The Prevalence of Mental Retardation Among Third Grade Elementary School Children in the Suwon Area, Korea

The purpose of this study was to estimate the prevalence of mental retardation (MR) in Korea. The study population comprised 1,757 third-grade elementary school children residing in a single school district in Suwon, Korea. We conducted the total population survey for 1,537 children who attended one of 5 schools in the district. For the remaining 220 children who did not attend a school in the school district, we found children with MR via inspection of the register list of the disabled. A total of 16 children (7 of the 1,537 children and 9 of the 220 children) were found to have MR, yielding a prevalence of MR of 9.1/1,000. Considering that about 60% of the people with disabilities are registered in Korea, there would be at least 6 unregistered children with MR among the 220 children, so that the prevalence of MR can be estimated at 12.5/1,000 for the Suwon area.

Shin Young Yim, Hyun Hee Yu,
Il Yung Lee

Department of Physical Medicine and
Rehabilitation, Ajou University School of Medicine,
Suwon, Korea

Address for correspondence
Shin Young Yim, M.D.
Department of Physical Medicine and
Rehabilitation, Ajou University School of Medicine,
San 5, Woncheon-dong, Paldal-gu, Suwon
442-749, Korea
Tel : +82.31-219-5284, Fax : +82.31-219-5209
E-mail : syyim@madang.ajou.ac.kr

INTRODUCTION

Mental retardation (MR) is one of the most frequent handicaps among children and can be a serious and life long disability, placing heavy demands on the society and the health system (1-3). According to the American Association on Mental Retardation's 1992 definition (4), the diagnosis of MR can be made if a person displays the following three characteristics: 1) the person's intellectual functioning level is approximately 70 to 75 or below; 2) there are related limitations in two or more applicable adaptive skill areas; 3) the age of onset is 18 yr or below. The adaptive behavior refers to the quality of everyday performance in coping with environmental demands. The quality of general adaptation is usually mediated by the level of intelligence, and thus, the two-concepts overlap (4).

In terms of prevalence of MR, Penrose's classical investigations revealed that the intelligence quotient (IQ) of 10 to 14-yr-old children without organic impairment was normally distributed, with a mean IQ of 100 and a standard deviation (S.D.) of 15, which gives a theoretical prevalence of 0.3% in the IQ range below 50, 2.3% for 50-70, and 2.5% for 70-75 (5-7). According to a literature review, prevalence rates for severe MR (IQ<50) seem to center on a true average value about 3-3.8 per 1,000, which coincides with the theoretical rate of 0.3% of severe MR (5-9). However, the range of prevalence rates for mild MR (IQ 50-70) is too large to allow valid conclusions (5-9). In 1981, Hagberg et al. reported a 0.4% prevalence of mild MR in Swedish school children (5). They stated that a high general socioeconomic level of Sweden could explain this low prevalence (6, 7). However, in that study, they used the Swedish standardization of the Wechsler Intelligence Scale for Children or Terman-Merrill test, which were standardized for Sweden 10 and 40 yr before, respectively. Therefore, they conjectured that the economic, social, and technical progress during those years might have resulted in a progressively increasing mean IQ performance and thus low prevalence of mild MR (5).

On the other hand, through the extensive literature review, Roeleveld et al. said that there was sufficient evidence to justify the conclusion that, even today, approximately 3% of children of school age were mentally retarded, of which a considerable proportion could have been prevented (8). However, the prevalence of MR in developing countries is known to be much higher than that in developed countries (8, 9).

Establishing the prevalence of MR is the first step in developing effective rehabilitation and educational programs for those already suffering from it, as well as appropriate prevention programs for those at risk. However, to the best of our knowledge, the prevalence of MR in Korea is still unknown. The purposes of this study were to estimate the prevalence of MR among the elementary school children in part of the

Suwon area, Korea, and to identify factors correlating with cognitive function in these children.

MATERIALS AND METHODS

Subjects

Suwon is the capital of Kyonggi Province, and has 856,404 residents (1998 census; 10, 11). The study population in the present study comprised 1,757 children (917 boys and 840 girls) who were born between March 1989 and February 1990 and resided in the school district in Keonsun-ku, Suwon (12). The majority of these children were in the third grade of elementary schools. The reasons for selecting children in this age group were that they could answer the IQ test on optical marker reader (OMR) cards and their curriculum was relatively less structured than that of higher-grade children, so that they had available time for the IQ testing. The reason for selecting this area was the manageable number of participants for a total population survey. This district had five public elementary schools, but no private elementary or special school.

Of the 1,757 children, 1,537 (794 boys, 743 girls) attended one of the five elementary schools. The demographic and developmental characteristics of children of these 1,537 subjects are presented in Table 1. The mean age of these 1,537 subjects was 8.82 ± 0.44 yr and the mean monthly household income was US$ $1,888 \pm 881$, which represents relatively lower than the average in Korea.

The possible explanations for the remaining 220 who were born between March 1989 and February 1990 and resided in this school district in Keonsun-ku, Suwon but did not attend any of the five elementary schools in the school district are as follows: 1) attending a private school for higher quality of education; 2) attending a special school for their disabilities; 3) staying home due to their severe disabilities or other medical conditions.

Table 1. The demographic and developmental characteristics of children participating in phase 1 of the study

Characteristics	Value
Boy: girl (n=1,537)	794:743
Gestational period (weeks, n=1,350)	39.71 ± 1.42
Birth weight (kg, n=1,417)	3.28 ± 0.43
Number of siblings (n=1,418)	1.10 ± 0.52
Age at the beginning of independent walking (months, n=1,404)	11.29 ± 2.02
Monthly family income (US dollar equivalent, n=1,025)	$1,888 \pm 881$*
Years of education of mother (n=1,194)	12.74 ± 2.01*
Years of education of father (n=1,196)	13.78 ± 2.35*

*: Characteristics with a significant correlation with IQ.

Procedure

The design of the study is shown in Fig. 1. It consisted of two phases. In the first, the Korean Intelligence Test-Primary (KIT-P; 13) was administered to the 1,537 children attending the elementary schools and a questionnaire designed to assess factors potentially correlating with children's cognitive function was filled out by the children's parents. The questionnaire that had been developed by the authors contained 7 questions on the children's perinatal history, developmental history, and socioeconomic status such as gestational period, birth weight, number of siblings, age at the beginning of independent walking, household income, and maternal and paternal educational levels. The KIT-P was an intelligence test developed for the IQ test for a large number of children at a time. It consists of 100 multiple-choice questions divided into four subtests (linguistic ability, general reasoning ability, mathematical ability, and perceptual ability). The KIT-P was administered to the children in their own classrooms, according to the directions on a cassette tape and under the supervision of schoolteachers and the first author. Administration of the KIT-P took about 45 min. The children filled the answers on the OMR card and the scoring was done by a computer system. Accuracy
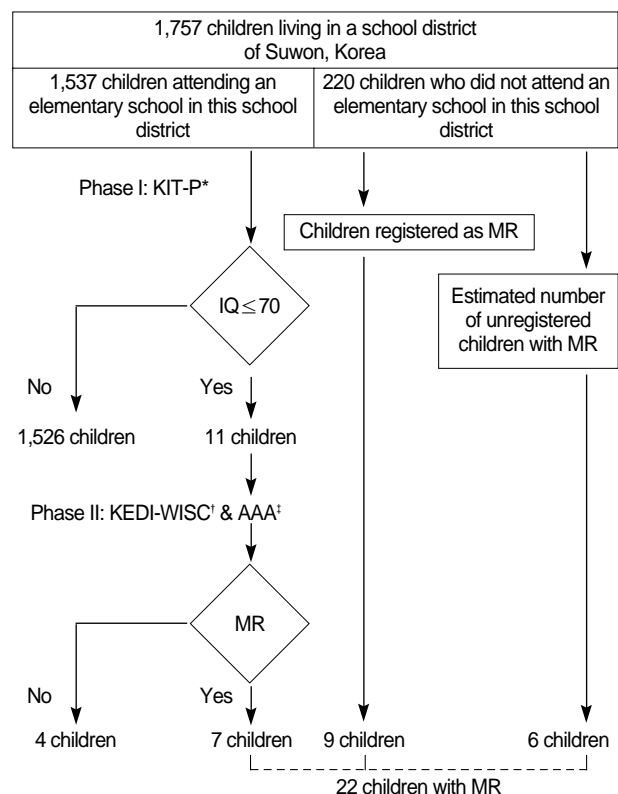

Fig. 1. Flow chart to identify children with mental retardation. *: Korean Intelligence Test-Primary. †: Korean Educational Development Institute-Wechsler Intelligence Scale for Children-Revised. ‡: Assessment of Adaptive Areas.

checks and necessary corrections for the use of OMR cards were made manually before and after the entrance of the data into the database. A child was screened as positive for MR in phase 1 of the study, if the IQ on the KIT-P was 70 or below.

All children who were screened as positive in phase 1 of the study were invited to our hospital in order to be evaluated by a pediatric physiatrist (SYY) and a psychologist (HHY). The individual assessment of IQs was conducted with the Korean Educational Development Institute-Wechsler Intelligence Scale for Children (KEDI-WISC; 14) and the examination of adaptive skills was done with the Assessment of Adaptive Areas (15). Diagnosis of MR was made according to the American Association on Mental Retardation's 1992 definition (4).

For the remaining 220 children who were born between March 1989 and February 1990 and resided in the school district in Keonsun-ku, Suwon but did not attend any of the five elementary schools in the school district, we could not have direct access to them with the above two phase procedures to identify the children with MR. Therefore, in order to identify the children with MR among the 220 children, the whole registration list of the disabled in this school district was reviewed. In South Korea, there is the disability registration program that provides benefits based on disability, where children can be registered with the diagnosis of MR through the disability determination process by the medical doctors in the related fields.

Statistical Analysis

Data are shown as mean±SD. To determine which characteristics correlated with children's IQs, a correlation analysis and multiple regression analysis were performed, using children's IQ as the dependent variable. The independent variables included gestational period, birth weight, number of siblings, age at the beginning of independent walking, household income and maternal and paternal educational levels.

RESULTS

On the IQ test using the KIT-P (phase I), the IQ of 1,537 children was 109.95±16.67 and 11 children (8 boys and 3 girls) obtained an IQ of 70 or less. Of these 11 children, 7 (5 boys and 2 girls) satisfied the American Association on Mental Retardation's 1992 definition on MR (Fig. 1). The mean IQ of these 7 children was 61.00±5.29 (range, 49-70), and the mean number of adaptive skill areas showing significant functional limitations was 4.80±2.59 in the Assessment of Adaptive Areas (15).

Among the 220 children who could not be assessed directly, we found 9 (5 boys and 4 girls) with a diagnosis of MR

Table 2. Multiple regression analysis of clinical characteristics of children and intelligence quotient

Characteristics	Standardized coefficients	Standard error	P-value
Monthly family income	0.007	0.001	0.847
Maternal educational level	0.152	0.367	0.001
Paternal educational level	0.090	0.304	0.036

R^2=0.049.

via inspection of the registration list of the disabled. Thus, a total of 16 children out of 1,757 (7 of 1,537 children and 9 of 220 children) were found to have MR, yielding an overall prevalence of 9.1 per 1,000 (16:1,757=9.1: 1,000). Even though we could not find any official report on the rate of disability registration in Korea, the officers working in that field generally estimated the rate of disability registration at about 60%. Therefore, with this rate of disability registration, we conjectured that there would be at least 6 unregistered children with MR among the 220 children (0.6:9=0.4:6), and estimated that there would be a total of at least 15 children with MR among the 220 children in this group. Therefore, the prevalence of MR could be estimated at 12.5 per 1,000 (7 of 1,537 children and 15 of 220 children, 22: 1,757=12.5:1,000) for the Suwon area.

The sex ratio of the 16 children was 1: 0.6 (10 boys and 6 girls) and showed a male preponderance among children with MR, although this tendency did not reach a statistical significance (p>0.05). There was no significant difference in the mean IQ scores between boys and girls (p>0.05).

Among the seven clinical characteristics (gestational period, birth weight, number of siblings, age at the beginning of independent walking, household income and maternal and paternal educational levels), three showed a significant correlation with children's IQ scores: household income, maternal educational level, and paternal educational level (Table 1). By the regression analysis, we obtained the following equation: IQ=0.152MED+0.090PED+0.007 INCOME, with an adjusted R^2 of 0.049, where MED, PED, and INCOME represented maternal educational level, paternal educational level, and household income, respectively (Table 2).

DISCUSSION

According to our literature review, this study appears to be the first on the prevalence of MR in Korea. According to this study, the prevalence and the estimated prevalence of MR among the third-grade elementary school children of an area in Suwon, Korea, were 9.1 and 12.5 per 1,000, respectively. The population of South Korea was about 46,430,000 at the time of this study (1998 census), and thus our data suggest that between 422,513 (9.1 per 1,000) and 580,375 (12.5 per 1,000) persons in South Korea have MR.

According to the literature we reviewed, the prevalence rate of MR in the United States lies between 41.66/1,000 in South Carolina (16) and 12.0/1,000 among 10-yr-old children in Metropolitan Atlanta (17). The prevalence of MR in Atlanta was barely one quarter of the South Carolina rate. The causes of this discrepancy are not clear, even though the different methodologies employed and the different socioeconomic status of the children in the two studies might have played a role. Recently, Larson et al. reported the combined prevalence of MR and/or developmental disabilities from the 1994/1995 National Health Interview Survey in the United States as 14.9 per 1,000 (18). On the other hand, Fernell reported a prevalence rate of 12.8 per 1,000 in school-aged children from a Swedish suburban municipality (19). According to the reports from developing countries, Durkin et al. estimated the prevalence of MR at 19.0/1,000 for serious retardation and at 65.3/1,000 children for mild retardation in Pakistan (20). In Bangladesh, according to Islam et al. the prevalence of serious MR in 2- to 9-yr-old children was 5.9/1,000, which is slightly higher than the prevalence range observed in developed countries (21).

The MR prevalence obtained in the present study may reflect social and demographic features unique to the Korean society, and therefore should be used with caution in making comparisons with those from populations reported by other investigators. Even with this caution, the prevalence of MR in Korea is very close to the levels reported in the 1994/1995 National Health Interview Survey in the United States, Atlanta, and the Swedish suburban municipality (17-19). Thus, as far as the prevalence of MR is concerned, Korea shows the features of developed countries, not those of developing countries. We think that the relatively high educational level and the continuing economic growth in Korea may partly explain this comparatively low prevalence of MR.

Generally, a striking association was found between mild MR and socioeconomic class (5-9, 20). The mean monthly household income in this study was about US$ 1,888±881 and the mean number of children per household was 2.10. Assuming that both parents were present in each household, we can estimate the average per capita income in this study at $ 5,525 [($ 1,888/month×12 months)÷4.10 persons]. The average per capita income in Korea in 1998 was $ 6,823 and thus the per capita income in this study was lower than the average in Korea. Therefore, the overall prevalence of MR in Korea could be equal to or lower than the prevalence obtained by the present study.

We should mention one of the serious methodological limitations of this study. Among the total 1,757 subjects, we could not directly examine the 220 children who did not attend to any of the five elementary schools in the school district. Again, the possible explanations for the remaining 220 are as follows: 1) attending a private school for further higher quality of education; 2) attending a special school for

their disabilities; 3) staying home due to their severe disabilities or other medical conditions. None of the five schools in this study had special classes for children with MR or other disabilities. Consequently, children with more severe MR (IQ<50) might be concentrated in these 220 children. Among them, we identified 9 children with MR from the register of the disabled. In Korea as in other countries, as a part of the national welfare system, the government has provided several benefits for the registered people with disabilities. Even though we could not find any official report on the rate of disability registration in Korea, the officers working in that field generally estimated the rate of disability registration at about 60%. Thus, we estimated that there would be a total of 15 children with MR among the 220 children. The estimated number of children with MR among these 1,757 children was thus 22, and the estimated prevalence of children with MR was 12.5/1,000.

Another limitation is that we could not provide the information on the etiologies of MR. However, initially we did not plan to analyze the etiology and pathogenesis of MR. Therefore, further studies for the etiologies of MR in Korea are reserved in a near future.

In this study, the sex ratio of the children with MR was 1:0.6, a 40% excess of males. According to the literature, for severe MR, the male-to-female ratio is remarkably constant and indicates a 20% excess of males. Some studies presented comparable male-to-female ratios for mild MR, ranging from a 40% excess of males in the Netherlands to an 80% excess in Sweden (5). Our previous study also reported that MR of unknown etiology in Korea was more common in males and the male-to-female ratio was 3:1 (1:0.3; 22). This might reflect a difference in registration and identification procedures, but could also indicate a greater susceptibility of the male central nervous system.

In this study, the maternal educational level was most strongly associated with the cognitive functioning of the children and, in addition, the household income and paternal educational level were significantly associated with the cognitive functioning. Dunkin et al. also reported that the lack of maternal education was strongly associated with prevalence of both serious and mild MR (20). We thought that, in many cases, the higher maternal educational level might lead to a more enriched environment for the cognitive development of the children as well as reflect a higher socioeconomic status. In fact, the children of mothers with MR are known to have a high risk of either genetically or environmentally caused low cognitive function (23, 24).

In conclusion, we found a total of 16 children with MR among 1,757 children who were born between March 1989 and February 1990 and resided in a single school district in Suwon, Korea. Thus, the prevalence rate for MR was 9.1 per 1,000 children. Considering the approximate 60% rate of disability registration in Korea, the true prevalence of MR was estimated to be 12.5 per 1,000. Cognitive functioning

was strongly associated with maternal educational level, paternal educational level, and household income, in descending order.

We believe that this is the first report on the prevalence of MR in Korea. Despite some limitations, the prevalence and associated factors for MR that are reported here from a designated population in Korea are expected to fill a gap in our information about the epidemiology of MR. Epidemiological studies on a large scale are needed for developing appropriate policies and related programs for the education and rehabilitation of children with MR in Korea in the near future.

ACKNOWLEDGMENTS

REFERENCES

1. Pollak M. *Handicapped children. In: Pollak M. Textbook of developmental paediatrics. Edinburgh, United Kingdom: Churchill Livingstone 1993; 459-504.*

2. Sonnander K, Claesson M. *Classification, prevalence, prevention and rehabilitation of intellectual disability: an overview of research in the people's Republic of China. J Intellect Disabil Res 1997; 41: 180-92.*

3. Swaiman KF. *Mental retardation. In: Swaiman KF, editor. Pediatric Neurology: Principles and Practice. 2nd ed. St. Louis, Missouri: Mosby Yr Book 1994; 133-46.*

4. American Association on Mental Retardation. *Mental retardation: definition, classification and systems of supports-workbook. Washington, DC: American Association on Mental Retardation, 1992.*

5. Hagberg B, Hagberg G, Lewerth A, Linberg U. *Mild mental retardation in Swedish school children. I. Prevalence. Acta Paediatr Scand 1981; 70: 441-4.*

6. Hagberg B, Hagberg G, Lewerth A, Lindberg U. *Mild mental retardation in Swedish school children. II. Etiologic and pathogenetic aspects. Acta Paediatr Scand 1981; 70: 445-52.*

7. Hagberg B, Kyllerman M. *Epidemiology of mental retardation-a Swedish survey. Brain Dev 1983; 5: 441-9.*

8. Roeleveld N, Zielhuis GA, Gabreels F. *The prevalence of mental retardation: a critical review of recent literature. Dev Med Child Neurol 1997; 39: 125-32.*

9. WHO. *Mental retardation: meeting the challenge. Joint commission on international aspects of mental retardation. WHO offset publication no. 86. Geneva: World Health Organization, 1986.*

10. Kyonggi-Do. *Statistical year book of Kyonggi. Suwon: Kyonggi-Do, 1999.*

11. The City of Suwon. *Suwon statistical year book. Suwon: The City of Suwon, 1999.*

12. Kyong Gi Province Office of Education. *Statistical yearbook of Kyong Gi Education. Suwon: Kyong Gi Province Office of Education, 1998.*

13. Korean Institute for Research in the Behavioral Sciences. *Korean Intelligence Test for Primary. Seoul, Korea: Korean Institute for Research in the Behavioral Sciences, 1996.*

14. Korean Educational Development Institute. *Manual for the Korean Educational Development Institute-Wechsler Intelligence Scale for Children (KEDI-WISC). Seoul, Korea: Special Education Publishers, 1991.*

15. Bryant BR, Taylor RL, Rivera DP. *Assessment of adaptive area. Austin, TX: PRO-ED, 1996.*

16. McDermott S. *Explanatory model to describe school district prevalence rates for mental retardation and learning disabilities. Am J Ment Retard 1994; 99: 175-85.*

17. Murphy CC, Yeargin-Allsopp M, Decoufle P, Drews CD. *The administrative prevalence of mental retardation in 10-yr-old children in Metropolitan Atlanta, 1985 through 1987. Am J Public Health 1995; 85: 319-23.*

18. Larson SA, Lakin KC, Anderson L, Kwak N, Lee JH, Anderson D. *Prevalence on mental retardation and developmental disabilities: estimates from the 1994/1995 National Health Survey Disability Supplements. Am J Ment Retard 2001; 106: 231-52.*

19. Fernell E. *Mild mental retardation in schoolchildren in a Swedish suburban municipality: prevalence and diagnostic aspects. Acta Paediatr 1996; 85: 584-8.*

20. Durkin MS, Hasan ZM, Hasan KZ. *Prevalence and correlates of mental retardation among children on Karachi, Pakistan. Am J Epidemiol 1998; 147: 281-8.*

21. Islam S, Durkin MS, Zaman SS. *Socioeconomic status and the prevalence of mental retardation in Bangladesh. Ment Retard 1993; 31: 412-7.*

22. Yim SY, Lee IY. *Clinical characteristics of children with mental retardation of unknown etiology in Korea. J Korean Med Sci 1999; 14: 128-32.*

23. Burack JA, Hodapp RM, Zigler E, editors. *Handbook of mental retardation and development. Cambridge, United Kingdom: Cambridge University Press, 1998.*

24. Feldman MA. *The effectiveness of early intervention for children of patients with mental retardation. In: Guralnick MJ, editor. The effectiveness of early intervention. Baltimore, Maryland: Paul H. Brookes Publishing Co 1997; 171-91.*