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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 2021, the journal celebrated its 16<sup>th</sup> 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 2022, the conference will take place in October in Piešťany, in the Slovak Republic.

> Prof. Miron Šrámka, MD, DSc. redactor-in-chief

### **COVID-19** Pandemic and Shoulder Joint Rehabilitation in Patients with Impingement Syndrome

### Pandémia COVID-19 a rehabilitácia ramenného kĺbu u pacientov s impingement syndrómom

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> Introduction: The consequences of the COVID-19 pandemic largely result in disorders of the musculoskeletal system and one of them is a problem in the shoulder joint. Many problems have been postponed due to the measures and regimes in place and have not been resolved in a timely manner, which has led to the development of "frozen shoulder" syndrome, even in impingement syndromes.

> Aims: The main aim of this work was to point out the significant influence of rehabilitation options in patients with impingement syndrome. In this work, we tried to draw attention to the deterioration of quality of life caused by shoulder problems during the COVID-19 pandemic, and we wanted to use selected rehabilitation options to improve the range of motion in the shoulder into flexion, abduction and reduce pain.

> Material and methods: The work is prepared for a prospective study. The study was carried out in a private rehabilitation facility in Piešťany. All measurements lasted from January 1, 2020 to August 22, 2020. The group consisted of 20 patients diagnosed with impingement syndrome, who used manual therapy, kinesiotherapy, electrotherapy and kinesiotaping. We used the Oxford Shoulder Score questionnaire to find out the effect of impingement syndrome on quality of life. We evaluated the overall pain using a numerical pain scale.

> Results: We evaluated the obtained results using descriptive statistics. Using the questionnaire, we were able to confirm how this syndrome affects the quality of life. Due to the chosen methods, the range of motion to flexion and abduction in the shoulder joint was improved. Due to the combination of methods, the overall pain was also significantly reduced.

> Conclusion: Shoulder problems are the second most common musculoskeletal disorder during COVID-19 after back pain. However, not all studies to date have been able to specify what its best treatment is, whether manual treatment, exercise therapy, or the application of electrotherapy or a combination of methods is appropriate. In order to achieve better results, we recommend using the mentioned rehabilitation methods within the therapy, not individually but in combination.

> Keywords: COVID-19 pandemic, frozen shoulder, impingement syndrome, Oxford Shoulder Score, shoulder joint, pain, rehabilitation.

**Úvod:** V dôsledku pandémie COVID-19 vo veľkej miere vznikajú poruchy statopohybového aparátu a jednou z nich sú aj ťažkosti v plecovom kĺbe. Pre opatrenia a zavedené režimy sa mnohé problémy odkladali a včasne neriešili, čo viedlo aj pri impingement syndrómoch k vzniku syndrómu *"frozen shoulder"*.

**Ciele práce:** Hlavným cieľom práce bolo poukázať na významný vplyv rehabilitačných možností u pacientov s impingement syndrómom. V práci sme sa snažili upozorniť na zhoršenie kvality života spôsobenej ťažkosťami s plecom počas pandémie COVID-19 a chceli sme pomocou zvolených rehabilitačných možností zlepšiť rozsah pohybu v pleci do flexie, abdukcie a znížiť bolesť.

**Materiál a metodika:** Práca je spracovaná pre prospektívnu štúdiu. Štúdia bola uskutočnená v súkromnom rehabilitačnom zariadení v Piešťanoch. Všetky merania trvali od 11. 11. 2019 do 22. 8. 2020. Súbor tvorilo 20 pacientov s diagnostikovaným impingement syndrómom, u ktorých bola využitá manuálna terapia, kinezioterapia, elekroliečba a kinesiotaping. Dotazníkom *Oxford Shoulder Score* sme zisťovali vplyv impingement syndrómu na kvalitu života. Numerickou škálou bolesti sme hodnotili celkovú bolesť.

**Výsledky:** Získané výsledky sme vyhodnotili pomocou deskriptívnej štatistiky. Pomocou dotazníka sa nám podarilo potvrdiť, ako tento syndróm ovplyvňuje kvalitu života. Vplyvom zvolených metód sa podarilo zlepšiť rozsah pohybu do flexie a abdukcie v plecovom kĺbe. Vplyvom kombinácie metód sa podarilo markantne znížiť aj celkovú bolesť.

**Záver:** Problémy s plecom sú po bolestiach chrbta druhým najčastejším muskuloskeletárnym ochorením počas COVID-19. Všetky doterajšie štúdie však nevedia doteraz bližšie špecifikovať, aká je jeho najlepšia liečba, či je vhodná manuálna liečba, pohybová liečba, či aplikácia elektroliečby alebo kombinácia metód. Pre dosiahnutie lepších výsledkov odporúčame v rámci terapie využívať spomenuté rehabilitačné metódy nie jednotlivo ale ich kombináciou.

Kľúčové slová: pandémia COVID-19, frozen shoulder, impingement syndróm, Oxford Shoulder Score, plecový kĺb, bolesť, rehabilitácia.

#### INTRODUCTION

Shoulder problems are the second most common musculoskeletal disease of the musculoskeletal system. The most common is impingement syndrome. The COVID-19 pandemic, due to measures and regime restrictions, caused a lack of exercise and increasing stress, which had a negative impact on the musculoskeletal system and mental health. Hypokinesia causes a wide range of ailments such as vertebrogenic cervical spine pain, thoracic spine block, lumbago, frozen shoulder syndrome and many more. During the pandemic, many problems with the shoulder joint were postponed and not resolved in time, which led to the so-called frozen shoulder.

#### AIM

Our aim was to show the beneficial effect of physiotherapeutic options and their combinations in the treatment of impingement syndrome.

#### MATERIAL AND METHODS

#### File characteristics

The examined group consisted of 10 men and 10 women with an average age of 47 years. In the group of women, the age ranged from 28 to 70 years with an average of 52.60 years, and in the group of men from 16 to 67 years with an average of 41.40 years.

#### Work methodology

To achieve our goals, we opted for a prospective study. We evaluated the results using descriptive statistics. Input and output measurements to the study took place in a private rehabilitation facility in Piešťany. All measurements lasted from November 11, 2019 to August 22, 2020. To diagnose impingement syndrome the examination was performed by a doctor

#### **Oxford Shoulder Score**

Patients completed a modified *Oxford Shoulder Score* questionnaire (Frich *et al.* 2011) on how impingement syndrome worsens quality of life in day-to-day activities with 12 questions. Patients responded on a scale of points from 1 (no problem) to 5 (significant problem). Subsequently, we calculated all points, evaluated the averages of individual patients and all patients in total.

#### Numerical scale of pain

Patients rated their overall pain on a modified numerical scale from 0 (no pain) to 10 (significant pain).

#### Range of motion

In patients, we measured the passive range of motion to flexion and extension.

#### **Rehabilitation plan**

We created a rehabilitation plan for each patient. Rehabilitation of patients took place twice a week for 5 weeks — a total of 10 visits (one visit — 50 min). At the first therapy, patients were educated on the exercise and workload at home. In all patients, we used soft techniques to relax the muscles and fascia around the cervical spine and shoulder (Lewit 2003). We adjusted the humeroscapular rhythm using the PNF method, we tried to increase the subacromial space by centering the humeral head (Rutowicz, Krzywoń 2019). We increased the range of motion first by passive and then by active exercise using a propriomed (into flexion, extension, abduction and external rotation). Exercise with theraband was focused to improve shoulder stability and strength. On limited movement range we mobilized the joint.

We reduced the pain using electrotherapy — direct and alternating current. We also used MLS laser (900 Hz, 10 minutes, intensity 100 %) and ultrasound (Gymna device) 10 times. The ultrasound intensity was 1 to 2 W/cm2 with a frequency of 1.4 MHz and an application time of 5 minutes. At the end of the therapy, we gave patients a kinesiotape (*m. deltoideus, m. supraspinatus* and *m. coracobrachialis*) (Kobrová, Válka 2012).

After fulfilling the physiotherapy plan, we performed a final examination. We evaluated the results using descriptive statistics.

#### Hypotheses and characteristics of hypothesis evaluation

**Hypothesis 1:** we assume that the effect of shoulder pain will worsen the performance of normal daily activities, which we will try to confirm using the *Oxford Shoulder Score* questionnaire.

**Hypothesis 2:** we assume that due to the influence of rehabilitation methods we can increase the range of motion to flexion in the shoulder joint.

**Hypothesis 3:** we assume that due to the influence of rehabilitation methods we can increase the range of motion to abduction in the shoulder joint.

**Hypothesis 4:** we assume that we can reduce shoulder pain due to rehabilitation methods.

In H1, we wanted to point out whether the quality of life is deteriorating during normal daily activities in patients with impingement syndrome. To confirm the hypothesis after evaluating the questionnaire, the values were higher than 2. For H2 and H3, we tried to prove whether there is an improvement in mobility in the arm to flexion and abduction, which we used statistical calculations to compare input and output measurements. In H4, we tried to confirm the hypothesis that we used rehabilitation to reduce shoulder pain. We did this using statistical calculations by comparing input (first) and output (second) measurements. We used IBM SPSS and MS Excel programs for statistical calculations.

#### **STUDY RESULTS**

Shoulder problems were present in the front area at 3 patients (15 %), in middle area at 10 patients (50 %) and in the back area 7 patients (35 %).

#### Description of cardinal variables

For a basic description of the cardinal variables (shoulder pain, flexion and abduction, and the *Oxford Shoulder score*) we present the average, standard deviation, median, modus, minimum and maximum value, and normality testing results. We also supplemented the analysis with values for individual parts of the shoulder — areas: front, middle and back.

The results of the average score for the research set and the standard are shown in Graph 1.

To compare the gross score of the *Oxford Shoulder Score* with the standard, we verified its normal distribution using the *Kolmogorov-Smirnov Test* for smaller sets, while the analysis confirmed the normal distribution of variables, on the basis of which it was possible to choose a parametric test within statistical inference.

The descriptive analysis showed a difference between the average score in the first and second measurements, with the average score of shoulder flexion increasing from an average value of 119.25 to 163.25 and an abduction value from 113 to 165.75 degrees. The median value in case of flexion increased from 110 (first measurement) to 170 (second measurement) and from 100 to 175 in the case of abduction. The average values and medians of both variables for the first and second measurements are shown in Graph 2.

We supplemented the analysis with average values for individual shoulder areas — respondents achieved the lowest value of flexion in the first measurement in the front area — 98.3, then in the back area — 118.57 and the middle area — 126.00. In the second measurement, the highest average score of 180 was found in the back area, followed by the middle area — 161 and the front area — 160. We see the highest improvement in the back area of the shoulder. The results are presented in Graph 3.

#### Graph 1:

Average score of the "Oxford Shoulder Score"



(Source: own processing)

#### Graph 2:

Average scores of flexion and abduction variables



(Source: own processing)

#### Graph 3:

Average score of flexion variable for shoulder areas



(Source: own processing)

Respondents achieved the lowest value of abduction in the first measurement in the front area -95, then in the back area -111.42 and the middle area -119.50. In the second measurement, the highest average score of 170 was found in the back area, followed by the front area -166.67 and the middle area -162.50. We see the highest improvement in the front area of the shoulder. The results are presented in Graph 4.

To select the statistical test, we also tested the normality of the flexion and abduction variables of the first and second measurements using the *Kolmogorov-Smirnov Test* for smaller sets, while the analysis confirmed the normal distribution of variables only at the first measurement — on which basis it was necessary to choose a non-parametric test for statistical inference (Table 1).

In Table 2, we present the descriptive characteristics of the pain variable for the first and second measurements, with a reduction in the pain rate indicating an improvement by the effect of the therapy. The avearge values and median of pain variables for the first and second measurements are shown in Graph 5.

#### Graph 4:

Average score of the abduction variable for shoulder areas



(Source: own processing)

#### Table 1:

Verification of normality of cardinal variables flexion and abduction

Kolmogorov-Smirnov Test							
Flexion — 1. measurement	0,198						
Flexion — 2. measurement	0,006						
Abduction — 1. measurement	0,046						
Abduction — 2. measurement	0,001						

(Source: own processing)

#### Table 2:

Description of the cardinal pain variable for the first and second measurement

N - 20	Pain					
N = 20	1. measurement	2. measurement				
Average	6,90	2,90				
Standard deviation	1,80	1,68				
Median	7	2,50				
Modus	7	1				
Min	4	1				
Мах	10	6				

(Source: own processing)

#### Graph 5:

Average score of the pain variable



(Source: own processing)

Respondents achieved the highest scores in the degree of pain in the first measurement in the front area of the shoulder -8and the same average score of 6.7 in the middle and back area. In the second measurement, the lowest average score of 2.42 was found in the degree of pain in the back area, followed by the middle area -3.00 and the front area -3.66. The results are presented in Graph 6.

#### Graph 6:

Average pain score for shoulder areas



(Source: own processing)

To determine the statistical significance of the differences between the averages, we tested the normality of the variable in order to select a statistical test. The results of the analysis (*Kolmogorov-Smirnov Test*) confirmed the normal distribution of the pain variable in the examined group also only in the first measurement, on the basis of which it was necessary to choose a non-parametric test for statistical inference.

#### Hypothesis verification results

**Hypothesis 1:** we assume that the impact of impingement syndrome will worsen the performance of normal daily activities, which we will try to confirm using the *Oxford Shoulder Score* questionnaire.

To verify Hypothesis 1, we compared the score of the examined group with a standard which value is 2. Higher values indicate a deterioration in the performance of normal daily activities. Based on the results of normality testing, we used the parametric *One-sample t-Test*, which allows you to compare the values of the research set with the standard. Statistical analysis showed that the examined group achieved a statistically significantly higher score than the standard. The results are presented in Table 3.

Based on the confirmation of Hypothesis 1, we also analyzed the values for the individual areas of the shoulder: front, middle and back. We also applied *One-sample t-Test* (normality was also confirmed when splitting files). The results of the analysis showed a statistically significant difference in the *Oxford Shoulder Score* of the questionnaire in all shoulder areas. The results are shown in Graph 7.

#### Table 3:

Test results of testing H1: One-sample t-Test

	Examined group	Standard	One-sample t-Test		
	М	м	Т	SD	Sig.
Oxford Shoulder Score	3,20	2,0	6,11	0,88	0,000

(Source: own processing)

#### Graph 7:

Average score of the "Oxford Shoulder Score compared to the standard"



(Source: own processing)

**Hypothesis 2:** we assume that due to the influence of rehabilitation methods we can increase the range of motion to flexion in the shoulder joint.

To verify Hypothesis 2, we used a comparison of variables that represent the differences between shoulder flexion in the first and second measurements. Based on the results of normality testing, a non-parametric *Wilcoxon Signed-rank Test* was used to compare the values of the two measurements (Table 4). The result indicates a significant difference (Sig. < 0001) between the values in the first and second measurements. In order, we see that all 20 patients showed an improvement (positive ranking) compared to the first measurement, which indicates an increase in shoulder flexion in the second measurement, and confirms Hypothesis 2.

**Hypothesis 3:** we assume that due to the influence of rehabilitation methods we can increase the range of motion to abduction in the shoulder joint.

To verify Hypothesis 3, we used a comparison of variables that represent the differences between shoulder abduction in the first and second measurements. A non-parametric *Wilcoxon Signed-rank Test* was used to compare the values of the two measurements based on the results of normality testing. Statistical analysis showed a significant difference (Sig. < 0001) between the values in the first and second

measurements. According to the order, we see that all 20 patients showed an improvement (positive ranking) compared to the first measurement, which indicates an increase in shoulder abduction in the second measurement. Based on the results of the analysis, we accept Hypothesis 3. The results are shown in Table 5.

In order to verify Hypothesis 4, we compared the pain degree at the first and second measurements. Based on the results of normality testing, a non-parametric *Wilcoxon Signed-rank Test* was used to compare the values of the two measurements. The analysis showed a statistically significant difference (Sig. < 0001) between the values in the first and second measurements. According to the order, we see that all 20 patients showed an improvement (negative ranking) compared to the first measurement, which indicates a reduction in pain in the second measurement. Based on the results of the analysis, we accept Hypothesis 4. The results are shown in Table 6., Graph 8

#### Graph 8:

Comparison of the first and second measurements of the examined variables



(Source: own processing)

The average score for the shoulder areas for performing daily activities according to the *Oxford Shoulder Score* questionnaire is shown in Graph 9.

#### Graph 9:

Average score for shoulder areas for daily activities according to the "Oxford Shoulder Score"



(Source: own processing)

#### DISCUSSION

The highest incidence of impingement syndrome is during the sixth decade of life. Garving et al. (2017) emphasize that the diagnosis itself is a big problem, as several pathologies in the shoulder can mimic the symptoms of impingement during the examination, so a proper clinical examination, taking a medical history and confirming the diagnosis by MRI is very important. According to Garving et al. (2017) an early conservative treatment is important. According to Kalter et al. (2011) kinesiotaping in combination with manual therapy is a suitable conservative treatment in terms of affecting pain and function, but the probability of efficacy is still the subject of a study.

In a pilot study of 22 patients lasting more than six weeks, they compared taping as an addition to conventional manual therapy with conventional rehabilitation. The authors found a significant improvement in function and a reduction in pain due to taping after two weeks of application. All three studies reported pain reduction and improved shoulder function. According to Kromer and Bastiaenen (2010), it is not possible to recommend most technical treatments, such as ultrasound or laser. However, the evidence is limited by poor methodological quality, short follow-ups and small patient sample sizes. In our study, we sought to combine all of the above interventions (Gúth, et al. 2015). We used manual therapy along with exercise to improve function and reduce pain. Subsequently, we used a combination of electrotherapy - direct and alternating current, me too laser, ultrasound and in the end we amend the therapy with the application of kinesiotaping, which prolonged the effect of the therapy at home. Using the methods we selected, the results in shoulder difficulties were very well affected. We reduced the pain and subsequently, with an appropriate intervention, we managed to improve the range of motion in flexion and abduction. However, our study included 20 patients, which is a relatively small representative sample, but indicated that it made sense to work on further studies focusing on conservative treatment in the future. In their study, Kromer and Bastiaenen (2010) point out that longer-lasting impingement symptoms can also be influenced by psychological factors. We were able to confirm this claim using the Oxford Shoulder Score. The result of the questionnaire was that almost all patients experienced life limitations during normal daily activities. This is one of the many reasons why a good physiotherapy intervention is very important.

#### CONCLUSION

In the study, we focused on the problems of impingement syndrome during the COVID-19 pandemic, which, if not resolved in time, also led to the development of the "frozen shoulder" syndrome (Schreiter 2018). According to a study by Kromer, Bastiaenenea (2010), shoulder problems are one of the most common musculoskeletal problems observed by healthcare professionals, with an incidence of 9.5 per 1000 patients. In our work, we focused on the effect of conservative treatment in order to improve shoulder problems. We focused on influencing pain and range of motion in flexion and abducTable 4: H2 test results: Wilcoxon Signed-rank Test

Order	N	Average order	Wilcoxon Test		
	Negative	0	0	Z	-3,922
Flexion 1. a 2. measurement	1. a 2. measurement Positive		10,50	Sig.	0,000
	Matches	0			
	Total	20			

Table 5: Test results H3: Wilcoxon Signed-rank Test

Order	N	Average order	Wilcoxon Test		
	Negative	0	0	Z	-3,922
Abduction 1. a 2. measurement	Abduction 1. a 2. measurement Positive		10,50	Sig.	0,000
	Matches	0			
Total		20			

Table 6: Test results H4: Wilcoxon Signed-rank Test

Order	N	Average order	Wilcoxon Test		
Negative		0	0	Z	-3,922
Pain 1. a 2. measurement	. a 2. measurement Positive		10,50	Sig.	0,000
Matche		0			
Total		20			

(Source: own processing)

tion through conservative treatment. In our study, we sought a combination of physiotherapeutic interventions. Using the methods we selected, the results in the shoulder were very well influenced. We reduced the pain in the shoulder and subsequently, with appropriate intervention, we were able to improve the range of motion in flexion and abduction. However, the study included 20 patients, which is a relatively small representative sample, but indicated that it makes sense to work in the future on further studies aimed at using a combination of rehabilitation methods for frozen shoulder syndrome.

Long-term pain in impingement syndrome can also affect psychological factors (Gúth *et al.* 2019). We were able to confirm this claim using the *Oxford Shoulder Score*. The result of the questionnaire was that almost all patients experienced life limitations during normal daily activities. Coronaviruses are a large group of viruses that contain a single RNA. They are said to cause 15-30 % of all respiratory infections (Neumannová 2011; Lakota 2022). This is why a good rehabilitation intervention is very important, in order to improve the difficulties and prevent patients from entering the chronic phase of the disease, which can lead to a deterioration of the mental condition.

#### **Conflict of interests:**

The authors have no conflict of interests to declare.

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## Communication barriers in people with hearing loss during COVID-19 pandemic

## Komunikačné bariéry osôb so sluchovým postihnutím v čase pandémie COVID-19

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**Introduction:** The widespread use of face coverings during the COVID-19 pandemic has created communication challenges for many individuals, particularly for people with hearing loss, who are deaf or hard of hearing. Anyone with hearing impairment can have difficulties with communication due to facemask.

**Objective:** The aim of our review article was to draw attention to communication barriers for people with hearing impairments, with special regard to the situation in the Slovak Republic

**Core of work:** Various studies published in world available literature reported that face coverings negatively impacted hearing, understanding, engagement, and feelings of connection with the speaker. These difficulties were noticeable in patients with severe hearing loss. Developing communication support strategies for people with hearing loss is an urgent need while COVID-19 measures are in place.

**Conclusion:** The vast majority of the hearing impaired in the population are hard of hearings or hearing impaired people who prefer communication in spoken language at various levels. The communication needs of hard of hearing who do not use sign language and rely on lipreading have been almost completely overlooked. The fact that they often have a problem understanding speech, it is not taken into account in the Slovak legislation concerning the hearing impaired

Keywords: hard of hearing, communication barriers, COVID-19 pandemic

**ABSTRAC** 

**Úvod:** Povinným používaním rúšok, respirátorov počas pandémie COVID-19 sa vytvorili problémy v komunikácii pre mnohých jednotlivcov, najmä však pre ľudí so stratou sluchu, ktorí sú nepočujúci alebo nedoslýchaví. Každý jedinec so sluchovým postihnutím môže mať ťažkosti s komunikáciou kvôli prekrytiu tváre.

**Cieľ:** Cieľom nášho prehľadového článku bolo upozorniť na komunikačné bariéry u ľudí so sluchovým postihnutím s osobitným zreteľom na ich situáciu v SR.

**Jadro práce:** Rôzne štúdie publikované v dostupnej svetovej literatúre uviedli, že zakrytie tváre negatívne ovplyvnilo komunikáciu, angažovanosť a pocity spojenia s hovoriacim. Rozvoj stratégií podpory komunikácie pre ľudí so stratou sluchu je naliehavou potrebou, kým sú zavedené opatrenia COVID-19.

**Záver:** Prevažná väčšina sluchovo postihnutých v populácii sú nedoslýchaví alebo sluchovo postihnutí, ktorí uprednostňujú komunikáciu v hovorenom jazyku na rôznych úrovniach. Komunikačné potreby nedoslýchavých, ktorí nepoužívajú posunkovú reč a spoliehajú sa na odčítanie z pier, boli takmer úplne prehliadané. S tým, že majú často problém porozumieť reči, sa v slovenskej legislatíve týkajúcej sa sluchovo postihnutých nepočíta.

Kľúčové slová: nedoslýchaví, komunikačné bariéry, pandémia COVID-19

#### INTRODUCTION

The current COVID-19 pandemic has forced worldwide mandatory adoption of social distancing measures and face masks to limit the diffusion of the SARS-CoV-2 infection via droplets. The new norm in the COVID-19 pandemic is wearing facemasks to prevent disease transmission. The widespread use of face coverings during the COVID-19 pandemic has created communication challenges for many individuals, particularly for those who are deaf or hard of hearing and for those who must speak through masks in suboptimal conditions. As a result of this preventive measure, the deaf and hearing-impaired people feel excluded from the hearing world or the major hearing population. Deaf people who rely on sign language still need facial expressions for full understanding of what is being communicated, and those with hearing aids or cochlear implants during rehabilitation rely on lip reading to better understand what is being heard. Anyone with hearing impairment will have difficulty with muffled speech due to facemask (Garg et al. 2021)

The extraordinary epidemiological situation during COVID-19 pandemic, a disease caused by the coronavirus SARS CoV-2, highlighted the communication barriers encountered by people with hearing impairments in the Slovak Republic in overcoming barriers in access to information, health care, social services and in other areas of life. Although the Slovak Republic has adopted the document "United Nations Convention on the Rights of Persons with Disabilities," in general we can state that the availability and use of new technologies, including information and communication technologies, communication aids, equipment and supportive devices, is insufficiently supported in Slovak legislation. These technologies (including transcription services) are suitable for people with different and different degrees of hearing impairment. In the Czech Republic, transcription service was introduced much earlier.

Proposals submitted by representatives of the hearing impaired people at the Ministry of Labour, Social Affairs and Family of Slovak republic are mainly aimed at the d/Deaf group, who prefer sign language in communication, less so to other groups of hearing impaired people such as the hard of hearing, postlingually deaf or cochlear implant users. Even when drafting social laws, the Slovak Republic somehow neglected or bypassed whether there are different categories of hearing impaired people who have different needs: other different needs have D/deaf and different needs have other hearing disorders (hard of hearings, poslingually deafenned or deafenned in older age, cochlear implant users). However, the vast majority of the hearing impaired in the population are hard of hearings or hearing impaired people who prefer and hear spoken language at various levels. The fact that they often have a problem understanding it is not taken into account in the Slovak legislation concerning the hearing impaired. The polarization of the entire hearing-impaired community is very significant not only in Slovakia but also in the Czech Republic, Germany, Austria and Hungary. Nevertheless, in the neighboring countries, both groups of the hearing

impaired have an equal status, which is unfortunately not possible to state in Slovakia, about the status of hearing-impaired persons who do not use sign language.

#### OBJECTIVE

This review was done to describe the challenges faced by the hearing-impaired people during the COVID-19 pandemic. Method of work was analysis of studies in database PubMed (Medline) dedicated to communication barriers in persons with hearing loss during COVID-19 pandemic. It also highlights the situation in Slovak republic and possible solutions which should be undertaken to make these hearing-impaired persons in Slovakia more inclusive in the currently masked world during COVID-19 pandemic.

#### PEOPLE WITH HEARING LOSS

Person with hearing loss is a person who is not able to hear as well as someone with normal hearing — hearing thresholds of 20 dB or better in both ears. Hearing loss may be mild, moderate, severe, or profound. It can affect one ear or both ears, and leads to difficulty in hearing conversational speech or loud sounds.

Various authors define hearing impairment differently. Medicine defines hearing impairment differently from social work or social policy. Pedagogy also defines hearing impairment differently from medicine or psychology. In principle, we can talk about two poles of identity for the hearing impaired individuals or people with hearing loss: deaf and/or hard of hearing (Groma 2012; Tarcsiová 2014).

Deaf people mostly have profound hearing loss, which implies very little (hearing residue) or no hearing. They often (but not always) use or prefer sign language for communication. The term "hard of hearing" refers to people with hearing loss ranging from mild to severe. People who are hard of hearing usually communicate through spoken language and can benefit from hearing aids, cochlear implants, and other assistive devices as well as captioning.

#### Deaf

At one pole of identities are the "lingual and cultural" d/Deaf. The group is made up of people who have unconditionally joined the Deaf community and attach a higher value to sign language in their lives than spoken language/speech. They do not aim for integration into the hearing majority by mastering communication in the form of spoken speech, as the hard of hearing, who prefer spoken language (speech). Representatives of this culture grew up in an environment of deaf peers, attended schools for the deaf or hard of hearing, from whom they learned sign language, or adopted it as deaf children of deaf parents. If we understand speech as a social creation of people, in which a specific version of the world is incorporated, it can be stated that the identity of the d/Deaf has its roots even in the impossibility of fully accepting the version of the intact (hearing) majority about the world of the hearing. This separates the deaf from the world of the hearing people and forces them to find a new identity as linguistically and culturally d/Deaf (written with a capital letter d). There is also a bicultural identity in which the deaf take the position that not only the speech of the hearers but also the sign language of the Deaf is important, thus promoting integration into both communities (Groma 2012). Sign language opens the door to the Deaf community.

#### Hard of hearing

At the other pole are individuals with hearing impairments who consider themselves part of the hearing world and participate in it. The hearing status of these "deaf people" can be very different: from mild hearing loss to complete deafness. They rely on spoken language and listening, often supplemented by looking spoken language from their mouths (lipreading). They mostly prefer spoken language communication. Their spoken language is usually built at a very good level and they have no problem understanding (their communication strategies are based on audio prosthetic devices such as hearing aids or cochlear implants, but also on looking speech from the speaker's lips). An important factor is the preference for spoken language. They grew up in a hearing, "integrated environment", achieving higher education than deaf people from schools for deaf or hearing impaired. These hearing impaired people understand the world of the hearing, their reservations about it most often relate to the insensitivity of the hearing, which is the source of many barriers and limitations in various areas of life (Groma 2012). The preference for oral speech over sign language has also been transferred to the labeling of their identity as "oral deaf". This group consists of people who hold the view that spoken language is more important than sign language. It points to a close alliance with hearing people and their cultural values and is accompanied by considerable efforts to be included in this community.

Hard of hearing people do not tend to form, similar to d/ Deaf so-called linguistic cultural minority within the majority hearing society and do not have such a strong tendency to associate in visible communities as linguistically and culturally d/Deaf. If they have mastered and preferred spoken language as a means of communication, they tend to integrate into the world of the hearing (hearing society or majority) and become a part of it. The identity of the hard of hearing is created in contrast and differently from the identity of culturally d/Deaf people: By considering themselves deaf, they are different from the hearing people: instead of emphasizing differences (using sign language, etc.), they place more emphasis on what they have with the hearing world in common.

There are still existing barriers to build pure integration and inclusion of people with hearing impairments and these have to meet many obstacles in the different field of daily-life activities, the mostly they have to push themselves to believe in themselves to be able to figure out their personal goals. Their quality of life is decreased by the less opportunities for self-development and employment (Budayová, Cintulová, Chanas, 2018). The another study focused on the marital status of young people, especially people up to 40, the most of the people with hearing impairments are willing to enter marriage and do not prefer cohabitation due the practical partnership communication (Ludvigh Cintulová, Radková, 2021).

This very large group of people of both productive and post-productive age (but also applies to children and young people of school age), in the Slovak Republic still does not have equal access to important information from politicians' appearances (press conferences) or decisions on measures taken from crisis meetings staff and other activities (online conferences, etc.). In addition, it encounters numerous barriers in communication and access to the provision of health and social work services. In the absence of a simultaneous transcription service and performances by speakers on television or online (virtual) communication with a veil on the speaker's face, this group does not have equal access to information. The veil, covering the speaker's face on the face, represents for them an insurmountable barrier to the successful perception of spoken speech, which is based on lipreading (the perception of the spatial dimension of spoken words). This group is the majority of the people with hearing loss and does not use sign language. In the current pandemic situation, where not only politicians or government officials are dealing with the face, but also health professionals, social workers and institutions, this part of the hearing-impaired population is severely discriminated against due to the difficulty of understanding the spoken word and he can't help looking at the speaker's face. In the absence of simultaneous transcription of the spoken word, equal access to information is not ensured for both groups of the hearing impaired. Access to information is currently provided only for a much smaller group of the hearing impaired — d/Deaf, who prefer and use primarily sign language in normal communication.

They need a safe environment based on trust and acceptance where the client feels listened to, understood and accepted without prejudice. It helps the client identify their own inner resources so that they are able to use them to solve their problems. It is a confidential and non-judgmental form of help, a process that requires a special kind of listening referred to as "active listening" (Hamarová 2021), even they have to face deaf problems. Study of Rác and Ludvigh Cintulová (2020) highlight the fact that the quality of life during the pandemic is influenced by the personal attitude to the crisis situation, coping strategies, but also the negative impact of the environment with unsupportive communication tools for the people with the hearing problems.

#### SOME STUDIES IN WORLD LITERATURE

Significant communication barriers in deaf and hard of hearing (DHH) patients were higlighted already in times before COVID-19 pandemic. Barriers to communication for those with hearing loss are not only associated with social, emotional, educational and occupational difficulties, but also with reduced access to essential healthcare services, health information, and poorer health outcomes (Emond *et al.* 2015). WHO has recommended various measures to combat the COVID-19 pandemic, including mask-wearing and physical distancing. However, these changes impair communication for individuals with hearing loss. Kataoka *et al.* (2021) investigated the changes in auditory communication associated with COVID-19 measures in 269 patients (male: 45.7 %, female: 54.3 %, median age: 54 y.o.). Most patients with hearing loss had difficulty engaging in auditory communication with people wearing masks, especially in noisy surroundings or with physical distancing. These difficulties were noticeable in patients with severe hearing loss. Therefore developing communication support strategies for people with hearing loss is an urgent need while COVID-19 measures are in place.

Atcherson *et al.* (2021) published study, in which included some newer mask options as well as transparent masks to help those who depend on lipreading and other facial cues. The results corroborate earlier published results for non-transparent masks, but transparent options have greater attenuation, resonant peaks, and deflect sounds in ways that non-transparent masks do not. Although transparent face coverings have poorer acoustic performance, the presence of visual cues remains important for both verbal and non-verbal communication. Fortunately, there are creative solutions and technologies available to overcome audio and/or visual barriers caused by face coverings. Ther results of this study were in agreement with the results published by Corey *et al.* (2020).

Health care professionals may wish to use any of the following mechanisms to ensure effective empathetic communication in these situations: reduce background noise; obtain the individual's attention; ask how the individual prefers to communicate; confirm hearing aid users are using them; speak slightly louder, and with a minimally reduced rate; rephrase — rather than repeating the same words, shouting, exaggerated pronunciation, etc; take turns when speaking; optimize positioning (ie, face to face, not moving around or walking); use low-tech methods (eg, pen-and-paper, clear partitions) or high-tech assistive technologies (eg, Wi-Fi–enabled computer tablets or various video chat applications on smart phones) to enable health care professionals, family members, and/or certified deaf interpreters to safely interact with patients without need for masks, etc. (Ten Hulzen and Fabry 2020).

Saunders *et al.* published study (2021) in which participants (with few exceptions) reported that face coverings negatively impacted hearing, understanding, engagement, and feelings of connection with the speaker. Impacts were greatest when communicating in medical situations. People with hearing loss were significantly more impacted than those without hearing loss. Face coverings impacted communication content, interpersonal connectedness, and willingness to engage in conversation; they increased anxiety and stress, and made communication fatiguing, frustrating and embarrassing — both as a speaker wearing a face covering, and when listening to someone else who is wearing one. Authors concluded that face coverings have far-reaching impacts on communication for everyone, but especially for people with hearing loss. Their findings illustrate the need for communication-friend-

ly face-coverings, and emphasise the need to be communication-aware when wearing a face covering.

The results of Chinese authors showed that older Deaf or Hard of hearing people had weak reception of critical information about the epidemic, and had suboptimal access to medical care during emergency quarantine, which increased interpersonal communication barriers to this group. Their findings highlight the urgent need for targeted strengthening of the original emergency communication and coordination mechanisms in public health emergencies, and for improving policy inclusiveness for older DHH individuals during the COVID-19 pandemic and emergencies alike (Di Xu et al, 2021).

During the COVID-19 pandemic, there has been a rapid increase in the amount of information about the disease and SARS-CoV-2 on the internet. If the language used in video messages is not clear or understandable to deaf and hard of hearing (DHH) people with a high school degree or less, this can cause confusion and result in information gaps among DHH people during a health emergency (Paludneviciene *et al.* 2021).

Even though the implementation of precautions (such as face masks, social distance) should be considered essential, their impact on the communicative skills is dramatic. Although hearing loss can be treated with hearing aids or cochlear implants, the impact is still severe because many patients rely also on the visual clues to properly understand speech. In addition, only a limited part of old patients use hearing aids or cochlear implants due to the limited access to an audiological evaluation, the underestimated possible benefit and the aesthetic issue. (Broto et al. 2021). Facial masks are indeed a barrier that impair speech production and perception, make lipreading impossible and facial expressions not visible: consequently, any additional clue to hearing perception is in the end missing. In addition, face masks make it difficult to read emotions from facial expression (Carbon 2020) and communication seem to be further limited in emotional conditions (Cohn et al. 2021).

In the study of authors Ludvigh Cintulová, Rottermund, Budayová (2021) includes research about the motivation of wear face masks in the pandemic time, it says that wearing face masks is not only tool for health protection, but also it makes the barriers between people to communicate, to recognise each other and to talk with understanding and active listening.

People are more likely to feel depression, suffer from obesity, addictions, pharmacy and they become more dependent on the care of workers in long-term facilities. This may have devastating effect due to isolation of elderly and negative impact on their mental health (Radi, Bundzelová, Oláh, Muss 2021).

The healthcare providers should not give up on the use of hearing aids and cochlear implants since the psychological support is necessary for the patients and also informed consent is based on the clear communications with healthcare workers (Brotto, *et al.* 2021).

Oláh (2016) highlights the key role of the professional workers to decrease these negative impacts linked with the coronavirus pandemic by face-to-face communication and using holistic approaches and supporting social work methods.

Many solutions have been proposed internationally so far (i.e. speech-to-text mobile apps, written scripts, masks with a plastic panel over the mouth), but their application in medical daily routine is still limited and has to be tested yet. Communication in prehospital patient care has so far played a subordinate role in the training of medical and non-medical staff to better understanding for people with hearing problems (Merkt, Vollmann, Krčméry 2021).

Smartphones can access numerous automated captioning apps. These provide another in-person communication tool and be used either on the patients' personal or institution's devices. These apps involve speaking slowly and clearly into the devices' microphone so that the voice can be transcribed for the listener. Apps with computer-generated speech have higher rates of errors with background noises or accents. Thus, it is important to speak slowly and distinctly and at a comfortable volume to allow for better transcription. There are also live-streaming operators who listen remotely and type what is said; these are more accurate but also more expensive. Fortunately, Automatic Speech Recognition (ASR) platforms, incorporating machine learning, is improving rapidly and will soon offer a suitable alternative for personal transcription needs. Some existing ASR platforms include Google Live Transcribe, Otter.ai, and Interact Streamer (McKee et al. 2020).

#### SITUATION IN SLOVAK REPUBLIC

Translating (interpreting) some sessions (eg press conferences with politicians, discussions with experts on anti-epidemic measures, etc.) into sign language is available. A gradual increase in the number of sign language interpreters or an improvement in the provision of interpreting services can be expected in our country after the introduction of a four-year professionally oriented bachelor's study program Slovak Language in Communication of Deaf in 2020 (the new study program in Slovakia at Trnava University in Trnava). This program is in line with the value priorities of Trnava University in Trnava. It focuses on language and interpreting skills and offers knowledge of the lives of the deaf. "The new accredited study program aims to fill the gap caused by the lack of qualified interpreters between the Slovak language and the Slovak sign language throughout Slovakia. It aims to remove the barriers that separate the deaf from those who do not have such disadvantages.

In Slovakia, hearing aids are available in adequate quantity and quality. The intact hearing population, and often the people who experience hearing loss, simply assume that hearing problems can be solved with a modern hearing aid, which is the best-known audio prosthetic device. From a medical point of view, these aids have often been presented as a panacea, as compensatory aids or devices that "restore" the ability to hear to the extent that we know a normal hearing person. This belief implied the erroneous assumption that providing an individual with a hearing impairment with a quality and well-tuned hearing aid is in itself a sufficient solution and eliminates the consequences of the hearing impairment. Accordingly, patients no longer need to be given another form of intervention. It must be said that the hearing aid never replaces hearing one hundred percent. It can only help with sound perception and communication. Hearing aids do not improve hearing, but their role as a compensatory aid is to help improve speech intelligibility and thus improve communication as such. Therefore, the notion that the hearing-impaired person does not even need any further intervention after being assigned a hearing aid is wrong (Groma 2009; Marak and Beno 2018). Some hearing-impaired by hearing aids may hear sounds but may not understand words. Even the most powerful hearing aid available will not help to improve speech intelligibility. Generally speaking, if a hearing aid can help improve speech intelligibility, then the hearing impaired are referred to as deaf people for better socialization, well-being and physical health.

Simultaneous transcription available, unlike the surrounding countries, is either missing (not used in healthcare) or its use is just getting started and in its infancy. However, what is often missing is an interest in solving the problems associated with hearing disorders in our society. There is a lack of solutions for those who do not speak sign language, and there are many more than linguistically and culturally d/Deaf. They are people with any hearing impairment, deaf, deaf, with a cochlear implant or the elderly, who lose their hearing as a result of old age. Hearing impairment in seniors is taken only as part of the so-called autumn of life, as something that does not endanger their health and life. One solution for them is to provide television news and other television subtitles. Barriers to communication and problems encountered by the hearing impaired who do not speak or use sign language can be summarized as follows:

- Television in the Slovak Republic, as the only country in the Visegrad Four (V4), does not have important broadcasts or programs provided by subtitling/online transcription of the spoken word
- A serious problem in equal access to information in the Slovak Republic is the unavailability of the online spoken word transcription service (in the Czech Republic this service is available as a social service in every region) and it is used not only by SP but also by people with mild mental disabilities.
- Press conferences of government members and other main news are still not broadcast with an online transcript, but an interpreter for Slovak Sign Language is almost always present in these sessions.
- The consequences of security measures against the spread of the Covid-19 disease in the form of information poverty and emergency are beginning to manifest themselves significantly in the hearing-impaired people in the Slovak Republic — e.g. problems with ever-changing restrictions and regulations in relation to measures against the spread of COVID-19. Deaf people who cannot make phone calls have had problems in communication with first contact

doctors (district doctors), who at the time of the corona crisis were instructed by the Ministry of Health to "telephone ordering".

Experience and recent knowledge gained during the COVID-19 pandemic have shown that some of the serious and wide-ranging negative effects of the pandemic include, in particular, those that affect mental health and resilience (Mašán, Hamarová 2021).

The problem with the current Slovak legislation (Act 447/2008; Act 448/2008) is that it is aimed only at people with severe disabilities. It does not apply to people we call hard of hearing. The current valid law 448/2008 Coll. on social services and on the amendment of Act no. 455/1991 Coll. on Trade Licensing (Trade Licensing Act), as amended, does not deal much with the differences between individual types of hearing impairment or their carriers. It does not address the fact that there are two categories of hearing-impaired people: deaf and hard of hearing, each of which is specific with its different needs. In the sections concerning social assistance or services to such persons, only a person with a hearing impairment who does not hear spoken language, a person with severe hearing loss on both sides and a deaf person are mentioned. However, such differentiation is unnecessary. Because according to the tables of Act 447/2008, hearing loss is so significant in all cases that everyone can be labeled as deaf. They all have hearing loss of over 80 % (according to Fowler). The law, of course, remembers its mitigation provisions, but these only apply to the part of the population with a hearing impairment that meets the prescribed limit (Marak 2018; Marak and Beno 2018). It does not take into account that the hearing-impaired, people who do not use sign language as a means of communication and who are the majority of the hearing-impaired population, also have their rights and specific problems in contact with the hearing majority.

The specifics encountered by hearing impaired people who do not speak and use sign language / language in relation to the quality of life in the hard of hearing population can be summarized as follows:

- Legislation in the Slovak Republic in this area has not taken into account for more than 20 years the needs and trends of a significantly growing population in the group of hearing impaired speakers who do not use sign language/speech compared to the numerically (much) much less represented group of hearing impaired d/Deaf they use sign language/speech when communicating.
- The Slovak Republic is the only country among the Visegrad Four (V4) countries that does not have affordable new generation of hearing aids (with a robotic or intelligent software solution for compensating for hearing impairment in the offer of modern hearing aids on the market with hearing aids).
- So, among the V4 countries, we are at this time, unfortunately, the worst in terms of the (un)availability of categorized hearing aids (apparatus) with a favorable surcharge for the patient. For example, a quality hearing aid with an intelligent and modern solution that really improves

the hearing quality of the hearing impaired, a Slovak citizen pays 600-900 Euros, while in Poland, Hungary or the Czech Republic a patient pays an average of 200 Euros for the same hearing aid.

#### CONCLUSION

People with hearing loss were significantly more impacted than those without hearing loss. Impacts were greatest when communicating in medical situations. Various studies published in world available literature reported that face coverings negatively impacted hearing, understanding, engagement, and feelings of connection with the speaker. Some limits are unbreakable, others can be overcome or circumvented by modern technology. In conclusion, further research to provide effective solutions and global strategies is needed.

During COVID-19 pandemic, bridging the gap in health literacy for d/Deaf or hard of hearing individuals is essential in both policy and practice, in order to ensure equal access to healthcare and universal compliance with health directives at the population level.

The solution would be to expand state intervention in Slovakia as well as provide assistance for people with lower hearing loss than prescribed by the current tables of laws (assistance to people who have to use a hearing aid). A change of attitude in the sense that deaf and hard of hearing people who do not use sign language/speech also form a unique, albeit diverse (inhomogeneous) group with their own life needs and life reality, which distinguishes them from the other group of hearing impairments who are socially and cultural d/Deaf. Support for activities that would increase the possibility of socialization and communication, rehabilitation to alleviate the negative mental and emotional consequences of hearing impairment.

The communication needs of those who rely on lipreading have been almost completely overlooked. The degree of hearing loss is significantly related to the way in which communication is made more difficult due to mask wearing. Age is a strong risk factor for both hearing loss and morbidity and mortality from COVID-19. The dramatic shift in health care norms places these individuals at a great disadvantage for being able to communicate and receive appropriate care.

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## Detection of circulating tumor cells using microfiltration with application of polycarbonate membrane

## Detekcia cirkulujúcich nádorových buniek mikrofiltráciou s použitím polykarbonátovej membrány

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**Objective:** The aim of our study was the potential detection of circulating tumour cells (CTCs) in early stage breast cancer patients. Our approach was cell microfiltration through polycarbonate membrane as a concentration method suitable for CTC selection in peripheral blood. The isolated cells on membrane were further analysed by laser scanning cytometry.

**Methods:** Sixteen patients were enrolled in the study, of which 13 had early stage breast carcinoma and 3 patients had metastatic breast carcinoma. The analyses were performed from 9 ml of peripheral blood, in one patient blood was drawn twice. Blood samples were taken after adjuvant chemotherapy but prior to adjuvant radiotherapy. The control group consisted of 12 clinically healthy subjects.

**Results:** In the control group 3 subjects out of 12 had 1 CTC, the mean CTC numbers being  $0.25 \pm 0.45$ . In the early stage breast cancer patients 0-36 CTCs were detected (mean  $13.9 \pm 12.9$  CTCs. Eight patients out of 13 had more than 2 CTCs (62 %). The used technique is a simple and reproducible method of detection of CTCs in peripheral blood. Sensitivity of the method is 88.5 %.

**Conclusions:** Detection of CTCs seems to be a promising method for the monitoring of adjuvant therapy in early stage breast cancer patients and for the identification of high risk patients in whom elevated numbers of CTCs are persisting following the termination of adjuvant therapy.

Keywords: microfiltration, circulating tumor cells, laser scanning cytometry

ABSTRAC

**Cieľ:** Cieľom našej pilotnej štúdie bola možnosť overiť detekciu cirkulujúcich nádorových buniek (CTC) u pacientiek v skorých štádiách karcinómu prsníka. Zamerali sme sa na využitie mikrofiltrácie cez polykarbonátovú membránu ako koncentračnej metodiky vhodnej pre selekciu CTC v perifernej krvi. Izolované bunky na membráne sme ďalej analyzovali pomocou laserovej skenovacej cytometrie.

**Metóda:** Do štúdie bolo zahrnutých 16 pacientiek. 13 pacientiek malo skoré štádium karcinomu prsníka. 3 pacientky mali metastatický karcinóm prsníka. Odoberali sme 9 ml perifernej krvi, u jednej pacientky sme realizovali 2 odbery. Odbery sme realizovali po adjuvantnej chemoterapii pred začiatkom adjuvantnej radioterapie. Kontrolnú skupinu tvorilo 12 klinicky zdravých darcov.

**Výsledky:** U kontrolnej skupiny sme namerali jednu CTC u 3 darcov, priemerné hodnoty CTC boli 0,25±0,45. V skupine pacientiek so skorým karcinómom prsníka sme namerali od 0-36 CTC. Priemerná hodnota bola 16,6 ± 16 CTC. 8 pacientiek malo 2≥ CTC (62 %).

**Zhrnutie:** použitá metodika je jednoduchá a reprodukovatelná na detekciu CTC v perifernej krvi. Senzitivita metodiky je 88,5 %.

**Záver:** Detekcia CTC je vhodná na monitorovanie adjuvantnej terapie u skorých štádii karcinómu prsníka a selekciu vysoko-rizikových pacientiek u ktorých po skončení adjuvantnej terapie pretrvávajú zvýšené hladiny CTC.

Kľúčové slová: mikrofiltrácia, cirkulujúce nádorové bunky, laserová skenovacia cytometria

#### INTRODUCTION

Despite advances in the treatment of early-stage breast cancer, relapse within 5 years is present in 30 % of node-negative and 60 % of node-positive patients (Early Breast Cancer Trialists' Collaborative Group 2012, (Early Breast Cancer Trialists' Collaborative Group 2014). With positive lymph nodes, approximately 40 % of patients live to be 10 years or older (Overgaard, Hansen, Overgaard et al 1997; Ragaz 1997). Currently used prognostic features are unable to select low and high risk subgroups in the node of positive and negative breast cancer patients. Current knowledge points to the independence of tumor cell proliferation by hematogenous and lymphogenic routes (Gerber, Krause, Muller et al. 2001). Bone marrow occult tumor cell (OTC) evidence is an independent prognostic feature for patients with breast (Diel, Kaufmann, Costa et al. 1996; Cote 1999; Wiedswang, Borgen, Karesen et al. 2005), lung (Pantel, Izbicki, Passlick et al. 1996) and colorectal cancer (Lindemann 1992). The tumor releases tumor cells into the circulation at an early stage (Racila, Euhus, Weiss et al. 1998; Beltsch, Clifford 2000), although the characteristics of these circulating cells are still unclear. O'Sullivan et al. pointed to an increased metastatic potential of OTC in patients with established bone marrow micrometastases preoperatively but not postoperatively (O'Sullivan, Collins, Kelly et al. 1997).

Peripheral blood tumor cell detection is an easily reproducible methodology as opposed to bone marrow puncture. The main obstacle in detecting circulating tumor cells (CTC) is the low concentration of CTC in the blood, less than 1 CTC/1 ml. To achieve maximum sensitivity, concentration methodologies have been developed that use immunomagnetic separation or microfiltration. It is currently the most common immunomagnetic method Allard et al. 2004). The advantage of immunomagnetic separation is its versatility for further work with CTC. A less common concentration methodology is microfiltration, as described by Vona et al. (Vona, Sabile, Louha et al. 2000). A polycarbonate membrane with a pore size of 8 [microns] is used for microfiltration. The size of the pores allows the passage of leukocytes and erythrocytes across the membrane and the CTC due to their size remain trapped on the membrane. The use of laser scanning cytometry /LSC / for membrane cell analysis has made it possible to simplify preparation and cytometric measurement of isolated cells (Hayes, Walker, Singh et al 2002). In our work, we focused on the development and standardization of a methodology suitable for clinical use to clarify the diagnosis of breast cancer. We present our preliminary measured results in patients with early-stage breast cancer.

#### **METHODS**

#### Sampling:

Blood was collected from patients with clinical stage I and II breast cancer., after informed consent. The patients were after surgery and chemotherapy before the start of adjuvant radiotherapy. We obtained clinical data from medical records. We collected 9 ml of blood from the anti-decubital vein into Vacutainer EDTA collection tubes (Becton Dickinson, California). Samples were also taken from volunteers from the medical staff, which we used as a negative control. Samples were processed within 24 hours of collection.

#### Sample preparation for LSC analysis:

We diluted the sample 1 : 1 with saline. For filtration, we used a 13 mm PCTE membrane (Genetics Reaserch Instrumentation Ltd., Braintree, UK) with pores with a diameter of 8  $\mu$ m. The membrane was mounted in a standard holder (Swinnex Milipore Ltd., Watford, UK). We filtered the sample under slight pressure. The filtration time was about 1 min. After filtration, the membrane was removed from the holder, rinsed in saline and fixed in methanol for 30 min. After fixation, we placed the membrane on a slide and attached it with glue. After attaching the membrane, we rehydrated 100 ml of saline. Subsequently, we stained the sample with CD45PE antibody at a dilution of 1:10 for 10 min at room temperature. The sample was rinsed 5 times with 1 ml saline and pan-cytokeratin-FITC diluted 1:10 for 10 min at room temperature. After the 2nd staining, we rinsed the sample again with  $5 \times 1$ ml saline and added 7-AAD at a dilution of 1:10 for 10 min. After staining, the staining solution was decanted from the membranes and the sample was covered with a coverslip.

After LSC analysis, we removed the specimen from the mechanical stool. The sample was stained with conventional Giemsa staining at a dilution of 1:10 for 20 min. Subsequently, we relocalized the selected cytokeratin positive cells.

#### LSC analysis:

Membranes were analyzed on a laser scanning cytometer (LSC, CompuCyte Inc., Cambridge, MA) using WinCyte PC-based software. We used a 20x lens and a 488-nm argon laser for scanning. An area on the slide with a diameter of 13 mm, including the membrane, was defined for scanning. Core contouring was performed using long red / 7AAD. We analyzed the measured events on a skatergram, where the green integral was shown on the Y axis and the CD45-PE integral on the X axis. After LSC analysis, we relocated cytokeratin positive events and created a gallery. After staining with conventional staining, we relocated the stored events using a 40x lens and used a CCD camera to visualize the cells. Finally, after a comparative analysis of the gallery, we selected tumor cells meeting the cytomorphological criteria for the tumor cell (Figure 1). Cut-off: the value was determined at 2 CTC / 4.5 ml blood.

#### **RESULTS**

We used blood from 2 volunteers to determine the sensitivity of the methodology. We collected 4 4.5 ml peripheral blood tubes from each volunteer. We added SKOV-3 tumor cells in descending dilutions to each tube. 1:10, 1 : 100, 1 : 1000, 1 : 10 000. We compared the measured data with the expected CTC values. We found 88.5 % sensitivity and 99 % linearity. In 17 samples from oncology patients, we measured an average of 3 291 leukocytes, ranging from 791 to 15 829. We performed negative control measurements in 12 healthy volunteers. We measured 1 CTC at 3 healthy volunteers.

Figure 1: Tumor cells



*Legend:* A, B: tumor cell cluster, C, D: isolated tumor cell ( $\downarrow$ ) a leucocyte ( $\Rightarrow$ ). A, C: dyeing 7-AAD, CK-FITC, CD45PE. B, D: conventional dyeing Giemsa

Of the 16 patients with breast cancer, 13 were in the early stage (I., II. Clinical stage). In one patient, initially classified as T1NO0, due to persistent elevated CA15-3 levels, multiple minor liver metastases were confirmed by MRI after re-examination. Patient referred for chemotherapy (CHT). We measured 52 CTCs before CHT. The patient completed 3 cycles of CHT, after which there was a decrease in markers and CTC (measured 15). One patient was initially IV. clinical stage. After neoadjuvant CHT Taxotere + epirubicin and subsequent surgery, the patient continued with CHT and zoladex + tamoxifen hormone therapy. The patient had metastases in the liver and skin. Subsequently, combination therapy with herceptin + navelbine was started on a weekly schedule. The patient completed 25 cycles with clinical disappearance of metastases. We did not measure any CTCs in the patient's peripheral blood.

In 13 patients with early stage breast cancer, we measured from 0 to 36 CTC, on average 16.6  $\pm$  16 CTC. 5 patients had a negative CTC test ( $\leq$  2 CTC) with a mean value of 1  $\pm$  1 and 8 patients had a positive CTC test (62 %) with a mean value of 22  $\pm$  9.6. In 4 patients with positive CTC, we collected after

adjuvant CHT, the average CTC values were  $18.3 \pm 7.8$ . In 4 CTC-positive patients, adjuvant CHT was discontinued due to age (above 70) and receptor positivity, and tamoxifen was continued for 5 years after radiotherapy. Patients had higher CTC values than patients after adjuvant CHT, averaging 25.8  $\pm$  10.8.

#### DISCUSSION

We used 2 membrane fluorochromes CD45-PE and pan-cytokeratin-FITC for CTC selection. The use of solo cytokeratin-FITC is associated with increased false positivity, as hematopoietic progenitors that may be present in the peripheral blood also express cytokeratin. The advantage of microfiltration separation over immunomagnetic separation lies in the possibility of direct staining of separated cells with various fluorochrome-labeled antibodies immediately after separation, e.g. vimentin-FITC in sarcomas, S100-FITC in melanomas. Whereas in immunomagnetic separation, in addition to the fluorochrome-labeled antibody, it is necessary to prepare an immunomagnetic grain for the separation of circulating cells. The use of monitoring CTC levels and the expression of HER-2 or other receptors on CTC represents a promising methodology for assessing the disease response to targeted monoclonal antibody therapy (Kramer, Erdal, Mertens *et al.* 2004; Cristofanilli, Budd, Ellis *et al.* 2004; Coumans, Sjoerd, Ligthart *et al.* 2012).

#### CONCLUSIONS

Despite the small set presented, the work pointed out interesting facts. 62 % of patients with early-stage breast cancer had  $2 \ge CTC$  in their circulation. Patients with CTC-positive and chemotherapy had fewer circulating cells than patients without surgery without adjuvant CHT. 1 patient with metastatic breast cancer after immunochemotherapy had no CTC in the peripheral blood. Detection of CTC appears to be a promising method for monitoring the efficacy of adjuvant therapy in patients with early-stage breast cancer and for identifying high-risk patients in whom increased CTC levels persist after the end of adjuvant therapy.

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## Occurrence of intestinal endoparasitic infections in children from the Košice region

## Výskyt črevných endoparazitárnych infekcií u detí v Košickom kraji

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ABSTRACT

**Introduction:** Despite the advances in the field of medicine and health, the prevalence of parasitic infections is relatively high. Endoparasitic infections in the population of children pose the highest risk. These infections usually have a severe impact on the health of children, with the retardation of tissue growth, anemia, deficiencies of basic elements, minerals, and vitamins.

**Research objectives:** This study aimed to bring insights into parasitic infections in children in Košice region from February 2017 to February 2020.

**Methods:** For this study, we used the ELISA method for the detection of Cryptosporidium antigen and the sedimentation method for the concentration of developmental stages of endoparasites in feces.

**Results:** A total of 327 children were examined. Endoparasitic infections occurred in children in 9.2 % of the samples. The reproductive stages of *Ascaris lumbricoides* parasites were found in 4.3 % of the samples, Hymenolepis spp. were detected in 1.8 % and Trichuris trichuria 0.9 % of the samples. *Cryptosporidium* antigen was detected in 3.1 % of children. The most affected group were preschool children, where parasitic infections occurred in 15.8 % of cases, followed by a group of children of younger school age, where parasitic infections occurred in 8.0 % of children. Intestinal endoparasitic infections were detected in 6.6 % children from hospital, and 40.0 % among children from marginalized community.

**Conclusion:** In Slovakia, intestinal endoparasitic infections are most frequent in pre-school and school children. The prevalence of parasitoses was not high, but it points however, it reflects the insufficient concern for these types of infections, which have the potential to transmit significantly in collectives of children.

Keywords: Endoparasitic infections, children population, prevalence

Úvod: Parazitárne infekcie majú aj napriek pokroku v oblasti medicíny a zdravia pomerne vysokú prevalenciu. Najvyššie riziko predstavujú endoparazitárne ochorenia pre detskú populáciu. Tieto infekcie majú často vážny dopad na zdravotný stav detí, dochádza retardácii rastu s vplyvom na vývoj tkanív, anémii, karenciám základných látok, minerálov aj vitamínov.

**Ciele výskumu**: Priniesť náhľad do výskytu parazitárnych infekcií u detí v Košickom regióne od februára 2017 do februára 2020.

**Metódy:** Pre výskum bola zvolená sendvičová metóda ELISA na stanovenie prítomnosti kryptosporídiového antigénu a sedimentačná metóda na koncentráciu propagačných štádií endoparazitov.

**Výsledky:** Celkovo bolo vyšetrených 327 detí. Endoparazitárne infekcie sa vyskytovali u detí v 9.2 % vzoriek. Detegované boli propagatívne štádiá parazitov *Ascaris lumbricoides v* 4.3 % vzoriek, *Hymenolepis* spp. v 1.8 % a *Trichuris trichuria* 0.9 % vzoriek. Kryptosporídiový antigén bol detegovaných u 3.1 % detí. Najviac postihnutou skupinou boli detí predškolského veku, kde sa parazitárne infekcie vyskytovali v 15.8 % prípadoch a za ňou nasledovala skupina deti v mladšom školskom veku, kde sa parazitárne infekcie vyskytovali u 8.0 % detí. Črevné endoparazitické infekcie boli zistené u 6,6 % detí z nemocnice a 40,0 % u detí z marginalizovanej komunity.

**Záver:** Na Slovensku sa s črevnými endoparazitárnymi infekciami najčastejšie stretávame u detí predškolského a školského veku. Úroveň prevalencie endoparazitóz nebola vysoká, avšak poukazuje na nedostatočný záujem o tento typ infekcií, ktoré majú značný potenciál sa šíriť v detských kolektívoch.

Kľúčové slová: Endoparazitárne infekcie, detská populácia, prevalencia

#### INTRODUCTION

Despite the advances in the field of medicine and health, the prevalence of parasitic infections is relatively high (Okyay, Ertug, Gultekin et al. 2004). Intestinal parasitoses are a specific group of infections, which have higher occurrence compared to other types of parasitoses. The most prevalent endoparasites are protozoan infections - cryptosporidiosis and amoebiasis, and roundworm infections - trichuriasis, ancylostomiasis, necatoriasis, and ascariasis. A large group of the population of children in developing countries suffers from more than one type of parasitic infection, mostly in coinfection with bacterial or viral pathogens. The occurrence of parasitic infections is linked with the socio-economic situation, lack of drinking water, undeveloped sewage systems, fecal contamination of the environment, malnutrition, contact with animals, low access to health care facilities, and many other factors. The most important group at risk are patients with compromised immunity, people suffering from chronic diseases, pregnant women, and children. Endoparasitic infections pose the highest risk in children of pre-school age (Bethony, Brooker, Albonico et al. 2006). This category of children is at risk because of their health condition, more specifically their immune status and behavioral habits (Robertson, Irwin, Lymbery, Thompson RCA, 2000). Young children are especially at risk because they lack basic hygienic habits, which are coupled with geophagy and onychophagy (Błaszkowska, Wojcik, Kurna-towski, Szwabe 2013). Helminthiases have a chronic impact on the health status of children, causing atrophy, growth retardation and tissue development, anemia, deficiencies of basic elements, minerals, and vitamins (Harhay, Horton, Olliaro, 2010). Insufficient access to drinking water, the lack of hygiene, poverty, low degree of education, and malnutrition are the factors supporting the higher occurrence of recurrent or chronic parasitic infections (Ramana 2012). The risks for the population and the environment are linked to asymptomatic carriers, in which the inapparent course of the infection is associated with the excretion of development stages of parasites (eggs, cysts) into the environment, leading to contamination of soil and water, with the possibility of infecting susceptible individuals or animals (Ramana 2012). There are ussually synergy concerning risk factors for infections related with high either overall or attributable mortality due to various communicable diseases, such as seasonal influenza, Covid-19, TB *etc.* (Krčméry, Bučko, Kimuli *et al.*, 2020).

#### **RESEARCH OBJECTIVES**

This study aimed to bring insights into parasitic infections in children in Košice region from February 2017 to March 2020.

#### MATERIALS AND METHODS

A small amount of feces was collected for the parasitological examination (approx. 10-15 g). With each sample, information about the sex and age of the patient was obtained. In our study, 327 stool samples were examined, from which 302 (92.0 %) came from children hospitalized at the Faculty Hospital for Children in Košice (DFN), and 25 samples (8.0 %) came from children living in district Košice — Luník IX 165 boys (50.5 %) and 162 girls (49.5 %) participated in the study. The Luník IX locality is known for the largest urban concentration of the Roma population in Slovakia. Its original hous-

Table 1: Prevalence of intestinal parasitic infections in child population by age group.

		Cryptospol	<i>ridium</i> spp.	A.lumbricoides		T.trichuria		T.trichuria	
Age group	Total	Samples	Prev. (%)	Samples	Prev. (%)	Samples	Prev. (%)	Samples	Prev. (%)
Infants and toddlers	6	0	0,00	0	0,00	0	0,00	0	0,00
Pre-school children	95	1	1,05	10	10,53	1	1,05	5	5,26
Early school age children	138	6	4,35	4	2,90	1	0,72	0	0,00
Older school age children	67	2	2,99	0	0,00	1	1,49	0	0,00
Adolescents	21	1	4,76	0	0,00	0	0,00	0	0,00
Total	327	10	3,06	14	4,28	3	0,92	5	1,53
Abbreviation: Prev., Prevalence									

(Source: own processing)

Table: Prevalence of intestinal parasitic infections in hospitalized children and in children from marginalized community.

	Posi	itive	Negative	Cryptosporidium spp.		A.lumbricoides		T.trichuria		T.trichuria	
Children	Samples	Prev. (%)	Samples	Samples	Prev. (%)	Samples	Prev. (%)	Samples	Prev. (%)	Samples	Prev. (%)
Hospitalized	20	6.62	302	9	2.98	9	2.98	2	0.66	0	0.00
Marginalized	10	40.00	20	1	4.00	5	20.00	1	4.00	5	20.00
Abbreviation: Prev., Prevalence											

(Source: own processing)

ing capacity was set at 2,400 people, but at the time of the census, there were 6,600 registered residents. There were approximately 2,200 children. On average, one apartment is occupied by 14-16 people. The housing estate faces several hygienic problems, such as corroded and clogged pipes, limited access to drinking water, contamination of the surrounding environment with excrement, accumulation of waste Children were divided into age categories depending on the stage of their development. The first group was composed of infants and toddlers up to 2 years of age (N =6), the second group was composed of pre-school children from 3 to 5 years of age (n = 95), the third group of children of early school age, from 6 to 10 years of age (n = 138), the fourth group of children of older school age, from 11 to 15 years of age (n = 67), and the last group composed of adolescents. From age 15 to 19 years of age (n = 21).

For *in vitro* diagnostic of *Cryptosporidium* spp. entigen from stool, sandwich ELISA method was selected, using the CRYP-TOSPORIDIUM 2nd GENERATION (FECAL) kit, (f. Diagnostic Automation, INC, Calbasas, USA) for qualitative detection of the *Cryprosporidium* antigen.

For in vitro helminthological examination of the development stages of parasites, PARAPREP L FORMALIN KIT (Mondial, France) was used for the concentration of parasitic eggs.

#### RESULTS

From the total 327 fecal samples, endoparasitic infections were present in 30 children (9.2 %). In the group of boys, 18 samples were tested positive (10.9 %) and in the group of girls, 12 samples were tested positive (7.1 %).

From the age perspective, the population of children was divided into five categories. In the first group (infants and toddlers), no endoparasitic infection was detected. In the category of pre-school children, 15 samples (15.8 %) were positive, in children of early school age, it was 11 children (8 %). In the group of children of older school age, 3 children (4.5 %) were positive, and from the group of adolescents, 1 sample (4.8 %) was positive (Table 1).

Of the total of 327 samples examined in this study, 302 came from children hospitalized at the DFN Košice, which represents 92 %. 25 samples came from children from a marginalized community, representing 8 %. In hospitalized children, intestinal parasites were present in 20 patients (6.6 %). In children from a marginalized community, 10 samples (40.0 %) were positive with endoparasites. *Cryptosporidium* antigen was detected in 9 (2.98 %) patients and in 1 (4.00 %) child from Luník IX. Occurrence of *A. lumbricoides* eggs was detected in 9 (2.98 %) of hospitalized children and in 5 (20.00 %) children from marginalized community. Propagative stages of *T. trichuria* were detected in 2 (0.66 %) hospitalized children and in 1 (4.00 %) child from marginalized community. Eggs of the tapeworm *Hymenolepis* spp. Were detected only in 5 (20.00 %) children from marginalized community (Table 2).

#### DISCUSSION

The prevalence of parasitoses in most countries with a high standard of public health decreased, thanks to hygienic measures. However, the increasing population density leads to overcrowding and the formation of segregated communities, which continues to create epidemiologic threats even in Slovakia. This concerns mostly the marginalized groups living in segregated neighborhoods.

In Slovakia, intestinal endoparasitic infections are most common in children of pre-school and school age (Dudlová, Juriš, Jurišová *et al.* 2016). This disproportion in the population has several bases: biological, ecological, epidemiological, and behavioral. Children have closer and more intense contact with the potentially contaminated environment. In children, basic hygienic habits are underdeveloped or absent, which is associated with geophagy and onychophagy (Błaszkowska, Wojcik, Kurnatowski, Szwabe 2013). The cause of the increased prevalence of endoparasites is the clustering of children at one place with close contact with each other for a prolonged period.

In our study, 327 children were examined for the presence of endoparasites. The prevalence of intestinal parasitoses in children was 9.2 %. The most frequently detected parasite was the helminth A. lumbricoides, with a 4.3 % prevalence, followed by Cryptosporidium spp., which were detected by the presence of Cryptosporidium antigen in the stool of 3.1 % of children. A similar prevalence of endoparasites was found in a country-wide study from Slovakia in 2016, where the prevalence of intestinal parasitoses reached 6.8 %. The population in the study was divided into two groups - children under 7 years of age, where the prevalence was 5.8 %, and older children, where it was 4.6 % (Dudlová, Juriš, Jurišová et al. 2016). Juriš et al. (2014) also examined samples for the presence of gastrointestinal parasites in children with pulmonary diseases, in which they observed a higher prevalence (19.85 %) compared to our study. In a study from 2017, focused on the prevalence of gastrointestinal parasites in children in Eastern Slovakia (Prešov and Košice region), 72 stool samples were positive, which represented a 16.9 % prevalence, which is much higher than in our study (Pipiková, Papajová, Šoltys, Schusterová 2017). Also, a similar prevalence was detected by Papajová a Šoltys, where it reached 12.99 %, and the most common parasite detected was A. lumbricoides in 12.03 % samples (Papajová, Šoltys 2019). Population of marginalized communities was included in these studies which caused higher prevalence of parasitic infections in these studies compared to our results.

In comparison with the above-mentioned studies, we can state considerable variance in the occurrence of endoparasites. This can be caused by the selection of the studied population with different proportions of children, coming from both the standard and segregated population, or by the different ratio of healthy children compared to the hospitalized ones. In the study from 2017, which was conducted in Prešov and Košice region, the prevalence of intestinal parasitoses was significantly higher compared to our study, authors observed the prevalence reaching 17 %. The study included children from marginalized settlements and hospitalized children, however, most hospitalized children were from marginalized settlements as well (Pipiková, Papajová, Šoltys, Schusterová 2017), in contrast with our study, which could explain the higher prevalence. Results from other studies also concluded the highest prevalence of endoparasites in pre-school children, followed by children of early school age, with a decreasing trend in older age groups (Chaudhry, Afzal, Malik 2004; Dudlová, Juriš, Jurišová et al. 2016; Pipiková, Papajová, Šoltys, Schusterová 2017). One of the reasons, why intestinal parasitoses in our study were observed mostly in pre-school children (15.8 %) and children of early school age (8.0 %) is characteristic for the phase of the socialization of the children, their integration with coevals, and the opportunity to play with them. The more frequent contact with other children, which is spent at the same time at one place (kindergartens, schools) can lead to a higher occurrence of endoparasites. The lower prevalence of parasitoses noted in older children and adolescents can be explained by the immune response and development of a higher level of hygienic habits, including personal hygiene (Juriš, Dudlová, Fábry et al. 2014). A similar disproportion between the children from the standard population and the segregated community was observed by Pipiková et al., (2017) where the prevalence of endoparasitic infections in children from the general population was only 0.66 %, compared to the segregated communities, where it exceeded 25 %. In a study also published in 2019 in Slovakia, differences in the occurrence of intestinal nematodes were noted when comparing the general population and segregated communities (Štrkolcová, Mravcová, Barbušinová et al. 2019). Papajová and Soltys also studied the prevalence of intestinal nematodes in context with the living conditions of the children. The prevalence of nematodes in children living in standard hygienic conditions was 0.59 %, in comparison to children living in low hygienic standard settlements, where a prevalence exceeding 27 % was shown (Papajová, Šoltys 2019).

In comparison with the mentioned studies, we can assess that the prevalence of intestinal parasitoses in children from marginalized neighborhoods (40.0 %) corresponds with the occurrence of endoparasites in children from other segregated settlements in Slovakia. High prevalence of infection by intestinal endoparasites in children from marginalized communities that we detected can be caused by the lifestyle and behaviour of these children as well as the charcteristics of their living enviroment. Papajová, Šoltys (2019) discovered considerable soil contamination by propagative stages of nematodes in marginalized settlements in Slovakia, where up to 87,5 % soil samples came up positive. Rudohradská et al. (2011) discovered high soil contamination by propagative stages of helminths at the residential area Luník IX. Among the detected species were the eggs of Ascaris spp., Trichuris spp. a Toxocara spp. Soil contaminated by propagative stages of endoparasites at Luníku IX is one of the modes of transmission in which the local children are infected as well as one of the explanation of the high prevalence that we discovered in children from this area. Key factor is not only the living accomodations and contaminated soil but lack of access to drinking vater as well. In many settlements there is only one source of drinking water in the form of a well which serves all the residents of the settlement. Quality of the water from this source is not being monitored on regular basis, which contributes to the high incidence of infectious diseases including the gastrointestinal infections.

Occurences of intestinal endoparasitic infection are manifested by diarrhoea, abdominal pain, weight loss, malnutrition and appendicitis. In massive infections we can observe obstructions of large intestine and perforation of cecum can also take place (Ok KS, Kim YS, Song JH et al. 2009). Complications in massive infection by helmiths are in most cases heavy anemia with lack of nutrients that can lead to growth retardation. Infection caused by a large number of T.trichuria can cause development of trichuris dysentery syndrome which combines symptoms of mucoid diarrhoea and occasional bleeding (Ok KS, Kim YS, Song JH et al. 2009). Tapeworm infection species is usualy asymptomatic. In serious infections we can observe colic, meteorism, nausea, vomiting, diarrhoea, malabsorbtion syndrome with weight loss and lack of vitamin B12 in infected children (Mohamed, Hegazi 2007; Huda-Thaher 2012).

Complications in female circumcision are both acute, late or even obstetric. If the complications are acute, there is bleeding, urinary retention, infection and injury to the retrovesical pouch. The late complications include infection (Radková, Ludvigh Cintulová, Bundzelová 2020).

Immunocompromised child patients are more susceptible to be infected by intestinal parasites (Mahdi, Al-Sadoon, Hassan 2007). Immuno-compromised individuals are more susceptible to acquire cryptosporidium infection. This includes patiens with Non-Hodgkin lymphoma, leucemia or protein energetic malnutritions while malnutritions are often concomitant diseases in oncological patients (Cimerman S, Cimerman B, Lewi 1999; Helmy et al., 2006; Nahrevanian and Assmar 2008). Cryptosporidium infection manifests in most cases as self limiting diarrhoea in immunocompetent individuals, while in immunosupressed individuals the diarrhoea can become chronic and be joined by gastroenteritis. Repeated episodes are recorded and it is assumed that immunity against cryptosporidiosis is only temporary or not complete (Newman, Sears, Moore et al. 1999). Increased risk of cryptosporidiosis in small children can lead to outbreak and development of infection with more severe progress then in the adults which can be related to the immaturity and development of immunity system in children younger the 5 years (Ravaszová, Halánová, Goldová et al. 2011). Endoparasitic infections in child patients with reduced immunity can be life threatening Tappeh et al. (2011) which is why the examination of children, especially the immunocompromised ones, for the presence of intestinal endoparasites before hospitalisation is recommended as one of the possible ways to prevent complications during the treatement of primary disease and spreading of the infection in hospital environment. The study has shown relation between environment and risks factors leading to the infections influencing the quality of life of the vulnerable people (Ludvigh Cintulová, Kafková, 2020).

Herd" immunity should subsequently protect the citizens against Coronavirus and any other similar epidemic in the future. Such scenario is intended to increase immunity but also poses a great risk of a high number of infections leading to death. (Subramanian, Shahum, Krčméry, 2020). On the level of charity work, it will be necessary to strengthen international and national missionary and charity social projects in individual countries whose aim is to provide healthcare, social, economic and pedagogic support (Mašán, Šrámka, Sabo et al., 2020). The study analyses the perception of risks of pandemic due COVID-19 by Roma people living in Roma settlement Žehra and their attitudes to quarantine, emergency actions and vaccination against influenza and their willingness to get vaccinated with the forthcoming vaccine against COVID-19 due to the infection risk. (Ludvigh Cintulová, Budayová, Radková, 2020).

#### CONCLUSION

The prevalence of endoparasites in children from our study was not high (9.9 %), however, it reflects the insufficient concern for parasitoses in collectives of children, or in health care facilities in which they can have a potential for nosocomial transmission. Endoparasites can present an increased risk for immunocompromised children, in which the infection can have fatal consequences. The high occurrence of endoparasites in the marginalized community in our study suggests environmental contamination by feces with eggs and other development stages of parasites, but also the lacking hygiene and low-quality living conditions.

#### **Conflict of interests:**

The authors have no conflict of interests to declare.

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## Assessment of the quality of life of seniors during the COVID-19 pandemic

## Posúdenie kvality života seniorov počas pandémie COVID-19

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ABSTRACT

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**Introduction:** Old age is the last period of human development. Aging is a process in which the human body goes through a number of changes. We consider it necessary to examine the quality of life of seniors in order to be able to ensure the satisfaction of bio-psycho-socio-spiritual needs even during the COVID-19 pandemic.

Aim: The main objective of the survey was to assess the quality of life of seniors during the COVID-19 pandemic.

**Methods:** The survey was conducted using the standardized WHOQoL questionnaire, from which we removed issues related to sexual life and supplemented with demographic issues and issues related to the COVID-19 pandemic. The questionnaire was anonymous and the results were evaluated in graphs in Excel. The questionnaire was distributed in retirement homes and social services homes in the Trnava and Trenčín regions. The selection of respondents was intentional and the criteria for inclusion in the survey: age over 65, permanent residence in these facilities and senior oriented in time, place and person. Data collection took place in the months December 2019 — February 2021.

**Results:** Our results from the survey show that the quality of life of seniors despite the COVID-19 pandemics is at a good level. Due to the gender of seniors, according to our results, the quality of life is at a similar level for both men and women. During the COVID-19 pandemic, the need for love affected men the most, 61.22 % and the need for freedom 43.86 %. Due to the age of seniors, we did not notice a difference in the quality of life.

**Conclusion:** We state that it is important to ensure a quality full life for seniors and to satisfy bio-psycho-socio-spiritual needs despite the COVID-19 pandemic.

Key words: senior, quality of life, pandemic, COVID-19, nursing care

**Úvod:** Staroba je posledným vývinovým obdobím **človeka**. Starnutie je proces, keď **ľudský** organizmus prechádza množstvom zmien. Považujeme za nevyhnutné skúmať kvalitu života seniorov, aby sme dokázali zabezpečiť uspokojovanie bio-psycho-sociálno-spirituálnych potrieb aj počas pandémie COVID-19.

Cieľ: Hlavným cieľom prieskumu bolo posúdiť kvalitu života seniorov počas pandémie COVID-19.

**Metodika:** Prieskum bol realizovaný metódou štandardizovaným dotazníkom WHOQoL, z ktorého sme odstránili otázky týkajúce sa sexuálneho života a doplnili demografickými otázkami a otázkami tykajúcich sa pandémie COVID-19. Dotazník bol anonymný a výsledky z neho boli vyhodnotené v grafoch v programe Excel. Dotazník bol distribuovaný v domovoch dôchodcov a domovoch sociálnych služieb v Trnavskom a Trenčianskom regióne. Výber respondentov bol zámerný a kritéria pre zaradenie do prieskumu: vek nad 65 rokov, trvalý pobyt v uvedených zariadeniach a senior orientovaný v čase, v mieste a v osobe. Zber údajov prebiehal v mesiacoch december 2019 — február 2021.

**Výsledky:** Z našich výsledkov **získaných v** prieskume vyplýva, že kvalita života seniorov napriek pandémií COVID-19 je na dobrej úrovni. Vzhľadom na pohlavie seniorov podľa našich výsledkov je kvalita života na podobnej úrovni aj u mužov, aj u **žien**. Seniorov počas pandémie COVID-19 najviac zasiahla **u** mužov 61,22 % potreba **lásky a u žien** 43,86 % potreba slobody. V súvislosti s vekom seniorov sme nezaznamenali rozdiel **v** kvalite života.

**Záver:** Konštatujeme, že je dôležité zabezpečiť seniorom kvalitný plnohodnotný život a uspokojovať bio-psychosociálno-spirituálne potreby napriek pandémii COVID-19.

Kľúčové slová: senior, kvalita života, pandémia, Covid-19, ošetrovateľská starostlivosť

#### INTRODUCTION

Aging is a process that is characterized by either functional or structural changes in the human body and also by a decrease in the performance and ability of the individual (Hrozenská, Dvořáčková 2013). Aging can be characterized by several characteristics, such as irreversible, uneven, regressive and genetically determined (Krajčík 2006). Old age is characterized by the occurrence of diseases that accumulate or recur during this period. As human adaptation capacity decreases, these diseases or syndromes often become the cause of death (Mačkinová, Musilová 2013). The connection between physical and mental changes is often pointed out. This is especially the case when seniors do not cope well with the biological and physical changes that accompany the aging process (Malíková 2020). When working with older people, it is very important to specify their needs. These people may have needs that are typical for a given period of life but also needs that are individual. Social support provided to seniors through medical staff or family helps them cope with adaptation to the end of their lives, especially the changes or feelings that accompany this period, such as. feeling useless, lonely or lonely. Social support is then provided carefully when we monitor the current social needs of seniors and adapt them to adequate care (Jamborová, 2015). Social support is considered to be an important positive factor influencing the impact of negative life situations on a person's health and mental state, and thus on their quality of life (Křivohlavý In: Lešková 2009). According to the World Health Organization (WHO) (In Krajčík 2006), the indicators of quality of life are as follows - physical health, psychological health, level of independence, social relations, environment and spirituality. Many definitions of quality of life seek to specify the factor that is most important when specifying quality of life. However, the perception of these factors is very subjective, so we can

only talk about a group of factors that affect the quality of human life directly or indirectly (Dvořáčková, Mojžíšová 2011). The COVID-19 pandemic has hit the lives of people around the world. The spread of SARS CoV-2 and subsequent diseases have had enormous health, but also social, psychological, economic and environmental consequences.

The most vulnerable group in this pandemic in the population are the elderly. In terms of their age and health, they are most exposed to the consequences of a pandemic (Buzalová, Radková, Ludvigh Cintulová 2021). The quality of life has changed due to the pandemic measures that was connected with the less satisfaction of well-being, anxiety, negative feelings and social isolation. (Ludvigh Cintulová, Rottermund, Budayová 2021). Krčméry *et al.* (2020) study has shown relation between the pandemic and the less ability to deal with the mental health and the dicreased level of well-being. Another research study confimed negative impact of the pandemic on the physical and mental health of the people who have been in social isolation more than six months (Rottermund, Ludvigh Cintulová, Budayová, Knapik 2021).

#### AIM

Our main goal of the survey was to assess the quality of life of seniors living in social care facilities and retirement homes during the COVID-19 pandemic. quality of life in relation to gender and age of the elderly during the COVID-19 pandemic.

#### METHOD

We conducted the survey using the standardized WHOQOL questionnaire, which is focused on the quality of life of sen-

iors, from which we excluded questions dealing with sexual activity. The questionnaire included demographic questions and own supplementary questions related to the COVID-19 pandemic. We conducted the survey in three retirement homes in the Trnava and Trenčín regions, where we obtained informed consent to data collection. The questionnaire was completed by seniors anonymously and voluntarily with the help of nurses who work in these facilities. Our research plan was intentional and the criteria for selecting respondents were - orientation in time, place, person, age over 65, permanent residence of a senior in a retirement home or in a home of social services. A total of 125 questionnaires were distributed and its total return was 84% (n = 106). Questionnaires that were incomplete were excluded from the survey sample. We conducted the survey during the second wave of the COVID-19 pandemic in December 2020 — February 2021. The results were processed and evaluated via Excel in numerical numbers and percentages.

#### RESULTS

The elderly population evaluates their quality of life in different spectra. The survey sample consisted of 100 % (n = 106) respondents. Of the overall results, 53.77 % of women (n = 57) and 46.23 % of men (n = 49) accounted for more women. The average age of men was 80 and the average age of women was 82 years. In the question of marital status, widows were the most represented in the form of 52.63 % (n = 30) and in men the answer was the same in the form of 61.22 % (n = 30).

We found out what the overall quality of life of seniors is during the COVID-19 pandemic (Graph 1).

Of the overall results for women, the highest percentage was 73.26 % (n = 42) for the answer "good." We find a similar result for men, who state in the answer "good" 65.31 % (n = 32). According to our results, women are neither satisfied nor dissatisfied with 59.65 % (n = 34). The men answered with the same answer in the form of 44.90 % (n = 22). Overall, our respondents report satisfaction with safety, the environment, health care and support from family and friends. We focused on assessing the domain that is most altered in the senior during the COVID-19 pandemic (Graph 2).

#### Graph 1:





(own results)

Graph 2: Domain Assessment 70,00% 60,00% 50,00% 40,00% 30,00% 20,00% 10,00% 0.00% Physical Psychic Economic Social None

Women

Men



The COVID-19 pandemic affected not only the elderly, but all the people in the world. In our survey, women answered that the COVID-19 pandemic affected them the most in the psychological field at 66.67 % (n = 38). The men answered with the same answer in the form of 57.14 % (n = 28). Everyone has their needs. Seniors are no exception.

Our overall results show that COVID-19 women were most (Graph 3) affected by the need for freedom of 43.86 % (n = 25). On the contrary, surprisingly, COVID-19 men disrupted the need for love in the form of 61.22 % (n = 30). Women replied that COVID-19 disrupted their activities a bit, while men responded moderately. To the question of whether there is a difference in the quality of life of seniors with respect to age during the COVID-19 pandemic. Due to the age during the COVID-19 pandemic, there are differences in the quality of life of respondents who answered that they experienced the greatest change in the mental area, but also in the social, physical and, last but not least, economic area, with the majority 62.26 %. In this area, the largest difference in quality of life was recorded by respondents aged 80 - 85, namely in 31.82 %, followed by respondents aged 65-70, where it was 28.79 %, and in the age of 85 - 90, 21 21 % and the last ones aged 75-80 recorded 18.18 % of responses. As the second change in the differences in quality of life before and during COVID-19 disease, we recorded in 21.2 %, in the social sphere of life where the largest difference was recorded at the age of 65 – 70 years, where it was 43.48 %, followed by 39, 13 % of people aged 80-85 followed and followed with 13.04 % aged 75 - 80 years and aged 85-90 it was 4.35 %. This is followed by a change in the economic phase, which was recorded by 9.43 % of respondents, where the largest change was recorded at the age of 65 - 70, namely 50 % of respondents, followed at the age of 80 – 85, with 3 % responding, followed by people aged 85 - 90 and 10 % answered them here. We noticed the last difference in the physical area, where only 6.60 % of all respondents gave this option. Most of them answered at the age of 65 - 70 years, this represents 42.86 %, followed by respondents at the age of 80 - 85 years, where there were 28.57 % of them, and subsequently in the age categories 75 - 80 and 85 - 90 they answered the same one respondent, which represented 14.29 %.

Graph 3:



(own results)

Given the respondents we asked to complete our questionnaire, we found that the pandemic caused by COVID-19 caused a marked difference in the mental field, as well as a large difference in the social sphere of life.

#### DISCUSSION

Our respondents consider the perception of overall quality of life and health in the elderly during the COVID-19 pandemic to be good. The authors Kopáčiková (2019), Bulková (2013), Kozáková (2010) state that most respondents consider health to be very important and also the most important area of life. Kopáčiková (2019) states that one third of the respondents are satisfied with the environment in which they live. A similar result is reported by Kozáková (2010), who says that whether the respondent lives with his family or separately, most respondents are satisfied with the living environment. On the contrary, Bartošová (2015) claims that seniors living in the natural environment indicate higher satisfaction with the area of housing. When assessing individual domains during the COVID-19 pandemic, which is the most changed for our respondents, we found that, similarly to Odvářková (2013), respondents state a lower level in the areas of leisure time. In her work, Vykydalová (2013) says that seniors most often engage in leisure activities: watching television and listening to the radio. Surá (2008) confirms Vykydalová's (2013) statement and also mentions leisure activity as the most popular and most accessible. On the contrary, Lozinčáková (2010) claims that reading books is one of the most common activities of seniors. Research study of authors has shown that the pandemic had negative impact of the physical activities and skeletal muscles of the seniors, that's why within the measures to increase their quality of life i tis important to support daily training and physical exercises (Rottermund, Cintulová, Budayová 2021).

We can state that the most common activities of seniors are reading books and watching television. This fact is also confirmed by Duffková (2008), who claims that seniors are among the group that watches television the most. In her research, Junková (2010) says that it is not important what activity seniors perform, but whether it leads to the satisfaction of their free time. Regarding whether there is a difference in the quality of life of seniors with regard to gender during the COVID-19 pandemic, we identify with Vykydalová (2013), who claims that women have a higher quality of life than men. Regardless of gender, Lozinčáková (2010) says that seniors are satisfied with their lives. From Hrabovská (2006) we learn a similar result as in Vykydalová (2013) that up to 57 % of women are more satisfied with the quality of life than men. On the contrary, Hrozenská (2008) claims that there is no difference in the quality of life between a man and a woman. The authors and Hrozenská (2008), Bukáčková (2008), Hamplová (2004) also achieved similar results. Our findings show that women have a quality of life and generally cope with better life situations than men. Another study of autors Hardy, Krčméry, Hamarová, Kozoň, Dubovcová M, Herdics, Oláh, Mrázová, Grey, West (2021) figured out that about 10 percent suffering on severe disease with the new diagnosis chronic postcovid syndrome (CPS) that will need multicare to support the quality life with the social and medical care.

#### CONCLUSION

The elderly population evaluates their quality of life in different spectra. Most of them look to the past and compare it with today's world. In the current situation, the quality of life is affected by the COVID-19 pandemic. The COVID-19 pandemic significantly affects the lives not only of seniors, but of all people in the world. In connection with it, there are prohibitions and restrictions that endanger human life and quality. At the end of our survey we state that in order to improve the quality of life of seniors it is necessary for nurses to devote sufficient free time to seniors, ensure sustainability of communication with family through phone calls or video calls during pandemics, activities and creative workshops seniors, ensure seniors communication with other seniors in the facility and to protect the elderly from possible COVID-19 infection. Seniors are among the most at risk group in connection with the corona virus and affect the mental health of the entire population. From the beginning of the pandemic, it was clear that a pandemic would bring various risks that would also affect people's mental and physical health. It is mainly stress from a crisis situation, a feeling of loneliness or isolation and the resulting anxiety or depression. Authors Mašán, Hamarová (2021) also confirmed that pandemic has a negative consequences on the mental health of the seniors that might caught the less autonomy in the daily life activities.

#### FINANCIAL SUPPORT

It's not.

#### **CONFLICT OF INTEREST**

The authors hereby declare no conflict of interest.

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