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Functional classifications for cerebral palsy: Correlations between the gross motor function classification system (GMFCS), the manual ability classification system (MACS) and the communication function classification system (CFCS)

Eliana Compagnone [a], Jlenia Maniglio [a], Serena Camposeo [b], Teresa Vespino [a], Luciana Losito [a], Marta De Rinaldis [a], Leonarda Gennaro [a], Antonio Trabacca [a,*]

[a] Scientific Institute I.R.C.C.S. "Eugenio Medea", "La Nostra Famiglia", Neurorehabilitation Unit 1 (Developmental Neurology and Functional Rehabilitation), Brindisi Research Centre, Brindisi, Italy
[b] Scientific Institute I.R.C.C.S. "Eugenio Medea", "La Nostra Famiglia", Neurorehabilitation Unit 2 (Developmental Psychopathology), Brindisi Research Centre, Brindisi, Italy

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ABSTRACT

This study aimed to investigate a possible correlation between the gross motor function classification system-expanded and revised (GMFCS-E&R), the manual abilities classification system (MACS) and the communication function classification system (CFCS) functional levels in children with cerebral palsy (CP) by CP subtype. It was also geared to verify whether there is a correlation between these classification systems and intellectual functioning (IF) and parental socio-economic status (SES). A total of 87 children (47 males and 40 females, age range 4–18 years, mean age 8.9 ± 4.2) were included in the study. A strong correlation was found between the three classifications: Level V of the GMFCS-E&R corresponds to Level V of the MACS ($r_s = 0.67$, $p = 0.001$); the same relationship was found for the CFCS and the MACS ($r_s = 0.73$, $p < 0.001$) and for the GMFCS-E&R and the CFCS ($r_s = 0.61$, $p = 0.001$). The correlations between the IQ and the global functional disability profile were strong or moderate (GMFCS and IQ: $r_s = 0.66$, $p = 0.001$; MACS and IQ: $r_s = 0.58$, $p = 0.001$; CFCS and MACS: $r_s = 0.65$, $p = 0.001$). The Kruskal–Wallis test was used to determine if there were differences between the GMFCS-E&R, the CFCS and the MACS by CP type. CP types showed different scores for the IQ level (Chi-square = 8.59, df = 2, $p = 0.014$), the GMFCS-E&R (Chi-square = 36.46, df = 2, $p < 0.001$), the CFCS (Chi-square = 12.87, df = 2, $p = 0.002$), and the MACS Level (Chi-square = 13.96, df = 2, $p < 0.001$) but no significant differences emerged for the SES (Chi-square = 1.19, df = 2, $p = 0.554$). This study shows how the three functional classifications (GMFCS-E&R, CFCS and MACS) complement each other to provide a better description of the functional profile of CP. The systematic evaluation of the IQ can provide useful information about a possible future outcome for every functional level. The SES does not appear to affect functional profiles.

* Corresponding author at: Developmental Neurology and Functional Rehabilitation. Scientific Institute I.R.C.C.S. "E. Medea", "La Nostra Famiglia", Brindisi Research Centre, Ex Complesso Ospedaliero "A. Di Summa", Piazza "A. Di Summa", 72100 Brindisi, Italy. Tel.: +39 0831349611/0831349643; fax: +39 0831349612.
E-mail addresses: ANTONIO.TRABACCA@OS.LNF.IT, ATRABACCA@TIN.IT (A. Trabacca).

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1. Introduction

Cerebral palsy (CP) is the commonest cause of neurological disability in childhood, with a stable incidence in developed countries of 2–2.5 per 1000 live births. In 2005, the following new definition and classification of CP was introduced: "a group of disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception and/or behavior, and/or by seizure" (Bax et al., 2005; Rosenbaum et al., 2007). As stated, these children often present with associated comorbidities such as symptomatic epilepsy, cognitive impairment and communication disabilities, which deeply limit their degree of participation in daily life and thereby affect their quality of life (QoL). QoL is also influenced by the functional profile that is typical of children with a high interindividual variability (Chen et al., 2013; Maher, Olds, Williams, & Lane, 2008, Pirpiris et al., 2006, Vargus-Adams, 2005, Varni et al., 2005; Chen, Tseng, Shieh, Lu, & Huang 2014). There are several classifications of CP based on factors such as type of tonus, distribution of impairments and level of independence (Balf & Ingram, 1955; Bax, 1964; Gorter et al., 2004; Hagberg, Hagberg, & Olow, 1975). Today the prevailing trend in clinical practice is to classify CP by functional independence in terms of gross motor function and fine motor function. Two classifications reflect this trend. The gross motor function classification system-expanded and revised (GMFCS-E&R) (Palisano et al., 1997; Palisano, Rosenbaum, Bartlett, & Livingston, 2008) and the manual abilities classification system (MACS) (Eliasson et al., 2006) were developed to characterize mobility and manual function in CP, respectively, based on the severity of motor functioning/performance impairments. A more recent classification system, the communication function classification system (CFCS) (Hidecker et al., 2011), characterizes the daily communication abilities of children with CP. The GMFCS-E&R, MACS and CFCS were designed to better delineate the functional profile of children with CP by focusing on activity and participation levels as described in the World Health Organization's (WHO) international classification of functioning, disability, and health. Children & youth version (ICF) (World Health Organization, 2001; World Health Organization, 2007). The GMFCS-E&R focuses on gross motor function, specifically self-initiated movements and, in particular, sitting and walking, according to five levels of function, from Level 1 = independent movement to Level 5 = complete assistance. Each level of the GMFCS-E&R provides functional descriptions for five age groups: 1–2, 2–4, 4–6, 6–12 and 12–18 years. The MACS evaluates how children with CP can use their hands when handling objects in daily activities by pointing out the child's typical manual performance – not the child's maximal capacity – and use of both hands together. Like the GMFCS-E&R, the MACS consists of five levels which are intended to be clinically meaningful. The CFCS classification was designed to assess the ability of people with CP to communicate with both unfamiliar and familiar communication partners in different environments in order to establish shared understandings. This classification, too, has a five-level distribution (Table 1).

Our study investigated a possible correlation between the GMFCS-E&R, MACS and CFCS functional levels in children with CP by CP subtype as well as a possible correlation of the three CP classification systems with intellectual functioning (IF) (as measured by Wechsler scales or estimated from clinical observation) and parental socio-economic status (SES).

2. Materials and methods

The study, which was approved by the hospital's Research Ethics Committee, was conducted at the Neurorehabilitation I (Developmental Neurology and Functional Rehabilitation) Unit of I.R.C.C.S. "E. Medea" – Brindisi Research Center.

A total of 87 children (47 males and 40 females, age range 4–18 years, mean age 8.9 ± 4.2) were included in the study. They had been admitted to our Pediatric Neurorehabilitation Unit for assessment and for a comprehensive neurorehabilitation program.

Table 1
Functional levels of GMFCS, MACS and CFCS.

	Level I	Level II	Level III	Level IV	Level V
GMFCS	Can walk without limitations.	Walk with limitations	Walk with assistive mobility device	Walking ability severely limited even with assistive devices. Use of power wheelchair	Transported by manual wheelchair
MACS	Handles objects easily and successfully	Handles most objects but with somewhat reduced quality and/or speed of achievement	Handles objects with difficulty; needs help to prepare and/or modify activities	Handles a limited selection of easily managed objects in adapted situations	Does not handle objects and has severely limited ability to perform even simple actions
CFCS	Effective sender and receiver with unfamiliar and familiar partners	Effective but slower paced sender and/or receiver with unfamiliar and familiar partners	Effective sender and receiver with familiar partners	Sometimes effective sender and receiver with familiar partners	Seldom effective sender and receiver even with familiar partners.