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FUNKCIONALNI PROFIL I PRIDRUŽENI POREMEĆAJI KOD DECE SA CEREBRALNOM PARALIZOM U SRBIJI

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SAŽETAK

Uvod/Cilj: Cerebralna paraliza je trajno i heterogeno stanje koje zahteva kontinuiranu i sveobuhvatnu podršku više različitih službi, uključujući zdravstvene radnike. Informacije o funkcionalnim karakteristikama osoba sa cerebralnom paralizom su neophodne kako bi se efikasno planirale usluge i savetovanje porodica u kliničkim uslovima. Ipak, u Srbiji ne postoji nacionalna baza podataka ili registar. Ova deskriptivna i eksplorativna studija imala je za cilj da ispita funkcionalne karakteristike i učestalost pridruženih smetnji kod uzorka dece školskog uzrasta sa cerebralnom paralizom u Srbiji.
Metode: Analiziran je prigodan uzorak od 117 dece i adolescenata sa cerebralnom paralizom (56,4% dečaka), uzrasta od 7 do 18 godina (M = 13,23; SD = 3,36). Podaci o tipu cerebralne paralize, funkcionalnosti grube motorike, finih i bimanualnih sposobnosti, intelektualnom funkcionisanju, senzornim oštećenjima (vida, sluha), epilepsiji i opštem zdravstvenom stanju prikupljeni su iz dostupne medicinske, obrazovne i psihološke dokumentacije i analizirani deskriptivnom statistikom.
Rezultati: Najčešći tip cerebralne paralize bio je spastični (65,8%), često praćen intelektualnim teškoćama (67,5%), oštećenjem vida (33,3%) i epilepsijom (24,7%). Gotovo dve trećine učesnika (64,1%) imalo je dve ili više pridruženih smetnji. Većina je imala ograničenja u kretanju, manuelnom funkcionisanju i finim motoričkim veštinama.
Zaključak: Osnovne funkcionalne karakteristike i učestalost pridruženih poremećaja bile su uglavnom u skladu sa nacionalnim i međunarodnim izveštajima, uz određene razlike u obrascima javljanja komorbiditeta. Visoka zastupljenost zdravstvenih i razvojnih teškoća potvrđuje da je uspostavljanje nacionalnog registra za cerebralnu paralizu u Srbiji urgentna potreba.

Ključne reči: spastična cerebralna paraliza, dečja cerebralna paraliza, komorbiditet, funkcionalni profil, Srbija

Uvod

Cerebralna paraliza (CP) je najčešći uzrok celoživotnog fizičkog i motoričkog invaliditeta koji počinje u detinjstvu širom sveta (1,2). CP se obično definiše kao grupa trajnih poremećaja razvoja posture i pokreta, koji uzrokuju ograničenje aktivnosti i koji se mogu pripisati neprogresivnim poremećajima koji su nastali u razvoju mozga u fetalnom ili dojenačkom uzrastu. U ovoj široko prihvaćenoj konceptualizaciji koju pružaju Bax i saradnici (3) i Rosenbaum i saradnici (4) u njihovim uticajnim definicijama, takođe je potvrđeno da cerebralnu paralizu često prate senzorne smetnje, smetnje kognicije, percepcije, komunikacije, bihejvioralne smetnje, kao i epilepsija i mišićno-skeletne komplikacije.

Iako se ove definicije i dalje široko koriste, dve decenije novih istraživanja značajno su poboljšale naše znanje o cerebralnoj paralizi. Nova istraživanja su istakla važnu ulogu genetike, upale i funkcije mozga tokom njegovog razvoja (5,6) i u njima je primećeno da usluge za odrasle sa cerebralnom paralizom treba razvijati, uz sve veću svest o složenom, jedinstvenom životnom iskustvu svake osobe (7). Prepoznavanje različitih kliničkih karakteristika cerebralne paralize na globalnom nivou sada uključuje podatke zasnovane na populacijama iz ze-

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FUNCTIONAL PROFILE AND ASSOCIATED IMPAIRMENTS IN SCHOOL-AGED CHILDREN WITH CEREBRAL PALSY IN SERBIA

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ABSTRACT

Introduction/Aim: Cerebral palsy is a permanent and heterogeneous condition that requires continuous, comprehensive support from multiple service providers, including healthcare professionals. Information on functional characteristics of individuals with cerebral palsy is necessary for effective service planning and counselling families in a clinical context. However, no national database or register is available in Serbia. This descriptive and exploratory study aimed to examine functional characteristics and frequency of associated impairments in a sample of school-aged children with cerebral palsy in Serbia.
Methods: A convenience sample of 117 children and adolescents with cerebral palsy (56.4% male), aged 7–18 years (M = 13.23, SD = 3.36), was analysed. Data on cerebral palsy type, gross motor function, fine manual and bimanual abilities, intellectual functioning, sensory impairments (visual, hearing), epilepsy, and general health problems were extracted from available medical, educational, and psychological records. Descriptive statistics were used for analysis.
Results: Spastic cerebral palsy was the most common type (65.8%), frequently accompanied by intellectual disability (67.5%), visual impairment (33.3%), and epilepsy (24.7%). Nearly two-thirds (64.1%) of participants had two or more associated impairments. The majority exhibited limitations in ambulation, manual performance, and fine motor skills.
Conclusion: The basic functional characteristics and frequency of associated impairments were generally in line with national and international reports, with some differences observed in comorbidity patterns. The high prevalence of multiple health and developmental challenges underscores the urgent need for a national cerebral palsy registry in Serbia.

Keywords: spastic cerebral palsy, infantile cerebral palsy, comorbidity, functional profile, Serbia

Introduction

Cerebral palsy (CP) is the most common cause of childhood-onset, lifelong physical and motor disability worldwide (1,2). Commonly, CP has been defined as a group of permanent disorders of movement and posture development, leading to activity limitations and attributed to non-progressive disturbances in the developing fetal or infant brain. This widely accepted conceptualisation, articulated in influential definitions by Bax et al. (3) and Rosenbaum et al. (4), also acknowledges the frequent co-occurrence of sensory, perceptual, cognitive, communicative, and behavioural difficulties, as well as epilepsy and musculoskeletal complications.

While these definitions are still widely used, two decades of new research have significantly improved our knowledge of CP. New research has highlighted the important roles of genetics, inflammation, and brain function in its development (5,6), and noted that services for adults with CP need to be better developed, with a growing awareness of the complex, unique, and lived experience of each individual (7). Global recognition of CP's diverse clinical features now

malja sa niskim i srednjim prihodima (8). Štaviše, perspektiva se promenila tako da sada uključuje društvene percepcije sa pristupom istaživanju i praksi koji je sve više inkluzivan, kolaborativan, dinamičan i individualno usmeren (9). Kao što je navedeno u predloženom ažuriranom opisu, cerebralna paraliza se može definisati kao „doživotno neurorazvojno stanje koje rano počinje, a karakterišu ga ograničenja aktivnosti zbog poremećaja razvoja pokreta i posture, i manifetsuje se kao spasticitet, distonija, horeoatetoza i/ili ataksija. Uzrokovana je poremećajem razvoja koji se pripisuje displaziji ili povredi mozga fetusa ili odojčeta koja nije degenerativna.“ Međutim, kliničke manifestacije se mogu menjati sa godinama (9). Autori dalje navode da je „fenotip cerebralne paralize složen i heterogen, pri čemu svaka osoba ima jedinstvenu kliničku manifestaciju“. Takođe napominju da se pored „motoričke disfunkcije, ljudi sa cerebralnom paralizom često susreću sa primarnim i sekundarnim smetnjama u različitim oblastima razvoja i funkcionisanja“ i da sve to može „značajno uticati na njihovo učešće u svakodnevnom životu“ (9).

Jedna novija studija koja je analizirala podatke od 1995. godine na globalnom nivou otkrila je značajne razlike u prevalenci cerebralne paralize na rođenju između zemalja sa niskim i srednjim prihodima (8). Kao što je prikazano, zemlje sa visokim prihodima, posebno u Evropi i Australiji, zabeležile su značajan pad prenatalne/perinatalne cerebralne paralize, dostižući oko 1,5 na 1.000 živorođenih (1,6 na 1.000 kada se uključi postneonatalna CP). Nasuprot tome, zemlje sa niskim i srednjim prihodima konstantno beleže mnogo veću prenatalnu/perinatalnu prevalencu cerebralne paralize, do 3,4 na 1.000 živorođenih (8). Na primer, ukupna stopa za period od 1981. do 1993. godine u Severnoj Irskoj bila je 2,24 na 1.000 živorođene dece (10). U Norveškoj, prevalenca diskinetičke cerebralne paralize na rođenju značajno se smanjila između 1996. i 2015. godine, verovatno zbog poboljšanja u prenatalnoj i perinatalnoj nezi (11). Međutim, nakon pada tokom 1990-ih, prevalenca cerebralne paralize kod prevremeno rođene dece u Danskoj počela je da se povećava na godišnjem nivou od 2001. godine pa nadalje, paralelno sa povećanjem preživljavanja (12).

Do danas, cerebralna paraliza se klasifikuje uz pomoć različitih sistema koji su usmereni na motorička oštećenja i funkcionalne sposobnosti. Tradicionalna klasifikacija cerebralne paralize zasniva se na topografskom obrascu zahvaćenih udova (hemiplegija, diplegija, kvadriplegija), zajedno sa kliničkim simptomima i znacima, kao što su spasticitet, diskinezija (uključujući distoniju i/ili horeoatetozu) i ataksija. S obzirom na složenost sindroma, klasifikacija često uključuje mišićni tonus (izotonični, hipotonični, hipertonični), vreme pretpostavljenog poremećaja (koji se javlja prenatalno, tokom porođaja i postneonatalno) i lokalizaciju moždane lezije (moždana kora, piramidalni trakt, ekstrapiramidalni sistem, mali mozak). Međutim, Nadzor cerebralne paralize u Evropi predlaže jednostavnu klasifikaciju koja se sada koristi širom sveta: spastična cerebralna paraliza (unilateralna, bilateralna), diskinetička i ataksična (1).

Topografska klasifikacija se često koristi pored funkcionalnih klasifikacija kako bi se osigurala tačna procena. Najpriznatiji, široko korišćeni i međunarodno validirani sistemi funkcionalne klasifikacije uključuju Sistem klasifikacije grubih motoričkih funkcija (GMFCS-E&R) (13), Sistem klasifikacije manuelnih sposobnosti (MACS) (14) i Bimanuelnu finu motoričku funkciju (BFMF) (15), između ostalih. GMFCS kategoriše pojedince na osnovu grubih motoričkih veština, od samostalnog hodanja do potrebe za pomoći. U isto vreme, MACS i BFMF se fokusiraju na funkciju šake, određujući manuelnu spretnost i stvarnu upotrebu ruku. Ovi sistemi klasifikacije pružaju uvid u individualne sposobnosti, omogućavajući zdravstvenim radnicima da osmisle personalizovane programe rehabilitacije i procene efikasnost lečenja tokom vremena, čime se podržava bolja komunikacija, istraživanje i individualizovana nega među osobama sa cerebralnom paralizom, njihovim porodicama i stručnjacima (16,17).

Povreda centralnog nervnog sistema u razvoju kod cerebralne paralize proteže se izvan motoričkog trakta, što dovodi do komorbiditeta kao što su intelektualne ili senzorne smetnje. Ovi komorbiditeti i pridružena stanja, uključujući senzorne smetnje, smetnje percepcije, kognicije, komunikacije i bihejvioralne smetnje, kao i epilepsiju i sekundarne mišićno-skeletne probleme često su jednako značajni kao i sam motorički poremećaj, sa dalekosežnim posledicama po planiranje i pružanje usluga (18). Istraživanja takođe pokazuju da osobe sa cerebralnom paralizom često doživljavaju ograničenja koja se tiču funkcionalne nezavisnosti, pri čemu mnogi prijavljuju visok kvalitet života (19–21). Međutim, smetnje percepcije se prenose na svakodnevno

includes population-based data from low- and middle-income countries (8). Furthermore, the perspective has shifted to include societal perceptions, with a more inclusive, collaborative, dynamic, and person-centred approach to research and practice (9). As outlined in the proposed updated description, CP could be defined as "an early-onset lifelong neurodevelopmental condition characterised by limitations in activity due to impaired development of movement and posture, manifesting as spasticity, dystonia, choreoathetosis, and/or ataxia. It results from maldevelopment attributed to dysplasia of or injury to the fetal or infant brain that is not degenerative. However, the manifestations may change with age" (9). The authors continue by stating that the "phenotype of CP is complex and heterogeneous, with each person experiencing a unique presentation". They also note that "in addition to motor dysfunction, people with CP frequently encounter primary and secondary impairments across various areas of development and functioning" and acknowledge that all of these mentioned can "significantly impact their participation in daily life" (9).

A recent study analysing global data since 1995 has revealed significant disparities in the birth prevalence of CP between high-income countries and low- and middle-income countries (8). As presented, high-income countries, particularly in Europe and Australia, have seen a notable decrease in pre-/perinatal CP, reaching about 1.5 per 1,000 live births (1.6 per 1,000 when including postneonatal CP). In contrast, low- and middle-income countries consistently show a much higher pre-/perinatal CP prevalence, up to 3.4 per 1,000 live births (8). For example, the overall rate for the period 1981–93 in Northern Ireland was 2.24 per 1,000 live births (10). In Norway, the birth prevalence of dyskinetic CP decreased significantly between 1996 and 2015, likely due to improvements in antenatal and perinatal care (11). However, following a decline in the 1990s, CP prevalence in preterm-born children in Denmark began to increase annually from 2001 onward, in parallel with an increase in survival (12).

To date, CP is classified using various systems that focus on motor impairments and functional abilities. The traditional classification of CP is based on the topographical pattern of affected limbs (hemiplegia, diplegia, quadriplegia), alongside clinical symptoms and signs, such as spasticity, dyskinesia (including dystonic and/or choreoathetotic forms), and ataxia. Given the complexity of the syndrome, classification often includes muscle tone (isotonic, hypotonic, hypertonic), timing of presumed insult (prepartum, intrapartum, postneonatal), and localisation of the brain lesion (cerebral cortex, pyramidal tract, extrapyramidal system, cerebellum). However, the Surveillance of Cerebral Palsy in Europe proposed a simple classification, now used worldwide: spastic CP (unilateral, bilateral), dyskinetic, and ataxic (1).

Topographical classification is often used in addition to functional classifications to ensure an accurate assessment. The most recognised, widely used, and internationally validated functional classification systems include the Gross Motor Function Classification System (GMFCS–E&R) (13), Manual Ability Classification System (MACS)(14), and Bimanual Fine Motor Function (BFMF)(15), among others. GMFCS categorises individuals based on gross motor skills, ranging from independent walking to requiring assistance. At the same time, MACS and BFMF focus on hand function, determining manual dexterity and the actual use of the hands. These classification systems provide insight into individual capabilities, allowing healthcare providers to design personalised rehabilitation programs and evaluate treatment effectiveness over time, thereby supporting better communication, research, and individualised care among individuals with CP, their families, and professionals (16,17).

An injury to the developing central nervous system in CP extends beyond the motor tracts, resulting in comorbidities such as intellectual or sensory impairments. These comorbidities and associated conditions, including disturbances of sensation, perception, cognition, communication, and behaviour, as well as epilepsy and secondary musculoskeletal problems, are frequently as significant as motor disorder itself, with far-reaching implications for service planning and delivery (18). Research also indicates that individuals with CP often experience limitations in functional independence, with many reporting high quality of life in general (19–21). However, perceptual deficits translate into everyday functioning and emotional behaviour (22), and individuals with severe CP and their families often need continuous support from rehabilitation

funkcionisanje i emocionalno ponašanje (22), a pojedincima sa teškim oblicima cerebralne paralize i njihovim porodicama često je potrebna kontinuirana podrška od strane službi zaduženih za rehabilitaciju, pored adekvatnog prilagođavanja na fizičko i socijalno okruženje (23). Longitudinalne studije pokazuju da odrasli sa cerebralnom paralizom mogu postići stabilne nivoe zadovoljstva kvalitetom života i postignućima u svakodnevnim aktivnostima tokom vremena, ukazujući na to da rehabilitacija koja je usmerena na mobilnost može poboljšati njihovu nezavisnost (24).

Da bi se obezbedile informacije za efikasnije i delotvornije planiranje usluga, preporučeno je osnivanje centralizovane baze podataka (25). Nacionalni registar za cerebralnu paralizu zasnovan na populaciji može da bude koristan na nekoliko načina: opisivanje kliničkog i demografskog profila cerebralne paralize u određenim geografskim regionima, pružanje potrebnih informacija za poboljšanje kvaliteta života i participacije, i vođenje savetovanja u kliničkim uslovima (8,26). Konačno, takav registar bi takođe mogao da posluži ka osnova za buduća istraživanja i kao infrastruktura za razvoj i pružanje usluga (27). Identifikacija funkcionalnih karakteristika osoba sa cerebralnom paralizom, zajedno sa njihovim potrebama i potrebama njihovih porodica, kao i relevantnim sredinskim faktorima, prvi je korak u doprinosu svakodnevnom životu i budućnosti osoba iz ove populacije. Koliko nam je poznato, u Srbiji trenutno ne postoji takva nacionalna baza podataka, dok su istraživanja koja su posebno usmerena na decu školskog uzrasta (7-18 godina) sa cerebralnom paralizom i njihove funkcionalne profile i dalje ograničena.

Cilj ove studije bio je da opiše funkcionalne karakteristike i učestalost pridruženih smetnji kod dece školskog uzrasta sa cerebralnom paralizom u Srbiji. Uključene su sledeće glavne karakteristike: vrsta cerebralne paralize, profil motoričkog funkcionisanja, nivo intelektualnog funkcionisanja, i prisustvo komorbiditeta i drugih pridruženih stanja.

Metod

U ovoj deskriptivnoj i eksplorativnoj studiji korišćen je metod prigodnog uzorkovanja. Kriterijumi za uključivanje bili su: CP dijagnostikovana prema 10. reviziji Međunarodne statističke klasifikacije bolesti i srodnih zdravstvenih problema (MKB -10) (28), oba pola, starosti 7 do 18 godina, sa prebivalištem na teritoriji Republike Srbije. Podaci su prikupljeni iz dostupne medicinske, obrazovne i psihološke dokumentacije 35 različitih zdravstvenih, obrazovnih i ustanova socijalne zaštite, kao i nacionalnih i lokalnih organizacija za osobe sa invaliditetom i udruženja osoba sa cerebralnom paralizom iz 48 opština u Srbiji od juna 2014. godine do aprila 2015. godine. Studija je odobrena od stručnih odbora Univerziteta u Beogradu (No. 61206-2385/2-14) i sprovedena je u skladu sa principima Helsinške deklaracije. Pismena saglasnost je dobijena od svih roditelja/staratelja.

Profil motoričkih sposobnosti obuhvatio je nivo grube motoričke funkcionalnosti koji je procenjen uz pomoć GMFCS-E&R, kao i fine manuelne funkcije (MACS) i bimanuelne sposobnosti (BFMF). Ova tri sistema klasifikuju funkcionalne sposobnosti dece sa cerebralnom paralizom na petostepenoj ordinalnoj skali, gde viši nivo ukazuje na veća funkcionalna ograničenja (17). GMFCS se koristi za kategorizaciju trenutnih sposobnosti deteta i ograničenja grube motoričke funkcije. Nasuprot tome, MACS opisuje tipične manuelne sposobnosti deteta, bez obzira na razlike u funkciji između dve ruke, dok BFMF klasifikuje finu motoričku funkciju kroz sposobnost deteta da hvata, drži i koristi predmete u svakoj ruci posebno, uključujući bilo kakvu asimetriju. Pored toga, prikupljeni su podaci o upotrebi pomagala koja se koriste za kretanje , kao što su ručna pomagala (hodalice, guralice, štake, štapovi), ručna ili električna pomagala sa točkovima, kao i podaci o potrebi za držanjem ili fizičkom pomoći i supervizijom.

Nivo intelektualne ometenosti pribavljen je iz dostupne lične medicinske, obrazovne i psihološke dokumentacije i kategorisan je kao normalna, kao granična, blaga, umerena i teška inetelektualna ometenost prema Međunarodnoj klasifikaciji bolesti (MKB-10). Među drugim komorbiditetima i pridruženim stanjima bili su senzorna oštećenja (vida, sluha ili kombinovana), epilepsija i opšti zdravstveni problemi. Prisustvo višestruke ometenosti definiše se kao dva ili više teških pridruženih poremećaja.

Podaci su analizirani uz pomoć deskriptivnih statističkih metoda i predstavljeni su kao frekvencije i relativni brojevi. Sve analize su sprovedene u SPSS, verzija 23 (IBM, SAD).

services, in addition to adequate adaptations to their physical and social environments (23). Longitudinal studies show that adults with CP can achieve stable levels of satisfaction with their quality of life and accomplishment in daily activities over time, suggesting that rehabilitation focusing on mobility can improve their independence (24).

To provide information for more effective and efficient service planning, it has been widely recommended to establish a centralised database (25). Having a national, population-based CP register could be beneficial in several ways: describing a clinical and demographic profile of CP across specific geographical regions, providing needed information for improving quality of life and participation, and guiding counselling in clinical settings (8,26). Finally, such a register could also serve as a foundation for future research and as an infrastructure for service development and delivery (27). Identifying the functional characteristics of individuals with CP, along with their needs and the needs of their families, as well as relevant environmental factors, is the first step in contributing to the daily living and future of individuals from this population. To the best of our knowledge, no such national database currently exists in Serbia, and research specifically focused on school-aged children (7–18 years) with CP and their functional profiles remains limited.

This study aimed to describe functional characteristics and the frequency of associated impairments among school-aged children with CP in Serbia. The following main characteristics were included: type of CP, profile of motor functioning, level of intellectual functioning, and the presence of comorbidities and other associated conditions.

Methods

The convenience sampling method was used in this descriptive and exploratory study The inclusion criteria were as follows: CP diagnosed according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) (28), both genders, aged 7–18 years, residing on the territory of the Republic of Serbia. The data were collected from the available medical, educational, or psychological records of 35 different health, educational, and social welfare institutions, as well as national and local disability organisations and associations of persons with CP from 48 municipalities in Serbia, during the period from June 2014 to April 2015. The study was approved by the Professional Boards of Belgrade University (No. 61206-2385/2-14) and conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all parents/caregivers.

The motor abilities profile included the gross motor level assessed by the GMFCS–E&R, as well as fine manual function (MACS) and bimanual abilities (BFMF). These three systems classify functional abilities in children with CP on a five-level ordinal scale, where a higher level indicates greater functional limitations (17). The GMFCS is used to categorise a child's present abilities and limitations in gross motor function. In contrast, the MACS describes a child's typical manual performance, irrespective of differences in function between the two hands, while the BFMF classifies fine motor function through the child's ability to grasp, hold and manipulate objects in each hand separately, including any asymmetry. Additionally, data on the use of mobility devices, such as handheld mobility devices (walkers, rollators, crutches, canes, etc.), manual or power-driven wheeled mobility devices, as well as on the need for holding or physical assistance and supervision, were collected.

The level of intellectual disability was collected from the available personal medical, educational or psychological records and categorised as normal, borderline, mild, moderate and severe intellectual disability, according to the ICD-10. Among other comorbidities and associated conditions were sensory impairments (visual, hearing or combined), data on epilepsy and general health problems. The presence of multiple disabilities was defined as two or more severe associated impairments.

The data were analysed by descriptive statistical methods and presented as frequencies and relative numbers. All analyses were performed in SPSS, version 23 (IBM, USA).

Results

The sample included 117 participants with CP, with a male-to-female ratio of 1.3:1 (66 males, 51 females; Table 1). The average age was 13 years and 3 months (SD = 3 years and 4 months). The most prevalent clinical form was spastic CP, diagnosed in nearly two-thirds of participants (65.8%). Among

Rezultati

Uzorak je obuhvatio 117 ispitanika sa cerebralnom paralizom, sa odnosom prema polu 1,3:1 (66 ispitanika muškog pola i 51 ženskog pola; Slika 1). Prosečna starost bila je 13 godina i 3 meseca (SD = 3 godine i 4 meseca). Najzastupljeniji klinički oblik bila je spastična cerebralna paraliza, koja je dijagnostikovana kod skoro dve trećine ispitanika (65,8%). Među njima, spastična kvadriplegija bila je najčešći podtip sa 32,5%. Ostali oblici bili su atetoidni (10,3%), ataksični (6,8%) i mešoviti (17,1%) (Tabela 1).

Kada je u pitanju gruba motorička funkcija, 13% ispitanika je klasifikovano uz pomoć GMFCS da pripadaju prvom nivou, što ukazuje na samostalno hodanje. Zatim je 45% ispitanika klasifikovano da pripadaju GMFCS nivoima II–III, gde je kretanje ograničeno i zahteva ručno pomagalo ili pomoć. Preostalih 42% ispitanika pripadalo je GMFCS nivoima IV–V, što ukazuje na ograničeno samostalno kretanje i zavisnost od invalidskih kolica (Slika 1).

Distribucija GMFCS nivoa blisko je odgovarala upotrebi pomagala za kretanje koja su ispitanici prijavili. Većina ispitanika je koristila invalidska kolica (50%) ili se kretala samosatlno (35%). Ostali spitanici su koristili ručna pomagala za kretanje ili ortoze (9%) ili im je bila potrebna fizička pomoć druge osobe (7%) (Slika 2).

Kada su u pitanju manuelne sposobnosti, skoro polovina ispitanika bila je relativno samostalna u svakodnevnim aktivnostima, sa 10% ispitanika na I MACS nivou i 33% ispitanika na II nivou. Nasuprot tome, 15% nije bilo sposobno da rukuje predmetima, što ukazuje na najteža ograničenja manuelnih funkcija (MACS nivo V). Preostalih 43% ispitanika bilo je na nivoima III–IV, što ukazuje na potrebu za modifikacijama zadataka ili koninuiranom podrškom (Slika 1).

Kada je u pitanju fina motorika, najveći deo ispitanika (42%) bio je na II BFMF nivou. Ono što je tipično za ovu grupu je da su učesnici imali ograničenja u naprednim veštinama fine motorike u obe ruke ili su koristili jednu ruku bez ograničenja, dok su drugom samo mogli da hvataju ili drže predmete. Nešto više od 30% ispitanika imalo je ozbiljna ograničenja fine motorike (BFMF nivoi IV–V), samo sa mogućnošću držanja ili hvatanja predmeta (Slika 1).

Kada je u pitanju intelektualno funkcionisanje, 23% ispitanika je imalo koeficijent inteligencije u normalnom rasponu (>90), dok je 9% bilo u graničnom rasponu (IQ 70-90). Intelektualna ometenost (IQ < 70) primećena je kod 68% ispitanika, pri čemu su blagi (27%) i srednji (29%) nivoi bili najčešći (Slika 3). Senzorne smetnje različitih vrsta i intenziteta bile su prisutne kod 46% ispitanika (Slika 4). Oštećenja vida bila su najčešća s obzirom da su bila prisutna kod 33% ispitanika, a zatim oštećenja sluha kod 4,3% ispitanika. Epilepsija je prijavljena kod 25% ispitanika (Slika 5). Kombinovana oštećenja vida i sluha potvrđena su kod 9% ispitanika, a skoro dve trećine (približno 65%) imalo je dva ili više pridruženih oštećenja (Slika 6).

Tabela 1. Demografske karakteristike ispitanika (n = 117)

Karakteristika	n	%
Pol deteta		
Muški	66	56,4
Ženski	51	43,6
Odnos muški/ženski pol	1,3:1	
Uzrast deteta (godine)		
7–12	48	41,0
13–18	69	59,0
Klinički oblik cerebralne paralize		
Spastična kvadriplegija	38	32,5
Spastična diplegija	24	20,5
Spastična hemiplegija	15	12,8
Diskinetička (atetoidna)	12	10,3
Ataksična	8	6,8
Mešovita	20	17,1

Diskusija

Cilj ove studije bio je da ukaže na nedostatak nacionalne baze podataka o cerebralnoj paralizi (CP) u Srbiji opisivanjem funkcionalnih karakteristika i pridruženih smetnji kod dece školskog uzrasta sa cerebralnom paralizom. Veća incidenca cerebralne paralize kod dečaka u poređenju sa devojčicama, koja je primećena u ovoj studiji sa odnosom muškog prema ženskom polu 1,3:1, u skladu je sa prethodnim nalazima studija zasnovanih na populaciji gde je taj odnos bio u rasponu od 1,1:1 do 1,5:1 (19,21,29–35).

Dominantnost spastičnog oblika cerebralne paralize u našem uzorku je u skladu sa nalazima nacionalnih i međunarodnih studija (10,21,26,29,31–34,36–39). U Sjedinjenim Američkim Državama, spastična cerebralna paraliza činila je 85% do 89%

these, spastic quadriplegia was the most common subtype at 32.5%. Other forms included athetoid (10.3%), ataxic (6.8%), and mixed (17.1%) (Table 1).

In terms of gross motor function, 13% of participants were classified as GMFCS level I, indicating independent walking. A further 45% were classified as GMFCS levels II–III, reflecting restricted ambulation requiring a handheld device or assistance. The remaining 42% of participants were GMFCS levels IV–V, indicating limited self-mobility and dependence on wheelchairs (Figure 1).

The distribution of GMFCS levels corresponded closely with the reported use of mobility aids. Most participants either used wheelchairs (50%) or moved independently (35%). Other participants used handheld mobility devices or orthoses (9%) or required physical assistance from another person (7%) (Figure 2).

Regarding manual abilities, nearly half of the participants showed relatively preserved independence in daily activities, with 10% of participants at MACS level I and 33% at level II. In contrast, 15% were unable to handle objects, indicating the most severe limitations in manual function (MACS level V). The remaining 43% of participants were at MACS levels III–IV, indicating a need for task modifications or continuous support (Figure 1).

Fine motor functioning showed that the largest proportion of participants (42%) were at BFMF level II. This group typically had limitations in advanced fine motor skills in both hands or used one hand without restrictions, while the other could only grasp or hold objects. Slightly more than 30% of participants had more severe fine motor limitations (BFMF levels IV–V), with the ability only to hold or grasp objects (Figure 1).

In terms of intellectual functioning, 23% of participants had an IQ in the normal range (>90), while 9% were in the borderline range (IQ 70–90). Intellectual disability (IQ < 70) was observed in 68% of participants, with mild (27%) and moderate (29%) levels being the most common (Figure 3). Sensory impairments of various types and intensities were present in 46% of participants (Figure 4). Visual impairments were the most frequent, affecting 33% of participants, followed by hearing impairments in 4.3%. Epilepsy was reported in 25% of participants (Figure 5). Combined visual and hearing impairments were confirmed in 9% of participants, and nearly two-thirds (approximately 65%) had two or more associated impairments (Figure 6).

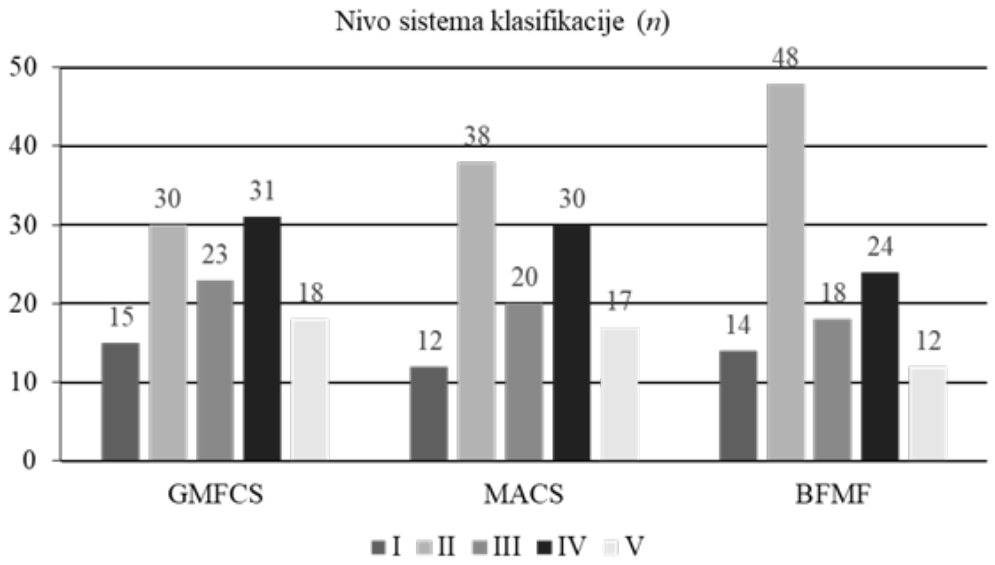
Table 1. Demographic characteristics of participants (n = 117)

Characteristic	n	%
Child gender		
Male	66	56.4
Female	51	43.6
Male/female ratio	1.3:1	
Child age (years)		
7–12	48	41.0
13–18	69	59.0
Type of cerebral palsy		
Spastic quadriplegia	38	32.5
Spastic diplegia	24	20.5
Spastic hemiplegia	15	12.8
Dyskinetic (athetoid)	12	10.3
Ataxic	8	6.8
Mixed	20	17.1

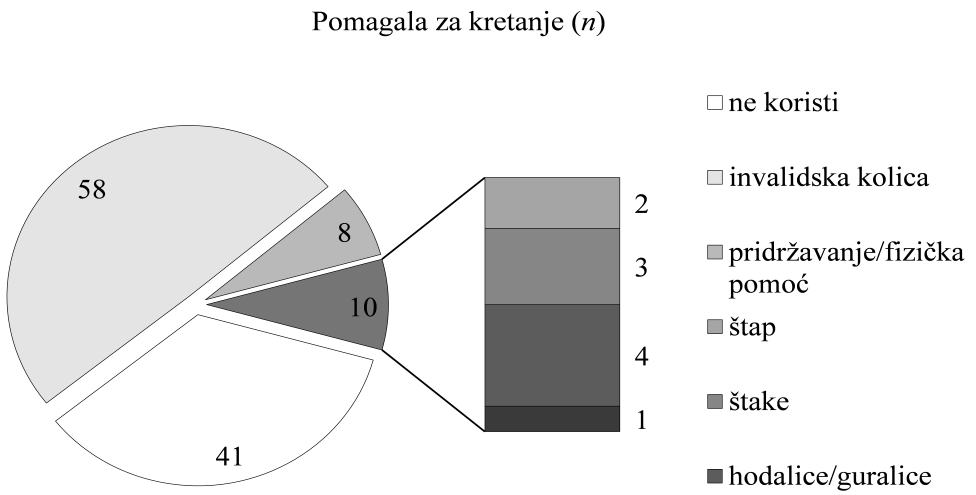
Discussion

This study aimed to address the lack of a national CP database in Serbia by describing the functional characteristics and associated impairments of school-aged children with CP. The higher incidence of CP in boys compared to girls, observed in this study with a male-to-female ratio of 1.3:1, is consistent with previous population-based findings ranging from 1.1:1 to 1.5:1 (19,21,29–35).

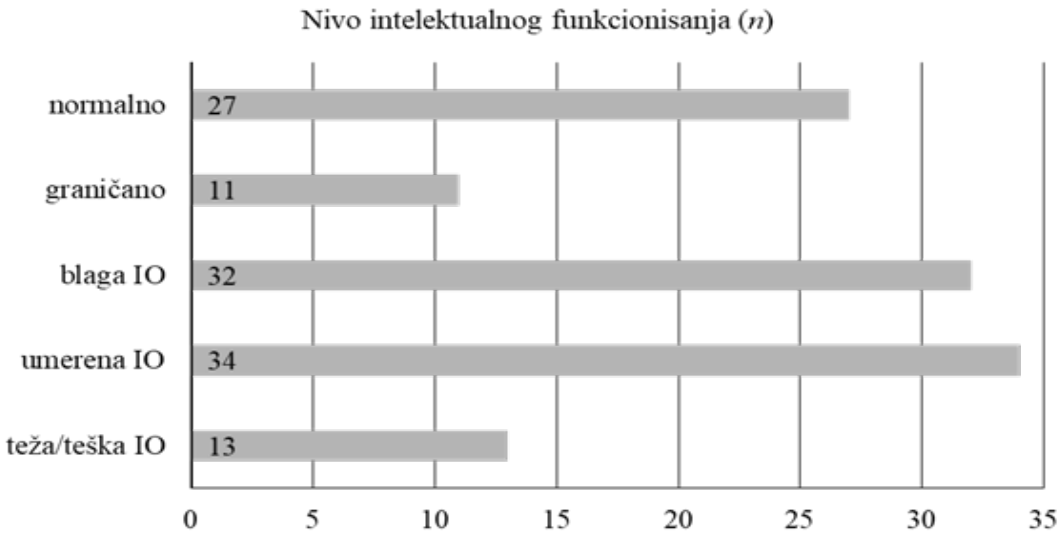
The predominance of the spastic form of CP in our sample aligns with both national and international findings (10,21,26,29,31–34,36–39). In the United States, spastic CP accounted for 85% to 89% of cases, with two-thirds classified as bilateral (36). Similarly, 88% of children in an Australian cohort (1999–2004) were diagnosed with spastic CP, with quadriplegia present in 32% (33). In Northern Ireland, bilateral spastic CP represented 55% of cases, and spastic hemiplegia 39% (10). The UK data showed spastic bilateral and unilateral forms in 54–56% and 33–35% of cases, respectively (40). In Saudi Arabia, 61.4% of children had spastic CP (29). In Europe, among children born between 1976 and 1990, 85.7% were diagnosed with spastic CP, most commonly the



Slika 1. Profil motoričkih sposobnosti: distribucija grubih motoričkih, finih manuelnih i bimanuelnih sposobnosti



Slika 2. Distribucija upotrebe pomagala za kretanje



Slika 3. Distribucija nivoa intelektualnog funkcionisanja (IO – intelektualna ometenost)

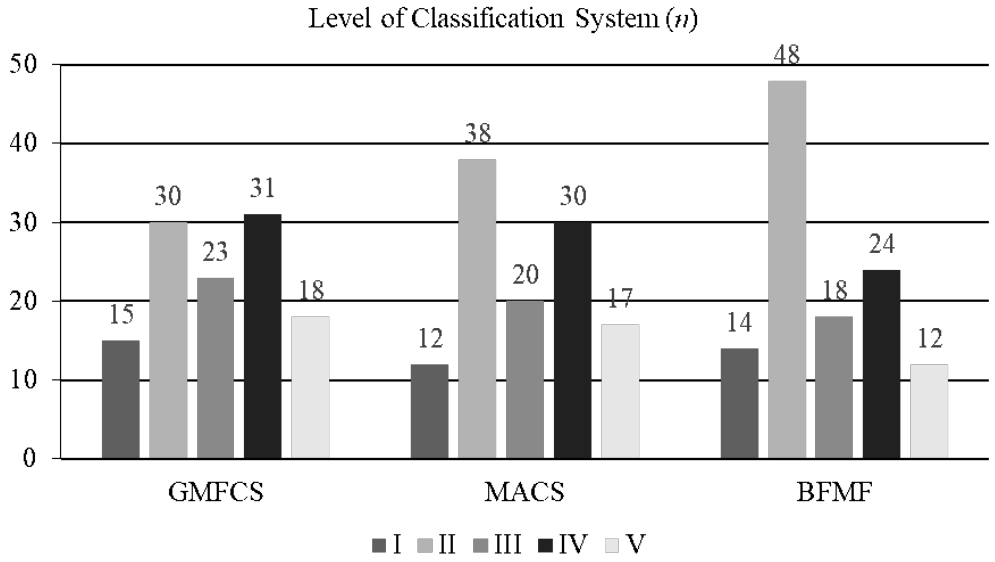


Figure 1. Motor abilities' profile: distribution of gross motor, fine manual and bimanual abilities

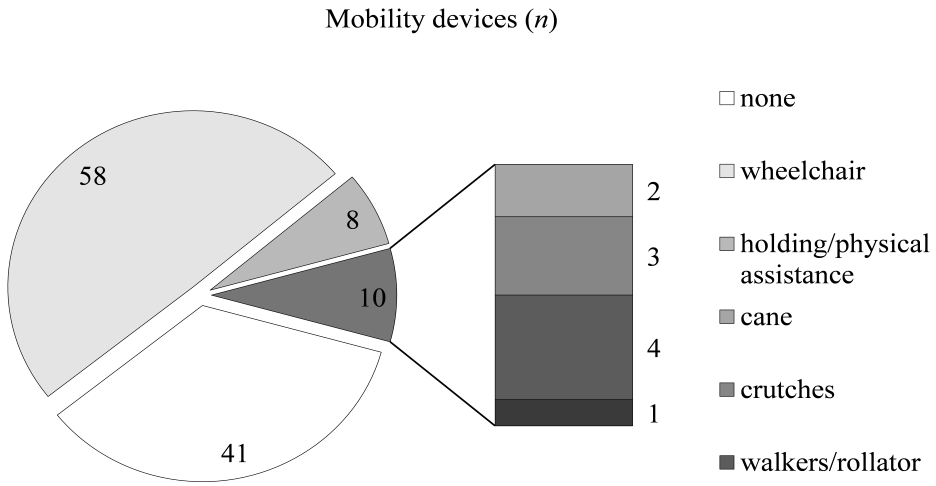


Figure 2. Distribution of the use of mobility devices

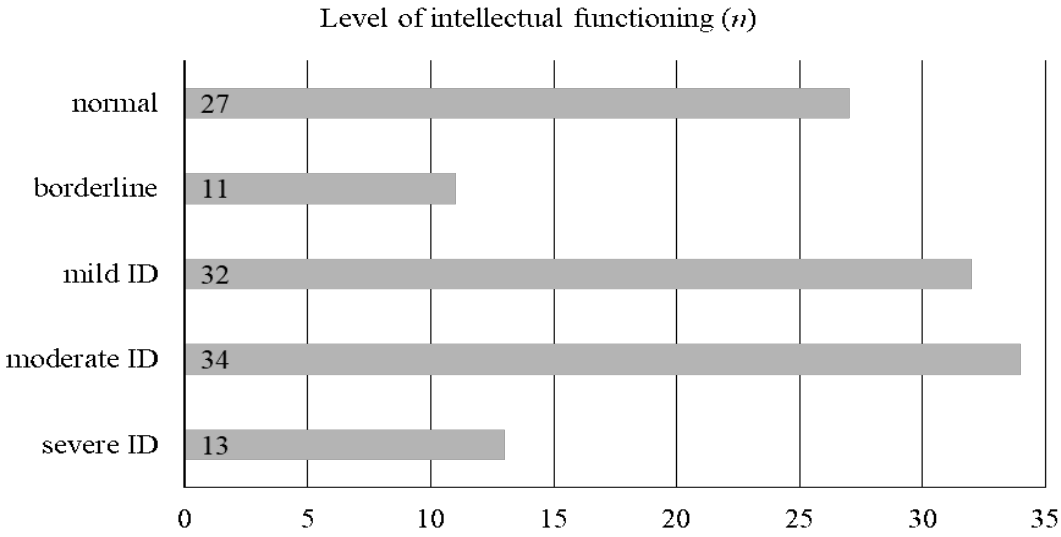
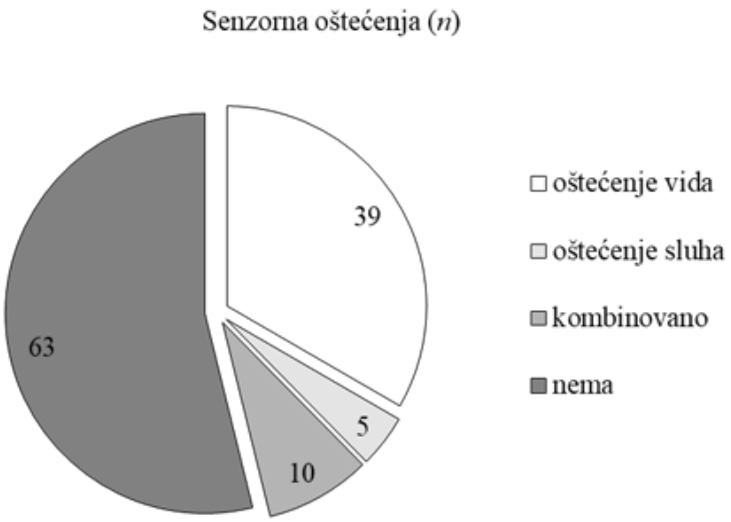
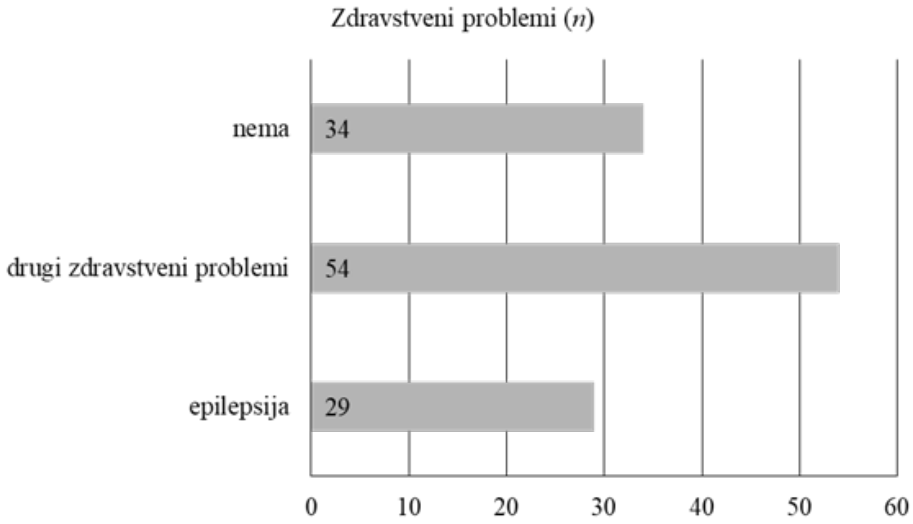


Figure 3. Distribution of the intellectual functioning level (ID - Intellectual disability)



Slika 4. Učestalost senzornih oštećenja



Slika 5. Učestalost epilepsije i zdravstvenih problema

Slika 6. Prisustvo višestruke ometenosti

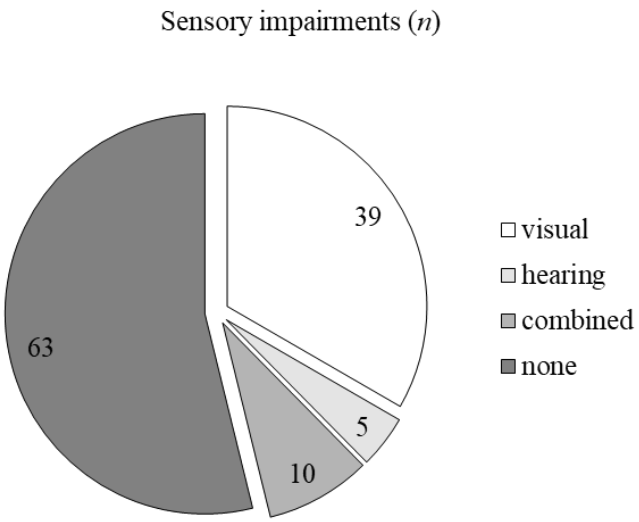


Figure 4. Frequencies of sensory impairments

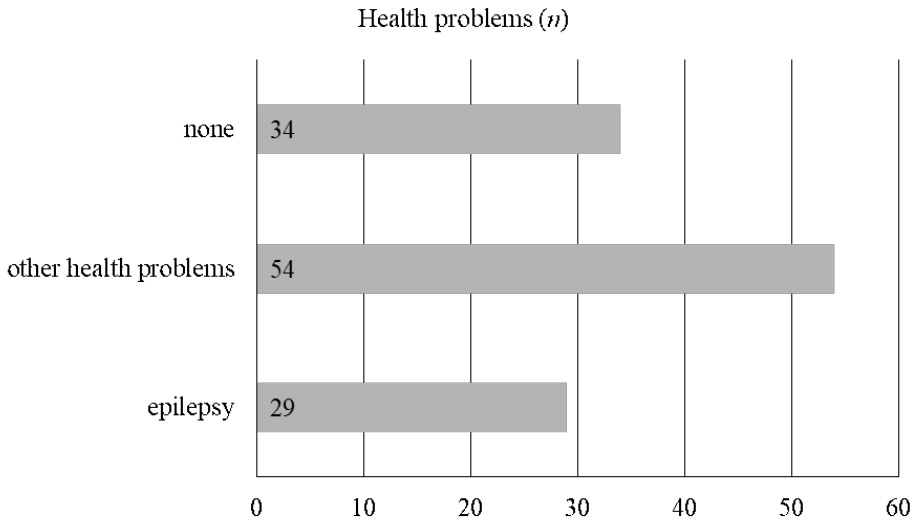


Figure 5. Frequencies of epilepsy and health problems

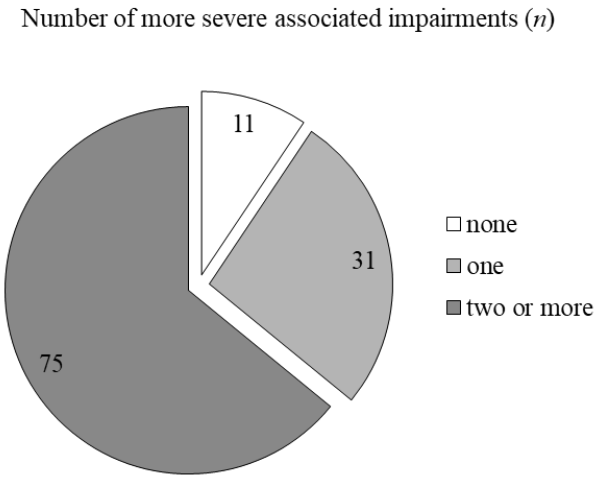


Figure 6. The presence of multiple disabilities

slučajeva, pri čemu su dve trećine slučajeva klasifikovane kao bilateralna cerebralna paraliza (36). Slično tome, kod 88% dece u jednoj australijskoj kohorti (1999–2004) dijagnostikovana je spastična cerebralna paraliza, dok je kvadriplegija bila prisutna kod 32% slučajeva (33). U Severnoj Irskoj, bilateralna spastična cerebralna paraliza bila je prisutna u 55% slučajeva, a spastična hemiplegija u 39% slučajeva (10). Podaci iz Velike Britanije ukazali su na spastične bilateralne i unilateralne oblike u 54-56%, odnosno 33–35% slučajeva (40). U Saudijskoj Arabiji, 61,4% dece je imalo spastičnu cerebralnu paralizu (29). U Evropi, među decom rođenom između 1976. i 1990. godine, kod 85,7% dece je dijagnostikovana spastična cerebralna paraliza, najčešće bilateralnog podtipa (54,9%), a zatim diskinetičke (6,5%) i ataksične (4,3%) forme (31). Nespastični tipovi cerebralne paralize, kao što su diskinetičke, ataksične, hipotonične, spastično-diskinetičke i neklasifikovane forme zajedno su činile 13,2% slučajeva u Sjedinjenim Državama (36). Diskinetičke i ataksične forme su posebno prijavljene kod 10,6% i 5,4% dece u Norveškoj i Švedskoj (38), i kod 11% i 4% u jednoj evropskoj studiji zdravstvenog stanja (30). Velika nacionalna studija zasnovana na registru u Norveškoj pokazala je da je diskinetička cerebralna paraliza relativno redak podtip (6,8%), sa opadajućom prevalencom u poređenju sa spastičnim podtipovima cerebralne paralize (11). U jednoj nacionalnoj studiji, diskinetička cerebralna paraliza je utvrđena kod 9% slučajeva, a ataksična u 5% slučajeva (41).

Međutim, nalazi naše studije o grubim motoričkim sposobnostima razlikovali su se od onih koji su prijavljeni u nekoliko prethodnih studija. Nasuprot našoj studiji, gde je samo 38% ispitanika moglo da hoda bez pomagala i pri tome su klasifikovani kao nivo I–II uz pomoć GMFCS sistema klasifikacije, u studijama zasnovanim na populaciji iz Švedske (32,39) i Australije (26,33,34) pokazano je da je veći procenat ispitanika, od 48% do 62% dece sa cerebralnom paralizom mogao da hoda bez pomagala za kretanje, i smatrano je da su njihova fizička oštećenja bila blaga. Sličan procenat ispitanika u našoj studiji mogao je da hoda u zatvorenom prostoru sa nekim ograničenjima (GMFCS nivo II), što je u skladu sa prethodnim nalazima (39,41). Takođe, procenat ispitanika u našem uzorku koji su klasifikovani kao GMFCS nivo III (mogli da hodaju uz pomoć pomagala) mogao se porediti sa prethodnim izveštajima (19,21,26).

Nasuprot tome, u našoj studiji je prijavljen veći procenat dece sa ozbiljnim motoričkim oštećenjem. Specifično, 42% ispitanika klasifikovano je da pripadaju GMFCS nivoima IV-V, što ukazuje na potrebu za invalidskim kolicima, u poređenju sa 27-36% ispitanika koji su prijavljeni u drugim studijama (10,26,32,34,41). Surman i saradnici (40) su slično primetili da je 29–31% dece imalo ozbiljno oštećenje funkcije donjih ekstremiteta. Podaci o drugim populacijama ukazuju na slične brojeve za GMFCS klasifikaciju nivoa IV–V, uključujući 40% (19) i 48% (21) među decom uzrasta od 8 do 18 godina.

U poređenju sa 55% dece sa cerebralnom paralizom koja su se kretala uz pomoć pomagala u studiji Vlesa i saradnika (21), skoro polovina (49,6%) naših ispitanika je prevožena u ručnim invalidskim kolicima ili su koristili pomagala za kretanje sa točkovima u većini situacija (Slika 2). Važno je napomenuti da su deca koja su klasifikovana kao V GMFCS nivo koristila značajno više pomagala za kretanje od onih u nivoima I–III, i da potrebe za pomoćnim sredstvima rastu sa uzrastom, posebno kod dece sa težim oblikom cerebralne paralize (npr. GMFCS nivoi IV i V) (42). Prema navodima starateljima dece sa cerebralnom paralizom, električna pomagala imaju pozitivan psihosocijalni uticaj, posebno kod dece sa ozbiljnim motoričkim ograničenjima zato što korišćenje ovih uređaja povećava autonomiju, inkluziju i osećaj pripadnosti deteta (43).

U našem uzorku, distribucija MACS i BFMF nivoa je u velikoj meri odražavala distribuciju GMFCS nivoa. Generalno govoreći, više od polovine ispitanika je bilo u stanju da rukuje predmetima sa obe ruke bez ograničenja ili sa ograničenjima u naprednijim finim motoričkim veštinama ili su mogli da drže predmete samo sa jednom rukom, što je u skladu sa ranijim nalazima (39). U poređenju sa podacima zasnovanim na populaciji iz Norveške i zapadne Švedske (38), manje naših ispitanika je klasifikovano kao I nivo uz pomoć GMFCS, MACS i BFMF sistema klasifikacije, dok je IV nivo bio češći. Kao i u ovim studijama, III nivo je bio najmanje učestao u svim sistemima klasifikacije.

Bilo je 22% dece kod koje je korišćenje ruke i/ili šake bilo nefunkcionalno (10), što je u skladu sa nalazima od 21–23%, a što ukazuje na ozbiljno oštećenje funkcije gornjih ekstremiteta (40), 25–30% dece koja su mogla samo da hvataju i drže predmete (39,41), i 23% kojima je bila potrebna

bilateral subtype (54.9%), followed by dyskinetic (6.5%) and ataxic (4.3%) types (31). Non-spastic CP types, such as dyskinetic, ataxic, hypotonic, spastic-dyskinetic, and unclassified forms, collectively accounted for 13.2% of cases in the United States (36). Dyskinetic and ataxic forms specifically were reported in 10.6% and 5.4% of children in Norway and Sweden (38), and in 11% and 4% in a European health status study (30). A large national registry-based study in Norway found that dyskinetic CP is a relatively rare subtype (6.8%), with declining prevalence compared to spastic CP subtypes (11). In one national study, dyskinetic CP was found in 9%, and ataxic in 5% of cases (41).

However, our findings on gross motor abilities differed from those reported in several previous studies. In contrast to our study, where only 38% of participants were able to walk without a mobility device and classified as GMFCS levels I–II, population-based studies from Sweden (32,39) and Australia (26,33,34) found that a larger proportion, ranging from 48% to 62% of children with CP were able to walk without a mobility device, and their physical impairments were considered mild. A similar proportion of participants in our study were able to walk indoors with some limitations (GMFCS level II), in line with previous findings (39,41). Furthermore, the proportion of participants in our sample classified at GMFCS level III (able to walk with assistive devices) was comparable to earlier reports (19,21,26).

In contrast, our study recorded a higher proportion of children with severe motor impairment. Specifically, 42% of participants were classified as GMFCS levels IV–V, indicating the need for wheeled mobility, compared to 27–36% reported in other studies (10,26,32,34,41). Surman et al. (40) similarly noted that 29–31% of children had severely impaired lower limb function. Other population data reports comparable figures for GMFCS IV–V classification, including 40% (19) and 48% (21) among children aged 8–18 years.

Compared to 55% of children with CP who moved using mobility equipment in the study by Vles et al. (21), nearly half (49.6%) of our participants were transported in a manual wheelchair or used wheeled mobility in most settings (Figure 2). It is important to note that children classified in GMFCS level V used significantly more mobility devices than those in levels I–III, and that assistive device needs tend to increase with age, particularly in children with more severe CP (e.g., GMFCS levels IV and V) (42). According to caregivers of children with CP, powered mobility has a positive psychosocial impact, especially on those with profound motor limitations because the use of these devices increases a child's autonomy, inclusion, and sense of belonging (43).

In our sample, the distribution of MACS and BFMF levels largely mirrored that of GMFCS. Overall, more than half of the participants were able to manipulate objects with both hands without restrictions or with limitations in more advanced fine motor skills or had the ability to grasp or hold objects with one hand only, consistent with earlier findings (39). Compared to population-based data from Norway and western Sweden (38), fewer of our participants were classified at GMFCS, MACS, and BFMF levels I, while levels IV were more frequent. As in these studies, level III was the least frequent across all classification systems.

Twenty-two per cent of the children had non-functional arm and/or hand use (10), which aligns with findings of 21–23% showing severely impaired upper limb function (40), 25–30% with only the ability to grasp, hold, or worse (39,41), and 23% who required assistance in all daily activities (21). Comparable data from Norway, Sweden, and France indicated that 24–35% of children had more severe impairment of bimanual fine motor function (BFMF levels IV/V) (1), which is consistent with our findings (Figure 1). On the other hand, the proportion of children with mild bimanual fine motor impairments (BFMF I/II) in our study (54%) closely resembles that reported in the European study on health in CP (59%)(30).

In our sample, normal and borderline intellectual capacity were each reported in 32.5% of children. However, other studies report varying distributions. For instance, among children aged 6.0–9.7 years, 32.9% had normal and 13.8% had borderline intellectual functioning (32). Reid et al. (33) found no intellectual impairment in 51% of children aged 5.1–11 years, while Badia et al. (19) reported this figure to be 16.1% among children aged 8–18 years.

Nearly half of the children with CP in Australia (26) and Northern Ireland (10) had some level of intellectual disability (48% and 45% of cases, respectively). In Saudi Arabia, 30.1% had mild intellectual disability (29), a finding similar to the

pomoć u svim svakodnevnim aktivnostima (21). Uporedni podaci iz Norveške, Švedske i Francuske ukazali su na to da je 24–35% dece imalo teže oštećenje bimanuelne fine motoričke funkcije (BFMF nivoi IV/V) (1), što je u skladu sa nalazima naše studije (Slika 1). Sa druge strane, procenat dece sa blagim bimanuelnim oštećenjima fine motorike (BFMF I/II) u našoj studiji (54%) veoma je sličan onom prijavljenom u evropskoj studiji o zdravlju kod dece sa cerebralnom paralizom (59%) (30).

U našem uzorku, normalan i granični intelektualni kapacitet prijavljen je kod 32,5% dece. Međutim, u drugim studijama je prijavljena različita distribucija. Na primer, kod dece uzrasta 6,0–9,7 godina, kod 32,9% je bilo normalno, a kod 13,8% granično intelektualno funkcionisanje (32). Reid i saradnici (33) nisu pronašli intelektualne smetnje kod 51% dece starosti od 5,1–11 godina, dok su Badia i saradnici (19) izvestili da je ovaj procenat bio 16,1% među decom uzrasta od 8 do 18 godina.

Skoro polovina dece sa cerebralnom paralizom u Australiji (26) i Severnoj Irskoj (10) imala je neki nivo intelektualne ometenosti (48% i 45% slučajeva). U Saudijskoj Arabiji, 30,1% ispitanika je imalo blagu intelektualnu ometenost (29), što je nalaz sličan onome od 28% prijavljenih u južnoj Holandiji (21) i 27% u našoj studiji (Slika 3). Procenat dece sa teškom intelektualnom ometenošću (IQ < 50) u evropskim kohortama bio je obično oko 30% (21,30,31). U Australiji je umerena do teške ometenosti utvrđena kod 22,7% dece, ili 37% kada se uračunaju i ona sa verovatnim, ali neodređenim stepenom oštećenja (26). U zapadnoj Švedskoj je prijavljeno 40% dece sa poteškoćama u učenju (39). Primetno je da se poteškoće u učenju i razumevanju povećavaju sa težinom motoričkog invaliditeta (32,35,38).

Oštećenja vida su takođe često prijavljena kod dece sa cerebralnom paralizom, sa stopama prevalence koje se kreću od 11% do 48% u različitim studijama (21,26,29,33,39,40). Među decom sa težim motoričkim oštećenjima (GMFCS nivoi IV/V), prevalenca problema sa vidom raste na 60% (35). U našoj studiji je kod jedne trećine ispitanika identifikovano oštećenje vida. Trenutni dokazi ukazuju na to da deca sa unilateralnom cerebralnom paralizom imaju značajne vizuelno-perceptivne smetnje, što je izraženije kod dece sa većim nivoima motoričkog oštećenja (22).

Procenat dece sa oštećenjima sluha u našoj studiji bio je 4% (Slika 4), što je u skladu sa prethodno prijavljenim rasponom od 2 do 13% (21,26,30,33,35,39,40). Na primer, u drugim studijama je utvrđeno da je 2 do 12% dece imalo teško oštećenje sluha do gubitka sluha (10,33).

Epilepsija je još jedan čest komorbiditet kod dece sa cerebralnom paralizom, sa procenama prevalence u rasponu od 18% do 46% (21,30,35,39,40). Prema podacima iz Evrope između 1980. i 1990. godine, 20,7% dece sa cerebralnom paralizom imalo je epilepsiju (31). U našem uzorku, 25% dece imalo je epilepsiju (Slika 5), što je u skladu sa ovim procentom. Slične stope su prijavljene u Australiji (27,8% u periodu 1996-2005 i 28% u periodu 1999–2004) (26), Severnoj Irskoj (22% od 1981–1999) (33), Saudijskoj Arabiji (25%) (29), i širom Evrope (21–22%) (21,30). Primetno je da su više stope prevalence prijavljene u zapadnoj Švedskoj (33%) (39).

Prema podacima iz naše studije, 75 dece (64%) moglo bi se klasifikovati kao deca sa višestrukim invaliditetom. Ovaj trend je sličan nalazima iz Saudijske Arabije, ali je viši od onih prijavljenih u Severnoj Irskoj, gde je polovina slučajeva imala najmanje jedan pridružen poremećaj (10), i Švedskoj, gde je 31% ispitanika imalo dva ili više pridruženih poremećaja (39). Među najčešćim pridruženim poremećajima u kliničkom profilu cerebralne paralize su različiti oblici i stepeni oštećenja vida i epilepsije, zajedno sa intelektualnim oštećenjem (32). Deca sa diskinetičkom cerebralnom paralizom imaju teža motorička oštećenja i pridružene poremećaje u poređenju sa decom koja imaju spastičnu bilateralnu ili unilateralnu cerebralnu paralizu, ali manje teška od onih sa spastičnom kvadriplegijom (11). Nedavni podaci pokazuju da više od polovine dece sa cerebralnom paralizom imaju višestruke motoričke poremećaje, koji obično uključuju spasticitet i distoniju i koja dovode do težih funkcionalnih oštećenja i većih stopa komorbiditeta (44). Stoga, ne iznenađuje da je skoro dve trećine naših ispitanika imalo dva ili više teških pridruženih poremećaja (Slika 6).

Prilikom tumačenja rezultata naše studije treba uzeti u obzir nekoliko ograničenja. Uočene razlike u distribuciji pridruženih oštećenja između našeg uzorka i onih iz prethodnih studija mogu se pripisati varijacijama u težini cerebralne paralize, s obzirom da niži nivoi intelektualnog funkcionisanja, epilepsija i senzorna oštećenja često prate teška oštećenja grube motorike. Štaviše, neophodno je uzeti u obzir specifične metodološke i strukt-

28% reported in the southern Netherlands (21) and the 27% found in our study (Figure 3). The proportion of children with severe intellectual disability (IQ < 50) in European cohorts was consistently around 30% (21,30,31). In Australia, moderate to severe impairments were found in 22.7% of children, or 37% when including those with probable but unspecified severity (26). In western Sweden, 40% of children were reported to have learning disabilities (39). Notably, learning and comprehension difficulties tend to increase with the severity of motor disability (32,35,38).

Visual impairments are also frequently reported in children with CP, with prevalence rates ranging from 11% to 48% across studies (21,26,29,33,39,40). Among children with more severe motor impairments (GMFCS levels IV/V), the prevalence of visual problems rises to 60% (35). In our study, one-third of participants were identified with visual impairments. Current evidence suggests that children with unilateral CP have significant visual–perceptual difficulties, which are more pronounced among children with higher levels of motor impairment (22).

The proportion of children with hearing impairment in our study was 4% (Figure 4), aligning with the previously reported range of 2–13% (21,26,30,33,35,39,40). For instance, other studies have found that 2–12% of children had severe to profound hearing loss (10,33).

Epilepsy is another common comorbidity in children with CP, with prevalence estimates ranging from 18% to 46% (21,30,35,39,40). According to data from Europe between 1980 and 1990, 20.7% of children with CP had epilepsy (31). In our sample, 25% of children were affected (Figure 5), which is consistent with this range. Similar rates have been reported in Australia (27.8% from 1996–2005 and 28% from 1999–2004) (26), Northern Ireland (22% from 1981–1993)(33), Saudi Arabia (25%) (29), and across Europe (21–22%) (21,30). Notably, higher prevalence rates have been reported in western Sweden (33%) (39).

According to our data, 75 children (64%) could be classified as having multiple disabilities. This trend is similar to findings from Saudi Arabia but higher than those reported in Northern Ireland, where half of the cases had at least one associated impairment (10), and Sweden, where 31% had two or more associated impairments (39). Among the most frequent associated impairments in the clinical profile of CP are various forms and severities of visual impairment and epilepsy, alongside intellectual disability (32). Children with dyskinetic CP have more severe motor and associated impairments than those with spastic bilateral or unilateral CP, but less severe than those with spastic quadriplegia (11). Recent evidence shows that more than half of children with CP have multiple motor disorders, usually involving both spasticity and dystonia and leading to more severe functional impairments and higher rates of comorbidities (44). Therefore, it is not surprising that nearly two-thirds of our participants had two or more severe associated impairments (Figure 6).

Several limitations should be considered when interpreting our findings. The observed differences in the distribution of associated impairments between our sample and those in previous studies may be attributed to variations in CP severity, as lower levels of intellectual functioning, epilepsy, and sensory impairments often accompany severe gross motor impairments. Furthermore, it is necessary to consider specific methodological and structural differences. These include variations in the average age and age range of participants, as well as the use of different sampling methods and data sources. Inconsistencies also exist in the definitions, stratification of impairments, and classification systems for both CP and intellectual impairment across studies. Despite these limitations, a key contribution of this study is its inclusion of children with profound motor limitations, a group frequently excluded from research (43).

Conclusion

This study provides comprehensive data on the functional characteristics and associated impairments in school-aged children with CP in Serbia. Our findings reveal a high proportion of children with severe motor and cognitive impairments, multiple associated conditions, and limited independent mobility. These results are largely consistent with international proportions of CP characteristics, including topography, clinical subtypes, and a male-to-female ratio.

The high prevalence of complex health problems among children with CP, combined with the consistency of our findings with international data, reinforce the need for a systematic, interdisciplinary approach to their

uralne razlike. One uključuju varijacije koje se tiču prosečne starosti i raspona starosti ispitanika, kao i korišćenje različitih metoda uzorkovanja i izvora podataka. Nedoslednosti takođe postoje u vezi sa definicijama, stratifikacijom oštećenja, i sistemima klasifikacije i za cerebralnu paralizu i za intelektualno oštećenje u različitim studijama. Uprkos ovim ograničenjima, ključni doprinos ove studije je inkluzija dece sa teškim motoričkim ograničenjima, što je grupa koja je često isključena iz istraživanja (43).

Zaključak

Ova studija pruža sveobuhvatne podatke o funkcionalnim karakteristikama i pridruženim smetnjama kod dece školskog uzrasta sa cerebralnom paralizom u Srbiji. Naši rezultati otkrivaju visok procenat dece sa teškim motoričkim i kognitivnim smetnjama, višestrukim povezanim stanjima i ograničenim samostalnim kretanjem. Ovi rezultati su u velikoj meri u skladu sa međunarodnim procentima koji se tiču karakteristika cerebralne paralize, uključujući topografiju, kliničke podtipove i srazmeru prema polu.

Visoka prevalenca složenih zdravstvenih problema među decom sa cerebralnom paralizom, u kombinaciji sa podudaranjem nalaza naše studije sa međunarodnim podacima, povećava potrebu za sistematskim, interdisciplinarnim pristupom zdravstvenoj zaštiti ove dece. Na osnovu ovih nalaza, potreban je koordinisan, interdisciplinarni napor da se uspostavi nacionalni registar cerebralne paralize u Srbiji, jer naši podaci služe kao snažna osnova za dugoročni epidemiološki nadzor i bolje razumevanje potreba ove populacije. Zatim, pristup pomagalima za kretanje i asistivnoj tehnologiji mora se smatrati prioritetom javnog zdravlja, posebno za decu sa teškim funkcionalnim ograničenjima. Takođe, sveobuhvatan, interdisciplinarni model nege koji uključuje sve pružaoce usluga, uključujući zdravstvene i socijalne radnike, neophodan je za rešavanje velikog broja pridruženih smetnji. Konačno, trebalo bi proširiti buduća istraživanja i razvoj usluga izvan motoričkih i kognitivnih funkcija kako bi se usredsredili na ishode povezane sa participacijom, kvalitetom života i socijalnom inkluzijom.

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Konflikt interesa

Autor izjavljuje da nema konflikta interesa.

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care. Based on these findings, a coordinated, interdisciplinary effort is needed to establish a national CP registry in Serbia, as our data serve as a strong foundation for long-term epidemiological surveillance and a better understanding of this population's needs. Next, access to mobility devices and assistive technology must be viewed as a public health priority, especially for children with severe functional limitations. Furthermore, a comprehensive, interdisciplinary model of care that involves all service providers, including health and social care professionals, is essential to address the high number of associated impairments. Finally, future research and service development should expand beyond motor and cognitive function to focus on outcomes related to participation, quality of life, and social inclusion.

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Competing interests

The author declared no competing interests.

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