

Autistic Behaviors Prevalence in Young Children Three Years after the Devastating Haiti Earthquake

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Abstract

The goal of this study was to examine, prospectively the prevalence of autistic behaviors in a cohort of young children three years following in utero exposure to a devastating earthquake. Method: Subjects were 364 children (50.8% boys) at 39 months old (3.3 years) who were in utero during the 2010 Haiti earthquake that resulted in a death toll of approximately 222,000. In August 2013, mothers completed several questionnaires including those about autistics behaviors and emotional problems in children (Echelle d'Evaluation des Comportements Autistiques Révisée -ECAR or Autistic Behaviors Scale Revised and the Child Behavior Check-List 1 ½-5). Results: Eight out of 364 (2.2%) children surveyed met criteria for intense autistic behaviors, 4 came from the epicenter and 4 were exposed as a foetus at the 3rd trimester, a large part of their mothers (7) needed psychological support, and 5 of those mothers experienced the death of family member following the disaster. Conclusions: the prevalence of autistic behaviors found in a cohort of 3 year old children exposed to the disaster is high compared to other estimates worldwide. The results of this first study to investigate the prevalence of autism in a cohort of exposed children in utero during the earthquake in Haiti underline the need for further and larger epidemiological research with culturally sensitive tools for the evaluation of young subjects exposed directly or indirectly to traumatic events in Haiti

Keywords: Maternal Stress; Prenatal exposure; Haiti's Earthquake; Autistic Behaviours

Introduction

Studies in the area of prenatal exposure to earthquakes and subsequent outcomes during early childhood development are rare. In the literature, two publications, including 18 years old students born from mothers who survived the 1976 Tangshan earthquake in China, have investigated associations between prenatal stress related to the catastrophe with depressive and schizophrenic symptoms [1,2].

Animal and human studies [3-5] suggest that genetic and environmental factors may contribute to the etiology of serious neurodevelopmental disorders, such as Autistic Spectrum Disorders (ASD), a condition associated with constant deficit in social communication, and social interaction in multiple situations. For example, deficits in social reciprocity, non-verbal communicative behaviors involved in social interaction and skills in developing, maintaining and understanding relationships [6]. Environmental factors such as prenatal exposure to stressful life events may also play a role in the etiology of ASD [7-10]. Recently, studies of cohorts of young people exposed in utero to natural disasters have demonstrated a strong association between prenatal exposure to hurricanes at 5-6 and 9-10 months of gestation [11] as well as exposure to an ice storm during the first trimester of pregnancy [12] and the increase in the prevalence of ASD in children.

Regarding the possible relationship between prenatal exposure to natural catastrophes and ASD, to our knowledge no publications in this area are yet known in low-income countries where the phenomenon is relatively common and usually carry an extraordinary impact on the survivor's quality of life. Meanwhile, the estimate rate for ASD is rising across epidemiological surveys around the globe over the past decades. Autism is a lifelong disorder with major impact in public health and the economy. In the long run, the annual societal cost for one individual affected by autism in the United States is 3.2 million US dollars [13] while for the UK the average is above 3 billion US dollars [14].

In March 2014, The Centers for Diseases Control and Prevention (CDC) in its press release revealed a prevalence rate of ASD across the United States at 1 out of 68 children or 14.7 per 1,000 (1.47%) young subjects of 8 years old. The increase in the prevalence rate is 30% compared to past estimates in 2012. The majority of epidemiological studies conducted with respect to the prevalence of ASD in children mainly describe only the situation in high-income countries: some North American (United States and Canada) and European countries (United Kingdom, Swedish, Germany, Portugal and France). Very poor data are available regarding the rate of ASD in eastern cultures. In the meta-analysis of the global prevalence of ASD [15] only two publications following systematic population based evaluation in Argentina and Venezuela [16] were found, only one was reviewed for a Caribbean country, Aruba [17].

On January 12 of 2010 the west and partial south regions of the island of Haiti was devastated by an earthquake of 7.3 magnitude on the Richter Scale. This earthquake came with a death toll of 222, 000 people and left 2.3 million Haitians homeless forcing 1.5 million to settle in camps. In addition, by the end of 2010, beside political instability and election related violence; the situation worsened due to the Cholera outbreak that killed 3,500 people and left 155, 000 sick as well as hurricane Thomas [18]. Research conducted in the field of mental health indicated major

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psychopathological consequences in different groups of survivors of the Haitian earthquake [19]. For example, one year after the earthquake, specifically in vulnerable population living in camps or in Shantytown such as women, the high estimate of Gender Based Violence (GBV) reported by human rights organization and other surveys were alarming [20,21]. Furthermore, the estimate of Post-Traumatic Stress Disorder (PTSD) and Depression in the children of refugees ranged between 68 % to 40% [22]. While, in previous study we found high score for PTSD symptoms among a cohort of mothers who were pregnant during the disaster (Blanc et al., submitted). Nevertheless, similar to other populations exposed to earthquake worldwide, 5 years after the deadliest natural catastrophe experienced by Haiti, there is a huge gap in data related to the probable effect of prenatal stress as a pre-traumatic risk factor for the development of offspring whose mothers have survived the traumatic event.

Therefore, the objective of this study was to examine prospectively the prevalence of autistic behaviors in a cohort of young children three years following in utero exposure to a devastating earthquake.

Method

This survey was conducted in August 2013, 3½ year after the disaster; the participants were from the west and south regions of Haiti devastated by the earthquake of 2010. The population composed of mother-offspring dyads and was part of a larger study investigating the impact of prenatal exposure to the earthquake on the psychological development of children at age 3. The children were exposed prior to birth during the disaster on January 12 of 2010. While pregnant, the mother was present in an area affected by the earthquake (the epicenter-Leogane, Jacmel, and the metropolitan area of Port-au-Prince) at the time of the event. The inclusion criteria were: mothers over the age of 18 years who were able to speak creole, their child was born between January 13 and the first week of October 2010. The exclusion criteria were intellectual disability, psychotic disorder and substance abuse during pregnancy for the mother or child death. Of the 374 dyads that were recruited from hospitals, refugee camps and in the communities, 10 dyads were excluded from the final analysis because of missing data, resulting in a final sample of 364 dyads (mean age mother = 27.31, SD = 5.93 and mean age of the child in months = 39.2 ± 2.9).

The Institutional Review Board of the State University of Haiti approved this protocol, and informed written or verbal consent (in case of illiteracy) was obtained from the mothers. One hundred and forty students with B.A degrees in Psychology fluent in Creole and French, and trained by the principal investigator participated in the data collection. All instruments were translated from English or French to Haitian Creole by the principal investigator, a bilingual psychologist, and then reviewed with the students at the training session prior the initiation of data collection.

Maternal variables

Sociodemographic data: In this section, we collected information on maternal age, level of education, professional status, marital status, living condition and geographical origin.

Gestational data: Mothers provided information on the context of pregnancy: gestational age at time of the disaster, the course of pregnancy, and any obstetric complications.

Traumatic experience related to the earthquake: Exposure to the earthquake was assessed with items adapted from the Earthquake Experience Questionnaire (EEQ) [23]. Mothers responded to questions about traumatic events, such as “being trapped under the rubble”,

“having been seriously injured”, or “having participated in rescue efforts”; as well as the extent of personal material and human lives lost during or immediately after the earthquake.

Child variables

All information on the child’s birth, past health condition and the presence of any autistic behaviors were provided by mothers.

Autistic behaviours: The “Echelle d’Evaluation des Comportements Autistiques Revisee-ECAR” (Autistic Behaviors Scale Revised- ABSR) was used for the observation of the child in his usual environment. It can be used to evaluate different types of young children behaviors, including social withdrawal, impaired verbal and non – verbal communication, etc. This scale is completed by a person who knows the child. The 29 items are rated on a 4-point Likert scale ranging from 1 = “Not at all” to 4 = “all the time”. The overall score indicates the intensity of autistic behaviors. The scale can be divided into two subscales: Relationship Deficit (RD) (items: 1, 2, 3, 4, 5, 6, 8, 9, 12, 23, 24, 26 and 28) and Modulation Skills Deficit (MSD). A cut-off score of 27 in the subscale RD is a reliable tool to detect ASD in children [24]. In the present study, the internal consistency (Cronbach’s alpha) for this subscale was 0.81.

Child Behavior Checklist for Ages 1 ½ -5 (CBCL / ½ -5): The CBCL scales are frequently used in research and clinical practice worldwide. As with all versions of the CBCL, the preschool forms, a revision of the CBCL 2/3, is a self-report questionnaire completed by the parents or any close individual who knows the child well. The 100 items are divided into 7 syndromes scales and each item is coded from 0= not true, 1= somewhat or sometimes true, and 2= very true or often true. These items describe psychopathological risk and emotional problems in preschool children. There are several ways to summarize and analyse data obtained from the questionnaire. The clinician can consider a T score to categorize the child’s overall behaviors, a T score below 65 is the normal range, T scores between 65 and 69 suggest a borderline range and T scores > 70 indicate clinical range. On one hand, a T score (global) is typically used for each syndrome to compare variability in the subject’s functioning; however, the results can also be interpreted in terms of “Internalizing” or “Externalizing” problems. For the purpose of formal diagnosis, the CBCL preschool forms are also comprised of 5 DSM Oriented Scales, among those are the Pervasive Developmental Problem (PDP) scale corresponding to the Pervasive Developmental Disorders (PDD) category. In this study, the PDP CBCL sub-scale score was used to cross data with ECAR for autistic symptoms. A PDP score < 9 implies that subject fell within the range of the clinical population [25]. It has been established by numerous studies that the CBCL 1 ½ -5 (subscales grouping PDP and Withdrawal) have relevant or cross-psychometric properties with other diagnostic tools such as the Gilliam Autism rating Scale (GARS) and the Autism Diagnostic Observation Schedule General (ADOS-G) for the assessment of autism spectrum disorders and autistic traits [26]. The internal consistency in our work for the PDP subscales was .75 (moderate) and .94 (strong) for the entire CBCL questionnaire.

Statistical analyzes

Descriptive statistical analyses were performed to describe the cohort of mother-child dyads screened. All data analyses were performed using Statistical Package for Social Sciences (SPSS) V.22. The level of alpha significance was set at 0.05 (bilateral).

Results

Dyads Characteristics

Dyads in our sample were mainly from the west Region of Haiti

(97.8%), which was severely hit by the disaster in 2010 with a small percentage (5.5%, 20 participants) of recruited from the epicenter (Leogane). The majority of mothers 76.4% (278) were unemployed (Blanc et al., submitted). More than half, 50.5% (185), of the child participants were male; of the entire sample, 4% (19) were born preterm between 7 and 8 months of gestation.

Prevalence of autistic behaviors

The average scores for maternal Peritraumatic Distress and symptoms of PTSD, and autistic behaviors in offspring were described elsewhere (Blanc et al., submitted).

Regarding the intensity of Autistic behaviors exhibited by children screened in actual survey: 2.2%(8) scored above the cut off score of 27 on the ECAR Relationship Deficiency subscale, while 25.8% (94) of the complete sample obtained a mean score above 9 on the CBCL PDP subscale; furthermore, the T (global) Score for the entire CBCL ranged between 65 and 69 (borderline range) for 4% (17) of the sample and above 70 for 44.8% (163) (clinical range) of the sample (Figure1).

Figure 1 shows the principal characteristics including demographics, prenatal exposure experience during the disaster and perinatal facts for the 8 children who presented severe autistic behaviors as measured by the ECAR RD subscale. As we can notice, there was no sex difference in the population. Half of the group was exposed to the earthquake at 3rd trimester and half also came from the epicentre. For most of them (5), the mother had a family member who died because of the disaster and the majority (7) fell in the clinical range to the CBCL Pervasive Developmental Problem subscale: mean score >9.

Discussion

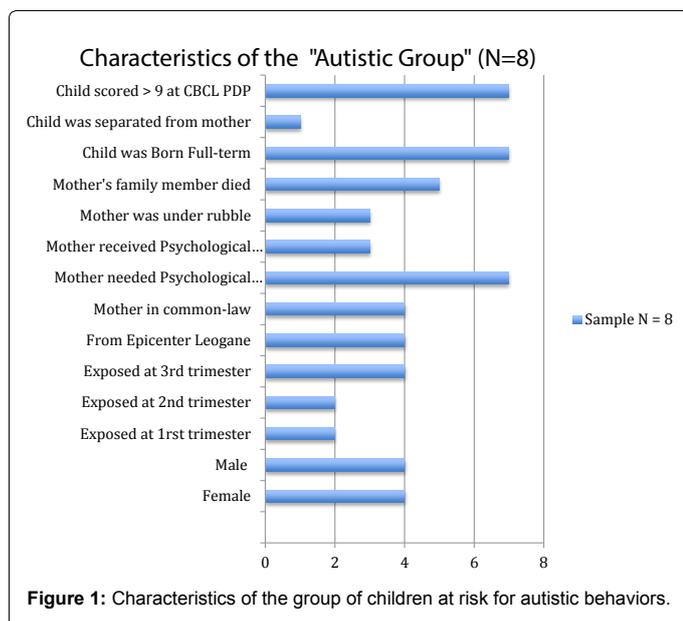
This study examined the prevalence of autistic behaviors in young children three years following in utero exposure to the most devastating earthquake in Haiti's history on January 12th, 2010. The participants were 364 mother-offspring dyads from the west and south cities of Haiti. As expected, and in line with the surveys conducted by Kinney et al., [11] and Walder et al., [12], in several cohorts of subjects exposed in utero to severe tropical storm in Louisiana or to Ice Storm in Quebec, we noticed a high prevalence rate for ASD behaviors in present sample:

8 (2.20%) out of the 364 children. We also observed based on our data, that many mothers of these children at risk for autistic behaviors had serious experience of other traumatic events resulting from the earthquake, such as need for psychological support, presence at the epicenter, loss of family member, or were trapped under rubble.

There are 3 ways one could analyse these estimates. First, the 2.20% does not seem to differ drastically from the increased prevalence rate observed ultimately in the literature worldwide: 14.7/1,000 (1.47%) in the United States (CDC, 2014), including some low-income Caribbean states, for example Aruba, where the last known prevalence was 1.9%/1,000 [17]. Second, this important rate obtained from our survey could be explained by a tool bias. Although the ECAR questionnaire filled out by mothers to assess autistic behaviors and the CBCL 1 ½ -5 maintain reliable psychometric properties, they are essentially built as a screener for behavioural problems in young children and not for diagnostic purposes. A third relevant way to interpret this great rate of ASD behaviors in our sample may reside in cultural aspects specific to the Haitian society. Elsabbagh et al [15] noted in their epidemiological survey review, regarding the global prevalence of Autism and other Pervasive Developmental Disorders, that despite the variability in the average estimates of ASD globally (62/10 000), there was no sufficient supporting data to report the impact of regional, cultural and socio-economical variables. However, besides the neuro-biological basis observed in the etiology of ASD, there is also evidence of cultural incidence in the diagnostic. In a multicross-cultural study including children from 4 different countries: Israel, South Korea, United Kingdom and United States, there was a significant difference among the 4 groups with respect to manifestation of nonverbal communication/socialization, verbal communication, and insistence of sameness and restricted interests [27]. Moreover, Freeth et al, [28] demonstrated that in other cross-cultural comparison of autistic traits in university students from UK, India and Malaysia, Autistic traits were reported to a greater extent in the Eastern populations than the Western culture. Consistent with these results, a possible difference in what it is considered to be normal for a Haitian mother compared to mothers from other culture when self-rating her child's behavior, could have impacted the score obtained on the ECAR and CBCL.

Strengths

To the best of our knowledge, this epidemiological study is the first attempt to determine prevalence of autistic behaviors in a cohort of children in Haiti. The first strength is the use of natural disaster as a natural experiment in the assessment of the effect of prenatal exposure to earthquake to the development of autistic behaviors in children at age 3; the results are consistent with previous publications about Prenatal Maternal Stress (PNMS) during a natural catastrophe and the long-term outcomes in offspring from a low-income country. As of today, no publication could be found in the literature about this lifelong condition in Haiti; the condition of individuals and families' affected by ASD. Therefore, a second strength of this research is the fact that it could be considered as baseline for a prospective study design in a larger national epidemiological investigation on ASD in Haiti. Furthermore, the last strength to emphasize in this work is the focus placed on the required prevention, and intervention to enhance resilience in a population usually identified as vulnerable such as pregnant women and infant-mother dyads after exposure to devastating disaster identical to the 2010 earthquake. Contrary to findings in their counterparts who had lived through an earthquake [29], pregnant and postpartum women who survived hurricane Katrina demonstrated resiliency, and could even appraise positive aspects following the traumatic event [30]. Though



present study highlights the urgent need for the overall improvement of the Haitian public health and health infrastructure in Haiti.

Limitations

Nonetheless, despite the extremely relevant conclusions brought to the community with our results, the study has limitations. In contrast to an abundant number of epidemiological surveys reviewed by Schaafsma et al. [31] that indicate a sex-specific male predominance in ASD possibly linked to antenatal exposure to stress, no sex difference was found in our data. Another limitation to be mentioned is the small sample size, the results found here might be specific to the cohort assessed. Consequently, the high prevalence noticed for ASD behaviors of 2.20% [8] measured with screening tools in 364 children of 39 months olds may not be generalizable at the national level.

Conclusion

Clinical Implications

Our findings indicate a high prevalence of ASD symptomatology in the offspring of mother survivors of a major earthquake in Haiti, similar to other results obtained in western populations of children exposed in utero to severe natural disasters. The consideration of a cultural bias in regards to the way the Haitian mothers rated their children's behavior is crucial in this context. Consequently, this study underlines the need for further and larger epidemiological research with culturally sensitive tools for the evaluation of young subjects exposed directly or indirectly to traumatic events in Haiti.

Conflict of Interest

The authors report no conflict of Interest.

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