



Storm Alex: acute stress responses in the pediatric population

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ABSTRACT

Introduction: On 2 October 2020, a violent storm (Alex) reached the French Riviera and caused significant damage in three inhabited valleys in the hinterland of the city of Nice. Entire populations were exposed to prolonged stress (no means of communication, electricity nor water) and were particularly at risk of suffering from psychological consequences. We first hypothesized that a majority of children would experience an acute stress reaction. However, we also hypothesized that their clinical expression would differ depending on their developmental age. Thus, we aimed to evaluate, according to the child's level of development, the presence of acute stress symptoms.

Methods: Consecutive interviews with the child/adolescent and his/her parents were conducted by child and adolescent psychologists and psychiatrists to assess symptomatology following storm Alex (from day 1 to day 3). Each interview assessed nine classes of symptoms that have been compared according to age-groups.

Results: 116 children have been evaluated (0.2-17.6 years, mean 9.1). The 0-5-years-old showed more agitation as well as developmental regression than children aged 6-11 ($p = .011$, $p = .045$) and 12-18 years ($p < .001$, $p < .001$). Anxiety was reported more frequently among the 6-11 years old than the 0-5 years children ($p = .018$). Overall, the interviewed children presented at least one manifestation of acute stress after the storm (94% for the 0-5 years; 83% for the 6-11 years and 74% for the 12-18 years).

Discussion: The results highlight the high rate of acute stress symptoms in a natural disaster context, their specificity depending on children's age. Therefore; it emphasizes the need to develop, improve and validate specific assessment tools. Scheduled follow-up evaluations will help to understand, after a natural disaster, the long-term stress response in children, paving the way for targeting early, intensive, specific and multidisciplinary symptomatic treatment approaches.

Trial registration: [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT04850924) identifier: NCT04850924.

Tormenta Alex: respuestas al estrés agudo en la población pediátrica

Introducción: El 2 de octubre de 2020, una violenta tormenta (Alex) llegó a la Riviera francesa y causó daños importantes en tres valles habitados en el interior de la ciudad de Niza. Poblaciones enteras estuvieron expuestas a un estrés prolongado (sin medios de comunicación, electricidad ni agua) y corrían un especial riesgo de sufrir consecuencias psicológicas. Primero planteamos la hipótesis de que la mayoría de los niños experimentarían una reacción de estrés agudo. Sin embargo, también planteamos la hipótesis de que su expresión clínica diferiría según su etapa de desarrollo. Así, nuestro objetivo fue evaluar, de acuerdo con el nivel de desarrollo del niño, la presencia de síntomas de estrés agudo.

Métodos: Psicólogos y psiquiatras de niños y adolescentes realizaron entrevistas consecutivas con el niño/adolescente y sus padres para evaluar la sintomatología posterior a la tormenta Alex (del día 1 al día 3). Cada entrevista evaluó nueve clases de síntomas que se compararon según grupos etarios.

Resultados: Se han evaluado 116 niños (0,2-17,6 años, media 9,1). Los niños de 0 a 5 años mostraron más agitación y regresión del desarrollo que los niños de 6 a 11 años ($p = 0,011$, $p = 0,045$) y de 12 a 18 años ($p < 0,001$, $p < 0,001$). La ansiedad se reportó con mayor frecuencia entre los niños de 6 a 11 años que entre los de 0 a 5 años ($p = 0,018$). En general, los niños entrevistados presentaron al menos una manifestación de estrés agudo después de la tormenta (94% para los 0-5 años; 83% para los 6-11 años y 74% para los 12-18 años).

Discusión: Los resultados destacan la alta tasa de síntomas de estrés agudo en un contexto de desastre natural, su especificidad dependiendo de la edad de los niños. Por lo tanto; esto

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关键词

自然灾害, 精神创伤, 急性
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HIGHLIGHTS

- Acute stress symptoms in children and adolescents are very frequent in the context of exposure to a natural disaster with specifications depending on the developmental age.

enfatisa la necesidad de desarrollar, mejorar y validar herramientas de evaluación específicas. Las evaluaciones de seguimiento programadas ayudarán a comprender, la respuesta al estrés a largo plazo en los niños después de un desastre natural, allanando el camino para el abordaje de tratamientos sintomáticos tempranos, intensivos, específicos y multidisciplinarios.

亚历克斯风暴：儿童人群的急性应激反应

简介: 2020年10月2日，一场猛烈的风暴（亚历克斯）抵达法国里维埃拉，并对尼斯市腹地三个居民区山谷造成重大破坏。整个人群长期处于应激之下（没有通讯、电和水），尤其面临遭受心理后果的风险。我们首先假设大多数儿童会经历急性应激反应。然而，我们还假设他们的临床表现会根据他们的发育年龄而有所不同。因此，我们旨在根据儿童的发育水平评估急性应激症状的存在。

方法: 儿童和青少年心理学家和精神科医生对儿童/青少年及其父母进行连续访谈，以评估风暴亚历克斯后（从第1天到第3天）的症状。每次访谈评估了已根据年龄组进行比较的九类症状。

结果: 对116名儿童进行了评估（0.2-17.6岁，平均9.1岁）。与6-11岁（ $p = .011$, $p = .045$ ）和12-18岁（ $p < .001$, $p < .001$ ）的儿童相比，0-5岁儿童表现出更多的焦虑和发育退化。6-11岁儿童比0-5岁儿童更频繁地报告焦虑（ $p = .018$ ）。总体而言，受访儿童在风暴后至少呈现出一种急性应激表现（0-5岁为94%；6-11岁为83%，12-18岁为74%）。

讨论: 结果强调了自然灾害背景下急性应激症状的高发生率，其特异性取决于儿童的年龄。所以，它强调需要开发、改进和验证具体的评估工具。计划的后续评估将有助于了解自然灾害后儿童的长期应激反应，为针对早期、强化、特异性和多学科对症治疗方法铺平道路。

1. Introduction

On October 2nd 2020, a violent storm (Alex) reached the French Riviera and caused significant damage in three inhabited valleys in the hinterland of the city of Nice (Storm Alex (2021)). During this event, nine people died. Many families found themselves in severe precariousness (house collapsed or unsafe). Entire populations were exposed to prolonged stress (no means of communication, electricity nor water) and thus were particularly at risk of suffering from psychological consequences (Cryder, Kilmer, Tedeschi, & Calhoun, 2006). Emergency measures were rapidly established in order to evacuate towards Nice via helicopter in secured facilities. After arriving in a dedicated area of Nice airport, the local Psychological Emergency Care Unit (CUMP Chauvelin et al., 2019) evaluated each individual in order to assess early stress symptoms via the national psychological emergency call scheme: 'Patient Emergency Checklist' (PEC). PEC allows rating of major symptomatic signs observed during the interview based on Acute Stress Reaction described in international classifications such as DSM-5. For the assessment of children and adolescents, the specific 'Patient Emergency Checklist for Children and Adolescent' (PEC-C) based on PEC has been used. The tool takes the form of an index card in which the CUMP professionals record the basic information about the patient and his family as well as the presence or absence of nine classes of clinical manifestations frequently observed during emergency stress situations in children of various ages. In fact, items are observable and thus easily identifiable manifestations of the child by the field's professionals on site (e.g. agitation, passiveness or regression). They are inspired from and in line with the more theoretical

criteria of international classifications such as DSM-5 and DC:0-5™ (Zero to Three: National Center for Infants, Toddlers, and Families, 2016).

PEC and PEC-C are therefore largely used to complete quick psychological assessment by CUMP teams, enabling early triage of patients and transmission of these informations for later use (e.g. to plan follow-up psychosocial care).

We hypothesize that after storm Alex, a majority of children will present symptoms of acute stress reaction but that their clinical expression will differ according to their developmental age. Thus, we aimed to assess the presence of acute stress symptoms according to the child's level of development.

2. Methods

Following storm Alex, CUMP teams were deployed at the dedicated area at the local airport (from day 1 after the storm to day 3) and consecutive interviews with the child/adolescent and his/her parents were realized by a pair of specifically trained professionals, from the CUMP teams. The interviews consisted of a systematic family time for all age groups where the evaluation was based on the parents' answers and observation of their child. This stage was reproducible for all age groups except for 2 adolescents whose parents were left behind. Then, an individual time with the child was proposed for the 6-11 and 12-18 age groups to perfect the clinical observation made during the previous time. Games or drawings were systematically proposed, but only to mediate the interview, especially for children aged 3 to 11. Symptoms of acute stress reaction were assessed using the PEC-C and were classified in 9 overall classes and evaluated for the

Table 1. Participant demographic characteristics and core results from Patient Emergency Checklist for Children and Adolescents (PEC-C).

| Characteristics | Participant, No. (%) | | | |
|--|------------------------------|------------------------------|------------------------------|-------------|
| | Age Groups | | | |
| | 0-5 years | 6-11 years | 12-18 years | Total |
| Overall | 38 (32.8) | 47 (40.5) | 31 (26.7) | 116 (100.0) |
| Sex | | | | |
| Male | 22 (57.9) | 24 (51.1) | 18 (58.1) | 64 (55.2) |
| Female | 16 (42.1) | 23 (49.9) | 13 (41.9) | 51 (44.8) |
| Clinical screening | | | | |
| Anxiety | 9^a (23.7) | 25^a (53.2) | 16^a (51.6) | 50 (43.1) |
| Sadness / Cries | 10 (26.3) | 16 (34.0) | 9 (29.0) | 35 (30.2) |
| Mutism / Apartness | 9 (23.7) | 7 (14.9) | 6 (19.3) | 22 (18.9) |
| Passiveness | 9 (23.7) | 9 (19.1) | 8 (25.8) | 26 (22.4) |
| Agitation / Panic / Desorganization | 16^b (42.1) | 8^b (17.0) | 1^b (3.2) | 25 (21.6) |
| Somatization | 2 (5.3) | 5 (10.6) | 2 (6.4) | 9 (7.8) |
| Developmental regression / Excessive attachment to caregiver | 13^b (34.2) | 7^b (14.9) | 0^b (0.0) | 20 (17.2) |
| Verbalization of fear | 12^a (31.6) | 21^a (44.7) | 5^a (16.1) | 38 (32.8) |
| Sleep disorders | 7 (18.4) | 5 (10.6) | 4 (12.9) | 16 (13.8) |
| No symptoms | 2^a (5.3) | 8(17.0) | 8^a (25.8) | 18(15.5) |

^aANOVA $p < .05$.^bANOVA $p < .01$.

Significant results (a, b) are highlighted in Bold.

three age groups (0-5, 6-11 and 12-18 years). Comparisons between age groups for the nine classes of symptoms were tested using ANOVA with post-hoc comparison using Bonferroni correction (Jamovi software). This study was registered on Clinical Trials (NCT04850924) and informed consents were given by all participants and parents.

3. Results

A total of 116 children (mean age = 9 years 1 month, SD = 4 years 5 months; age range: 2 months – 17 years 7 months) were evaluated (sex ratio male/female 1.23) which represents the total number of children evacuated from this site during the first three days after the disaster.

Analysis revealed several differences in clinical responses of acute stress according to age group (see Table 1). There is an effect of age group on the agitation response ($p < .001$), verbalization of fear ($p = .03$), developmental regression behaviours ($p < .001$) and anxiety ($p = .013$). The 0-5 years-old children showed more agitation as well as developmental regression than the 6-11 ($p = .011$, $p = .045$) and 12-18 years-old ($p < .001$, $p < .001$). Anxiety was reported more frequently among the 6-11 than the 0-5 years children ($p = .018$). Intergroup differences failed to reach significance for the verbalization of fear. Overall, the interviewed children presented at least one manifestation of acute stress after the storm (94% for the 0-5; 83% for the 6-11 and 74% for the 12-18 years-old). Nevertheless, adolescents (12-18 years) were significantly ($p = .019$) less often reporting symptoms than young children (0-5 years).

4. Discussion

The majority of the interviewed children, especially the younger ones, presented at least one manifestation

of acute stress after being exposed to storm Alex. The clinical profiles differ according to developmental stage, with developmental regression and restlessness in young children. These external symptoms (such as fits of anger, agitation or oppositional behaviour) might be explained in young children by a level of emotional control that is too low in a context of anxiety and fear or by the children's perception of the parental distress and their own manifestation of stress. Thus, social and cognitive capacities in the context of stress could then be undermined and prevent the child to express his/hers own suffering other than by external symptoms (Côté et al., 2017).

The results highlight the high rate of acute stress symptoms in the pediatric population in a natural disaster context, and their specificity depending on the child's age and therefore the need to develop, improve and validate specific assessment tools. Authors also want to emphasize the necessity for emergency team members to have access to knowledge and tools that reflect the current state of scientific data on pediatric psychological trauma and acute stress, also taking into account the developmental level of the children.

The main limitations of these preliminary results are the use of a non-validated but frequently used national French questionnaire collecting acute stress symptoms corresponding to international classifications such like DSM-5 and DC:0-5™, and the lack of consideration of pre-event mental health status. The present results of the acute phase do not include follow-up data. Nevertheless, the study will be completed by follow-up evaluations including lifetime medical and psychiatric history. Thus, considering previous mental health status in line with acute stress evaluation and follow-up evaluations will help to understand the specificity of stress reactions after a natural disaster in children depending on their age, paving the way for targeting early, intensive, specific

and multidisciplinary symptomatic treatment approaches.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Contributors' Statement Page

All authors conceptualized and designed the study. AR, MG and ON designed data collection instruments, collected data and carried out the initial analyses. AR, AF and ST drafted the initial manuscript. All authors reviewed and revised the manuscript and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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