Systematic Review on Prevalence for Autism Spectrum Disorder with Respect to Gender and Socio-Economic Status

Bappaditya Adak¹ and Santoshi Halder*²

¹University of Calcutta, India
²Department of Education, University of Calcutta, India

Abstract

The prevalence of Autism Spectrum disorder has been increased rapidly worldwide in last few years. However most of the estimation comes from developed regions of western countries. There are no reliable and consistent data from non-western or non-affluent countries.

Aim: The primary aim of this systematic review was to synthesise the results of wide range of epidemiological studies to estimate prevalence of ASD with respect to gender and socio-economic status (SES). Secondly, available studies were analyzed with identified themes for assessing the trend of these studies.

Methods: Based on pre-defined inclusion and exclusion criteria epidemiological reports were identified by internet search and recent relevant papers were included (2005-2015).

Results: 27 eligible studies were identified for review of which 22 estimated Autism spectrum Disorder (ASD) or Pervasive developmental disorder (PDD) and 4 concentrated on typical Autism. Most of the studies used special educational and mainstream school records (N=11) for data extraction. Overall mean age of study samples ranged between ages 2-17 years. International classification of disabilities (ICD)-9 and 10 criteria as well as Diagnostic Statistical Manual (DSM)-III and IV criteria were retained for diagnostic assessment. The average prevalence of these twenty seven studies was 91.92 per 10,000 populations. The reported prevalence of ASD varied substantially by country and continent, use of methodology, assessment tools, gender, geographic region and Socioeconomic status (SES).

Conclusion: Recent studies provided higher estimation and prevalence rate in developed or much affluent countries as well as urban areas. Also Parental high SES was found positively associated with prevalence of ASD. Analyses suggest more strong instruments and awareness is needed. Also more population based investigations is needed in rural as well as developing countries for revealing clear picture of this disability.

Keywords: Autism spectrum disorder; Prevalence; Systematic review; Gender; Socio-economic status

Introduction

In last two decades the number of diagnoses of Autism Spectrum disorder (ASD) has been increased drastically throughout the world [1,2]. The diagnosis rate of ASD increases 4.5 per 10,000 children’s in 1943 [3] to 110 per 10,000 in 2009 [4] in western countries. Prevalence studies suggest that most of the estimation comes from regions of Europe and United States, where standardised services are available for diagnosis. According to recent report Centers for Disease Control and Prevention [5] identified 1 per 68 children’s (1 in 42 boys and 1 in 189 girls) have ASD in United States. In last two decades preliminary efforts have been taken in non-western countries to estimate prevalence of ASD. As an example presently more than 10 million children are (aged between 9 to 10 years) effected by ASD in India. In some other Asian countries the prevalence rate increases accordingly, Japanese has 21.1 per 10,000 to 181 per 10,000, South Korea reported 264 per 10,000 in 2011 [6], and China has 10.3 per 10,000 children’s [7]. But this estimates show a great amount of inconsistency while researchers considered that the numbers are increasing truly.

Though researchers identified drastically increase of ASD universally, but there remains a great amount of inconsistency in the prevalence rate in developed and developing countries. Literature shows that the dramatically increase rate of ASD risen in developed countries most of the time [8]. There was a great imbalance in delivery of services around the world. Specifically Low Resource Community and Countries (LRCC) faced more problems than high resource countries. Therefore low or middle income regions of developed countries have not identified so much increase of ASD rate than high resource community and countries. According to a recent estimation epidemiological studies identified around 87% of the ASD cases in Europe, Japan and North America, while only 10% of the worlds children’s lives in these countries [9]. Due to lack of knowledge, awareness and socio-economic disparities majority of individuals with ASD living in low and middle income countries and were not identified properly. Therefore these unidentified peoples were not represented in world prevalence studies.

Because of this inconsistent estimation recently researchers descended on debate over whether this is real increase or not. Several explanation have been proposed by the researchers for this high estimation including modified diagnostic criteria, improved diagnostic instruments, the broader definition of ASD, uses of different research...
Methodological improvement

Researchers give strong explanation that the methodology used by several studies throughout the years has been changed according to the needs of the time. After precise the case definition researcher should made effort to find out sampling criteria. Prevalence estimation varied with sampling methodology and survey designed including already diagnosed large clinical samples to non-clinical undiagnosed populations or misdiagnosed and milder forms of ASD phenotype. Depending on the study context researcher may include random non-random samples with high representativeness to target populations to estimate prevalence of ASD. Most of the time non-random samples have common limitations that undiagnosed and non- -documented cases were not included in national registry or education, health or other service provider’s database, therefore many remains unrecognized [10]. Presently prevalence estimation are derived from a number of ways through non-random sampling such as national registries, health and special education registers, service providers records, retrospective accounts and telephone interviews. Researchers also used random sampling methodology to identify cases through multi-source records-review surveillance approach, multiphase total population surveillance approach and whole area surveys. No doubt research methodologies can impact on result of prevalence estimation. But these sampling methodologies have some limitations. As an example national registries can be helpful for countries with single health care system and small geographic area [11]. Also special educational information’s are only used for service use purposes. Therefore only those children’s were counted who meet the service criteria and others (home-schooled) remain underestimated in prevalence categories. Similarly health records are not sufficient due to lack of quality diagnosis. Therefore it is obvious that ASD rates may differ in terms of methodology used for data extraction.

Improved diagnostic criteria

The ever changing diagnostic criteria and definition of subcategories of ASD have been considered the common reasons of increased prevalence of ASD [12,13]. In 1980, Diagnostic and Statistical Manual of mental disorders (3rd edition) first included ASD and offer formal diagnostic criteria [14]. After that APA expanded and modified the diagnostic criteria accordingly with [15]. Through this updated diagnostic edition DSM changes the classification of symptom recognition and categorized ASD. Therefore periodic revision of diagnostic criteria and used of different criteria when estimate ASD prevalence may increased the possibility of misinterpreted increase. Specifically after the publication of DSM-5 [15] the diagnostic criteria have been changed totally and merged five categories in one umbrella term ASD; and expansion the age on set criteria into childhood ASD. This changes no doubt impact the existing prevalence of ASD. Also some researchers used International classification of diseases (ICD) series as parallel diagnostic criteria of ASD; which also increases the complexity of understanding of increases rate of ASD because DSM-III (R) criteria are different from ICD-10.

Improved diagnostic instruments

In conjunction with modification of diagnostic criteria of ASD assessment tools have been improved over the years. In recent years based on developmental history of child and direct observation clinicians developed several standardised systematic diagnostic instruments. These instruments improved the detection process of ASD and measured the degree of impairment properly. Moreover researchers give emphasis on collection of systematic developmental data of children’s as complex diagnostic assessment. Diagnostic tools such as Autism Diagnostic Interview revised [16], Autism Diagnostic Observational Schedule, and Diagnostic Interview for Social and Communication Disorder (DISCO) are commonly used worldwide by professionals with good training. The changing assessment tools can contribute to marked increase of cases in different studies [17]. But in low resource country like India researcher compel to use western countries diagnostic instruments without any cross cultural verification and revalidation. These tools are costly, lengthy, and need professional training to administer. Also these research tools were not extended due to lack of free access services. Researchers stated that due to inequality and convenience sampling approach most of the ASD research focused on high economic group for the development of assessment tools [18]. So there remains some inconsistency in ASD prevalence in low and middle income countries like India.

Socio-economic advancement

Cultural beliefs, norms and expectations greatly influenced the identified features of ASD [13]. Also socio-economic condition of parents affects the diagnosis and prevalence of ASD. Because parent’s with a high income and high education are much more aware of the problems and are close to important services. Therefore in comparison to other countries the prevalence of ASD is much higher in developed countries. This socio-economic inequalities build our knowledge biased and incomplete because most of the researches concentrate on high income setting which might miss other perspectives of ASD including cultural back ground, sociological impact and natural history of ASD [18]. Also low recourse countries cannot avail the existing services due to cost and feasibility. More over research funding is limited in India for improving diagnostic tools and translate popular assessment instruments. Therefore inaccessibility impacts the world population of ASD increasingly.

In the same time researcher found a male dominance of the disorder from the earlier time. But presently there is no reliable statistics on prevalence of ASD in many countries including India. Thus present study attempt to review the trend of prevalence of ASD in respect to SES and gender for the last 15 years worldwide including developed and developing countries. The primary objective of this systematic review is to provide a clear picture of the methodology used by epidemiological studies and their results regarding prevalence of ASD worldwide. Meanwhile the limitation is that present review included very few available studies, therefore extensive coverage is not found (Table 1).

Outcome of the results

As per the inclusion and exclusion criteria overall 26 studies were included in the present systematic review. Most of the studies have been published in last 10 years and cover 18 countries (Table 1). The included studies were analysed with the following themes that is trend with respect to country or continent, geographical origin of the study that is rural or urban, gender, SES, the tools used for assessing prevalence, methodology adopted for exploring the prevalence and limitation of the studies conducted. Most of the studies focusing on 2-17 years old children’s as participant of the study. The population size varied with the reviewed studies ranged from 500 to 1.32 billion. Also 60% (N=16) studies uses the term Autism Spectrum Disorder (ASD), 10% (N=3) studies uses Autism Spectrum Condition (ASC), 15% (N=4)
studies uses Pervasive developmental Disorder (PDD) and 15% (N=4) studies concentrate on pure Autism. For the better understanding of the occurrence of ASD in general population a considerable literature has been developed, which reported that incidence of ASD increasing reportedly. Therefore present systematic review chronologically synchronizes the samples.

Country/continent

Present systematic review conducted on study of 18 countries under 5 major continent namely (1) Europe including Netherland, England, Iceland, Sweden, Spain, Portugal, and UK (N=7), (2) North America including Canada and USA (N=2), (3) South America including Venezuela, (4) Asia including China, South Korea, Thailand, Israel, Iran and India (N=6) and Australia including a single study (N=1). Therefore present review covers only main five continent of the world and other two continents namely Africa and Antarctica were not presented due to lack of studies and inclusion and exclusion criteria not met for these studies. Present study covers 26% of the Asian studies (N=7), 28% of the American studies (N=8) and 41% Europe continent studies (N=11) and 3% Australian studies (N=1). Review also shows that 63% studies were conducted in urban locality (N=16, studies like Sun et al.; Lowe et al.; Taylor et al.) and 33% studies were conducted in both rural and urban locality combined (N=9, studies such as Saemundsen et al. [19], Ping et al. [20]; Idring et al. [21]). Only one study in Chiang Mai held on rural population [22].

According to Table 1 in Asian countries South Korea had maximum rate of prevalence (264 per 10,000, Kim et al. [6]). It was the first population based prevalence study in Korea as well as in Asia in recent years. Therefore the significance of this study was very high because researchers included both general and high probability group of ASD from entire elementary schools of South Korea. Also this study estimated prevalence of ASD in different settings with phenotypic variability. In the same time it includes a big amount of children’s for screening (that is 55266 children’s) as cross section of rural and urban areas. Also this special educational centre; as well as screen new cases from mainstream children’s. As researchers schools records can cover broad geographical areas as well as cross section of rural and urban areas. According to methodology used worldwide present systematic review found total four sample sources by this investigations including, a) 25% followed general population based sampling technique (N=6; as a example study of Kim et al. [6]; Samadi et al. [24]), b) 10% studies followed medical and health records, (N=3; as a example study of Ping et al.; Taylor et al. [25]; Montiel-Nova et al. [26]), c) 40% studies followed special educational and mainstream schools records, (N=11; as a example study of Roelfsema et al. [23]; Aguiler a et al. [27]; Sun et al. [7]; Lowe et al. [28]), and d) 25% studies followed national birth register or birth cohort (N=7; as a example study of King et al. [29]).

According to present review most of the studies used special educational and mainstream school records to estimate prevalence of ASD in a particular region of country. This technique can include a high percentage of representative random samples from special education centre; as well as screen new cases from mainstream children’s. As an example Roelfsema et al. [23] include three information and technology based areas samples (Eindhoven, Haarlem and Utrecht) from mainstream school aged children’s through formal diagnosis and identified a great amount of children’s successfully. According to researchers schools records can cover broad geographical areas as well as cross section of rural and urban areas. Also this special educational records help researchers to identify children’s with ASD easily because only special education centres allow disabled children’s to pursue their education.

Present review show that most of the developed countries (as an example study of Roelfsema et al. [23]; Aguiler a et al. [27]; Sun et al. [7]) as well as developing countries (as an example study of Sharda et al. [24]; Surinkae et al. [22]) used special educational and mainstream enrolments data for identification of cases in estimating prevalence of ASD.
Age of the sample

In present review some studies mentioned children’s age groups, while some measure children’s age specific estimation as well. Overall 0-37 years old age peoples were presented by these studies. According to present review (Table 2) 11% studies included preschool children’s that is 0-5 years old children’s (N=3; as an example studies of Ping et al. [20]); 51% studies used primary school age children’s that is 6-12 years old children’s (N=14, as an example studies of Saemundsen et al. [19]; Taylor et al. [25]; King et al. [29]; Maenner et al. [30]); 25% studies include pre to secondary school age long age group that is 0-18 years old (N=7, studies like; William et al. [13]); and 11% studies include

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Authors</th>
<th>Year</th>
<th>Journal</th>
<th>Country</th>
<th>Continent</th>
<th>Region</th>
<th>Age group</th>
<th>Population</th>
<th>Number affected</th>
<th>Diagnostic Criteria</th>
<th>Diagnostic tools</th>
<th>Gender ratio</th>
<th>Prevalence per 10,000</th>
<th>Limitation</th>
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<td>ASD</td>
<td>2431649</td>
<td>8-18</td>
<td>9109</td>
<td>DSM-IV-TR</td>
<td>ADI, CARES, ADOS</td>
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<td>50</td>
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<td>Reykjavik</td>
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<td>0-8</td>
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<td>ADOS, ADI-R</td>
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<td>Urban</td>
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<td>6-11</td>
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<td>ADOS, CAST</td>
<td>4:1</td>
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<td>Ping et al.</td>
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<td>Tianjin</td>
<td>Mixed</td>
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<td>1.5-2.5</td>
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<td>stratum-adjusted Cochran-Mantel-Haenszel tests</td>
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<td>Europe</td>
<td>Eindhoven, Haarlem, Utrecht</td>
<td>Urban</td>
<td>ASC</td>
<td>269504, 285215, 288401</td>
<td>4-16</td>
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<td>Under-diagnosis and over-diagnosis may be the reason of prevalence difference between three regions</td>
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<td>Mixed</td>
<td>Autism</td>
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<td>4-37</td>
<td>74</td>
<td>DSM-IV</td>
<td></td>
<td>2:1</td>
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<td>SAGE</td>
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<td>1.32 million</td>
<td>5</td>
<td>3181</td>
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<td>6.62</td>
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<td>5:1</td>
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<td>Autism Spectrum Quotient, Autism Diagnostic Observation Schedule</td>
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<td>Journal</td>
<td>Country</td>
<td>Region</td>
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<td>Age</td>
<td>ASD</td>
<td>ICD Number</td>
<td>SES Measure</td>
<td>Notes</td>
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<td>King et al.</td>
<td>2011</td>
<td>Am Sociol Rev</td>
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<td>USA</td>
<td>California</td>
<td>Urban</td>
<td>ASD</td>
<td>4,906,926</td>
<td>2.9-9</td>
<td>18731</td>
<td>California based data may have better access of services than other parts of country</td>
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<td>15</td>
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<td>Gothenburg</td>
<td>Urban</td>
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<td>2</td>
<td>40</td>
<td>DSM-IV TR, M-CHAT,ADOS DISCO-11</td>
<td>Very narrow age limit of the study</td>
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<td>Wisconsin</td>
<td>Urban</td>
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<td>DSM-IV</td>
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<td>17</td>
<td>Durkin et al.</td>
<td>2010</td>
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<td>US</td>
<td>USA</td>
<td>12 ADDM</td>
<td>Urban</td>
<td>ASD</td>
<td>557689</td>
<td>0-8</td>
<td>3680</td>
<td>DSM-IV TR</td>
<td>area-level measures of SES that might not have served as accurate proxies for the SES of individuals or specific families or households</td>
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<td>18</td>
<td>Lazzof et al.</td>
<td>2010</td>
<td>The Canadian Journal of Psychiatry</td>
<td>Iceland</td>
<td>Europe</td>
<td>Montreal</td>
<td>Urban</td>
<td>PDD</td>
<td>23635</td>
<td>3-17</td>
<td>187</td>
<td>5.4:1</td>
<td>79.1</td>
<td>diagnosis could not be directly confirmed, and it is therefore possible that PDD diagnoses were overused, leading to diagnostic misclassification and overestimation of the prevalence</td>
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<td>Baron-Cohen et al.</td>
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<td>Cambridge</td>
<td>Mixed</td>
<td>ASC</td>
<td>3373</td>
<td>5-9</td>
<td>37</td>
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<td>CAST, ADIR, ADOS</td>
<td>3:2</td>
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<td>20</td>
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<td>2009</td>
<td>Journal of Neurodevelopmental disorder</td>
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<td>Caribbean</td>
<td>Urban</td>
<td>ASD</td>
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<td>69</td>
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<td>2008</td>
<td>SAGE</td>
<td>Venezuela</td>
<td>America</td>
<td>Maracaibo</td>
<td>Urban</td>
<td>PDD</td>
<td>254,905</td>
<td>3-9</td>
<td>430</td>
<td>DSM-IV TR</td>
<td>ADOS, CARS</td>
<td>3:3:1</td>
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<td>Journal of Paediatrics and Child Health</td>
<td>Australia</td>
<td>Western Australia</td>
<td>Mixed</td>
<td>Autism</td>
<td>0-16</td>
<td>35-40</td>
<td>Due to similar features many cases were included as ASD which cannot be considered as ASD according to DSM-IV criteria</td>
<td></td>
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<td>23</td>
<td>Aguilera et al.</td>
<td>2007</td>
<td>The British Journal of Developmental Disabilities</td>
<td>Spain</td>
<td>Europe</td>
<td>Seville</td>
<td>Urban</td>
<td>ASD</td>
<td>127,350</td>
<td>3:21</td>
<td>200</td>
<td>DSM-IV</td>
<td>1CD-10</td>
<td>5:1</td>
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<td>24</td>
<td>Oliveira et al.</td>
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<td>Developmental Medicine and Child Neurology</td>
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<td>Europe</td>
<td>Mainland Azores</td>
<td>Urban</td>
<td>ASD</td>
<td>332,808</td>
<td>10,910</td>
<td>6-9</td>
<td>198</td>
<td>120</td>
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</table>
adult age group (N=3, studies like Sharda et al. [24]; Brugha et al. [10] and Aguilera et al. [27]) (Table 1).

Present review showing the trend of age groups of samples and it is notified that maximum studies represented primary children’s as samples of their prevalence studies. Therefore it is considered that researcher should involve pre-primary and primary group children’s for prevalence estimation because the sign and symptoms are more prominent among these children’s which help researchers to identify confidently. Montiel-Nava et al. [26] identified children’s with ASD from general population with the mean age of 5.33. According to them the proportion of children’s diagnosed with ASD decreased with age. According to Oliveira et al. [31] elementary education is free and compulsory in Portugal; and 100% children’s attending schools in this age group. Therefore it was expected that all the children’s with ASD should enrolled in three forms of education namely public, private and special education centres [31]. Interestingly developing countries found much older samples in their study such as Raz found 8 to 18 years old young people; Sharda et al. [24] found a wide age range with 4 to 37 years old people in their study.

**Assessment tools**

Table 2 show that prevalence studies were used variety of diagnostic and screening instruments ranging from detailed clinical inspection to use of standardized tests. Also DSM based definitions as well as ICD-9 and 10 criteria were retained to a large extent which reflects diagnostic assessment. According to Table 2, 37% studies not mentioned any screening or assessment instruments in their report or not use any diagnostic instruments (N=10; studies like Lowe et al. [28]; Sharda et al. [24]; maenner et al. [30]; Frieden et al. [2]). On the other hand systematic table reported that rest of the studies (67%) used renowned and popular instruments to diagnosed children’s with ASD for estimating prevalence (N=17). For conducting first phase screening investigators used several standardized instruments, as an example 30% studies used Autism Diagnostic and Observation Schedule (ADOS) (N=8; studies like Saemundsen et al. [19]; Brugha et al. [10]), 15% studies used The Autism Diagnostic Interview-Revised (ADI-R) (N=4; studies like Samadi et al. [24]; Baron-Cohen et al. [17]; Oliveira et al. [31]), 12% studies used Childhood Autism Rating scale (CARS) (N=3; Monteil-Nava and Pena, [26]; Oliveira et al. [31]), and 8% studies used Checklist for Autism in Toddlers (CHAT) (N=2; Baron-Cohen et al. [17]). Rest of the studies used other popular assessment instruments like Modified Checklist for Autism in toddlers (MCHAT), Social Communication Questionnaire (SCQ), Autism Spectrum Screening Questionnaire, PDDSQ=Pervasive Developmental Disorder Screening Questionnaire, DISCO=The Diagnostic Interview for Social and Communication Disorder.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Year</th>
<th>Country</th>
<th>Age</th>
<th>Instruments</th>
</tr>
</thead>
</table>
| Frieden et al. | 2006 | USA | 11 ADDM network | ASD 307,790 0-6 5151 DSM-IV/TR ICD-9
| Suntraew et al. | 2005 | Thailand | Rural | PDD 618 2-6 2 DSM-IV PDDSQ 32
| Chakraborti et al. | 2005 | England | Midland | PDD 10,903 4-6 64 DSM-IV ADI-R 8:1 22

*12 ADDM=12 Automatic Database Diagnostic Monitor network.
*11 ADDM=11 Automatic Database Diagnostic Monitor network.
*DMS-IV=Diagnostic and Statistical Manual of Mental Disorder, fourth edition.
*DMS-TR=Diagnostic and Statistical Manual of Mental Disorder, fourth edition (Text Revision).
*ICD-10=International Classification of Diseases, Tenth Revision.
*ICD-9=International Classification of Diseases, Ninth Revision.


**Table 2:** Socio economic background of families of these ASD children's.
studies not mentioned gender ratio in their report (37%, N=10). The overall male female gender ratio was ranged from 6:1 to 1.8:1 [19]. Most of the studies found male dominance in their study. As an example Kim et al. [6] found 3:1.1 found 3:4:1; Lowe et al. [28] found 5:2:1 ratio in their study successfully. Therefore continuation with history no study found girl dominance in ASD. After a complete review of these studies and giving weighted on each sex ratio with the help of 53183 subjects, an average weighted estimate of 3.77:1 found.

Therefore most of the studies show similar kind of results of male dominance. Researchers hypothesized that brain structure and chromosomal affects among boys increases the chance of getting diagnosed with ASD. Researchers also rationalized that the inability of widely used assessment tools that is ADOS, ADI-R may underestimate female child [17]. Systematic analysis also shows that children’s are as young as the male female difference is more prominent. Younger children’s has more male dominance than older. As an example Ping et al. [20] found 4:1 ratio with age limit of 1.5 to 2.5 years old child’s, Nygren found 4:1 among 2 years old child’s, Saamadai et al. [24] found 4:1 among 5 year old child’s as well. Interestingly study uses much older people in their study and the ratio of gender difference getting decreased accordingly, as an example Sharda et al. [24] found 2:1 ratio with 4 to 37 years old people, Raz found 4:4:5:6 ratio among 8 to 18 years old teenagers. The rational may behind these male dominance may be female child’s are not in the picture due to social stigma, cultural disbeliefs and lack of educational structure and parental concern. In a single Australian study [13] nation wise health records shows that more than 80% of identified child’s of ASD are male.

Prevalence estimations

Near about all the studies (97%, N=26) calculate the prevalence rate in their report (excepting Durkin et al. [32] ADDM network study). Also interesting finding is that South Korea had maximum prevalence of 264 per 10,000 school age child’s in Asia (Kim et al. [6]). Similarly in Europe continent Netherlands had greater increase of ASD among 4-16 years old child’s with 229 per 10,000 (Roelfsema et al. [33]). As America is the pioneer in the field of ASD throughout the years, Blumberg and colleagues (Blumberg et al. [4]) shows that 200 per 10,000 children had ASD in the age group of 4-16. On the other hand in Europe continent country like Portugal and Spain had lower prevalence rate in comparison to other countries with 9.4 per 10,000 (Oliveira et al. [31]) to 12.97 per 10,000 [27] in school going children. Saemundsen et al. [19] assessed 22,229 Iceland children aged between 0- to 8-years with the estimation of 120.1 per 10,000. In Asian countries Sun et al. [7] found a rate of 119 per 10,000 children aged between 6- to 11-years in Beijing. In India Sharda et al. [24] found a sample of 74 students with a prevalence of 12 per 10,000. The average prevalence of the twenty five studies was 91.92 per 10,000 populations.

Interesting finding is that all the studies found higher prevalence out of USA and UK, involved both urban and rural population (Kim et al. [6]; Roelfsema et al. [33]; Saemundsen et al. [19]). Therefore it is significant that ASD is not only based on urban industrial regions of country but also in rural areas. The trend of increasing prevalence rate is found much higher in developed countries than developing. Which maintain the worldwide trend of ASD prevalence and the researcher may hypothesized that due to improved services and greater awareness of the population these difference was found. Meanwhile these studies were conducted sporadically in worldwide, but year wise estimation shows that the prevalence rate increasing continually. Studies from USA (Blumberg et al. [4]) and UK [17] maintain their previous record of high estimation as found by others studies.

**ASD and socio-economic condition**

Table 2 shows that total 22% studies (N=6) demonstrate the socio economic background of families of these ASD child’s. Meanwhile only 11% studies found positive association between ASD and parental high socio-economic status and education. Brugha et al. [10] found no association between high parental income and presence of ASD in child’s. Similarly Sharda et al. [24] not find any significant relationship between children’s ASD outcome and increased parental age, marital relation and per-capita income through an Indian study. Oliveira et al. [31] found no association with increased prevalence of ASD and parental high SES in Portugal. King et al. [29] found that having a male child, or older and educated parents increase the risk of ASD. Meanwhile Roelfsema et al. [33] demonstrate that ASD is more common in high socio-economic families than low respected to higher education and higher income. Durkin and colleagues found that increases of income of parents are positively correlated with increasing rate of ASD [30]. According to Durkin et al. [30] when co-occurring cognitive impairment is missing the evidence of SES gradient was strong among ASD prevalence. King et al. [29] rationalize that, parents with high SES delaying in childbirth and ASD is correlated with socioeconomic ingredient. Individual with high resources can receive early diagnosis. Meanwhile other studies not discussed about the impact of SES on diagnosis of ASD.

**Limitation of Studies**

Present systematic review identified several limitations of these studies. This limitation’s can help future researchers to execute better responsibility. Methodological limitation was very common issue of these prevalence studies. As 22% (N=6) studies mentioned that their populations were not properly defined or had vast incidence that might influence the prevalence (studies like Ping et al. [20]; Taylor et al. [25]). Sufficient sample size is important for any kind of prevalence estimation and it need to be unbiased and representative. In the same time sampling error, mismatch of samples, small sample size and over estimation or under estimation was found in 35% (N=9) studies (as an example study of Ping et al. [20]; Idring et al. [21]). Administration and selection of diagnostic instruments is a key concern for researchers. Specifically when number of instruments is available it is difficult to select an appropriate tool to screen child’s. Present review shows that 15% (N=4) studies found lack of reliability, validity and culture biasness in their administered screening instruments (studies like Blumberg et al. [4]; Idring et al. [21]; Samadi et al. [24]). Also researchers screen haphazardly with the help of teachers, parents and existing school records (15%, N=4) which may misguide the diagnoses process (as an example study of Ingrid et al. [21]; Baron-Cohen et al. [17]). A diagnostic criterion is a common issue for over diagnosis and under diagnosis. Present systematic review shows that due to overlapping of diagnostic criteria and misclassification 8% (N=2) studies considered that prevalence estimation was effected. Also statistical analysis may be a issue due to lack of power [10].

Frieden et al. [2] rationalize that they used a great amount of general population to estimate prevalence of ASD, but majority of sites include little data from clinical and service provider’s, private and charter schools. Therefore a major portion of children’s remained unidentified. Similarly Aguiler et al. [27] describes that due to similar features of ASD many mild cases were included in the sample list which cannot be considered as ASD according to DSM-IV criteria. Montell-Nava and Pana [26] find that high functioning ASD were left from case
ascertainment. School records always not a good choice for prevalence estimation because many remains out of centres or home schooling. Also previous year’s records were not available sometimes.

**Conclusion and Future Directions**

In determining prevalence and providing unbiased picture of affecting factors of ASD epidemiological studies have great importance in the field research. Considering the difference between methodological surveys researchers believed that surveys can provide consistent results. Present systematic review revealed that the rates of ASD were higher among primary school going children’s. These epidemiological methodologies have been great educational significance because of multi-stage case findings. Also these surveys can promote the necessity of investigations of ASD in underdeveloped and developing countries also. This type of surveys is important for bringing awareness among professionals and stake holders about ASD. Their planning and conduct can help in raising the awareness among health professionals and educational authorities about ASD and other severe developmental disorders. Review suggests that in developed country like South Korea had maximum prevalence of 264 per 10,000 school age children in Asia.

Therefore it will not be unlucky to say that current estimation is significantly higher than previous records of Asian countries. But there are some questions remain unanswered. One of that is whether this increased prevalence rate is true or the improvements of diagnostic criteria and screening instruments are responsible for these rapid increasing. Present systematic review shows that ASD is more prevalent in males and prevalence rate is higher in developed countries in comparison to developing countries of Asia. Further research is needed for developing country like India. Presently there is no exact data for prevalence of ASD. Also parental high socio-economic condition is associated with increased rate of ASD or not it is mere a chance of further research. Prevalence rate is much higher in urban localities, so there is a need for further population based investigation in rural areas.

**Delimitation of the review**

Before concluding, several limitations of this review are worth nothing. First, results were based on limited number of studies (27). Second conclusion based on data collected and reported by the reviewed studies. Thirdly, due to limited numbers of studies choices of screening instruments and association between age groups were not discussed in this review. Thus, generalization of these findings is limited and future studies should carefully consider the results.

**References**


