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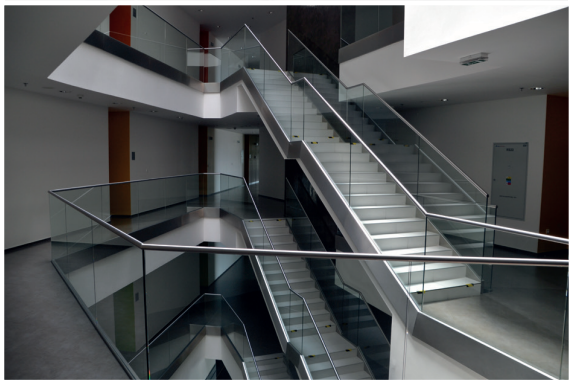

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## Reviewers

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# EDITORIAL

**Dear Readers**,

The journal "Zdravotníctvo a sociálna práca" (*Health and Social Work*) was renamed in 2021 to International Journal of Health, New Technologies and Social Work.

Our long-term effort is to gradually acquire for the journal European significance and be included in international databases. Starting with issue No. 4 in 2016, the journal accepted the Harvard style of referencing, and changed guidelines for the authors. The aim of the changes was to move closer to the standard in international journals published in English in the area of health and helping professions. The editors are aspiring for registration in other relevant international databases. Since last 2020 the journal has published all articles in English only.

The journal "Zdravotníctvo a sociálna práca" (*Health and Social Work*) was established in 2006 at Faculty of Health and Social Work blessed to P.P. Gojdič in Prešov and St. Elizabeth University College of Health and Social Work in Bratislava. In 2020, the journal celebrated its 15th year of publication.

Previously professional journal, within 5 years developed into an international, peer-reviewed scholarly journal, published quarterly (4 issues per year). The journal were published by the St. Elizabeth University of Health and Social Work in Bratislava. The journal became international in 2009. The journal was published and distributed in the Slovak Republic and also in the Czech republic.

Since 2011, the journal is published both in print and as electronic issues, available from: www.zdravotnictvoasocialnapraca.sk. Starting by issue No. 3 in 2014, the scope of the journal has broaden and the journal is covering health sciences, such as Public Health, Nursing, Laboratory Medicine, but also helping professions such as Social Work or Pedagogy. Collaboration with Faculty of Health and Social Work of Trnava University in Trnava was initiated.

The journal is indexed in the following databases: Central and Eastern European Online Library – CEEOL (since 2018), Bibliographia Medica Slovaca (BMS), and Slovak reference database CiBaMed.

The part of journal is Supplementum, to publish abstracts from international conferences organized by the St. Elizabeth University of Health and Social Work in Bratislava. In 2020, the conference was planned, similarly to last year, in Ustroń, Poland. Due to the unfavorable epidemiological situation, the conference was postponed by the organizers to October 2021.

Prof. Miron Šramka, MD, DSc.
redactor-in-chief

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# Post-COVID syndrome and nervous system

## Postcovidový syndróm a nervový systém

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**ABSTRACT** **Introduction:** The WHO declared COVID-19 a pandemic and a threat to international public health. Many countries are monitoring post-covid syndrome and looking for solutions to prevent the consequences of COVID-19. The pandemic is a serious health and socio-economic problem.

**Research objectives:** Protecting the population from COVID-19 and its consequences requires clinical, diagnostic and epidemiological studies. COVID-19 severely affects the nervous system. It is essential to prevent complications and consequences of the disease.

**Core of Work:** The presented article focuses on consequences of the pandemic on the nervous system. We compare the impact of Spanish influenza and COVID-19. Clinical symptoms of nervous system disease associated with COVID-19 and the effects of coronavirus on the nervous system lead to neurological and psychiatric diseases. It is currently possible to predict the consequences of COVID-19 pandemic by artificial intelligence. COVID-19 models have difficulties coping with the new situation. In addition to the potential for passive treatment based on immunity using antibodies collected from the plasma of cured COVID-9 patients, there is ozone therapy. Post-covid rehabilitation is necessary in the elimination of secondary neurological complications. The use of virtual reality in the rehabilitation process has a particularly motivating effect on the patient.

**Conclusion:** From the current publications dealing with the post-covid situation, it is important to identify the possible consequences of COVID-19 such as post-covid syndrome, neurotic post-traumatic and neurodegenerative diseases, loss and reduction of cognitive functions.

**Keywords:** COVID-19 pandemic, nervous system disorders, mental health, virtual reality, artificial intelligence, Spanish influenza, treatment of consequences COVID-19

**ABSTRAKT** **Úvod:** WHO vyhlásila ochorenie COVID-19 za pandémiu a hrozbu pre medzinárodné zdravie. Mnohé krajiny sledujú postcovidový syndróm a hľadajú riešenie ako predchádzať následkom ochorenia COVID-19. Pandemický stav je vážnym zdravotným a sociálno-ekonomickým problémom.

**Ciele práce:** Ochrana obyvateľstva pred ochorením COVID-19 a jeho dôsledkami si vyžaduje klinické, diagnostické a epidemiologické štúdie. Ochorenie COVID-19 výraznou mierou postihuje nervový systém. Je nevyhnutné predchádzať komplikáciám a následkom ochorenia.

**Jadro práce:** V práci popisujeme dôsledky pandémie na nervový systém, porovnávame vplyv Španielskej chrípky a ochorenia COVID-19. Klinické príznaky nervového ochorenia spojené s ochorením COVID-19 a účinky koronavírusu na nervový systém vedú k neurologickým a psychiatrickým ochoreniam . V súčasnosti je možné predikovanie dôsledkov pandémie COVID-19 umelou inteligenciou. COVID-19 modely sa ťažko vyrovnávajú s novou situáciou, nedokážu vyriešiť problémy, tak ako je schopný ľudský mozog. Okrem potenciálu pasívnej liečby založenej na imunite s použitím protilátok zhromaždených z plazmy uzdravených pacientov je aj ozónová terapia. Nevyhnutná je postkovidová rehabilitácia pri odstraňovaní sekundárnych neurologických komplikáciách Využitie virtuálnej reality v procese rehabilitácie má pre pacienta obzvlášť motivačný charakter.

**Záver:** Zo súčasného prehľadu publikácií zameraných na situáciu po pandémii je dôležité identifikovať možné následky ochorenia COVID-19 ako je postkovidový syndróm, neurotické posttraumatické a neurodegeneratívne ochorenia, stratu a zníženie kognitívnych funkcií.

**Kľúčové slová:** pandémia COVID-19, poruchy nervového systému, psychické zdravie, virtuálna realita, umelá inteligencia, Španielska chrípka, liečba dôsledkov COVID-19

## INTRODUCTION

The WHO declared COVID-19 a pandemic and a threat to international public health (WHO COVID 2021).

The past well-mapped pandemic is the Spanish flu, with the first wave in the spring of 1918, quickly spread throughout the world. The pandemic was caused by the H1N1 influenza virus, whose gene segment sequence was not mapped until 2006 (Taubenberger 2006). The virus infected more than 500 million people worldwide (Barro *et al.* 2020), about 30% of the world's population, and caused 50 to 100 million victims (Johnson 2002; Tumpey *et al.* 2005; Taubenberger 2006), about 4% of the population.

Measures of public health and the media influence created a profound climate suspicion and mistrust (Cohn 2018). Fear of a lethal influenza dramatically altered social interactions (Phillps *et al.* 2003). In addition to economic and psychological problems after 1920, Parkinson's disease manifested as a consequence of Spanish influenza 30-50 years later (Dvorak *et al.* 1973; Hayase 1997).

Due to the similarities between pandemics, the health and economic impacts of the current COVID-19 pandemic are monitored (Brainerd *et al.* 2003).

## CONSEQUENCES OF SPANISH INFLUENZA AND COVID-19

Most of the victims of the Spanish flu were young adults. This differs from standard influenza outbreaks, which tend to affect



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young and older population. The Spanish flu killed people aged 15-34 (Mamelund 2011). The Spanish flu and the associated condition of social disruption and generalized mistrust had permanent consequences on individual behaviour. These were inherited in some way by the descendants of immigrants to the United States (Aassve *et al.* 2021). The spread of influenza in Italy and the high mortality rate in the country was enhanced by the fact that the peak of influenza coincided with the end of the First World War. Hunger, hardship, transfers of soldiers and refugees, this all contributed to the spread of influenza. In 1920, 35% of the Italian population died of influenza aged 20-40 (Erkoreka 2010; Kolata 2020). The gradual reduction of cases of Spanish flu occurred at the end of 1920 (Vilensky 2007).

The number of deaths from COVID-19 has risen significantly over the age of 50, in contrast to Spanish flu (NCHS 2021). In the US, younger people are at higher risk that the old ones due to adverse mental health symptoms, increased narcotics use, suicidal ideation during a pandemic, and an increase in anxiety and injuries compared to previous years (CCMH 2021). At the turn of 2020 and 2021 (the second wave of the pandemic), the British variant hit Europe and the situation got worse. As a result of the increased vaccination at the beginning of 2021, the situation began to improve in April 2021. Many countries are monitoring post-covid syndrome and looking for solutions to prevent the consequences of COVID-19.

The COVID-19 pandemic also has an impact on social and economic life. Due to widespread uncertainty and new circumstances, the pandemic knocked the global economy down. For more than a year, the number of diseases has been increasing, countries have closed their borders, trade has fallen sharply, and GDP has fallen in the entire world. Social life has almost stopped due to restrictions.

## CONSEQUENCES OF THE PANDEMIC ON THE NERVOUS SYSTEM

Protecting the population from COVID-19 and its consequences requires clinical, diagnostic and epidemiological studies. A distinction must be made between complications such as hypoxic encephalopathy, acute neuropathy, including infectious, para-infectious and post-infectious encephalitis. Other complications include hypercoagulable conditions, nervous system diseases, changes and consequences on the mental state of patients after overcoming COVID-19.

It will be challenging to recognize nervous system disease associated with COVID-19 in which the infection is moderate or asymptomatic. If primary COVID-19 is accompanied with olfactory and taste disorders, patients should be isolated as soon as possible (Moein *et al.* 2020). These patients can have serious neurological and psychological consequences. Neurological disorders occur in the central nervous system (CNS), the peripheral nervous system (PNS) and the psyche (PS). They may occur in the absence of other clinical symptoms. Acute cerebrovascular disease is another serious complication of COVID-19. The risks in patients due to severe acute respiratory syndrome SARS-CoV-2 vary with age and comorbidity (Fang *et al.* 2020). Clinical symptoms of nervous system disease associated with COVID-19 and the effects of coronavirus on the nervous system lead to neurological and psychiatric diseases (Varatharaj *et al.* 2020). Published changes and diseases have been described as Parkinson's disease, encephalopathy, encephalitis, neuropsychiatric diagnoses, psychosis, dementia-type neuro-

cognitive syndrome, and affective disorders (Ellul *et al.* 2020).

Neurological symptoms usually occur with the onset of respiratory symptoms preceded by cough and fever with irritability, confusion, and decreased consciousness, sometimes associated with seizures (Bernard-Valnet *et al.* 2020; Sohal *et al.* 2020), psychotic symptoms (Vollono *et al.* 2020) and renomination (Wong *et al.* 2020). Encephalitis, such as inflammation of the brain parenchyma caused by infection or the body's immunity, has been described in association with COVID-19 infection. Like encephalopathy, changes of personality, behaviour, cognition, consciousness disorder, delirium, or coma (Slooter *et al.* 2020). In patients with encephalopathy and COVID-19 who do not have encephalitis, it may be caused by hypoxia, drugs, toxins, and metabolic disorders (Solomon *et al.* 2012). Patients with severe respiratory disease experienced dizziness, headache and consciousness disorder. Acute disseminated encephalomyelitis (Zanin *et al.* 2020; Zhang *et al.* 2020), multifocal demyelinating syndrome (Dugue *et al.* 2020; Helms *et al.* 2020; Mao *et al.* 2020; Paniz-Mondol *et al.* 2020; Zhou *et al.* 2020) acute haemorrhagic necrotizing encephalopathy (Poyiadji *et al.* 2020) and myelitis (Zhao *et al.* 2020) have occurred.

Nervous system diseases described in association with COVID-19 include: Guillain-Barré syndrome, acute polyradiculopathy with progressive symmetrical limb weakness and sensory disorders, loss of sensitivity (Toscano *et al.* 2020), facial nerve impairment, dysphagia (Camdessanche *et al.* 2020), respiratory failure (Zhao *et al.* 2020), ophthalmoplegia (Gutiérrez-Ortiz *et al.* 2020; Dinkin *et al.* 2020), ataxia with areflexia, acute vestibular syndrome (Escalada-Pellitero *et al.* 2020), rhabdomyolysis (Jin *et al.* 2020). Miller Fisher syndrome is included among other neuropathies (Gutiérrez-Ortiz *et al.* 2020). Neurological symptoms with changes in magnetic resonance imaging (MRI) of the brain have been reported eight months after infection (Nuzzo *et al.* 2021).

The pandemic is a serious health and socio-economic problem. More frequent neurological manifestations (Chen *et al.* 2020), over time (Carfì *et al.* 2020), neurological and neuropsychiatric disorders, anosmia, ageusia, dysgeusia, headache, muscle and joint pain, fatigue and brain fog, may persist for months (Rudroff *et al.* 2020). They can lead to delirium and psychosis, inflammatory syndromes, strokes (Rudroff *et al.* 2020; Morgul *et al.* 2020; Satici *et al.* 2020; Iadecola *et al.* 2020). Headaches and cognitive disorders, including mental confusion, delirium, and dementia, have been described (Liotta *et al.* 2020). Encephalopathy can occur mainly in the elderly with pre-existing chronic diseases (Nuzzo *et al.* 2020). Cognitive decline and dementia in those over 60 years of age with a predisposition to cerebrovascular disease, arterial hypertension, diabetes, or dyslipidaemia have a higher risk of ischemic stroke during COVID-19 (Qureshi *et al.* 2020). Peripheral nervous system involvement, acute neuropathy and poly-neuropathy, Guillain-Barré syndrome cause nerve impairment with consequent loss of muscle strength, while also respiratory muscles are affected (Webb *et al.* 2020). Difficulty with walking, weakness in the lower limbs, lack of pelvic girdle muscle strength and skin hyperalgesia. Drowsiness and malaise, examination showed diffuse hypotension and limb weakness. Absence of movement in bed and immobilization cause a decrease in muscle mass, chronic fatigue, headaches, finger paraesthesia, anxiety and depression. Hyperintensive areas are detected on the brain MRI in the periventricular and subcortical white matter and centrum semiovale. After five months, neurological disorders occurred along with major depression and seizures (Nuzzo *et al.* 2021). In patients after COVID-19, brain examination should be performed by MRI. Patients with severe COVID-19 need a multidisciplinary team. The neurotropism of SARS-CoV-2 is unclear



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(Harapan *et al.* 2021). Inflammatory eye disease may be the first sign of COVID-19. Red eye is also a symptom of emerging tumours of eyes, orbit, and auxiliary organs (Furdova *et al.* 2020). Chronic eye diseases, such as age-related macular degeneration, head and face oncological diseases, should also be considered, as these diseases may have the same symptoms (Krasnik *et al.* 2014).

The emergence of individual locomotor apparatus disorders and syndromes when using mobile devices during COVID-19 is the result of failure to maintain good posture as well as unsuitable working conditions when working in the home environment (Masan *et al.* 2021). Patients with severe COVID-19 had persistent feelings of physical and mental fatigue, muscle weakness, drowsiness, lack of concentration, and decreased cognitive function. They perceive physical exhaustion and experience feelings of fatigue and lack of energy. It affects their daily lives (Carfi *et al.* 2020; Goertz *et al.* 2020). GABAergic dysfunction underlies fatigue and explains apathy and performance deficits (Orteli *et al.* 2020) that demonstrated the dysexecutive syndrome (Orteli *et al.* 2020; Helms *et al.* 2020). COVID-19 has a negative effect on motivational aspects and a direct correlation has been identified between apathy and depressive symptoms. During the acute phase of COVID-19, a hyperinflammatory condition developed, which was associated with complications of the central and peripheral nervous systems. Altered mental condition, psychosis, affective disorders, neurocognitive disorders (similar to dementia), headache, encephalitis, myelitis, myopathy and/or myositis, Guillain-Barré syndrome and mononeuritis or multineuritis (Filosto *et al.* 2020; Koralnik *et al.* 2020; Romero-Sanchez *et al.* 2020; Zhao *et al.* 2020). 6 months after the onset of the disease symptom, patients experienced fatigue or muscle weakness, sleeping difficulties, anxiety and depression. Patients with severe course of the disease experienced reduced capacity of pulmonary diffusion (Huang *et al.* 2021). Hyperinflammation and endothelitis contribute to the disruption of the blood-brain barrier in the brain (Najjar *et al.* 2020; Najjar *et al.* 2020). The virus enhances hypercoagulability through mechanisms and interrelationships between thrombosis and inflammation (Wang *et al.* 2020). Post COVID-19 Neurological Syndrome (PCNS) with prolonged muscle weakness and forms of myopathy (Wijeratnea *et al.* 2020c). A study of the previous SARS epidemic reported active central nervous system involvement and chronic fatigue even after four years of infection (Chan *et al.* 2003; Lam *et al.* 2009). COVID-19 has been associated with varying degrees of depression, sleep disorders, and anxiety in healthcare professionals with COVID-19 (Junhua *et al.* 2020). Studies have shown signs of severe post-traumatic stress disorder (PTSD) (Bo *et al.* 2020). Asymptomatic or mildly symptomatic patients experience long-term symptoms such as muscle pain, dizziness, headache, fatigue, and anosmia for months (Goërtz *et al.* 2020). Particular attention needs to be paid to inflammation markers in peripheral blood, in particular the ratio of neutrophils to lymphocytes, C-reactive protein, D-dimers, serum ferritin (Wijeratne *et al.* 2020a).

As with the Spanish flu, acute and long-term neurological manifestations can be expected, especially in the elderly. Interdisciplinary research teams focused on minimizing long-term neurological damage will benefit the global community (Wijeratnea *et al.* 2020b).

## ARTIFICIAL INTELLIGENCE FOR PREDICTING THE CONSEQUENCES OF COVID-19

Machine learning (ML) algorithms assume consistency between the past and the future. When things change, models fail. COVID-19 has changed our habits, and therefore our data. COVID-19 models have difficulties coping with the new situation (Ružicky *et al.* 2021). The COVID-19 pandemic has highlighted the need for

rapid and viable predictions of health threats. Searching data on social media to monitor influenza and other events in real time (i.e. "Nowcasting") has become a major focus for public health, informatics and other disciplines. One of the cited examples of using search query data to predict disease is Google Flu Trends (GFT 2015).

While digital trace data from sources such as search engines have huge potential for tracking and understanding human behaviour, this data stream lacks information about the actual experiences of the people generating the data. In addition, most current methods ignore or make insufficient use of human thinking capabilities to solve problems that computers have not yet been able to solve, just as the human brain is able to make correct predictions (Wojcik *et al.* 2021).

## TREATMENT METHODS OF THE COVID-19 CONSEQUENCES

In addition to the potential for passive treatment based on immunity using antibodies collected from the plasma of cured COVID-9 patients, there is ozone therapy (Masan *et al.* 2021). It combines a mixture of oxygen $O_2$ and $O_3$. Ozonides are able to release oxygen, thereby raising pH in degenerative processes and/or ischemic conditions (Di Mauro *et al.* 2019; Smith *et al.* 2017). Ozone activity protects against oxidative stress-induced apoptosis (Smith *et al.* 2017; Sagai *et al.* 2011). Oxidative stress can contribute to neuronal damage. It affects the pathogenesis and progression of neurodegenerative diseases (Singh *et al.* 2019). In neuroprotection, activation by mechanisms (calorie restriction, physical exercise, polyphenols) may be a way to improve health (Zhang *et al.* 2015; Schmidlin *et al.* 2019; Silva-Palacios *et al.* 2018). Antioxidants can act in neurodegenerative diseases (Leri *et al.* 2020; Calabrese 2020). Ozone increases blood flow through the brain, improves metabolism and regulates chronic oxidative stress. Neuronal cells can reactivate the synthesis of antioxidant enzymes, which is essential to normalizing the redox state and blocking cell death. Therapeutic directions for the treatment of neurodegenerative diseases include stem cells, rehabilitation with virtual reality, electromagnetic fields and ozone therapy (Mitrecic *et al.* 2020). Ozone treatment supports blood circulation to the tissues, has an immunomodulatory effect, energetic effect of the organism, regenerative and reparative properties. It appears to be an effective treatment method with no side effects.

Clinical and experimental studies to determine the optimal dosing regimen and to evaluate the combination of ozone therapy with other treatment methods are aimed at increasing the effectiveness of treatment of post-covid neurological syndrome. Phototherapy, sunlight, is effective in reducing mortality and morbidity from influenza and the spread of infection among population (Roelandts *et al.* 2005). Patients with severe infections exposed to sunlight have recovered better than patients treated indoors. Treatment prevented patient deaths and infections in healthcare professionals (Hobday 2009). Pulsed blue light at 450 nm is 40 to 100 times more effective than blue light; it alleviates opportunistic bacterial infections associated with COVID-19, and has the potential to inactivate viruses (Masson-Meyers *et al.* 2020; Bumah *et al.* 2020).

Post-covid rehabilitation is necessary in the elimination of secondary neurological complications, respiratory insufficiency, cognitive disorders, disorders of coping with normal activities, disorders of swallowing and communication, post-covid psychosis and memory disorders. The minimum recommended rehabilitation time is 2 to 4 weeks, depending on the severeness.

## VIRTUAL REALITY

The key elements in the use of virtual reality as a rehabilitation method are the effects creating



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emotional changes that motivate the patient to rehabilitate (Šramka *et al.* 2020), using both the classical approach and virtual reality. The use of virtual reality in the rehabilitation process has a particularly motivating effect on the patient. The created virtual environment and the focus on fulfilling demanding game instructions have a direct impact on the quality of individual rehabilitation exercises. As patients pointed out, they prefer a realistically processed 3D scene, in terms of the created environment, in which it is possible to move around comfortably and focus directly on the activity performed.

## CONCLUSION

At the beginning of the pandemic, there was information about olfactory loss, followed by reports of other symptoms such as headaches, confusion, hallucinations and delirium, depression, anxiety and sleep problems. SARS-CoV-2 virus was thought to enter the brain along the olfactory nerve and the symptoms were related to the brain inflammation. High-resolution post-mortem MRI with COVID-19 confirmed microvascular damage and fibrinogen leakage in the brain. Clots, inflamed epithelium and barrier leaks can contribute to brain damage associated with COVID-19. Inflammatory signals can change the way the brain creates neurotransmitters – serotonin, norepinephrine and dopamine, which help nerve cells communicate. The relationship between inflammation and mental illness in athletes was confirmed by repeated blows to the head. Similar evidence suggests that people with depression have high levels of inflammation. After a year of the pandemic, depression and anxiety are on the rise. This increase can be particularly sharp in people who have had stressful diagnoses, illnesses and isolation. From the current publications dealing with the post-covid situation, it is important to identify the possible consequences of COVID-19 such as post-covid syndrome, neurotic post-traumatic and neurodegenerative diseases, loss and reduction of cognitive functions.

## Conflict of Interest

None

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# Skeletal muscle damage in Covid-19 disease and its social-psychological aspects

## Uszkodzenie mięśni szkieletowych w chorobie covid-19 i jej aspekty społeczno-psychologiczne

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**ABSTRACT**

**Introduction:** The health risks associated with the COVID-19 virus apply not only to the period of acute infection but also to people who are already ill. It is already known that pathological changes affect virtually every human organ. We do not know all the complications, especially the long-term ones, but they will be a challenge for services, not just for medical services.
**Aim:** The article describes the impact of the Covid-19 virus on the human body and its pathological changes that occurred in the people who overcome coronavirus.
**Core:** Skeletal muscles play a very important role in the biochemical processes of the human body, above all they enable the performance of movements. During the disease, the muscles lose their mass and weaken significantly.
The article presents an evaluation of muscles selected from the literature in patients with COVID-19 and possible causes of reduced skeletal muscle efficiency and endurance. At the same time, the possibility of facing pathologies occurring in the muscles was indicated, with special emphasis on the use of physical exercises. Physiotherapists play an important role in the period of re-convalescence.
**Conclusion:** Proper, often long-term cooperation of treatment teams with patients makes it possible to restore the functional abilities of muscles before the disease period.

**Key words:** COVID-19 virus, skeletal muscles, muscle damage, physical training

**STRESZCZENIE**

**Wprowadzenie:** Zagrożenia zdrowotne jakie związane są z wirusem COVI-19 nie dotyczą tylko okresu ostrej infekcji, ale i osób, które już przechorowały. Wiadomo już, że patologiczne zmiany obejmują praktycznie każdy narząd człowieka. Wszystkich powikłań, szczególnie tych długoterminowych jeszcze nie znamy, jednak stanowić one będą wyzwania dla służb, nie tylko medycznych.
**Cel:** W artykule opisano wpływ wirusa Covid-19 na organizm człowieka oraz jego zmiany patologiczne, które zaszły u osób, które pokonały koronawirusa.

**Tekst podstawowy:** W artykule przedstawiono wybrane z piśmiennictwa oceny mięśni u chorych na COVID-19 oraz potencjalne przyczyny obniżenia sprawności i wytrzymałości mięśni szkieletowych. Wskazano jednocześnie na możliwość przeciwdziałania patologiom występującym w mięśniach, ze szczególnym uwzględnieniem stosowania ćwiczeń fizycznych. W tym obszarze istotną rolę pełnią fizjoterapeuci.

Mięśnie szkieletowe pełnią bardzo istotne role, przede wszystkim umożliwiają wykonywanie ruchów, ponadto odpowiadają za procesy biochemiczne organizmu człowieka. Mięśnie w trakcie choroby zmniejszają swoją masę i ulegają znacznemu osłabieniu.

**Streszczenie:** Poprawna, niejednokrotnie długotrwała współpraca zespołów leczniczych z chorymi umożliwia przywrócenia sprawności funkcjonalnej mięśni sprzed okresu choroby.

**Słowa kluczowe:** wirus COCID-19, mięśnie szkieletowe, uszkodzenie mięśni, ćwiczenia fizyczne

## INTRODUCTION

The COVID-19 pandemic has lasted for almost a year and a half. This time proved to be very difficult for all societies, more than 150 million people in the world have been treated due to this virus, and unfortunately, almost 3.5 million died (updated 05/05/2021). The measure against the coronavirus has led to the development of knowledge about this unknown virus, its complications and has indicated the need for different methods of treatment. The symptoms of the disease are well known at his times (Odyniec, Rożniewski 2020), which are very diverse and heterogeneous. SARS-CoV-2 virus infection affects all systems and organs in the human body. We will mention only the most important in the respiratory, circulatory, and neurological systems. In the respiratory system, the pulmonary alveoli are damaged, causing difficulty in exchanging air at an intensity that does not cause the least risk for acute respiratory failure requiring intensive treatment (Chen *et al.* 2020). On the other hand, myocardial infarction and inflammation occur in the circulatory system, heart rhythm is impaired, and heart failure worsens. Thromboembolic complications are common and life-threatening. COVID-19 infection increases the risk of thromboembolic complications during the acute period of the disease, but also after the recovery process (Zhao *et al.* 2021; Gasecka *et al.* 2021). Serious complications of the nervous system include stroke and light but important for the quality and comfort of life is the so-called brain fog causing impaired concentration, short-term memory, and confusion. These pathologies may persist for longer periods after overcoming the infection (Taquet *et al.* 2021; Sramka *et al.* 2020), is often accompanied by anxiety and depression. SARS-CoV-2 virus particles have been isolated from various tissues in the body, including the digestive system, central nervous system, and heart.

SARS-CoV-2 virus can cause serious illness in adults and cause death. In children, the course of the disease is usually mild, but even in this population, especially in the case of new virus mutations, the state of life is often endangered.

One of the symptoms of a viral infection is muscle pain, which occurs in about 35% -50% of patients, muscle development and/or dermatomyositis. Skeletal muscle is the largest tissue in the human body and it is one of the tissues affected by SARS-CoV-2 the most (Nasiri *et al.* 2020). Muscle pain, fatigue is some of the main symptoms of the virus (Zhu *et al.* 2020). The



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extent and duration of muscle pain depend mainly on the severity of the disease (Finsterer, Scorza 2021). The experience of hospitalized patients suggests that muscle pain is associated with an abnormal lung picture, with an unfavorable prognosis, especially in elderly people (Zhang *et al.* 2020).

The exact mechanism of muscle damage in patients with COVID-19 is uncertain. As well as the long-term consequences for convalescents, it is difficult to predict at this stage of knowledge. It is not possible to determine unambiguously what effects mutations in viruses will have, because muscles, in addition to static and dynamic work, also play other roles, such as those involved in glucose metabolism.

## ASSESSMENT OF MUSCLE FUNCTIONS OF PATIENTS WITH COVID-19

Using computed tomography (CT) to assess body composition (Ufuk *et al.* 2020], significant metabolic changes and quantitative reductions in lean body mass (LBM) has been demonstrated Gualtieri (2020), mainly in obese patients. Patients with Covid-19, as well as convalescents, often have a significant loss of body weight (Haraj *et al.* 2021). Skeletal muscle dystrophic damage is suspected in this group of patients (Jin, Tong 2020).

Laboratory studies focused on 27% of hospitalized patients showed a significant increase in biomarkers of muscle loss, such as creatine kinase (CK) (Disser *et al.* 2020). Increased keratin kinesis was observed in elderly patients with the severe course and comorbidities (Pitscheider *et al.* 2020). Higher values of CT index indicate damage and/or inflammation of the heart and skeletal muscles. A disturbing observation, also in young patients with renal failure, is the breakdown of muscle cells. Rhabdomyolysis, detected by magnetic resonance imaging (MRI), is caused by infection with the SARS-CoV-2 virus in these patients, and the symptoms are characteristic. A conscious patient initially reports symptoms such as muscle tenderness, muscle pain, swelling (may not occur until the patient is hydrated), muscle stiffness, and contractures with subsequent weakening and loss of function (within muscle groups affected by rhabdomyolysis). There is a dark or red-brown color of urine associated with the presence of myoglobin (Sarwiński 2012).

During the diagnosis of pulmonary fibrosis, the cross-section of the pectoral muscles was also assessed. The found weakening of these muscles results in poorer ventilation of the lungs. On this basis, it is possible to conclude about the respiratory efficiency in critically ill patients, even about survival (Ufuk *et al.* 2020). Survivors studied had a reduced voluntary contraction of the quadriceps (54%) and biceps (69%) from the normal value (Paneroni *et al.* 2021).

The evaluation of skeletal muscle endurance and physical fitness of patients who recover from Covid-19 can be performed by spirometry tests, using tests (e.g. six-minute walk or other short tests) and cardiopulmonary tests (exercise tests). Measurements of the circumference of the lower and upper limbs and chest mobility may be helpful in assessing the progress of rehabilitation.

## FOUND CONSEQUENCES OF SKELETAL MUSCLE DAMAGE

Numerous observations of the effects of the Covid-19 pandemic suggest significant pathologies, especially in the respiratory, circulatory, and muscular systems. They apply to hospitalized and mildly symptomatic patients and to patients without any symptoms. The above test results indicate the reduced functional efficiency required to perform even normal daily activities. Weakness and shortness of breath during activities and physical activities are closely related to limited muscle strength. Other observations of people not affected by Covid-19, including the relationship between health and quality of life (SF-36), suggest a very close relationship and a

low level of the range of physical domains (Knapik 2019). Decreased mobility and quality of life, especially during a pandemic, are associated with concomitant depression (Paneroni *et al.* 2021). Decreased motor neuron action potential in Covid-19 rhabdomyolysis patients has been observed by electromyography despite normal nerve conduction (Rosato *et al.* 2020). Damage to the motor and sensory fibers has also been observed in patients after several months of convalescence (He, Chen 2020). In short, such skeletal muscle damage in the future can cause disability of varying severity, and thus worsen the quality of life of convalescents.

## POTENTIAL MECHANISMS OF SKELETAL MUSCLE PATHOLOGY IN PATIENTS WITH COVID-19

The unambiguous cause of pathology in skeletal muscle is difficult to determine, it can be assumed that it is the result of several interrelated factors. Elderly people were affected by Covid-19 during the first periods of the pandemic. Metabolic and inflammatory disorders (obesity, cancer and cardiovascular disease, diabetes) have been reported in this group of patients, and protein and energy problems are common. Old age is often associated with sarcopenia (Strzelecki, Ciechanowicz, Zdrojewski 2011), which contributes to the weakening of muscle strength and endurance. In addition, older people usually declare less physical activity, so they do not build up the reserves that may be needed for prolonged immobilization and subsequent convalescence. Changes in muscle structure and physiology in the elderly can be significant (Pitscheider *et al.* 2020).

Weight loss can be caused by anorexia. Generalized cachexia has been reported in patients treated with COVID-19 at home and in hospitalized patients. However, greater weight loss was recorded in the hospital and intensive care unit (ICU). Decreased body weight and muscle loss have been observed in obese patients (Di Filippo *et al.* 2020). This may be due to the need for intubation and forced mechanical ventilation causing accelerated protein loss. Essential drugs administered to critically ill patients (e.g. Dexamethasone) can also cause muscle damage and immobilization of supine muscles (Welch *et al.* 2020). Forced abdomen, necessary in the treatment of critically ill patients, causes immobility, ie a lack of any physical activity.

The main cause of spinal cord pathology is catabolism, which breaks down the breakdown of complex chemical bonds in the partial part, most commonly the protein. They come to something when the rest of the body is supplied with a small amount of energy sufficient to consume. The organism is then assembled for the purpose of stocks: unglowed, fat and white. (Głażewski, Dyrla, Gil 2017). Since the largest white matter is found in the months, the weight of the catalytic action begins to be a matter of course. Flammability and inflammatory tents shall be considered as serious factors affecting the development of cytokine exchanges in persons rescuing COVID-19. In such a situation, the active production of cytokines - a protein stimulating other chambers of immunological deposition in specific reactions – (https://www.newscientist.com/definition/cytokine-storm/).

Excess cytokine is extremely low and stores many tools, including the vitreous, which obscure the birth (Welch *et al.* 2020). The main causes of spinal and pathological pathology link with anorexia, boredom and excrements, also including some patients with COVID-19. No need to provide energy in the state of the bowie head is a major factor in the breakdown of proteins in the body (Zhan *et al.* 2020). Other one who are able to use hormones to ignite the spinal cord, e.g. testosterone (Zhou, Liu, Yang 2021).

## PREVENTION AND MINIMIZATION OF SPINAL CORD INJURY IN COVID-19 DISEASES

Treatment of patients with COVID-19 must be carried out comprehensively, taking into account all health problems of patients, including comorbidities. In the presented study, we deal with the prevention of loss of muscle mass and efficiency, and when it does, we deal with the regeneration activities of skeletal muscles. First of all, you should take care of a high-protein diet and vitamin D (100-1600 IU / day) combined with exercises to strengthen the muscles (Liao *et al.* 2019). This will help to meet the energy needs of the body and ensure the work of the muscles. Active limb exercises recommended for patients in contact will improve blood circulation and prevent blood clots. Patients in critical health condition should be provided with adequate enteral nutrition (protein and dietary supplements), and passive exercises of the upper and lower limbs should be performed (Cawood *et al.* 2020). Kinesiotherapeutic care is complemented by changing the patient's position. Protein and amino acid supplementation have been reported to reduce disease severity and the effects of immobility (Cengiz *et al.* 2020).

An important element is the respiratory rehabilitation of patients, enables the improvement of lung ventilation and maintains respiratory performance. Patients are offered suitable breathing exercises, which mainly involve the diaphragm and maintain the necessary chest mobility. The patient needs to be positioned correctly and the position changed frequently. Lying people require stimulation of breathing with an emphasis on the work of the diaphragm and activation of the respiratory muscles of the chest.

Neuromuscular electrostimulation can be used to maintain skeletal muscle efficiency in the upper and lower limbs. Alternating muscle contractions will improve blood flow to the muscles and proper tissue nutrition will reduce muscle loss. Manual and mechanical massages may prove effective (Kasprzak 2011).

Any hygienic procedures to which patients are subjected, especially those in critical condition, also have a therapeutic role. Washing with sponges and pads is the perfect complement to physical therapy, as is the forced change of position and position during patient care. It is advised to use sunlight; thus, the synthesis of vitamin D is stimulated. Vitamin D increases the body's resistance and protein synthesis in muscles, and also prevents demineralisation of the skeleton (Rottermund 2012).

The main goal of physiotherapy with the patient who recovered COVD-19 virus, is to restore the patient's fitness to the level from before the infection, thus improving the quality of life. There are a number of specific goals covering the improvement of all organs affected by the disease process. In the presented article, we deal with skeletal muscles, so below we will only present suggestions related to the improvement of muscle strength and general physical fitness. The aim of physical exercise is to gradually increase the activity level and the level of tolerance of exercise loads. The initiation of physical exercises is always based on the assessment of indications for therapy, the patient's possibilities and assessment of treatment progress, taking into account existing and developing complications. The duration of exercises and their pace must be selected individually, with the current assessment of psychophysical parameters and body temperature.

1. Mild form - exercises: breathing, relaxing, active;
2. Severe form (requiring hospitalization) - exercises: respiratory-circulatory, anti-coagulant, slowly active and stressful, relaxation techniques, general fitness training (continuous or interval), standing, bedside exercises, walking;
3. Very difficult form (mechanically ventilated patients) - optimization of breathing, prevention of negative effects of

immobilization, change of body position, passive exercises, gradual activation and mobilization of the patient (antigravity positions), gradual introduction of supported and active exercises;

4. Convalescents (convalescents) - general fitness training, aerobic exercises (walking and faster march, or other more intense forms), breathing and chest stretching, resistance (strength) exercises;
5. Stationary physiotherapy (not fully functional), most often performed at the place of residence - after examination (detailed interview, stress test, assessment of dyspnoea and general fitness) the patient is qualified for one of the models (A, B, C, D, E), which differ mainly in the intensity of teaching hours.

## CONCLUSION

In patients with COVID-19, virtually all organs are damaged. The extent and extent of deficits and effects depend primarily on the course and form of the disease. In addition, each patient has their own specific conditions, different goals, and individual predispositions. Such long-lasting isolation and blocking also changes people's psyche and attitudes towards the environment, thus increasing fear and anxiety.

The skeletal muscles that perform the movements must be fully functional in order to prevent damages. Damage and dysfunction in the muscular system are diverse and are caused by various factors. Accurate diagnosis at the beginning of the disease and regular diagnosis after it will make it possible to identify the causes with immediate treatment. Treatment teams include the fight against impending pathologies. Today, the medical world is somewhat familiar with the dangers of the COVID-19 virus, making it easier and more effective to treat patients. However, it is still unknown what long-term effects will be visible in human organisms.

When indicating the basic goals of rehabilitation, we must not forget that the patient with COVID-19 is treated and is treated as a psychosomatic unit, which also has other diseases and health problems. Their neglect during therapy will prolong the return to full condition and achieve satisfaction with the entire rehabilitation process. With good cooperation between the treatment teams and the patient, it is possible to restore the functional effectiveness of the muscles before the disease. In situations of significant pathology and general exhaustion of the organism, this process may prove to be significantly longer.

## Conflict of interest

The authors declare there is no conflicts of interest in the connection with the published article.

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# Patient-related risk factors for periprosthetic joint infection

## Pacient z pohľadu rizika infekcie totálnej kĺbnej endoprotézy

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**ABSTRACT** **Introduction:** Periprosthetic joint infection is still a serious surgical complication with incidence of 0.5 – 2 %. Prevention is the most effective therapeutic method of infectious complications. Recognizing and treating modifiable patient-related risk factors for infection can significantly reduce the risk of periprosthetic infection.

**Objective:** The aim of this study is to provide a comprehensive summary of individual modified patient-related risk factors for periprosthetic joint infection and suggest recommendations for minimizing post-surgery infectious complications.

**Findings:** There are several studies examining general and local patient-related risk factors for infection in joint replacement surgery. General risk factors mainly include comorbidities, smoking and alcohol abuse. Local risk factors are the presence of chronic skin infections and skin defects associated with venous insufficiency.

**Conclusions:** A total joint replacement is almost always an elective procedure, which allows the surgeon to prepare the patient for the surgery and thus minimize the risk of periprosthetic joint infection. It is essential to identify and treat modified patient-related risk factors for infection. Personal discussion with the patient preoperatively is very important, to sensitized him to the risk of infection, screening and prevention. However, there is no patient without a risk of infection complications.

**Key words**: arthroplasty, periprosthetic joint infection, prevention, risk factors, comorbidities

**ABSTRAKT** **Úvod:** Periprotetická infekcia je v súčasnosti stále závažnou komplikáciou v ortopédii s incidenciou 0,5-2 %. Prevencia je najúčinnejším spôsobom v snahe zabrániť infekcii. Identifikácia a liečba rizikových faktorov periprotetickej infekcie vo vzťahu k pacientovi, môže výrazne redukovať riziko infekčných komplikácií.

**Cieľ:** Cieľom tejto práce je predstaviť aktuálne literárne poznatky o jednotlivých modifikovateľných rizikových faktoroch infekcie vo vzťahu k pacientovi a ponúknuť praktické odporúčania na minimalizáciu pooperačných infekčných komplikácií.
**Zistenia:** Existuje viacero štúdií popisujúcich celkové a lokálne rizikové faktory periprotetickej infekcie vo vzťahu k pacientovi. Medzi celkové modifikovateľné rizikové faktory patria hlavne komorbidity, fajčenie a nadmerné užívanie alkoholu. Z lokálnych faktorov ide najmä o prítomnosť chronických infikovaných kožných defektov, často súvisiacich s chronickou venóznou insuficienciou.
**Závery:** Totálna kĺbna náhrada je takmer vždy elektívnou operáciou, čo chirurgovi umožňuje pripraviť pacienta na operáciu a tak minimalizovať riziko rozvoja periprotetickej infekcie. Je nevyhnutné identifikovať a ak možno liečiť modifikovateľné rizikové faktory infekcie vo vzťahu k pacientovi. Taktiež je potrebné predoperačné poučenie pacienta o riziku infekcie, potrebe jej prevencie, ako aj o dôležitosti skríningu jednotlivých rizikových faktorov infekcie.

**Kľúčové slová:** artroplastika, periprotetická infekcia, prevencia, rizikové faktory, komorbidity

## INTRODUCTION

Total hip and knee arthroplasty provides significant pain relief in patients suffering with osteoarthritis, while restoring the range of motion, as well as the actual function of these weight-bearing joints, and thus significantly improves the quality of patients' life (Bozic *et al.* 2014). Despite the great success of this surgery, periprosthetic joint infection with the incidence of 0.5 – 2 % reported in the literature is a relatively rare but devastating complication (Figure 1 and 2), and is one of the main causes of endoprosthesis failure (Maier *et al.* 2014). Treatment of periprosthetic joint infections is very demanding from a surgical, psychological and economic point of view (Figure 3 and 4). This treatment is often associated with multiple surgeries, long-term a of antiobiotic treatment and challenging recovery. In some cases, even a revision joint replacement after treatment of the infection ends up with a failure and poor functional outcome (Tomáš *et al.* 2008). Due to the increasing number of implanted endoprostheses, an increase in the number of periprosthetic joint infections is expected in the near future simultaneously (Bozic *et al.* 2014). Despite the established perioperative methods of infection prevention, it is necessary to focus on the identification and management of patient-related medical risk factors for infection, particularly comorbidities.

Morbid obesity, diabetes mellitus and rheumatic diseases are reliably identified as significant risk factors for infection (Baek *et al.* 2014). However, there is individual variability in the evaluation of other comorbidities, such as coagulopathy, preoperative anemia, cardiovascular diseases, chronic obstructive pulmonary disease, chronic kidney disease, chronic venous insufficiency of lower extremities, depression and psychosis. Local risk factors that must be identified prior to surgery are the presence of chronic skin infection, especially erysipelas and dystrophic skin changes associated with venous insufficiency. A history of septic arthritis and osteomyelitis around the joint also increases the risk of infection after implantation of total joint replacement. Likewise, implantation in a post-traumatic case or after previous repeated operations may pose as a risk (Tomáš *et al.* 2008).

Strategies to reduce the incidence of periprosthe-tic infection should begin with consideration of modifiable "patient - related"



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**Figure 1** X ray of periprosthetic joint infection of total knee replacement, loosening of tibial component (Source: Photo P. Polan).

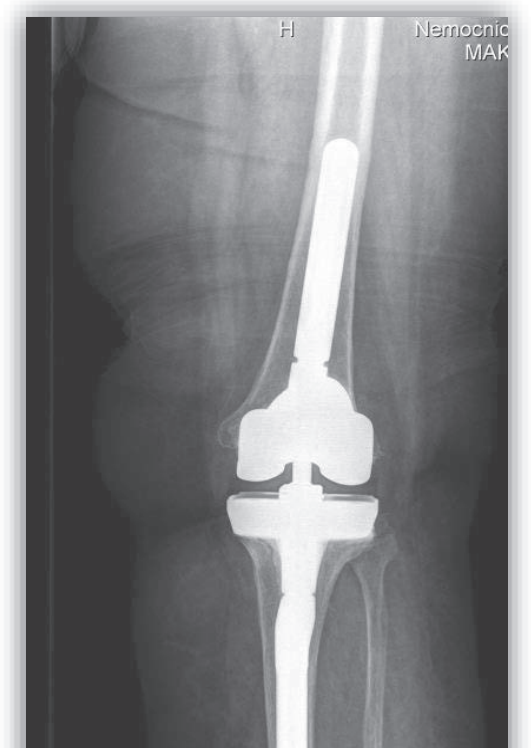

**Figure 1** X ray after reimplantation of revision total knee replacement after periprosthetic joint infection (Source: Photo P. Polan).

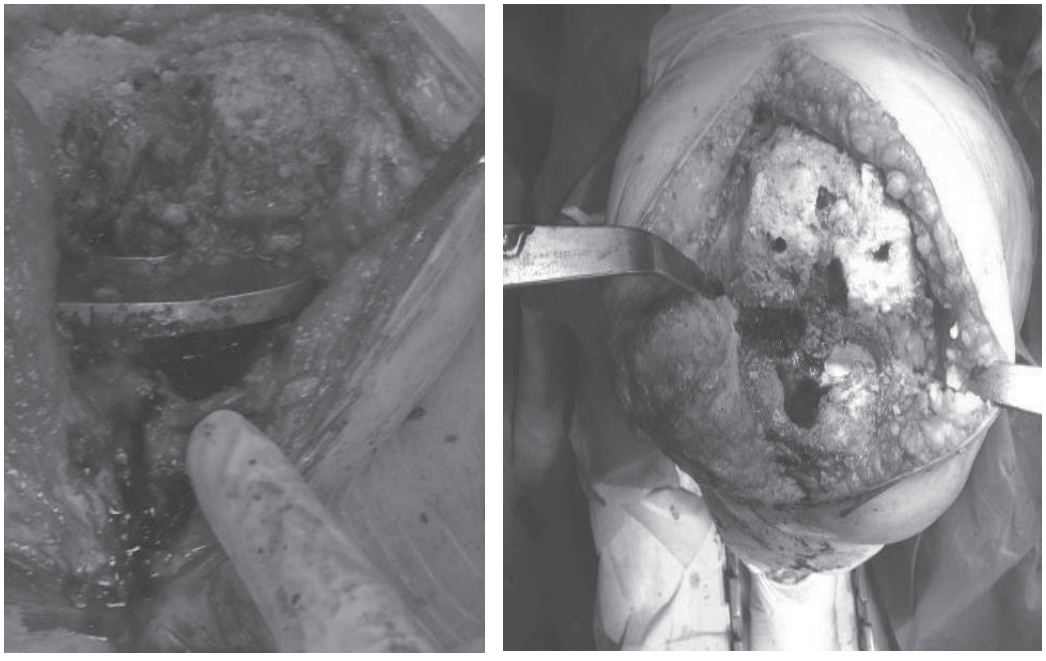

**Figure 3** intraoperative pictures show loosening of the tibial component on the left side and explantation of infected knee replacement on the leftside (Source: Photo P. Polan)

**Figure 2** clinical picture of periprosthetic joint infection of the hip (Source: Photo P. Polan)

medical risk factors for infection. It is essential for orthopaedists to know these factors, identify them before the planned implantation of a total joint replacement, and then responsibly consider each indication and timing for surgical treatment.

## GENERAL RISK FACTORS FOR PERIPROSTHETIC JOINT INFECTION

### Morbid obesity

Obesity is associated with an increased risk of developing other comorbidities, such as diabetes mellitus, ischemic heart disease and arterial hypertension. Obese patients are more likely to undergo replacement surgery, however, they also face an increased risk of perioperative complications (Arsoy *et al.* 2014). These patients face a higher risk of developing an infection compared to patients without obesity. The risk is up to 73 % higher for hip replacements and 22 % higher for knee replacements (Baek *et al.* 2014). In patients with a BMI over 40, the risk of periprosthetic joint infection is 3.3 times higher, and in patients with a BMI over 50, the risk is up to 21 times higher than in non-obese patients (Chen *et al.* 2013). Indirectly, the risk of infection in obese patients also increases due to prolonged operative time and the increased need for blood transfusion (Liabaud *et al.* 2013). These patients are also at risk in terms of surgical wound healing disorders. More frequent occurrences of surgical wound dehiscence, surgical wound hematoma and prolonged serous secretion from the surgical wound have been reported.

Preoperative weight reduction with a BMI below 40 should be recommended for obese patients in order to reduce the risk of developing a periprosthetic joint infection in an elective surgery.

### Hyperglycemia and poorly compensated diabetes mellitus

Diabetes mellitus significantly increases the risk of developing osteoarthritis, with the incidence of diabetes in patients with total knee arthroplasty being 12.2 % (Yang *et al.* 2014). Periprosthetic joint infection in diabetic patients occurs in 1.59 % of total hip replacement patients and 2.19 % of total knee replacement patients, against 0.66 % and 0.48 % of non-diabetic patients (Jämsen *et al.* 2012). Level of adequate treatment and/or diabetes compensation is also crucial. The level of glycated hemoglobin in the blood, which is a criterion for sufficient long-term compensation for diabetes, is reported by many



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authors at 7 %. In a patient with poorly controlled diabetes, the risk of early postoperative wound infection is significantly higher. Periooperative hyperglycemia is another risk factor for periprosthetic joint infection; it has been proven that hyperglycemia over 20 mmol/l doubles this risk (Mraovic *et al.* 2011).

We know from our own experience that compliance of diabetic patients is sometimes low. Working with these patients preoperatively, in outpatient check-ups is (all the more) required in order to minimize the risk of postoperative complications, mainly (the) infection.

**Rheumatoid arthritis**

Almost 5 % of patients with endoprosthesis have rheumatoid arthritis. Several studies identify this disease as a risk factor for periprosthetic joint infection, with the infection risk being 71 % higher for hip replacement and 18 % higher for knee replacements than in patients without rheumatoid arthritis (Berbari *et al.* 1998). The disease itself, the associated diseases, as well as the immunosuppressive treatment contribute together to an increased infectious rate in rheumatics.

Immunosuppressive treatment includes corticosteroids (e.g. prednisone) and drugs from the group of DMARDs (e.g. methotrexate), which inhibit the production of inflammatory mediators and thus the immune response of the mechanism (Momohara *et al.* 2011). Postoperative wound healing disorders are more common in these patients. Several studies have shown that discontinuation of methotrexate perioperatively (1 week before and after the surgery) reduces the risk of periprosthetic joint infection (Giles *et al.* 2006). The International Organization for Periprosthetic Joint Infection recommends discontinuing immunosuppressive therapy prior to elective implantation of endoprostheses and has issued therapeutic recommendations for specific immunosuppressants (Table 1). Perioperative consultation with the patient's rheumatologist is beneficial.

**Table 1.** Recommendations for iscontinuation of immunosuppressive therapy prior to implantation of a total joint replacemenet according to the International Society for Periprothetic Infection

| **Recommendation / interruption of treatment** | **Drug** |
|---|---|
| It is recommended to continue therapy until and including the day of surgery | Hydroxychlorochin /Plaquenil/ |
| Discontinue at least 1 and a half weeks before surgery | Etanercept |
| Discontinue 3 weeks before surgery | Infliximab |
| Discontinue one month before surgery | Adalimumab, Tocilizumab |
| Discontinue 6 weeks before surgery | Leflunomid |
| Discontinue 2 months before surgery | Rituximab |
| Discontinue the week before surgery | NSAID, Allopurinol, Colchocine, Probenecid, Sulfasalazin, Azatioprin, Methotrexate |

Source: Baek 2014

**Malnutrition**

Malnutrition is a significant risk factor for periprosthetic infection. It increases the risk of developing serious complications of surgical wound healing up to 7 times and also prolongs patient's hospitalization (Astin *et al.* 2011). The incidence of malnutrition in healthy patients and paradoxical malnutrition in obese patients are not

uncommon. Multiple studies suggest serum albumin levels less than 3.5g/dL and total lymphocyte counts of less than 1500 cells/mm3 are associated with poor wound healing potential. Nutritional deficits should be specifically targeted in patients at risk for cachexia, morbid obesity, malignancy, alcoholics, or in patients with a history of surgical wound healing disorders (Matar *et al.* 2010).

**Preoperative anemia**

Preoperative anemia is defined as a hemoglobin level of less than 12 g/dL in women and less than 13 g/dL in men. It regularly occurs in 15 % – 33 % of patients undergoing total joint replacement (Greenky *et al.* 2012). Patients with significant anemia face a 36 % higher risk of periprosthetic jont infection in the hip endoprosthesis and 26 % in the knee endoprosthesis, compared to patients without anemia (Bozic *et. al* 2014). The exact relationship of anemia to the development of periprosthetic infection has not been described in the literature. This is probably due to the fact that anemic patients receive more frequent blood transfusions postoperatively, a factor proven to increase the risk of infection.

Prescription and administration of human recombinant erythropoetin may be considered as a solution to preoperative anemia, however, this is quite expensive and is not commonly used in practice.

**Cardiovascular diseases**

There are several studies identifying cardiac patients as having a higher infection risk (Table 2). Bozic *et al.* describes how individual cardiovascular diseases increase the risk of infection after orthopaedic surgery compared to a healthy population: ischemic heart disease by 28 %, heart valve defects by 15 %, pulmonary hypertension by up to 42 % (Bozic *et al.* 2012).

**Table 2** Cardiac diseases that must be treated before implantation of total joint replacement

| |
|---|
| **Unstable coronary syndrome**<br>• unstable resp. severe angina pectoris<br>• recent myocardial infarction (up to 4–6 weeks) |
| **Decompensated chronic heart failure**<br>• unable to perform any physical activity without discomfort<br>• resting symptoms of heart failure such as tiredness, palpitations or dyspnoea<br>• discomfort worsening during physical activity |
| **Severe arrhythmias**<br>• Tertiary, Mobitz II atrioventricular block<br>• Symptomatic ventricular arrhythmias<br>• Supraventricular arrhythmias (including atrial fibrillation) with a heart rate ≥ 100 / min at rest<br>• Symptomatic bradycardia<br>• Newly diagnosed ventricular tachycardia |
| **Serious valve defects**<br>• Severe or symptomatic aortic stenosis<br>• Symptomatic mitral stenosis |

Source: Ng V 2013



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Of course, atrial fibrillation and myocardial infarction also increase the risk of infection. We hypothesize that the increased risk of infection in cardiac patients can be attributed to the aggressive anticoagulant treatment that these patients often undergo.

In order to minimize the risk of periprosthetic joint infection, patients diagnosed with cardiovascular diseases should be preoperatively examined by a cardiologist, their anticoagulant therapy should be modified or perioperatively discontinued, and they should, of course, have normalized hemocoagulation parameters (Aggarwal *et al.* 2013).

**Chronic renal failure**

Chronic renal failure is currently becoming an increasing problem. These patients are initially treated with medication, but many of them subsequently require hemodialysis and a kidney transplant. Patients undergoing long-term hemodialysis are more likely to suffer from arthropathy (Tornero *et al.* 2013). Renal transplant patients have been treated with corticosteroids for a long time, which makes them more susceptible to avascular necrosis of the femoral head. Patients with chronic kidney disease require up to 6 times more frequent implantation of a total joint replacement than patients with normal kidney function, whether due to osteoarthritis, osteonecrosis or a femoral neck fracture (Lieu *et al.* 2014). These patients are at an increased risk of infection, which is up to 22 % higher in hemodialysis patients and up to 8 % in kidney transplant patients compared to the healthy population (Shrader *et al.* 2006).

It is essential that the prophylaxis and treatment of periprothetic joint infection in patients with renal failure be closely monitored for possible nephrotoxicity of antibiotics.

**Smoking**

In patients with total joint replacement, smoking reduces blood flow to the healing tissue and therefore impairs the availability of humoral and cellular components of the immune system to the surgical site. Nicotine in cigarettes causes vasoconstriction, hypoperfusion of tissues and has immunomodulatory effects, thereby impairing the function of immune cells and causes disorders with surgical wound healing. Smokers are also in higher risk of periprosthetic joint infection (Argintar *et al.* 2012). Cessation of smoking before surgery has been shown to reduce the risk of postoperative complications, especially wound healing disorders. Although there is no exact timing set to stop smoking preoperatively, several studies documented that it is 4–8 weeks before surgery, with a positive effect, especially on the healing of postoperative wound (Mills *et al.* 2011).

It is necessary to preoperatively identify tobacco use and smoking in the patient history and subsequently strongly support cessation or suspension of smoking to optimize the risk of periprosthetic joint infection.

**Excessive alcohol consumption**

Excessive alcohol consumption increases the risk of postoperative bleeding and infection with both malnutrition and a negative effect on the immune system. Alcohol abstinence 4 weeks before surgery has been shown to significantly reduce the risk of postoperative complications (Tønnesen *et al.* 2009). Of course, abstinence from alcohol after surgery also important.

**Depression**

Patients with depression have a 28 % higher risk of periprosthetic joint infection than patients without depression. Although the patho-physiology of this relationship is not fully understood, the effect of malnutrition, which is more common in these patients, and the consequent need for blood transfusion, which in particular is a risk factor for periprosthetic joint infection, is hypothesized (Bozic *et al.* 2012). In addition, depression also has a negative effect on

the immune system, which increases the susceptibility of these patients to infection.

Depression should be part of preoperative screening prior to elective implantation of endoprosthesis, which should be postponed if necessary until the depression is therapeutically managed and the patient is compensated (Kim *et al.* 2011; Eka *et al.* 2015).

**Local risk factors for periprosthetic joint infection**

Of the local risk factors influencing the development of periprosthetitc joint infections, **prosthesis implantation in the post-traumatic or traumatic case** is especially important. According to some authors, the risk of infection is up to 6 times higher in these patients compared to patients with primary osteoarthritis (Tomáš *et al.* 2008).). In addition, **previous operations of a given joint** into which an endoprosthesis is subsequently implanted increase the risk of infection by up to 2.5 times (Tomáš *et al.* 2008).) This risk also depends on the type of previous surgery, its length and timing from the implantation of the endoprosthesis (Gallo *et al.* 2006). **Revision joint replacements** are also burdened with a higher risk of infection compared to primary implantation.

Implantation of an endoprosthesis in a patient with a **history of septic arthritis or osteomyelitis** in the vicinity of a given joint can also pose as a risk factor. In these patients, it is appropriate to perform a preoperative microbial culture examination of a joint aspirate, examination of serum CRP levels and erythrocyte sedimentation, as well as taking several tissue samples perioperatively for microbial culture examination (Larson *et al.* 2009). When septic arthritis is confirmed or these parameters are positive, the operation should be postponed for at least one year, until normalization of these inflammatory parameters occurs.

**Intraarticular injection of a corticosteroid** in combination with a local anesthetic is quite often used as part of a conservative treatment for osteoarthritis. Although there is no convincing evidence (Pang *et al.* 2008), corticosteroid injections may predispose to periprosthetic joint infection. Therefore, most orthopaedists recommend an interval of at least three months from the injection to the operation itself.

The risk of periprosthetic joint infection is also increased by the incidence of **chronic skin infections** on the operated limb, such as erysipelas and trophic soft tissue defects developing due to chronic venous insufficiency of the lower limbs. **Erysipelas** is a significant risk factor for periprosthetic infection, same as significant risk factor of acute surgical wound infection after arthroplasty.

In the immediate postoperative period, the risk of periprosthetic joint infection is constituted by slowed healing of the surgical wound, wound dehiscence, hematomas, prolonged secretion from the surgical wound, and superficial wound infection (McPherson *et al.* 2002).

**CONCLUSION**

Several patient-related factors that increase the risk of periprosthetic joint infection are reported. A total hip or knee replacement is almost always an elective procedure, which allows the surgeon to prepare the patient for this demanding operation and thus minimize the risk of periprosthetic joint infection (Table 3). On the other hand, there exists a group of non- modifiable risk factors like age, gender, genetic predisposition, bacterial colonization.

Personal discussion with the patient in preoperative planning is very important. In this manner, the patient will be sensitized to the risk of infection, screening and prevention. It is essential to involve patients in this process in order to provide them with necessary information, educate them and have them understand the responsibility



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**Table 3** Patient related risk factors for periprosthetic joint infection

| Risk factor | Relation to periprosthetic joint infection | Treatment | Treatment objective |
|---|---|---|---|
| Morbid obesity | Prolonged operative time, increased risk of problematic wound healing, other comorbidities | Diet, exercise, bariatric surgery | BMI≤40 |
| Uncontrolled diabetes mellitus and hyperglycemia | Glycation products, increased defense against bacteria | Diet, exercise, insulin | HgBA1c ≤8%, glycemia ≤200mg / dL |
| Rheumatoid arthritis | Immunosuppressive therapy, other comorbidities, wound healing disorders | Perioperative discontinuation of immunosuppressive therapy | |
| Malnutrition | Disorder of surgical wound healing, prolonged wound seceration | Protein administration, vitamin and mineral supplementation, increase caloric intake | transferrin <200 mg / dL<br>albumin <3.5 g / dL<br>prealbumin <22.5 mg / dL<br>total lymphocyte count <1200-1500 cell / mm3 |
| Preoperative anemia | Need for postoperative blood transfusions | Preoperative screening for anemia | HgB ≥12g / dL in females and 13g / dL in males |
| Cardiovascular diseases | Chronic anticoagulant therapy, increased hematoma formation and wound healing disorders | Preoperative discontinuation of anticoagulant treatment preoperatively and examination by a cardiologist | INR level ≤2 |
| Chronic renal failure | Immunoosuppression in hemodialysis and kidney transplantation | examination by nephrologist and postoperative control of renal parameters | |
| Smoking | Hypoperfusion, tissue hypoxia, wound healing disorders | Perioperative smoking cessation, quitting | |
| Excessive alcohol consumption | Malnutrition, decreased immunity, wound healing disorders | Stop drinking alcohol perioperatively | |
| Depression | Other comorbidities, immunomodulatory effect | Treatment of depression preoperatively | |

Source: Baek 2014

for this risk. For example overweight and smoking are modifiable risk factors related to patient motivation.

There are several studies examining patient-related risk factors for infection in joint replacement surgery, however, there are still some questions and uncertainties about their significance, impact, and specific mechanism in relation to infection. Further research in this area is needed in order to better identify patients at risk, to better prepare them for this demanding surgery. It should be borne in mind that no patient with a total joint replacement is without a risk of infection complications and that there might exist certain risk factors for infection that still need to be better investigated.

The authors focused on the risk factors of periprosthetic joint infection. They provide current literature review of these risk factors, focusing mainly on modifiable factors and comorbidities. This review also includes practical recommendations for screening as well as treatment options of these conditions in order to minimize the risk of developing periprosthetic joint infection.

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**Conflict of interests**

The authors declare that they have no conflict of interests.

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# Health prevention and health promotion for people with a migration background

## Gesungheitsprävention und Gesundheitsförderung für Menschen mit Migrations-hintergrund

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**ABSTRACT** **Introduction:** In the present study, preventive health care and health promotion possibilities for migrants are discussed. Various prevention projects dedicated to people with a migration background are presented.

**Research objectives:** The article explains how preventive health care services can be designed specifically for people with a migration background.

**Material and methodology:** Various investigations of random samples, projects, surveys and observations were carried out by different institutions. The main concern of the network is to improve access to the health system and psychosocial care for people with a migration background and ensure the opportunities available to them in these areas are equal to those available to the autochthonous population.

**Conclusions:** The health situation of people with a migration background in Germany is presented and the possibilities of and obstacles to their participation in preventive health measures are discussed. Existing or completed exemplary prevention projects are also presented. These prevention projects offer informative materials in different languages and have appropriately trained or multilingual staff, which is a positive step. This kind of medical care and information must especially be guaranteed in initial reception camps for refugees. Attention to the medical concerns of people with a migration background has naturally been heightened by the current refugee situation but should become an integral part of politics and social efforts if this group is to be permanently and sustainably integrated into the health system.

**Key words:** health prevention, health promotion, migration, migration background

**ABSTRAKT** **Einleitung:** In der vorliegenden Studie werden nun Möglichkeiten der Gesundheitsprävention und Gesundheitsförderung für Migranten diskutiert. Anschließend werden verschiedene konkrete Präventionsprojekte vorgestellt, die sich Menschen mit Migrationshintergrund widmen.

**Forschungsziel:** Der folgende Beitrag soll erläutern, wie Gesundheitsprävention bzw. Gesundheitsvorsorge speziell für Menschen mit Migrationshintergrund gestaltet werden kann
**Material und Methodik:** Es wurden verschiedene Untersuchungen von Stichproben, Projekten Befragungen und Beobachtungen von unterschiedlichen Institutionen durchgeführt. Hauptsächliches Anliegen ist es, auf der Ebene des Gesundheitssystems und der psychosozialen Versorgung die Situation von Menschen mit Migrationshintergrund zu verbessern und Chancengleichheit im Vergleich zur autochthonen Bevölkerung herzustellen.
**Ergebnisse:** Zum einen wird die gesundheitliche Situation von Menschen mit Migrationshintergrund in Deutschland dargestellt, zum anderen werden Möglichkeiten und Hemmnisse hinsichtlich der Teilnahme an gesundheitspräventiven Maßnahmen dieser Personengruppe diskutiert und einige bestehende abgeschlossene Präventionsprojekte vorgestellt.
**Disskussion:** Es ist zu begrüßen, dass Informationsmaterial der Präventionsprojekte in verschiedenen Sprachen anboten werden und entsprechend geschultes bzw. mehrsprachiges Personal zur Verfügung steht. Gerade bei der medizinischen Versorgung und Information z. B. in Erstaufnahmelagern für Flüchtlinge muss dies auch gewährleistet sein.
**Schlussfolgerung:** Die Aufmerksamkeit für die medizinischen Belange von Menschen mit Migrationshintergrund wird durch die aktuellen Flüchtlingsbewegungen naturgemäß erhöht, sollte aber – wenn diese Gruppe dauerhaft und nachhaltig in das Gesundheitssystem integriert werden soll – ein fester Bestandteil der Politik werden.

**Schlüsselwörter:** Gesundheitsprävention, Gesundheitsförderung, Migration, Migrationshintergrund

## INTRODUCTION

In 2020, approximately 20.8 million people with an immigrant background were living in Germany, corresponding to more than one-fifth (24.3%) of the country's population (Destatis 2020). The present study discusses options for preventive health care and health promotion for migrants.

The following is intended to explain how preventive health care can be designed specifically for people with a migration background. First, the relevant terms are explained and the general situation of preventive health care in Germany is described. Following this, various specific prevention projects are presented that are devoted to people with a migration background.

### *CONCEPTUAL CLASSIFICATION*

Preventive measures are an important part of any functioning health system, referring to the "entirety of institutions and service providers whose core task is to promote, protect and restore health" (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2007, p. 14). With regard to prevention and promotion, different terms and cornerstones of the system must be distinguished from one another (see below, Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2007, p. 14).

Prevention is generally understood to mean all the measures that appear suitable for preventing the occurrence, spread and negative consequences of various health disorders and preventable diseases. Prevention also includes accident avoidance. When planning a preventive measure,

the possible causes of health problems and accidents must be understood; only then can potential risk factors be isolated and, if possible, eliminated. "In contrast to health promotion, prevention is specific and always states which ailments should be prevented or recognized early" (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2007, p. 14). Colon cancer prevention and sex education for HIV prevention fall into this category.

The following types of prevention can be distinguished from one another:

- Disease prevention includes measures aimed at preventing certain diseases or minimizing the likelihood of their occurrence.
- Accident prevention includes measures aimed at avoiding accidents in the areas of work, sport, traffic and leisure.
- Behavioral prevention aims at influencing the behavior of people, enabling them to develop the appropriate skills to deal with health risks in a self-determined and responsible manner by offering them information, education and advice.
- Relational prevention includes measures that are intended to change human "living, working and environmental conditions" (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2007, p. 14) through regulatory measures such as bans on certain substances or measures to encourage health-promoting behavior such as opening free advice centers. If it is a question of measures that are generally aimed at maintaining health and do not focus on specific groups or diseases, one speaks of general health promotion.

The area of prevention also includes health and consumer protection.

- Health protection is understood to mean a "risk reduction and avoidance of damage to the health" aimed at sustainability (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2007, p. 14). As a rule, the individual person has no influence on the existing health risks (e.g. fine dust pollution). The relevant regulations are usually firmly anchored in law.
- Consumer protection specifically relates to the health of consumers of goods and services. The focus is on protection against the harmful effects of various chemicals, radiation exposure, food and other consumer goods. To this end, these potential risk factors are assessed and the results are published. This is intended to encourage consumers to consciously decide whether or not to use certain products or to deal responsibly with the associated dangers (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2007, p. 14).

## *HEALTH PREVENTION AND PROMOTION FOR MIGRANTS IN GERMANY*

When developing and implementing preventive measures for people with a migration background, it should be noted that this is a very heterogeneous target group for which it is only possible to record relevant migration-specific health data to a limited extent (Robert Koch Institute 2019, p. 121). This is because there are no precisely defined or uniform guidelines concerning the inclusion of certain migration-specific backgrounds (e.g. language and cultural characteristics).

When integrating into a society, it is to be expected that migrants' cultures of origin will be mixed with that of the host society, which is why preventive measures cannot solely be aimed at a certain cultural group. Instead, competencies are required that target different groups across cultures; these are known as transcultural competencies (Domenig 2001). "In order to successfully avoid diseases or prevent their progression, the specifics of the target group, people with a migration background, must be analyzed and in the conception preventive offers



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are observed" (Robert Koch Institute 2008, p. 121).

These special features include certain specific risk factors concerning the living situation in the country of residence, special individual migration experiences and the consequences of the individual phases of migration (Sluzki 2001, p. 121).

Prevention does not only refer to the situation of people with a migrant background who have been living in the host country for a long time; it also refers to the process of migration itself. This fact is becoming increasingly important in the context of the current refugee crisis. It is important to make preventive health care available to migrants as early as the orientation phase in the host country.

## *POSSIBLE OPPORTUNITIES AND DIFFICULTIES*

The problem of prevention, specifically the difficulty of uniformly recording the prevention needs of people with a migration background, has already been addressed. A owever exist even after expulsion of the target group have specific access barriers for those responsible as well as concerned (Robert Koch Institute 2008, p. 121f.). Deficits in the use of preventive measures are clearly based on the low participation of migrants, especially children.

The evaluation of school entrance examinations has shown that some groups of children with a migration background have very low vaccination rates (Pallasch *et al.* 2005, p. 33ff.). Children with a migration background, especially the children of refugees, also tend to have less frequent early detection examinations than the population average (Gardemann 2003; quoted in the Robert Koch Institute 208, p. 121).
Another indication of potential for improvement in preventive health care is the relatively high incidence and prevalence of diseases that can actually be combated very successfully through preventive measures. The death rate of infants and the occurrence of tuberculosis exemplify this issue (Robert Koch Institute, 2019, p. 121). In addition, children with a migration background suffer from tooth decay significantly more often than children without a migration background (Brunner-Strepp 2001, p. 108).

There is no one factor causing this situation, but rather many difficulties.

- As already mentioned, the development of preventive measures for people with a migration background is difficult and only possible if the necessary information has been collected in advance. This information includes culture-specific ways of life and personal health concepts or the possible and used opportunities for participation of those affected. At this point, the Federal Center for Health Education demands cultural sensitivity from those responsible (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2007, p. 14).
- Immediately after the act of migration to the destination country, those affected must deal with significant changes on a psychological, social and cultural level. At this point in time, they are particularly susceptible to mental and physical illnesses and typically lack access to preventive measures.
- In the situation described, those affected are exposed to a variety of demands and stresses that make their own health seem like a less urgent concern in comparison.
- Another problem concerns the country of origin, where preventive health care often hardly plays a significant role or where they are "culturally not secured by appropriate patterns of action" (Robert Koch Institute 2008, p. 121). This can also lead to an increased need for prevention offers for these people, but there is hardly any demand for them.
- Access to preventive health care for people with a migration background is also made more difficult by the inconsistency of this target group. Different culturally determined

attitudes towards preventive health care, social situations, levels of education, residence statuses and individual linguistic competences can become obstacles in the effort to address these individuals.

- For the group of asylum seekers, there are also formal legal difficulties. Asylum seekers only have a limited right to health services, which is limited to acute illnesses and accidents. It is implicit that prevention is not provided for this group (Robert Koch Institute 2008, p. 121).

## *PRESENTATION OF INDIVIDUAL CONCRETE PREVENTION PROJECTS AND DISCUSSION*

Dorn *et al.* point out that in Germany there is a wide range of prevention projects for people with a migration background; for the most part, these projects are set up regionally (Dorn *et al.* No year, p. 17, as well as the Federal Government Commissioner for Migration, Refugees and Integration 2011 p. 7). To catalog and systematically record these projects, the Federal Center for Health Education set up a database to map the diverse range of such prevention projects for people with a migration background (Dorn *et al.* OJ 2011, p. 17).

In the following paragraphs, some prevention projects that focus on the health issues of people with a migration background are presented.

The MiMi project (With Migrants for Migrants) has been carried out by the Hanover Ethno-Medical Center since 2003 and is based on the effect of multipliers (Robert Koch Institute 2019, p. 125). It is supported by the BKK Bundesverband, the Hesse and North state associations and the social ministries of Lower Saxony, Hesse and Schleswig-Holstein.

A total of 24 cities, districts and regions from 10 federal states are cooperating in this project. The aim is health promotion and disease prevention for people with a migration background using intercultural health mediators. These mediators are recruited from people who themselves have a migration background. Their training takes place within a framework of courses lasting several days. Candidates must be well integrated, interested in health topics, have a good command of German and their native language and have a high level of education (Robert Koch Institute 2008, p. 125).

The mediators are then supported by healthcare professionals in carrying out multilingual prevention campaigns in the home environment of the target group. A total of 565 health mediators were trained as part of the project between 2003 and 2006; these health mediators then carried out 592 information events with 8,320 participants (Robert Koch Institute 2008, p. 125). The events' participants mostly became aware of the events through word-of-mouth marketing and hoped that participation would help them make up for their own knowledge deficits. For example, "event participants stated that the most important motive was that they needed health information" (Robert Koch Institute 2008, p. 125).

Only around 33% of the participants had a good knowledge of German, and 34% did not speak German at all, which is proof of the importance of the bilingual mediators.

Most of the participants were relatively well informed about the availability of general practitioners, pharmacies, dentists and hospitals. There were deficits in knowledge about specialists, psychiatric treatment options, the public health system and health insurance (Robert Koch Institute 2008, p. 126): "44% had not yet heard of social psychiatric services, 54% did not know any crisis services and 39% were not aware of the facilities of the patient advice centers" (Robert Koch Institute 2008, p. 125).

Another project, which is also funded by the EU, is the so-called MIGHEALTHNET (Information Network Migration and Health) (Dorn *et al.* 2011, p. 18). The aim is to optimize the dialogue between the specialist public in the health care system on the one hand and people with a migration background on the other hand,



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and to "work up the deficits in the level of knowledge about the health situation of people with a migration background" (Dorn et al., 2011, p. 18). In order to achieve this goal, an interactive communication platform in the form of a wiki was established by Bielefeld University. This platform allows experts, specialists and interested parties to exchange experiences and to "gain specialist knowledge about the health of migrants and about ethnic minorities in the To bundle the European Union" (Dorn *et al.* 2011, p. 18).

MIGHEALTHNET exists in 17 EU countries, with each country having its own interactive and publicly accessible database. Various background information can be found at the German website (www.mighealth.net/de) regarding the populations of people with a migration background, the health status of these populations and the use of health services in these populations (Dorn *et al.* 2011, p. 18).

Another Internet platform financed by the State Ministry of the Interior, Sport and Integration is GeMiNie (Health for Migrants in Lower Saxony), which is aimed at multipliers from the fields of health, social work, migration and integration (Dorn *et al.* 2011, p. 18). The main focus of the platform is to enable people with a migration background and insufficient knowledge of German to communicate in their mother tongue if they have health problems (Landesvereinigung für Gesundheit und Akademie für Sozialmedizin Niedersachsen, cited in Dorn et al., 2011, p. 18). With the help of the platform, it is possible to research service providers from the health sector in the state of Lower Saxony and to filter these providers according to specialization, language skills and location. In addition, a separate model project for the "intercultural opening of hospitals in Lower Saxony" (Dorn et al., 2011, p. 18) was developed and implemented. As part of this project, guidelines for dealing with people with a migrant background were developed. The management, medical staff and nursing staff in hospitals can use these guidelines for orientation (Dorn *et al*. 2011, p. 18). As part of our own training courses, the employees in the hospitals are encouraged and instructed to strengthen their own intercultural competence. Ultimately, the model project also serves to establish multilingualism in the clinics, to align menus with an intercultural approach and to enrich the staff with people with a migration background.

In 2009, the Federal Center for Health Education (BZgA) commissioned the study "Women live – Family planning and migration in the life course" and trusted the social science women's research institute in Freiburg (SoFFI F.) with its implementation (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2011; cited by Dorn *et al.*, p. 19).

The study showed that women with a migration background make up a large "proportion of the female population in the reproductive phase" in many German cities (Dorn *et al.* 2011, p. 19).

As part of the study, women and their parents from Turkey and other parts of Eastern and Southeastern Europe were asked about family planning. The aim was to determine the extent to which they need information about and support with their own planning and how social and cultural factors influence this process. The respondents had "a strong and early marriage and family orientation" (Dorn *et al.* 2011, p. 19). However, the women with a Turkish migration background were relatively inflexible when it came to dealing with this step of life planning. For example, they were less willing to postpone plans to have children, regardless of economic or professional issues (Dorn *et al.* 2011, p. 19). Nevertheless, it turned out that such rigorous family planning in no way excludes the beginning of pregnancy: "A fifth to a quarter of women with a migration background have experience of an abortion" (Dorn *et al.* 2011, p. 19).

The Intercultural Health Network Bremen was launched in 2005 with the participation of many

Bremen institutions and associations (Dorn *et al.* 2011, p. 32). The starting point was the merger of 27 member associations from the fields of health, education and social affairs to form the Landesvereinigung für Gesundheit e.V. The Intercultural Health Network Bremen emerged in 2008 through the initiative of the Center for European Legal Policy at the University of Bremen (ZERP), the EU project XENOS, the Landesvereinigung für Gesundheit Bremen eV (LVG) and the Migration and Health Department of the Bremen Health Department (Dorn *et al.* 2011, p. 32). The institutions involved are active in 10 areas:

- Psychosocial and mental health;
- Intercultural opening of the health system;
- Asylum seekers;
- Migrant health;
- Aid for the elderly;
- Health promotion and prevention;
- Health self-help groups;
- Migration and disability;
- Help for addicts;
- Structured personnel development and qualification (Dorn *et al.* 2011, p. 32).

The main concern of the network is to improve access to the health system and psychosocial care for people with a migration background and ensure the opportunities available to them in these areas are equal to those available to the autochthonous population.

Finally, the KAMAHH project of the Children's and Family Center in Schnelsen (KiFaZ) has the task of providing information about AIDS prevention in a culturally sensitive manner (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2016, p. 115).

This project was launched in 2014 and aims to establish AIDS mediators in the city of Hamburg who independently carry out AIDS prevention work in the city's districts and address the concerns and sensitivities of people with a migration background. It should succeed in "making the existing counseling resources more accessible for migrants, reducing their fears and strengthening personal responsibility for participation in the health system" (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2016, p. 115).

It began with an information event for possible mediators to which migrants who were already active as mediators in the project "With Migrants for Migrants" were also invited. After completing the appropriate training, the mediators were able to start their campaigns in the relevant migrant communities, taking into account the needs of the different groups concerning the venues and types of events (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2016, p. 117).

The initiators of the project note that they have succeeded in training numerous mediators and winning them over to active awareness-raising work, which would speak in favor of transferring the project to other regions (Beauftragte der Bundesregierung für Migration, Flüchtlinge und Integration (Hrsg.) 2016, p.118).

## CONCLUSION AND RECOMMENDATIONS FOR ACTION

The present study presented the health situation of people with a migration background in Germany along with options and obstacles concerning their participation in preventive health care. Existing or completed prevention projects were also presented as examples.

It was shown that people with a migration background are by no means a homogeneous group even at the level of medical precaution and care needs. In addition to their diversity in terms of age, gender, social situation and education, there are also cultural, religious and, in some cases, refugee-related characteristics that hardly permit a uniform prevention strategy.



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Existing prevention projects that are directly aimed at people with a migration background already exist but are rarely as specifically oriented as the KAMAHH project on AIDS prevention. Most projects either focus on training mediators or building networks to facilitate information gathering. Projects such as the initiation of intercultural openings of hospitals can be successful as a model, but it is necessary to establish corresponding standards across the board that go beyond regional field trials. Ultimately, "in the area of health care and social acceptance of people with a migration background [...] there are still challenges and open the questions" (Robert Koch Institute 2008, p. 132).

The prevention projects offer informative materials in different languages and have appropriately trained or multilingual staff, which is a positive step. This kind of medical care and information must especially be guaranteed in initial reception camps for refugees. In the long run, however, this must not lead to the fact that the language of the target country is neglected and the people concerned may trust that they can continue to master the language of origin on their own.

Often, those affected have had few positive experiences with institutional bodies, including various health services, in their country of origin. They may also possibly experience rejection or discrimination in their host country. For this reason, it makes sense to not only offer prevention services, but also meet with people in their homes and proactively practice preventive health care. This requirement is already being met in part through the training of mediators.

The path that has already been taken should be continued in the future. Attention to the medical concerns of people with a migration background has naturally increased due to the current refugee situation but should become an integral part of political and social efforts if this group is to be permanently and sustainably integrated into the health care system.

## Conflict of Interest

The authors decleare that there is no conflict of interest in connection with the published article.

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# The effect of holistic approach on the treatment of low back pain due to somatovisceral kidney dysfunction

## Efekt holistického přístupu v terapii bolestí dolní části zad zapříčiněných somatoviscerální dysfunkcí ledvin.

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**ABSTRACT** **Introduction:** Staying in a children's home has a major impact on the quality of life of children. It has a profound effect on experiencing and psychosocial needs of children, placed in children's homes for a variety of reasons.
**Aim:** The survey and the paper aim to present the subjective evaluation of their quality of life by children placed in children's homes.
**Material and methods:** The survey was conducted using qualitative data analysis, and specifically, using the grounded theory technique. A sample of opinions was gathered from a total of 577 children from all regions of the Czech Republic. The survey data were obtained by questioning, and specifically, using the structured interview technique. The interviewee's answers were recorded and further evaluated using a three-level coding system. As the main result, specific and generic grounded claims were formulated.
**Results and discussion:** The main contribution of the survey was in the conclusion that despite the fact that children in children's homes are inconvenienced by certain circumstances and are also affected by past experiences, their stay in a children's home is not overwhelmingly stressful for them, and most of the children are at least relatively satisfied, although there is still room for improvement, which constitutes a challenge especially for children's home workers.
**Conclusion:** The analysis and interpretation of the obtained data revealed that the stay in a children's home is not overwhelmingly stressful for children, barring exceptions, and that most of them are at least relatively satisfied with their subjective quality of life.

**Keywords:** Quality of life; children's home; psychosocial experiencing, life goals
(CTR#: NTC 04694170)

**ABSTRAKT** **Úvod:** Není dostatečné množství přístupů, které kombinují Čínskou medicínu a jógu za účelem přínosné terapie bolesti dolní části zad. Z tohoto důvodu jsme zrealizovali níže uvedenou pilotní experimentální studii.

**Materiál a metodika:** Cvičení jógy a životní styl upravený dle Čínské medicíny byly porovnávány s konvenční fyzioterapií během 4-týdenního terapeutického programu. Byly vytvořeny 2 skupiny pacientů s bolestí dolní části zad pro dva terapeutické přístupy. Experimentální skupina (n=6) byla léčena konvenční fyzioterapií obohacenou o holistický přístup. Kontrolní skupina (n=6) byla léčena pouze konvenční fyzioterapií. Pro hodnocení byl použit dotazník SF-36 a Mann-Whitney test. Ve studii jsou zahrnuty CTR a informovaný souhlas pacienta dle Helsinské deklarace a IRB Etické komise FTVS UK v Praze číslo 204/2019 na 17.10.2019. CTR souhlas s klinickou studií na lidských účastnících byl schválen pod číslem NTC 04694170, registrovaný zpětně 26.12.2020, veřejný od 4.1.2021.

**Výsledky:** Signifikantní efekt byl potvrzen pro oba přístupy. Velmi vysoká statistická významnost [$p<0.01$] byla potvrzena pro experimentální skupinu.

**Závěr:** Je-li bolest beder způsobena reflexním vlivem vnitřních orgánů je holistický přístup jedním z doporučených terapeutických postupů.

**Klíčová slova:** bolest dolní části zad, dysfunkce ledvin, cvičení jógy, Čínská medicína (CTR#: NTC 04694170)

## INTRODUCTION

The kidney function is crucial for the lumbar area's well-being and the muscle system's function (Tekur *et al.* 2007; Affaitati *et al.* 2020). Muscles as deep stabilizers of the lumbar spine are crucial for low back pain. Unfortunately, lumbar pain syndromes are also visible when deep stabilizers are active and without weakening (Tekur *et al.* 2007; Park *et al.* 2018). Due to the urinary system's visceral connection with the diaphragm, fascia of quadratus lumborum, psoas major, transversus abdominis muscles and other soft tissue, the painful picture may be transferred in the remote locality of the human body (Affaitati *et al.* 2020). Maciocia (2008) describes several cases of kidney's Yang emptiness. Inner cold, feeling cold in the human body, especially in the lumbar region, cold and painful knees, tinnitus, dizziness, paleness in the face, apathy, urinating large amounts of light urine and swelling of lower extremities are the main signs of this syndrome (Standring 2008). Due to the anatomy innervation, there are two primary mechanisms of the incidence of kidneys' clinical problems and low back pain. The kidney's functional changes may lead to the axial movement system changes due to the nerve pathway and reflex changes. Secondary problems can lead to issues with the primary organ again, and we know this as "circulus vitiosus", which complicates the differential diagnostics. Viscerovertebral and vertebrovisceral relationships exist due to the interneuronal network. The sensitive systems pathway ends on an interneuronal level where the subsequent excitation is processed and consequently reflexed to the body's surface (Temme, Pan 2017). Although conventional therapy's influence on low back pain has been researched yet (Gedin *et al.* 2017; Sha, Palmer, Yeo 2017), we observed the effect of an applied holistic approach against conventional physiotherapy for low back pain.



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According to Chinese medicine, we observed the effect of regimen restriction and yoga set intervention against conventional - standard physiotherapy.

## RESEARCH OBJECTIVES

This research aimed to clarify the effect of a holistic approach on the low back pain known from middle Europe incidence, especially the Czech Republic, in 2020. This is pilot experimental study.

## METHODS

We compared a four-week conventional physiotherapeutic program with a therapy program enriched with compiled regimen and yoga exercises. First, an experimental group of patients (n=6) with nonspecific low back pain and kidneys dysfunction undergo physiotherapy supplemented with regimen measures and yoga exercises. Second, a controlled group of patients (n=6) and nonspecific low back pain and kidneys dysfunction undergo only conventional physiotherapy without any yoga or regimen input. A total of 12 probands were in this study. Ten females and two males, the criteria for enrolment were age between 25-55 years, low back pain lasting longer than 12 weeks and degree of pain ≥ three on a visual analogue scale (VAS). A therapist carried out the selection according to the entered criteria blinded the study; he was no involved in the next part of the study.

The agreement of patient content according to Helsinki declaration and IRB Ethics committee of FTVS of Charles University in Prague No.204/2019 at 17.10.2019. CTR approval of a clinical study in human participants was performed under No. NTC 04694170, registered retrospectively 26.12.2020, public from 4.1.2021. We focused on statistically significant differences in therapy's effectiveness by using the questionnaire "quality of life in connection with health" Short-form-36, visual analogue scale /VAS/ and kinesiologic examination.

An anamnestic questionnaire evaluated each patient contained 28 yes/no questions. We required the positive presence of more than half of the evaluated symptoms for inclusion in the study. Evaluated symptoms were, e.g. hibernation, insomnia, night sweat, tinnitus, cold legs, tiredness, palpitation, headache around occiput. We choose the questions according to a recommendation of Chinese medicine (Maciocia, 2008).

Probands underwent a **kinesiologic analysis** based on viscerosomatic projection of kidney and urinary bladder system disorders and TCM knowledge. There was a maximum of 14 points, and inclusion into the study was required more than half. The case of examined signs ware: shoulder pain, spasm of thoracolumbal erector spinae muscle, hypertonia of quadratus lumborum and iliopsoas muscles, blockage of tibiofibular joint and thoracolumbal crossing. After that, probands illustrated their pain intensity on **the visualized analogue pain scale** (VAS). The **SF-36 questionnaire** was used for subjective evaluation of the patient's quality of life and designing all psychometric standards.

We excluded patients who demonstrated the followings signs: red flags, neurological symptoms, several systems diseases, pregnancy, low or higher blood pressure, analgetic antiphlogistic and myorelaxation pills intake, other current therapy.

Probands who met the criteria for participation in the research were then randomly divided into two groups. **The experimental group** (n=6) underwent 60 minutes of therapy twice a week for four weeks. Each therapeutic unit consisted of conventional physiotherapy supplemented by yoga set exercising and TCM regimen restriction for kidney organ. Regimen measures consisted of, for example, these principles:

- Take several deep breaths when you feel anxiety or fear, exercise Nadi Shodhana Pranayama.
- Have a regular rest, meditation, moving three times a week, take a sauna or massage.
- Go to bed at the same time every day, have at least 8 hours.
- Keep your lumbar spine and legs warm, avoid cold, care about your feet.
- Do a yoga practice every day.
- Limit the alcohol, coffee drinks and cold drinks. Drink warm drink during the day. Avoid raw foods during wintertime.
- Eat hot meals every day – soups, cooked vegetables.
- Unsuitable foods: Foods containing oxalic acid simultaneously consume foods rich in calcium. Coffee, chocolate, cranberries, purple fruits, red wine. Excessive consumption of sweet and too salty foods (industrially processed).

Also, probands received a yoga exercising set composed of asanas for kidney meridian, pictured in Figure 1.

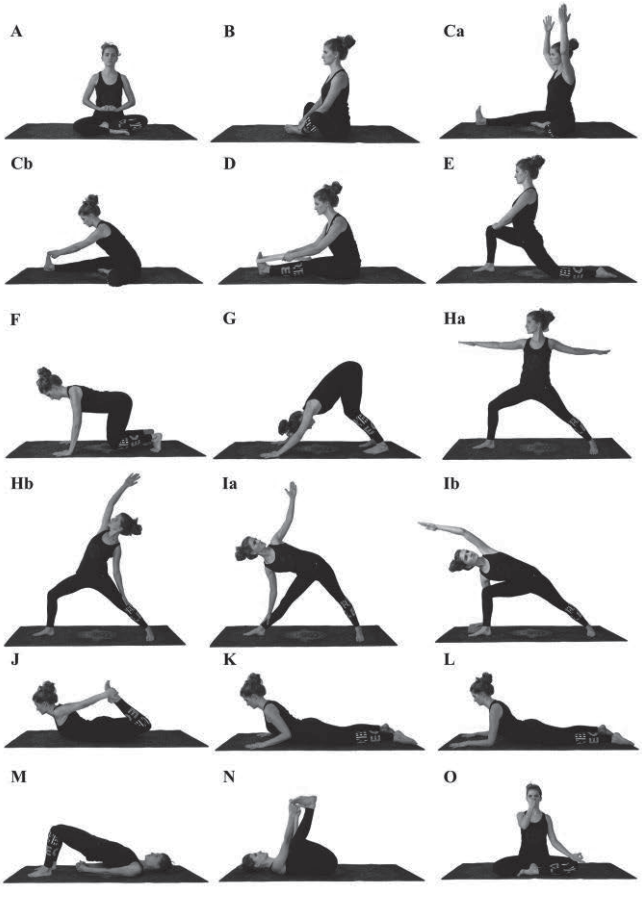


**Figure 1:** Used set of yoga (author archive). A- pranayama, Brahma mudra. B – Badhakonasana. C – MahaMudra /starting and final position/. D – Paschimottanasana. E – Adzanejasana. F,G – starting and final positions of Adhomukhasvanasana. H1,2 – Virabhadrasana II. I1 – Triconasana. I2- Parshvakonasana. J – Dhanurasana. K – Budzangasana. L – SalambaBudzandgasana. M – Setubandha Sarvangasana. N – Ananda Balasana. O – Nodi Shodhana Pranayama.



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It was necessary to adhere strictly to the regime's measures and to practice yoga set every day. Each asana and technique were targeted to the kidney and urinary bladder meridian. Yoga set included breathing exercising, positions of Badhakonasana, MahaMudra, Paschimottanasana, Adzenejasana, Adhomukhasvanasana, Virabhadrasana, Triconasana, Parshvakonasana, Dhanurasana, Budzangasana, Salamba Budznagasana, Setubandha Sarvangasana, Ananda Balasana, Nodi Shodhana Pranayama.

**The control group was treated according to standard - conventional** physiotherapy twice a week for 60 minutes for four weeks. Used physiotherapy techniques included soft tissue techniques, mobilization of peripheral joints and spine, individual kinesiotherapy, reflex and fibrous massage. However, there was no yoga asanas and any regime restrictions.

Both groups of patients were treated under researcher supervision for all therapies.

**DATA ANALYSIS**:

We compared the examining data at the beginning and at the end of the experiment. The **anamnestic questionnaire** and the **kinesiological analysis** compared the number of positive answers during entered and final examinations. The **VAS scale** assessed pain intensity reported at the beginning and at the end of the intervention. The **questionnaire of life quality SF-36** evaluated nine areas. It was possible to achieve a maximum score of 900 % and a minimum of 0 %. A higher score means a higher quality of life concerning health. The percentage was converted to points (1% = 1 point), the maximum possible value of the test was 900 points for each proband.

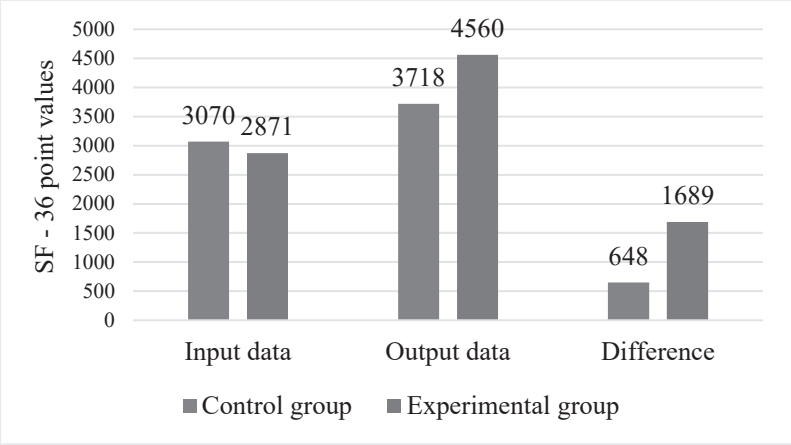
Furthermore, the differences between the entered and final examination and the sum of these differences were calculated. The STATISTIKA software analysed statistics data. Because of the small examining groups, the comparison was made using the Mann-Whitney U test. Statistical significance was assessed at the significance level $p< 0.05$ and $p<0.01$.

**RESULTS**

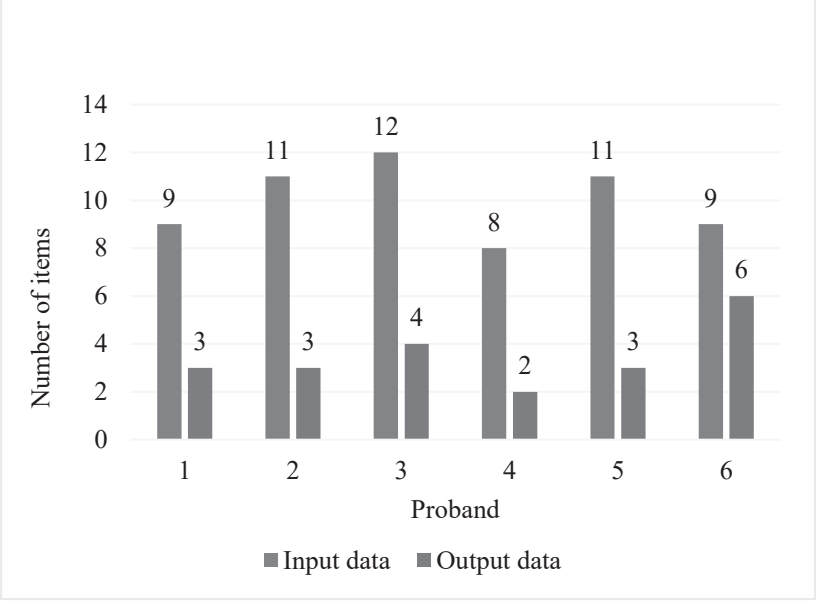
According to the Mann-Whitney calculation, we found the statistical significance of differences in evaluated individual areas of the **SF-36 questionnaire** between the experimental and the control groups. In the area of Vitality, a very high level of significance, $p <0.01$, was visible. In emotional problems and general mental health, high statistical significance at the level of $p <0.05$ was demonstrated. We also evaluated the results at the level of significance, $p <0.1$. In this level of significance, $p <0.1$ were identifiable areas: Physical Activity, Social Activity, Physical pain, Overall perception of health and Change in health. Physical Activity was different in the experimental and control groups; there was only a difference of 10 points, which is not significant.

Graf 1 shows the graph **"comparison of SF-36 value",** where the point values are compared to control (blue) and experimental (orange) groups. There were 1689 changes in the experimental group against 648 changes in the control group. The experimental group has shown more changes in the quality of life after complex therapy. However, the control group's improvement was also significant in that we subjected the results to statistical processing. These changes are pictured in graph 1 – Comparison of SF-36 value.

The result of **kinesiologic examination** evaluating the number of reflex changes and joint dysfunction is visible in Graphs 2 and 3. Decreased output data of both groups talk about the very positive effect of therapy. 1-6th probands in the experimental group showed decreased examined signs in more than 50% (graph 2). 7-12th probands in the control group showed decreased examined sings not more than 50% (graph 3).




**Graph 1:** Graph of comparison of SF-36 value. Input and output and differences values of SF-36 experimental and control group on the horizontal line and number of changes in the vertical line.




**Graph 2:** Number of items in the kinesiological analysis in the experimental group. Comparison of input and output data.



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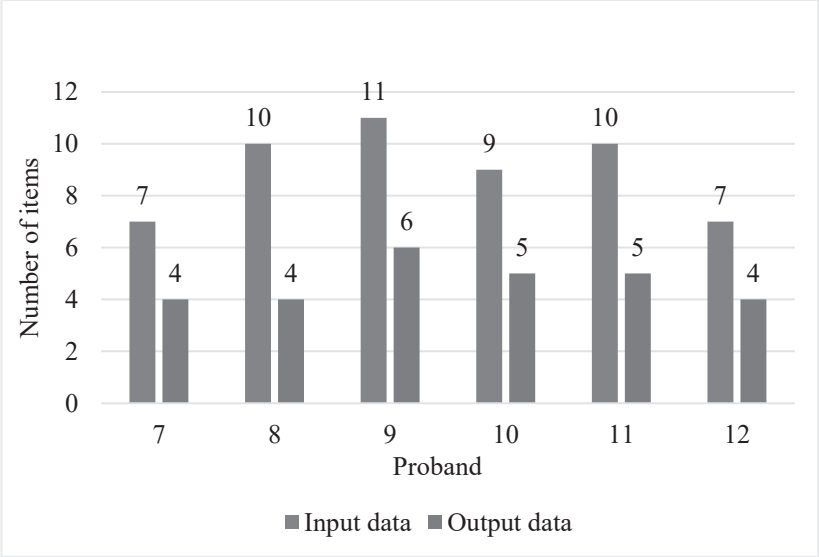


**Graph 3:** Number of items in the kinesiological analysis in the control group. Comparison of input and output data.

Numbers on the vertical line show the count of positive changes during all therapeutic process. As clearly visible, both interventions had a positive therapeutic effect, but the experimental group shows a higher therapeutic effect than the control group. The difference in the number of points in the kinesiological analysis between the experimental and the control groups turned out to be highly statistically significant at the significance level $p < 0.05$ after calculating the Mann-Whitney U test.

After therapy, the evaluation of **anamnestic data** showed a higher effect in the experimental group than in the control group. There were 48 positive answers in the anamnestic questionnaire against the 22 positive changes in the control group. The experimental group's therapeutic effect is almost twice as significant as the control group's therapeutic effect. The evaluation of the difference in points within the anamnestic questionnaire was statistically significant at the significance level $p < 0.01$ after calculating the Mann-Whitney U test. There were summed up differences of **VAS evaluation** results initially, and at the end of the experiment. The experimental group shows a score difference of 22 points compared to 17 points in the control group. The difference in values is demonstrating the general effect of therapy and decreasing pain on VAS. The difference in the evaluation of pain intensity on the VAS scale at the level of $p < 0.01$ and $p < 0.05$ was not statistically significant.

## DISCUSSION

We confirm the statistically significant difference in evaluating the quality of life according to SF-36 in the experimental group compared to the control group. The comparison with other studies also shows the positive effect of yoga exercising. Sha yet (Sha, Palmer, Yeo 2017), in their scoping review, found eight articles about this topic. Despite different protocols, yoga reduced specific lower urinary tract symptoms by increasing pelvic floor muscle strength, regulating the autonomic nervous system, and activating the central nervous system. Their output is that rigorous studies are needed to determine the mechanism of yoga in the urinary system. Tekur (Tekur *et al.* 2007) compared an intensive 1-week yoga program with other exercises for 80 patients with low back pain. Both groups had a very

positive score, but the yoga group that was interactive with lifestyle was more successful in reducing low back pain and improving mobility. Against other studies, we compared fewer patients (n=12) and only in the regional middle Europe area.

## CONCLUSION

We demonstrate statistically significant differences in the therapy effectiveness through the Quality-of-life questionnaire SF-36 on the very high level of significance. The statistically significant therapeutic effect was found in the kinesiologic examination and anamnestic data. Only low back pain intensity on the VAS scale was not confirmed at statistical significance.

However, from all evaluated data, it is visible that four weeks of complex therapy of low back pain through the kidneys and urinary bladder approach described by traditional Chinese medicine and yoga exercising is very effective.

### Competing interests:

There are no conflicts of interest from any authors and helping research in this study and paper.

### Funding statement:

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Conference information

St. Elizabeth University of Health and Social Work in Bratislava, Slovak Republic

in collaboration with Slovak Chamber of Nurses and Midwives, Bratislava, Slovak Republic
and with Slovak Chamber of Social Workers and Social Work Assistants, Bratislava, Slovak Republic

and in collaboration with Medical University of Silesia in Katowice,
Faculty of Health Sciences in Katowice, Department of Physiotherapy

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the 16th international scientific and professional conference

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**POLISH – CZECH – SLOVAKIAN STUDIES**

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social work and other helping professions in the 21st century.

**Conference topics:**
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Active participants are welcome in the plenary or panel sections.
Each conference presentation is limited to 10 minutes, the discussion to 5 minutes.

**If the unfavorable epidemiological situation caused by COVID-19 pandemics will persist, the conference will be organized in the distant form as videoconference or online conference.**

Abstracts of conference papers presented at the conference will be published on
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