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Fakulta Tělesné Kultury

MEASUREMENT OF LEISURE-TIME PHYSICAL ACTIVITY FOR CZECH PEOPLE WITH PARAPLEGIA

Diplomová práce
(magisterská)

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Physical Activity and Active Living

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Abstract:

Background: For people with spinal cord injury (SCI) is challenging to be physically active as they encounter barriers, physical and psychological health problems in addition to the injury. The majority of people with SCI are characterized by low or no physical activity level. To be active, LTPA is the easiest and most effective activity for the SCI population. **Objective**: This is a study to measure leisure-time physical inactivity (LTPA) in Czech people with paraplegia. **Method**: fifty-eight persons with paraplegia living in the Czech Republic were recruited. They completed a PARA-SCI interview which consisted of items about personal characteristics, types of LTPA, hours of LTPA, and LTPA intensity. **Results**: The result showed that 32% performed low-intensity LTPA, 38% performed moderate-intensity, and 14% performed high-intensity LTPA. The mean minutes per day of total LTPA was 85. The most frequently performed activities were stretching and strengthening exercises (29%), wheeling (22%), hand biking (22%), and gardening (22%). Gender and level of injury were significantly associated with LTPA. Men were more physically active than women and low paraplegia participated more than a high level of paraplegia. **Conclusion:** The intensities that were used in physical activities were at an appropriate level (moderate). Overall, the time spent on LTPA achieved the SCI physical activity guidelines except for WHO physical activity guidelines.

Keywords: spinal cord injury, leisure-time physical activity, paraplegia, demographics

Bibliografická identifikace

Jméno a příjmení autora: Thwe Thazin Swe

Název práce: Hodnocení množství, intenzity a typu volnočasových pohybových aktivit u českých paraplegiků

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Abstrakt:

Pozadí: Pro osoby s poraněním míchy (SCI) je náročné být fyzicky aktivní, protože se potýkají s trvalými následky zranění ať už fyzickými, psychickými či sociálními. Většina osob se spinální lézí vykazují nízkou nebo žádnou úrovnň fyzické aktivity. Pokud chtějí být tyto osoby více aktivní, měli by se věnovat volnočasovým pohybovým aktivitám (LTPA), které jsou nejjednodušším a nejúčinnějším prostředkem. **Cíl**: Jedná se o studii zaměřenou na měření volnočasových pohybových aktivit u českých osob s paraplegií. **Metodika**: Výzkumu se zůčastnilo 58 osob s paraplegií žijících v České republice. Byl s nimi veden polo-strukturovaný rozhovor PARA-SCI, ze kterého byly vyhodnboceny informace o osobních charakteristikách, typech LTPA, trvání LTPA a intenzitě LTPA v průběhu 3 dnů. **Výsledky**: Výsledeky ukázaly, že 32 % paraplegiků provedělo LTPA s nízkou intenzitou, 38 % se střední intenzitou LTPA a 14 % s vysokou intenzitou zatížení. Průměrný počet minut za den celkové LTPA byl 85. Nejčastěji prováděnými aktivitami bylo protahovací a posilovací cvičení (29 %), jízda na kole- handbike (22 %), ruční kolo- ruční ergometr (22 %) a práce na zahrádce (22 %). Faktory pohlaví a výšky spinální léze výrazně ovlivnili množství a intenzitu LTPA. Muži byli fyzicky aktivnější než ženy a osoby s nízkou paraplegie se účastnily více LTPA nežosoby s vysokou paraplegií. **Závěr**: Intenzita pohybových aktivit, které bylo dosaženo při pohybových aktivitách, byla na odpovídající úrovni (střední). Celková doba strávená LTPA dosáhla doporučeného množství minut dle směrnice pohybové aktivity osob SCI a pokynů WHO.

Klíčová slova: poranění míchy, pohybová aktivita ve volném čase, paraplegie, demografie

Acknowledgment

I hereby declare that I have completed this Master's thesis independently under the supervision and help of Prof. Jarmila Štěpánová.

Special thanks go to my family, who supported me with their unconditional support, love, and encouragement.

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1 Literature review

1.1 Spinal Cord Injury

Spinal cord injury (SCI) is trauma or damage to the spinal cord resulting in substantial motor, sensory, or autonomic functions below the level of the lesion (Itodo et al., 2022; Miller, 2021; Sweis & Biller, 2017). Based on the anatomy of the human spine, the spinal cord is composed of 33 spinal bones or vertebrae; 7 cervical vertebrae, 12 thoracic vertebrae, 5 lumbar vertebrae, 5 sacral vertebrae, and 3-4 fused coccygeal vertebrae (Figure 1) and 31 pairs of spinal nerves; 8 pairs of cervical nerves, 12 pairs of thoracic nerves, 5 pairs of lumbar nerves, 5 pairs of sacral nerves and 1 pair of coccygeal nerves (Figure 2) (Miller, 2021). SCI impacts various functions of life including bladder, bowel, respiratory, cardiovascular, and sexual functions as well as social, financial, and psychological impacts (Jackson et al., n.d.).

Tetraplegia (previously termed quadriplegia) refers to impairment or loss of motor and/or sensory function in the cervical segments of the spinal cord resulting in impairment of function in the arms, trunk, legs, and pelvic organs. C5 is the most common level of injury in the cervical spine.

Paraplegia refers to impairment or loss of motor and/or sensory function in the thoracic, lumbar, or sacral segments of the spinal cord with loss of function in the trunk, pelvic region, and legs (Flank, 2016). Th12 is the most common level of neurological injury.

Incomplete injury is a lesion of any sensory and/or motor function partially below the neurological level that includes the lowest sacral segments S4-S5 (Flank, 2016). Recovery is possible, the nerves are only slightly damaged (not all the nerves are severed) in the incomplete lesion (Borms et al., n.d.).

Complete injury is the total loss of sensory and motor function in the lowest sacral segments (Flank, 2016). It shows no motor or sensory function preserved and the nerves are severed in a complete lesion (Borms et al., n.d.).

1.1.1 Classification of Spinal Cord Injury

The International Standards for the Neurological Classification of Spinal Cord Injury (ISNCSCI) is a classification system to examine the determination of the level and severity of the injury whether an individual has full, partial, or no sensory and motor function. The level of injury is classified by using the American Spinal Injury Association (ASIA) Impairment Scale (AIS scale) (modified from the Frankel classification) (Chin & Kopell, 2018; Miller, 2021). AIS scale has been used for accurate characterization of incomplete and complete spinal cord injuries with ranging sensory and motor grades from A to E, with A being the most severe injury and E being the least severe (Roberts et al., 2017). Table 1 presents the grades based on the severity of injuries.

Table 1

American Spinal Injury Association (ASIA) Impairment Scale (AIS Scale)

AIS Grade	Clinical State
A	Complete—No motor or sensory function is preserved in the sacral segments S4–S5
B	Incomplete—Sensory but not motor function is preserved below the NLI and includes the sacral segments S4–S5
C	Incomplete—Motor function is preserved below the NLI, and more than half of the key muscles below the NLI have a muscle grade less than 3
D	Incomplete—Motor function is preserved below the NLI, and at least half of the key muscles below the NLI have a muscle grade of 3 or more
E	Normal—Motor and sensory function is normal

Note. Retrieved from " The Role of Magnesium in the Secondary Phase After Traumatic Spinal Cord Injury. A Prospective Clinical Observer Study," By André Sperl, Raban Arved Heller, Bahram Biglari, Patrick Haubruck, Julian Seelig, Lutz Schomburg, Tobias Bock, and Arash Moghaddam, 2019, *Antioxidants*, 8, 509, 1-12.

1.1.2 Secondary Health Complications

People with SCI have a high possibility of complications as they have a loss of sensory or motor functions (Yuan et al., 2018). Chest complications, deep venous thrombosis, and pulmonary embolism are early complications of SCI (Bergström et al., 2006). And, the consequences of prolonged bed rest after SCI may cause loss of muscle and bone tissue in the affected areas (e.g., upper and lower limbs in tetraplegia, lower limb in paraplegia) (Flank, 2016). People with high-level, motor complete SCI are more likely to develop cardiovascular disease (Krassioukov et al., 2019). Additionally, in low-income countries, it is a higher rate of secondary complications such as urologic complications and pressure sores after SCI (Flank, 2016). Willig (2019) indicated that 21% of individuals became overweight and 54% became obese over time after five years of SCI. Depression is the most common psychological complication and interestingly 2 to 6 times more common in suicide mortality compared with the general population (Flank, 2016).

1.1.3 Etiology

1.1.3.1 Causes of Spinal Cord Injury

SCI can occur as a result of traumatic causes, and non-traumatic causes. Traumatic SCI occurs normally due to damage to the spinal cord by an external physical impact, such as falls; from a height or simple falls, road traffic accidents (RTAs), or motor vehicle accidents (MVAs)/motor vehicle crashes, sports-related accidents, or violence. Non-traumatic SCI occurs due to damage to the spinal cord by acute or chronic disease, such as degeneration, inflammatory or auto-immune, neoplasms, vascular diseases, infection, or tuberculosis (Sub-Saharan Africa) (Ahuja et al., 2017; Jaraczewska, n.d.). Among them, the leading cause of SCI in developed countries is falls (used to be MVAs in the previous) and falls are the major cause of injury in developing countries (Jaraczewska, n.d.). In the study by Flank (2016) and

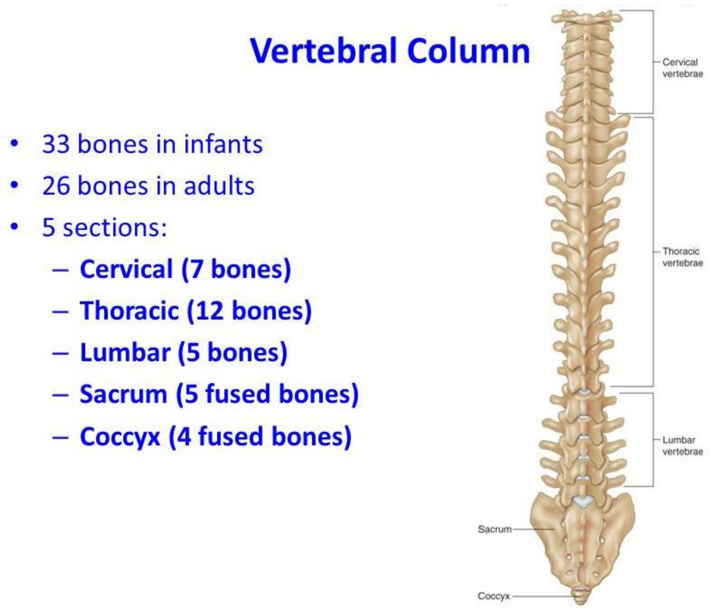
Yuan et al. (2018), the injury was caused by falls mostly and followed by road traffic accidents (RTAs) and sports-related injuries.

1.1.3.2 Level and Severity of the Injury

Lower cervical C5–C7, mid-thoracic T4–T7, and thoracolumbar T10–L2 are the most frequently injured areas of the vertebral column (Bergström et al., 2006). In China, the low level of injuries, such as thoracolumbar, and lumbosacral injuries, are more common than cervical and thoracic injuries (Yuan et al., 2018). As Miller (2021) explained, about 40% of SCI occurs as being considered paraplegic (19.6% incomplete and 20.2% complete), with 59.5% of injuries classified as tetraplegia (47.2% incomplete and 12.3% complete).

Figure 1

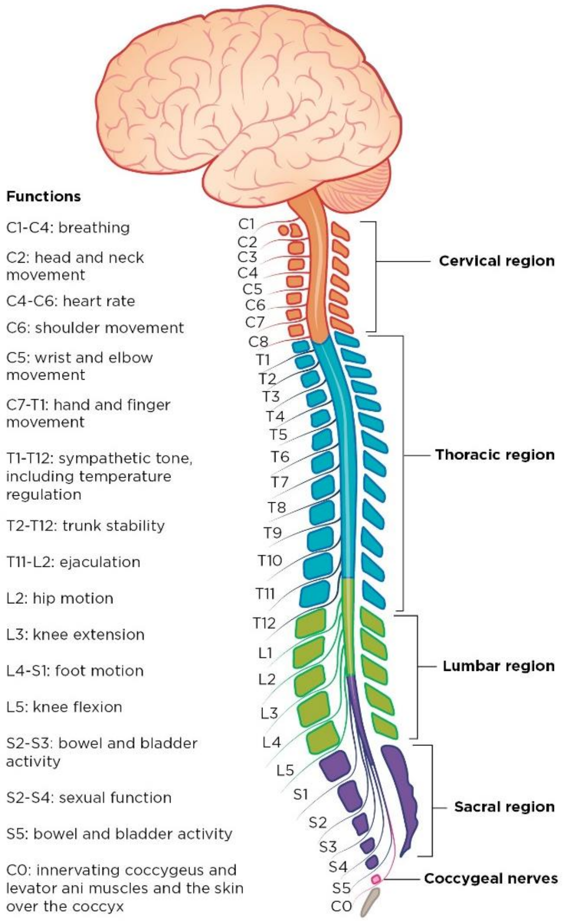
Structure of the Spinal Bones



Note. Adapted from "Vertebral Column and Thoracic Cage Note," By Cody Harmon, 2016, retrieved from https://slideplayer.com/slide/9217074/.

Figure 2

The Spinal Nerves and their Functions



Note. From "Nervous system 4: the peripheral nervous system – spinal nerves," By Zubeyde Bayram-Weston, Maria Andrade-Sienz, John Knight, 2022, *Nursing Times* (online), 118 (6). Copyright 2022 by EMAP.

1.1.4 Epidemiology

1.1.4.1 Incidence and Prevalence

As of 2022, National Spinal Cord Injury Statistical Center (NSCISC) (2022) reported that the number of people with SCI living in the United States was approximately 299,000 persons, with a range from 253,000 to 378,000 persons. The average age for the occurrence of SCI is within the range of 16-30 years of age, with approximately 78% of SCI subjects being male. The incidence has varied annually among regions (Borms et al., n.d.) and most of developing countries are not available data of the incidence of spinal cord injury (Yuan et al., 2018). According to Borms et al., n.d. and Golestani et al. (2022), the prevalence and incidence of SCI are more common in developing countries than in developed countries. The cervical and lumbosacral injuries were the highest levels of incidence from 2009 to 2020 and falls were the predominant cause of injury (Golestani et al., 2022). According to the NSCISC (2022), the most frequent neurological category is incomplete tetraplegia, followed by incomplete and complete paraplegia.

1.1.4.2 Mortality and Life Expectancy

Life expectancy depends on the age at injury, gender, ventilator status, and etiology of injury. Besides, it is highly associated with the level of injury and completeness, e.g., highest in those with incomplete lesions, followed by complete paraplegia and complete tetraplegia (Bergström et al., 2006). For instance, patients with ASIA grade D requiring a wheelchair for daily activities have approximately 75% of a normal life expectancy and patients not requiring a wheelchair and catheterization may have a higher life expectancy up to 90% of a normal individual (Borms et al., n.d.). The mortality rate is higher, especially in patients aged > 60 years due to poor cardiac and respiratory function (Sweis & Biller, 2017) and also young adults with SCI (age > 25 years) are more likely to commit suicide (Chin & Kopell, 2018). If the severity and level of injury/lesion are higher, the survival and life expectancy are lower (Flank, 2016). The major causes of death are pneumonia, pulmonary embolism, or septicemia after SCI (Chin & Kopell, 2018). Although secondary complications of SCI are preventable in developed countries, developing countries have become a common cause of death due to the absence of adequate medical care (O'Reilly, n.d.).

1.1.5 Healthy Aging with Spinal Cord Injury

As spinal cord injury is a long disability, it is very important to live long together with it after injury with a good quality of healthcare and rehabilitation. To do that, there are factors to be aware of in older adults with long-term SCI, such as secondary health conditions, activity limitations, and life satisfaction (Sophie Jörgensen et al., 2017). Jörgensen et al.

(2021) indicated that life satisfaction is the most important one among all aspects of well-being. Life satisfaction defines a subjective judgment of the current life situation and is significantly low in the SCI population. Living with SCI is challenging and accompanied by psychological issues, such as depression. For psychological well-being, the role of social support (family, friends, healthcare workers, and peers with SCI) is essential (Jenkins & Cosco, 2021). Moreover, functional independence is associated with aging but Osterthun et al. (2020) evidenced that persons under 65 years of age with a motor complete SCI showed no decreasing functional independence for a long period. Besides, long-term SCI people should be aware of the health and fitness benefits of participation in LTPA and try to maintain their physical, and psychological health (S Jörgensen et al., 2017)

1.2 Spinal Cord Injury and Physical Activity

The term ‘Exercise is Medicine’ becomes a global health initiative in which promoting physical activity (PA) is essential to the prevention, management, and treatment of diseases (Toni Louise et al., 2018). Physical activity, generally, is the body movement produced by the contraction of skeletal muscle that increases energy expenditure and can be classified in various ways, including type, intensity, and purpose. Moreover, physical activity differs in the occupational, household, leisure time (subdivided into competitive sports, recreational activities, and exercise training), or transportation (U.S. Department of Health and Human Services, 1996).

The survivors of spinal cord injuries encounter sudden and significant changes with various complications including loss of function, and reduced mobility (Williams, 2019). Besides the sedentary nature of SCI, this population experiences secondary health complications such as cardiovascular disease (one of the important causes of mortality), increased adiposity, hypertension, orthostatic hypotension, glucose intolerance and/or insulin insensitivity, urinary tract infections, pressure sores, and osteoporosis (Ravenek et al., 2015; Rodrigues et al., 2020). By the evidence of Amatachaya et al. (2011), the participants had medical complications for 6 months after discharge from the hospital. Among them, neuropathic pain, urinary tract infection, and pressure ulcers were most widely reported.

Physically active is important for everybody. In U.S. general population, about 25 percent of adults reported no physical activity at all in their leisure time (U.S. Department of Health and Human Services, 1996). And the majority of people with SCI have lived sedentary or inactive lifestyles with little to no physical activity (Ravenek et al., 2015; Williams, 2019), and 60% of people in this population remain low participation in exercise and physical activity (Crane et al., 2017; Hoevenaars et al., 2022). Therefore, persons with disability are more important to be active (Ravenek et al., 2015; Williams, 2019) and promotion of participation in physical activity is also needed (Hoevenaars et al., 2022).

Physical inactivity is the level of activity less than that required to maintain good health (U.S. Department of Health and Human Services, 1996). Physical inactivity is one of the leading causes of death globally and has been described as the greatest public health challenge of the 21st century with negative environmental, social, and economic consequences (Bornstein & Davis, 2014). Some of the major health problems as consequences in disabled people are mainly related to physical inactivity (Dearwater et al., 1985). Additionally, the combination of SCI and insufficient levels of physical activity may, eventually, lead to a change in the health conditions such as fat accumulation and overweight, and obesity (Rodrigues et al., 2020). Treatment of diseases related to physical inactivity costs a lot and therefore preventing the onset of disease such as promoting physical activity is the most feasible economic model moving forward (Bornstein & Davis, 2014).

Amatachaya et al. (2011) described that subacute SCI patients can improve their functional abilities by participating in a rehabilitation program. Moreover, people with SCI can improve exercise performance with endurance training resulting in improved cardiovascular and respiratory function similar to the general population (Levins et al., 2004). Subsequently as described by Amatachaya et al. (2011), maintaining those abilities is difficult to continue after discharge because of environmental constraints such as lack of home adaptation and assistive devices. And there are numerous risks, benefits, and barriers to participating in physical activity and exercises for people with spinal cord injury (Ravenek et al., 2015).

1.2.1 Benefits of Physical Activity Participation

Ravenek et al. (2015) stated that physical activity has positive health effects physically, psychologically, and socially. However, there is less information about interventions that emphasized increasing PA participation. Levins et al. (2004) revealed that involvement in physical activity is a priority to positively understand their strengths and limitations. Another important benefit is developing self-confidence overtimes with certain skills, abilities, and appearances (Levins et al., 2004). Among them, the most important and needed for them is increasing physical independence and physical capacity for their activities of daily living (ADL) (Ravenek et al., 2015).

Improvements in mobility, cognition, fatigue, pain, mental state, and quality of life result from participation in physical activity for disabled people (Silveira & Motl, 2019; U.S. Department of Health and Human Services, 1996). The association between physical activity and health-related outcomes for people with spinal cord injury as described by (2020) is that physical activity can improve walking function, muscular strength, and upper extremity function, reduce shoulder pain, improve vascular function, and enhance health-related quality of life.

The role of quality of life for persons with SCI is gradually significant for all health care providers and policymakers in the areas of various assistant programs to create successful rehabilitation interventions, evaluate programs and assistance services, and meet the needs of people with SCI (Filipcic et al., 2021). Rodrigues et al. (2020) also stated that exercise and activity interventions have been gradually assumed as a possible non-pharmacological treatment strategy when promoting health (physical and mental) and quality of life in people with SCI.

1.2.2 Barriers and challenges of Physical Activity Participation

Barriers mean all the obstacles and factors to not engaging in any kinds of activities, having a desire to quit the activities, or having negative experiences with activities (Williams, 2019). People with Spinal cord injury have many challenges in physical activity to achieve and maintain physical function (Crane et al., 2017). Moreover, there are limitations to engaging in exercise and participating in appropriate options for physical activity. Furthermore, numerous physical activity barriers encountered by people with disabilities, both in their daily life and PA participation, were described in many studies. Nowadays, the interaction between the built environment, social cognition, and physical activity in the general population has been growing interested (Silveira & Motl, 2019) but not in people with disabilities.

Ravenek et al. (2015) mentioned that SCI presents barriers to PA participation, extrinsic and intrinsic. Persons with SCI may face extrinsic barriers such as lack of accessible fitness facilities, lack of finances, unaffordable equipment, gym memberships, poor weather, and built environment such as uneven sidewalks, a lack of or inadequate curb cuts, and/or wheelchair ramps (Crane et al., 2017; Ravenek et al., 2015; Williams, 2019). Some intrinsic barriers may include the absence of knowledge about SCI-specific exercise programs, fear of injury, motivation to participate, self-efficacy (Crane et al., 2017; Ravenek et al., 2015), depression, lack of self-confidence, lack of time, embarrassment, lack of social support such as friends, family, peers, and other disability groups (Williams, 2019). Besides, another facing barriers were the exercise or fitness instructors who have less experience, lack of privacy, and fear of injury (Richardson-smith, 2016).

The covid-19 pandemic peaked in 2021 and so, there was restricted access to all public areas including health care services and fitness centers. People in this population have encountered more physical and psychological issues as a result of staying at home for a long time. Mehta et al. (2021), therefore, introduced telerehabilitation to overcome barriers and access services during the covid-19 pandemic targeting people with chronic SCI living in the community. The study conducted aerobic and strength-training physical activities with 60 min sessions, twice weekly for six weeks, and resulted in improvement in their physical and psychological health, particularly social connectedness and decreased feeling of isolation.

1.2.3 Social-ecological model to understand factors impacting physical activity participation

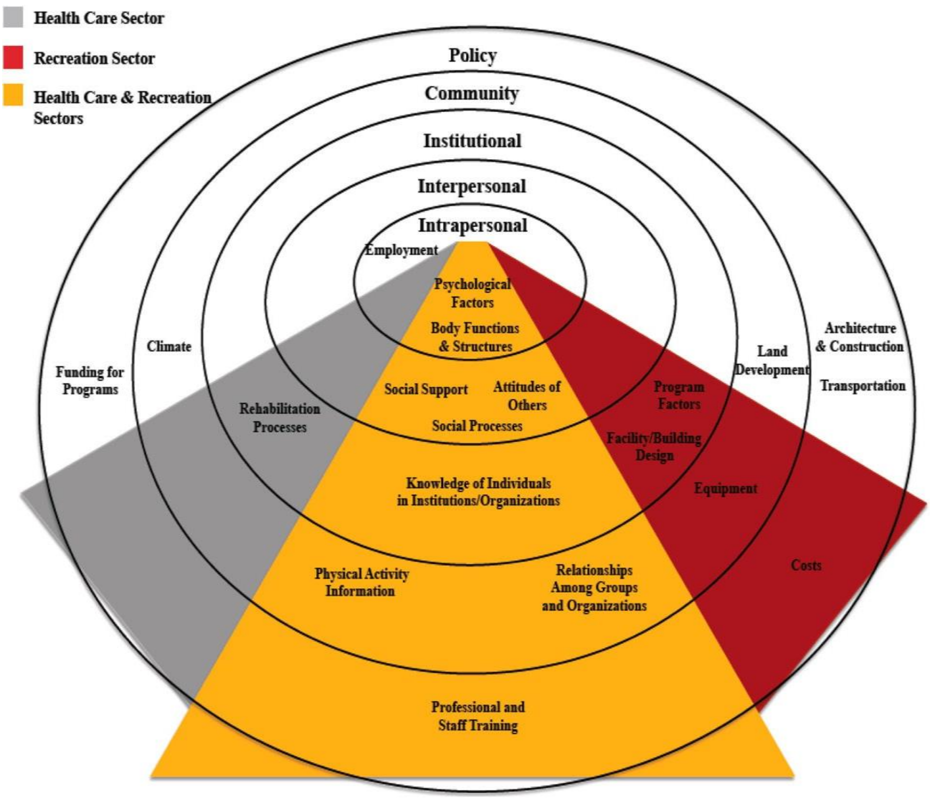
Many professionals and researchers use the social-ecological model as a framework to engage in physical activity, guide health promotion, and solve cultural and religious concerns**.** Mccracken (2017) stated that social-ecological models (SEMs) were designed to promote physical activity participation with multi-sector collaboration. The model states the role of inter-sectoral or coalition groups (e.g., public health, sport, fitness industry), agencies (e.g., park and recreation departments, transportation department, education, media, medical), policies, and environments (supportive settings (e.g., neighborhoods, worksites, schools)), facilities (e.g., health clubs, parks, cycling paths) and programs (e.g., aerobics classes, sports teams, supervised recreation, behavioral counseling) (Sallis et al., 1998). Additionally, Sallis et al. (1998) emphasized the ecological models which refer to people's transactions with their physical and sociocultural environments to promote physical activity.

Social-ecological models (SEMs) identify the correlation between physical, social, and individual-level variables as determinants of health and health behaviors (Silveira & Motl, 2019), and these levels are influenced by each other (Úbeda-colomer et al., 2019). For example, offering financial support for people with disabilities and family members or friends in PA participation at the organizational level could positively affect social support at the interpersonal level (Úbeda-colomer et al., 2019). The model can be used for planning and evaluations by health and fitness professionals regarding facilitators or barriers to be integrated with understanding and improving health (King & Gonzalez, 2018; Úbeda-colomer et al., 2019).

The model is a framework that those five levels influenced by individuals' surroundings can result as facilitators or barriers to physical activity (King & Gonzalez, 2018). Five levels of behavioral influences specified by Sallis et al. (1998) and Mccracken (2017) consist of intrapersonal, interpersonal, institutional, community, and public policy (see Figure 3). The social-ecological model clarifies that individual knowledge and attitudes have less impact on health behavior but environments in which community residents live, play, work, and learn more dominate health behavior (King & Gonzalez, 2018; Úbeda-colomer et al., 2019). And in a systematic review by Golden & Earp (2012), the intervention activities were mostly focused more on the individual and interpersonal levels than on institutional, community levels, and policies in different settings (schools, rehabilitation, and so on).

Figure 3

Social-ecological Model with Factors related to Five Levels for Physical Activity Promotion



Note: Adapted from “A Systematic Review of Review Articles Addressing Factors Related to Physical Activity Participation among Children and Adults with Physical Disabilities,” by Kathleen A. Martin Ginis, Jasmin K. Maa, Amy E. Latimer-Cheung and James H. Rimmer, 2016, *Health Psychology Review*, 10 (4), 478-494. Copyright by Health Psychology Review.

Intrapersonal factors include characteristics of the individual experiences, knowledge, beliefs, attitudes, skills, emotions, self-perceptions, psychological and biological variables, as well as developmental history such as secondary health issues, fitness, and function (King & Gonzalez, 2018; Mccracken, 2017; Sallis et al., 1998). The main reason for not being willing to incorporate physical activity is the lack of motivation, leading to laziness in many studies. Limitations to engaging in activities for disabled people are characteristics of their disability and being physically inefficient to perform activities that can affect their health and well-being (Levins et al., 2004). Silveira & Motl (2019) found that engaging in leisure physical activity among disability status resulted in improving mainly self-efficacy and social support.

The Interpersonal level includes culture, social networks, and support systems, including family, friends, and coworkers (King & Gonzalez, 2018; Mccracken, 2017; Sallis et al., 1998). Societal attitudes are an important role in physical activity participation according to the report by Mccracken (2017). Family members and friends play an important role in engaging in activities such as praise and encouragement (U.S. Department of Health and Human Services, 1996). Levins et al. (2004) stated that societal attitudes consider a barrier and affect self-perception, and physical and social environment whereas exercises and physical activity help in the rehabilitation process to their injury or the society to which they will return. Moreover, Arbour-nicitopoulos et al. (2010) discovered that it is indirectly influenced by neighborhood perceptions but directly influenced by neighborhood behaviors or supports when designing interventions to increase leisure-time physical activity intentions.

Institutional factors related to physical activity participation are organized social institutions with formal or informal rules and regulations such as companies, schools, health agencies, or health care facilities. Other institutional factors include encouragement, counseling and information from professionals, and building accessibility for participation (Mccracken, 2017; Sallis et al., 1998). Moreover, the need for training programs for individuals (exercise instructors, physiotherapists, and community center workers) and the knowledge or practices of individuals and organizations are required to increasingly be active (M. Ginis, Ploeg, et al., 2021).

The community level of influence includes relationships among organizations, institutions, and social networks or society. In terms of community level, the built and natural environments (e.g., climate and technology) are the main categories impacting physical activity participation (King & Gonzalez, 2018; Mccracken, 2017; Sallis et al., 1998).

Public policy consists of laws and policies at the local, state, national, governmental, and supranational levels. The areas of laws and policies are, particularly, for health, financial expense, and transportation (Mccracken, 2017; Sallis et al., 1998), for example, health policies, transportation services, systems and policies, and architecture and construction policies (Martin et al., 2016). In the study of Bornstein & Davis (2014), emphasis on establishing policies and practices that can increase individuals' activity levels has been increasingly given by organizations such as the World Health Organization (WHO), the American College of Sports Medicine (ACSM), and the American Heart Association (AHA).

1.2.4 Exercise or Physical Activity Guidelines for People with Spinal Cord Injury (SCI)

The existence of SCI-specific exercise guidelines with evidence-based is important to obtain fitness and cardio-metabolic health benefits with minimum thresholds in the SCI population. For people with SCI use 3.1 ml VO2 ·kg–1 ·min–1 of oxygen in 1 MET while using 3.5 ml VO2 ·kg–1 ·min–1 of oxygen for a 70-kg person, for an able-bodied person

(Todd & Ginis, 2019). As a consequence, the resting metabolic rate is lower (Todd & Ginis, 2019), and also energy expenditure is lower than in able-bodied individuals (Itodo et al., 2022). Besides that, facing barriers and challenges in exercise participation for persons with SCI is not easier to meet WHO guidelines for individuals with SCI (e.g., 150 min/week of moderate-intensity aerobic activity).

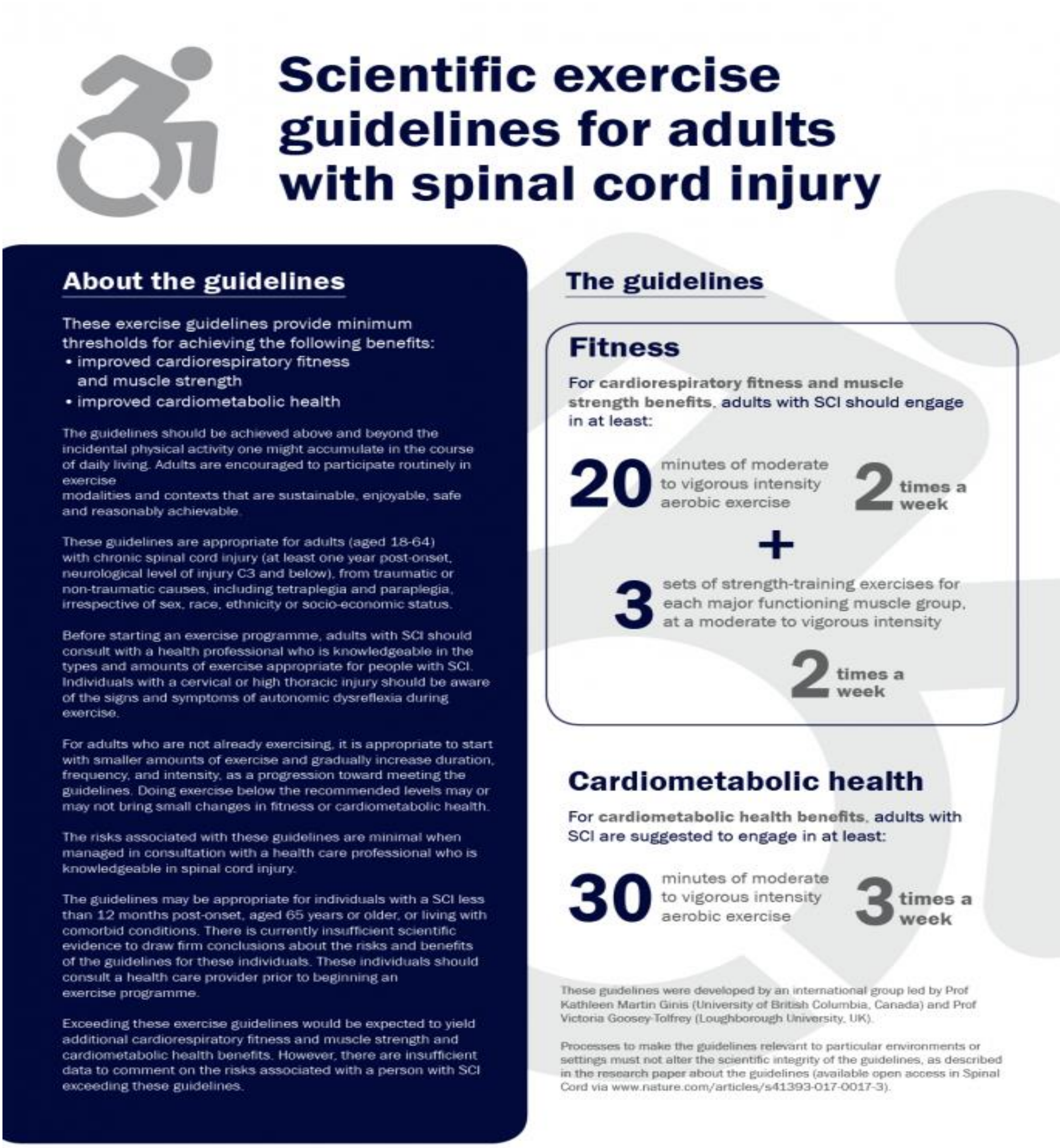
Meeting the physical activity guidelines, especially WHO exercises guidelines depends on personal and social demographics (sex, age, height, educational level), level of injury, and type of locomotion (Hoevenaars et al., 2022). For example, individuals with injury levels above the T-6 segment may have less chance to reach moderate or vigorous-intensity exercise (Itodo et al., 2022). Likewise, the perceptions of appropriate physical activity vary in gender, age, body weight, level of disability, cultural background, and social experiences (U.S. Department of Health and Human Services, 1996). The findings of Amatachaya et al. (2011) showed that participating in rehabilitation depends on the level of recovery. People with disabilities who followed existing guidelines could not be attained the WHO guidelines (Ginis, Latimer-cheung, et al., 2021), and achieving recommended exercises has been very difficult with numerous barriers (Groot & Cowan, 2021).

Sedentary individuals are encouraged to perform a moderate level of physical activity and significantly improved health-related outcomes in a population with long-term illness. However, maintenance of current ability to perform is the most important for people who can perform exercise programs and can be attained through recreational or sports activities (U.S. Department of Health and Human Services, 1996). The type of physical activity is preferred according to the individual (U.S. Department of Health and Human Services, 1996) and it is also necessary to set and use the physical activity guidelines to obtain health benefits. Furthermore, the guidelines for clinical practices are needed to be considered the benefits, risks, values, and preferences of the people who will use the guidelines (Ginis et al., 2018).

Chyba! Nenalezen zdroj odkazů. presents scientific exercise guidelines for adults with SCI. And some exercise guidelines for adults with SCI are shown in Table 2.

Figure 4

Scientific Exercise Guidelines for Adults with Spinal Cord Injury



Note. Adapted from “SCI Action International“, In the University of British Columbia, n.d., Retrieved 2018, from https://sciactioncanada.ok.ubc.ca/sci-action-international-2/. The work is licensed by the University of British Columbia and Loughborough University under a Creative Commons licenc

Table 2

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Guideline/recommendation	Type of training	Frequency	Intensity	Duration	Activities
WHO guidelines (WHO Guidelines on Physical Activity and Sedentary Behaviour, 2020)	Moderate aerobic physical activity	150–300 minutes/week at least	Moderate	21-43 minutes/day	
	Vigorous-intensity aerobic physical activity	75–150 minutes/week at least	Vigorous	11-21 minutes/day	
	An equivalent combination of moderate- and vigorous-intensity activity		Moderate & vigorous		
Cardiovascular and Muscular Strength/Endurance Recommendations (Evans et al., 2015)	Cardiovascular Health	Minimum 2 days/week	Moderate to vigorous	20-30 minutes/session	Wheeling, arm cycle, sports, recumbent stepper, aquatics, cycling, circuit training, functional electrical stimulation
	Muscle Strength and Endurance	Minimum 2 days/week	8-10 reps (1 set)	3 sets; 1-2 minutes rest between sets (30-60 minutes total)	Free weights, elastic resistance bands, cable pulleys, weight machines, functional electrical stimulation
	Flexibility and Range of Motion	Daily	30-60 seconds/stretch; gentle, slow, pain-free	2 sets; 5-15 minutes	Standing in a standing frame (if medically cleared); passive and active static stretching

CDC's (Center of Disease Control and Prevention) Physical Activity Guidelines (Blauwet & Donovan, 2016)	Moderate-intensity aerobic exercise & Strength training	150 minutes/week of moderate-intensity aerobic exercise & 2 or more days/week of strength training	Moderate for aerobic exercise & 10 reps (1 set) for stretch training	20-25 minutes/day for aerobic exercise & 1-2 sets for stretch training	All possible major muscle groups for strength training
	Vigorous-intensity aerobic exercise & Strength training	75 minutes/week of vigorous-intensity aerobic exercise & 2 or more days/week of Strength training	Vigorous for aerobic exercise & 10 reps (1 set) for stretch training	10-11 minutes/day for aerobic exercise & 1-2 sets for stretch training	All possible major muscle groups for strength training
	A mix of moderate- and vigorous-intensity aerobic exercise and strength training	2 or more days/week of strength training	Moderate & vigorous for aerobic exercise & 10 reps (1 set) for stretch training	1-2 sets for stretch training	All possible major muscle groups for strength training
SCI-specific physical activity guidelines (Evans et al., 2015; Ginis et al., 2018; Rocchi et al., 2017)	Moderate to vigorous-intensity aerobic physical activity	20 min/week at least	Moderate to vigorous	10min/day (two times/week)	
	Resistance activity	2 sessions per week	8–10 reps of each exercise	3 sets/session	

One cross-sectional study has attempted to assess the rates of physical activity participation in a sample of Canadian adults with SCI relative to the SCI-specific physical activity guidelines, as for the aerobic and resistance guidelines, (at least 20 min of moderate to vigorous-intensity aerobic physical activity two times per week and resistance activity two sessions per week, where each session consists of three sets of 8–10 repetitions of each exercise). This study found that only 12% of participants met the guidelines in combined aerobic and resistance activities and a large number of participants did not meet both the aerobic and resistance physical activity guidelines (Rocchi et al., 2017).

In the most recent study, (Hoevenaars and colleges (2022) reported that Dutch people with SCI met two SCI-specific exercise recommendations, one with 29% and the other one 22% respectively, which showed a challenge for most of them. The recommendations are 150 min of moderate exercise or 60 min of vigorous exercise or 150/90 min of a combination of moderate/vigorous exercise two times per week for all, and 90 min of moderate and/or vigorous cardio-metabolic exercise and 40 min of moderate and/or vigorous fitness exercise with two times per week. The results showed improved respiratory function, exercise capacity, and a better range of BMI compared to the inactive group (Hoevenaars et al., 2022).

The data or research concerning high-intensity interval training (HIIT) in people with SCI is limited. HIIT intervention is 10 to 30 min in general and includes alternating bouts of intense exercise (Groot & Cowan, 2021). Nevertheless, based on the existing data by Astorino et al. (2021), engaging in HIIT delivered the enjoyment and the onset of shoulder pain or discomfort as side effects. The authors, additionally, suggested that it is suitable to study the effects of interval training in persons with SCI who are ambulatory and have greater exercise tolerance.

In a systematic review by Rodrigues et al. (2020), the authors evaluated the effect of strength training on the physical and mental health and quality of life of people with spinal cord injury. The interventions were 40 min in each session with 2 to 3 times per week and 2 to 3 months programs. The results showed increased physical health such as muscle strength, fat mass, and increased functionality, positive effects on mental health such as self-confidence, reduced anxiety and depression, and improved quality of life in people with SCI.

In order to reduce sedentary time and increase physical activity, Faulkner et al. (2021) studied robotic-assisted gait training (RGT) in people with SCI. The study used the wearable RGT exoskeleton for a total of 90 min with five consecutive days of practice. And the results demonstrated increases in time spent upright (13 min; 46% increase), walking (14 min, 140% increase), and stepping (330 steps; 170% increase). But did not meet ASCM's (American College of Sports Medicine) guidelines (Faulkner et al., 2021) which recommend 30 minutes minimum of moderate-intensity aerobic activity, five days a week, 20 minutes minimum of vigorous-intensity aerobic activity, three days a week, and muscle strengthening activities 2 days a week for all healthy adults (American College of Sports Medicine, Physical Activity Guidelines). It, also, showed improved cardiovascular health. However, another study by Escalona et al. (2018) found that 85% of the participants with SCI met at least a moderate level of physical activity while walking with the robotic exoskeleton in an 18-session overground locomotor training program (2–3 sessions per week). And it demonstrated cardiorespiratory health benefits while incorporating the program.

1.3 Physical activity

Physical activity is any type of movement by the body by contraction of skeletal muscles, that results in energy expenditure. Types of physical activity include leisure, transport, household, education, and occupational activities (Tomasone et al., 2022). Depending on the nature of the activity, everyday physical activity can be divided into lifestyle, and leisure-time (Arora & Saskatchewan, 2014).

1.3.1 Leisure-time physical activity

Leisure-time physical activity (LTPA) refers to any physical activity performed during an individual's leisure time resulting in energy expenditure with benefits of psychological, social, and physical health (Phang et al., 2012). LTPA can be measured by using the Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI). It is a SCI-specific, self-report tool measures the type, frequency, duration, and intensity of all physical activity performed in the past 3 days (Phang et al., 2012). The types of activities include exercise, sports, and active play (including with children or pets) (Tomasone et al., 2022). And, examples of leisure-time physical activities for people with SCI consist of wheeling (i.e., self-propelling one's own wheelchair), arm/hand cycling, resistance training, walking, playing sports such as wheelchair basketball, wheelchair rugby, sledge hockey, wheelchair tennis, boccia, and wheelchair curling, gardening, woodworking, taking the dog for a walk, playing with children, general fitness activities such as yoga, aerobic fitness classes, and tai chi, fishing, standing, and swimming (Tomasone et al., 2022).

Participation of LTPA differs according to the culture and seasons. Urbański et al. (2021) found that people with SCI engaged LTPA more in spring and summer than in autumn and winter. Kim et al. (2021) stated that LTPA had an impact on the development of active coping strategies that result in increased life satisfaction for individuals with physical disabilities and it is important to promote LTPA participation by recreational therapists and activity professionals. Table 3 demonstrates examples of physical activities according to LTPA category (Ginis et al., 2008).

Table 3

Examples of Activities in the LTPA Category

LTPA category	*Specific examples*
Resistance training	Lifting weights Resistance band exercises
Cardiovascular exercise	Arm or leg ergometry Body-weight supported treadmill training Wheeling Aerobics Pool walking Functional electrical stimulation
Sports participation	Basketball, rugby, sledge hockey, volleyball, athletics, skiing, billiards, bowling, water skiing
Play	Playing with children Playing with pets Playing catch
Hobbies	Gardening Woodworking

Note. Adapted from " Establishing evidence-based physical activity guidelines: Methods for the Study of Health and Activity in People with Spinal Cord Injury (SHAPE SCI)," by K.M. Ginis et al., 2008, *Spinal Cord*, 46, 216–221.

1.3.2 Intensity of physical activity

The intensity of physical activity is the effort that needs to perform an activity or exercise and can be described as either absolute or relative intensity. Absolute intensity refers to the energy required to use activity such as calories or joules of energy per minute, oxygen uptake, or the metabolic equivalent of the task. Calories and joules are measurements of energy needed to heat by the body, and oxygen uptake is the transportation and utilization of oxygen in a person during exercise. The MET is the unit that shows the amount of energy used by the body during activity (Arora & Saskatchewan, 2014).

In relative intensity, energy expenditure can be expressed as maximal oxygen uptake reserve (VO2 max) or heart rate reserve (HRR). The VO2max is the maximum oxygen consumed in 1min whereas HRR is the difference between maximal and resting heart rate. The absolute and relative intensity of physical activity can be divided into mild, moderate, and heavy intensities. Furthermore, exercise intensity can also be identified by subjective measurements such as the Borg Rating of Perceived Exertion (RPE), and physiological (breathing or heart rate, skin, or muscle temperature) (Arora & Saskatchewan, 2014). Table 4 shows the classification of physical activity intensity.

Table 4

Classification of Physical Activity Intensity

	Relative Intensity			Absolute Intensity	
Intensity	$\dot{V}o_2$max (%) Heart Rate Reserve, %*	Maximal Heart Rate, %	RPE	Intensity	METs
Very light	<25	<30	<9	Sedentary	1–1.5
Light	25–44	30–49	9–10	Light	1.6–2.9
Moderate	45–59	50–69	11–12	Moderate	3.0–5.9
Hard	60–84	70–89	13–16	Vigorous	≥6.0
Very hard	≥85	≥90	>16		
Maximal	100	100	20		

Note. Adapted from “Guide to the Assessment of Physical Activity: Clinical and Research Applications,” by Scott J. Strath et al., 2013, *Circulation*, 2259-2279. Copyright 2013 by American Heart Association.

1.3.3 Exercises for People with Spinal Cord Injury

In the cases of SCI, it is impossible to be prevented from getting the injury and so, engaging in effective treatments is critically important (Ahuja et al., 2017). People with chronic SCI were less active and 22% were completely inactive (Rocchi et al., 2017).

Performing exercises regularly is essential on a daily basis for people with chronic SCI as they have more chance to suffer cardiovascular disease, osteoporosis, and muscular weakness additionally (Miller, 2021). If an individual has the ability to move around in a wheelchair, it represents independence and increased social participation (Willig, 2019). Therefore, as acute care and intervention programs are crucially important to prevent further medical complications, subsequent rehabilitation programs are also important to be functionally independent and better quality of life.

To obtain the fitness, health, and well-being of people living with SCI, they should involve in exercise, sports, and physical activity, especially leisure-time physical activity (LTPA) (Ginis, Úbeda-colomer, et al., 2021). Exercises that provide greater benefit for persons with SCI include;

- Aerobic exercise to maintain cardiovascular health and prevent secondary conditions
- Strength training to maintain and improve the ability to perform activities of daily living and mobility, to aid in transfers, and to prevent injury through muscular balance
- Flexibility training to improve range of motion and reduce spasticity (Best Exercises for Persons with SCI, n.d.)

1.3.3.1 Aerobic

The maximal volume of oxygen consumed per unit time (VO2max) is to measure cardiorespiratory fitness in the general population (Willig, 2019). Exercise prescription for cardiovascular fitness is needed to be safe and effective and considers the individual's health status, baseline fitness, goals, exercise preferences, as well as neurological level of injury (Jackson et al., n.d.). And, Willig (2019) stated that low levels of aerobic fitness occur in people with chronic SCI. Therefore, in the aerobic training program, it is important to begin with lower intensities and short duration and then, intensity and duration should be gradually increased until meeting the targeted training goals (Miller, 2021). Aerobic exercise programs for upper limbs, such as arm ergometer, hand cycling, and wheelchair ergometer/propulsion are beneficial mainly to cardiorespiratory fitness and body composition for individuals with wheelchair-dependent SCI (Willig, 2019). Example of aerobic exercise training is shown in Table 5.

Table 5

Aerobic Exercise Training for Individuals with Spinal Cord Injury

Type of training	Frequency	Intensity	Time (Duration)
Modes of training • Arm-crank ergometry • Electrical stimulation cycling • Wheelchair treadmill	• Begin with 1session/week • Progress to 2-3days/week	• Begin with light to moderate intensity of 30% to <60% of VO2 or HRR, 55-70% of MHR, or RPE of 9-13 on the Borg 6-20 point scale • Increase intensity gradually	• Begin with 15-20 minutes sessions • Increase gradually to 30 minutes sessions
VO2=oxygen consumption; HRR=heart rate reserve; MHR=maximal heart rate; RPE=rating of perceived exertion.			

Note. Adapted from "Aerobic and Resistance Training for Individuals With Spinal Cord Injuries," By Joshua M. Miller, 2021, *Strength and Conditioning Journal*, 43(6), 1-8. Copyright by National Strength and Conditioning Association.

1.3.3.2 Strength training

Strength training refers to training in which resistance or weight applied to a working muscle is gradually increased (Jackson et al., n.d.). One Repetition Maximum (1 RM) is the maximum amount of weight or resistance that a person can lift or move to complete the movement in one repetition (Jackson et al., n.d.). In terms of resistance, it can be used with body weight, free weights, machines, or powerbands (O'Reilly et al., n.d.). People with SCI have a problem with decreased muscle mass over time unless they have engaged in exercise or physical activity during the rehabilitation process. It is a crucial role to maximize the available muscular function and regain muscle strength. In addition, as SCI people are wheelchair users, they have used the upper trunk, particularly the upper limbs for wheelchair mobility, functional independence, and activities of daily living (ADL) (Willig, 2019).

SCI population should do the exercises to improve strength as a part of their routine throughout their life (Flank, 2016). Especially, People with cervical spine injury require rehabilitation for movement and strength recovery of the upper body and probable respiratory training (Borms et al., n.d.). Also, wheelchair mobility skills are essential, especially for individuals with paraplegia. To possess the skills, the upper limbs need to be strengthened and it is vital for full community participation and the performance of various activities of daily living (ADLs) (Phang et al., 2012). O'Reilly et al., (n.d.) differed the repetition of strength training with low, moderate, and high, <5 Reps, 6-15 Reps, and 15-30 Reps respectively. Additionally, Jackson et al., (n.d.) suggested an effective dosage of progressive resistance training; 1-3 sets of 8-12 repetitions with a rest of 1-3 minutes between sets, 8-12 Repetition Maximum (60-70% of 1RM), 2-3 times a week. An example of strength/resistance training is shown in Table 6.

Table 6

Resistance Training for Individuals with Spinal Cord Injury

Type of training	**Frequency**	**Intensity**	**Time (Duration)**
Modes of training • Weight training machines and free weights • Bodyweight resistance • Elastic tubing • Household items (i.e., cans and jugs)	• Begin with 1 or 2 sessions per week • Progress to 3 or 4 d per week; can divide body parts into the split program	• Begin with 8–10 exercises with resistance of 40–60% of 1RM. • Emphasis placed on multijoint exercises Increase intensity gradually to 65–85% of 1RM	• Start with 1 set per exercise of 10– 12 repetitions. • Increase to 2–3 sets per exercise gradually. Recovery period between multiple sets may be necessary of 1– 2 min
1RM = 1 repetition maximum			

Note. Adapted from "Aerobic and Resistance Training for Individuals With Spinal Cord Injuries," By Joshua M. Miller, 2021, *Strength and Conditioning Journal*, 43(6), 1-8. Copyright by National Strength and Conditioning Association.

A systematic review by Ginis et al., (2017) found the effects of exercises on the fitness of adults with SCI. The study indicated that aerobic and strength exercises improved cardiorespiratory and muscle strength while the aerobic exercise alone required more frequency and longer duration to gain the targeted goals. However, muscle strength exercises provided for both cardiorespiratory fitness and muscle strength. Wolfe et al., (2013) also incorporated that moderate intensities of aerobic exercise or resistance training can significantly lead to improve cardiovascular fitness and physical work capacity in persons with SCI. And, the evidence indicated that regular exercise reduces post-SCI pain, including shoulder pain.

1.3.3.3 Flexibility training

People with SCI (especially upper motor neuron lesions) usually experience increasing in muscle tone (spasticity) and is leading to joint contracture and changes in muscle length (Jackson et al., n.d.). The majority of spinal injured individuals have muscle contractures and stiffness. Regular flexibility exercises can reduce muscle contractures, increase muscle extensibility, and joint range of motion (ROM) (Achparaki et al., 2021). And for SCI people, they are likely to sit leaning forward constantly and push the wheelchair forward. Therefore, to prevent them and muscle tightness, flexibility is necessary to maintain in shoulders, arms, and back (Petrie, 2020).

The types of flexibility training according to National Center on Health, Physical Activity and Disability (NCHPAD), are passive and active resistance, theraband and standing in a standing frame (if not medically contraindicated) (Flexibility Training Guidelines, n.d.).

The American College of Sports Medicine (ACSM) guidelines describe that adults with SCI should try to do flexibility exercises at least two to three days per week to improve their range of motion (Summers & Moss, 2003). Stretching is most effective when the muscle is warm so always do some light to moderate aerobic activity beforehand. Summers & Moss (2003) stated the some factors to do flexibility, they are performing stretching as a warm-up and cool-down before and after exercises. Static stretches need to hold for 10-30 seconds or to develop flexibility further, it is required to hold stretches for at least 60 seconds (Summers & Moss, 2003).

2 Aim of the study

This thesis aims

1) to measure the leisure-time physical activity (LTPA) by using PARA-SCI interview for Czech people with paraplegia,
2) to examine the relationship between LTPA and the demographics and injury characteristics of people with paraplegia and examine the nature of their actual physical activities spent in their free time.

Research questions

1) Do Czech people with paraplegia meet the scientific exercise guidelines while participating in LTPA?
2) What kind of physical activities do they do in their leisure time?
3) Do men or women participate more based on the intensity levels of LTPA?
4) Do men more participate in LTPA than women based on the time spent per day?
5) Do the level of injury affect on participation in LTPA?

3 Methods

3.1 Participants

Participants were 58 in total, 48 men and 10 women, with paraplegia (mean age 41.8 years, range 24–67 years, SD 9.73) recruited from a list of people who had previously agreed to participate in the data collection. The majority were men (83%), all the participants were paraplegia (Th1-L2), and originally from the Czech Republic. Participants met the following study inclusion criteria: (1) 12 months or more after SCI, (2) no cognitive impairment, (3) 18 years of age or older, and (4) used a wheelchair as the primary mode of mobility outside the home. Informed consent was obtained from all participants.

3.2 Measures

3.2.1 Leisure-time physical activity

To assess LTPA, the SCI-specific physical activity recall assessment for people with spinal cord injury (PARA-SCI) was used. The Physical Activity Recall Assessment for People with SCI (PARA-SCI), a SCI-specific, 3-day activity recall measure of all physical activity performed, was completed according to a standardized, semi-structured interview protocol by Ginis & Latimer (2008). The PARA-SCI was administered over the telephone by an interviewer and included: demographic and impairment details including the level of injury (paraplegia vs tetraplegia). Before the interview, participants received a chart with validated SCI-specific definitions of 4 PA intensity levels: nothing at all (no physical effort), mild (very light physical effort), moderate (some physical effort), and heavy (maximum physical effort). Participants used this chart during the interview to rate the intensity of each PA recalled over the previous 3 days (two days during weekdays (Thursday and Friday) and one day during the weekend (Saturday)), indicating the time they woke up and went to sleep each day. And, all activities performed were reported, including LTPA (for example, sports or going for a walk/wheel) and activities of daily living (ADLs) (for example, dressing, grocery shopping, or transfers). For the purposes of the present study, only LTPA data were analyzed. The PARA-SCI was scored by calculating the mean number of minutes of LTPA per day performed at each intensity. And, different activities performed in their leisure or free time on the number of 3 days in a week were also recorded.

3.2.2 Demographic characteristics

Participants reported their age, sex, height, weight, and residential location. All categorical variables were assessed with fixed response options and coded prior to analysis. Moreover, participants reported years post-injury and level of injury. Years post-injury were calculated as the number of years between the injury date and the interview. Injury severity was coded and the level was categorized as high paraplegia (Th1 – Th6) and low paraplegia (Th7 – L2).

3.2.3 Data Management

PARA-SCI data were calculated average minutes a day of LTPA performed at a low, moderate, and high intensity over a 3days period. Statistical data was processed in the program Exel.

4 Results

4.1 Demographics and injury characteristics

In Table , the mean ± SD values of age, and time since injury, the general characteristics regarding to gender, level of injury, residential location, BMI, and years post-injury, as well as the percentage of time and the amount of min/day spent on LTPA are presented. 58 participants had completed the PARA-SCI interview and were included in this study. Their mean age was 41.8 years, their mean time since injury was 10.8 years and the majority (83%) were men. Participants reported approximately 85 min per day spent on LTPA. Men were more active than women. The distribution of participants in SCI severity was seen more in low paraplegia (57%) and the majority lived in cities (33%) and towns (34%). 60% were in the range of normal BMI, where 22% reported overweight and 9% reported underweight and obese. Mostly (47%) are 5-15 years after injury. In the variables of BMI and years after injury, it was reported 57 participants. LTPA decreased as years post-injury.

4.2 Leisure-time Physical Activity

32% (33min/day) performed low intensity LTPA, 38% (39min/day) performed moderate-intensity LTPA and 14% (15min/day) performed high intensity LTPA. In

Figure ***5*** and

Figure **6**, the percentages of time spent on LTPA according to the duration (min/day) at the low, moderate, and high levels of intensity among men and women are presented. Both men and women were at the highest with a moderate level of LTPA.

Type of LTPA; In Table 7, the types of reported LTPA among the participants are presented. The most frequently reported activities were stretching and strengthening exercises (29%), wheeling (22%), hand biking(22%), gardening (22%), and playing floorball (22%).

Table 5

LTPA (in min/day and percentage) as Demographics and Injury Characteristics of Czech People with Paraplegia completing the PARA-SCI (n=58)

Variables		% time in total LTPA	Mean min/day
Gender (n (%))			
Men	48 (83)	84	87
Women	10 (17)	16	77
Age (year, mean±SD; range)	41.8±9.7; 24-67		
Time since injury (year, mean±SD; range)	10.8±8; 2-30		
Level and severity of injury (n (%))			
SCI Th1 – Th6	25 (43)	43	84
SCI Th7 – L2	33 (57)	57	85
Residential location (n (%))			
Capital	10 (17)	19	94
City	19 (33)	34	85
Town	20 (34)	32	80
Village	9 (16)	15	80
BMI (n=57) (n (%))			
Underweight	5 (9)	8	82
Normal	34 (60)	67	98
Overweight	13 (22)	19	98
Obese	5 (9)	5	54
Years post injury (n=57) (n (%))			
< 5	18 (32)	33	91
15-May	27 (47)	46	85
>5	12 (21)	21	85

Note. PARA-SCI = the physical activity recall assessment for people with spinal cord injury; SD = standard deviation; BIM = body mass index; Paraplegia; SCI Th1 – Th6 = high paraplegia; SCI Th7 – L2 = low paraplegia.

Figure 5

Percentage of Low, Moderate, and High LTPA in Czech Men with Paraplegia

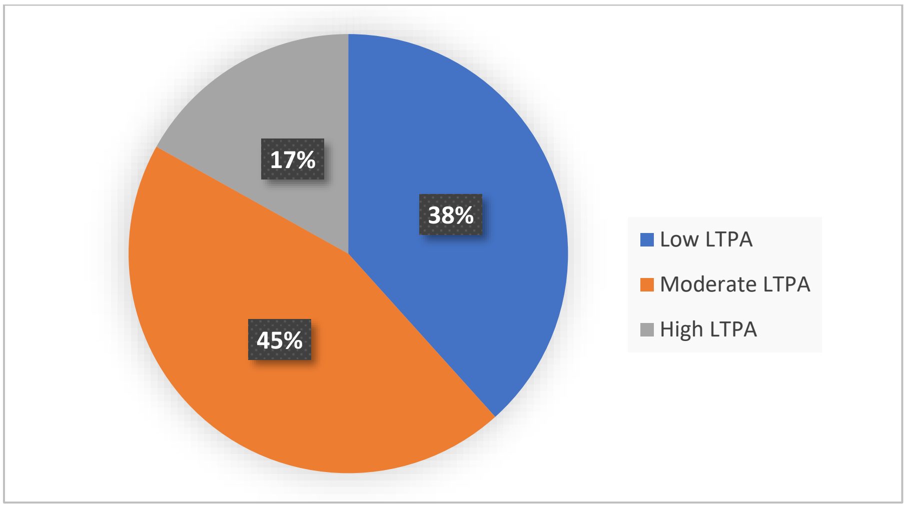

Figure 6

Percentage of Low, Moderate, and High LTPA in Czech Women with Paraplegia

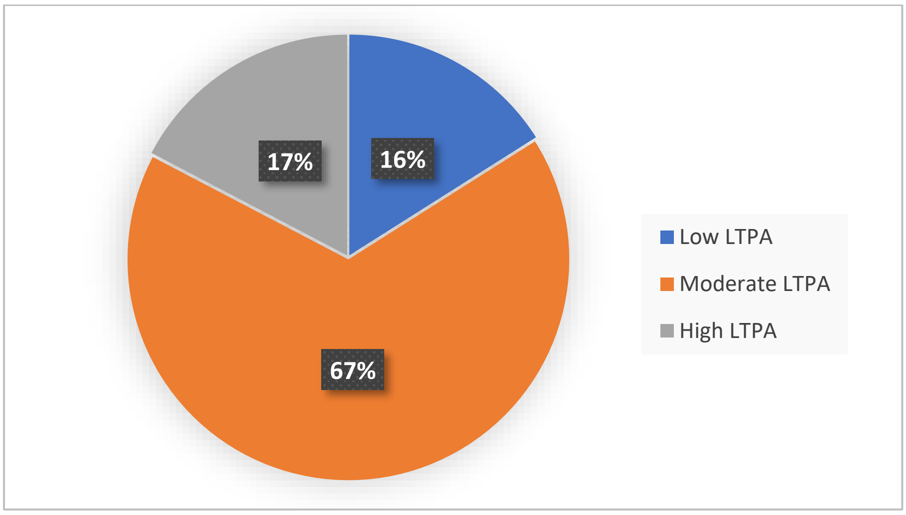

Table 7

Types of Activities reported by Czech People Paraplegia (n=55)

Type of activity	n (%)
Stretching and strengthening exercises	16 (29)
Wheeling	12 (22)
Handbiking	12 (22)
gardening	12 (22)
Playing floorball	12 (22)

Walking with dog	10 (18)
Swimming	9 (16)
Exercise in gym	9 (16)
Play with children or pets	8 (15)
Other sports (yoga, table tennis, athletics)	6 (11)
Playing instruments (guitar, piano)	4 (7)
Skiing	3 (5)
Riding on guard bike & a scooter	2 (4)
Shopping	2 (4)
Party or celebration	2 (4)

5 Discussion

This is a study to assess LTPA and the prevalence of leisure-time physical inactivity and associated factors in a Czech population with paraplegia. Normally the data is not accurate in frequency, activity time per week, or work intensity by using self-reported physical activity (Flank, 2016). And, the measurement findings of physical activity with PARA-SCI are not very reliable as the participants have to recall the time spent on activities from the previous 3 days and the physical activity levels could, probably, vary from time to time or day by day. However, using the PARA-SCI interview, there are advantages compared with other PA assessments. PARA-SCI is for a population with SCI specifically and the shorter duration for application and data collection, as well as the content-rich details about the type of physical activities and exercise-specific behaviors (Eitivipart, 2021).

Leisure activities are a main source of pleasure for all if they can do any activity depending on their circumstances and preferences. And, for the SCI population, activities in leisure time are the easiest and most effective way of not having a sedentary lifestyle and other additional demands, such as money or time. For example, people with SCI can be physically active while they are reading or watching TV in their daily routines. Therefore, they can easily engage in LTPA with freedom, enjoyment, and no barriers (I. T. Kim et al., 2011). LTPA is strongly associated with life satisfaction and self-esteem.

However, the majority of the people with SCI are having a sedentary lifestyle because of many reasons such as secondary complications, lack of motivation, family or social support, etc. Therefore, they need to increase awareness and knowledge about the benefits and effectiveness of LTPA, and healthcare associations and professionals also try to promote SCI-specific guidelines or recommendations for participation in LTPA. In this study, the average amount of LTPA of total low, moderate, and high intensity was 85 min/day, whereas

33min/day with a low level of intensity, 39min/day with moderate, and 15min/day with high. In order to meet scientific exercise guidelines for SCI (see Table 2), it is possible to meet CDC's PA guidelines (Blauwet & Donovan, 2016) (20-25 min/day of moderate-intensity aerobic exercise or 10-11 min/day of vigorous-intensity aerobic training), SCI-specific PA guidelines (Evans et al., 2015; Ginis et al., 2018; Rocchi et al., 2017) and scientific exercise guidelines for SCI (at least 10 min/day of moderate-to-vigorous intensity aerobic PA).

WHO exercise recommendations are generally challenging and high for both tetraplegia and paraplegia. The majority of individuals with SCI do not meet the current physical activity recommendations (Rocchi et al., 2017). However, the study by Rauch et al. (2016) found that SCI people in Switzerland met the WHO exercise recommendations with PA high levels. The other studies by Rocchi et al. (2017) and Hoevenaars et al. (2022) showed achieving the SCI-specific exercise recommendations among the participants.

The most frequently performed activities during the free time of this study were exercising (stretching and strengthening), wheeling, gardening, and hand biking. These physical activities were also reported as commonly practiced by patients with SCI in previous studies; for example, in the study of S Jörgensen et al. (2017), the most common activities for LTPA were wheeling and walking, I. T. Kim et al. (2011) found wheeling, sports such as lawn ball, and stretching exercises as most common activities and outdoor activities, exercise, and gardening in the study of Lundström et al. (2014). The reason why these studies showed similar results is probably because these activities are easier for patients with SCI to access than other exercises. Among them, wheeling is the most common activity because of using a wheelchair in daily living.

In this study, most of the leisure time physical activities were implemented at a moderate level of intensity (45% in men and 67% in women). The results showed that men participated more in low-level activities than women (38% vs 16%), but women participated more in moderate-level (45% vs 67%). The same percentage (17%) of men and women participated in a high level of activities. Oppositely, by self-reported physical activity, Swedish people with SCI were low participation in moderate or vigorous-intensity (Flank, 2016).

The energy expenditure and physical activity levels were found to be greatly influenced by demographic variables (Ginis et al., 2010; S Jörgensen et al., 2017; Perrier & Ginis, 2016). And, other studies have also reported that hours of participation in LTPA are correlated with personal characteristics such as gender, age, years post-injury, and the degree of injury (K. A. M. Ginis et al., 2010; Pitsavos et al., 2005; Lundström et al. 2014). The results of this study showed that the areas of leisure activities reported by males versus that of females were 84% (87min/day) versus 16% (77min/day). A study by Pitsavos et al. (2005) found a similar percentage of men (53%) and women (48%) in activities engaging. In the study of K. A. M. Ginis et al. (2010), males were more physically active than women but those aged > 34 years are commonly inactive. of men and women were classified as physically active.

We could see that men are more active and have higher participation in activities than women in almost every study. It is possible to depend on the intrapersonal and interpersonal factors for PA participation. Between them, intrapersonal factors, such as experiences, emotions, and secondary health problems, are one of the main reasons for being not willing to incorporate the activities. Likewise, interpersonal factors, such as social, and cultural networks, and support (family, friends, peers), are encouraged to participate more. In terms of society and culture, women may restrict their mobility and participation by surrounding people’s attitudes and cultural rules.

The level of the injury is significantly associated with leisure-time physical activity engaging (Lundström et al., 2014). The results of this study showed that people with low paraplegia (Th7 – S2) engaged more in LTPA with 57% compared with high paraplegia (Th1 – Th6) (43%). K. A. M. Ginis et al. (2010) also found that manual wheelchair users and motor-complete paraplegia were associated with the highest LTPA levels. After SCI, people with SCI encounter increased sedentary lifestyle, and cardiorespiratory health (Farkas et al., 2020), and decreased mobility and social participation (Lemay et al., 2012). The level of injury (tetraplegia vs low paraplegia) is related to the manual wheelchair skills of people with SCI (Lemay et al., 2012). People with low paraplegia, especially, are more capable of mobility, activities, and social participation compared with high paraplegia because the motor and sensory functions are higher in high paraplegic people.

To promote an active lifestyle for the SCI population, accessibilities and barriers are significantly important to consider. Kerstin et al. (2006) stated that role models are also important facilitators for participation in physical activity. Besides, five levels of the social-ecological model (intrapersonal, interpersonal, community, institutional, and public policy) help to promote PA interventions for the aspect of related professionals. For SCI survivors, exercise after the injury from acute hospital care to long-term rehabilitation is a crucial role.

Gym Exercise Program for Paraplegic T5 as an Example

Health and functional performance can improve with regular exercises after SCI. Everyday activities are not enough to maintain cardiovascular fitness in people with SCI (Blauwet & Donovan, 2016). Regular exercise (in a gym or home-based) helps to improve and maintain the person's ability, muscle strengthening, and cardiovascular health. In terms of exercise program, it includes three parts; stretching, aerobic exercise, and strength training. Gym Exercise is for muscle strengthening by using machines, especially for the upper limbs. People with paraplegia need to strengthen their shoulders, arm, and back muscles for their functional independence.

Table 8

Possible Upper Limbs Exercises for Paraplegia T5 in a Gym

Exercise	Instruction	Muscle
Triceps press	Grasp the handles, keep the back straight, contract stomach muscles while contracting the triceps to press the weight down. Stop before the arms are completely straight, and slowly return to the starting position.	Triceps (shoulders, abdominal and upper back)
Butterfly chest press	Grasp the handles straight, Press your arms together in front of your chest with a slow, controlled movement together with stomach muscles contraction, stop with closed arms, and open the arms to the starting position.	Pectoralis
Adaptive rowing	Sit on the rowing machine with arms straight, back upright, and knees and ankles flexed, lean forward slightly, keeping back tall, push with legs while contracting the core, pull the handle towards the torso, legs are straight, and lean back to about 45 degrees.	Arms, legs, shoulders, back, and core
Arm and leg pedal	Sit on the bike, hold the handles, strap the feet with the footrest, adjust the weight, and bike the pedal.	Shoulders, arms, and legs
Arm swinging (using SkiErg)	Grasp the handles, extend the arm back of the wheelchair maximally with core contraction, and return to the starting position above the head.	Shoulders and arms

For each exercise; 5-10 Reps, 2-3 sets, rest 1-2 min between sets

Frequency and duration: 20-30 min/day and 2-3 days/week

Intensity: Start with a low weight and increase the weight slowly

During exercise need to avoid painful positions and overuse. Shoulder pain is the most common overuse injury in people with SCI (Blauwet & Donovan, 2016). Besides these possible exercises, free weights, dumbells, and theraband can be used for the specific upper limbs' muscles either in a gym or at home.

Strengths and Limitations of the Study

There were limitations in this study. The study did not assess all domains of physical activities including occupational. The other limitations are associated with a self-report measure of LTPA, such as recall bias and misunderstanding of questionnaire items (K. Arbour-nicitopoulos et al., 2012). And, the subjects for this research were recruited from SCI people with paraplegia. However, the PARA-SCI interview is the most practical approach for conducting SCI population-level assessments of LTPA. Like objective measurement of physical activity, such as an accelerometer, cannot distinguish physical activity between LTPA and ADL and also, may not use a direct measure of LTPA.

6 Conclusion

In conclusion, the present study demonstrates that most of the Czech people with SCI met the current physical activity recommendations necessary for promoting health and preventing secondary complications, except for WHO exercise recommendations. The areas of leisure activities in which they had most likely experienced changes after the SCI were outdoor activities, exercise, wheeling (in the park), and gardening. And based on time spent on LTPA, the intensities with which physical activities were used implemented were at an appropriate level (moderate). The study also showed an association between gender, level of injury, and leisure-time physical activity.

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doc. Mgr. Erik Sigmund, Ph. D.
Mgr. Zdeněk Svoboda, Ph. D.

Na základě žádosti ze dne 11.1.2016 byl projekt doktorské práce

autorky **Mgr. Jarmily Štěpánové**

s názvem **Standardizace polostrukturovaného rozhovoru PARA-SC I sloužícího k analýze intenzity a objemu pohybové aktivity osob se spinální lézí**

schválen Etickou komisí FTK UP pod jednacím číslem: 4/2016

dne: 23.2.2016

Etická komise FTK UP zhodnotila předložený projekt a **neshledala žádné rozpory** s platnými zásadami, předpisy a mezinárodními směrnicemi pro výzkum zahrnující lidské účastníky.

Řešitelka projektu splnila podmínky nutné k získání souhlasu etické komise.

za EK FTK UP
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předsedkyně

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