# Original Article

# Profile of Social, Environmental and Biological Correlates in Intellectual Disability in A Resource-Poor Setting in India

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ABSTRACT

**Background:** Intellectual disability (ID) is a major public health issue in India. Social, environmental and biological factors all contribute to the nation's high rate of ID. **Objective:** We aimed to investigate the distribution, differences and the association of social, environmental and biological factors with different types of ID in a mixed (tribal and non-tribal) population in India. **Materials and Methods:** Secondary data was collected during a community-based rehabilitation project and analyzed with descriptive statistics: Frequency, percentage and $\chi^2$. **Results:** Poverty, low levels of parental education and a family history of epilepsy and ID were all associated in both tribal and non-tribal populations ($P < 0.05$). **Conclusion:** The outcome of this study may be helpful in planning public health initiatives that aim to reduce the burden of ID in mixed populations.

**Key words:** *Cerebral palsy, determinates, down syndrome, epilepsy, family history, India, intellectual disability, tribal*

## INTRODUCTION

In India, Intellectual Disability (ID) has gained more attention than all other developmental disabilities. Across the world, the prevalence of developmental disabilities has been increasing, but the US has seen the prevalence of ID decline because of advancements in public health and healthcare facilities. Among American children, the rate of ID has fallen by 1.5% over the last decade.[1] Currently, no one yet knows if the prevalence of ID is also declining in India. However, developing nations have almost double the prevalence of ID compared to developed nations.[2] Such developed nations, like the US, can accurately estimate and predict prevalence trends and their social, environmental and biological correlates. Conversely, India is still struggling to accurately estimate ID prevalence. While estimates of ID in India vary widely, the best estimate suggests that ID affects 1 to 32 persons per 1,000 people, indicating that ID is a serious public-health concern.[3]

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Several studies have documented aetiological factors of people with ID in India. Genetic disorders, malnutrition, infectious diseases, early- or late-age pregnancy and poor medical care before, during and after birth are the major contributing factors for ID.[4-7] Similarly, the major social, environmental and biological determinates of ID are poverty, poor nutrition, lack of awareness regarding preventive measures, illiteracy, poor healthcare facilities and lack of access to health care services. Overall, these factors negatively affect pre,

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peri and postnatal care of an individual with ID.[8-12] To develop a culturally sensitive and need-based public health programme, we must first better understand the how these key social, environmental and biological factors influence ID in India.[13-15]

### Objective

This study investigated the distribution, differences and association of social, environmental and biological determinates with different levels (severities) of ID.

## MATERIALS AND METHODS

In this study, we used secondary data collected in a community-based rehabilitation (CBR) project sponsored by a non-government organization, Ashagram Trust (AGT). AGT, which offers services related to disability, health and mental illness, is based in the town of Barwani in the state of Madhya Pradesh, India. The CBR was initiated in 1999 with financial help from Action Aid, India. The screening survey was conducted in 2000 using the National Institute for the Mentally Handicapped Developmental Screening Schedule (NIMH-DDS).[16-18] The screening survey was administered by the community-based rehabilitation workers under the supervision of experts in intellectual disabilities.

In total, 63,789 people (24,681 tribal and 39,108 non-tribal) were screened. Only children between the ages of 3-18 were screened. All people who the screen identified as having ID were further evaluated by two experts in intellectual disabilities (one of which was the author). The experts administered two common diagnostic tests: The Developmental Screening Test (DST) and the Vinland Social Maturity Scale (VSMS).[19] They also performed clinical observation and conducted a parental interview prior to making the diagnosis. All cases were classified on the intelligence quotient (IQ)-based The International Classification of Diseases, 10th Revision (ICD-10) criteria of intellectual disability: Borderline: IQ >70; Mild: IQ, 50-69; Moderate: IQ, 35-49; Severe: IQ, 20-34 and Profound: IQ <20. Secondary conditions were diagnosed on the basis of clinical observations and specific testing.

The determinants of ID were classified in to three categories:

1. Social: Socio-economic status, gender, parent education and population type;
2. Environmental: Family history of intellectual disability, mental illness and epilepsy and
3. Biological: Down syndrome, cerebral palsy, epilepsy, behavioural disorders, communication disorders and enuresis.

Regarding the overall population, 63% of people in the Barwani district were living under the poverty level at the time of the survey, but slightly more of the population screened by the CBR was in poverty. The CBR classified families as being either poor or not poor. If families had no source of income other than the seasonal labour, they were considered poor. Those that had brick houses, livestock and agricultural land were considered not poor.

### Statistics

Frequency and percentage of categorical variables were used to describe the data in terms of association or difference of social, environmental and biological factors with different categories of ID. The $\chi^2$ test statistic was used to observe differences or to measure associations. We also occasionally used $\chi^2$ with the Yates correction. The Statistical Package for Social Science (SPSS), student version, was used for statistical analyses.

## RESULTS

Contingency tables were formed with each category of ID, and then the frequency of the variable was compared within that category using the $\chi^2$ statistic. For example, we used the $\chi^2$ statistic to determine if, in the borderline ID group, the frequency of borderline ID differed in males and females. As shown in Table 1, the distribution of ID in each ID group (borderline, mild, etc.) did not differ between gender or population type (tribal vs. non-tribal). Of the children with ID, children with mild, moderate and severe ID more frequently had impoverished parents, whereas children with borderline and profound ID were more often associated with wealthier parents. Parental (the father's) education differed between all the ID categories. Most children had parents with little or no education. In addition, the child's family history of mental illness was equal among all categories of ID, but severe ID was more highly associated with family history of ID, while mild ID was not associated with family history of ID. History of epilepsy was associated with severe and profound forms of ID, but it was not associated with moderate and mild ID [Table 2]. In terms of secondary conditions, cerebral palsy is highly associated with severe and profound ID, but not with mild and moderate ID. Epilepsy is strongly associated with severe and profound ID, but not with mild ID. Down syndrome is associated with moderate ID; behaviour disorders are associated with all forms except severe and profound ID; and communication disorders are associated with all forms except moderate ID. Enuresis was not associated with any type of ID [Table 3].

## DISCUSSION

We found that the distribution of ID type among the

children we studied was consistent with other studies.[7] However, we did not observe a difference in prevalence between males and females, even though ID prevalence is usually higher in males.[2,20,21] This inconsistency may have arisen because a substantial percentage (39%) of the people studied were part of the tribal population. Historically, tribal communities have discriminated less on gender differences than their non-tribal counterparts. As such, in certain states in India tribal communities have a ratio of 1,126 female children to 1,000 male children. In non-tribal communities, the sex ratio is the opposite: Some states in India have only 893 female children per 1,000 male children.[22-24]

As in other studies, we also found that low socio-economic status — in terms of poverty and low education levels — is associated with ID.[2,20,25] Previous studies have found that a family history of ID and epilepsy are

**Table 1: Socio-economic correlates of intellectual disability (ID): Gender, poverty, population type and parental education**

| | | Gender | | | |
|---|---|---|---|---|---|
| **ID categories** | **Male/Female** | **Yes (number & %)** | **No (number & %)** | **$\chi^2$** | ***P*-value** |
| Borderline | male | 2 (0.76) | 136 (51.90) | 0.035 | 0.567 |
| | female | 3 (1.14) | 121 (46.18) | | |
| Mild | male | 40 (15.26) | 98 (37.40) | 0.189 | 0.688 |
| | female | 39 (39.88) | 85 (32.44) | | |
| Moderate | male | 54 (20.61) | 84 (32.06) | 0.224 | 0.702 |
| | female | 45 (17.1) | 79 (30.15) | | |
| Severe | male | 32 (12.21) | 106 (40.45) | 0.242 | 0.667 |
| | female | 31 (11.83) | 93 (35.49) | | |
| Profound | male | 10 (3.81) | 128 (40.85) | 1.25 | 0.98 |
| | *female* | 5 (1.90) | 119 (45.41) | | |
| Poverty (poor vs. not poor) | | | | | |
| Borderline | poor | 2 (0.76) | 200 (76.33) | 0.122* | 0.046 |
| | not poor | 3 (1.14) | 57 (21.75) | | |
| Mild | poor | 65 (24.80) | 137 (52.29) | 1.718 | 0.204 |
| | not poor | 14 (5.35) | 46 (17.55) | | |
| Moderate | poor | 78 (29.77) | 124 (47.32) | 0.257 | 0.652 |
| | not poor | 21 (8.01) | 39 (14.88) | | |
| Severe | poor | 49 (18.70) | 153 (58.39) | 0.14 | 1.00 |
| | not poor | 15 (5.72) | 45 (17.17) | | |
| Profound | poor | 8 (3.05) | 194 (74.04) | 5.09 | 0.05 |
| | not poor | 7 (2.67) | 53 (20.22) | | |
| Type of population (tribal vs non-tribal) | | | | | |
| Borderline | tribal | 1 (0.38) | 139 (53.05) | 0.093* | 0.130 |
| | non-tribal | 4 (1.52) | 118 (45.03) | | |
| Mild | tribal | 42 (16.03) | 98 (37.40) | 0.003 | 1.00 |
| | non-tribal | 37 (14.12) | 85 (32.44) | | |
| Moderate | tribal | 57 (21.75) | 83 (31.67) | 1.096 | 0.309 |
| | non-tribal | 42 (16.03) | 80 (30.53) | | |
| Severe | tribal | 35 (13.35) | 105 (40.07) | 0.053 | 0.886 |
| | non-tribal | 29 (11.06) | 93 (35.49) | | |
| Profound | tribal | 5 (1.90) | 135 (51.52) | 2.584 | 0.119 |
| | non-tribal | 10 (3.81) | 112 (42.74) | | |
| Parental education level | | | | | |
| | Yes/No | None | Primary | Middle | High school | Bachelor | | |
| Borderline | yes | 1 (2.3) | 0 (0.0) | 3 (1.14) | 1 (10.38) | 0 (0.0) | 0.286* | 0.000 |
| | no | 199 (37.78) | 17 (6.48) | 18 (6.87) | 9 (3.43) | 14 (5.34) | | |
| Mild | yes | 58 (3.05) | 12 (4.58) | 6 (2.29) | 1 (0.28) | 2 (0.76) | 0.247* | 0.002 |
| | no | 142 (54.1) | 5 (1.90) | 15 (6.72) | 9 (3.43) | 12 (4.58) | | |
| Moderate | yes | 79 (30.1) | 4 (1.52) | 8 (3.05) | 0 (0.0) | 8 (3.05) | 0.192* | 0.040 |
| | no | 121 (46.18) | 13 (4.96) | 13 (4.96) | 10 (3.81) | 6 (2.29) | | |
| Severe | yes | 53 (20.22) | 1 (0.38) | 4 (1.52) | 5 (1.90) | 1 (0.38) | 0.190* | 0.044 |
| | no | 147 (56.10) | 16 (6.10) | 17 (6.48) | 5 (1.90) | 13 (5.96) | | |
| Profound | yes | 9 (3.43) | 0 (0.0) | 0 (0.0) | 3 (1.14) | 3 (1.14) | 0.267* | 0.000 |
| | no | 191 (72.90) | 17 (6.48) | 21 (8.01) | 11 (4.19) | 11 (4.19) | | |

*$\chi^2$ with Yates correction

**Table 2: Environmental correlates of intellectual disability (ID): Family history of mental illness, epilepsy and ID**

| | | Mental illness (Yes/No) | | | |
|---|---|---|---|---|---|
| ID categories | Yes/No | Yes (number & %) | No (number & %) | $\chi^2$ | *P*-value |
| Borderline | yes | 0 (0.0) | 5 (1.90) | 0.064* | 0.297 |
| | no | 46 (17.55) | 211 (80.53) | | |
| Mild | yes | 11 (4.41) | 68 (24.95) | 1.031 | 0.378 |
| | no | 35 (13.25) | 148 (56.48) | | |
| Moderate | yes | 19 (7.25) | 80 (30.53) | 0.294 | 0.618 |
| | no | 27 (10.30) | 136 (51.90) | | |
| Severe | yes | 13 (4.96) | 51 (19.46) | 0.444 | 0.571 |
| | no | 33 (12.56) | 165 (62.97) | | |
| Profound | yes | 3 (1.14) | 12 (4.58) | 0.066 | 0.732 |
| | *no* | 43 (16.41) | 204 (77.86) | | |
| Intellectual disability (yes/No) | | | | | |
| Borderline | yes | 0 (0.0) | 5 (1.90) | 0.062* | 0.317 |
| | no | 43 (16.41) | 214 (81.67) | | |
| Mild | yes | 3 (1.14) | 76 (29.00) | 13.12 | 0.000 |
| | no | 143 (54.58) | 40 (15.26) | | |
| Moderate | yes | 18 (6.87) | 81 (30.91) | 0.363 | 0.607 |
| | no | 25 (1.21) | 138 (52.67) | | |
| Severe | yes | 19 (7.25) | 45 (172.13) | 10.879 | 0.002 |
| | no | 24 (9.16) | 174 (66.41) | | |
| Profound | yes | 39 (1.14) | 12 (4.58) | 0.024* | 0.699 |
| | no | 40 (15.26) | 207 (79.00) | | |
| Epilepsy (yes/No) | | | | | |
| Borderline | yes | 0 (0) | 5 (1.90) | 0.077* | 0.209 |
| | no | 62 (23.66) | 195 (74.42) | | |
| Mild | yes | 12 (4.58) | 67 (25.57) | 4.49 | 0.039 |
| | no | 50 (1.90) | 133 (50.76) | | |
| Moderate | yes | 12 (4.58) | 87 (33.20) | 11.73 | 0.001 |
| | no | 50 (19.08) | 113 (43.12) | | |
| Severe | yes | 32 (12.21) | 33 (12.59) | 28.77 | 0.000 |
| | no | 31 (11.83) | 166 (63.35) | | |
| Profound | yes | 7 (2.67) | 8 (3.05) | 0.132* | 0.031 |
| | no | 55 (20.99) | 192 (0/95) | | |

*$\chi^2$ with Yates correction

often associated with the ID population, supporting the aetiology of a genetic basis for ID.[26-29] Furthermore, we found that epilepsy, cerebral palsy and Down syndrome also correlate with ID, constituting a list of biological factors that influence ID. Down syndrome is one of the known genetic causes of ID, and it might be more prevalent in the Indian population because of consanguineous marriages,[30,31] which are very common among Muslims and Hindus and also in tribal communities in certain states. This kind of relationship makes offspring more likely to inherit ID, increasing the prevalence of ID in the population.[27,29,31,32]

Similarly to Down syndrome, epilepsy, cerebral palsy, behavioural problems and communication disorders strongly correlate with ID. Epilepsy and cerebral palsy

**Table 3: Biological correlates of intellectual disability (ID): Cerebral palsy, epilepsy, down syndrome, behavioural disorders, communication disorders and enuresis**

| | | Cerebral palsy (Yes/No) | | | |
|---|---|---|---|---|---|
| ID categories | Yes/No | Yes (number & %) | No (number & %) | $\chi^2$ | *P*-value |
| Borderline | yes | 0 (0) | 5 (1.90) | 0.094* | 0.128 |
| | no | 82 (31.29) | 175 (0.38) | | |
| Mild | yes | 1 (0.38) | 78 (29.77) | 47.44 | 0.000 |
| | no | 81 (30.91) | 102 (38.93) | | |
| Moderate | yes | 14 (5.34) | 85 (32.44) | 21.78 | 0.000 |
| | no | 68 (25.95) | 95 (36.25) | | |
| Severe | yes | 51 (19.40) | 13 (4.96) | 92.22 | 0.000 |
| | no | 31 (11.90) | 167 (63.74) | | |
| Profound | yes | 15 (5.72) | 0 (0.0) | 0.343* | 0.000 |
| | no | 67 (25.57) | 180 (68.70) | | |
| Epilepsy (Yes/No) | | | | | |
| Borderline | yes | 0 (0.0) | 5 (1.90) | 0.077* | 0.209 |
| | no | 62 (23.66) | 195 (74.42) | | |
| Mild | yes | 3 (1.14) | 76 (29.00) | 24.71 | 0.000 |
| | no | 59 (22.51) | 124 (47.32) | | |
| Moderate | yes | 18 (6.87) | 81 (30.91) | 2.64 | 0.134 |
| | no | 44 (16.79) | 119 (45.41) | | |
| Severe | yes | 32 (12.21) | 32 (12.21) | 32.51 | 0.000 |
| | no | 30 (11.45) | 168 (64.12) | | |
| Profound | yes | 9 (3.43) | 6 (2.53) | 0.206* | 0.001 |
| | no | 53 (20.22) | 194 (74.04) | | |
| Down syndrome (Yes/No) | | | | | |
| Borderline | yes | 0 (0.0) | 5 (1.90) | 0.039* | 0.528 |
| | no | 19 (23.66) | 238 (90.83) | | |
| Mild | yes | 5 (1.90) | 74 (28.24) | 0.149 | 0.801 |
| | no | 14 (5.34) | 169 (64.50) | | |
| Moderate | yes | 12 (4.58) | 87 (0.43) | 5.61 | 0.026 |
| | no | 7 (2.67) | 156 (59.54) | | |
| Severe | yes | 1 (0.38) | 63 (24.04) | 0.124* | 0.044 |
| | no | 18 (6.87) | 180 (68.70) | | |
| Profound | yes | 1 (0.38) | 14 (53.43) | 0.006* | 0.928 |
| | no | 18 (6.87) | 229 (87.40) | | |
| Behavioural disorders (Yes/No) | | | | | |
| Borderline | yes | 2 (0.76) | 3 (1.14) | 0.149* | 0.015 |
| | no | 212 (80.91) | 45 (17.17) | | |
| Mild | yes | 70 (26.71) | 9 (3.43) | 3.62 | 0.081 |
| | no | 144 (54.96) | 39 (14.88) | | |
| Moderate | yes | 73 (27.86) | 26 (9.92) | 6.707 | 0.013 |
| | no | 141 (53.81) | 22 (8.39) | | |
| Severe | yes | 56 (21.37) | 8 (3.05) | 1.917 | 0.196 |
| | no | 158 (60.30) | 40 (15.26) | | |
| Profound | yes | 13 (4.96) | 2 (0.76) | 0.032* | 0.607 |
| | no | 201 (76.71) | 46 (17.55) | | |
| Communication disorders (Yes/No) | | | | | |
| Borderline | yes | 1 (0.38) | 4 (1.52) | 0.148* | 0.018 |
| | no | 179 (68.32) | 78 (29.77) | | |
| Mild | yes | 32 (12.21) | 47 (17.93) | 41.81 | 0.000 |
| | no | 148 (56.48) | 35 (13.35) | | |

**Table 3: (Continued)**

| | | Cerebral palsy (yes/no) | | | |
|---|---|---|---|---|---|
| **ID categories** | **Yes/No** | **Yes (number & %)** | **No (number & %)** | **$\chi^2$** | ***P*-value** |
| Moderate | yes | 68 (25.95) | 31 (11.83) | 0.000 | 1.00 |
| | no | 112 (42.74) | 51 (19.48) | | |
| Severe | yes | 64 (24.42) | 0 (0.0) | 38.58 | 0.000 |
| | no | 116 (44.24) | 82 (31.29) | | |
| Profound | yes | 15 (5.72) | 0 (0.0) | 0.164* | 0.007 |
| | no | 165 (62.97) | 82 (31.29) | | |
| Enuresis (Yes/No) | | | | | |
| Borderline | yes | 0 (0) | 5 (1.90) | 0.047* | 0.444 |
| | no | 27 (10.30) | 230 (87.78) | | |
| Mild | yes | 7 (2.67) | 72 (27.48) | 0.255 | 0.825 |
| | no | 20 (7.63) | 163 (62.21) | | |
| Moderate | yes | 11 (4.19) | 88 (33.58) | 0.112 | 0.835 |
| | no | 16 (6.10) | 147 (56.10) | | |
| Severe | yes | 9 (34.35) | 55 (20.99) | 1.29 | 0.247 |
| | no | 18 (6.87) | 180 (68.70) | | |
| Profound | yes | 0 (0.0) | 15 (5.72) | 0.083* | 0.176 |
| | no | 27 (10.30) | 220 (83.96) | | |

*$\chi^2$ with yates correction

can both increase the severity of ID and put people at greater risk of mortality.[33-35] Within these coexisting disorders, Trisomy 21 in Down syndrome was most associated with ID; generalized tonic clonic seizures in epilepsy were most associated with ID and ataxic, then athetoid cerebral palsy were most associated with ID. The most common communication disorders seen in children with ID were delayed language, articulation and voice-related disorders. In ID, delayed language often arises because of lack of appropriate stimulation, but voice-related disorders may arise from excessive crying and vocal abuse; articulation disorders likely come from faulty learning. Regarding enuresis, bed wetting is a common behavioural problem for children with ID; it comes from skill deficits, lack of control and a response to fear and punishment. Clinical interviews reveled that several children — especially around age 10 with mild and moderate ID who had acquired control over urine in past — pathologically lost their urine control later on and were diagnosed with enuresis.

To combat its increasing rate of ID, similar public health initiatives are needed in India, at two different levels.[36-38] First, India must understand the magnitude and relationship of the social, environmental and biological determinates of ID; second, they must develop appropriate prevention and health promotion plans that are sensitive to different races, religion and geographically diverse populations.

### Strengths and limitations

This is the first study that describes the profile and distribution of various determinates of ID in a tribal population. Logistic regression likely would have offered a better description of the data and reduced potential multi-collinearity effects.

## CONCLUSION

This study demonstrates that socioeconomic, environmental and biological factors are associated with certain categories of ID. This understanding may help professionals develop better rehabilitation plans for people with ID and help parents and communities learn about the preventive aspects of ID. The findings of this study also provide insight into the problems and associated factors that public health professionals, governments and non-government agencies face when developing a need-based public health plan.

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