DEVELOPMENT AND STANDARDIZATION OF SCREENING CHECKLIST FOR AUTISM SPECTRUM DISORDERS (ASD) IN AN INDIAN POPULATION.

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CHAPTER I

INTRODUCTION

Autism and other pervasive developmental disorders (PDDs) are a set of neuropsychaitric disorders, which is still a field of mystery in the areas of diagnosis, differential diagnosis, assessment and treatment/intervention. Not many people have given attention to the condition until Leo Kanner (1943), a psychiatrist who noted that 11 of his patients showed similar symptoms labelled “early infantile autism”. Pervasive Developmental Disorders (PDDs) are a set of related neuropsychological disorders, characterized by patterns of both delay and deviance in multiple areas of development, their onset being typically in the first month of life (Vilkman & Lord, 1998).

Wing (1981) used the term autistic spectrum continuum and later in 1988 she used the label autistic spectrum disorders to emphasize the wide range of social and communication difficulties.

Autistic disorder, also known as childhood autism, infantile autism, and early infantile autism is a condition where there is a marked and sustained impairment in social interaction, deviance in communication, and restricted or stereotyped patterns of behavior and interest. Abnormalities in functioning in each of these areas must be present by age 3 (Volkamar, Klin & Schultz, 2005).

PDD is a collection of disorders consist of few common features (Mauk, 1993).

- Impairment in social interaction
- Impairment in verbal and nonverbal communication
- Impairment in imaginative activities
- Limited number of interest and repetitive activities.

Autism spectrum disorders (ASDs) constitute a group of severe disorders of development, disrupting social relationships, communication, play, academic skills, and usually leading to life-long disability. ASD affects up to 60 children in 10,000 (Baird et al., 2000 Bertrand et al. 2001)

The term pervasive developmental disorders (PDDs) was first implemented to provide a formal diagnosis for individuals who shared critical deficits similar to those associated with autism but who did not meet the full criteria of a diagnosis of autism.

In pervasive developmental disorders there will be either delay or deviance in these aspects like Communication, social and other skills. Since the child with PDD's social interaction will be lacking, the child will show interest in the inanimate objects. This is a typical characteristic of children with PDD.

This includes motor mannerisms (stereotypies), resistance to change, and idiosyncratic interests and preoccupations (Volkamar, Klin & Schultz, 2005).

The category of PDD outlined in the DSM-IV published in 1994 includes Autistic disorders, Asperger syndrome, Pervasive developmental disorder – not otherwise specified (PDD NOS). Childhood autism is the prototypic disorder in the spectrum of autistic disorders (DSM-IV, APA, 1994; ICD-10, WHO, 1993). All the disorders within the autistic spectrum are characterized by

1. Qualitative impairment in social interaction,
2. Qualitative impairment in social communication and
3. Restricted repertoire of interests, behaviours and activities.

According to the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV-RT, 2000) classification system of ASD can be sub grouped into five types. They

are Autism, Childhood disintegration disorders, Rett's syndrome, Asperger syndrome and Pervasive developmental disorder not otherwise specified [PDD-NOS].

DSM-IV-TR (2000) criteria for Autistic disorder is as follows:

(I) A total of six (or more) items from (A), (B), and (C), with at least two from (A), and one each from (B) and (C)

- (A) qualitative impairment in social interaction, as manifested by at least two of the following:
  - 1. marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction
  - 2. failure to develop peer relationships appropriate to developmental level
  - 3. a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people, (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)
  - 4. lack of social or emotional reciprocity (note: in the description, it gives the following as examples: not actively participating in simple social play or games, preferring solitary activities, or involving others in activities only as tools or "mechanical" aids)
- (B) qualitative impairments in communication as manifested by at least one of the following:
  - 1. delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
  - 2. in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
  - 3. stereotyped and repetitive use of language or idiosyncratic language
  - 4. lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level
- (C) restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least two of the following:
  - 1. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
  - 2. apparently inflexible adherence to specific, nonfunctional routines or rituals
  - 3. stereotyped and repetitive motor mannerisms (e.g hand or finger flapping or twisting, or complex whole-body movements)
  - 4. persistent preoccupation with parts of objects

(II) Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years:

- (A) social interaction
- (B) language as used in social communication
- (C) symbolic or imaginative play

(III) The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder

DSM V (2014) has give further classification of Autism Spectrum Disorders and had given clear guidelines between Autism Spectrum Disorders and Social Pragmatic disorders. Along with these changes in ASD, there have been few modifications in communication disorders and autism spectrum disorders. The details are as follows:

Communication Disorders: The DSM-5 communication disorders include language disorder (which combines DSM-IV expressive and mixed receptive-expressive language disorders), speech sound disorder (a new name for phonological disorder), and childhood-onset fluency disorder (a new name for stuttering). Also included is social (pragmatic) communication disorder, a new condition for persistent difficulties in the social uses of verbal and nonverbal communication. Because social communication deficits are one component of autism spectrum disorder (ASD), it is important to note that social (pragmatic) communication disorder cannot be diagnosed in the presence of restricted repetitive behaviors, interests, and activities (the other component of ASD). The symptoms of some patients diagnosed with DSM-IV pervasive developmental disorder not otherwise specified may meet the DSM-5 criteria for social communication disorder.

Autism Spectrum Disorder: ASD is a new DSM-5 name that reflects a scientific consensus that four previously separate disorders are actually a single condition with different levels of symptom severity in two core domains. ASD now encompasses the previous DSM-IV autistic disorder (autism), Asperger's disorder, childhood disintegrative disorder, and pervasive developmental disorder not otherwise specified. ASD is characterized by 1) deficits in social communication and social interaction and

2) restricted repetitive behaviors, interests, and activities (RRBs). Because both components are required for diagnosis of ASD, social communication disorder is diagnosed if no RRBs are present.

Epidemiology

Prevalence of Autism Spectrum Disorders

According to the study conducted by Chakrabarti & Fombonne, (2001) in UK, with target population size of 15,500 using ICD-10 1992 criteria, the prevalence rate per 10,000 is 16.2.

Baird et al. (2002) also conducted a study in UK with a target population of 16,235 using ICD-10 1992 criteria and found that the prevalence rate per 10,000 is 30.8.

While Indian epidemiological studies are lacking, it is established to be one in every 500(Action for Autism-AFA,2006)

Sex ratio

• Studies based on clinical and epidemiological samples have suggested a higher incidence of autism in boys rather than in girls, with ratios reported averaging around 3.5 or 4.0 to 1.

• However, these ratios vary as function of intellectual functioning. Some studies reported ratios of up to 6.0 or higher to 1 in individuals with autism without mental retardation, whereas ratios within moderate to severely mentally retarded range have been reported to be as low as 1.5 to 1.

• One possibility for the discrepancy seen in the sex ratio is that males have a lower threshold for brain dysfunction than females, or conversely, more severe brain damage is required to cause autism in a girl. According to this hypothesis when the

person with autism is a girl, she is more likely to be severely cognitively impaired Baird et al. (2002).

• **Social classes**: autism is clearly seen in all social classes and in all countries.

The main problem areas of Autism include social impairment, language impairment and behavior concerns. Where social impairment consists of marked impairment in the use of multiple nonverbal behaviours to regular social interaction, failure to develop peer relationships appropriate to the developmental level. A lack of spontaneity to share enjoyment, interests or achievements with other people and lack of social or emotional reciprocity.

Language impairment may include delay in, or total lack of the development of spoken language, marked impairment in the ability to initiate or sustain a conversation despite adequate speech, stereotyped and repetitive use of language or idiosyncratic language, “Flipping” pronouns, or pronomal reversal, echolalia, repeating or reciting lines, having a very literal and concrete use of language and a robotic voice or monotonic voice.

Behavioral issues include encompassing preoccupations with one or more stereotypical and restricted patters of interests, apparently inflexible adherence to specific, nonfunctional routines or rituals, stereotypical and repetitive motor mannerisms and persistent preoccupation with parts of objects.

ASD includes:

1. ***Autism/ Autistic disorder***: It is the most severe extreme along the continuum of the Autism Spectrum Disorders. Autism is a neurobiological disorder of development that causes discrepancies in the way information is processed. This difference in information processing leads to inability to understand and use language to interact

and communicate with people, events, objects and environment and learn to think in the same way the typically developing children. The effects of Autism on learning and functioning can range from mild to severe.

A. Qualitative impairment in social interaction, as manifested by following characteristics:

a) Marked impairment in the use of multiple nonverbal behaviors such as eye to eye gaze, facial expression, body postures and gestures to regulate social interaction.

b) Failure to develop peer relationships appropriate to developmental level.

B. Qualitative impairments in communication as manifested by following characteristics:

a) Lack of varied, spontaneous make-believe play or believe play or social imitative play appropriate to developmental level.

b) In individuals with adequate speech, marked impairment in the ability to initiate or sustain conversation with others.

C. Restrictive repetitive and stereotyped patterns of behavior, interests and activities, as manifested by the following characteristics:

a) Encompassing preoccupation with one or more stereotyped and restricted patterns in interest that is abnormal either in intensity or focus.

b) Stereotyped or repetitive motor mannerisms (Ex: hand or finger flapping or twisting or complex whole body movements).

2. ***Rett's disorder:*** "Rett syndrome is an X-linked dominant neurological disorder that affects only girls and is one of the most common causes of mental retardation in females".

The hallmark of Rett syndrome is the loss of

- *Purposeful hand use and its replacement with stereotyped hand-wringing*.
- *Screaming, fits and inconsolable crying are common*.

Girls affected with Rett's Syndrome show normal development during first 6-18 months of life followed first by a period of stagnation and then rapid regression in motor and language skills.

Characteristics:

a) Normal prenatal and perinatal development.

b) Normal psychomotor development through the first five months after birth.

c) Normal head circumference at birth.

d) Deceleration of head growth between ages 5 and 48 months.

e) Loss of previously acquired purposeful hand skills between ages 5 and 30 months with the subsequent development of stereotyped hand movements.

f) Loss of social engagement early in the course.

g) Appearance of poorly coordinated gait or trunk movements.

h) Severely impaired expressive and receptive language development with severe psychomotor retardation.

3. ***Childhood Disintegrative Disorder (CDD):****"Childhood Disintegrative Disorder is a rare condition characterized by a marked regression in multiple areas of development after several years of normal development*." (Saddock & Saddock, *Comprehensive Text Book of Psychiatry*)

Characteristics:

a) Normal development for at least first 2 years after birth as manifested by the presence of age appropriate verbal and nonverbal communication, social relationships, play and adaptive behaviour.

b) Clinically significant loss of previously acquired skills.

c) Abnormalities of functioning in at least two of the following areas.

4. ***Asperger's Syndrome:*** Asperger's syndrome is a relatively new diagnosis in the field of autism and is named after the Austrian paediatrician *Hans Asperger* (1906–80).

Asperger's syndrome is characterized by impairment in social interaction and restricted interests and behaviors as seen in autism. In its early developmental course, it is marked by lack of any clinically significant delay in spoken or receptive language, cognitive development, self-help skills, and curiosity about the environment.

Characteristics:

a) The disturbance causes clinically significant impairment in social, occupational or other important areas of functioning.

b) There is no clinically significant delay in language (Ex: single words used by age two years, communicative phrases used by age 3 years).

c) There is no clinically significant delay in cognitive development or in the development of age appropriate self- help skills, adaptive behavior (other than social interaction) and curiosity about the environment in childhood.

5. ***Pervasive Developmental Disorder- not otherwise specified (PDD-NOS):*** It is a heterogeneous group comprising of those children whose symptoms do not fall neatly

into any one of the diagnostic criteria of the ASDs. It has been diagnosed as a sub-threshold category which offers no specific guidelines for diagnosis (Yale Child Study Centre, 2004a). Sometimes it is called as ‘Atypical Autism).

In the study by Chawarska et al (2006), results revealed that there are noticeable differences between PDD-NOS and Autism with respect to Age of Recognition (AOR) and type of first concern. There was poor social-communicative and nonverbal cognitive functioning when the Age of recognition was delayed.

It is challenging to identify Autism at an earlier age, where most of the time children are referred for later evaluation. The parents report autism around at the age of 17-18 months. (Chawarska et al., 2007). There are also evidences where children are not diagnosed even at the age of 4 or later. It is primarily based on child’s socio-economic status (Gray et al., 2006).

Early detection and subsequent early intervention can lead to substantially better prognosis, including improved language, social relationships, and adaptive functioning, as well as fewer maladaptive behaviors, which increases the chance of successful inclusion in public education (Eaves and Ho, 2004; Harris & Handleman, 2000).

Researchers have indicated that early identification plays a major role in social and behavioral developmental milestones. Landa et al. (2007) found social, communication, and play behavior in the early-diagnosis group differed from low risk group and typically developing group by 14 months of age.

By 24 months, the later-diagnosis group differed from the non-autism spectrum disorder groups in social and communication behavior, but not from the early diagnosis group.

There is always a dire need to screen children who are most likely to fall into ASD category. Kleinman et al. (2008) suggested that children with ASD are not diagnosed before 4 years of age but the American Academy of Pediatrics (2006) recommends universal screening for ASDs beginning at 18-months of age, but even earlier diagnosis may be possible (Stone et al. 2008). Earlier identification is very much crucial to give behavioural rehabilitation as early as possible to improve their functioning normally in all the domains which are primarily affected by Autism.

There are several checklists and screening tools which are developed to evaluate or detect the early signs of ASD in the first 2 years of life in the general population or in at-risk children.

Broadband Screeners

Broadband screeners are designed to detect a wide range of developmental problems, including communication and social deficits that are key features of ASD.

Parents' Evaluation of Developmental Status (PEDS): Developed by Glascoe in 2006, it consists of 10 items. It is a brief parent report of concerns of their child's development that can be used to identify at-risk young children (starting at about 18 months). Glascoe et al. (2007) found that 34% of 427, 18–59 month children who were considered at-risk for developmental delay based on the PEDS were identified at risk for ASD based on the *Modified Checklist for Autism in Toddlers* (M-CHAT: Robins, Fein, Barton, & Green, 2001). The authors identified specific patterns of scores that varied given the child's age that reduced over-referrals and maintained acceptable sensitivity. Pinto-Martin et al. (2008), on the other hand, found that the PEDS had very low sensitivity based on the M-CHAT, although their results have been questioned (Glascoe and Squires 2009). It has been found that neither study

actually diagnosed ASD, but instead compared the PEDS to another screener that may not accurately predict ASD diagnosis.

The Infant–Toddler Checklist (ITC), part of the *Communication and Symbolic Behavior Scales Developmental Profile* (CSBS DP: Wetherby and Prizant 2002) asks parents 25 questions about possible child communication delays. In a prospective study of a general population sample of 5,385 children less than 24 months of age, the ITC correctly identified 93% of children who developed ASD (Wetherby et al. 2008). However, the ITC did not discriminate ASD from other communication delays unless the child score was less than the tenth percentile on the social composite (Wetherby et al. 2008).

ASD-Specific Screeners

Several early detection instruments have been developed specifically to find children in the general population who may develop ASD.

The Checklist for Autism in Toddlers (CHAT: Baird et al. 2000; Baron-Cohen et al. 2000) combines parent report with health care professional observations to screen for ASD at 18 months of age.

Modified Checklist for Autism in Toddlers (M-CHAT): The 23 item parent report M-CHAT initially showed promise (Robins et al. 2001), but subsequent studies have hardened the utility of the M-CHAT as an accurate ASD screener for the general population when used on its own.

Pandey et al. (2008) suggested that the M-CHAT has high sensitivity, but for low risk children under 24-months it had low positive predictive value and did not differentiate children with ASD, language delays or global delays.

The two-stage ***Early Screening of Autistic Traits Checklist/checklist/questionnaire*** (ESAT: Dietz et al. 2006) for infants around 14 months old consists of four prescreen items completed by the infant's physician and a follow-up 14-item screening by a trained psychologist during a home visit. From a population sample of 31,724 Dutch infants between 14 and 15 months of age, 69% of children who were positive on the 4-item prescreen received the 14 item follow-up. The specificity and predictive power of the checklist is low and therefore, the value of the ESAT as an ASD-specific screener is questionable.

The ***Pervasive Developmental Disorders Screening Test- II*** (PDDST-II: Siegel 2004) is a parent report instrument that has been used to detect ASD in young children. Stage 1 is a general screener for paediatricians. Stage 2 looks at developmental delay, and Stage 3 focuses on ASD. Based on clinical impression, Stage 1 ASD sensitivity was .92 and specificity was .91, but there was no confirmation of ASD diagnosis (Siegel 2004). Screening clinic practitioners have questioned the clinical utility of the PDDST-II (McQuistin and Zieren 2006).

ASD-Specific Second-Order Screeners Using Infants at Biological Risk

Screening Tool for Autism in Two-Year-Olds (STAT)

The STAT is a 12-item, 20 min interactive test conducted by a trained professional and measures ‘‘play (two items), requesting (four items), directing attention (four items), and motor imitation (four items)’’ (Stone et al. 2008, p. 562). Stone and colleagues tested the appropriateness of using the Screening Tool for Autism in Two-Year-Olds (STAT) with 71 at-risk infants (59 infant sibs and 12 for whom there were concerns about ASD) between 12 and 23 months old (Stone et al. 2008). They found that the STAT had reasonable sensitivity (.93) and specificity (.83) for at-risk infants >14 months of age. A higher proportion of false positive was obtained in the 12–13 month group.

The ***Autism Observation Scale for Infants*** (AOSI: Bryson et al. 2008) was designed to track early signs of ASD in 6–18 month old infants with older affected siblings. It uses a set of structured play activities to elicit 18 behavior related to ‘‘Visual Tracking, Disengagement of Attention, Orientation to Name, Reciprocal Social Smiling, Differential Response to Facial Emotion, Social Anticipation and Imitation’’ (Bryson et al. 2008, p. 733). The AOSI showed potential to distinguish high from low risk infants as early as 12-months of age (Zwaigenbaum et al. 2005).

Parent Observation of Early Markers Scale (POEMS) Feldman et al. (2012) is a checklist that parents can use to monitor 61 specific behaviors that may be possible early symptoms and associated behaviors of an ASD in their 1–24 month old infants. Items were social and communication deficits, and intolerance to waiting. The POEMS had acceptable psychometric properties and promising predictive validity.

In summary, few broadband and ASD specific instruments show promise detecting ASD in children under 24 months. Two brief broadband parent-report screeners

(PEDS, ITC) may accurately screen for likely ASD, but more work is needed to confirm initial findings. Two ASD specific instruments, the STAT and AOSI, both require direct testing of the child by trained professionals, have limited research and neither has detected ASD in the first year of life.

CHAPTER II

REVIEW OF LITERATURE

Autism is a developmental neuropsychiatric disorder affecting children. The primary characteristics exhibited by children with autism include impaired social interaction, poor communication and restricted repetitive stereotypic behaviour patterns.

There have been major changes taken place in the criteria given for Autism Spectrum Disorders in recent years from DSM IV to DSM-IV-TR to DSM V criteria. The

The cause of autism is unknown. There are studies which indicate that autism has genetic cause. Some indicate it is caused by environmental factors, others say it is genetic triggered by environmental factors. Still the cause remains a mystery in the field.

There are several studies which have examined the relationship between individual events during pregnancy and the neonatal period and risk of developing autism. The following factors have been identified as associated with increased risk for autism: lower (Larsson et al. 2005) and higher (Croen et al. 2002; Glasson et al. 2004) maternal age, higher paternal age (Larsson et al. 2005), higher (Croen et al. 2002) maternal education, threatened abortion before 20 weeks'(Glasson et al. 2004),

bleeding during pregnancy (Gardener et al. 2009), , maternal diabetes (Gardener et al. 2009) and epilepsy (Saemundsen et al. 2007); preterm delivery (Larsson et al. 2005); multiple gestation (Croen et al. 2002), small-for gestational age (SGA)(Larsson et al. 2005), breech presentation (Larsson et al. 2005), caesarean delivery (Glasson et al. 2004), and fetal distress (Glasson et al. 2004). Males have consistently been found to be at a much higher risk than females (Croen et al. 2002).

Juul-Dam N, Townsend J, Courchesne E. (2001) did a study to examine the prenatal, perinatal and neonatal factors in Autism, PDD-NOS and the data is compared with normal population. A total of 74 children (61 autism and 13 PDD NOS) diagnosed as autism within the age range of 2.5 to 4 years participated in the study. 28 prenatal, perinatal and neonatal factors were identified by parental interview and medical review and investigated in the two groups of children. Results indicated that autism group was found to have a significantly higher incidence of uterine bleeding, a lower incidence of maternal vaginal infection, and less maternal use of contraceptives during conception when compared with the general population. Similarly, the PDD-NOS group showed a higher incidence of hyperbilirubinemia when compared with the general population.

Wilkerson D.S., Volpe A.G., Dean R.S., Titus J.B. (2002) conducted study to investigate on the predictors of infantile autism taking into consideration the perinatal complications. Maternal Perinatal Scale (MPS), a maternal self-report that surveys complications of pregnancies and medical condition of mother, was completed by the biological mothers of 183 autistic children and 209 typically developing children. MPS consists of 47 items divided into 3 sections, containing prenatal, perinatal and

neonatal factors. Results indicated that gestational age (post term birth) and low birth weight was found to be more in autistic children. Maternal morphology also showed significance difference. Increased weight and taller height was found in most mothers having autistic children. Intra uterine stress (bleeding during pregnancy, amount of stress experienced by mother during pregnancy, medication during pregnancy, and previous gynaecological surgery) also shows significant difference wherein stress during pregnancy is experienced more by mothers of autistic children when compared with typically developing children. Apart from these, prolonged length of labor, breech or other abnormal delivery, low birth weight, use of medication during pregnancy and viral infections were found to be higher in mothers of autistic children. Uterine bleeding during pregnancy was also found more in mothers of autistic children but statistically significant difference was not there. The authors also found the urinary infection, higher temperatures and depression were also experienced significantly by mothers of autistic individuals.

Glasson E.J., Bower C., Petterson B., de Klerk N., Chaney G., Hallmayer J.C. (2004) studied on the development of autism by considering the perinatal factors. They did the study to find if there is any association between the same. The study was conducted in children born in Western Australia. 465 children with autism were compared with 1313 typically developing children. Information of the clients was obtained from the research database. Parental characteristics (maternal and paternal age at the time of the infant's birth), pregnancy characteristics (pregnancy complications like urinary tract infection; preeclampsia; antepartum hemorrhage; premature membrane rupture), labor and delivery characteristics (type of anesthesia used, labor onset, labor, hours of labor, type of delivery, and birth presentation) and

infant characteristics (birth order, gestational age, head circumference, length, weight, Apgar scores at 1 and 5 minutes, time to spontaneous respiration, and time spent in special care) was considered as factors for the study. Results indicate that increased maternal and paternal age was significantly seen in autistic group. Mothers of autistic population had greater frequencies of threatened abortion, epidural caudal anesthesia use, labor induction, and labor duration of less than 1 hour. Autistic infants had foetal distress, and had an Apgar score of less than 6 at 1 minute. Autistic population had more complications than those with pervasive developmental disorder not otherwise specified or Asperger syndrome. The authors concluded that a single obstetric factor cannot be the cause of autism. It may be an underlying genetic factor or the interaction of the factors with the environment which causes the manifestation of autism.

Sugie Y, Sugie H, Fukuda T, Ito M (2005) studied the neonatal factors in infants with autistic disorder and typically developing infants. 225 children with ASD were compared with 1580 typically developing children. The factors were compared between the groups. Children with PDD-NOS, delayed motor development and any underlying diseases was excluded from the study. the cognitive level of the children varied from normal to severely impaired. Factors considered for the study included parental age, gestational age in weeks, birth weight, hyperbilirubinemia, history of phototherapy, asphyxia and respiratory distress. Medical record examination and parental interview was carried out to collect the information. Results show that although there were no significant group differences in the factors like prematurity, rates of hyperbilirubinemia, a history of phototherapy, and neonatal asphyxia, they were significantly higher in the autism group. Birth weight and post-term births were significantly higher in males with Autistic Disorder compared with typically

developing children. However, there were no significant differences between females in the autism and control groups. The authors concluded that the percentage of individuals with neonatal complications was significantly higher in the Autistic Disorder group than in the control group for both sexes and this was attributed to neonatal stress.

Larsson HJ, Eaton WW, Madsen KM, Vestergaard M, Olesen AV, Agerbo E, et al.(2005) did a study to find the risk factors of autism by taking into consideration the factors like perinatal factors, parental psychiatric history and socio-economic status.the authors hypothesised that heriditary and early fetal development plays a crutial role in the cause of autism. The study was conducted in Denmak. The factors considered for the study included fetal presentation, mode of delivery, Apgar score at 5 minutes, birth weight, gestational age at birth, and weight for gestational age, multiple gestation, preeclampsia, and number of antenatal visits, number of previous pregnancies, maternal smoking reported at the first antenatal visit, maternal citizenship, and maternal and paternal ages, parental psychiatric history and socio-economic status. On analysis, the results showed no statistically significant association between autism and birth weight, parity, number of antenatal visits, parental age or socio economic status. The authors concluded from the study that prenatal environmental factors and parental psychopathology are associated with the risk of autism.

Kolevson A, Gross R, Reichenberg A (2007) did a review of the prenala and the perinatal risk factors leading to Autism. Data was collected by searching relevant

articles from MEDLINE, screening reference lists of original studies, and searching major journals likely to publish epidemiological studies on the topic. Parental characteristics and obstetric complications were included in the study. The parental characteristics which were associated with autistic spectrum disorders were advanced paternal age, advanced maternal age and maternal place of birth outside Europe or North America. The obstetric conditions which have a strong association with autism include low birth weight and small for gestational age and intrapartum hypoxia. The authors concluded after the review that parental age and obstetric conditions are associated with an increased risk of autism.

Bilder, D., Pinborough-Zimmerman, J., Miller, J., & McMahon, W. (2009) did study to find the association of prenatal, perinatal and neonatal factors with Autism spectrum disorders. A total of 132 children with autism of 8 years age was considered for the study and each child was matched by gender to 100 controls. A total of 23 factors under prenatal, perinatal and neonatal were taken up for the study. Results indicate that under the prenatal factors, advanced maternal age and parity was found more frequently in autistic children. Higher education of mothers in autistic children was prevalent and showed statistical significance. Perinatal factors which shows significance included breech delivery and primary caesarean delivery. There was no significant association found between ASD and neonatal factors. The authors concluded from the study that there is a shared etiology between breech presentation and ASD in the absence of other complications.

Gardener, H., Spiegelman, D., &Buka, S. L. (2009) did a quantitative review and meta analysis of the association between maternal pregnancy complications and

pregnancy related factors and how it has an effect on the risk of autism. They have collected data bases from Pubmed, embase and PsycINFO for epidemiological studies. Parental interviewing and medical record reviews were done to collect data. Out of these forty studies were included for the meta analysis. there were more than 50 prenatal factors that have been examined and out of which the factors associated with autism risk included advanced parental age at birth, maternal depression/ emotional strain, prenatal medication use, bleeding, gestational diabetes, being first born v. third or later, and having a mother born abroad. The factors which are not suggestive of having autism risk included previous fetal loss and maternal hypertension, proteinuria, pre-eclampsia and swelling.

Zhang, X., Chao Lv. C., Tian J., Miao R. J., Xi W., Hertz- Picciotto I., Qi L. (2010) did study to find the prenatal and perinatal risk factors associated with autism in Chinese population. They took 190 children with autism and compared and matched with age and gender with children without autism. Parental characteristics like age, personality and medical issues were noted. Prenatal factors considered for the study include maternal smoking and second-hand cigarette smoke exposure, alcohol consumption, exposure to X-rays, work on computer, use of tocolysis therapy, attempt to terminate pregnancy, contact with toxins, emotional state, disease history and medication history, maternal disease, maternal gestational complications. Perinatal factors included infant gestational age at birth, foetal nuchal cord (umbilical cord wrapped around neck), caesarean delivery, breech birth, and birth weight (in grams), delayed crying and abnormal skin colour due to hypoxia, apnoea, aspirated pneumonia, intracranial haemorrhage, scleroderma neonatorum, neonatal jaundice, febrile convulsion, congenital malformations, anoxic encephalopathy, congenital

rubella, and gastrointestinal diseases. Results revealed advanced paternal age (>30 years old) has a significant association with autism whereas maternal age at delivery greater than 30 was not. prenantal maternal stress was significantly associated with autism. Maternal second-hand smoke exposure during pregnancy , maternal chronic or acute medical conditions unrelated to pregnancy, maternal unhappy emotional state, gestational complications, edema, abnormal gestational age (<35 or>42 weeks), nuchal cord, gravidity was significantly associated with autism.

Gardener, H., Spiegelman, D., &Buka, S. L. (2011) did a comprehensive meta analysis to study the perinatal and neonatal risk factors for autism. databases from PubMed, Embase, and PsycInfo was taken and 40 studies have been filtered out for the meta analysis. there were almost over 60 perinatal and neonatal factors which were examined and the factors which have strong association with autism risk included abnormal presentation, umbilical-cord complications, fetal distress, birth injury or trauma, multiple birth, maternal hemorrhage, summer birth, low birth weight, small for gestational age, congenital malformation, low 5-minute Apgar score, feeding difficulties, meconium aspiration, neonatal anemia, ABO or Rh incompatibility, and hyperbilirubinemia. Factors not associated with autism risk included anesthesia, assisted vaginal delivery, postterm birth, high birth weight, and head circumference.

Dodds L., Fell B. D., Shea S., Armson A. B., Allen C. A, Bryson S. (2011) did study to investigate the whether the prenatal, obstetric and neonatal factors has an association in the development of autism. They did a cohort study of infants born between 1990 and 2002 in Nova Scotia, Canada. Factors which are evaluated included

pre-pregnancy factors, prenatal factors and pregnancy diseases/conditions, labor and delivery variables, and neonatal factors and neonatal diseases/ conditions. Bryson et al's (1988) optimality scale was used. It constituted 60 factors. The results suggest that children with high genetic susceptibility, only maternal pre-existing medical conditions, male sex and CNS anomaly were significantly associated with increased risk of autism, while birth weight over 4,000 grams was associated with reduced risk of autism. They also found that pre-pregnancy obesity and excessive weight gain during pregnancy can lead to have risk on autism.

Seizure and Autism

Saemundsen E., Ludvigsson P., Hilmarsdottir I., and Rafnsson V. (2007) did a study to see whether the attack of seizure during the first year of life has an association with autism spectrum disorder. The study was conducted in Iceland in children diagnosed as having seizures with onset between 28 days and 12 months of age. Data was collected from database stored in computer and by parental interview and by completing social communication checklist/checklist/questionnaire. 84 children participated in the study that has possible ASD features. Results indicated that there is higher prevalence of autism spectrum disorder in children who had history of seizure in the first year of life. Hence, the authors concluded that children with ASD and history of seizure in the first year of life have higher prevalence of congenital brain abnormalities and are more often female, than other children with ASD.

Neonatal hyperbilirubinemia and autism

Neonatal hperbilirubinemia or jaundice is caused by the elevated levels of the bilirubin production by the abnormally increased breakdown of foetal erythrocytes and a low hepatic excretory capacity resulting from general immaturity of the liver. Statistics shows that jaundice is seen visually in 80% of preterm neonates and 60% of term neonates. Exposure to high serum bilirubin levels, hyperbilirubinemia, is of concern because unconjugated bilirubin is neurotoxic and can cause death in newborns or have lifelong sequelae. Exposure to moderate serum bilirubin levels is associated with impaired child development, especially autistic disorders classified as pervasive developmental disorders.

Croen L.A., Yoshida C.K., Odouli R., Newman T.B. (2005) did a study to find if there was any association between neonatal hyperbilirubinemia and ASD. 338 subjects participated in the study. They were randomly sampled and frequency matched according to gender, birth year and birth hospital. The results indicated that almost 28% of both groups received more than 1 bilirubin test in the first 30 days of life. The authors found that children with any degree of bilirubin level elevation were not at increased risk of ASD, after adjustment for gender, birth facility, maternal age, maternal race/ethnicity, maternal education, and gestational age. Hence they concluded that neonatal hyperbilirubinemia is not a risk factor for ASD.

Maimburg RD, Vaeth M. (2010) studied the association between neonatal jaundice and autism or other psychological development. The study was conducted in Denmark. Data was obtained from the information stored in the database about the infants. Information on parent's age, mother's citizenship, maternal smoking in early pregnancy, birth weight (in grams), gestational age, irregular fetal presentation,

congenital malformations, and Apgar score were obtained from the database. Both crude and adjusted HRs were computed. The potential confounders included in the analysis were selected from the already known risk factors for jaundice or disorders of psychological development and included mother's smoking status, irregular fetal presentation, gender, birth weight, gestational age, Apgar score, parents' ages, mother's citizenship, and congenital malformations. The results indicate that there is an increased risk of autism in children exposed to neonatal jaundice and hence concluded that there is a positive association between ASD and neonatal jaundice.

Parental age and autism

Shelton, J., Tancredi, D., & Hertz-Picciotto, I. (2010) studied the association between independent and dependent contributions of advanced paternal and maternal ages to autism risk. They have taken autism cases from California Department of Developmental Services Records. They grouped the parental age into 5 groups. The lowest being <25 and highest >40. Results indicate that there is stepwise increase in risk of autism was observed per 5-year interval of age in the maternal age category. Compared with mothers within the age range of 25–29 years of age, mothers over age 40 had 51% higher odds of having a child with autism. In the paternal age category, each 5-year increase in age resulted in an approximate eleven percent increase in the odds for autism. Fathers with age >40 had 36% increased odds of having a child with autism compared to fathers aged 25–29. Advancing maternal age increases the risk of autism independent of father's age, while advancing father's age increases the risk of autism primarily for mothers under 30. The authors concluded that the risk of having a child with autism increases with maternal age, but increased risk from advancing paternal age primarily occurs among younger mothers (>30).

Grether K. J., Anderson C. M., Croen A. L., Smith D., and Windham C. G. (2009) did a study to find the association between increasing maternal and paternal age and the risk of autism spectrum disorder. The study was conducted in North American population. Children with autism were identified through electronic files of the California Department of Developmental Services (DDS). Maternal and paternal ages at the time of the child's birth were obtained from birth certificates. The investigators had taken to analyses, maternal age 15–44 years and paternal age 15–64 years. The results indicate that there is a statistically positive significant difference in the risk of autism with increased maternal and paternal age.

Durkin, M. S., Maenner, M. J., Newschaffer, C. J., Lee, L. C., Cunniff, C. M., Daniels, J. L., et al. (2008) studied to find the association between increasing parental age and risk of Autism. 1,251 children, diagnosed as autism, according to DSM-IV, aged 8 years with complete parental age information participated in the study. Maternal and paternal age was independently associated with autism, after controlling the other factors. The results of the study indicate that firstborn offspring of 2 older parents were 3 times more likely to develop autism than were third- or later-born offspring of mothers aged 20–34 years and fathers aged <40 years. The authors concluded that there is a positive association between increased parental age and autism.

Croen, L. A., Najjar, D. V., Fireman, B., &Grether, J. K. (2007) did a study to find the association between maternal and paternal age and risk of autism. The authors found that the risk of ASD increased significantly with each 10 year increase in

maternal and paternal age. They concluded that advanced maternal and paternal ages are independently associated with autism.

Preterm birth and Autism

Buchmayer S., Johansson S., Johansson A., Hultman M. C., Sparén P. and Cnattingius S. (2009) did study to see whether there is any association between preterm birth and risk of autism. The study was done on Swedish population. Preterm infants were compared with infants born at term. the data suggests that there is increased risk of autistic disorders related to preterm birth and this is mediated primarily by prenatal and neonatal complications that occur more commonly among preterm infants. Neonatal hypoglycemia, respiratory distress, and neonatal jaundice were associated with increased risk of autistic disorders for term but not preterm infants.

Mercury and ASD

Mutter J., Naumann J., Schneider R., Walach H. & Haley B. (2005) studied the risk of autism with mercury exposure. Previous studies have found correlation between mercury exposure through thimerosal, a preservative used in vaccines, and the risk of autism. It was also found that autistic children had a higher mercury exposure during pregnancy due to maternal dental amalgam and thimerosal-containing immunoglobulin shots. hence the authors hypothesized that children with autism have a decreased detoxification capacity due to genetic polymorphism. Mercury and thimerosal in levels found several days after vaccination inhibit methionine synthetase (MS) by 50%. Normal function of MS is crucial in biochemical steps necessary for brain development, attention and production of glutathione, an

important antioxidative and detoxifying agent. Repetitive doses of thimerosal leads to neurobehavioral deteriorations, increased oxidative stress and decreased intracellular levels of glutathione. Subsequently, autistic children have significantly decreased level of reduced glutathione. The authors concluded from the study that treatments of autism involve detoxification of mercury, and supplementation of deficient metabolites.

On the Indian front, an ex post facto, study was conducted in profiling mental retardation (Venkatesan and Rao 1996) who found several such risk factors correlated with mental retardation. Similar study is necessitated in our contexts.

It has been found from the review of literature that most of the studies, in an attempt to find the cause of autism, resulted in contradicting findings. Almost all the studies are done in western context so adapting the finding in Indian context in questionable. The life style and living set up and parental factors differ among different regions. So considering this factor, it is necessary to develop a screening tool for autism in Indian context, incorporating not just factors during pregnancy and child birth but also considering parental, behavioural and other factors.

Aim of the study

To aim of the present study is to develop and standardize a screening checklist in Autism spectrum disorder in Indian population.

Objectives of the study

The objectives of the present study are

1. Development of screening checklist for early identification of the autism spectrum disorders.
2. Standardization of the developed screening checklist in Indian population.

CHAPTER III

METHOD

Subjects / Participants

Parent / Caregiver of 120 children with autism ~~spectrum~~ disorders (diagnosed by SLP using DSM-IV criteria) and 80 typically developing children who know the early childhood history of their child were considered as the subjects for the present study. Intelligence and hearing testing was done for all the children with autism spectrum disorders. The parents of the children with autism/autistic disorder along with mild to moderate level of intellectual disability but normal hearing were considered for this study. These care givers/parents were selected from different parts of the country. The age range of these children selected were 3-8 years.

Materials

The study was conducted in two phases.

Phase I- Development of screening checklist for Autism Spectrum disorders (ASD).

Phase II- Administration of the developed screening checklist on parents/caregivers of children with ASD for calculating its sensitivity, validity and specificity.

Phase I

The checklist/checklist/questionnaire in English was formulated including the parental, prenatal, perinatal and post natal and behavioural high risk indicators of autism spectrum disorders, from several sources~~.~~

Formulation of Checklist/questionnaire

The checklist/questionnaire was developed consisting of questions categorized into five main divisions such as parental, prenatal, perinatal, post natal and behavioural high risk indicators of autism spectrum disorders (ASD). High risk factors relevant to

the Indian context were included in the checklist/questionnaire. Among the two checklist/questionnaires prepared, one was for medical professionals and other for non-medical professionals. The checklist/questionnaire meant for both medical and non-medical professionals had same risk indicators with different terminologies and sentence structure. The checklist/questionnaire for non-medical professionals had simple terminologies and sentence structure that even laymen could easily understand them.

The developed non-medical checklist/questionnaire was given to ten well experienced speech language pathologists for the adequacy(specificity/sensitivity/validity) of the checklist/questionnaire and they were asked to rate each question on a 4-point rating scale (0 = Understandable, 1= need to change the sentence structure, 2= Need to change the terminologies, 3 = need to change both terminology and sentence structure).

The medical checklist/questionnaire uses terminologies mostly used by doctors and professionals. For Medical checklist/questionnaire ten pediatricians experienced in management of children with autism spectrum disorders were considered for checking adequacy of the checklist/questionnaire. The suggestions given by the speech language pathologists and pediatricians were incorporated in the final checklist/questionnaire with lot of items deleted/ added/ modified for viability. Above 80% consensus was obtained for sensitivity & specificity of the contents in the checklist (content validity).

Procedure

Pilot study

The modified checklist/questionnaire was administered to ten parents /caregivers of children with autism spectrum disorders for a pilot study to know the feasibility of the checklist/questionnaire developed. A modification of the checklist/questionnaire was done according to the suggestions by the SLPs.

Phase II

Method of administration

The checklist/questionnaire was administered on ~~each~~ one parent (either mother or father) / Caregiver of 120 children with autism spectrum disorders (ASD) specifically autism /autistic disorder(owing to the availability in large no.). It was also administered on the parent/ caregiver of 80 typically developing children who knew the early childhood history of the child for comparison with the ASD population. A face to face interview was conducted by the investigator or by a translator to the parents / caregivers of children with autism spectrum disorders from all over India. The interview was conducted in English or subjects native language. The responses of the parent were recorded in the checklist/questionnaire at the same time.

20% of the subjects were again administered the checklist/questionnaire after a gap of 15 days for the purpose of test – retest reliability and above 80% concurrence was obtained.

Analysis

The present study used standard group comparison research design to compare the performance between scores of parents with typical children and parents with

autism disorder. The data is subjected to statistical analysis using SPSS version 17. The variables are compared between parents of typical children and parents of Autism disorder to understand the differences between the two groups.

Statistical analysis

- Descriptive statistical analysis was used to compute the total count and percentage of the variables (parental, prenatal, perinatal and postnatal, behavioural and communication factors).
- Chi Square test was used to test the association between the factors and the risk of autism.
- Sensitivity and specificity index were obtained for the checklists.

CHAPTER IV

RESULTS AND DISCUSSION

The present study aimed at developing and standardization of a screening checklist in children with Autism Spectrum Disorder in Indian population. Parents/ Caregivers of a total of 120 children with autism and 80 typically developing children, within the age range of 3 8 years participated in the study. The checklist/questionnaire was developed which consists of information pertaining to prenatal, perinatal and postnatal history. It also contains questions related to behavioural and pre-linguistic domains. The developed checklist/questionnaire was administered in these populations and subjected to statistical analysis using SPSS version 17.

As a measure of test- retest reliability, 20% of the total subjects were again administrated the checklist after a gap of 15 days and above 80% consensus was obtained.

The results of the present study are discussed under the 4 main headings.

I. Parental and other factors

II. Prenatal factors

III. Perinatal factors

IV. Postnatal factors

V. Behavioural and communication

PARENTAL AND OTHER FACTORS

1. Consanguinity

Table 1 shows the no: of participants and percentage of consanguineous marriage in both autism and typical population.

Table 1: *Total no: of participants and percentage of consanguineous marriage within autism and typical population*

			Consanguinity		Total
			Negative	Positive	
Group	Autism	Count	104	16	120
		% within group	86.7%	13.3%	100.0%
	Typical	Count	78	2	80
		% within group	97.5%	2.5%	100.0%

Descriptive statistics reveals that percentage of positive consanguineous marriage is more in autistic population when compared to typical population. Pearson

chi square test was carried out to check the association of consanguineous marriage with respect to the risk of autism. The test of association showed a significant positive association between consanguineous marriage and autistic population at (χ^2 (1) = 6.878, p<0.05).

Family history

Table 2 shows the total number of participants and percentage of negative and positive family history (sibling and first/ second generation)

Table 2: *Total no: of participants and percentage of positive and negative family history within autism and typical population*

			Family history			Total
			Negative	1st/2nd generation	Siblings	
Group	Autism	Count	79	32	9	120
		% within group	65.8%	26.7%	7.5%	100.0%
	Typical	Count	74	6	0	80
		% within group	92.5%	7.5%	0.0%	100.0%

Descriptive statistics reveals that percentage of positive family history is more in autistic population when compared to typical population. Both sibling history and first/second generation history is seen to be higher in autistic population. Pearson chi square test was carried out to check the association of sibling history and first/second generation history with respect to the risk of autism. The test of association showed a significant positive association between consanguineous marriage and autistic population at (χ^2 (2) = 19.743, p<0.05).

Living set up

Table 3 shows the total number of participants and percentage of participants staying in India and outside India.

Table 3: *Total no: of participants and percentage of participants living outside and in India within autism and typical population*

			Living set up		
			India	outside India	Total
Group	Autism	Count	99	21	120
		% within group	82.5%	17.5%	100.0%
	Typical	Count	75	5	80
		% within group	93.8%	6.3%	100.0%

Descriptive statistics shows that percentage of autistic children is more in individuals staying outside India when compared to typical population. Even though most of the population stay in India, the percentage of people staying outside India shows strong association with the risk of autism at (χ^2 (1) = 5.371, $p<0.05$)

Flat/ independent house

Table 4 shows the total number and percentage of participants staying at flat and independent house within autism and typical population.

Table 4: *Total no: of participants and percentage of persons residing in flats and independent houses within autism and typical population*

			flat/ independent house		
			flat	IH	Total
group	Autism	Count	36	84	120
		% within group	30.0%	70.0%	100.0%
	Typical	Count	19	61	80
		% within group	23.8%	76.3%	100.0%

Descriptive statistics reveals that percentage of families living in flats and independent houses is comparatively similar or near value in both autistic population and typical population. More percentage of families stays at independent house in typical population when compared to autistic population. The test of association showed a negative association between family staying in flat /independent house and autistic population at (χ^2 (1) = 0.940, p>0.05).

Joint/nuclear

Table 5 shows the total number and percentage of participants staying in nuclear and joint family set up within autism and typical population

Table 5: *Total no: of participants and percentage of joint / nuclear family within autism and typical population*

			joint/nuclear		Total
			joint	nuclear	
group	Autism	Count	32	88	120
		% within group	26.7%	73.3%	100.0%
	Typical	Count	56	24	80
		% within group	70.0%	30.0%	100.0%

Descriptive statistics shows that percentage of individuals staying in nuclear family is seen more in autistic population whereas in typical group most of them stay in a joint family set up. The test of association shows a positive association between risk of autism and family staying in a nuclear set up (χ^2 (1) = 36.580, $p<0.05$).

Paternal age

Table 6 shows the total number and percentage of fathers falling under different age group (between 20 and 50 years) at the time of child birth within autism and typical population.

Table 6: *Total no: of participants and percentage of fathers with age between 20 and 50 within autism and typical population*

			Paternal age			
			Between 20 & 30	Between 30 & 40	Between 40 & 50	Total
group	Autism	Count	24	85	11	120
		% within group	20.0%	70.8%	9.2%	100.0 %
	Typical	Count	55	25	0	80
		% within group	68.8%	31.3%	0.0%	100.0 %

Descriptive statistics shows that percentage of fathers falling under the age range of 30-40 and 40-50 is seen more in autistic population. Advancing paternal age is shown consistently higher in autistic group. The test of association revealed that there is a significantly high positive association between advancing paternal age and risk of autism at (χ^2 (2) = 59.887, $p<0.05$)

Maternal age

Table 7 shows the total number and percentage of mothers falling under different age groups (between 20 and 50) at the time of birth of the child within autism and typical population.

Table 7: *Total no: of participants and percentage of mothers with age between 20 and 50 within autism and typical population*

			Maternal age			Total
			<20	20-30	30-40	
group	Autism	Count	4	87	29	120
		% within group	3.3%	72.5%	24.2%	100.0%
	Typical	Count	0	73	7	80
		% within group	0.0%	91.3%	8.8%	100.0%

Descriptive statistics shows that percentage of mothers falling under the age range of 30-40 during the time of child birth is seen more in autistic population. Advancing maternal age is shown to have risk in autistic group. The test of association revealed that there is a significantly high positive association between advanced maternal age and risk of autism at (χ^2 (2) = 11.114, $p<0.05$).

Father's education

Table 8 shows the total number and percentage of the educational level of fathers of autism and typical population.

Table 8: *Total number and percentage showing the educational level of fathers of children with and without autism.*

			Father's education			Total
			<10	10-12	Degree and above	
group	Autism	Count	3	31	86	120
		% within group	2.5%	25.8%	71.7%	100.0%
	Typical	Count	0	15	65	80
		% within group	0.0%	18.8%	81.3%	100.0%

Descriptive statistics shows that percentage of mother education level falling below 12^{th} grade is seen more in autistic population. In typical population, father's fall at a higher educational qualification level. Even though the data shows slight difference, the test of association revealed that there is a no significantly association between father's educational level and risk of autism at (χ^2 (2) = 3.631, p>0.05).

Mother's education

Table 9 shows the total number and percentage of the educational level of mothers of autism and typical population.

Table 9: *Total number and percentage showing the education level of mothers of children with and without autism.*

			mother's education			Total
			<10	10-12	Degree and above	
group	Autism	Count	2	45	73	120
		% within group	1.7%	37.5%	60.8%	100.0%
	Typical	Count	0	25	55	80
		% within group	0.0%	31.3%	68.8%	100.0%

Descriptive statistics shows that percentage of mother's education level falling below 12^{th} grade is seen more in autistic population. In typical population, mother's fall at a higher educational qualification level. Even though the data shows slight difference, the test of association revealed that there is a no significant association between mother's educational level and risk of autism at (χ^2 (2) = 2.339, p>0.05).

Father's occupation

Table 10 shows the percentage of the occupation of fathers of both autistic and typical population.

Table 10: *Total number and percentage showing the occupation of fathers within autism and typical population*

			father's occupation			
			no job	Low profile	Moderate profile	High profile
group	Autism	Count	1	29	53	37
		% within group	0.8%	24.2%	44.2%	30.8%
	Typical	Count	0	11	55	14
		% within group	0.0%	13.8%	68.8%	17.5%

Descriptive statistics shows that there is higher percentage of low profile and high profile occupation of father in autistic group. Low profile job includes workers, coolies, carpenters etc. Moderate profile includes clerks, teachers, bank employees etc. high profile includes IT professionals, doctors, business men etc. In typical population, father's fall in the category of moderate profile. The test of association revealed that there is a significantly positive association between father's occupation and risk of autism at (χ^2 (3) = 11.989, $p<0.05$).

Mother's occupation

Table 11 shows the percentage of occupation of mothers of both autistic and typical population

Table 11: *Total no: of participants and percentage showing the occupation of mothers within autism and typical population*

			Mother's occupation				Total
			No job	low profile	moderate profile	high profile	
group	Autism	Count	98	1	11	10	120
		% within group	81.7%	0.8%	9.2%	8.3%	100.0%
	Typical	Count	57	7	14	2	80
		% within group	71.3%	8.8%	17.5%	2.5%	100.0%

Descriptive statistics shows that there is higher percentage of high profile occupation and no job condition in mothers of autistic group. In typical population, mother's fall in the category of moderate profile. The test of association revealed that there is a significantly positive association between mother's occupation and risk of autism at (χ^2 (3) = 13.582, $p<0.05$).

Language spoken

Table 12 shows the total number and percentage of children exposed to more than one language within autism and typical group.

Table 12: *Total no: of participants and percentage showing the no: of language spoken at home within autism and typical population*

			language spoken		Total
			1 language	>1 language	
group	Autism	Count	95	25	120
		% within group	79.2%	20.8%	100.0%
	Typical	Count	75	5	80
		% within group	93.8%	6.3%	100.0%

Descriptive statistics shows that there is higher percentage of children exposed to more than one language in autistic group. In typical population, majority of the children fall in the category of exposure to single language during the developmental period. The test of association revealed that there is a significantly positive association between language exposure and risk of autism at (χ^2 (1) = 8.007, $p<0.05$).

Employed mother

Table 13 shows the total number and percentage of mothers employed during the phase of pregnancy in both autistic and typical population.

Table 13: *Total no: of participants and percentage of employed mothers within autism and typical population*

			Employed mother		Total
			-ve	+ve	
group	Autism	Count	93	27	120
		% within group	77.5%	22.5%	100.0%
	Typical	Count	73	7	80
		% within group	91.3%	8.8%	100.0%

Descriptive statistics shows that there is higher percentage of employed mother during the time of pregnancy in autistic group. In typical population, there is only a few percentage of employed mothers during the phase of pregnancy. The test of association revealed that there is a significantly positive association between father's occupation and risk of autism at (χ^2 (1) = 6.432, $p<0.05$).

Nature of work

Table 14 shows the number and percentage of mothers who underwent stress condition during work at the time of pregnancy in autistic and typical population.

Table 14: *Total no: of participants and percentage showing the stressed nature of work of employed mothers within autism and typical population*

			nature of work		Total
			-ve	+ve	
group	Autism	Count	102	18	120
		% within group	85.0%	15.0 %	100.0%
	Typical	Count	74	6	80
		% within group	92.5%	7.5%	100.0%

Descriptive statistics shows that there is higher percentage of positive stress condition in autistic group. Even though there are slight differences, the test of association revealed that there is no significant positive association between stress nature at work and risk of autism at (χ^2 (1) = 2.557, p>0.05).

Table 15 shows the degree of association of the various parental and other factors related to the risk of autism.

Table 15: *Results of Chi Square Test for the parental and other factors related to autism*

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Consanguinity	6.878[a]	1	.009*
Family history	19.743[a]	2	.000*
Living set up	5.371[a]	1	.020*
Flat/ independent house	.940[a]	1	.332
Joint/ nuclear	36.580[a]	1	.000*
Paternal age	49.887[a]	2	.000*
Maternal age	11.114[a]	2	.004*
Father's education	3.631[a]	2	.163
Mother's education	6.878[a]	1	.009*
Father's occupation	11.989[a]	3	.007*
Mother's occupation	13.582[a]	3	.004*
Language spoken	8.007[a]	1	.005*
Employed mother	6.432[a]	1	.011*
Nature of work	2.557[a]	1	.110

(* indicates statistical significant association at 0.05 level)

In the present study, under parental and other factors which can be a cause of autism risk, the following factors showed significant association in the Pearson Chi Square test for association. Those include consanguinity, positive family history, outside India living set-up, staying in nuclear family, advanced maternal and paternal age during the birth of child, higher education of mother, occupation of father and

mother, exposure to more than one language at home, employed mother at the time of pregnancy.

Consanguinity or consanguineous marriage is shown to be an important factor associated with risk of autism as per results indicate. The recessive genetic factors may get dominant by consanguinity and it may be promoted by the environmental factors also. The results of the present study go in parallel with the finding of Glasson et al. (2004) where they found the same and concluded that underlying genetic factor or the interaction of those factors with the environment causes the manifestation of autism.

Similar is the condition in family history. A family with positive history of autism disorder or sibling history is found to be more prone to propagate autistic behaviours and characteristics in the early phase of life of the child. This can be triggered more by the other environmental factors and parent-child interaction factors too. The present study finding goes in concurs with the findings of Lauritsen et al. (2005) where they found that highest risk of autism was found in families with a risk of autism.

The fact of parents staying abroad (outside India) is also found to have significant association with risk of autism. The living life style and environmental factors may promote the risk for autism. The result of the present study is supported by the findings of gardener et al. (2009) where they found mothers born abroad will have risk of having children with autism. The BSRC (2013) also supports our finding of positive sibling history. They found that younger siblings of children with ASD are at increased risk of developing ASD and other developmental challenges.

The fact of families staying in a nuclear set up also leads to a risk of autism, as per results indicates. Most people staying in nuclear family set up seldom finds time to spend time with children and moreover there are less people around always in such a set up.

Advanced maternal age and paternal age are found to have a positive association with risk of autism. Maternal age may be associated with autism because of increased risk of chromosomal abnormalities in ova of increased age or as a result of unstable trinucleotide (Gardener et al., 2009). The result of the present study goes in consensus with the findings of Glasson et al. (2004), Kolevson et al. (2007), Croen et al. (2007), Durkin et al. (2008), Gardener et al. (2009), Bilder et al. (2009), Zhang et al. (2010) and Shelton et al (2010) where they found advanced paternal age and maternal age can be a risk for autism spectrum disorders. The finding is contradicted by the finding of Larsson et al. (2005) where they found parental age has no association with the risk of autism.

Higher education level of mother is also found to have a positive association with risk of autism. The findings of the present study is supported by the findings of Bilder et al. (2009) where he found that higher education of mothers raised a positive association for autism risk.

The occupation of the parents has a positive association with autism risk. The higher the profile of occupation is, the less time is spent with the children. Most of the parents who have a high profile occupation spent only very limited time or no time with the children who ultimately end up leaving the child with caretaker or in front of television. This leads to disruption in the social and communication development of the child leading to risk of autism. This finding is contradicted with the finding of

Larsson et al (2005) where they found no association of socio- economic status with autism risk. More studies need to be done in this aspect to support/ negate/ substantiate the results.

Exposure to more than one language at home also has a positive association for autism risk. This may be due to the confusion created in the child. Exposure to more than one language during the early development of the child leads to stress and confusion in the child. This may produce a possible risk for autism in children whereas there are contradicting findings also which claim that exposure to more language is beneficial which needs to be further investigated.

Employed mothers during pregnancy also promote as a positive factor with autism risk. This may be due to the stressful nature of the work and travel and other factors leading to psychological stress in mothers. These conditions may also result in increasing autism risk in children.

Other factors which do not contribute to the risk of autism include education of the father and staying in a flat or independent house.

II. PRENATAL FACTORS

Miscarriage

Table 16 shows the total number and percentage of previous history of miscarriage in mothers of autistic and typical population.

Table 16: *Percentage of miscarriage in autistic and typical population*

			Miscarriage		Total
			-ve	+ve	
group	Autism	Count	105	15	120
		% within group	87.5%	12.5%	100.0%
	Typical	Count	76	4	80
		% within group	95.0%	5.0%	100.0%

Descriptive statistics indicates that there is higher percentage of positive miscarriage history in autistic population when compared to the typical population. However, the test of association shows there is no significant positive association between history of miscarriage and risk of autism (χ^2 (1) = 3.140, p>0.05).

Diabetes

Table 17 shows the number and percentage of mothers having diabetes during the prenatal period in both autistic and typical population.

Table 17: *Percentage of mothers with diabetes in autism and typical population*

			Diabetes		Total
			-ve	+ve	
group	Autism	Count	108	12	120
		% within group	90.0%	10.0%	100.0%

Typical	Count	78	2	80
	% within group	97.5%	2.5%	100.0%

Descriptive statistics indicates that there is higher percentage of positive diabetes history during prenatal period in autistic population when compared to the typical population. The test of association shows there is significant positive association between history of diabetes during prenatal phase and risk of autism (χ^2 (1) = 4.147, $p<0.05$).

Blood Pressure (BP)

Table 18 shows the number and percentage of mothers with BP during the prenatal phase in both autistic and typical population.

Table 18: *Percentage of mothers with BP in autistic and typical population*

			BP		Total
			-ve	+ve	
Group	Autism	Count	108	12	120
		% within group	90.0%	10.0%	100.0%
	Typical	Count	72	8	80
		% within group	90.0%	10.0%	100.0%

Descriptive statistics indicates that there is no higher or lower percentage of positive diabetes history during prenatal period in autistic population when compared to the typical population. The test of association shows there is no significant positive

association between history of BP during prenatal phase and risk of autism (χ^2 (1) = 0.000, p>0.05).

Hormonal issues

Table 19 shows the number and percentage of mothers with hormonal issues during the prenatal phase in both autistic and typical population.

Table 19: *Percentage of mothers with Hormonal problems in autistic and typical population*

			Hormonal issues		Total
			-ve	+ve	
Group	Autism	Count	117	3	120
		% within group	97.5%	2.5%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics indicates that there is slightly higher percentage of positive hormonal issue history during prenatal period in autistic population when compared to the typical population. However, the test of association shows there is no significant positive association between history of hormonal issues during prenatal phase and risk of autism (χ^2 (1) = 2.030, p>0.05).

Bleeding

Table 20 shows the percentage of mothers with history of bleeding during the prenatal phase in both autistic and typical population.

Table 20: *Percentage of history of bleeding in autistic and typical population*

	Bleeding	Total

			-ve	+ve	
Group	Autism	Count	108	12	120
		% within group	90.0%	10.0%	100.0%
	Typical	Count	76	4	80
		% within group	95.0%	5.0%	100.0%

Descriptive statistics indicates that there is slightly higher percentage of positive bleeding history during prenatal period in autistic population when compared to the typical population. However, the test of association shows there is no significant positive association between history of hormonal issues during prenatal phase and risk of autism (χ^2 (1) = 1.630, p>0.05).

Smoking

Table 21 shows the percentage of mothers exposed to smoking during the prenatal period in autistic and typical group of children.

Table 21: *Percentage of mothers exposed to smoke in autistic and typical population*

			smoking		Total
			-ve	+ve	
Group	Autism	Count	117	3	120
		% within group	97.5%	2.5%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics indicates that there is slightly higher percentage of smoke exposure during prenatal period in autistic population when compared to the typical population. However, the test of association shows there is no significant positive

association between history of smoke exposure during prenatal phase and risk of autism (χ^2 (1) = 2.030, p>0.05).

Alcohol consumption

Table 22 shows the percentage of mothers exposed to alcohol consumption during the prenatal period in both autism and typical group of children.

Table 22: *Percentage of mothers with history of alcohol consumption in autistic and typical population*

			Alcohol consumption	Total
			-ve	
Group	Autism	Count	120	120
		% within group	100.0%	100.0%
	Typical	Count	80	80
		% within group	100.0%	100.0%

Descriptive statistics indicates that there is no history of alcohol consumption by the mothers during prenatal period in autistic as well as typical population. Since alcohol consumption is a nonentity no statistics were computed.

Vomiting

Table 23 shows the percentage of mothers who had excessive vomiting during the prenatal period in both autism and typical group of children.

Table 23: *Percentage of mothers with history of excessive vomiting in autistic and typical population*

		vomiting		Total
		-ve	+ve	

Group	Autism	Count	101	19	120
		% within group	84.2%	15.8%	100.0%
	Typical	Count	71	9	80
		% within group	88.8%	11.3%	100.0%

Descriptive statistics indicates that there is slightly higher percentage of positive history of excessive vomiting during prenatal period in autistic population when compared to the typical population. However, the test of association shows there is no significant positive association between history of excessive vomiting during prenatal phase and risk of autism (χ^2 (1) = .837, p>0.05).

Mental stress

Table 24 shows the percentage of mothers who had mental stress during the prenatal period in both autism and typical group of children.

Table 24: *Percentage of mothers with history of mental stress in autistic and typical population*

			mental stress		Total
			-ve	+ve	
Group	Autism	Count	60	60	120
		% within group	50.0%	50.0%	100.0%
	Typical	Count	73	7	80
		% within group	91.3%	8.8%	100.0%

Descriptive statistics indicates that there is a significantly higher percentage of positive mental stress condition in mothers during the prenatal period in autistic population when compared to the typical population. The test of association (Pearson

Chi Square Test) shows there is significant positive association between mental stress condition during prenatal period and risk of autism (χ^2 (1) = 36.663, p<0.05).

Medication

Table 25 shows the percentage of mothers who had medication during the prenatal period in both autism and typical group of children.

Table 25: *Percentage of mothers with history of medication in autistic and typical population*

			Medication		Total
			-ve	+ve	
Group	Autism	Count	88	32	120
		% within group	73.3%	26.7%	100.0%
	Typical	Count	71	9	80
		% within group	88.8%	11.3%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of positive medication history during prenatal period in autistic population when compared to the typical population. The test of association shows there is significant positive association between history of medication during prenatal period and risk of autism (χ^2 (1) = 7.000, p<0.05).

Table 26: Results of Chi Square Test for prenatal factors

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Miscarriage	3.140[a]	1	.076
Diabetes	4.147[a]	1	.042*
BP	0.000[a]	1	1.00
Hormonal	2.030[a]	1	.154
Bleeding	1.630[a]	1	.202
Smoking	2.030[a]	1	.154
Alcohol consumption	---	--	-----
Vomiting	.837[a]	1	.360
Mental stress	36.663[a]	1	.000*
Medication	7.000[a]	1	.008*

(* indicates statistical significant association at 0.05 level)

Among the prenatal factors, a significant association for autism risk was seen in history of having diabetes, maternal stress and medication during the time of pregnancy, mostly for urinary tract and vaginal infection. Other factors even if they showed high percentage in autistic group when compared to typical group, they did not show significant association.

Previous history of miscarriage or abortion is seen in autistic group more but statistically not much association is shown for the risk of autism. This result of the present study goes in consensus with the findings of Gardener et al. (2009) where the authors found negative association between previous history of abortion and risk of autism.

Diabetes during the prenatal period has a significant positive association with risk of autism. The results go in parallel with the findings of gardener et al. (2009) where they found similar result indicating prenatal diabetes condition that had a positive association with autism risk.

Blood pressure has a negative association with autism risk, as results indicate. This goes in consensus with the finding of Gardener et al. (2009) where they found blood pressure during prenatal period had a negative association with risk of having autism.

History of uterine bleeding during pregnancy is found to have negative association with risk of autism. The result of the present study contradicts with the findings the finding of Wilkerson et al. (2002) and Juul-Dam et al. (2001) where they found that bleeding during prenatal phase has a positive association with risk of autism.

Exposure to smoke is also found to have a negative association with autism even though the percentage is slightly higher in autistic group. This result is supported by the findings of Zhang et al. (2010) where they found that there is a positive association between exposure to smoke and risk of autism.

Presence of mental/ psychological stress is found to have a significant positive association with risk of autism. This finding is supported by the findings of Zhang et al. (2010), Gardener et al. (2009) and Wilkerson et al. (2002) where they also found similar results. From their study they concluded that maternal stress during prenatal phase has a positive association with risk of autism.

Medication during time of pregnancy also finds to have a significant positive association with the risk of autism. Medications may cross the placenta and affect fetal development. Studies have found that psychiatric medication use suggests 68% increased risk of autism (Gardener et al., 2009). The results of the present study go in consensus with the findings of Dodds et al. (2011), Zhang et al. (2010), Gardener et al. (2009) and Wilkerson et al. (2002) where they found similar results. It was found that prenatal medication had a positive association with autism.

III. PERINATAL FACTORS

Pre or post term

Table 27 shows the percentage of preterm and post term infants in both autism and typical group of children.

Table 27: *Percentage of preterm and post term delivery in autistic and typical population*

			pre or post term			Total
			normal	preterm	postterm	
group	Autism	Count	102	14	4	120
		% within group	85.0%	11.7%	3.3%	100.0%
	Typical	Count	80	0	0	80
		% within group	100.0%	0.0%	0.0%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of preterm birth in autistic population when compared to the typical population. Post term birth is also higher in autistic group but not significantly higher. The test of

association shows there is significant high positive association between preterm birth and risk of autism (χ^2 (2) = 1.187, p<0.05).

Delivery

Table 28 shows the percentage of type of delivery in both autism and typical group of children.

Table 28: *Percentage of type of delivery in autistic and typical population*

			Delivery			Total
			Vaccum	Normal	Cessarian	
group	Autism	Count	1	57	62	120
		% within group	0.8%	47.5%	51.7%	100.0%
	Typical	Count	0	53	27	80
		% within group	0.0%	66.3%	33.8%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of cessarian delivery in autistic population when compared to the typical population. There was report of one case of vacuum delivery also in autistic group. The test of association shows there is significant positive association between cessarian delivery and risk of autism (χ^2 (2) = 7.197, p<0.05).

Labor length

Table 29 shows the percentage of duration of labor in mothers in both autism and typical group of children.

Table 29: *Percentage of duration of labor in mothers in autistic and typical population*

			Labor length		Total
			normal	long/delayed	
group	Autism	Count	64	56	120
		% within group	53.3%	46.7%	100.0%
	Typical	Count	59	21	80
		% within group	73.8%	26.3%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of delayed or longer labor length in autistic population when compared to the typical population. The test of association shows there is significant positive association between labor length and risk of autism (χ^2 (1) = 8.450, p<0.05).

Birth cry

Table 30 shows the percentage of delayed birth cry in both autism and typical group of children.

Table 30: *Percentage of delayed birth cry in autistic and typical population*

			Birth cry		Total
			Normal	Delayed	
group	Autism	Count	104	16	120
		% within group	86.7%	13.3%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of delayed birth cry in autistic population when compared to the typical population. The test of association shows there is significant positive association between delayed birth cry and risk of autism (χ^2 (1) = 11.594, p<0.05).

Birth weight

Table 31 shows the percentage of birth weight in both autism and typical group of children.

Table 31: *Percentage of birth weight in autistic and typical population*

			Birth weight			Total
			Normal	Low birth weight	Overweight	
group	Autism	Count	97	2	21	120
		% within group	80.8%	1.7%	17.5%	100.0%
	Typical	Count	75	2	3	80
		% within group	93.8%	2.5%	3.8%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of overweight infants in autistic population when compared to the typical population. The test of association shows there is significant positive association between overweight infants and risk of autism (χ^2 (2) = 8.660, p<0.05).

Table 32: *Results of Chi Square Test for Perinatal factors*

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pre/post term	13.187[a]	2	.001*
Delivery	7.197[a]	2	.027*
Labor length	8.450[a]	1	.004*
Birth cry	11.594[a]	1	.001*
Birth weight	8.660[a]	2	.013*

(* indicates statistical significant association at 0.05 level)

In the perinatal factors, almost all the factors show a significant positive association with risk of autism.

Preterm delivery is found to have a positive association with risk of autism, as per the results indicated. Post term deliveries are also more in autism group when compared to typical group but it is not significantly associated. This finding goes in consensus with the findings of Gardener et al. (2009), Larsson et al. (2005) and Kolevson et al. (2007) where they found similar results. But this finding is contradicted by the findings of Zhang et al. (2010), Wilkerson et al. (2002) and Sugie et al. (2005) where they found that post term delivery has a positive association with risk of autism. Bauchmayer et al. (2009) found in his study that preterm delivery has a negative association with risk of autism.

Results indicate that caessarian delivery has a positive association with risk of autism. This finding goes parallel with the finding of Bilder et al. (2009) where they found cessarian and breech delivery has a positive association with autism.

Prolonged or delayed labor length is found to have a positive association with risk of autism. This finding goes in consensus with the findings of Wilkerson et al. (2002) where they also found to have a positive association between prolonged labor length and risk of autism.

Delayed birth cry is found to be a positive risk factor for autism. This may be due to reduced or delayed oxygen supply to the brain resulting in improper functioning of the neural cells leading to risk of autism.

Birth weight is the net result of three factors- genetic growth potential, duration of pregnancy and rate of fetal growth. High birth weight is found to be a positive indicator for children with autism in the present study. The result of the present study is found contradicting to the findings by Gardener et al. (2011), Dodds et al. (2011), Kolevson et al. (2007), Sugie et al. (2005) and Wilkerson et al. (2002) where they found low birth weight has a positive association with risk of autism.

IV. POSTNATAL FACTORS

Hypoxia

Table 33 shows the percentage of hypoxic condition in both autism and typical group of children.

Table 33: *Percentage of hypoxic condition in autistic and typical population*

			Hypoxia		Total
			-ve	+ve	
group	Autism	Count	107	13	120
		% within group	89.2%	10.8%	100.0%
	Typical	Count	79	1	80
		% within group	98.8%	1.3%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of hypoxia condition in autistic population when compared to the typical population. The test of association shows there is significant positive association between presence of hypoxia condition during postnatal period and risk of autism (χ^2 (1) = 6.772, p<0.05).

Neonatal Jaundice

Table 34 shows the percentage children who had neonatal jaundice in autism and typical group of children.

Table 34: *Percentage of children with neonatal jaundice in autistic and typical population*

			Jaundice		Total
			-ve	+ve	
group	Autism	Count	88	32	120
		% within group	73.3%	26.7%	100.0%
	Typical	Count	70	10	80
		% within group	87.5%	12.5%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of children affected with neonatal jaundice in autistic population when compared to the typical population. The test of association shows there is significant positive association between neonatal jaundice and risk of autism (χ^2 (1) = 5.807, p<0.05).

Rh incompatibility

Table 35 shows the percentage of Rh incompatible factor in both autism and typical group of children.

Table 35: *Percentage of Rh incompatibility in autistic and typical population*

			Rh incompatibility		Total
			-ve	+ve	
group	Autism	Count	118	2	120
		% within group	98.3%	1.7%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics indicates that there is only a minor percentage increase in Rh incompatible condition in autistic population when compared to the typical population. The test of association shows there no significant positive association between Rh incompatibility and risk of autism (χ^2 (1) = 1.347, p>0.05).

Umbilical cord complication

Table 36 shows the percentage of umbilical cord complication seen in both autism and typical group of children.

Table 36: *Percentage of umbilical cord complication in autistic and typical population*

			umbilical cord complication		Total
			-ve	+ve	
group	Autism	Count	118	2	120
		% within group	98.3%	1.7%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics indicate that there is only a minor percentage of increase of umbilical cord complication in autistic population when compared to the typical population. The test of association shows there no significant positive association between Rh incompatibility and risk of autism (χ^2 (1) = 1.347, p>0.05).

Seizure

Table 37 shows the percentage of seizure attack in early ages of life in both autism and typical group of children.

Table 37: *Percentage of seizure attack in autistic and typical population*

			Seizure		
			-ve	+ve	Total
Group	Autism	Count	96	24	120
		% within group	80.0%	20.0%	100.0%
	Typical	Count	78	2	80
		% within group	97.5%	2.5%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of seizure attack condition in autistic population when compared to the typical population. The test of association shows there is significant positive association between seizure condition during postnatal period and risk of autism (χ^2 (1) = 12.997, p<0.05).

Seizure medication

Table 38 shows the percentage of children undergoing seizure medication since early infancy in both autism and typical group.

Table 38: *Percentage of seizure medication taken by children with autistic and typical population*

			seizure medication		Total
			-ve	+ve	
group	Autism	Count	101	19	120
		% within group	84.2%	15.8%	100.0%
	Typical	Count	78	2	80
		% within group	97.5%	2.5%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of children who had taken seizure medication in early infancy in autistic population when compared to the typical population. The test of association shows there is significant positive association between seizure medication and risk of autism (χ^2 (1) = 9.080, $p<0.05$).

Antibiotic intake

Table 39 shows the percentage of children who had antibiotic intake in early infancy in both autism and typical group.

Table 39: *Percentage of antibiotic intake in early infancy in autistic and typical population*

			Antibiotic intake		Total
			-ve	+ve	
group	Autism	Count	62	58	120
		% within group	51.7%	48.3%	100.0%
	Typical	Count	66	14	80
		% within group	82.5%	17.5%	100.0%

Descriptive statistics indicates that there is significantly higher percentage of antibiotic intake during early infancy period in autistic population when compared to the typical population. The test of association shows there is significant positive association between intake of antibiotic and risk of autism (χ^2 (1) = 19.806, p<0.05).

Trauma

Table 40 shows the percentage trauma during early years of life in both autism and typical group of children.

Table 40: *Percentage of trauma in autistic and typical population*

			trauma		Total
			-ve	+ve	
group	Autism	Count	117	3	120
		% within group	97.5%	2.5%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics indicates that there is only a slight increase in higher the percentage of trauma in autistic population when compared to the typical population. The test of association shows there is no significant positive association between trauma during postnatal period and risk of autism (χ^2 (1) = 2.030, p>0.05).

Duration spent with father

Table 41 shows the percentage of time spent by father with autism and typical group of children.

Table 41: *Percentage of duration spent by fathers with autistic and typical population*

			duration spent with father				Total
			no time	<1 hr	2-5hrs	>5hrs	
group	Autism	Count	46	37	32	5	120
		% within group	38.3%	30.8%	26.7%	4.2%	100.0%
	Typical	Count	2	26	45	7	80
		% within group	2.5%	32.5%	56.3%	8.8%	100.0%

Descriptive statistics reveals that in autistic group, the percentage of the duration of time spent by fathers with them falls majorly in the category of <1 hour and 2-5 hours per day. Spending more than 5 hours per day with the children is seen very less. In typical group of children, the reverse is observed. Fathers spent more time with the children (2-5 hours and >5 hours) in typical group as per results indicated. The test of association reveals that there is a high positive association between duration of time spent by father with the child and risk of autism (χ^2 (3) = 38.315, $p<0.05$).

Duration spent with mother

Table 42 shows the percentage of time spent by mother with autism and typical group of children.

Table 42: *Percentage of duration spent by mothers with autistic and typical population*

			Duration spent with mother				Total
			no time	<1hr	2-5hrs	>5hrs	
group	Autism	Count	5	24	64	27	120
		% within group	4.2%	20.0%	53.3%	22.5%	100.0%
	Typical	Count	0	0	25	55	80
		% within group	0.0%	0.0%	31.3%	68.8%	100.0%

Descriptive statistics reveals that in autistic group, the percentage of the duration of time spent by mothers with them falls majorly in the category of 2-5 hours per day. Spending more than 5 hours per day with the children is seen less compared to typical group. In typical group of children, mothers spent more time with the children (2-5 hours and >5 hours), as per the results. The test of association reveals that there is a high positive association between duration of time spent by mother with the child and risk of autism (χ^2 (3) = 49.636, p<0.05).

Age at which child was left with caregiver

Table 43 shows the percentage children left with caretaker at an early age in both autism and typical group of children.

Table 43: *Percentage of birth weight in autistic and typical population*

			Age left with caregiver		Total
			no	0-2yrs	
group	Autism	Count	111	9	120
		% within group	92.5%	7.5%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics reveals that percentage of children left with caretaker at an early age is seen more in autistic group. In typical group of children, the children were not left with the caretaker at early age. The test of association reveals that there is a high positive association between age at which the child was left with the caretaker and risk of autism (χ^2 (1) = 6.283, p<0.05).

Duration of TV exposure

Table 44 shows the percentage TV exposure duration per day in both autism and typical group of children.

Table 44: *Percentage of TV exposure duration in autistic and typical population*

			Duration of TV exposure			Total
			don't watch	< 2 hrs	>3 hrs	
group	Autism	Count	18	36	66	120
		% within group	15.0%	30.0%	55.0%	100.0%
	Typical	Count	23	49	8	80
		% within group	28.8%	61.3%	10.0%	100.0%

Descriptive statistics reveals that more than 50 percent of children get exposed to television for more than 3 hours per day. In typical group of children, more percentage is seen in watching TV for less than 2 hours a day . The test of association reveals that there is a high positive association between duration of time exposed to TV by the child and risk of autism (χ^2 (2) = 41.727, p<0.05).

Age at which TV exposure started

Table 45 shows the percentage of children showing the age at which the TV exposure started in both autism and typical group.

Table 45: *Percentage of age at which TV exposure started in autistic and typical population*

			Age at which TV exposure started				Total
			don't watch	<1 yr	1-2 yrs	>2 yrs	
group	Autism	Count	19	51	34	16	120
		% within group	15.8%	42.5%	28.3%	13.3%	100.0%
	Typical	Count	23	0	19	38	80
		% within group	28.8%	0.0%	23.8%	47.5%	100.0%

Descriptive statistics reveals that in autistic group, more percentage of children for which early exposure to TV started is less than 1 year. In typical group of children, the age at which TV exposure commenced is seen more in the age of greater than 2 years. The test of association reveals that there is a high positive association between age at which TV exposure started and risk of autism (χ^2 (3) = 58.947, $p<0.05$).

Consumption of sweets

Table 46 shows the percentage children with consumption of sweets/chocolates at an early age autism and typical group.

Table 46: *Percentage of sweet consumption in autistic and typical population*

			consumption of sweets			Total
			no	occasionally	frequently	
group	Autism	Count	29	35	56	120
		% within group	24.2%	29.2%	46.7%	100.0%
	Typical	Count	3	48	29	80
		% within group	3.8%	60.0%	36.3%	100.0%

Descriptive statistics reveals that more percentage of children with autism consumes sweets/chocolates frequently whereas in typical population, the children consumed sweets occasionally. The test of association revealed that there is a high positive association between consumption of sweets and risk of autism (χ^2 (2) = 24.727, $p<0.05$).

Consumption of noodles

Table 47 shows the percentage children with consumption of noodles at an early age autism and typical group.

Table 47: *Percentage of noodle consumption in autistic and typical population*

			consumption of noodles			Total
			no	occasionally	frequently	
group	Autism	Count	44	25	51	120
		% within group	36.7%	20.8%	42.5%	100.0 %
	Typical	Count	31	43	6	80
		% within group	38.8%	53.8%	7.5%	100.0 %

Descriptive statistics reveals that more percentage of children with autism consumes noodles frequently whereas in typical population, the children consumed sweets occasionally. The test of association revealed that there is a high positive association between consumption of noodles and risk of autism (χ^2 (2) = 35.984, $p<0.05$).

Consumption of fish

Table 48 shows the percentage children with consumption of fish at an early age autism and typical group.

Table 48: *Percentage of fish consumption in autistic and typical population*

			consumption of fish			Total
			no	occasionally	frequently	
group	Autism	Count	39	17	64	120
		% within group	32.5%	14.2%	53.3%	100.0%
	Typical	Count	15	50	15	80
		% within group	18.8%	62.5%	18.8%	100.0%

Descriptive statistics reveals that more percentage of children with autism consumes fish frequently whereas in typical population, the children consumed sweets occasionally. The test of association revealed that there is a high positive association between consumption of fish and risk of autism (χ^2 (2) = 51.368, $p<0.05$). This however, needs to be confirmed with advanced research.

Sleep disturbance

Table 49 shows the percentage of children with sleep disturbance in both autism and typical group.

Table 49: *Percentage of children with sleep disturbance in autistic and typical population*

			sleep disturbance		Total
			negative	positive	
group	Autism	Count	95	25	120
		% within group	79.2%	20.8%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics reveals that percentage of children with sleep disturbance is seen more in autistic group whereas in typical population, the children never had sleep disturbance, as per the results. The test of association revealed that there is a high positive association between sleep disturbance and risk of autism (χ^2 (2) = 19.048, $p<0.05$).

Table 50: *Results of Chi Square Test for Postnatal factors*

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Hypoxia	6.772[a]	1	.009*
Jaundice	5.807[a]	1	.016*
Rh incompatibility	1.347	1	.246
Umbilical cord complication	1.347	1	.246
Seizure	12.997	1	.000*
Seizure medication	9.080	1	.003*
Antibiotic intake	19.806	1	.000*
Trauma	2.030	1	.154
Duration spend with father	38.315	3	.000*
Duration spend with mother	49.636	3	.000*
Age left with caretaker	6.283	1	.012*
Duration of TV exposure	41.727	2	.000*
Age of TV exposure started	58.947	3	.000*
Consumption of sweets	24.727	2	.000*
Consumption of noodles	35.984	2	.000*
Consumption of fish	51.368	2	.000*
Sleep disturbance	19.048	1	.000*

(* indicates statistical significant association at 0.05 level)

In the postnatal factors, many show a positive association with risk of autism. Those include hypoxia, neonatal jaundice, seizure, seizure medication, intake of antibiotics, duration spent with parents, age at which child was left with caretaker,

duration of TV exposure and age at which it started, consumption of excess sweets, fish and noodles and sleep disturbance.

Hypoxia or birth asphyxia is found to have a positive association with autism risk. This may be due to reduced oxygen level reaching the brain cell and thereby causing malfunctioning of the neural cells leading to autism risk. The findings of the present study go in consensus with the finding of Kolevson et al. (2007) and Sugie et al. (2005) where they found similar results.

Neonatal jaundice in infants shows a positive association with risk of autism. Hyperbilirubinemia is caused by the elevated levels of the bilirubin production by the abnormally increased breakdown of foetal erythrocytes Exposure to moderate serum bilirubin levels is associated with impaired child development, especially autistic disorders classified as pervasive developmental disorders. Hyperbilirubinemia presence with positive association with autism risk is found by the authors Sugie et al. (2005), Gardener et al. (2011), Juul-Dam et al (2001), Croen et al. (2005), Maimburg et al. (2010) and Bauchmayer et al. (2009) supporting the present findings.

Umbilical cord complication during the delivery of the child is also found to have a positive association with autism risk. This finding is supported by the findings of Zhang et al. (2010) and Gardener et al. (2011) where they found umbilical cord complications has a positive association with autism risk.

Rh incompatibility is also found to have a positive association with autism. This finding go in consensus with the finding of Gardener et al. (2011) where they found positive association between autism risk and Rh incompatibility.

Seizure and seizure medication during early years of life shows a significant positive association with autism risk. This finding goes in consensus with the findings of Saemundsen et al. (2007) where they found risk of autism and seizure during the first year of life.

Trauma during delivery or during the early years of life has a negative association with autism, as per results indicate. This finding goes contradicting to the finding to Gardener et al. (2011) where they found a positive association between trauma and risk of autism.

Duration of time spent with parents actively has a positive association with risk of autism. It has been found that in autism group, parents spent very little time with the children actively. Poor interaction with the child leads to poor socialisation skills and communication skills. These circumstances lead the child to build their own world and gets more eccentric into it. Such factors can lead to autism risk.

Duration of TV exposure per day and the age at which the child started TV exposure also have a positive association with risk of autism. It has been found that children with autism gets exposed to TV for more than 3 hours per day and it may extend till 10 hours, as per data indicate. And also the age of commencement of TV exposure started at a very early age of less than one year. This can the developmental stages of the child especially communication and intend for communication leading to risk of autism.

Consumption of fish is excess has a positive indication of autism risk. Fish had high mercury content in them. When consumed in large quantity, it may get deposited in the brain cells and can lead to risk of autism. It has been found that autistic children

have low level of glutathione which actually helps in neutralizing the mercury level. Since they have it in low levels, this process of neutralization of mercury does not happen leading to risk of autism (Mutter et al., 2005). Further investigation is warranted.

V. BEHAVIOURAL AND COMMUNICATION

Behavioural problems

Table 51 shows the percentage of children with behavioural problems in both autism and typical group.

Table 51: *Percentage of children with behavioural problems in autistic and typical population*

			behavioural problems		Total
			negative	positive	
group	Autism	Count	12	108	120
		% within group	10.0%	90.0%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics reveals that percentage of children with behavioural problem is seen more in autistic group whereas in typical population, the children had no behavioural problems, as per the results indicate. The test of association revealed that there is a high positive association between sleep disturbance and risk of autism (χ^2 (1) = 156.522, $p<0.05$).

Socialization

Table 52 shows the percentage of social skills in both autism and typical group of children.

Table 52: *Percentage showing social skills in autistic and typical population*

			Socialization		Total
			no socialization	with family	
group	Autism	Count	65	55	120
		% within group	54.2%	45.8%	100.0%
	Typical	Count	0	80	80
		% within group	0.0%	100.0%	100.0%

Descriptive statistics reveals that percentage of children with no socialisation is seen more in autistic group whereas in typical population, the children had socialisation skills developed at an early age. The test of association revealed that there is a high positive association between lack of socialisation skills and risk of autism (χ^2 (1) = 64.198, $p<0.05$).

Response to name call

Table 53 shows the percentage of children's response to name call in both autism and typical group.

Table 53: *Percentage of response to name call in autistic and typical population*

			response to name call		Total
			negative	positive	
group	Autism	Count	49	71	120
		% within group	40.8%	59.2%	100.0%
	Typical	Count	0	80	80
		% within group	0.0%	100.0%	100.0%

Descriptive statistics reveals that percentage of children with no socialisation is seen more in autistic group whereas in typical population, the children had socialisation skills developed at an early age. The test of association revealed that there is a high positive association between lack of socialisation skills and risk of autism (χ^2 (1) = 43.267, p<0.05).

Parent recognition

Table 54 shows the percentage parent recognition of children with autism and typical group.

Table 54: *Percentage of parent recognition in autistic and typical population*

			parent recognition		Total
			negative	positive	
group	Autism	Count	8	112	120
		% within group	6.7%	93.3%	100.0%

	Typical	Count	0	80	80
		% within group	0.0%	100.0%	100.0%

Descriptive statistics reveals that more percentage of children with autism showed no parent recognition whereas in typical population, the children parent recognition in various forms. The test of association revealed that there is a high positive association between lack of parent recognition and risk of autism (χ^2 (1) = 5.556, p<0.05).

Eyecontact

Table 55 shows the percentage eyecontact shown by children with autism and typical group.

Table 55: *Percentage of eyecontact shown by autistic and typical population*

			eyecontact		Total
			negative	positive	
group	Autism	Count	79	41	120
		% within group	65.8%	34.2%	100.0%
	Typical	Count	0	80	80
		% within group	0.0%	100.0%	100.0%

Descriptive statistics reveals that autistic children showed more percentage of negative response, that is less eye contact while communication whereas in typical population, the children had maintained eye contact skills while communication. The test of association revealed that there is a high positive association between lack of eye contact and risk of autism (χ^2 (1) = 87.052, p<0.05).

Hyperactivity

Table 56 shows the percentage of children with hyperactivity in autism and typical group.

Table 56: *Percentage of hyperactive children in autistic and typical population*

			hyperactivity		Total
			negative	positive	
group	Autism	Count	32	88	120
		% within group	26.7%	73.3%	100.0%
	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics reveals that percentage of children with hyperactivity is seen more in autistic group whereas in typical population, the children had no hyperactive nature. The test of association revealed that there is a high positive association between hyperactivity and risk of autism (χ^2 (1) = 104.762, p<0.05).

Self stimulatory behaviour

Table 57 shows the percentage of self stimulatory behaviour in both autism and typical group of children.

Table 57: *Percentage of self stimulatory behaviour in autistic and typical population*

			self stimulatory behaviour		Total
			negative	positive	
group	Autism	Count	23	97	120
		% within group	19.2%	80.8%	100.0%

	Typical	Count	80	0	80
		% within group	100.0%	0.0%	100.0%

Descriptive statistics reveals that percentage of children with self stimulatory behaviour is seen more in autistic group whereas in typical population, the children had no self stimulatory behaviour. The test of association revealed that there is a high positive association between self stimulatory behaviour and risk of autism (χ^2 (1) = 125.566, $p<0.05$).

Non verbal communication

Table 58 shows the percentage of children with non verbal communication in both autism and typical group.

Table 58: *Percentage of non verbal communication in autistic and typical population*

			Non verbal communication		Total
			negative	positive	
group	Autism	Count	46	74	120
		% within group	38.3%	61.7%	100.0%
	Typical	Count	0	80	80
		% within group	0.0%	100.0%	100.0%

Descriptive statistics reveals that percentage of children with no non verbal communication is seen more in autistic group whereas in typical population, the children had good non verbal communication skills developed at an early age. The test of association revealed that there is a high positive association between lack of non verbal communication skills and risk of autism (χ^2 (1) = 39.827, $p<0.05$).

Table 59: *Results of Chi Square Test for behavioural factors*

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Behavioural problems	156.522	1	.000*
Socialization	64.198	1	.000*
Response to name call	43.267	1	.000*
Parent recognition	5.556	1	.018*
Eyecontact	87.052	1	.000*
Hyperactivity	104.762	1	.000*
Self stimulatory behaviour	125.566	1	.000*
Non verbal communication	39.827	1	.000*

(* indicates statistical significant association at 0.05 level)

In behavioural and communication, all the factors indicate a positive association with risk of autism.

Behavioural problems at early age, lack of socialization skills, response to name call, poor parent recognition, lack of eyecontact, presence of hyperactive nature, self stimulatory behaviour and non verbal communication all show a positive cue for the risk of autism. Changes in behavioural pattern, reduced socialisation skills, reduced peer group interaction and play behaviour serves as a key factor to identify children at risk of autism. Exhibition of these behaviours in subtle manner also calls for attention of the parents/ caretaker to take necessary steps for screening for autism.

The result of the present study is supported by Lisa Ibenez and Daniel Messinger (2012) where they found difficulties with non verbal communication can have risk of autism.

It may be warranted to further explore the significance and contribution of the different factors/ variables identified as coexistant with autism in the present study, while no claim is made to establish a causal tie between any of these factors visa-versa ASD whether these factors contribute to cause/ precipitate/ perpetuate/ aggravate the risk for ASD needs to be affirmed and if so, to what extent needs to be further studied on a long term basis and in depth as it is indicated in the case of mental retardation (Venkatesan and Rao 1996).

Specificity and Sensitivity

A different sample having 10 ASD and 10 normal children was collected to measure sensitivity and specificity values. The value of sensitivity was 0.8 and specificity was 1 indicating good true positive and true negative rates.

The details are given below

Checklist predicted conditions

	ASD	Normal
ASD	8 (true positive)	2 (false negative)
Normal	0 (false positive)	10 (true negative)

$$\text{Sensitivity} = \frac{\text{No. Of True positive}}{\text{True positive + false negative}} = \frac{8}{10} = 0.8$$

$$\text{Specificity} = \frac{\text{True negative}}{\text{True negative + false positive}} = \frac{10}{10} = 1.0$$

Both the checklists yielded similar results. Thus, the checklists were found to be specifically valid and sensitive.

CHAPTER V

CONCLUSION

Autism is a neuro- developmental disorder, coming under the classification of autism spectrum disorder according to DSM-IV TR. Children with autism primarily shows deficits in social interaction, peer interaction, play behaviours, communication skills and they exhibit stereotypic behaviour pattern. Some shows hyperactivity, self stimulatory behaviours and self injurious behaviours according to the severity of the disorder.

There is no one factor that can be highlighted to indicate as a cause of autism. Several conditions can lead to autism. There are researches that indicate autism is a genetic factor, some insist it is environmental and others opine genetic factors along with environmental factors contribute to the causation/ perpetuation/ precipitation of autism.

Several tests (formal and screening) are available to find autism at an early age. But most of the studies are done on western population. There is very limited study done in Indian context to study the factors that coexist or that lead to risk of autism. Hence the present study is focused on developing and standardizing a parental checklist/questionnaire targeting on some selected (random) issues with respect to the parental, prenatal, perinatal, postnatal and behavioural factors which contributes to the risk of autism.

The outcome of the study gives researchers an idea about the factors like consanguinity, positive family history, advanced parental age, maternal stress during pregnancy, active time duration spent with child by the parents, TV exposure at early age, medication during pregnancy can have a link to the risk for autism. This checklist/questionnaire is a parental checklist/questionnaire so the participation of the child is not necessary. It covers almost all the factors which contribute/ perpetuate/ precipitate/ trigger the risk of autism. Hence this checklist/questionnaire acts as a useful screening(language free) tool to identify a possible autism risk at a very early age so that appropriate measures can be taken further with respect to intervention/ rehabilitation and other aspects.

However, only preliminary data on autism in comparison with typical data of the developed tool was obtained in the present study and greater number of long term studies are required to establish the validity of the developed tool in Indian context.

Limitations of the study

1. Due to non availability of cases only Autism/ Autistic Disorder which is the prime variety of ASD was considered.
2. A normative table/ chart was not included for long term study. This may be taken up in further studies.
3. Sub grouping of the client group was not considered with respect to mild and moderate/ no intellectual disability .

Future directions for research

1. The variables studied in the present study need to be verified on a larger population and for a longer predictive validity.

2. The list of factors/ variables may be made more exhaustive than that made in the present study.
3. These risk factors may be studied for their exact contribution with respect to causation/ perpetuation/ precipitation/ concurrence etc in ASD.

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APPENDIX A

Checklist/questionnaire for studying/ identifying the High Risk factors (parental, prenatal, perinatal, postnatal and behavioural) in children with Autism in the Indian Context.

General Information

Name: Age: Case no:

Diagnosed as:

No: of sibling: Typical Disabled (specify)

Are the parents married among relatives:

Family history:

Living set up/places:

India	Outside India	Flat/ Independent house	Duration	Happy/Stressed

Joint Family/ Nuclear family

	Father	Mother
Age (at present)		
Age (when child was born)		
Education		
Occupation		
Mother tongue		
Languages spoken		
Language spoken at home		

Mother: ☐ Home maker ☐ Employed

Was the mother employed/working during the time of pregnancy?

Was the mother employed/working after the child is born?

From which month was leaves taken during the time of pregnancy?

Till which months the leave had been taken?

Duration of working hours- (specify)

Nature of work (stress induced): Yes No

Prenatal

1. History of Abortion: Yes No

2. Diabetes

3. High BP

4. Hormonal issues

5. Bleeding

6. Thyroid problem

7. Exposure to smoke

8. Alcohol consumption

9. Excessive vomiting

10. Maternal stress during pregnancy

11. Psychological Stress/ Mental Stress/ Depression

Home ☐ Spouse/ others ☐ Office/ work place ☐ Natural calamities ☐

Death of family member ☐

12. Medication during pregnancy: Physical illness ☐ Mental illness ☐

- Urinary Tract Infection
- Others

Perinatal

1. Gestational age at birth

   (during which month of pregnancy was the child born)

2. Was the child born before or after the due date of delivery?

3. Type of delivery

   - Normal
   - Caessarian
   - Vaccum
   - Breach

4. Labor length- Long Very Long Short

5. Birth cry: Normal Delayed

6. Birth weight:

7. Others

Postnatal

1. Asphyxia (Blue Baby)/ Foetal distress/ Hypoxia (Respiratory distress)
2. Neonatal Jaundice
3. Rh incompatibility
4. Umbilical cord complications
5. Attack of seizure
    - Age of onset
    - Frequency of attack
    - Age at which it subsided
    - Medication taken

Allopathy ☐ Ayurvedic ☐ Homeopathy ☐ ☐ Others

    - Duration of medication

6. MMR vaccination: Yes ☐ No ☐
7. Intake of antibiotics/ other medication in early childhood : Yes ☐ ☐ No

    If Yes, specify …….

8. History of trauma
    - Head injury
    - Mental trauma/ stress for infant
9. Parent child interaction
    - Duration spent with the child
        - Mother
        - Father

- How do you interact with the child

	Mother (No: of hours)	Father (No: of hours)
Play with toys		
Talking to the child		
Feeding and talking		
Watch TV together		
Goes to park together		
Telling stories		
Narrating events		
Engage in play activities		

10. For working mothers

- Details of caregiver

  Education

  Age of the caretaker

- Age at which child was left with the caretaker:
- Duration that the child spends with the caretaker:

11. Diet

- Ordinary food- Indian style Veg ☐ Non Veg ☐
- Fast food-(if yes, specify frequency of intake)
- Sweets
- Noodles
- Fish intake- Daily ☐ Weekly ☐

12. Exposure to TV

- Duration of exposure/ day
- Age at which it started:
- Age at which it stopped:

13. Sleep disturbance present absent

14. Behavioural issues present absent

	Present	Absent	Age at which it is noticed
Social smile			
Responds to sounds/ name call			
Recognising parents			
Eye contact			
Hyperactivity			
Self stimulatory behaviour (rocking/vacant staring/hand flapping)			
Non verbal communication (eye gaze, pointing, gestures etc)			

Any others: (any other possible cause, you as a parent think might be the cause for the disorder)

Parent/caregivers Signature:

Date:

APPENDIX B (For Professionals)

Checklist/questionnaire for studying/ identifying the High Risk factors (parental, prenatal, perinatal, postnatal and behavioural) in children with Autism in the Indian Context.

General Information

Name: Age: Case no:

Diagnosed as:

No: of sibling: Typical Disabled (specify)

Consanguinity (married among relatives):

Family history:

Living set up/places:

India	Outside India	Flat/ Independent house	Duration	Happy/Stressed

Joint Family/ Nuclear family

	Father	Mother
Age (at present)		
Age (when child was born)		
Education		
Occupation		
Mother tongue		
Languages spoken		
Language spoken at home		

Mother: ☐ Home maker ☐ Employed

Was the mother employed/working during the time of pregnancy?

Was the mother employed/working after the child is born?

From which month was leaves taken during the time of pregnancy?

Till which months the leave had been taken?

Duration of working hours- (specify)

Nature of work (stress induced): Yes No

Prenatal

13. History of miscarriage/ Abortion: Yes No

14. Diabetes

15. High BP

16. Hormonal issues

17. Bleeding

18. Thyroid problem

19. Exposure to smoke

20. Alcohol consumption

21. Excessive vomiting

22. Maternal stress during gestation period

23. Psychological Stress/ Mental Stress/ Depression

Home ☐ Spouse/ others ☐ Office/ work place ☐ Natural calamities ☐

Death of family member ☐

24. Medication during pregnancy: Physical illness ☐ Mental illness ☐

- Urinary Tract Infection
- Others

Perinatal

8. Gestational age at birth

(during which month of pregnancy was the child born)

9. Preterm/ post term

10. Type of delivery

- Normal
- Caessarian
- Vaccum
- Breach

11. Labor length- Long Very Long Short

12. Birth cry: Normal Delayed

13. Birth weight:

14. Others

Postnatal

15. Asphyxia (Blue Baby)/ Foetal distress/ Hypoxia (Respiratory distress)

16. Hyperbilirubinemia

17. Rh incompatibility

18. Umbilical cord complications

19. Attack of seizure

- Age of onset
- Frequency of attack
- Age at which it subsided
- Medication taken

Allopathy ☐ Ayurvedic ☐ Homeopathy ☐ ☐ Others

- Duration of medication

20. MMR vaccination: Yes ☐ No ☐

21. Intake of antibiotics/ other medication in early childhood : Yes ☐ ☐ No

If Yes, specify …….

22. History of trauma

- Head injury
- Mental trauma/ stress for infant

23. Parent child interaction

- Duration spend with the child
    - Mother
    - Father

- How do you interact with the child

	Mother (No: of hours)	Father (No: of hours)
Play with toys		
Talking to the child		
Feeding and talking		
Watch TV together		
Goes to park together		
Telling stories		
Narrating events		
Engage in play activities		

24. For working mothers

- Details of caregiver

  Education

  Age of the caretaker

- Age at which child was left with the caretaker:
- Duration that the child spends with the caretaker:

25. Diet

- Ordinary food- Indian style Veg ☐ Non Veg ☐
- Fast food-(if yes, specify frequency of intake)
- Sweets
- Noodles
- Fish intake- Daily ☐ Weekly ☐

26. Exposure to TV

- Duration of exposure/ day
- Age at which it started:
- Age at which it stopped:

27. Sleep disturbance present absent

28. Behavioural issues present absent

	Present	Absent	Age at which it is noticed
Social smile			
Responds to sounds/ name call			
Recognising parents			
Eye contact			
Hyperactivity			
Self stimulatory behaviour (rocking/vacant staring/hand flapping)			
Non verbal communication (eye gaze, pointing, gestures etc)			

Any others: (any other possible cause, you as a parent think might be the cause for the disorder)

Parent/caregivers Signature:

Date: