Stability and change of cognitive attributes in children with uneven/delayed cognitive development from preschool through childhood

Pinchen Yang [a], For-Wey Lung [b,c,d,e], Yuh-Jyh Jong [f,g], Hsiu-Yi Hsu [f], Cheng-Chung Chen [h,*]

[a] Department of Psychiatry, Kaohsiung Medical University and Kaohsiung Medical University Hospital, Kaohsiung, Taiwan
[b] Department of Psychiatry, Kaohsiung Armed Forces General Hospital, Kaohsiung, Taiwan
[c] Department of Neurology, Kaohsiung Medical University, Kaohsiung, Taiwan
[d] Department of Psychiatry, National Defense Medical Center, Taipei, Taiwan
[e] Calo Psychiatric Center, Pingtung County, Taiwan
[f] Department of Pediatrics and Laboratory Medicine, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan
[g] Graduate Institute of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan
[h] Kaohsiung Kai-Suan Psychiatric Hospital, No. 130, Kai-Suan 2nd RD, Ling-Ya District, Kaohsiung 802, Taiwan

ARTICLE INFO

ABSTRACT

As part of an ongoing clinical service program for children with developmental delay in an Asian developing country, we analyzed the cognitive attributes of 362 Taiwanese children (average age 48.5 ± 12.9 month-old) with uneven/delayed cognitive development as they were assessed repeatedly with average duration of 39.7 ± 22.6 months from preschool through early childhood. The objectives were to determine the stability and related factors in cognitive scores of these 362 children belonging to three diagnostic subgroups: 181 children with non-autistic mental retardation (MR), 95 children with autism spectrum disorder (ASD) and 64 children with mixed type developmental language disorder (DLD); and to contribute to the accumulation of data on cognitive outcome in preschool children with developmental delay. Analysis revealed that mean initial cognitive score (IQ1) was 64.9 ± 16.9 while mean cognitive measure at follow-up (IQ2) was 72.2 ± 19.7. Whole group analysis showed the correlation between IQ1 and IQ2 was moderate ($r = 0.73$, $p < 0.001$). Analysis by a general linear model showed only male gender ($\beta = 4.95$, $p = 0.02$, C.I. = 0.8–9.1) and IQ1 ($\beta = 0.79$, $p < 0.001$, C.I. = 0.68–0.90) to be significant predictors of IQ2. There were differences among three groups in IQ1 ($p < 0.001$), IQ2 ($p < 0.001$) and IQ change ($p < 0.001$). Correlation coefficients of IQ1 and IQ2 were 0.6 for ASD group, 0.7 for MR group and 0.4 for DLD group respectively. The greatest proportion of children remained within the same cognitive range for both assessment points, however, it is noted that a substantial minority of children changed IQ ranges drastically from preschool through early childhood. Our results suggest that measurements of cognitive function at preschool age for children with developmental delay were valid in the context of a developing country, and the observed change in cognitive scores during follow-up emphasized the need to interpret the initial results of cognitive tests with caution.

© 2010 Elsevier Ltd. All rights reserved.

* Corresponding author at: No. 130, Kai-Suan 2nd RD, Kaohsiung, Taiwan, 802. Tel.: +886 9 36360220; fax: +886 7 7512494.
E-mail address: pichya@kmu.edu.tw (C.-C. Chen).

1. Introduction

Children's developmental trajectories are shaped by sources of resilience as well as vulnerabilities (Anderson et al., 2003). It has been emphasized that modern health care for children should focus on screening and intervention for the existing problems, for risk and resilience factors, and for opportunities to optimize each child's developmental potential (Sege & De Vos, 2008). Evaluation of cognitive strengths and weaknesses forms an essential part of clinical examination, because knowledge of a child's cognitive status can facilitate the planning of education and/or interventions and provide information about prognosis when the child has developmental disorders.

Cognitive ability, as measured with standardized intelligence tests, is considered to be stable over time in normal school age children (Honzik, MacFarlane, & Allen, 1948; Moffitt, Caspi, Harkness, & Silva, 1993; Neyens-Lidwien & Aldenkamp, 1997; Schuerger & Witt, 1989; Tuma & Appelbaum, 1980). As for children with clinical conditions, cognitive ability has been reported to be stable in school-age children with hemiplegia (Gonzalez-Monge et al., 2009), with autism, and with mental retardation (Freeman, Ritvo, Needleman, & Yokota, 1985; Lord & Schopler, 1989a) throughout childhood; in teenage subjects with learning disabilities through young adulthood (Ingesson, 2006) and in low-birth weight children from childhood through adulthood (Mortensen, Andresen, Kruuse, Sanders, & Reinisch, 2003). Nevertheless, it is thought that the stability and predictability of cognitive scores, as measured with standardized intelligence tests, increase after children have reached their fifth year of age; hence, such scores are usually treated with caution before 5 years of age. The value of cognitive testing in preschool children with developmental delay is further compromised by at least two factors. First, the abilities tested at very early age are different from those measured at school age or adulthood (Rapin, 2003). Developmental tests for preschoolers tap sensory and motor capacities that cannot easily be compared with those of measures of later intelligence such as conceptual thinking. Second, these tests have usually not been developed for and validated with children with developmental disabilities (Neisworth & Bagnato, 2004). Moreover, it may be difficult to test some preschool children with social–emotional developmental delay because they have limited attention skills and/or communicative and social abilities.

As the current emphasis of clinical care is on early detection and intervention of preschool children with developmental delay, more information is needed on the validity of early assessments and possible outcome. The purpose of the present study was to describe stability and change of cognitive attributes in Taiwanese children of uneven/delayed cognitive development as they were followed from preschool through childhood. As part of an ongoing clinical service program for children with developmental delay in an Asian developing country, we analyzed the cognitive attributes of a group of children with uneven/delayed cognitive development as they were assessed repeatedly in their early development. The objectives were to determine the stability and related factors in change of cognitive scores of children from three diagnostic subgroups: non-autistic mental retardation (MR), autism spectrum disorder (ASD) and mixed type developmental language disorder (DLD) and to contribute to the accumulation of data on cognitive outcome in preschool children with developmental delay.

2. Methods

This retrospective chart review investigation was performed at the developmental clinic of Kaohsiung Medical University Hospital, Taiwan. This developmental clinic is a government-designated regional referral center for preschool children suspected to have developmental delays. This study was approved by the Institute Review Board of the Kaohsiung Medical University Hospital.

2.1. Participants

We retrospectively reviewed the medical records of children visiting the developmental clinic of Kaohsiung Medical University Hospital from the center's inauguration date April 1997–December 2005 for analysis. The range of this cohort was chosen so that children entering elementary school as of September 1, 2009 were selected. The total number of the source population was 4527 children who were seen primarily for a developmental concern and diagnostic assessment (those initially referred for physical complaints were not included but the presence of comorbid disorders was not a reason for exclusion). All the children underwent the following procedures when they were evaluated at the clinic. Their caregivers first had to complete the Screening Scale of Developmental Delay-II (SSDD-II) to clarify whether there was any possible delay in the five major developmental domains (i.e. gross motor, fine motor, communication/language, cognition and social/emotional domain). SSDD-II is a convenient Chinese screening scale with established validity and was applied extensively in the clinical practice in Taiwan (Huang, Shieh, Chen-Yu, & Jong, 2002). Among the 4527 preschool children, 656 were suspected to have developmental delay in cognitive domain by parent-reported SSDD-II. These 656 children were accordingly examined by pediatricians for ascertainment of developmental status. If the child was suspected to be cognitively delayed by the clinician's assessment, standardized cognitive tests would be administered by child psychologists. The caregivers were interviewed in detail with a focus on early symptoms, associated handicaps and diseases, developmental milestones, family history, siblings and general social situations. Children who were suspected to have autistic traits and/or language delay were further arranged to be evaluated by a child psychiatrist and a pediatric neurologist. Among the 656 children seen by pediatricians, 636 were reported to have uneven/delayed cognitive profile by standardized tests. Of these 636 preschoolers, 403 of them came back to the developmental clinic for follow-up evaluation