and public health*, 12(12), 15419-15433.
- Alisic E, Jongmans MJ, Wesel FV, Kleber RJ. Building child trauma theory from longitudinal studies: a meta-analysis. *Clin Psychol Rev*. 2011; 31:736-747.
- Alpino, T. A., Sena, A. R. M. D., & Freitas, C. M. D. (2016). Desastres relacionados à seca e saúde coletiva—uma revisão da literatura científica. *Ciência & Saúde Coletiva*, 21, 809-820.
- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (DSM-5®). American Psychiatric Pub.
- Anuário brasileiro de desastres naturais : 2013 / Ministério da Integração Nacional. Secretaria Nacional de Proteção e Defesa Civil. Centro Nacional de Gerenciamento de Riscos e Desastres. – Brasília: CENAD; 2014.
- Balaban, V. (2006). Psychological assessment of children in disasters and emergencies. *Disasters*, 30(2), 178-198.
- Balbus, J. M., & Malina, C. (2009). Identifying vulnerable subpopulations for climate change health effects in the United States. *Journal of occupational and environmental medicine*, 51(1), 33-37.
- Bannon, W., DeVoe, E. R., Klein, T. P., & Miranda, C. (2009). Gender as a moderator of the relationship between child exposure to the World Trade Centre disaster and behavioural outcomes. *Child and Adolescent mental health*, 14(3), 121-126.
- Bartlett, S. (2008). Climate change and urban children: impacts and implications for adaptation in low-and middle-income countries. *Environment and Urbanization*, 20(2), 501-519.
- Beck J, Grant D, Read J, Clapp, J, Coffey S, Miller L. The Impact of Event Scale-Revised: Psychometric properties in a sample of motor vehicle accident survivors. *J Anxiety Disord*. 2008; 22(2):187- 198.

- Becker-Blease, K.A., Turner, H. A., & Finkelhor, D. (2010). Disasters, victimization, and children's mental health. *Child Development, 81*(4), 1040-1052.
- Below, R., Wirtz, A., & Guha-Sapir, D. (2009). Disaster category classification and peril terminology for operational purposes (No. UCL-Université Catholique de Louvain).
- Bennett, C. M. & Friel, S. Impacts of climate change on inequities in child health. *Children* 2014, 1, 461-473
- Berry, H. L., Bowen, K., & Kjellstrom, T. (2010). Climate change and mental health: a causal pathways framework. *International journal of public health, 55*(2), 123-132.
- Bokszczanin, A. (2007). PTSD symptoms in children and adolescents 28 months after a flood: Age and gender differences. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies, 20*(3), 347-351.
- Bordin IAS, Mari JJ, Caeiro MF. Validação da versão brasileira do "Child Behavior Checklist (CBCL) (Inventário de Comportamentos da Infância e Adolescência): dados preliminares. *Rev ABPAPAL. 1995; 2*(17): 55-66.
- Bromet, E. J., Goldgaber, D., Carlson, G., Panina, N., Golovakha, E., Gluzman, S. F., ... & Schwartz, J. E. (2000). Children's well-being 11 years after the Chernobyl catastrophe. *Archives of General Psychiatry, 57*(6), 563-571.
- Burke, S. E. L., Sanson, A. V. & Van Hoom, J. The psychological effects of climate change on children. *Current Psychiatry Reports* (2018) 20:35
- Carliner, H., Gary, D., McLaughlin, K. A., & Keyes, K. M. (2017). Trauma exposure and externalizing disorders in adolescents: results from the National Comorbidity Survey Adolescent Supplement. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(9), 755-764.
- Carpenter, A. L., Elkins, R. M., Kerns, C., Chou, T., Greif Green, J., & Comer, J. S. (2017). Event-related household discussions following the Boston Marathon bombing and associated posttraumatic stress among area youth. *Journal of Clinical Child & Adolescent Psychology, 46*(3), 331-342.
- Castellanos, D., Perez, M., Lewis, J., & Shaw, J. A. (2003). Youth suicide and Hurricane Andrew. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*(2), 131.
- Catani, C., Jacob, N., Schauer, E., Kohila, M., & Neuner, F. (2008). Family violence, war, and natural disasters: A study of the effect of extreme stress on children's mental health in Sri Lanka. *BMC psychiatry, 8*(1), 33.
- Cerdá, M., Bordelois, P. M., Galea, S., Norris, F., Tracy, M., & Koenen, K. C. (2013). The course of posttraumatic stress symptoms and functional impairment following a disaster: what is the lasting influence of acute versus ongoing traumatic events and stressors?. *Social psychiatry and psychiatric epidemiology, 48*(3), 385-395.
- Chen Z, Zhang Y, Liu Z, Liu Y, Dyregrov A. (2012) Structure of the Children's Revised Impact of Event Scale (CRIES) with children and adolescents exposed to Debris Flood. *Plos One, 7*(8): 1- 6.

- Chen, S. H., & Wu, Y. C. (2006). Changes of PTSD symptoms and school reconstruction: A two-year prospective study of children and adolescents after the Taiwan 921 earthquake. *Natural Hazards*, 37(1-2), 225-244.
- Chen, S. H., Lin, Y. H., Tseng, H. M., & Wu, Y. C. (2002). Posttraumatic stress reactions in children and adolescents one year after the 1999 Taiwan Chi- Chi earthquake. *Journal of the Chinese Institute of Engineers*, 25(5), 597-608.
- Chu, D. A., Williams, L. M., Harris, A. W., Bryant, R. A., & Gatt, J. M. (2013). Early life trauma predicts self-reported levels of depressive and anxiety symptoms in nonclinical community adults: Relative contributions of early life stressor types and adult trauma exposure. *Journal of psychiatric research*, 47(1), 23-32.
- Clayton, S., Manning, C. M., & Hodge, C. (2014). Beyond storms & droughts: The psychological impacts of climate change. Washington, DC: American Psychological Association and ecoAmerica.
- Coelho, A. E., Adair, J. G., & Mocellin, J. S. (2004). Psychological responses to drought in northeastern Brazil. *Interamerican Journal of Psychology*, 38(1), 95-103.
- Copeland, W. E., Wolke, D., Shanahan, L., & Costello, E. J. (2015). Adult functional outcomes of common childhood psychiatric problems: a prospective, longitudinal study. *JAMA psychiatry*, 72(9), 892-899.
- Costello, E. J., Compton, S. N., Keeler, G., & Angold, A. (2003). Relationships between poverty and psychopathology: A natural experiment. *Jama*, 290(15), 2023-2029.
- CRED, Centre for Research on the Epidemiology of Disasters. (2018). *Natural Disasters 2017*. Brussels: CRED; 2018 EM-DAT file dated 02/07/2018. This document is available at: https://cred.be/sites/default/files/adsr_2017.pdf
- Crum, K. I., Cornacchio, D., Coxe, S., Green, J. G., & Comer, J. S. (2015). Conduct problems among Boston-area youth following the 2013 marathon bombing: the moderating role of prior violent crime exposure. *Journal of Clinical Child & Adolescent Psychology*, 1-10.
- Curtis, T., Miller, B. C., & Berry, E. H. (2000). Changes in reports and incidence of child abuse following natural disasters. *Child abuse & neglect*, 24(9), 1151-1162.
- Dai, W. et al. Predictors of recovery from post-traumatic stress disorder after the dongting lake flood in China: a 13–14 year follow-up study. *BMC Psychiatry* (2016) 16:382
- De Young, A. C., Kenardy, J. A., & Cobham, V. E. (2011). Trauma in early childhood: A neglected population. *Clinical child and family psychology review*, 14(3), 231.
- Dean, J. G., & Stain, H. J. (2010). Mental health impact for adolescents living with prolonged drought. *Australian Journal of Rural Health*, 18(1), 32-37.
- Deeba F, Rapee RM, Prvan T. Psychometric properties of the Children's Revised Impact of Events Scale (CRIES) with Bangladeshi children and adolescents. *PeerJ*. 2014; 2:e536.
- Demir, T., Demir, D. E., Alkas, L., Copur, M., Dogangun, B., & Kayaalp, L. (2010). Some clinical characteristics of children who survived the Marmara earthquakes. *European child & adolescent psychiatry*, 19(2), 125-133.

- Ebi, K. (2011). Climate change and health risks: assessing and responding to them through 'adaptive management'. *Health Affairs*, 30(5), 924-930.
- Ebi, K. L. & Bowen, K. Extreme events as sources of health vulnerability: Drought as an example. *Weather and Climate Extremes*. (2015).
- Ekşi, A., Braun, K. L., Ertem-Vehid, H., Peykerli, G., Saydam, R., Toparlak, D., & Alyanak, B. (2007). Risk factors for the development of PTSD and depression among child and adolescent victims following a 7.4 magnitude earthquake. *International Journal of Psychiatry in Clinical Practice*, 11(3), 190-199.
- Fan, F., Zhang, Y., Yang, Y., Mo, L., & Liu, X. (2011). Symptoms of posttraumatic stress disorder, depression, and anxiety among adolescents following the 2008 Wenchuan earthquake in China. *Journal of traumatic stress*, 24(1), 44-53.
- Fan, W., Zhou, M., Cheung, F. M., Zhang, J., & Zhou, X. (2016). Contributions of resilience to mental health in Chinese secondary school students at different disaster stress levels. *The Asia-Pacific Education Researcher*, 25(3), 389-398.
- Felix, E., Hernández, L. A., Bravo, M., Ramirez, R., Cabiya, J., & Canino, G. (2011). Natural disaster and risk of psychiatric disorders in Puerto Rican children. *Journal of abnormal child psychology*, 39(4), 589-600.
- Felix, E., You, S., Vernberg, E., & Canino, G. (2013). Family influences on the long term post-disaster recovery of Puerto Rican youth. *Journal of abnormal child psychology*, 41(1), 111-124.
- Feo, P., Di Gioia, S., Carloni, E., Vitiello, B., Tozzi, A. E., & Vicari, S. (2014). Prevalence of psychiatric symptoms in children and adolescents one year after the 2009 L'Aquila earthquake. *BMC psychiatry*, 14(1), 270.
- Fernandez, A. et al. Flooding and mental health: a systematic mapping review. *Plos One* 10(4): e0119929. doi:10.1371/journal.pone.0119929 (2015).
- Fleitlich-Bilyk, B. & Goodman, R. (2004). Prevalence of child and adolescent psychiatric disorders in Southeast Brazil. *J. Am. Acad. Child Adolesc. Psychiatry*, 23(6): 727-734.
- Furr, J. M., Comer, J. S., Edmunds, J. M., & Kendall, P. C. (2010). Disasters and youth: A meta-analytic examination of posttraumatic stress. *Journal of consulting and clinical psychology*, 78(6), 765.
- Galea S, Nandi A, & Vlahov D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiol Rev.*; 27, 78-91.
- Garcia, D. M., & Sheehan, M. C. (2016). Extreme weather-driven disasters and children's health. *International journal of health services*, 46(1), 79-105.
- Giannopoulou I, Smith P, Ecker C, Strouthos M, Dikajakou A, Yule W. Factor structure of the Children's Revised Impact of Event Scale (CRIES) with children exposed to earthquake. *Pers Individ Differ*. 2006; 40(5): 1027- 1037.
- Goldmann, E., & Galea, S. (2014). Mental health consequences of disasters. *Annual review of public health*, 35, 169-183.
- Grassi-Oliveira R, Stein L M, Pezzi JC. Tradução e validação de conteúdo da versão em português do Childhood Trauma Questionnaire. *Rev Saude Publ*. 2006; 40(2): 249-255.

- Green, B. L., Korol, M., Grace, M. C., Vary, M. G., Leonard, A. C., Gleser, G. C., & Smitson-Cohen, S. (1991). Children and disaster: Age, gender, and parental effects on PTSD symptoms. *Journal of the American Academy of Child & Adolescent Psychiatry*, 30(6), 945-951.
- Guha-Sapir, D., Hoyois, P., & Below, R. (2016) *Annual Disaster Statistical Review 2015: The Numbers and Trends*. Brussels: CRED.
- Hayes, K. & Poland, B. (2018). Addressing mental health in a changing climate: incorporating mental health indicators into climate change and health vulnerability and adaptation assessments. *Int. J. Environ. Res. Public Health*, 15, 1806.
- Hayes, K., Blashki, G., Wiseman, J., Burke, S. & Reifels, L. (2018). Climate change and mental health: risks, impacts and priority actions. *Int J Ment Health Syst*, 12:28.
- Henry, D. B., Tolan, P. H., & Gorman-Smith, D. (2004). Have there been lasting effects associated with the September 11, 2001, terrorist attacks among inner-city parents and children?. *Professional Psychology: Research and Practice*, 35(5), 542.
- Herrman, H., Stewart, D. E., Diaz-Granados, N., Berger, E. L., Jackson, B., & Yuen, T. (2011). What is resilience?. *The Canadian Journal of Psychiatry*, 56(5), 258-265.
- Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: A measure of subjective stress. *Psychosom Med*. 1979; 41(3): 209- 218.
- Howe, P. D., Boudet, H., Leiserowitz, A., & Maibach, E. W. (2014). Mapping the shadow of experience of extreme weather events. *Climatic change*, 127(2), 381-389.
- Hughes V. The roots of resilience. *Nature*. 2012; 490:165-167.
- Intergovernmental Panel on Climate. *Climate Change 2014: Synthesis Report*. Available online at <http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_LONGERREPORT_Corr2.pdf>.
- Iwadare, Y., Usami, M., Suzuki, Y., Ushijima, H., Tanaka, T., Watanabe, K., ... & Saito, K. (2014). Posttraumatic symptoms in elementary and junior high school children after the 2011 Japan earthquake and tsunami: symptom severity and recovery vary by age and sex. *The Journal of pediatrics*, 164(4), 917-921.
- Jensen, T. K., Dyb, G., & Nygaard, E. (2009). A longitudinal study of posttraumatic stress reactions in Norwegian children and adolescents exposed to the 2004 tsunami. *Archives of Pediatrics & Adolescent Medicine*, 163(9), 856-861.
- Jia, Z., Shi, L., Duan, G., Liu, W., Pan, X., Chen, Y., & Tian, W. (2013). Traumatic experiences and mental health consequences among child survivors of the 2008 Sichuan earthquake: a community-based follow-up study. *BMC public health*, 13(1), 104.
- Jin, Y., Liu, D., & Guan, W. (2015) Symptoms of post-traumatic stress disorder and anxiety among adolescents following the 2010 Yushu earthquake. *African Journal of Psychiatry (South Africa)*, 18 (1), 1-6.
- Kar, N. (2009). Psychological impact of disasters on children: Review of assessment and interventions. *World Journal of Pediatrics*, 5(1), 5–11. Epub 2009 Jan 27.
- Kar, N., & Bastia, B. K. (2006). Post-traumatic stress disorder, depression and generalised anxiety disorder in adolescents after a natural disaster: a study of comorbidity. *Clinical Practice and Epidemiology in Mental Health*, 2(1), 17.

- Kar, N., Mohapatra, P. K., Nayak, K. C., Pattanaik, P., Swain, S. P., & Kar, H. C. (2007). Post-traumatic stress disorder in children and adolescents one year after a super-cyclone in Orissa, India: exploring cross-cultural validity and vulnerability factors. *BMC psychiatry*, 7(1), 8.
- Kiliç, E. Z., Özgüven, H. D., & Sayil, I. (2003). The psychological effects of parental mental health on children experiencing disaster: The experience of Bolu earthquake in Turkey. *Family process*, 42(4), 485-495.
- King, L. S., Osofsky, J. D., Osofsky, H. J., Weems, C. F., Hansel, T. C., & Fassnacht, G. M. (2015). Perceptions of trauma and loss among children and adolescents exposed to disasters a mixed-methods study. *Current Psychology*, 34(3), 524-536.
- Kletter, H., Rialon, R. A., Laor, N., Brom, D., Pat-Horenczyk, R., Shaheen, M., ... & Lieberman, A. (2013, August). Helping children exposed to war and violence: Perspectives from an international work group on interventions for youth and families. In *Child & Youth Care Forum* (Vol. 42, No. 4, pp. 371-388). Springer US.
- Krishna, R. N., Ronan, K. R., & Alisic, E. (2018). Children in the 2015 South Indian floods: Community members' views. *European journal of psychotraumatology*, 9(sup2), 1486122.
- La Greca, A. M., Lai, B. S., Llabre, M. M., Silverman, W. K., Vernberg, E. M., & Prinstein, M. J. (2013, August). Children's postdisaster trajectories of PTSD symptoms: Predicting chronic distress. In *Child & youth care forum* (Vol. 42, No. 4, pp. 351-369). Springer US.
- Lai, B. S., Auslander, B. A., Fitzpatrick, S. L., & Podkowirow, V. (2014) Disasters and depressive symptoms in children: a review. *Child Youth Care Forum*. 43(4): 489–504.
- Lai, B. S., Kelley, M. L., Harrison, K. M., Thompson, J. E., Self-Brown, S. (2015). Posttraumatic stress, anxiety, and depression symptoms among children after hurricane Katrina: a latent profile analysis. *J Child Fam Stud*. 24(5): 1262–1270.
- Lau JTF, Yeung NCY, Yu X, Zhang J, Mak WWS, Lui WWS, Zhang J. (2013). Validation of the Chinese version of the Children's Revised Impact of Event Scale (CRIES) among Chinese adolescents in the aftermath of the Sichuan Earthquake in 2008. *Compr Psychiat*; 54: 83-90.
- Lau, J. T., Yu, X., Zhang, J., Mak, W. W., Choi, K. C., Lui, W. W., & Chan, E. Y. (2010). Psychological distress among adolescents in Chengdu, Sichuan at 1 month after the 2008 Sichuan earthquake. *Journal of Urban Health*, 87(3), 504-523.
- Lee, T. M., Markowitz, E.M., Howe, P.D., Ko, C.Y., & Leiserowitz, A.A. (2015). Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change*, 5(11), 1014.
- Liao, T. L., Chen, Y. S., Chen, C. Y., & Chien, L. Y. (2014). Self-reported internalizing and externalizing behaviours among junior high school students at 2 and 4 years after the 921 earthquake in Taiwan. *Stress and Health*, 30(4), 265-271.
- Lieber, M. (2017). Assessing the mental health impact of the 2011 great Japan earthquake, tsunami, and radiation disaster on elementary and middle school children in the Fukushima prefecture of Japan. *PLoS one*, 12(1), e0170402.

- Lipina, S. J., & Colombo, J. A. (2009). *Poverty and brain development during childhood: An approach from cognitive psychology and neuroscience*. American Psychological Association.
- Liu, A., Tan, H., Zhou, J., Li, S., Yang, T., Wang, J., ... & Wen, S. W. (2006). An epidemiologic study of posttraumatic stress disorder in flood victims in Hunan China. *The Canadian Journal of Psychiatry, 51*(6), 350-354.
- Liu, D., Fu, L., Jing, Z., & Chen, C. (2016). Post-traumatic stress disorder and its predictors among Tibetan adolescents 3 years after the high-altitude earthquake in China. *Archives of psychiatric nursing, 30*(5), 593-599.
- Liu, M., Wang, L., Shi, Z., Zhang, Z., Zhang, K., & Shen, J. (2011). Mental health problems among children one-year after Sichuan earthquake in China: a follow-up study. *PloS one, 6*(2), e14706.
- Liu, X., Yang, Y., Yuan, P., Zhang, X., Han, Y., Cao, Y., & Xiong, G. (2010). A study of the relationship between mental health and menstrual abnormalities in female middle school students from post-earthquake Wenchuan. *Bioscience trends, 4*(1).
- Lopes, D. D. C (2010). *Gestão de riscos e de desastres: contribuições da psicologia: formação à distância*.
- Maclean, J. C., Popovici, I., & French, M. T. (2016). Are natural disasters in early childhood associated with mental health and substance use disorders as an adult? *Social Science & Medicine, 151*, 78-91.
- Magalhães, S. D. S., Miranda, D. K., Paula, J. J. D., Miranda, D. M. D., Romano-Silva, M. A., & Malloy-Diniz, L. F. (2018). Psychometric properties of a Brazilian Portuguese version of the Children's Revised Impact of Event Scale (CRIES-8). *Archives of Clinical Psychiatry (São Paulo), 45*(2), 27-32.
- Marin, O. (2016). Developmental timing and critical windows for the treatment of psychiatric disorders. *Nature medicine, 22*(11), 1229.
- Marsee, M. A. Reactive Aggression and Posttraumatic Stress in Adolescents Affected by Hurricane Katrina. *Journal of Clinical Child & Adolescent Psychology, 37*(3), 519–529, 2008
- Marshall, A. D. Developmental timing of trauma exposure relative to puberty and the nature of psychopathology among adolescent girls. *J Am Acad Child Adolesc Psychiatry 2016;55*(1):25–32.
- Masten A, & Osofsky J. (2010). Disasters and their impact on child development: Introduction to the special section. *Child Dev. 81*(4): 1029- 1039.
- Masten, A. S. (2014). Global perspectives on resilience in children and youth. *Child development, 85*(1), 6-20.
- Masten, A. S., & Narayan, A. J. (2012). Child development in the context of disaster, war, and terrorism: Pathways of risk and resilience. *Annual review of psychology, 63*, 227-257.
- Math, S.B., Tandon, S., Girimaji, S.C., Benegal, V., Kumar, U., Hamza, A., Jangam, K., & Nagaraja, D. (2008) Psychological impact of the tsunami on children and adolescents from the Andaman and Nicobar islands. *Primary Care Companion to the Journal of Clinical Psychiatry, 10*(1), p. 31-37.

- Mazzon, J. A., & Kamakura, W. A. (2016). *Estratificação socioeconômica e consumo no Brasil*. Editora Blucher.
- McDermott, B. M., Cobham, V. E., Berry, H., & Stallman, H. M. (2010). Vulnerability factors for disaster-induced child post-traumatic stress disorder: the case for low family resilience and previous mental illness. *Australian & New Zealand Journal of Psychiatry*, *44*(4), 384-389.
- McDermott, B. M., Lee, E. M., Judd, M., & Gibbon, P. (2005). Posttraumatic stress disorder and general psychopathology in children and adolescents following a wildfire disaster. *The Canadian Journal of Psychiatry*, *50*(3), 137-143.
- McDermott, B., Berry, H., & Cobham, V. (2012). Social connectedness: A potential aetiological factor in the development of child post-traumatic stress disorder. *Australian & New Zealand Journal of Psychiatry*, *46*(2), 109-117.
- McFarlane, A. C., & Van Hooff, M. (2009). Impact of childhood exposure to a natural disaster on adult mental health: 20-year longitudinal follow-up study. *The British Journal of Psychiatry*, *195*, 142-148.
- Mitrushina M, Boone KB, Razani J, Delia LF. Handbook of normative data for neuropsychological assessment. Oxford University Press; 2005
- Najarian, L. M., Sunday, S., Labruna, V., & Barry, I. (2011). Twenty-year follow-up of adults traumatized during childhood in Armenia. *Journal of Affective Disorders*, *135*, 51-55.
- National Academies of Sciences, Engineering, and Medicine. (2015). *Mental disorders and disabilities among low-income children*. National Academies Press.
- Nepomuceno, B. B., Cardoso, A. A. V., Ximenes, V. M., Barros, J. P. P., & Leite, J. F. (2016). Mental health, well-being, and poverty: A study in urban and rural communities in Northeastern Brazil. *Journal of prevention & intervention in the community*, *44*(1), 63-75.
- Nieto (2006), G. C. Capítulo V – Atención psicosocial a la infancia y la adolescencia. p. 97 – 125. In Rodríguez, Jorge – ed Guía práctica de salud mental en situaciones de desastres Washington, D.C.: OPS, © 2006.
- Noffsinger, M. A., Pfefferbaum, B., Pfefferbaum, R. L., Sherrieb, K., & Norris, F. H. (2012). The burden of disaster: Part I. Challenges and opportunities within a child's social ecology. *International journal of emergency mental health*, *14*(1), 3.
- North, C. S. (2016). Disaster mental health epidemiology: methodological review and interpretation of research findings. *Psychiatry*, *79*(2), 130-146.
- Oh EA, Park EJ, Lee SH, Bae SM. Validation of the Korean version of the Children's Revised Impact of Event Scale. *Clin Psychopharm Neu*. 2014; *12*(2):149-156.
- Osofsky, J. D., Osofsky, H. J., Weems, C. F., Hansel, T. C., & King, L. S. (2014). Effects of stress related to the Gulf Oil Spill on child and adolescent mental health. *Journal of pediatric psychology*, *41*(1), 65-72.
- Overstreet, S., Salloum, A., & Badour, C. (2010). A school-based assessment of secondary stressors and adolescent mental health 18 months post-Katrina. *Journal of school psychology*, *48*(5), 413-431.

- Peek-Asa, C., Ramirez, M., Young, T., & Cao, Y. (2012). Flood-related work disruption and poor health outcomes among university students. *Prehospital and disaster medicine, 27*(6), 503-508.
- Perrin, S., Meiser-Stedman, R., & Smith, P. (2005). The Children's Revised Impact of Event Scale (CRIES): Validity as a screening instrument for PTSD. *Behavioural and Cognitive Psychotherapy, 33*(4), 487-498.
- Pfefferbaum, B. et al. (2013). Research methods in child disaster studies: a review of studies generated by the September 11, 2001, terrorist attacks; the 2004 Indian ocean tsunami; and hurricane Katrina. *Child Youth Care Forum, 42*:285–337
- Pfefferbaum, B., Noffsinger, M. A., Sherrieb, K. & Norris, F. H. Framework for research on children's reactions to disasters and terrorist events. *Prehosp Disaster Med. 2012 December ; 27*(6): 567–576.
- Pfefferbaum, B., Sconzo, G. M., Flynn, B. W., Kearns, L. J., Doughty, D. E., Gurwitch, R. H., ... & Nawaz, S. (2003). Case finding and mental health services for children in the aftermath of the Oklahoma City bombing. *The Journal of Behavioral Health Services & Research, 30*(2), 215-227.
- Philipsborn, R. P., & Chan, K. (2018). Climate change and global child health. *Pediatrics, 141*, e20173774.
- Piyavhatkul, N., Pairojkul, S., & Suphakunpinyo, C. (2008). Psychiatric disorders in tsunami-affected children in Ranong province, Thailand. *Medical principles and practice, 17*(4), 290-295.
- Pollack, A. A., Weiss, B., & Trung, L. T. (2016). Mental health, life functioning and risk factors among people exposed to frequent natural disasters and chronic poverty in Vietnam. *BJPsych open, 2*(3), 221-232.
- Poulsen, K. M., McDermott, B. M., Wallis, J., & Cobham, V. E. (2015). School- Based Psychological Screening in the Aftermath of a Disaster: Are Parents Satisfied and Do Their Children Access Treatment?. *Journal of traumatic stress, 28*(1), 69-72.
- Rataj, E., Kunzweiler, K. & Garthus-Niegel, S. (2016). Extreme weather events in developing countries and related injuries and mental health disorders - a systematic review. *BMC Public Health, 16*:1020 . DOI 10.1186/s12889-016-3692-7
- Reijneveld, S. A., Crone, M. R., Verhulst, F. C. & Verloove-Vanhorick, S. P. The effect of a severe disaster on the mental health of adolescents: a controlled study. *Lancet 2003; 362*: 691–96
- Rincón-Cortés, M., & Sullivan, R. M. (2014). Early life trauma and attachment: immediate and enduring effects on neurobehavioral and stress axis development.
- Roberts, Y. H., Mitchell, M. J., Witman, M., & Taffaro, C. (2010). Mental health symptoms in youth affected by Hurricane Katrina. *Professional Psychology: Research and Practice, 41*(1), 10.
- Salmon, K., & Bryant, R. A. (2002). Posttraumatic stress disorder in children: The influence of developmental factors. *Clinical psychology review, 22*(2), 163-188.
- Saulnier, D. D., Ribacke, K. B. & Schreeb, J. von. No calm after the storm: a systematic review of human health following flood and storm disasters. October 2017 *Prehospital and Disaster Medicine*

- Saunders, B. E. & Adams, Z. W. (2014). Epidemiology of traumatic experiences in childhood. *Child and Adolescent Psychiatric Clinics*, 23(2), 167-184.
- Silove, D., Steel, Z., & Psychol, M. (2006). Understanding community psychosocial needs after disasters: Implications for mental health services. *Journal of postgraduate medicine*, 52(2), 121.
- Sims, A. J., Boasso, A. M., Burch, B., Naser, S., & Overstreet, S. (2015, August). School dissatisfaction in a post-disaster environment: The mediating role of posttraumatic stress symptoms. In *Child & Youth Care Forum* (Vol. 44, No. 4, pp. 583-595). Springer US
- Stanke, C., Murray, V., Amlôt, R., Nurse, J., & Williams, R. (2012). The effects of flooding on mental health: Outcomes and recommendations from a review of the literature. *PLoS currents*, 4.
- Stoddard, F. J. (2014). Outcomes of traumatic exposure. *Child and Adolescent Psychiatric Clinics*, 23(2), 243-256.
- Stough, L. M., & North, C. S. (2018). The association of adverse mental health effects with repeated exposure to disasters.
- Stratta, P., Capanna, C., Dell'Osso, L., Carmassi, C., Patriarca, S., Di Emidio, G., ... & Rossi, A. (2015). Resilience and coping in trauma spectrum symptoms prediction: A structural equation modeling approach. *Personality and Individual Differences*, 77, 55-61.
- Stuber, J., Galea, S., Vandivere, S., Moore, K., Pfefferbaum, B., & Fairbrother, G. (2005). Behavior problems in New York City's children after the September 11, 2001, terrorist attacks. *American Journal of Orthopsychiatry*, 75(2), 190-200.
- Tanaka, E., Tsutsumi, A., Kawakami, N., Kameoka, S., Kato, H., & You, Y. (2016). Long-term psychological consequences among adolescent survivors of the Wenchuan earthquake in China: a cross-sectional survey six years after the disaster. *Journal of affective disorders*, 204, 255-261.
- Teasdale, B., Stephens, P. C., Sloboda, Z., Stephens, R. C., & Grey, S. F. (2013). The effect of Hurricane Katrina on adolescent feelings of social isolation. *Social Science Quarterly*, 94(2), 490-505.
- Thienkrua, W., Cardozo, B. L., Chakkraband, M. S., Guadamuz, T. E., Pengjuntr, W., Tantipiwatanaskul, P., ... & Tappero, J. W. (2006). Symptoms of posttraumatic stress disorder and depression among children in tsunami-affected areas in southern Thailand. *Jama*, 296(5), 549-559.
- Thomson, J., Seers, K., Frampton, C., Hider, P., & Moor, S. (2016). Sequential population study of the impact of earthquakes on the emotional and behavioural well being of 4 year olds in C anterbury, N ew Z ealand. *Journal of paediatrics and child health*, 52(1), 18-24.
- Tian, W., Jia, Z., Duan, G., Liu, W., Pan, X., Guo, Q., ... & Zhang, X. (2013). Longitudinal study on health-related quality of life among child and adolescent survivors of the 2008 Sichuan earthquake. *Quality of Life Research*, 22(4), 745-752.

- Trickey, D., Siddaway, A. P., Meiser-Stedman, R., Serpell, L., & Field, A. P. (2012). A meta-analysis of risk factors for post-traumatic stress disorder in children and adolescents. *Clinical psychology review, 32*(2), 122-138.
- Verlinden E, et al. Characteristics of the Children's Revised Impact of Event Scale in a clinically referred Dutch sample. *J Trauma Stress. 2014; 27:338–344.*
- Vins, H., Bell, J., Saha, S. & Hess, J. J. The mental health outcomes of drought: a systematic review and causal process diagram. *Int. J. Environ. Res. Public Health* 2015, 12, 13251-13275; doi:10.3390/ijerph121013251
- Weems, C. F., Russell, J. D., Neill, E. L., Berman, S. L., & Scott, B. G. (2016). Existential anxiety among adolescents exposed to disaster: linkages among level of exposure, ptsd, and depression symptoms. *Journal of Traumatic Stress, 29*(5), 466-473.
- Wei, Y., Wang, L., Wang, R., Cao, C., Shi, Z., & Zhang, J. (2013). Prevalence and predictors of posttraumatic stress disorder among Chinese youths after an earthquake. *Social Behavior and Personality: an international journal, 41*(10), 1613-1623.
- Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee- Lorenz A, et al. Principles of good practice for the translation and cultural adaptation process for patient- reported outcomes (PRO) measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. *Value Health. 2005; 8*(2): 94- 104.
- World Health Organization. (2012). Atlas of health and climate.
- Wu, H. C. (2014). Protectors of indigenous adolescents' post-disaster adaptation in Taiwan. *Clinical Social Work Journal, 42*(4), 357-365.
- Yagi, J., Fujiwara, T., Yambe, T., Okuyama, M., Kawachi, I., & Sakai, A. (2016). Does social capital reduce child behavior problems? Results from the Great East Japan Earthquake follow-up for Children Study. *Social psychiatry and psychiatric epidemiology, 51*(8), 1117-1123.
- Yoshida, H., Kobayashi, N., Honda, N., Matsuoka, H., Yamaguchi, T., Homma, H., & Tomita, H. (2016). Post-traumatic growth of children affected by the Great East Japan Earthquake and their attitudes to memorial services and media coverage. *Psychiatry and clinical neurosciences, 70*(5), 193-201.
- Zhang, Y., Zhang, J., Zhu, S., Du, C., & Zhang, W. (2015). Prevalence and predictors of somatic symptoms among child and adolescents with probable posttraumatic stress disorder: a cross-sectional study conducted in 21 primary and secondary schools after an earthquake. *PloS one, 10*(9), e0137101.
- Zhong, S. et al. The long-term physical and psychological health impacts of flooding: a systematic mapping. *Science of the Total Environment* 626 (2018) 165–194
- Ziaaddini, H., Nakhaee, N., & Behzadi, K. (2009). Prevalence and correlates of PTSD among high school students after the earthquake disaster in the city of Bam, Iran. *American Journal of Applied Sciences, 6*(1), 130-132.

ANEXOS

I. Termo de Consentimento Livre e Esclarecido – escolas BH

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Título da pesquisa:

Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes

Prezado (a),

Gostaríamos de convidar seu filho (a) para participar de uma pesquisa cujo objetivo é avaliar o impacto de fenômenos climáticos extremos, como secas e inundações, na saúde mental de crianças e adolescentes. Além disso, estamos interessados em entender como crianças e adolescentes percebem as mudanças do clima no seu dia-a-dia e como fatores psicossociais desses indivíduos influenciam seu comportamento, aprendizado e qualidade de vida. Indivíduos expostos a eventos extremos de variação climática podem apresentar maior nível de estresse, ansiedade, dificuldade de aprendizagem, perda de suporte social, menor qualidade de vida, dentre outros. Crianças e adolescentes são particularmente sensíveis a essas situações e podem ser mais gravemente afetados pelas mudanças climáticas.

Este estudo irá nos ajudar a compreender melhor o efeito das mudanças climáticas na saúde mental de crianças e adolescentes para que ações específicas para essa população possam ser elaboradas.

Leia abaixo as informações sobre o estudo antes de autorizar ou não a participação de seu filho (a).

Caso você concorde com a participação de seu (sua) filho (a) na pesquisa, vamos pedir que você responda um breve questionário para que informações sobre a história de vida da criança, estado de saúde, educação e comportamento sejam recolhidas. Depois, vamos solicitar que seu filho(a) realize alguns testes que avaliam aprendizagem e inteligência, assim como percepções, reações e entendimento sobre as mudanças climáticas. Em uma dessas atividades, vamos pedir que seu filho(a) crie uma história a partir de uma foto que representa uma condição climática e sua história será gravada utilizando-se um gravador de som. Em outra, imagens serão apresentadas em uma tela de computador, e o movimento dos seus olhos, expressões faciais e o suor das mãos serão analisados por instrumentos específicos. Para isso, o estudante precisará usar sensores nos dedos que não irão incomodá-lo e não acarretam nenhum dano ou risco. Essas atividades serão realizadas durante um encontro de, aproximadamente, 60 minutos.

Os riscos de participação na pesquisa são mínimos. Durante a realização da pesquisa, a criança ou o(a) adolescente poderá sentir desconforto, cansaço e/ou ansiedade. No entanto, a entrevista será conduzida de modo a cuidar do bem-estar físico e psicológico dos participantes, através de pequenas pausas e esclarecimentos. A pesquisa será interrompida ao menor sinal de desconforto ou quando solicitado. A participação nesta pesquisa não trará prejuízos físicos, emocionais ou cognitivos aos participantes.

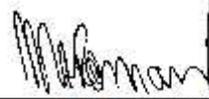
A participação de seu (sua) filho (a) na pesquisa é voluntária. Você tem a liberdade de se recusar a participar ou, se aceitar participar, retirar seu consentimento a qualquer momento, sem sofrer nenhum tipo de prejuízo. Participar da pesquisa não implicará em nenhum custo e você não será pago por sua participação.

Todos os dados coletados serão mantidos de forma confidencial. Os resultados da pesquisa poderão ser usados em publicações científicas ou apresentados em eventos científicos, sem revelar a identidade dos participantes em qualquer circunstância.

Estão garantidas todas as informações e esclarecimentos que você queira, antes, durante e depois do estudo.

O pesquisador prof Dr Marco Aurélio Romano Silva é o responsável pela pesquisa e junto à equipe de pesquisadores poderá esclarecer eventuais dúvidas a respeito da participação no estudo. As informações de contato seguem abaixo.

Agradecemos sua atenção e valiosa colaboração.
Atenciosamente,



Prof. Dr. Marco Aurélio Romano Silva

CRM-23889

Prof. Titular do Departamento de Saúde Mental da UFMG

Contato: (31) 3409-9650; Av. Prof. Alfredo Balena, 190 - sala 114 / Belo Horizonte - MG

Para maiores esclarecimentos: Comitê de Ética em Pesquisa (COEP-UFMG), na Av. Antônio Carlos, 6627 – Unidade administrativa II, 2º andar, sala 2005 / Campus Pampulha, Belo Horizonte, MG : Tel: (31) 3409-4592/ E-mail: coep@prpq.ufmg.br

Responsável: Eu, _____, abaixo assinado (a), declaro ter sido informado (a) sobre os objetivos, procedimentos e propostas da pesquisa "Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes" e concordo voluntariamente com a com a participação voluntária de _____, pelo (a) qual sou responsável. Eu li e discuti com o investigador responsável pelo presente estudo os detalhes descritos neste documento. Entendo que eu sou livre para aceitar ou recusar e que eu posso interromper a participação a qualquer momento sem precisar justificar minha decisão. Eu concordo que os dados coletados para o estudo sejam usados para o propósito acima descrito. Atesto também o recebimento de uma via assinada deste documento.

_____ (local), _____ de _____ de _____

Assinatura

II. Termo de Consentimento Livre e Esclarecido – escolas das cidades afetadas por desastres naturais

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Título da pesquisa:

Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes

Prezado (a),

Gostaríamos de convidar você e seu filho (a) para participar de uma pesquisa cujo objetivo é avaliar, ao longo do período de um ano, o impacto de fenômenos climáticos extremos, como secas e inundações, na saúde mental de crianças e adolescentes. Além disso, estamos interessados em entender como crianças e adolescentes percebem as mudanças do clima no seu dia-a-dia e como fatores psicossociais desses indivíduos influenciam seu comportamento, aprendizado e qualidade de vida. Indivíduos expostos a eventos extremos de variação climática podem apresentar maior nível de estresse, ansiedade, dificuldade de aprendizagem, perda de suporte social, menor qualidade de vida, dentre outros. Crianças e adolescentes são particularmente sensíveis a essas situações e podem ser mais gravemente afetados pelas mudanças climáticas. Este estudo irá nos ajudar a compreender melhor o efeito das mudanças climáticas na saúde mental de crianças e adolescentes para que ações específicas para essa população possam ser elaboradas. A pesquisa está organizada em três etapas que serão explicadas a seguir.

Leia abaixo as informações sobre o estudo antes de autorizar ou não sua participação e a de seu filho(a) na pesquisa.

Caso você concorde com sua participação e a de seu (sua) filho (a) na pesquisa, na primeira etapa será realizada com você uma entrevista de aproximadamente 60 minutos, com utilização de questionários, para que informações sobre a história de vida da criança, estado de saúde, educação e comportamento sejam recolhidas. Depois, vamos apresentar ao seu filho(a) tarefas que avaliam seu desempenho escolar, aprendizagem, inteligência, atenção, memória e linguagem, assim como percepções, reações e entendimento sobre as mudanças climáticas. Em uma dessas atividades, vamos pedir que ele(a) crie uma história a partir de uma foto que representa uma condição climática e a história será gravada utilizando-se um gravador de som. Em outra, imagens serão apresentadas em uma tela de computador, e o movimento dos olhos, expressões faciais e o suor das mãos serão analisados por instrumentos específicos. Para isso, os estudantes precisarão usar sensores nos dedos que não irão incomodá-los e não acarretam nenhum dano ou risco. Ainda nessa etapa, um profissional de saúde habilitado fará a coleta de 20mL de sangue e irá retirar uma pequena porção do cabelo da região da nuca da criança para mensuração do estresse.

Após essa primeira etapa, algumas pessoas serão selecionadas para participar da segunda fase da pesquisa. Nessa segunda etapa realizaremos uma nova entrevista com você, com duração aproximada de 60 minutos, para aprofundar e detalhar informações sobre o comportamento de seu (sua) filho(a).

Na terceira etapa, após o período de um ano, você será novamente contatado pela equipe da pesquisa para acompanhar as possíveis mudanças que ocorreram com seu (sua) filho(a). Nesse momento, você será novamente entrevistado e vamos solicitar que responda alguns questionários sobre comportamento e estado de saúde de seu (sua) filho(a). Além disso, reavaliações, de aproximadamente 30 minutos, serão conduzidas com a criança para avaliar seu desempenho na escola.

Os riscos de participação e o risco biológico envolvido na pesquisa são mínimos. A coleta de sangue pode doer um pouco e deixar uma mancha no local, mas, como numa escoriação rotineira, desaparece com o passar do tempo. Todo o material utilizado para coleta é estéril e descartável. O procedimento de pegar uma pequena parte do cabelo dos participantes não é doloroso, pois o cabelo será cortado por instrumento adequado e não irá comprometer esteticamente a criança. Durante a realização da pesquisa, você ou seu filho(a) poderão sentir desconforto, cansaço e/ou ansiedade. No entanto, todas as etapas serão conduzidas de modo a cuidar do bem-estar físico e psicológico dos participantes, através de procedimentos de relaxamento, pequenas pausas e esclarecimentos. A avaliação será interrompida ao menor sinal de desconforto ou quando solicitado. A participação nesta pesquisa não trará prejuízos físicos, emocionais ou cognitivos aos participantes.

A sua participação e a de seu (sua) filho (a) na pesquisa é voluntária. Você tem a liberdade de se recusar a participar ou, se aceitar participar, retirar seu consentimento a qualquer momento, sem sofrer nenhum tipo de prejuízo. Participar da pesquisa não implicará em nenhum custo e você não será pago por sua participação.

Todos os dados coletados serão mantidos de forma confidencial. Os resultados da pesquisa poderão ser usados em publicações científicas ou apresentados em eventos científicos, sem revelar a identidade dos participantes em qualquer circunstância.

Por fim, você receberá os resultados das entrevistas e avaliações realizadas pela equipe multidisciplinar das áreas de Pediatria e Psicologia. Caso seja identificado algum problema de saúde ou alguma necessidade educacional, a família será orientada e a criança encaminhada para serviços disponíveis na comunidade para que possa receber o acompanhamento necessário. Estão garantidas todas as informações e esclarecimentos que você queira, antes, durante e depois do estudo.

O pesquisador prof Dr Marco Aurélio Romano Silva é o responsável pela pesquisa e junto à equipe de pesquisadores poderá esclarecer eventuais dúvidas a respeito de sua participação e de seu filho(a). As informações de contato seguem abaixo.

Agradecemos sua atenção e valiosa colaboração.

Atenciosamente,


Prof. Dr. Marco Aurélio Romano Silva

CRM-23889;

Prof. Titular do Departamento de Saúde Mental, UFMG. Contato: (31) 3409-9650; Av. Prof. Alfredo Balena, 190 - sala 114 / Belo Horizonte-MG

Para maiores esclarecimentos: Comitê de Ética em Pesquisa (COEP-UFMG), na Av. Antônio Carlos, 8627 – Unidade administrativa II, 2º andar, sala 2005 / Campus Pampulha, Belo Horizonte, MG Tel: (31) 3409-4592/ E-mail: coep@prpq.ufmg.br

Participante e Responsável: Eu, _____ abaixo assinado (a), declaro ter sido informado (a) sobre os objetivos, procedimentos e propostas da pesquisa "Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes" e concordo voluntariamente com a minha participação e com a participação voluntária da criança/adolescente _____ pelo (a) qual sou responsável.

Eu li e discuti com o investigador responsável pelo presente estudo os detalhes descritos neste documento. Entendo que eu sou livre para aceitar ou recusar e que eu posso interromper minha participação e de meu filho a qualquer momento sem precisar justificar minha decisão. Eu concordo que os dados coletados para o estudo sejam usados para o propósito acima descrito. Atesto também o recebimento de uma via assinada deste documento.

_____ (local), _____ de _____ de _____

Assinatura

III. Termo de Assentimento Livre e Esclarecido – escolas BH

TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO

Título da pesquisa:

Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes

Prezado (a),

Estamos entrevistando crianças e adolescentes entre 8 e 18 anos, de escolas públicas de cidades do interior de Minas Gerais para uma pesquisa sobre o efeito de secas e inundações na saúde mental e bem-estar de crianças e adolescentes. Além disso, estamos interessados em entender como crianças e adolescentes percebem as mudanças do clima no seu dia-a-dia e como fatores pessoais e do seu ambiente familiar, social e escolar influenciam seu comportamento, aprendizado e qualidade de vida. Por isso, sua participação é fundamental.

Leia abaixo as informações sobre o estudo antes de concordar ou não com sua participação.

Caso você concorde em participar, vamos pedir para que você realize alguns testes que avaliam aprendizagem e inteligência, assim como percepções, reações e entendimento sobre as mudanças climáticas. Em uma dessas atividades, vamos pedir que você crie uma história a partir de uma foto que representa uma condição climática e sua história será gravada utilizando-se um gravador de som. Em outra, imagens serão apresentadas em uma tela de computador, e o movimento dos seus olhos, expressões faciais e o suor de suas mãos serão analisados por instrumentos específicos. Para isso, você precisará usar sensores nos dedos que não irão lhe incomodar e não acarretam nenhum dano ou risco. Essas atividades serão realizadas durante um encontro de, aproximadamente, 60 minutos.

Os riscos de participação na pesquisa são mínimos. Durante a realização da pesquisa, você poderá sentir desconforto, cansaço e/ou ansiedade. No entanto, a entrevista será conduzida de modo a cuidar do seu bem-estar físico e mental, através de pequenas pausas e esclarecimentos sobre o modo como a entrevista irá acontecer. A pesquisa será interrompida ao menor sinal de desconforto ou quando você nos disser que gostaria de parar.

Para participar deste estudo, o responsável por você deverá assinar um termo de consentimento. Além disso, a sua participação na pesquisa é voluntária. Você e seu responsável têm a liberdade de não aceitar participar ou, se aceitar, vocês poderão desistir a qualquer momento, sem que isso seja um problema. Participar da pesquisa não implicará em nenhum custo e você não será pago por sua participação.

Todas as informações coletadas serão mantidas de forma confidencial, ou seja, não será revelado o seu nome e demais dados pessoais seus em qualquer circunstância. Os resultados da pesquisa poderão ser usados em publicações científicas ou apresentados em eventos científicos.

Pode ser que este documento, Termo de Assentimento Livre e Esclarecido, contenha palavras que você não entenda. Nesse caso, peça ao pesquisador para lhe explicar qualquer palavra ou informação que você não entenda claramente.

Estão garantidas todas as informações e explicações que você queira, antes, durante e depois do estudo.

O pesquisador prof Dr Marco Aurélio Romano Silva é o responsável pela pesquisa e junto à equipe de pesquisadores poderá esclarecer dúvidas que você pode ter a respeito da participação no estudo. As informações de contato seguem abaixo.

Agradecemos sua atenção e importante colaboração.
Atenciosamente,



Prof. Dr. Marco Aurélio Romano Silva
CRM-23889

Prof. Titular do Departamento de Saúde Mental da UFMG
Contato: (31) 3409-9650; Av. Prof. Alfredo Balena, 190 - sala 114 / Belo Horizonte - MG

Para maiores esclarecimentos: Comitê de Ética em Pesquisa (COEP-UFMG), na Av. Antônio Carlos, 6627 – Unidade administrativa II, 2º andar, sala 2005 / Campus Pampulha, Belo Horizonte, MG Tel: (31) 3409-4582/ E-mail: coep@prpq.ufmg.br

Participante: Eu, _____, abaixo assinado (a), declaro ter sido informado (a) sobre os objetivos, procedimentos e propostas da pesquisa "Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes". Sei que o meu responsável poderá modificar a decisão da minha participação na pesquisa, se assim desejar. Com o consentimento do meu responsável já assinado, declaro concordar voluntariamente com a minha participação no estudo.
Eu li, discuti e tirei dúvidas com o investigador responsável pelo presente estudo os detalhes descritos neste documento. Concordo que os dados coletados para o estudo sejam usados para o objetivo acima descrito. Confirmando também o recebimento de uma via assinada deste documento.

_____ (local), _____ de _____ de _____.

Assinatura

IV. Termo de Assentimento Livre e Esclarecido – escolas das cidades afetadas por desastres naturais

TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO

Título da pesquisa:

Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes

Prezado (a),

Estamos entrevistando crianças e adolescentes entre 8 e 18 anos, de escolas públicas de cidades do interior de Minas Gerais para uma pesquisa sobre o efeito de secas e inundações na saúde mental e bem-estar de crianças e adolescentes. Além disso, estamos interessados em entender como crianças e adolescentes percebem as mudanças do clima no seu dia-a-dia e como fatores pessoais e do seu ambiente familiar, social e escolar influenciam seu comportamento, aprendizado e qualidade de vida. Por isso, sua participação é fundamental. Essa pesquisa possui três etapas que vamos explicar para você.

Leia abaixo as informações sobre o estudo antes de concordar ou não com sua participação na pesquisa.

Caso você concorde em participar, no *primeiro* encontro vamos solicitar que você realize tarefas que avaliam seu desempenho na escola, aprendizagem, inteligência, atenção, memória e linguagem, assim como percepções, reações e entendimento sobre as mudanças climáticas. Em uma dessas atividades, vamos pedir que você crie uma história a partir de uma foto que representa uma condição climática e sua história será gravada utilizando-se um gravador de som. Em outra, imagens serão apresentadas em uma tela de computador, e o movimento dos seus olhos, expressões faciais e o suor de suas mãos serão analisados por instrumentos específicos. Para isso, você precisará usar sensores nos dedos que não irão lhe incomodar e não acarretam nenhum dano ou risco. Ainda nessa etapa, um profissional de saúde habilitado fará a coleta de 20mL de sangue e irá retirar uma pequena porção de seu cabelo.

A segunda etapa será realizada apenas com o responsável por você e envolve entrevistas sobre sua história de vida, estado de saúde, educação e comportamento.

Por último, depois de um ano, vamos realizar a *terceira* e última etapa da pesquisa. Vamos entrar em contato de novo com você para que possamos acompanhar as possíveis mudanças que ocorreram nesse período. Nessa ocasião, vamos pedir que você novamente faça algumas tarefas para avaliar seu desempenho na escola.

Os riscos de participação e o risco biológico envolvido na pesquisa são mínimos. A coleta de sangue pode doer um pouco e deixar uma mancha no local, mas, como num machucado rotineiro, desaparece com o passar do tempo. Todo o material utilizado para coleta é estéril e descartável. O procedimento de pegar uma pequena parte do cabelo não vai lhe causar dor, pois o cabelo será cortado com instrumento adequado e não irá comprometer o seu visual e aparência. Durante a entrevista e aplicações dos testes, você poderá sentir desconforto, cansaço e/ou ansiedade. No entanto, a entrevista será conduzida de modo a cuidar do seu bem-estar físico e mental, através de pequenas pausas e esclarecimentos sobre o modo como a entrevista irá acontecer. A pesquisa será interrompida ao menor sinal de desconforto ou quando você nos disser que gostaria de parar.

Para participar deste estudo, o responsável por você deverá assinar um termo de consentimento. Além disso, a sua participação na pesquisa é voluntária. Você e seu responsável têm a liberdade de não aceitar participar ou, se aceitar, vocês poderão desistir a qualquer momento, sem que isso seja um problema. Participar da pesquisa não implicará em nenhum custo e você não será pago por sua participação.

Todas as informações coletadas serão mantidas de forma confidencial, ou seja, não será revelado o seu nome e demais dados pessoais seus em qualquer circunstância. Os resultados da pesquisa poderão ser usados em publicações científicas ou apresentados em eventos científicos.

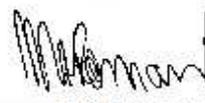
Pode ser que este documento, **Termo de Assentimento Livre e Esclarecido**, contenha palavras que você não entenda. Nesse caso, peça ao pesquisador para lhe explicar qualquer palavra ou informação que você não entenda claramente.

Ao final da pesquisa, o responsável por você irá receber os resultados das entrevistas e avaliações realizadas pela equipe de pesquisadores. Caso seja identificado algum problema importante com sua saúde ou o seu desempenho na escola, sua família será orientada a procurar serviços disponíveis na sua comunidade para que possa receber o acompanhamento necessário.

Estão garantidas todas as informações e esclarecimentos que você queira, antes, durante e depois do estudo.

O pesquisador prof Dr Marco Aurélio Romano Silva é o responsável pela pesquisa e junto à equipe de pesquisadores poderá esclarecer eventuais dúvidas a respeito de sua participação. As informações de contato seguem abaixo.

Agradecemos sua atenção e importante colaboração.
Atenciosamente,



Prof. Dr. Marco Aurélio Romano Silva
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Para maiores esclarecimentos: Comitê de Ética em Pesquisa (COEP-UFMG), na Av. Antônio Carlos, 8627 – Unidade administrativa II, 2º andar, sala 2005 / Campus Pampulha, Belo Horizonte, MG - Tel: (31) 3409-4592/ E-mail: coep@prpq.ufmg.br

Participante: Eu, _____, abaixo assinado (a), declaro ter sido informado (a) sobre os objetivos, procedimentos e propostas da pesquisa "Avaliação do impacto de fenômenos climáticos extremos na saúde mental e no bem-estar de crianças e adolescentes". Sei que o meu responsável poderá modificar a decisão da minha participação na pesquisa, se assim desejar. Com o consentimento do meu responsável já assinado, declaro concordar voluntariamente com a minha participação no estudo.

Eu li, discuti e tirei dúvidas com o investigador responsável pelo presente estudo os detalhes descritos neste documento. Concordo que os dados coletados para o estudo sejam usados para o propósito acima descrito. Confirmando também o recebimento de uma via assinada deste documento.

_____ (local), _____ de _____ de _____.

Assinatura