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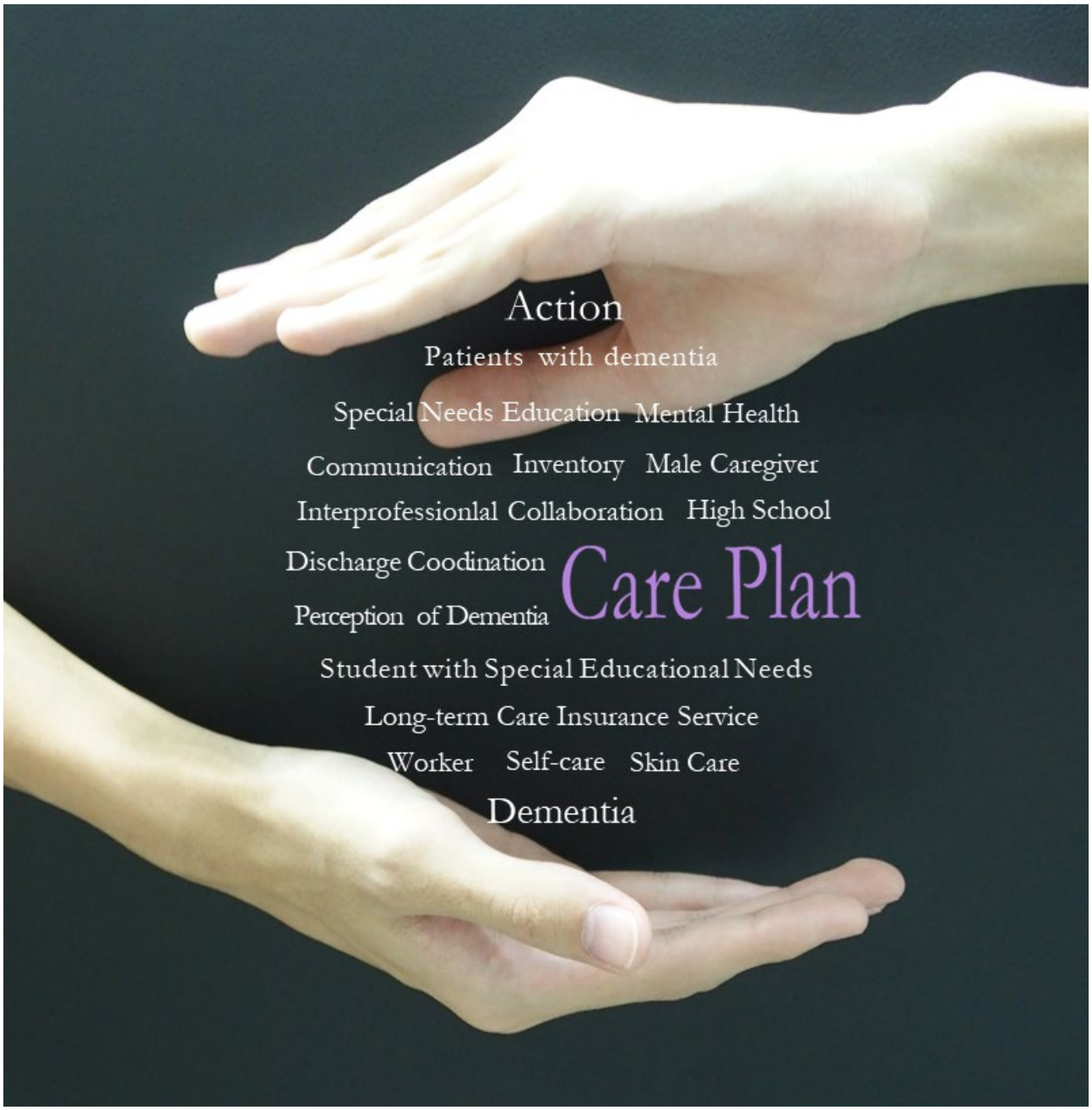

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SHORT PAPER

Physiology and Pathological Characteristics of Children with Physical Disabilities;
Medical Treatment and Education

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ABSTRACT

In Special Needs education and inclusive education, it is important to consider the physiology and pathological aspects of children with disabilities. The education of children with physical disabilities is especially important, and educational support and understanding of their medical treatment should be provided. This support and understanding needs to be inclusive of physiological and pathological diseases such as Cerebral Palsy (CP), Spina Bifida (SB), and Muscular Dystrophy (MD).

Therefore, the purpose of this study is to investigate how to characterize physical disabilities based on physiology and pathology, and to discuss possible medical treatments and education within the characterizations. These findings may assist future research to develop a teaching method based on physiology and pathology.

＜Key-words＞
physiology, pathology, physical disability, cerebral palsy, medical treatment and education

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I. Introduction

According to the Ministry of Education, Culture, Sports, Science and Technology (MEXT, 2011), in addition to an ordinary school specialty, to educate children with physical disabilities, educational specialization and guidance according to the characteristics of the disability are required.

Currently, in schools that offer special needs education, understanding the psychology, physiology and pathological characteristics of children with disabilities should be made a requirement (Kohara, Kwon, Goto, & Nagahama, 2015; Nagai, 2019).

However, in Special Needs education and inclusive education, there are curriculums that consider psychological and social perspectives, but not many curricula consider the disease from a medical perspective (Nagai & Nagai, 2017; Nagai, 2019). Therefore, the purpose of this study is to investigate characterizing physical disabilities focused on physiology and pathology, and to discuss possible medical treatments and education based on these characterizations.

II. Understanding "Physical Disability" from Physiological and Pathological Characteristics: Medical Diagnosis

Physical Disability (PD) is the long-term impairment of part of a person's mobility, bodily function, physical capacity, dexterity, or stamina, resulting in a limitation of physical functioning (Cabinet Office,2018; Achieve Australia, 2019; Handicaps Welfare Association,2018). Due to the functional impairment, the person will experience an inability to perform normal movements of the body, such as the use of hands and arms, muscle control, mobility, walking, sitting, and standing.

The causes of Physical Disability are: 1) Hereditary and Congenital, and 2) Acquired: accident, infection, disease, or as an effect of a medical condition. The categories of physical disabilities are: Cerebral Palsy (CP), Spina Bifida (SB), Muscular Dystrophy (MD), Poliomyelitis, Epilepsy, spinal cord injury, Osteogenesis Imperfecta, and amputations or loss of limbs. Out of the many physical disabilities, this study focuses on Cerebral Palsy (CP), Spina Bifida (SB), and Muscular Dystrophy (MD).

1. Cerebral Palsy (CP)

As adopted by the International Consensus, Cerebral Palsy (CP) is a group of permanent disorders affecting the development of movement and posture, causing limitations in activity, and which is attributed to non-progressive disturbances occurring in the developing fetal or infant brain (Rosenbaum, Paneth et al. 2007; Gulatia & Sondhi, 2018). CP is a neurodevelopmental condition that affects muscle control, mobility, and muscular motor skills (Aisen, Kerkovich, Mast et al, 2011). National population-based

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studies report that the prevalence of Cerebral Palsy (CP) is about 1.8 - 2.3 cases per 1000 children (Hasegawa, Toyokawa, Ikenoue, et al. 2016; Robertson, Ricci, O'Grady et al.2017; Sellier, Platt, Andersen et al., 2016).

Classification of Cerebral Palsy are; 1) Spastic Cerebral Palsy, 2) Dyskinetic Cerebral Palsy and Athetoid Cerebral Palsy) ,3) Ataxic Cerebral Palsy, 4) Mixed Cerebra Palsy (Table1). In the CP, Spastic Cerebral Palsy is the most common type, making up 70 to 80 percent of cases. children of Spastic CP often experience exaggerated or hypertonia.

<Table 1> Classification of Cerebral Palsy

Classification	Description
Spastic Cerebral Palsy	・About 70 to 80 percent of CP ・Increased muscle tone associated with hyperactive muscle stretch reflexes (deep tendon reflexes) ・Increase in resistance to rapid muscle stretch. ・Extensor plantar responses. ・Includes 1) Spastic unilateral Cerebral Palsy 2) Spastic bilateral Cerebral Palsy
Dyskinetic Cerebral Palsy Athetoid Cerebral Palsy	・About 10 percent of CP ・Extrapyramidal cerebral palsy, ・Impairment of voluntary movement because of the presence of interfering involuntary movements ・Inappropriate co-contraction of agonist and antagonist muscles (dystonia). ・Includes 1) Choreo-athetotic Cerebral Palsy 2) Dystonic Cerebral Palsy.
Ataxic Cerebral Palsy	・About 10 percent of CP ・Dominated by signs of cerebellar dysfunction. ・Including Hypotonia, Ataxia, Dysdiadochokinesis, Dysmetria, Dysarthria and Nystagmus. ・Reflexes may be pendular, although there are often also signs of spasticity.
Mixed Cerebral Palsy	・less than 10% of all CP ・The most common Mixed Cerebral Palsy is a combination of Spastic CP and Athetoid CP.

Edit based on ICD-11(International Classification of Diseases-11th), 2018

2. Spina Bifida (SB)

Spina Bifida (SB) is occurs in about 2.7 to 3.8 per 10,000 live births, the most common group of birth defects referred to as neural tube defects (Mukherjee & Pasulka, 2017). Spina Bifida affects the backbone and, sometimes, the spinal cord (Table 2). SB occurs because of an incomplete closure of the neural tube for approximately 28 days during gestation (Wiener, Suson, Castillo et al., 2017).

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<Table 2> Description of Spina Bifida

Classification	Description
Spina Bifida	・The most common congenital neural tube condition ・A pocket of skin may form, containing meninges (meningocele) or spinal cord and meninges (myelomeningocele). ・Different subtypes are distinguished according to the location of the defect. 1) Paraplegia (paralysis of lower limbs) 2) Hydrocephaly 3) Chiari malformation (result of the attached spine during life in utero) 4) Urinary and anorectal incontinence. ・The intensity of signs varies greatly with the level and extent of the lesion.

Edit based on ICD-11(International Classification of Diseases-11th), 2018

3. Muscular Dystrophy (MD)

Muscular Dystrophy (MD) is a progressive, hereditary, skeletal-muscular disease characterized by wasting, defects in muscle proteins, muscle weakness, necrosis of muscle tissue, and replacement of muscle tissue with connective and fatty tissue (International Classification of Diseases-11th, 2018; The Muscular Dystrophy Association Center at Johns Hopkins Medicine, 2019). MD is usually diagnosed in children between 3 and 6 years, early signs of the illness include a delay in walking, difficulty get up from a sitting or lying position on the floor (The Muscular Dystrophy Association (MDA), 2019).

Classification of Muscular Dystrophy are; 1) Becker Muscular Dystrophy (BMD), 2) Duchenne Muscular Dystrophy (DMD), 3) Emery-Dreifuss Muscular Dystrophy (EDMD), 4) Facioscapulohumeral Muscular Dystrophy (FSHD), 5) Limb-girdle Muscular Dystrophy (LGMD), 6) Scapuloperoneal Muscular Dystrophy, 7) Congenital Muscular Dystrophy (Table 3, International Classification of Diseases-11th, 2018).

III. Medical Treatment and Education for Physical Disability

1. Medical treatment

Children with physical disabilities have a high probability of suffering secondary disabilities and disability-related acute health problems (WHO, 2011). Actions are needed to reduce the impact of an already established disease by restoring function and reducing disease related complications. (Smith ,2000; Atijosan, Simms, Kuper, Rischewski & Lavy, 2009). According to the Cabinet Office (2018), medical treatments for children and people with physical disabilities are: 1) enhancement of appropriate health and medical services, 2) prevention and treatment of diseases including early detection, and 3) promotion of mental health and medical care measures (Table 4).

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<Table 3> Classification of Muscular Dystrophy

Classification	Description
Becker Muscular Dystrophy (BMD)	・A group of genetic, degenerative diseases primarily affecting voluntary muscles. ・Similar to DMD, however allows the voluntary muscles to function better than DMD.
Duchenne Muscular Dystrophy (DMD)	・A severe X-linked myopathy caused by mutation in the dystrophin gene with symptoms appearing before the age of 6 with a rapid disease progression. ・Symptoms may include fatigue, learning difficulties (the IQ can be below 75), Muscle weakness, problems with motor skills, frequent falls and progressive difficulty walking.
Emery-Dreifuss Muscular Dystrophy (EDMD)	・A muscle disease characterised by muscular weakness and atrophy, with early contractures of the tendons and cardiac involvement (arrhythmias, cardiomyopathy).
Facioscapulohumeral Muscular Dystrophy (FSHD)	・An autosomal dominantly inherited muscle disease characterized by progressive muscle weakness with initial focal involvement of the facial, shoulder and arm muscles.
Limb-girdle Muscular Dystrophy (LGMD)	・constitutes a group of genetically determined, ・progressive disorders of muscles, in which the pelvic or shoulder girdle musculature is predominantly or primarily involved. ・May be inherited in an autosomal recessive or dominant fashion.
Scapuloperoneal Muscular Dystrophy	・Group of genetically heterogeneous myopathies characterized by progressive weakness and wasting of scapular and anterior leg muscles.
Congenital Muscular Dystrophy	・With central nervous system abnormalities ・A heterogeneous group of autosomal recessively inherited degenerative muscle disorders associated with cerebral and cerebellar dysplasia, white matter abnormalities and ocular abnormalities in some subtypes.

Edit based on ICD-11(International Classification of Diseases-11th), 2018

<Table 4> Medical treatment for children with physical disability

Medical treatment	Description
Enhancement of appropriate health and medical services	• Medical care and medical rehabilitation 1) Provision of medical care and rehabilitation medical care (Physical therapy;PT , Occupational therapy ;OT, Speech-language pathology; S/L) 2) Securing of medical rehabilitation • Health medical care services
Prevention and treatment	• Prevention and Early Detection 1) Health checkup for early detection and early treatment 2) Health guidance for pregnant women, neonates, premature infants, etc 3) Prevention of lifestyle diseases; such as cancer, diavtes and toher NCDs (noninfectious diseases) • Treatment of diseases • Dissemination of correct knowledge
Promotion of mental health and medical care measures	• Mind health promotion • Early detection and treatment of mental disorders

Edit based on Cabinet Office, 2018

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2. In Education

In schools, it is important for students to respect the lives of others as well as themselves and to understand the practical necessity for general safety in daily life, including developing attitudes and abilities that allow for safe living (WHO,2011). Special Needs education and inclusive education are individualized educational focuses helping children with special needs to learn (Nicholas, 2018; Nagai, 2019).

PD children will have communication obstacles (including social mixing) and movement and control difficulties including processing and organizing information as well as spatial and perceptual impediments (Cabinet Office 2018; Aisen, Kerkovich, Mast et al., 2011; Kohara, Kwon, Goto et al., 2015). Children with severe physical disabilities may have minimal special educational needs, while those with minimal physical disability may have serious learning needs. In addition, the focus on understanding the needs of the individual and tailoring educational plans to them is crucial for children with physical disabilities (CP, BP, MD, etc.) because the intellectual abilities of individuals with these conditions can vary significantly. Therefore, along with a psychological examination, it is important to understand the medical diagnosis and to evaluate Activities of Daily Living (ADL), motor function, muscular strength, range of motion, muscle tone, reflexes, language, qualification of skills, hearing, and intelligence to meet the educational needs of children with PD (Bourke-Taylor, Cotter, Lalor & Johnson, 2018, European Commission, 2013).

There needs to be an alliance between medical treatment and educational services for children with PD throughout their schooling years as well as beyond their school. To provide enough support for students with physical disabilities, it is critical to improve the physiological and pathological expertise of teachers (Nagai, 2019; Kwon, Aoki, Yano, 2016).

Recently, inclusive schools have allied with health practitioners to advocate for educating and providing support to children within the schools (Cabinet Office, 2018). According to Bourke-Taylor (2018), Special Needs Education teachers need training and support from allied health practitioners. Physiological and pathological expertise for teachers can assist in tracking a child's learning and support their needs. In addition, the teachers can work with the families to put in place any reasonable adjustments their children may need at school. School professionals, allied health practitioners, families, and children can work together to improve the student experience.

Specialized training can later be providing in particular areas to enhance teachers' physiological and pathological expertise. This curriculum would be helpful to prepare teachers to educate children with physical disabilities.

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