Incidence of and Risk Factors for Acute Stress Disorder in Children with Injuries

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Background: **To assess the incidence of and risk factors for Acute Stress Disorder (ASD) in children with injuries. Numerous studies have documented the increased incidence of PTSD in those initially diagnosed with ASD. PTSD symptoms cause tremendous morbidity and may persist for many years in some children.**

Methods: **Children hospitalized with one or more injuries were interviewed and assessed with the following: Child Stress Disorders Checklist (CSDC), Family Strains Scale, Brief Symptom Inventory (BSI) and Facial Pain Scale.**

Results: **Participants included sixty-five children (ages 7–18 years). The mechanisms of injury varied (e.g. MVC, penetrating). The mean injury severity score was 8.9 ± 7. The mean length of hospital stay was 4.6 ± 4.6 days. Altogether, 18 (27.7%) of participants met DSM IV criteria for ASD during their acute hospital stay. Risk factors such as level of family stress, caregiver stress, child's experience of pain, and child's age were predictive of acute stress symptoms.**

Conclusion: **We have identified four risk factors of ASD that have implications for the treatment, and possibly, preventative intervention for PTSD. Further investigation and greater understanding of risk factors for ASD in children with injuries may facilitate the design of acute interventions to prevent the long-term negative outcomes of traumatic events.**

Key Words: **Acute Stress Disorder, Incidence, Risk factors, Children with injuries.**

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Injuries are the single largest cause of morbidity and mortality among children in the United States.[1,2] The Centers for Disease Control and Prevention reported that close to 10 million children and adolescents under the age of 15 were seen in hospital emergency rooms for injuries in 2000.[3] In 2002, the United States Department of Transportation[4] reported that over 300,000 children ages 15 and younger in the United States are injured in motor vehicle accidents each year. Given the prevalence of pediatric trauma and its relevance to public health, it is important to gain greater understanding of the variables that contribute to the development of mental health problems in these children. The present study seeks to aid in this understanding by investigating risk factors for Acute Stress Disorder (ASD) in children following a traumatic event. This study reports the first assessment in a prospective investigation of Post-traumatic Stress Disorder (PTSD) in children with injuries, thus providing a look at ASD during the child's acute hospital stay.

ASD encompasses core features of a child's initial psychiatric reactions to traumatic events.[5] ASD describes the psychopathological response in the immediate aftermath of a traumatic event that occurs within one month of the trauma. According to the Diagnostic and Statistical Manual of Mental Disorders Version IV (DSM-IV), a diagnosis of ASD requires that the person be exposed to a traumatic event that involved actual or threatened death or serious injury, to which the person responded with intense fear, helplessness and horror.[6] Diagnostic criteria also require the person to have three or more dissociative symptoms (e.g., a subjective sense of numbing, a reduction in awareness of his or her surroundings, derealization, etc.) and at least one symptom in each of the following areas of criterion: re-experiencing, avoidance, and hyperarousal. Although ASD is a relatively new psychiatric diagnosis, its importance is highlighted by the fact that it may be a predictor for the development of PTSD. PTSD symptoms cause tremendous morbidity and may persist for many years. If children who are at risk for PTSD can be identified early, there is a greater likelihood that preventative interventions can be initiated.

ASD is the main psychiatric diagnosis for an acute traumatic event. Until recently a majority of studies investigating the prevalence of ASD have focused only on traumatized adults.[7–11] These studies demonstrate that ASD prevalence rates differed depending on the type of trauma experienced; rates ranged from 6% in survivors of natural disasters[12] to

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Table 1 Measurements

Measure	Reporter	Participant
The Child Stress Disorders Checklist (CSDC)	Parent	Child
The Diagnostic Interview for Children and Adolescents (DICA)	Child	Child
The Colored Analogue Pain Scale (CAS)	Child	Child
Injury Severity Score (ISS)	ER physician	Child
Brief Symptom Inventory	Parent	Parent
Family Strains Scale	Parent	Parent

33% in survivors of violent assault.[11] Variation within similar traumatic events has also been demonstrated. For example, Harvey and Bryant[13] found ASD rates of 13% in motor vehicles crashes, whereas others found a prevalence rate of 21%.[8] As information about prevalence rates of ASD and variation within traumatic events become established, researchers have begun to investigate major trauma outcomes such as quality of life,[14–16] subjective perception of recovery,[17] general health,[18] and return to work[19] in adults with injuries.

ASD has only recently begun to be assessed in groups of traumatized children. Due to possible differences in symptom development in children and adults, researchers have stressed the need for empirical research in areas of both ASD diagnosis and ASD symptomatology.[5] A broad range of ASD symptoms in separate cohorts of children with injuries have been reported.[5,20] A study by Daviss and colleagues[5] found that ASD is widely though divergently reported by parents and nurses in children hospitalized for an injury. There have also been few studies of the prevalence of ASD diagnoses in children.[5,20,21] Saxe and colleagues[21] reported an ASD prevalence rate of 31% among children with burns. Koplin et al.[20] reported an ASD in 28% of children who had experienced a traffic injury. There have been few studies investigating the predictors of and risk factors for ASD in children.[5,20] A number of longitudinal studies have identified risk factors such as parent's symptoms,[22–24] family stress and changes,[22–24] patterns of parenting,[25,26] age,[27] gender,[23,24,27–29] re-exposure to the trauma,[25,26] which affect the course of posttraumatic symptoms. Cross-sectional studies of traumatized children have found that the degree of exposure,[30–34] levels of ongoing stress,[30,35,36] family stress,[36] parents symptoms,[37–39] prior traumatic events,[35] and individual/developmental variables such as psychiatric history,[36] trait anxiety,[30] and coping style[32,36] are related to posttraumatic symptoms.

The current study presents initial findings from the baseline assessment of a prospective study investigating PTSD in children with injuries. The aim of this study was to determine the incidence of and risk factors for ASD in children hospitalized with injuries by choosing to examine a set of variables identified in the empirical literature as described above. These variables include but are not limited to parent's symptoms, family stress, child's anxiety, and child's depression.

MATERIALS AND METHODS

Participants

Participants were drawn from a sample of children who were admitted to Boston Medical Center and subsequently admitted to the hospital for injuries between April, 2002 and January, 2004. All children aged 7–18 admitted to the hospital with an injury were eligible to participate unless they or their parents did not speak sufficient English to complete the study instruments, had a Glasgow Coma Scale equal to or less than 7 at the time of their admission, or lived more than two hours away from the hospital (complicating follow-up interviews).

Procedure

The families of children who were admitted to BMC with an injury were introduced to the study by a trained researcher, once the child was deemed medically stable by the attending surgeon (e.g., they did not have a delirium, an active infection and were not receiving mechanical ventilation). Families were told that the study was investigating a child's coping following injury. All families were informed that participation in the study was voluntary and to decline participation would not affect their level of care. Written informed consent was obtained from both parents and child after the researcher gave a comprehensive description of the study. The BMC Institutional Review Board approved the study protocol and all established guidelines for the treatment of human participants were adhered to. A researcher interviewed the child and the primary caregiver during the initial hospital stay using the psychometric assessment package described below (Please refer to Table 1 for an outline of measurement by reporter and participant). Every effort was made to interview the child and caregiver separately, however the sensitive and complicated nature of the hospital stay and setting (e.g., grief, anxiety, doctor consultations, nurses visits, vitals being taken, etc.) prevented this to occur at some times. Patients were paid for participation in the acute assessment.

Outcome Measures

ASD symptoms: Child Stress Disorders Checklist (CSDC)[40] is a measure of acute stress symptoms based on observer report. This 30 item scale assesses dimensions of the child's acute and post-traumatic stress response that corre-

spond with the DSM IV symptom criteria for both ASD and PTSD. In the present study, the child's primary caregiver rated the child's acute stress symptoms on a 3-point scale (0 = "not true," 1 = "sometimes true," 2 = "very true"). The scores ranged from 0 to 75 with higher scores reflecting greater ASD symptoms etiology. Internal consistency for the CSDC was found to be 0.75. Test-retest reliability, calculated by correlating scores reported by parents, two days apart, was found to be 0.72.

ASD diagnosis: Diagnostic Interview for Children and Adolescents (DICA)[41] is a semi-structured interview schedule that has been widely used in clinical and nonclinical populations of children and has demonstrated reliability and validity.[42–44] It has been used in a number of different samples of traumatized children including victims of an earthquake, Cambodian refugees, children who were abused, and burn victims. We modified the PTSD module of this instrument to allow for a diagnosis of ASD. Separate raters administering the DICA-ASD to 17 acutely burned children had perfect agreement (Kappa = 1.0) for ASD. Internal consistency for the five symptoms of ASD was good (chronbach's alpha 0.67). We also assessed a variety of parameters (for example, total body surface area burned) known to be related to acute stress in acutely burned children to establish validity. The findings of that study support the validity and reliability of the DICA-ASD module.

Risk Factor Measures

Pain: Colored Analog Pain Scale (CAS)[45] is a pocket-sized visual analog instrument used to assess both intensity of pain and pain affect with children. To assess pain intensity, the child slides a marker along a ten-centimeter line marked with increasing intensity of red color corresponding to increased intensity of current pain. The facial affective scale used to assess the aversive component of pain is composed of nine drawings of faces demonstrating a range of expressions, from least distressed to most distressed. On the back of both scales are numeric equivalents, which correspond to the child's response. This instrument has been used with many groups of children who have pain. Children with more painful syndromes score higher on this instrument compared with those with less painful syndromes. The CAS has been found to be easier to administer than other visual analog scales.

Injury Severity: Injury Severity Score (ISS)[46] is a well-validated index of the injury severity. The ISS is related to the likelihood of survival after injury and is determined by rating the severity of injury for six body areas (i.e., head, neck, face, chest, abdomen, extremity and external) on a five-point scale known as the abbreviated injury scale (AIS). The AIS ranges from 1 (minor injury) to 5 (critical injury). The numerical score represents the degree of life threat associated with the anatomic injury. The ISS is derived from the sum of the squares of the AIS score with a range of 0-75. For patients with multiple traumas the three most severe injures are squared and summed. A trained trauma nurse coordinator assigned the ISS score of the participants in this study.

Parent's psychologic distress: Brief Symptom Inventory[47] measures psychiatric symptoms in the caregivers of child participants. This is a 53-item self-report symptom inventory that reflects the psychologic symptom patterns of the child's caregiver. Each item is scored on a five-point scale of distress (0-4), ranging from "not at all" to "extremely." The scoring includes nine primary symptom dimensions and three global indices of distress. This study focused on the Global Severity Index (GSI) global indices. The GSI combines information on both numbers of symptoms and intensity of distress and is the most sensitive single indicator of the caregiver's distress level. The GSI has an internal consistency measure ranging from 0.71- 0.85 and a test re-test reliability ranging from 0.68 to 0.91. The BSI has a stability coefficient of 0.90.

Family stress: Family Strains Scale[48] is a 10-item instrument that measures the level of stress experienced by the child's family in the year before the injury. This instrument asks parents about 10 possible stressful experiences in the previous year such as conflict between parents, conflict between children, financial hardship and the strain of caring for an ill family member. The Family Strains Scale is part of a larger instrument, the Family Inventory of Life Events and Changes,[48] which is designed to broadly assess family functioning. This instrument has been used with a number of populations of medically ill children. The Family Strains Scale has an internal consistency of 0.72 and a test-retest reliability of 0.73. Validity is supported by data indicating that families with a high degree of conflict and a low degree of cohesion have much higher scores.

Child's self-esteem: Piers Harris Children's Self Concept Scale 2[49] measures the child participant's self-concept. This 60-item self-report measure assesses self-attitudes describing and evaluating one's behavior and attributes. A high score on this scale reflects a positive self-evaluation and a low score reflects a negative self-evaluation. This instrument has six different "cluster scales": Behavior, intellectual and school status, physical appearance and attributes, anxiety, popularity, and happiness and satisfaction. Each of these scales measures self-concept or self-esteem derived from its respective scores. Test-retest reliability coefficients on this scale have ranged from 0.42 to 0.96. Internal consistency estimates of the total score range from 0.88 to 0.93. This instrument also appears to have sufficient convergent and discriminant validity.

Parent's acute stress: Stanford Acute Stress Reaction Questionnaire (SASRQ)[50] is a 30-item questionnaire designed to evaluate acute stress in accordance with the DSM-IV criteria for ASD. The items on the questionnaire assess dissociation, reexperiencing, avoidance, anxiety, hyperarousal and impairment in functioning. Across varied samples and studies, the scale has demonstrated very good

reliability (alpha range: 0.87-.95) and strong construct, predictive, discriminant and convergent validity.

Child's anxiety: The Multidimensional Anxiety Scale for Children (MASC)[51] is a 39-item self-report measure of pediatric anxiety symptoms. Mean intraclass correlation coefficients for the MASC at three weeks and three months were 0.79 and 0.93, respectively, demonstrating satisfactory to excellent test-retest reliability. The MASC has also demonstrated good convergent and divergent validity through its relation to instruments known to measure anxiety, depression, and externalizing symptoms.

Child's depression: Children Depression Inventory (CDI)[52] is a 27-item self report measure of depressive symptoms in children and adolescents. This measure has documented reliability; reliability coefficients are good (ranging from 0.71 to 0.89) and test-retest reliability correlations have demonstrated acceptable levels. Numerous studies have established concurrent and divergent validity.

Demographic Variables

Socio-Economic Status (SES): SES data were gathered from the Child Behavior Checklist (CBCL).[53] SES was calculated with an updated version of Hollingshead's (1975)[54] system for scoring SES based on parents' occupations. This system is based on a parent's self report of occupation(s) and is scored on a range from 10 or low SES (e.g., farm laborer) to 90 high SES (e.g., architect).

Statistical Analyses

All statistical analyses were conducted with the statistical software SPSS 11.0 for Windows[55] or M-plus 2.1.[57] An alpha level of 0.05 was used. Based on each child's report of acute stress items on the DICA, we specified the percentage of our sample that met criterion for each ASD symptom group. We then calculated incidence as the number of participants diagnosed with ASD, as outlined in the DSM-IV,[6] out of the total number of participants during their acute hospital stay. Frequencies were conducted to determine the percentage of participants who met criteria for each symptom cluster of ASD.

Variables were chosen for investigation if there is evidence from the empirical literature that the given variable could be a risk factor for PTSD. We divided variables into two categories 1) ASD symptoms (dependent variable): A continuous variable of ASD determined by a total sum of the caregiver's ratings on the Child Stress Disorders Checklist. 2) Risk factors (independent variables): Injury severity score, life stress, caregiver's psychologic distress, child's self-esteem, child's report of pain, caregivers acute stress, child's anxiety, child's depression and various demographic variables (age, gender, SES and ethnicity).

Using these variables we conducted pathway analyses to determine the best predictors for the dependent variable (ASD symptoms). To constrain the number of paths in this model, we deleted paths whose bivariate relationship with ASD was less than 0.20. These bivariate relationships or beta weights provide a standardized correlation that allows us to measure the relationship between two variables while controlling for all other variables. We chose a model that consisted of a combination of the aforementioned variables that accounted for a high percentage of the variance of ASD symptoms (high R^2) and fit with our theoretical understanding of ASD.

Approach to Missing Data

Problems related to missing data can reduce the number of participants for a particular analysis to a less than optimal level. To prevent this, we employed Muthen and Muthen's [56] "M-plus 2.1" full information maximum likelihood estimator statistical package, which accounts for missing data. This procedure enabled us to utilize our entire sample ($N = 65$) for each variable included in the path analysis. In this study the covariance coverage values, which represent the proportion of data not missing, ranged from 60% to 100%, exceeding the recommended minimum of 10%. This is considered an acceptable procedure for randomly missing data.[57] M-plus is preferred since it is able to use the full information maximum likelihood procedure in concert with the Satorra-Bentler correction for non-normal data. See the work of Graham et al.,[57] and McArdle and Cattell[58] for a discussion of the advantages of imputation over more traditional listwise and pairwise deletion procedures for missing data.

RESULTS

A total of 114 families were referred for recruitment by the attending psychiatric nurse. Of these, 65 families consented to participation, 35 families declined to participate and 12 were discharged before they could be approached for recruitment. Six participants were excluded from the current study. Four were excluded because the family did not meet the language requirement and two were excluded due to a Glasgow Coma scale below 7. Demographic information, decline demographic information, mechanism of injury and incidence of ASD are shown in Table 2, Table 3, Table 4 and Table 5 respectively.

Risk Factors for ASD

According to the aforementioned protocol, we chose four independent variables (parent's psychologic distress symptoms, child's report of pain, life stress and age) that fit our theoretical model and accounted for the highest amount of the variance (R^2) for our main dependent variable of ASD symptoms. The main dependent variable (CSDC) was normally distributed, kurtosis < 3. The four independent variables accounted for 49% of the variance of ASD ($R^2 = 0.49$). The path analysis model yielded strong fit indices, using the Chi Square ($\chi^2 = 1.123$, df $= 2$, $p = 0.57$), the Comparative Fit Index (CFI $= 1.0$), the Root Mean Square Error of Approximation (RMSEA $= 0.0$) and Standardized Root Mean Square Residual (SRMR $= 0.03$). Figure 1 displays the re-

Table 2 Demographic Variables

	Participants, No. (%)*
Gender	
Female	18 (28)
Male	47 (72)
Race	
African American	32 (49)
Asian	2 (3)
Hispanic	12 (18)
White	19 (29)
Socio-economic status	
Low (0 - 30)	15 (23)
Middle (31 – 70)	15 (23)
High (71 – 90)	5 (8)
Undetermined	30 (46)

* 65 participants; age, 13.5 ± 4, range 7–18; ISS 8.9 ± 7; length of hospital stay, 4.6 ± 5 days.

sults; standardized regression coefficients (Betas) are given for each relationship between the dependent and independent variables. As can be seen, parents' psychologic distress, life stress before the trauma, child's report of pain and child's age were all risk factors for parents' rating of child ASD. Demographic variables (age, gender and ethnicity), child's anxiety, child's depression and ISS were not significantly related to ASD. The correlation between ISS and ASD symptoms was negligible ($r = 0.06$).

Table 3 Decline Demographic Variables

	Participants, No. (%)*
Gender	
Female	13 (28)
Male	33 (71)
Race	
African American	12 (26)
Asian	0 (0)
Hispanic	4 (9)
White	13 (28)
Native American	1 (3)
Other	2 (4)
Missing	15 (32)

* total declines, 47; age, 14.14 ± 2.96, range 8–18.

Table 4 Mechanism of Injury

Injury	Participants, No. (%)
Pedestrian struck	24 (37)
MVA/MCA	13 (20)
Falls	9 (14)
GSW/stabbing	9 (14)
Bicycle	4 (6)
Assault	4 (6)
Suffocation	1 (1.5)
Other	1 (1.5)

MVA, Motor Vehicle Accident; MCA, motorcycle, GSW, gunshot wound.

Table 5 Incidence of ASD symptom clusters and diagnosis

Symptom Cluster	Patients Meeting Criterion: No. (%)
Traumatic Event	65 (100)
Anxiety Reaction	54 (83)
Dissociation	48 (73)
Numbing	33 (51)
Reduced awareness of surroundings	40 (62)
Derealization	54 (83)
Depersonalization	49 (75)
Dissociative amnesia	37 (57)
Reexperiencing	49 (75)
Avoidance	38 (59)
Increased Arousal	51 (79)
Diagnosis	
Met DSM-IV criteria for ASD diagnosis	18 (28)

DISCUSSION

More than a quarter of the participants met DSM-IV criteria for ASD. This is one of the first studies to document the incidence of ASD in a sample of traumatized children. If this incidence rate persists with a larger sample and is replicated in other samples it would suggest that a considerable number of children with injuries have significant acute psychiatric symptoms. Further, as ASD may be a risk factor for PTSD, this incidence rate suggests that many children with injuries may be at risk for persistent psychiatric problems.

Our assessment of risk factors yielded four variables that together accounted for 49% of the variance of ASD. These variables were: 1) parent's psychologic distress (measured by Brief Symptom Inventory), 2) life stress (measured by the Family Strains Scale), 3) the child's report of pain (measured by the Facial Pain Scale), and 4) the child's age. Interestingly, the magnitude of the injury measured by the Injury Severity Score did not influence ASD symptoms. Each of these variables offers the possibility for intervention.

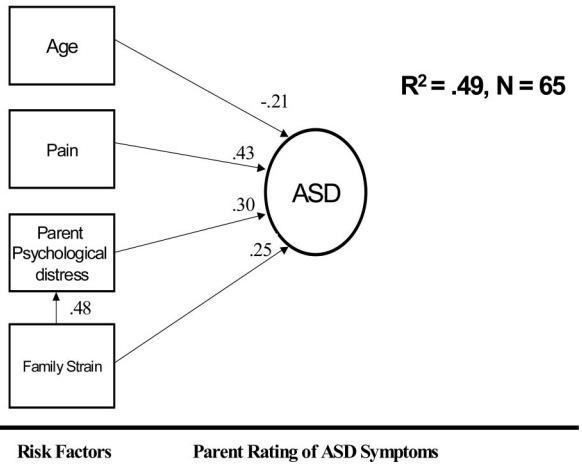

Fig 1. *Pathway analysis model of risk factors for ASD. Betas for each pathway are depicted above the arrows.*

The findings that younger children with injuries are more likely to have ASD symptoms than older children is interesting and suggests that younger children require special attention for the assessment of ASD symptoms on hospital units. This data are consistent to what we have reported on separation anxiety among burned children in intensive care units.[21] In that study, we found that children who were managing separation anxiety (symptoms highly related to younger age) while on a unit for children with burns were at highest risk for ASD. We did not directly measure separation anxiety in the present study. This finding on the relationship between younger age and ASD suggests that possible mediating variables (such as separation anxiety) ought to be assessed.

Our data on the relationship between pain and ASD has important implications for treatment. If symptoms of pain, parent distress and family strain can be identified in the acute aftermath of a trauma and strongly contribute to the risk of ASD, then it is critical to be able to assess these symptoms and to intervene accordingly. There are well-described interventions for these risk factors of pain, parent distress and family distress.[59–61] Effective pain management, for example, may diminish psychiatric morbidity in children at high risk. Clinicians who routinely assess acutely traumatized children should be vigilant for and treat complaints of pain. We have previously reported that the equivalency dose of morphine that a child receives for a burn significantly diminishes PTSD symptoms over six months following discharge from the hospital.[62] Our findings in the present study that pain is a risk factor for ASD suggests that opiate medications may turn out to be a preventative intervention in the nonburn injured population as well.

Our findings on caregivers' psychologic distress and the degree of family stress predicting children's symptoms is important and suggests that parents who are overwhelmed with their own symptoms, may have diminished capacity to help their child while he or she is recovering following an injury. This finding may be indicative of a shared biological or genetic vulnerability to traumatic stress. The relationship between caregivers' symptoms, the degree of family stress and a child's ASD symptoms suggests that children and their parents must be assessed and offered treatment if they are experiencing psychologic difficulty in the aftermath of a child's traumatic event. Psychosocial interventions to help with such stressors such as housing, marital, and financial problems may help the child's symptoms.

A limitation of this study is its cross-sectional nature, which may fail to capture the complexity of the relationship between symptoms and risk factors that contribute to the emergence and maintenance of ASD over time. However, this is the first assessment of a four assessment longitudinal prospective study, which will allow further investigation of the incidence of and risk factors for ASD and PTSD in children with injuries. Further investigation and greater understanding of risk factors for ASD in children with injuries may facilitate the design of acute interventions to prevent the long-term negative outcomes of traumatic events. Negative outcomes of major trauma have been well established in adult who have been injured.[14–19] Similar research has not been conducted with child populations. Future research should not only address information about risk factors of ASD but also investigate the consequences of major trauma in the lives of children.

Forty-three percent (N = 49) of patients referred by the attending psychiatric nurse declined to participate or were discharged before consent was obtained. It is possible that the relatively large number of patients who were not enrolled in this study may bias the sample by under or over representing those with ASD symptoms and may reduce the generalizability of the findings. There was no significant difference in demographic information (age, race and gender) between those enrolled in the study and those who declined participation. Furthermore, previous research on the prevalence of ASD in children following a traumatic accident has produced findings similar to the incidence rate found in this present study.[20,21]

Another limitation of this study is the small sample size. A small sample size has several effects on this study. One effect is the possibility of making a Type II error. Another is that it does not allow us to account for potential age differences. Our data indicates that there is a relationship between younger children and increased ASD symptoms. It is likely that risk factors for and incidence of ASD, is variable between different age groups. However, due to the small sample size in this study we are unable to make meaningful conclusions about potential differences between developmentally distinct age groups. Future research should stratify by age when investigating the incidence and etiology of ASD.

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