ISSN 2671-3497 (Online)

INTERNATIONAL JOURNAL

Institute of Knowledge Management

M E D I S

Vol. 2. 3.

MEDICAL SCIENCES & RESEARCH

ISSN 2671-3497 (Online)

MEDIS – International Journal of Medical Sciences and Research

Volume 2, Issue 3, September 2023.

https://medisij.com

IMPRESSUM

International Journal of Medical Sciences and Research
(MEDIS IJMSR)
(Volume 2, Issue 3 September 2023.)

Editor in chief:
Prof. d-r Robert Dimitrovski

Executive editor:
Prof. dr. Lazar Stošić

Publisher:
Institute of Management and Knowledge
Address: Gjuro Gjonovikj, 11/4 , Skopje 1000, Macedonia
Phone: +389 70 207 370, + 381 63 700 4281

http://medisij.com
E-mail: editor@medisij.com

For publisher:
Prof. d-r Robert Dimitrovski

Print:
GRAFOPROM Bitola

Circulation:
50 copies

CONTENTS

Stoyanov H., & Yaneva, R. (2023). Study of revenue change in university multiprofile hospitals for active treatment in Bulgaria, *MEDIS - Medical Science and Research, 2*(3), 1-5. doi: 10.35120/medisij020301s
UDK: 336.2:{614.2:[616.98:578.834(497.2)"2019/2021"

STUDY OF REVENUE CHANGE IN UNIVERSITY MULTIPROFILE HOSPITALS FOR ACTIVE TREATMENT IN BULGARIA

Hristo Stoyanov[1], Rumyana Yaneva[1]*

[1]Department of Health Economics, Faculty of Public Health "Prof. Tzekomir Vodenicharov, MD, DSc, Medical University - Sofia, Sofia, Bulgaria, e-mail: h_stoyanov70@yahoo.com; yaneva.1968@abv.bg

Abstract: The success of a hospital medical care system needs to be measured by how efficiently and effectively it addresses the needs of the users of the services it provides.

The difficulties caused by the spread of COVID-19 did not prevent the University Multiprofile Hospitals for Active Treatment from continuing to perform their public service functions - they took over the treatment of the most significant part of patients with SARS-CoV-2 infection, while at the same time continued to provide the necessary conditions for conducting practical medical education for future medical specialists.

The aim of the study is to perform a comparative analysis of the change in revenue of the University Multiprofile Hospitals for Active Treatment for the period 2019 – 2021.

Methodology: The following methods were used for processing and analyzing the received information: Documentary method - the source of the information is the annual reports of the medical facilities for hospital care, which are received and processed annually at the National Center for Public Health and Analyzes at the Ministry of Health; System analysis method; Comparative-analytical method; Economical analysis; Financial and accounting analysis; Statistical methods, including: analysis of the dynamics of phenomena and graphic analysis - to visualize the obtained results.

Results: There is a trend of increasing the total revenues of UMHAT for the studied period by 32.6%. The first year since the onset of the COVID-19 pandemic (2020) has seen the strongest increase in revenue from the Ministry of Health, followed by revenue from donations. In 2021, the increase in revenues from voluntary health insurance companies was most pronounced, but there was a decrease in revenues from the Ministry of Health.

Discussion: In the Report on the health of citizens of the Minister of Health, it is stated that the growth of costs in 2020 compared to those reported in 2019 in the system of the Ministry of Health by more than 58% is due to the complicated epidemic background, in connection with which the ministry initiated a number of activities to ensure the treatment of those affected and limit the spread of the infection.

Conclusion: Based on the changes in the environment, as well as to the dynamically changing needs of hospital services, a more flexible adaptation to them is necessary for the modern university hospitals, in which teaching activities are carried out in addition to treatment.

Recommendations: An essential condition for University Hospitals to ensure the quality that patients and future medical specialists are looking for is the attraction of additional financial resources, both to improve their material base and as a means of conducting a successful personnel policy.

Keywords: revenues, University Multiprofile Hospitals for Active Treatment, COVID-19, Ministry of Health

Field: 3) Medical sciences and Health

1. INTRODUCTION

The success of a hospital medical care system needs to be measured by how efficiently and effectively it addresses the needs of the users of the services it provides. This is the reason why the management of financial resources in medical institutions, including University Hospitals, guarantees the achievement of high health outcomes that correspond to the achievement of the set goals. [2]

The main sources of income for the medical institutions in the Republic of Bulgaria, including the University Hospitals, are:

-The National Health Insurance Fund, which pays for the treatment of patients on clinical paths, outpatient procedures and clinical procedures;

- the state budget - through subsidies from the Ministry of Health;

- municipal budgets;

- voluntary health insurance, which, according to the amendments to the Health Insurance Act of 2012, is carried out on the basis of a medical insurance contract within the meaning of the Insurance

*Corresponding author: h_stoyanov70@yahoo.com

Code. [2, 6, 7]

- from the activity of medical institutions according to the Law on Medical Institutions - sales of medical goods, services and others, other sales and other income, which may include interest on bank funds, as well as income from rented premises, etc.;
- income in the form of donations.

The National Center for Public Health and Analyzes (NCPHA) collects and summarizes on an annual basis the information on the main economic indicators of the activity of medical institutions for hospital care in the system of public health care in the Republic of Bulgaria.

According to the Law on Medical Institutions, Art. 90, para. 2 "The Ministerial Council, on the proposal of the Minister of Health, determines which of the medical institutions or their clinics or departments received approval from the Minister of Health for the activities: clinical training of students and doctoral students in medicine, dentistry and pharmacy; clinical training of students in specialties from the professional field of "Health care" and postgraduate training to acquire a specialty in the health care system, acquire the rights of university hospitals/clinics or departments for the duration of the approval. The proposal of the Minister of Health is made on the basis of a motivated request from the relevant rector of the higher education institution, agreed with the head of the medical institution. [1]

The spread of COVID-19, declared a pandemic by the World Health Organization, had a significant adverse impact on all spheres of public life. The University Hospitals were affected not only by the periodic restrictions on planned admissions, but also by the restructuring of clinics and wards in COVID structures.

The mentioned difficulties did not prevent the University Hospitals from continuing to fulfill their public functions - they took over the treatment of the most significant part of patients with SARS-CoV-2 infection, while at the same time they continued to provide the necessary conditions for conducting practical medical education of future medical professionals. [8]

The aim of the study is to perform a comparative analysis of the revenue change of the University Multiprofile Hospitals for Active Treatment for the period 2019 – 2021.

Table 1. Number of medical facilities included in the study

A group of medical facilities for hospital care	Abbreviation used	2019	2020	2021
University and National Multiprofile Hospitals for Active Treatment	UNMHAT	18	19	19

Source: NCPHA, Bulletin 22

Hospitals in the public health care system in the Republic of Bulgaria are included in the analysis.

2. MATERIAL AND METHODS

The study used the following methods for processing and analyzing the information received: Documentary method - the source of the information is the annual reports of the medical institutions for hospital care, which are received and processed annually at the National Center for Public Health and Analyzes at the Ministry of Health; System analysis method; Comparative-analytical method; Economical analysis; Financial and accounting analysis; Statistical methods, including: analysis of the dynamics of phenomena and graphic analysis - to visualize the obtained results.

3. RESULTS

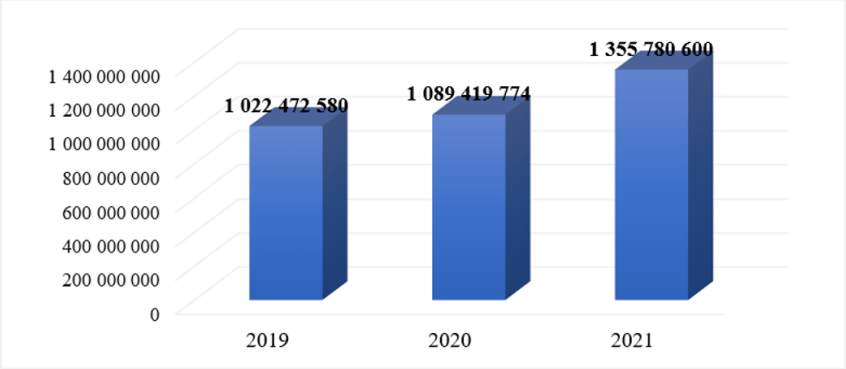

Figure 1. Total revenues by sources of UNMBAL in BGN

For the considered period 2019-2021, all revenues by sources of the University Multiprofile Hospitals for Active Treatment increased by 32.6%.

Figure 2 presents the dynamics of changes in income by source.

In the first year of the outbreak of the COVID-19 pandemic (2020), the strongest increase in revenues from the Ministry of Health was observed - by 95.62%.

Revenues from donations increased by 30.86 percent, revenues from the National Health Insurance Fund increased by only 2.69% and those from municipalities by 1.87%.

In the case of the other sources of income, there is a decrease, which is most pronounced in the income from the voluntary health insurance companies (VHIC), by as much as 90.87%. Revenue from user fees decreased by 14.66 percent, other revenues by 9.83 percent and revenues from sales of goods, services, etc. by 7.08 percent.

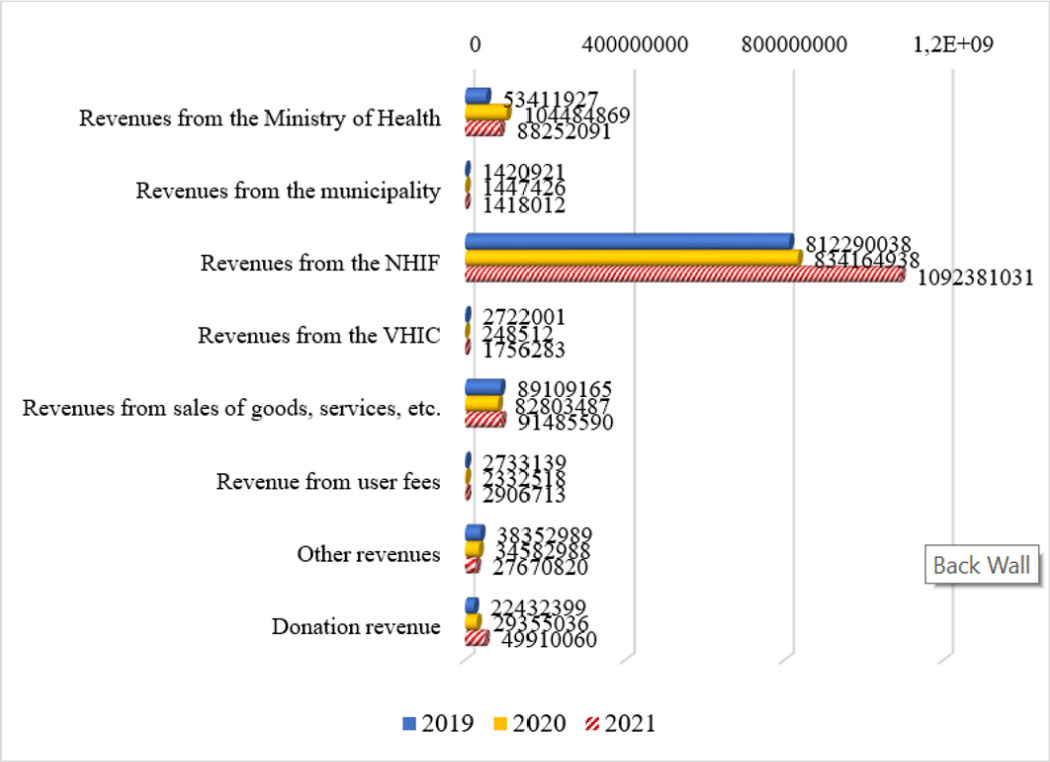

Figure 2. Revenues by sources in UNMBAL in BGN

As can be seen from fig. 2, in the second year of the pandemic - 2021, compared to 2020, the dynamics of the change in the income of University and National Multiprofile Hospitals for Active Treatment is as follows:

A strong impression is made by the significant increase of 606.72% in revenues from voluntary health insurance companies. We also observe an increase of 70.02 percent in the income from donations, with 30.96% in those from the main source of income in the health care system - NHIF. Revenues from user fees increased by ¼, and revenues from sales of goods, services, etc. by 10.49 percent.

There is a decrease of 1/5 in other revenues, by 15.54 percent in revenues from the Ministry of Health and by 2.07% in revenues from municipalities.

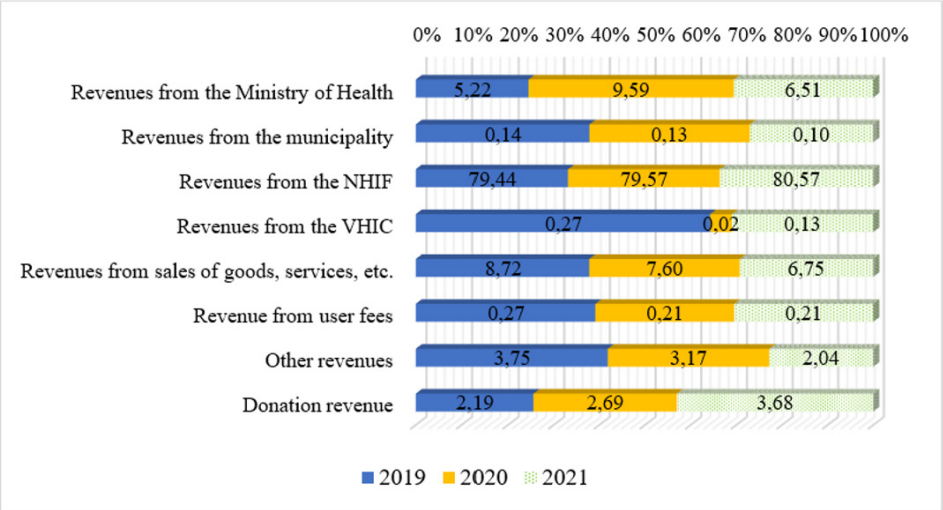

Figure 3. Revenues by sources in UNMBAL in %

In fig. 3 the relative share of different sources of income is shown. 80 percent is the share of revenues from the National Health Insurance Fund. In second place are the revenues from sales of goods, services, etc., where we observe a downward trend for the three-year period - from 8.7 to 6.7 percent, and in the first pandemic year, the second place is occupied by revenues from the Ministry of Health - 9.6 %. In third place are other incomes, where we again observe a continuous downward trend and therefore at the end of the period they are displaced by the income from donations. There is a slight decline in revenues from user fees. The relative share of income from voluntary health insurance is low, especially with the drastic decline in 2020. The share of revenues from municipalities is the lowest.

4. DISCUSSION

In the Report on the health of citizens of the Minister of Health, it is noted that the growth in costs in 2020, compared to the reported 2019 in the system of the Ministry of Health, is over 57.8%, which is a consequence of the complicated epidemic situation related to the spread of coronavirus infection on the territory of the Republic of Bulgaria. The Ministry of Health initiated a number of actions, including regulatory changes, in order to create an organization to ensure the treatment of those affected and limit the spread of the infection. Given the danger to the health of the nation, it was necessary to take a number of quick and targeted measures to restructure the health system, especially the medical facilities for hospital care. [3]

The decrease in financial resources by BGN 137,932.2 in 2021, compared to 2020, is due to the expenses incurred at the end of 2020 in connection with the provision of vaccines, medicinal products, subsidies for maintaining readiness to provide medical care and other costs necessary for the health system to meet the challenge of the next stages of the high spread of COVID-19. [4]

5. CONCLUSIONS

As a result of the research conducted and the results obtained, we reach the following conclusions:

- There is a trend of growth of the total revenues of UNMBAL for the researched period by 32.6%.
- During the year of the outbreak of the COVID-19 pandemic, the highest growth values - by 96 percent, we observe in the revenues from the Ministry of Health, and the revenues from donations increase by 30%. Voluntary health insurance revenues decrease very strongly - by 91 percent.
- For 2021, compared to 2020, there is a drastic increase (by 606%) of the income from Voluntary Health Insurance companies, followed by the income from donations - by 70 percent. Revenues from the National Health Insurance Fund increased by 1/3. Revenues from the Ministry of Health decreased by 15%.
- Based on the changes in the surrounding environment, as well as to the dynamically changing needs of hospital services, a more flexible adaptation to them is necessary for the modern university

hospitals, in which, in addition to the treatment, there is also teaching activity.

- Emergency situations require a stable and competent leadership that has a clear vision in terms of planning and optimal use of available resources and is able to organize and control the activities of medical facilities.

6. RECOMMENDATIONS

Public health systems around the world function to a greater or lesser extent under conditions of scarcity of financial resources. This fact is valid for the entire system of public health care in Bulgaria and especially for the activity of the medical facilities for hospital care.

An essential condition for University Hospitals to ensure the quality that patients and future medical specialists are looking for is the attraction of additional financial resources, both to improve their material base and as a means of conducting a successful personnel policy.

Additional sources of income according to the existing regulations are the income from voluntary health insurance companies, or own income from offering medical services paid outside the NHIF, for which consumers are willing to pay.

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Jovanović, S., & Denović, P. (2023). Damage control in orthopedics, *MEDIS - Medical Science and Research, 2*(3), 7-10.
doi: 10.35120/medisij020307j
UDK: 616.71-005.1-06-089

DAMAGE CONTROL IN ORTHOPEDICS

Jovanović Saša[1], Denović Predrag[1]*

[1]CHC Kosovska Mitrovica, Department of Orthopedic Surgery and Traumatology, Serbia
e-mail: sasaajovanovic@gmail.com; predragdenovic1996@gmail.com

Abstract: Introduction:DAMAGE CONTROL - in orthopedic surgery and traumatology, it is indicated for fresh fractures, especially for trauma with open bone fractures. In all these fresh fractures, hemodynamic instability of the body occurs. In these cases, a minimally invasive procedure is recommended, which initially aims to temporarily stabilize the fractures and control bleeding

Material and methods:In our work, we will present the official literature that deals with the issue of damage control in orthopedics.

Discussion: One of the leading causes of death in people under 40 is polytrauma. Fractures of the diaphysis of the tibia, femur, and pelvis are the most common fractures that are stabilized using external fixation. Bilateral fractures of the femoral diaphysis are associated with a poor prognosis in terms of mortality and fat embolism syndrome.Hemodynamically stable patients should always undergo definitive fracture fixation. Any prolonged intervention in hemodynamically unstable patients worsens the favorable outcome. Then the immune response can be triggered and increased, which is identified with the clinical condition "Second trauma". Therefore, these patients should be immediately subjected to DAMAGE CONTROL with temporary stabilization and then delayed definitive fixation for a period of 5-10 days from damage control, i.e. in the second act. Orthopedic surgeons should be very careful and recognize the triangle of death - acidosis, hypothermia and coagulopathy, which are interconnected and eventually become irreversible and lead to death as the final outcome. Damage control surgery in orthopedics includes three stages: the first stage of treatment involves controlling bleeding, reducing contamination, and achieving temporary fracture fixation. The time in which all this is done should be as short as 1-2 hours. The second phase involves the stabilization of vital parameters in the ICU as well as the reanimation of the child with the prescription of the necessary therapy as well as blood replacement

The aim: The aim of our work is to demonstrate the outcome and feasibility of damage control in orthopedic surgery for both adults and children with multiple limb injuries and polytraumatized patients

Conclusion: Polytrauma is a condition of the body that requires immediate action and a special approach because the patient's life is at risk in a high percentage. The principles used to manage patients with multiple injuries including head, lower leg. Early fracture fixation led to earlier mobilization of patients and thus And reduced the percentage of complications, wound infections as well as reducing treatment costs. DAMAGE CONTROL is not only used in traumatized adult patients. It is also necessary to do it in children's patients.

Keywords: damage, control, polytrauma, orthopedics
Field: Medicine research

INTRODUCTION

DAMAGE CONTROL - in orthopedic surgery, it is useful for fresh fractures, especially for trauma with open bone fractures (1). In all these fresh fractures, hemodynamic instability of the body occurs. In these cases, a minimally invasive procedure is recommended, which initially aims to stabilize the bones fragments and control bleeding. Therefore, DAMAGE CONTROL becomes a priority in the orthopedic treatment of fresh fractures. The concept is different depending on the degree of injury and hemodynamic instability. It is absolutely indicated in patients with bone fractures of the extremities and/or pelvis. As a type of operation in DAMAGE CONTROL in orthopedics, an external fixator is used. (2-6). The severity of injuries should be assessed based on ISS and/or NEW ISS (NISS) scores, in order to assess which procedure to use as orthopedic treatment or only for damage control as a form of temporary treatment (7-8). With patients with a score of less than 36, definite early stabilization of the fracture is indicated. Patients with a higher NISS score should undergo damage control in orthopedics (9-10). After the operation, the patient should be transferred to the intensive care unit, where after additional analyzes and stabilization of the general condition, further treatment will be decided.

*Corresponding author: sasaajovanovic@gmail.com

MATERIAL AND METHODS

In our work, we will present the official literature that deals with the issue of damage control in orthopedics. All the mentioned articles respect modern orthopedic postulates and very closely connect us with the principles and importance of damage control.

DISCUSSION

In people younger than 40 years of age, one of the main causes of death is polytrauma (11,12). patients who are between 5-30 years old, polytrauma most often occurs as a result of a traffic accident. Fractures of long bones and pelvis are present in 55% of patients with polytrauma on an annual basis, with a frequency of 80-100 patients.Unfortunately, as a result of mass injuries to the bones of the lower limb, 12% of patients had amputation. Of all fractures resulting from a traffic accident, fractures of the body of the femur and tibia are most often stabilized with external fixation. Bilateral femoral fractures are always associated with high mortality and fat embolism syndrome.

The Berlin definition gives us data that polytrauma is made up of the disruption of three or more systems in the human organism, or sometimes we can take into account two anatomical regions (14). In such cases, the hemodynamic status of the patient should always be monitored and the degree of polytrauma assessed. The most widespread system is the ISS proposed by Baker. ISS includes 6 systems: head (including cervical spine), face, thorax (including thorax), abdomen (including lumbar spine), extremities (including pelvis) and of course external skin injuries. We present the final grade and severity of the injury through the AIS score. High-energy forces can cause major injuries. Then the body's defense systems, composed of cytokines, macrophages and other inflammatory cells, are activated. All this happens as a consequence of the activation of interleukin (IL8) as well as other components of the inflammatory response that leads to SIRS, namely C5a and C3a (15,16). The SIRS response can take several hours or days depending on the severity of the injury.(17). Also, markers of the immune response as well as inflammatory reactants reach their peak in the first 24-72 hours after the trauma, which is why those first 73 hours are the most critical for the patient's life. Immune response markers are divided into: 1) acute phase reactants, 2) mediator activity marker, 3) cellular activity marker. In orthopedic traumatology, the most important are TNF-a, IL-1, IL-10. Previous experiences as well as a review of world literature show that early stabilization of fractures increases patient survival (18-21).

Hemodynamically stable patients should always undergo definitive fracture fixation. Any prolonged intervention in hemodynamically unstable patients worsens the favorable outcome. Then the immune response can be triggered and increased, which is identified with the clinical condition "Second trauma". Therefore, these patients should be immediately subjected to DAMAGE CONTROL with temporary stabilization and then delayed definitive fixation for a period of 5-10 days from damage control, i.e. in the second act (22-24). For those patients who are on the verge of doing damage control or a definitive method of treatment, the great experience of the orthopedist, as well as the appropriate material at their disposal, is secondary. Polytrauma is a condition of the body that requires urgent action and a special approach because the patient's life is at risk in a high percentage. The principles used to manage patients with multiple injuries including head, thoracic, abdominal and pelvic injuries require special attention. The treatment of such severe orthopedic patients has changed over the decades. Fracture traction was previously used as a form of stabilization, but the percentage of complications such as: muscle atrophy, lung embolism, lung infections... Bone and co-authors conducted a prospective study with 178 patients who were divided into two groups: a) Early fixation (24h), b) delayed (48h) fixation of femur fracture.. Early fixation of the fracture led to earlier mobilization of patients, thereby reducing the percentage of complications, wound infections, and reducing treatment costs. DAMAGE CONTROL is not only used in traumatized adult patients. It is also necessary to do it in children's patients, both in severe trauma and sports injuries (25-28). First, it is necessary to stabilize children with conditions that lead to large blood losses, as well as patients with a high risk of infection. The second step involves resuscitation in the pediatric intensive care unit. And the third step involves a definitive method of fracture stabilization and tissue reconstruction. Orthopedic surgeons should be very careful and recognize the triangle of death - acidosis, hypothermia and coagulopathy, which are interconnected and eventually become irreversible and lead to death as the final outcome. Damage control surgery in orthopedics includes three stages: the first stage of treatment involves controlling bleeding, reducing contamination, and achieving temporary fracture fixation. The time in which all this is done should be as short as 1-2 hours. The second phase involves the stabilization of vital parameters in the ICU as well as the reanimation of the child with the

prescription of the necessary therapy as well as blood replacement. And of course, when everything is normalized, the decision is made for the third phase, which implies a definitive method of treatment, which may also include the use of an external fixator (29 ,30).

THE AIM

The aim of our work is to demonstrate the outcome and feasibility of damage control in orthopedic surgery for both adults and children with multiple limb injuries and polytraumatized patients (31).

CONCLUSION

Polytrauma is a condition of the body that requires immediate action and a special approach because the patient's life is at risk in a high percentage. The principles used to manage patients with multiple injuries including head, lower leg, thoracic, abdominal, and pelvic injuries require special attention. The treatment of such severe orthopedic patients has changed over the decades. Earlier, fracture traction was used as a form of stabilization, but the percentage of occurrence of complications such as: muscle atrophy, lung embolism, lung infections was increasing. Bone and co-authors performed a prospective study with 178 patients who were divided into two groups: a) early fixation (24h), b) delayed (48h) fixation of femur fractures.. Early fracture fixation led to earlier mobilization of patients and thus And reduced the percentage of complications, wound infections as well as reducing treatment costs. DAMAGE CONTROL is not only used in traumatized adult patients. It is also necessary to do it in children's patients.

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UDK: 615.838:[616.98:578.834

BENEFITS OF BALNEO AND MUD TREATMENT FOR LATE SEQUENCES OF COVID-19

Galina Mratskova[1*]

[1]*Department of Medical Rehabilitation and Ergotherapy, Physical Medicine and Sports, Faculty of Medicine, Trakia University, Stara Zagora, Bulgaria, e-mail: doc_mratzkova@abv.bg*

Abstract: Balneotherapy is one of the most used therapies, where natural factors are applied for treatment and prevention. It is used in various pathological conditions, with evidence of a good effect in rheumatic and neurological diseases, and in recent years also in patients recovering from COVID-19. The therapeutic factors that are used include: natural mineral or thermal waters, natural peloids (mud) and other environmental therapeutic factors. The pandemic of COVID-19 turned out to be a significant factor that led to changes in lifestyle and habits and, accordingly, the use of balneotherapy procedures for prevention and treatment. Balneotherapy (SPA-therapy) is recommended by the European SPA association after COVID-19, for better recovery of health and limitation of long-term symptoms in patients with post-COVID-19 syndrome (PCS). It is suggested that balneo-climate-treatment can improve lung function, increase the physical activity capacity and the performance of therapeutic exercises as well as the quality of life of patients in the recovery phase after COVID-19. The purpose of the present review is to investigate the benefits and effectiveness of both balneo and mud therapy in patients with long-term post-COVID-19 sequelae. Materials and methods: For the purpose of the present study, a review was made of the known scientific articles published in the world databases (Google Scholar, Pubmed, Science Direct Web of Science, Scopus, and literary sources in Cyrillic). The results were searched for the following keywords: post-COVID-19 condition, long-term effects of COVID-19, post-COVID-19 syndrome (PCS), rehabilitation, balneotherapy, SPA therapy, peloidotherapy, mud treatment, lye therapy, treatment with Rapa (highly concentrated solution of salts (most often NaCl)). Results: The review of the scientific literature published in specific medical journals found evidence for the therapeutic effectiveness and benefits of balneo and mud therapy in patients with long-term consequences of COVID-19. The described application methods are characterized by variety in the application methodology, both for external (baths, bathtubs, showers, therapeutic SPA applications) and for internal application (mainly through inhalations). On the other hand, different recommendations were found regarding the type and chemical characteristics of mineral (thermal) water and therapeutic mud that are preferred for therapy. Overwhelmingly, studies recommend combining balneo (SPA) and mud therapy with resort and climate treatment, moderate physical activity and a dietary regimen tailored to the individual characteristics of patients. Conclusion: Balneo (SPA) treatment, therapies with natural and preformed physical factors could have a preventive role, in order to improve the body's reactivity to the adverse factors of the external environment and pathogenic microorganisms and to increase insusceptibility to infectious diseases.

Keywords: Long-term effects of COVID-19, Post-COVID-19 syndrome (PCS), rehabilitation, balneotherapy, SPA therapy, peloidotherapy, mud treatment.

Field: Medical sciences and Health

1. INTRODUCTION

Balneotherapy is one of the most used therapies, where natural factors are applied for treatment and prevention in many European countries. It is used in a variety of illnesses, with evidence of good effect in rheumatic diseases including: osteoarthritis, fibromyalgia, rheumatoid arthritis, low back pain (Maccarone, M.C. et al. (2021); Marinkev, M. & Angelov, I. (2008); Vladeva, E. et al. (2014)), and in recent years in patients recovering from COVID-19. (Gvozdjáková A. et al. (2022); Kokhan, S. et al. (2022); Petrova, M. et al. (2023) Petrova, M. S. (2022)). The therapeutic factors that are used include: natural mineral or thermal waters, natural peloids (mud) and other environmental therapeutic factors (Maccarone, M.C. et al. (2021); Koleva, I. & Yoshinov B. (2022)).

The pandemic of COVID-19 turned out to be a significant factor that led to changes in lifestyle and habits and, accordingly, the use of balneotherapy procedures for prevention and treatment. The introduction of numerous restrictions in the public sphere and the freedom of movement have substantially limited the possibility of applying mineral water and natural mud treatments in resort settings (Maccarone M.C. et al. (2021)). At the same time, there have been a number of scientific reports that have reported that patients who have refused prophylactic SPA treatments have experienced increased pain complaints, a reduced ability to perform activities of daily living, and increased psycho-emotional distress, which on

*Corresponding author: dmanahilova@abv.bg

the other hand has been associated with a decreased quality of life. In patients with chronic diseases who did not undergo balneotherapy, increased number of consultations with medical specialists (26.5%) and use of medication treatment (30.1%) was observed (Katsarova, S. (2022)).

Currently, the European SPA Association (European SPA Association) is emphasizing the importance of spa treatment for the prevention and prophylaxis of health and maintenance of an adequate status of the immune system (Katsarova (2022)). Balneotherapy (SPA-therapy) is recommended by the European SPA association after COVID-19, for better recovery of health and limitation of long-term symptoms in patients with post-COVID-19 syndrome (PCS) (Gvozdjáková et al. (2023)). This therapeutic approach could be effective in patients whose main symptoms include: general fatigue, decreased physical activity, muscle and joint pain, shortness of breath, cough, augesia and anosmia, sleep problems and cognitive and memory disorders, depression, impaired quality of life. Very commonly, researchers report prolonged reduced daily activity in about 35% of patients, limited mobility in about 33%, and very commonly chronic pain in more than a third of patients (Walle-Hansen et al. (2021)). Other investigators report that limitations in daily activity persist in about 50% of patients, even 6 months after hospitalization for COVID-19 (Taboada et al. (2021)). It is suggested that balneo-climate-treatment can improve lung function, increase the physical activity capacity and the performance of therapeutic exercises as well as the quality of life of patients in the recovery phase after COVID-19. (Angelova, T. (2022 (a,b)). Rehabilitation begins in the acute phase, and the rehabilitation programs are prescribed by a specialist in Physical and Rehabilitation Medicine in collaboration with specialists from other medical fields who are involved in the design and implementation of each patient's individual treatment plan (Gerasimova et al. (2021); Milushev, (2021) Takeva, et al. (2021)). The rehabilitation programs are fully tailored to the patients' local and general status. They are dynamic over time, and they follow any change in the patient's condition (Mratskova (2021)). After the acute phase is dealt with, patients are referred to inpatient or transitional rehabilitation units (Milanova & Georgiev (2021)).

Conducting rehabilitation in spa resorts is part of the overall process of recovery and long-term medical care (Petrova M. et al. (2023). Integrative approach to the application of natural physical factors, therapeutic exercises and physical electro-modalities is essential for the recovery of premorbid activity and for the prevention of pre-existing comorbidity (Mollova, K. et al. (2021); Grishechkina, et al. (2023); Krumova & Uzunova (2022)), whilst also potentially having a beneficial impact in reducing the health and economic consequences of COVID-19 (Kashilska & Petkov (2021)).

The purpose of the present review is to investigate the benefits and effectiveness of both balneo and mud therapy in patients with long-term post-COVID-19 sequelae.

2. MATERIALS AND METHODS

For the purpose of the present study, a review was made of the known scientific articles published in the world databases (Google Scholar, Pubmed, Science Direct Web of Science, Scopus, and literary sources in Cyrillic). The results were searched for the following keywords: post-COVID-19 condition, long-term effects of COVID-19, post-COVID-19 syndrome (PCS), rehabilitation, balneotherapy, SPA therapy, peloidotherapy, mud treatment, lye therapy, treatment with Rapa (highly concentrated solution of salts (most often NaCl)).

3. RESULTS

The review of the scientific literature published in specific medical journals found evidence for the therapeutic effectiveness and benefits of balneo and mud therapy in patients with long-term consequences of COVID-19. The described application methods are characterized by variety in the application methodology, both for external (baths, bathtubs, showers, therapeutic SPA applications) and for internal application (mainly through inhalations). On the other hand, different recommendations were found regarding the type and chemical characteristics of mineral (thermal) water and therapeutic mud that are preferred for therapy. Overwhelmingly, studies recommend combining balneo (SPA) and mud therapy with resort and climate treatment, moderate physical activity and a dietary regimen tailored to the individual characteristics of patients.

4. DISCUSSIONS

Recovery from SARS-COV-2 disease is a process that requires prolonged medical monitoring and post-COVID care especially in patients with prolonged symptoms after COVID-19. A number of studies have described different symptoms and/or symptom clusters that are a consequence of acute infection or that occur immediately after infection. Persistent symptoms can be registered in all organs and systems, but impairment of the respiratory, musculoskeletal, cardiovascular, nervous, digestive, and other systems is most commonly described. Very often, these clinical manifestations are accompanied by increased fatigue, reduced physical capacity, limited daily activity, cognitive and psychosocial impairment, and result in decreased quality of life (Jimeno-Almazán et al. (2021)). Due to the unfavorable health and economic consequences, recently not only medication therapy has been paid attention to, but also models for comprehensive recreation through the incorporation of natural and preformed physical factors and combined rehabilitation programs in the recovery process after SARS-CoV-2 illness are gradually starting to be developed and improved (Szromek, A.R. (2021)), while complying with all safety requirements of the therapy (Antonelli & Donelli (2020); Masiero, et al. (2020)).

Balneotherapy is applied in the form of natural or artificial mineral and gas waters for external (bathtubs, baths, bathing, etc.) or internal application (drinking or inhalation) (Vladimirova, (2022)); Angelova, (2022)). In balneological resorts, rehabilitation interventions are usually performed on patients with musculoskeletal and neurological disabilities either on their own or in combination with other traditional balneotherapeutic procedures (Edreva, (2009); Masiero, et al. (2018); Bernetti, et al. (2020)), including patients with persistent respiratory symptoms after COVID-19. (Maccarone & Masiero (2021); Angelova, (2022(a)); Katsarova, (2022)).

In the medical rehabilitation of patients after suffering COVID-19, in resort settings, the application of hydro- and balneotherapy is recommended. (Petrova, et al. (2023)) Water procedures (rinsing, scrubbing, bathing in a swimming pool) have an active influence on the mechanisms of thermos-adaptation and are the basis of the hardening regime. Due to its mild and gentle action, the wet rub procedure is recommended in the beginning of a SPA course (Lobzin et al. (2020)). The treatment of choice is the conduct of sodium chloride baths, which have a regulatory effect on the functional state of the central nervous system, endocrine and cardiovascular systems, stimulating non-specific immunological reactivity. Carbon baths (with carbonated mineral waters and waters enriched with carbon dioxide and dry carbonated baths), which have a beneficial effect on the work of the respiratory and cardiovascular systems, contribute to reducing hypoxemia and increase tolerance to hypercapnia. A gentler method of SPA treatment is dry carbonic baths (Nikityuk, et al. (2020)). They increase the synthesis of biologically active substances, activate oxidative-repair processes, have pronounced anti-inflammatory effects, lead to favorable changes in immunological parameters, improve gas exchange, resulting in a decrease in compensatory hyperventilation. Natural carbonated mineral water deposits in Bulgaria are located in Mihalkovo. Another variety of gas baths are oxygen baths, which improve gas exchange, eliminate oxygen deficiency and improve the functional state of the central nervous system (Khan & Razumov (2018); Abuseva, et al. (2020)).

Mineral water inhalations, aerosol and nasal douches specifically target the respiratory tract and are recommended in the treatment of respiratory diseases (Corradi, et. al. (2012)). There is evidence that inhalations of sulphur-rich mineral waters administered to COPD patients result in an increase in muco-ciliary clearance, reduce the synthesis of pro-inflammatory cytokines and decrease the levels of elastase produced by neutrophils. Combination with sauna therapy, on the other hand, leads to a reduced risk of developing pneumonia. At the same time, inhalation with salt-iodine-bromine thermal water has a mild anti-inflammatory effect on the respiratory tract in COPD (Khaltaev, et al. (2020)). Inhaled salt-iodine mineral water therapy has a vasodilating effect on the bronchial mucosa, increases secretory IgA production and improves muco-ciliary clearance (Khaltaev, et al. (2020)). Another study, Passalie t al. (2013) found that a 14-day inhalation course of radioactive (radon) waters resulted in improved muco-ciliary clearance and a reduction in the inflammatory response (Passali, et al. (2013)).

Another method of application of mineral waters is the partial or total immersion of the body in water (bathtubs, baths and bathing pools). Although it is difficult to accurately determine the effect of these treatments, due to the fact that they are often combined with reshaped physical factors (electromagnetic fields, light, ultrasound, etc.) and/or underwater gymnastics, it has been found that procedures with immersion lead to significant improvements in terms of dyspnea and spirometric findings after therapy and at least 6 months afterwards (Passali, et al. (2017)). In COPD patients, exercises in mineral water have been shown to be more suitable compared to land-based exercises (Khaltaev, et al. (2020)). In smokers, mineral baths improve biochemical parameters in exhaled air condensate (Carubbi, et al. (2019)).

The balneotherapy for post-COVID-19 patients with persistent pulmonary symptoms is performed in a resort setting by a multidisciplinary team and combines specific balneotherapy procedures, including mineral water inhalation, with respiratory gymnastics, kinesitherapy and pre-formed physical factors. The therapeutic complex is directed towards conducting rehabilitation aiming to improve the function of the respiratory system (Antonelli, & Donelli (2020); Masiero et al. (2020)). From the studies conducted, mineral water inhalation was found to be effective in improving the elastic properties of the pulmonary interstitium, reducing inflammation, and stimulating muco-ciliary function. One of the current hypotheses explaining the mechanism of action of inhalation therapy is that inhalation may act on glutathione (GSH), reducing oxidative stress associated with inflammation in lung damage and reactive oxygen radical (ROS) production (Corradi, et al. (2012)). On the other hand, the thermal factor that acts in aquatic immersion treatments improves the function of the respiratory system and probably modulates both innate and acquired immune defenses (Cohen, (2020); Maccarone, et al. (2020); Angelova, (2022)). Furthermore, SPA treatments improve psycho-emotional tone, lead to relaxation, reduce stress levels and increase quality of life (QoL) (Antonelli & Donelli (2020); Masiero, et al. (2020)). Balneotherapy could also positively affect comorbidities, such as obesity, COPD, fatigue, neurological and musculoskeletal conditions, among others (Masiero, (2008); Masiero, et al. (2018); Masiero, et al. (2020); Maccarone, et al. (2021)).

Peloid therapy in the recovery phase after COVID-19. Peloid therapy is a commonly used physiotherapy procedure that is based on treatment with natural factors. In the recovery period of patients after COVID-19 complicated with pneumonia, mud therapy is applied in order to maximize the resorption of the forming fibrotic changes and adhesions. Mud has bio stimulatory, regenerative and trophic effects. Suitable muds are sulphatic peloses, which are applied in complex resort treatment (Valiullina & Pogonchenkova (2020)).

According to Grozeva, A. (2019), the studies conducted so far show that Bulgaria has mud healing resources of diverse composition and origin (Grozeva, A. (2019)). The main mud deposits are concentrated in coastal lakes (limans). For prophylactic and therapeutic purposes, the mud from Lake Shabla (highly sulphidic); Taukliman in the resort Rusalka (the lake is fresh-water lake, the mud belongs to the class of carbonate sapropels, medium sulphidic); Balchikska Tuzla (highly mineralized, medium sulphidic mud); Pomorie Lake (in the black layer the mud is medium sulphidic, in the grey layer it is slightly sulphidic); Lake Atanasovskoe (medium sulphidic). The advantage of Bulgarian mud therapy is the possibility to combine peloid therapy with sea climatic factors, thalassotherapy, heliotherapy, warm sea water, psamotherapy (therapy with warm sea sand). This combination facilitates prophylaxis and rehabilitation in patients after COVID-19 and in the presence of PCS. Lime mud is mostly inorganic and is formed in saline coastal lakes. It is black in color, contains hydrogen sulphidic and iron iron hydrosulfide, with an alkaline reaction, creamy consistency, flexible, fine texture, and minor contamination (Grozeva, (2022); Monova, et al. (2022)).

Although mud therapy is a method that has been used since antiquity, it also finds application in modern balneology. The mechanism of the action is still not fully understood. It is mostly based on the complex action of the chemical, physical and biological factors of mud. Another mechanism of action is through radiant energy, due to the radioactive content of the peloids. Mud possesses bacteriostatic and bactericidal action and also good absorption properties (Grozeva, (2022)). The most commonly applied mud treatments include the “Egyptian method” in the open air (Ismailova, et al. (2018)), applicative methodology (complete or partial mud treatments) after the procedure the patient takes a shower with sea or rap water, intracavitary treatments (intracavitary methodology), mud bath (mud is diluted with mineral, sea or lake water-rap); mud iontophoresis. In Pomorie, mud baths 10-20% suspension (mixture of mud with rapa) are applied at a temperature of 36-38°C, a course of 12-14 baths (Grozevaq (2022)). Among the studies conducted there are reports describing the effectiveness of peloid therapy in diseases of the musculoskeletal system, especially the mud from Pomorie Lake, Balchishka Tuzla, Varna Lake (Grozeva, (2022)). Good therapeutic effects have also been reported by a number of other authors in their studies (Fioravanti, et al. (2015(a)); Pascarelli, et al. (2016); Fioravanti, et al. (2015(b)); Koçak, et al. (2020)). The immunostimulatory effect of mud treatments has also been demonstrated (Masiero, (2020); Maccarone et al. (2020); Maccarone et al. (2021)) Other studies, of patients who underwent balneotherapy and mud treatment, have shown an improvement in quality of life, a reduction in hospital admissions and medication intake over a one-year period (Pascarelli, et al. (2016); Fioravanti, et al. 2015(b)); Koçak, et al. (2020)).

The exact mechanism of action of balneo- and mud therapy is not yet fully understood, but at present the positive effects of this therapy on humoral and cellular immunity have been demonstrated, which is essential both for patients with post-COVID syndrome and for prevention. The rich mineral composition of the mineral water and the mud contribute to the improvement of muscle function and to the reduction of muscle pain in post-COVID-19 patients. Limanic mud is a powerful natural physical factor, which, due

to its anti-inflammatory, analgesic, immunoregulatory and blood circulation improving effects, has been successfully applied in the rehabilitation of a number of diseases, including those following a coronavirus infection (Grozeva (2022)).

Therapy with rapa and lye in prolonged symptoms after COVID-19. In rehabilitation programs in balneotherapy, very often mud therapy is applied in parallel with rapa and lye. The rapa is the water above the mud layer in the liman lakes. Its chemical composition is identical to that of the liquid phase of mud and seawater but differs from them in the concentration of salts dissolved in it (highly concentrated solution of salts (most often NaCl). Lye is the by-product of salt extraction in the Burgas and Pomorie salt pans (Koleva & Yoshinov (2022); Grozeva, (2022)). Lye contains all the elements of sea and lake water, in different salt concentration and ionic state, biologically active substances formed during the decomposition of plankton in the lake and from the healing mud because of diffusion processes in the rapa. The most applied methodologies are lye electrophoresis, lye compresses, lye baths, magnetic field through lye, lye massage and lye inhalation (Grozeva, (2022)). After the application of lye therapy, a reduction of pain (VAS) and paresthesia in peripheral nerve damage is found (Grozeva & Angelova-Popova (2017)). Lye applications can be an effective means of reducing musculoskeletal and peripheral nerve symptoms after experiencing COVID-19. Their application in combination with interferential currents and magnetic field can reduce clinical symptomatology (Mratskova & Elkova (2022).

At this time, there is accumulated clinical experience and scientific evidence of the therapeutic effectiveness of mud and lye therapy, sea treatment and rap therapy in patients with PCS, including those with muscle pain, weakness and fatigue (Grozeva, (2022)). In patients with PCS and concomitant symptoms on the respiratory system, inhalation with 2% lye solution, or stay in a salt room, as well as infrared sauna is indicated. In patients with neuromuscular symptoms after coronavirus infection, it is also necessary to conduct electrical stimulation of hypotonic and hypo trophic muscle groups and magnetic therapy in the presence of joint stiffness. In addition, balneotherapy in the course of complex rehabilitation includes individually dosed kinesitherapy depending on the general condition of the patient.

5. CONCLUSIONS

Balneo (SPA) treatment, therapies with natural and preformed physical factors could have a preventive role, in order to improve the body's reactivity to the adverse factors of the external environment and pathogenic microorganisms and to increase insusceptibility to infectious diseases. It is likely that all of these potential health benefits could play a favorable role in limiting the spread, scope, and consequences of pandemically spread diseases, including COVID-19.

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UDK: 615.38.07:614.3

KEY FACTORS FOR SAFE AND RATIONAL SECURITY OF BLOOD AND BLOOD COMPONENTS

Aleksandra Penjišević[1], Branislav Sančanin[1]*

[1]University Union – Nikola Tesla, Belgrade, Faculty of Management, Sremski Karlovci, Serbia,
e-mail: aleksandra.penjisevic@famns.edu.rs; branislav.sancanin@famns.edu.rs

Abstract: The use of human blood for therapeutic purposes requires the continuous construction of safety and quality systems, in order to minimize potential risks during the process of collection, processing, circulation and final use. Safety, security, rationality, and reliability are important prerequisites for the continuous provision of blood products, regardless of their purpose. Health institutions for blood and blood products should have an organized quality system that will be compatible with strategic goals, while at the same time emphasizing the self-sufficiency of a particular community. In this context, it is necessary to establish a stable and applicable mechanism for issuing permits and accreditation by certified institutions, from this field, which would ensure their operation in accordance with current regulations. Modern blood transfusion practice must provide guarantees to voluntary blood donors regarding the security and confidentiality of all data related to the health of each individual. The key factors, on which safe and rational provision of blood and blood products are based, are visible through continuous activities associated with the promotion of voluntary and unpaid blood donation, thus contributing, in a specific way, to raising and maintaining high standards. Medical and other personnel involved in the process of collection, examination, processing, storage and circulation of human blood and blood components should be qualified and should undergo continuous education. The future development of transfusiology will be based on teamwork and interdisciplinary cooperation, as well as continuous monitoring and application of regulations from this field. The implementation of the Type and Screen method, i.e., blood group typing and antibody screening, should become a standard in the rationalization of the need for blood, which ensures a greater number of available blood units, increases self-sufficiency and directly contributes to the preservation of the health of donors and recipients of blood and blood components.

Keywords: transfusion, blood, blood groups, compatibility
Field: Medical Sciences and Health

1. INTRODUCTION

The first successful transfusion of blood from man to man was carried out in 1818 by the English doctor James Blundell. A turning point in transfusionology was the discovery of the ABO blood group system by the Austrian physician Karl Landsteiner. (Nikolić et al., 2022)

People belonging to the AB+ blood group are universal recipients, i.e., their relaxed position is based on the fact that they can receive all blood groups, while those with O- have the least choice as recipients considering that in case of a transfusion they are limited only to O- donors.

The aim of this paper is to point out the practical importance of ensuring safe, secure and comfortable blood donation, as well as the harmonization of national statutory regulations with international recommendations, guidelines and directives.

Stefanović et al. (2021) indicate that there is a need to rationalize testing and consumption of blood during transfusions. In this sense, the introduction of the Type and Screen method (T&S), which includes the determination of the blood group in the ABO and Rh system and screening for clinically significant antibodies, is generally sufficient for patients being admitted for hospital treatment. The Type and Screen list became the standard for blood product requirements at the Đorđe Joanović General Hospital in Zrenjanin (Serbia). During the period from October 1, 2010 to July 31, 2011, and following the parameters of the crossmatch/transfusion ratio (C/T), the probability of transfusion (%T) and the transfusion index (TI) for surgical departments that need blood, it was established that the number of units of blood that are routinely reserved for certain operations was rationalized: the use of reserved blood increased, i.e., the number of patients for whom blood was taken off a reservation decreased. (Tešić et al., 2013)

*Corresponding author: aleksandra.penjisevic@famns.edu.rs

2. COMPATIBILITY OF BLOOD GROUPS

On the surface of erythrocytes there are hereditary chemical structures - antigens, which can cause the immune system to react by producing antibodies against them. Emphasizing the importance of matching blood groups, i.e., that the recipient receives compatible blood during the transfusion, the American Society of Hematology (https://www.hematology.org/) states that people have 35 major groups, as well as other smaller groups, but two are considered, ABO and RhD groups. Blood type in humans is determined by the presence of antigens within these groups: type A, type B, type AB (the presence of both A and B antigens) and type O (having neither A nor B antigens), followed by the presence or absence of the Rh antigen.The presence of antigens within these groups determines a person's blood group. Blood types are called type A, type B, type AB (with both A and B antigens), and type O (with neither A nor B antigens), followed by the presence or absence of the Rh antigen. The most important Rh antigen is RhD: most people have the RhD present on the surface of their red blood cells and are RhD positive, while those who do not have the RhD are RhD negative. Individuals belonging to the O group are called universal red blood cell donors, while universal plasma donors are individuals belonging to the AB blood group. (https://www.redcrossblood.org)

Table 1. Blood type compatibility chart

		DONOR							
		O-	O+	B-	B+	A-	A+	AB-	AB+
RECIPIENT	AB+	●	●	●	●	●	●	●	●
	AB-	●		●		●		●	
	A+	●	●			●	●		
	A-	●				●			
	B+	●	●	●	●				
	B-	●		●					
	O+	●	●						
	O-	●							

Source: Authors

Universal donors of plasma and platelets are AB negative donors, because these blood components can be given to any patient through transfusion. When a donor is AB positive, he is considered a universal plasma donor, given that this blood component can be given to all patients, regardless of their blood group. And positive erythrocytes and platelets can receive A positive and AB positive, while A negative blood group can be transfused only to patients with A positive and AB positive and AB negative blood groups. B negative erythrocytes can be given to patients who have B positive, B negative, AB positive and AB negative blood types. If the donor has B positive erythrocytes, blood can be given to patients who also have B positive as well as AB positive blood group. The zero positive blood group (0+) is the most useful in practical application, because it can be given to all patients with a positive Rh group, while the zero negative blood group (0-) is compatible with all other blood groups. (https://www.rch.org.au/)

2.1. Complications and risks of donating blood

Complications associated with donating blood are rare, with the most common being fainting. However, this complication can be minimized if the donor is suggested not to stand up immediately after donating blood, but also to be given enough fluids to drink or eat. In addition, there are sometimes bruises on the flesh of the needle. Sometimes, bruising occurs at the needle injection site.

Erythrocyte hemolysis may occur if ABO-incompatible erythrocytes are transfused. Reactions resulting from blood group incompatibility can lead to shock, renal failure, and death. (https://www.rch.org.au/)

If the recipient develops antibodies against minor antigens on the transfused red blood cells, delayed hemolytic reactions may occur. These reactions are, for the most part, mild: rash, itching, fever, low TA, etc. However, when a patient receives massive blood transfusions, complications may develop on the lungs accompanied by inflammatory reactions.

The greatest attention is paid to infections, especially those caused by agents known to be blood-borne.

Medical indications permitting, a patient can have blood taken for a transfusion in advance, prior to

the planned surgical procedure. This method, although not without risks, is the safest form of transfusion for a recipient, as it eliminates the potential risks of blood-borne infections such as HIV, hepatitis B or hepatitis C.

Pre-transfusion testing includes blood analysis for infectious agents (Milošević Manojlović et al., 2005):

- Hepatitis B surface antigen (HbsAg). This test detects the outer envelope of the hepatitis B virus;
- Hepatitis C;
- Human immunodeficiency virus (HIV). EIA tests, fluorescence microscopy techniques and PCR can be used for proof;
- Treponema pallidum - Syphilis.

Antigens of the ABO blood system gholes are determined by genes located at three independent loci. Weakening or loss of ABO antigen expression is often associated with hematological malignancies, as well as solid tumors in the body. A change in the expression of ABO antigens leads to problems when determining the blood group and represents a risk of incompatible transfusions. (Grujić et al., 2022)

Authorized institutions for transfusion medicine are required to establish a unified system for reported adverse and unexpected events and reactions related to the collection and testing of blood, as well as the production, storage and distribution of blood derivatives, that is their application in case of doubt about effectiveness, quality and harmlessness. (Law on Blood and Blood Products, 2011)

3. PROMOTION OF VOLUNTARY BLOOD DONATION

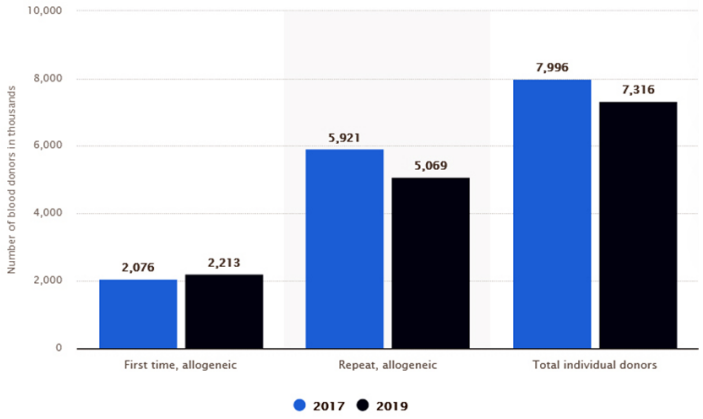
The donor can be any healthy adult weighing more than 50 kg, with a body temperature of less than 37º C, a pulse between 50 and 100/min, blood pressure not lower than 110/50 and not higher than 180/90 kPa, hemoglobin must be above 135 g /l for men, i.e., 125 g/l for women, hematocrit greater than 0.40 for men and 0.38 for women, while the interval between donating blood is three months for men and four months for women. (https://itm.org.mk)

In general, the age limit for voluntary blood donors of 18 to 65 years of age can be deviated from in case of autologous transfusion of blood and blood components, in that case a minor donor can give blood only with the written consent of a parent or guardian. The exception also applies when the recipient is unconscious, or for other reasons is unable to give consent, with the opinion of the competent doctor who provides an emergency measure (Law on Transfusion Medicine, 2017)

During one calendar year in the Republic of Serbia, it is necessary to provide 240,000 units of blood. Although 64% of the population can donate blood, out of 100 inhabitants aged 18 to 65, on average, only three are voluntary blood donors. The average age of a blood donor in Serbia is 38 years of age. The majority of voluntary donors are men (73.5%), while women are less represented (26.5%). (https://itks.rs/)

The total number of blood donors in the USA in 2019 was 7.3 million blood donors. However, almost 5.1 million were multiple donors. Given that the O blood group can be given as a substitute for any other, and considering the fact that it is the most common blood group in the American population (45%), this blood group is also the most sought after. The most common reason for postponing blood donation is low hemoglobin/hematocrit of donors (Statista, 2022a).

Figure 1. Number of first donations and multiple blood donors in the USA in 2017 and 2019 (In 000)



Source: *Statista, 2022b*

Countries with larger populations have a large number of blood donations, in absolute terms these are: Italy is the first with three million donors and a population of 59.6 million, France has 67 million inhabitants and 2.8 million donors while Germany has 82.2 million inhabitants and 2.4 million donors. However, when viewed per capita, Greece comes out on top with 0.053 blood donations per capita, while the United Kingdom ranks fourth in absolute terms with 1.7 million, but ranks 24th out of 26 countries per capita with 0.026, which means one donation for every 38 people.

The Ipsos survey of more than 23,000 adults from 28 countries, assessed international sentiments on a range of health topics such as quality of care, access to medical professionals and waiting times. The respondents were also asked if they agree with the statement, "I often give blood to help others". 58% of Saudis said that they agree with the statement and often donate blood, this share was 52% in India and 36% in Serbia. The following are the countries with significantly lower agreeable responses: USA and France 23%, United Kingdom 18%, Germany 17%, Russia and Canada 16% and Japan 11% (Ipsos, 2018).

Countries of the European Union were required to harmonize their national regulations by August 31, 2006 in order to ensure the continuous implementation and maintenance of the quality system, which implies the validation of all procedures, premises and equipment, sufficiently educated personnel with clear tasks and responsibilities, unambiguous procedures for identification, interviewing and assessment of donors, whereby the risk of microbial contamination must be minimized, as well as labeling, dispensing, storage and distribution of blood and blood components. (Commission Directive 2005/61/EC, 2005

4. STATUTORY FRAMEWORK

The field of collection, storage, and circulation, as well as complex technical requirements, is regulated by the European Union with directives, on the basis of which the national legislation of 27 member states has been harmonized:

- Directive 2002/98/EC of the European Parliament and Council of January 27, 2003 establishing quality and safety standards for the collection, testing, processing, storage and circulation of human blood and blood components and amending Directive 2001/83/EC (SL L 033, 8. 2. 2003),
- Directive 2004/33/EC of March 22, 2004 implementing Directive 2002/98/EC of the European Parliament and of the Council in relation to certain technical requirements for blood and blood components (OJ L 091, 30. 3. 2004),
- Commission Directive 2005/61/EC of September 30, 2005 implementing Directive 2002/98/EC of the European Parliament and of the Council with regard to requirements for traceability and notification of serious adverse reactions and events (OJ L 256, 1. 10. 2005),
- Directive 2005/62/EC of September 30, 2005 implementing Directive 2002/98/EC of the European Parliament and of the Council regarding standards and specifications of the Community in relation to the quality system of authorized institutions for blood and blood products (OJ L 256, 1. 10. 2005).

European Union countries must ensure that blood and blood product establishments adhere to safety and quality standards, and ensure that good practice guidelines are available and used by all blood banks. In addition, the Directive constitutes an obligation to control the quality of blood and blood components from non-EU countries before they are imported into the EU. (Commission Directive 2005/61/EC, 2005)

The manner, procedure, conditions, organization, and activity of transfusion medicine in the Republic of Serbia is regulated by the Law on Transfusion Medicine (2017), which includes the promotion, planning, collection, testing, processing, storage and distribution of blood and blood components. The provisions of this Law refer to the collection and testing of blood and blood components, but not to the supply of medicines obtained from human blood or plasma, nor to stem cells that create blood cells. The promotion of voluntary, unpaid and anonymous donation of blood and blood components within the territory of the Republic of Serbia is carried out by transfusion institutions and the Red Cross, and they must be continuous and aligned with the need for sufficient amounts of safe blood and blood components throughout the year. In this context, it was decided that the Institute for Blood Transfusion of Serbia will adopt an annual plan for the needs of blood and components, no later than November 15 of the current year for the following year.

Similar solutions and wording can be found in the Law on Blood and Blood Components of the Federation of Bosnia and Herzegovina (2017), as well as in the Law on Transfusion Activity of the Republic of Srpska (2015). Within the territory of the Federation of Bosnia and Herzegovina, transfusion centers and transfusion departments have approval for the performance of transfusion activities, which is

issued for a period of five years. The Federal Ministry of Health maintains a register of authorized health institutions. In order to provide expert assistance to the Ministry of Health and Social Protection, the Government of the Republic of Srpska establishes a ten-member Council for Transfusion Activity with the aim of defining a general policy in the field of transfusion activity, as well as for giving an opinion on the proposal of an annual plan for blood and blood components.

Blood collection and testing, as well as the production of blood derivatives in the Republic of Croatia, can only be performed by an authorized health institution that has a permit for the performance of transfusion activities, which is issued for a period of five years. Authorized healthcare institutions must establish a quality assurance system aligned with the requirements of internationally recognized standards for transfusion medicine and scientific and technological development. (Law on Blood and Blood Products, 2011)

The Law on Safe Collection of Blood in Macedonia (2007) created formal and legal prerequisites for ensuring self-sufficiency and meeting the national needs for blood and blood groups. Predictable needs for blood are determined by an annual plan, which is adopted by the Minister of Health at the suggestion of the transfusion institution. In addition, the minister determines areas for blood collection based on professional, medical, economic, and other criteria, and the Institute for Transfusion Medicine and the Red Cross are responsible for implementation. Donating blood is based on the principles of voluntariness and anonymity and does not involve monetary or any other compensation. The institution for transfusion medicine is required to keep the documentation obtained, or created, during the performance of its activities for a period of at least 30 years, while ensuring the confidentiality and secrecy of data in the manner regulated by regulations on the protection of personal data and the protection of patients' rights.

5. CONCLUSION

Improvements to voluntary blood donation should be resolved by systemic measures that involve the organization of a significantly larger number of transfusion centers, in order to enable donors to give blood in a fast, safe, and comfortable manner. In addition, more efficient planning, implementation, and valorization of public health campaigns has been suggested. Health education and stressing the irreplaceability of blood donation, due to its relevance, should be highly positioned in curricula starting from primary school. This paper affirms voluntary, anonymous, and unpaid blood donation and points to the necessity of establishing measures and instruments for the stronger public recognition of donors. Certified health facilities should adopt blood supply management plans, as well as change their approach to attracting, recruiting, selecting, and retaining health personnel, as the most important resource they have. This paper emphasizes the positive reflections of the introduction of the Type and Screen method, i.e., determination of the blood group in the ABO and Rh system and screening for clinically significant antibodies, which has been confirmed as a reliable and rational standard for the use of blood products. However, this standard must be periodically revised in order to comply with the latest global standards.

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ASSESMENT OF QUALITY OF LIFE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AND DIABETIC POLYNEUROPATHY

Nikolay Kostadinov[1], Tzvetelina Totomirova[2]*

[1]University Prof. Dr. Asen Zlatarov-Burgas, Bulgaria, e-mail: n.kostadinov_m.d@abv.bg
[2]Clinic of Endocrinology and Metabolic Diseases, MMA-Sofia, Bulgaria, e-mail: cvet@gbg.bg

Abstract: Diabetes mellitus is a chronic disease that has a great effect on the quality of life of patients. It is one of the most progressively increasing chronic diseases of the 21st century. Modern medical practice defines the disease as an important risk factor for the development of severe debilitating complications, reduced quality of life. Predominant among the health-related complications reducing the quality of life is diabetic neuropathy. It is a serious and frequent complication of diabetes mellitus, with a chronic progressive course of development, which without adequate treatment can lead to potentially life-threatening complications, significant morbidity and increased mortality among people with diabetes. The aim of the present study was to assess satisfaction and health-related quality of life in individuals suffering from type 2 diabetes and a realized neurological complication. Researched and surveyed during the period November 2022 – April 2023, there are 20 patients, respectively 10 men and 10 women with type 2 diabetes mellitus and a diagnosed complication - diabetic neuropathy. With the help of a questionnaire consisting of 69 questions, divided into 3 groups of previously formulated questions, the patients were surveyed. Medical records were also used. Regarding general health, 80%(8) of men and 80%(8) of women rated it as good. 20%(2) of men and 20%(2) of women rated it as poor. 60% (6) of men and 20% (2) of women have no difficulty in daily walking of more than 1 mile (1.6 km) as a result of the disease and the complication. 40%(4) of women report very limited motor activity as a result of the polyneuropathy. 40%(4) of men and 40%(4) of women reported minor difficulties in motor activity. When asked if they had experienced pain in the last 4 weeks, 40%(4) of men answered that it was mild. 40% (4) of men and 100% (10) of women reported moderate pain, 20% (2) of men reported experiencing very severe pain in the past 4 weeks. Patients with DM and a realized neurological complication are not only physically sick, but also have a lower self-assessment of quality of life, compared to the healthy population. Diabetes has an effect on patients' quality of life. Pain, discomfort and impaired mobility are among the most common complaints that alter the quality of life.

Keywords: diabetes mellitus, diabetic neuropathy, quality of life
Field: Medical Sciences and Health

INTRODUCTION

Diabetes mellitus is one of the most common chronic diseases, which has an effect on the patient's quality of life, especially when they have other co-morbidities(Fowler, M.J., 2008). Globally, more than one in 10 adults are currently living with diabetes mellitus (IDF, 2021). Diabetes mellitus is one of the chronic diseases with the most progressively increasing frequency during the present century.

Diabetes is a global problem that also affects our country. Currently, in Bulgaria there is an increase in the prevalence of diabetes by 20.88% over a period of 6 years, or an average of 3.5% per year (Borisova, A.M., 2019).

In recent decades, the term "quality of life" has become increasingly popular in the field of medicine and healthcare. It is the subject of a number of international studies. Many factors influence the evaluation of the quality of life, i.e. the physical, spiritual and health condition of the individual, depending on the value system of the person, what cultural environment he belongs to, etc. Different concepts of quality of life are interconnected, indicating the three different components – health, happiness and lifestyle and are part of an international study International Quality of Life Assessment (IQOLA) (Nestorova, D., 2009).

In 1997, the World Health Organization (WHO) introduced the first definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease". WHO defines quality of life (QoL) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. Therefore, apart from the definition of a person's physical health, QoL includes a psychological state, a person's level of independence, social life and personal beliefs (WHOQOL,1998).

*Corresponding author: n.kostadinov_m.d@abv.bg

Modern medical practice defines the disease as an important risk factor for the development of severe debilitating complications, correspondingly, a reduced quality of life, requiring significant economic costs. Patients with diabetes mellitus have a worse quality of life (QoL) compared to people without diabetes (Rubin, R., 1999).

Health-related quality of life (HRQoL) is one of the most widely measured outcomes of the self-report approach to the health effects of chronic disease treatment and monitors the physical, psychological, and social aspects of personal health. It is influenced by the individual's expectations, beliefs, perceptions and experiences (Megari, K.,2013).

All aspects of the quality of life depend on demographic factors such as age, sex, marital status, education level, employment status, and duration of illness.(Olukotun, O. et all, 2021)

In a Dutch study of adult female patients with type 2 diabetes mellitus, insulin treatment, obesity and presence of complications were associated with lower HRQoL (Redekop, W.K. et al. 2002).

A deterioration in the QoL of patients with diabetes mellitus is reported when complications begin to develop or comorbidities exist. Predominant among the health-related complications in reduced quality of life (HRQoL) but not related to risk factors (genetic, birth weight or other) is coronary artery disease, followed by renal failure, blindness and a combination of micro- and macrovascular complications and in some studies and sexual dysfunction. However, no increased rates of mild mental disorders were found among patients with diabetes, but when comorbid symptoms were usually more severe (Viinamдki, H. et al., 1995).Furthermore, neuropathy has been found to predict the onset of psychiatric disorders (Shim, Y.T. et al., 2012).

One of the most common complications of diabetes is neuropathy.It is one of the most unpleasant health problems that interferes with the life and daily routine of diabetics. Diabetes complications are directly related to quality of life: the higher the number of complications, the worse the patients' QoL becomes.The duration of the disease is one of the main factors that has an effect on the quality of life. The longer the duration, the worse the QoL(Jing, X et al, 2018). In chronic disease management, assessment of patients' QoL is considered an important outcome measure (Prajapati, V.B. et al., 2018).

Cerebrovascular disease and neuropathy had a negative impact on overall HRQoL in both types of diabetes, while coronary artery disease had an impact on those with type 1 diabetes.

Diabetic neuropathy is defined as the presence of symptoms and/or signs of impaired peripheral nervous system function after exclusion of other causes.Diabetic neuropathy is a serious and frequent complication of diabetes mellitus, characterized by a chronic progressive course of development, which without adequate treatment can lead to potentially life-threatening complications, significant morbidity and increased mortality among people with diabetes.It is a clinical condition of nerve damage in which the patient reports complaints (pain, paresthesias) or has evidence of a neurological deficit that leads to the development of problems such as impaired sensation in the feet. Diabetic neuropathy is found in 35-50% of patients with diabetes mellitus, and when using electrophysiological tests, the frequency can increase to 80% (Tankova, Tz., 2013).Patients with this pathology more often report symptoms such as paresthesia and pain (Gylfadottir, SS. et al., 2022).

Patients with diabetic neuropathy have worse QoL compared to those without complication (Benbow, S.J. et al., 1998). Painful neuropathy reduces quality of life (QoL), which appears to be mediated by increased anxiety, depression, physical exertion, emotional disturbances, and mobility limitation. Relief of neuropathic pain with pharmacological agents has been shown to improve QoL (Moore, A. et al, 2014).

People with diabetes mellitus have a worse quality of life than those without diabetes, especially in terms of physical functioning and well-being.(Hayes, A. et al., 2016).

MATERIALS AND METHODS

The aim of the present analysis is to investigate satisfaction and health-related quality of life in individuals suffering from type 2 diabetes and a diagnosed neurological complication - diabetic polyneuropathy. 20 patients, 10 men with an average age of 57.4±7.7 years and 10 women with an average age of 68.8±5.11 years, with established type 2 diabetes mellitus and a diagnosed complication - diabetic neuropathy, were examined and surveyed. The patients were surveyed using a questionnaire that is an extended version of the SF36, composed of 69 questions, divided into 3 groups of pre-formulated questions. The SF 36 is a general instrument that measures various health concepts: general health, limitations in physical functioning, physical health problems, bodily pain, vitality, social functioning, emotional changes, and mental health. Determined total SF 36 score, with higher scores reflecting better QoL.

In order to clarify the patient's medical status and history of the disease and accompanying complications and treatment, the patient's medical file was used. The study period is November 2022–April 2023. Statistical analysis included descriptive statistics, Student's t-test, and Spearman's correlation analysis. A value of $p<0.05$ is accepted for statistical dependence.

RESULTS

The demographic characteristics of the study group of patients are presented in Table 1

Table 1. Sociodemographic characteristics and therapeutic approach in the analized patients with diabetic polyneuropathy

Demographic characteristic (n=20)	Values
Sex (%)	
male	50
female	50
Age at onset, years (mean years ± SD)	
male	57.4±7.7
female	68.8±5.11
Duration of diabetes (mean years ± SD)	4.9±5.51
Type of therapy (%)	
metformin	25
sulfanilurea	25
metformin with sulfanilurea	50
HBA1C (%)	7,9±1.97
Fasting blood sugar (mmol/l)	9,0±2.16
BMI (kg/m2)	31±5,21
Waist measurement	102,3±14,48

In the studied group of patients, the duration of diabetes mellitus was 4.9 ± 5.5 years, BMI was 31.0 ± 5.21 kg/m2, waist circumference was 102.3 ± 14.48 sm. The antidiabetic therapy in the surveyed patients was as follows: - Metformin - 25% (n=5), SUP - 25% (n=5) and SUP + Metformin - 50% (n=10). All respondents had suboptimal glycemic control of diabetes - respectively HBA1C-7.9±1.97% and fasting blood sugar - 9.0±2.16 mmol/l.

Regarding their general health, 80% (n=8) of men and 80% (n=8) of women rated it as good; 20% (n=2) of men and 20% (n=2) of women rate it as weak (Fig.1)

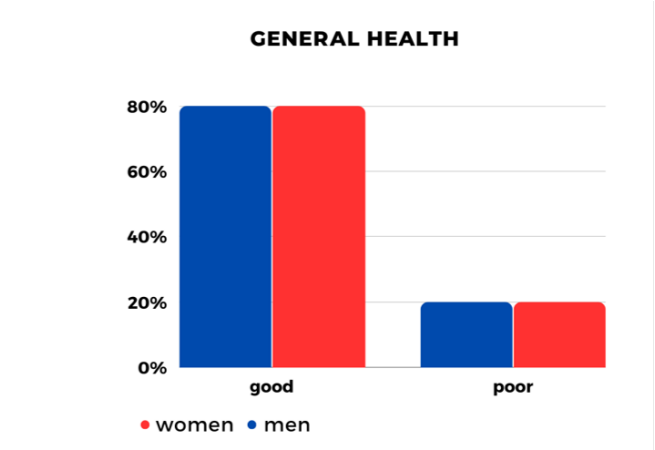

Fig.1

Compared to the state 1 year ago, 20% (n=2) of men and 20% (n=2) of women define their health as slightly better now; 40% (n= 4) of men and 20% (n=2) of women defined it as the same; 40% (n=4) of men and 60% (n=6) of women think that their health is slightly worse now compared to 1 year ago (Fig. 2).

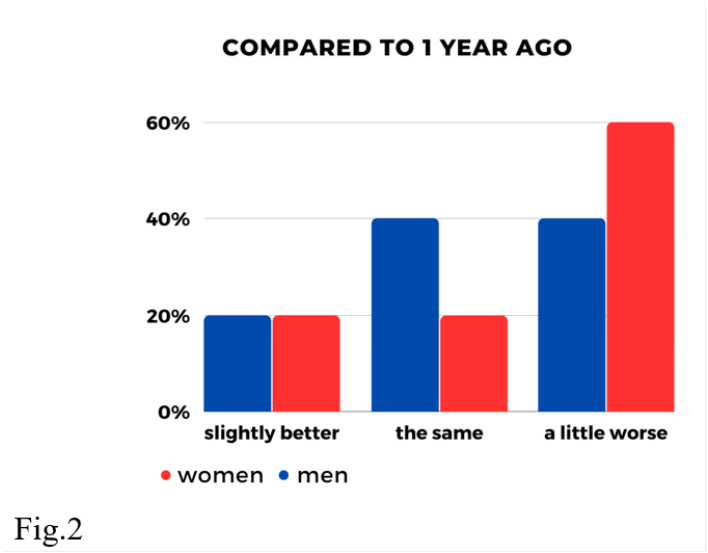

Fig.2

When asked about their activities of daily living, 60% (n=6) of men and 20% (n=2) of women had no difficulty in their daily walking of more than 1 mile (1.6 km) as a result of the disease and complication; 40% (n=4) of women reported very limited motor activity as a result of the polyneuropathy; 40% (n= 4) of men and 40% (n=4) of women reported minor difficulties in motor activity (Fig. 3).

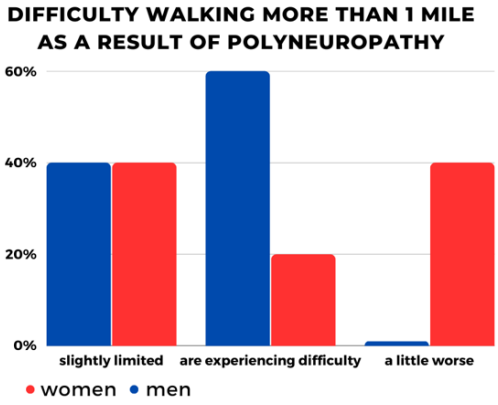

Fig.3

When asked if they had experienced pain in the last 4 weeks, 40% (n=4) of men answered that it was mild; 40% (n=4) of men and 100% (n=10) of women reported moderate pain, 20% (n=2) of men reported very severe pain in the past 4 weeks; 20% (n=2) of the men surveyed reported that the pain experienced in the last 4 weeks did not prevent them from fulfilling their work duties, 20% (n=2) of the men did, but relatively little. Moderate difficulties as a result of the pain syndrome were experienced by 60% (n=6) of men and 100% (n=10) of women (Fig. 4).

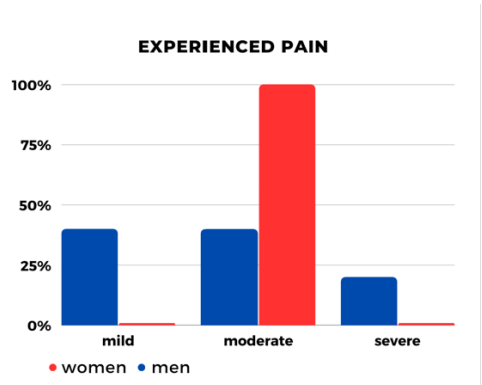

Fig.4

Regarding glycemic control, 30% (n=6) of the respondents had satisfactory glycemic control - HBA1C below 7.0%, 30% (n=6) had poor glycemic control - HBA1C between 7.0 and 8.0% and 40% (n=8) of the patients had very poor glycemic control - HBA1C above 8.0%. Depending on the level of glycemic control, there is a difference in the responses given. 30% (n=6) of respondents with HBA1C above 8.0% rated their health as poor and slightly worse now compared to one year ago. 10% (n=2) of respondents with HBA1C above 8.0% rated their health as good. 30% (n=6) of them with HBA1C between 7.0 and 8.0% rated their health as good, and the remaining 30% (n=6) with HBA1C below 7.0% also rated their health as good. All patients with HBA1C below 7.0% rate their health slightly better now compared to 1 year ago. Of the group of patients with HBA1C between 7.0 and 8.0%, respectively, 30% (n=6) consider their health to be slightly worse compared to one year ago, and 10% (n=2) with HBA1C above 8.0% thought it was the same.

Regarding the three treatment groups, we did not find a significant difference in the answers given by the patients in the survey.

DISCUSSION

Data from our study confirm the relationship between the quality of life of patients with type 2 diabetes mellitus and diagnosed polyneuropathy. Patients with type 2 diabetes mellitus and a realized neurological complication are not only physically sick, but also have a lower self-assessment of quality of life. The reasons for this are most often related to the altered sensibility of these patients, frequent complaints of paresthesias and pain symptoms, and also due to altered motor activity in many cases. A limitation of our study is the relatively small number of patients followed, as well as the therapy they received. Until now, the patients have not received treatment to maximize the therapeutic effect (so far they have only been treated with the metformin and SUP groups) and no one has received the so-called newer therapeutic classes (such as GLP1 agonists, SGLT2 inhibitors and DPP4 inhibitors).Follow-up and assessment of quality of life for improvement in control after inclusion of treatment with any of the representatives of the indicated groups is pending. The main drawback of the study is the limited number of patients included and the need for additional and more thorough research.

CONCLUSION

QoL in patients with type 2 diabetes mellitus and polyneuropathy can be affected at different levels. Pain, paresthesias and mobility are the main problems that affect the QoL of patients with diabetes. It is believed that modern antidiabetic therapy providing strict glycemic control is the key to prevent the occurrence of complications and their negative impact on QoL in patients with type 2 diabetes.Regular assessment of QoL would provide an indication for prompt intervention in patients with the aim of improving their emotional well-being, self-esteem and overall disease control.

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UDK: 616.314-008.28-76

OCCLUSAL SPLINTS, RETAINERS AND THE RELATION BETWEEN THEM – A REVIEW ARTICLE

Dobromira Shopova[1], Desislava Bakova[2], Miroslava Yordanova[3], Svetlana Yordanova[3]*

[1]Department of Prosthetic Dentistry, Faculty of Dental Medicine, Medical University-Plovdiv, Bulgaria
e-mail: dent.shopova@gmail.com
[2]Department of Health Care Management, Faculty of Public Health, Medical University-Plovdiv, Bulgaria,
e-mail: desislavabakova@abv.bg
[3]Department of Orthodontics, Faculty of Dental Medicine, Medical University-Plovdiv, Bulgaria
e-mail: mirajord@gmail.com; svetlaj@gmail.com

Abstract: This article reviews different types of occlusal splints and retainers, and current trends of their creation by digital technologies. They were systematically searched by key words, single or combined. The key words were: bruxism, retainer, modification of occlusal splints, modification of retainers, 3D printing, CAD/CAM. It was used peer-reviewed articles published in Google scholar until July 2023. The articles were in English with available at least abstract with clear conclusion part. Paid for the reader articles are not included in the review. In this article are presented main and additional types of occlusal splints, different types of retainers and their modifications, the contact point between splints and retainers and their digital creation.

Keywords: Occlusal splints, retainers, digital technologies, CAD/CAM technology, 3D printing.
Field: Medical Sciences and Health

Occlusal splints:

Bruxism, a common parafunctional habit, arises from a variety of factors including biological, physiological, and exogenous influences. It can significantly impact individuals' quality of life by leading to dental issues such as tooth wear, frequent dental restoration fractures, and orofacial pain. Clinically, it manifests through symptoms like muscle fatigue in the masseter area, temporomandibular joint pain, ear discomfort, tingling sensations, soreness, or a sense of teeth instability. Despite its prevalence, there isn't a definitive and cost-effective clinical method for diagnosing bruxism with reliable diagnostic and technical validity [Koyano]. Two types of bruxism are recognized: static (involving compression only) and dynamic (involving compression and horizontal movements). It can occur during both daytime (primarily static clenching) and nighttime (dynamic grinding) [Okeson]. The term "splint," according to orthodontic terminology, refers to various devices, appliances, or apparatus employed to stabilize or support teeth or bones. These devices resist motion or displacement of fractured or injured structures [Jacobson]. In the literature, two main categories of splints are described: Okeson splints and Stabilization appliances. The latter category includes Anterior Repositioning Appliances (ARA) or Mandibular Orthopedic Repositioning Appliances (MORA) [Okeson]. Additional types encompass Anterior/Posterior bite planes, Pivoting appliances, and Soft/Resilient appliances made from materials like silicone [Moin, Dhannawat]. Dawson's classification further breaks down splints into permissive splints/muscle deprogrammers, non-permissive splints/directive splints, and pseudo-permissive splints (e.g., Soft splints, Hydrostatic splints) [Dhannawat, Dawson].

The stabilization splint is primarily used to address symptoms related to masticatory dysfunction, encompassing issues like muscle pain, temporomandibular joint (TMJ) pain, clicking, crepitation, restricted movement, and coordination difficulties. This type of splint is typically recommended for continuous wear, except during meals, and can be positioned on either the upper or lower jaw [Al-Ani]. On the other hand, a repositioning splint is employed to address alterations in intermaxillary relationships and muscle function. Joint clicking could result from swift changes in disc or condyle positions during condylar translation. The classic repositioning splint involves placing a vestibular arch on the frontal teeth area, with smooth surfaces distally [Wiliamson]. Anterior bite splints, featuring a horizontal plane at the front, are worn on the upper jaw and only occlude with the lower front teeth. They are used to manage muscular dysfunction and disturbances in occlusal relationships. Additionally, they can serve orthodontic purposes for treating deep bites [Farha]. Posterior bite splints, with a bilateral distal horizontal plane, are crafted for the lower jaw, often with both halves connected by a metal connector. They are indicated for addressing lower third

*Corresponding author: dent.shopova@gmail.com

of the face height loss and disarticulation of both jaws [Gelb]. In cases of painful articulation accompanied by a sensation of traction, a pivot splint is advised. It is constructed with a single contact of the distal teeth [Hamlin]. Soft splints are typically commercially manufactured. They are utilized to prevent trauma in sports and, to a lesser extent, treat bruxism and parafunctional habits. Some variants are thermoformed, offering elasticity and covering the entire tooth surfaces [Wright]. A recent study focused on the efficacy of anterior repositioning splints (ARS) revealed an impact on dental anomalies. These splints are designed by moving the lower jaw forward to attain a Class I position between the molars, with a 5 mm gap between the premolars. This movement positions the joint disc correctly, a placement that endures even after treatment, fig. 1 [Al Ouran]:

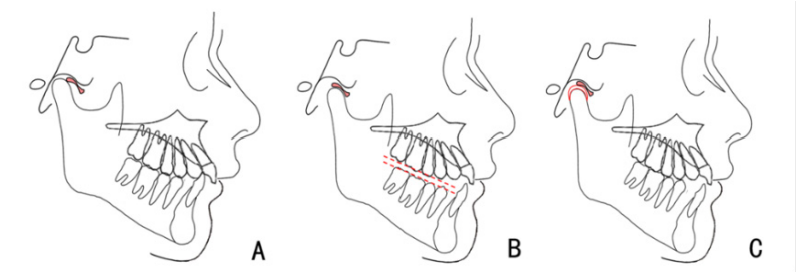

Figure 1. Change the position of the articular disc: A - before treatment; B - protrusion of the lower jaw with the correct position of the articular disc; C - final result of repositioning splint treatment [Al Ouran]

In a comparative study, the activity of the anterior temporalis and masseter muscles was measured using electromyography (EMG) while wearing hard and soft splints. The results indicated that wearing hard splints led to a decrease in EMG activity in both muscles compared to no splint, especially in the anterior temporalis muscle during maximum clenching. On the other hand, wearing soft splints resulted in a slight increase in activity in both muscles, with a greater impact on the masseter muscle. The decrease in temporalis muscle activity relative to masseter muscle activity could contribute to the therapeutic effect of both hard and soft splints, although the decrease was more pronounced with hard splints [Al Ouran]. Another perspective suggests that the use of rigid occlusal bite plates might not be highly effective in reducing overall signs of bruxism, but it could help mitigate deviations in mouth opening [Respero]. Infrared thermography can also be employed to register muscle activity. When achieving balance after wearing splints for one to three months, a decrease in registered temperature is naturally observed due to the conditions created for reducing joint inflammation and muscle overload [Taneva]. In certain cases, antidepressant therapy can be considered. In one investigation, patients were treated with a tricyclic antidepressant (Amitriptyline HCl, 10 mg/day) for three months. The study concluded that occlusal splint therapy might be more effective than tricyclic antidepressants in bruxism treatment [Alkan]. Other researchers propose combining occlusal splints with cognitive-behavioral treatment, which includes techniques like problem-solving, progressive muscle relaxation, nocturnal biofeedback, and training for relaxation and enjoyment. These combined approaches have shown significant reductions in sleep bruxism activity, self-assessment of bruxism activity during sleep, psychological distress, and an increase in positive stress-coping strategies [Ommerborn].

Retainers:

The retention phase in orthodontic treatment is crucial for preventing teeth from reverting to their original positions [Melrose]. Sustaining teeth in their corrected alignment post-orthodontic treatment is challenging due to influences from periodontal, gingival, occlusal forces, growth-related factors, and natural aging changes. Since orthodontics cannot accurately predict which patients will experience relapse, who will remain stable, and the extent of potential relapse, practitioners must approach all patients as potentially high-risk for relapse. Therefore, advocating for long-term retention is recommended [Blake, Littlewood, Joondeph]. Retainers are devices utilized after active orthodontic treatment to preserve treatment outcomes while hard and soft tissues remodel, or skeletal growth completes. These can be categorized as fixed or removable retainers. Removable retainers can be taken out by patients for thorough oral hygiene and part-time wear as required. However, certain situations mandate continuous retainer wear to minimize relapse risk, often necessitating the use of fixed retainers [Johnson]. Among globally used removable retainers, the Hawley-type retainers (with acrylic baseplate and wire labial bow) and thermoplastic retainers are prevalent. Vacuum-formed retainers are more effective than Hawley

retainers in maintaining the alignment of maxillary and mandibular labial segments. This superiority is especially significant in the mandibular arch when addressing single tooth displacement, fig. 2 [Rowland].

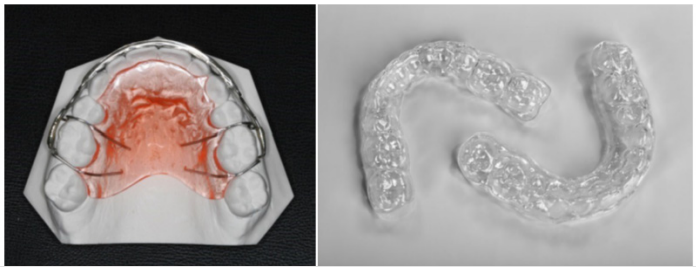

Figure 2. Hawley style removable retainer and Clear thermoplastic removable retainers [Rowland]

The Begg retainer, also known as the Wrap-around Retainer, is a variant of the Hawley retainer. A typical Begg design consists of a wire arch (labial bow) with adjustment loops at the canines, contoured closely to the second molars [Sahoo]. In a comparison between Essix and Begg retainers, more individuals wearing Essix retainers reported comfort and acceptable appearance, whereas those with Begg retainers found them more suitable for biting and chewing. Both types allowed some degree of post-treatment tooth relapse, with minimal clinically significant differences over a 6-month period [Kumar]. A modified Essix retainer can address tongue thrusting habits. This version incorporates a rigid stainless-steel wire on the palatal surface. Known as tongue cribs, these retainers prevent patients from practicing tongue thrusting or thumb sucking, thereby reducing the risk of relapse, fig. 3 [Thakur].

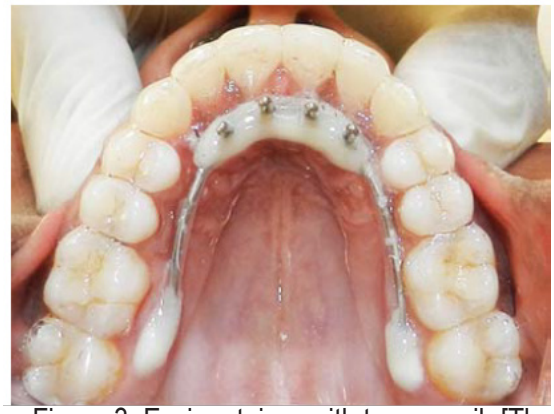

Figure 3. Essix retainer with tongue crib [Thakur]

A fixed retainer technique was introduced for the precise application of the modified 3-3 multistrand wire retainer described by Zachrisson. This lingual retainer or splint is minimally invasive to dental tissue and can be removed reversibly [Becker]. Another method involved etching the inner side of cast fixed partial denture frameworks to create a retentive mechanism. The etched metal ceramometal restoration was then bonded to the enamel surface using acid etching technique. Enhanced resin-bonded retainers offer innovative, conservative, and practical alternatives to traditional fixed prosthodontics [Liyaditis]. In terms of occlusion, research demonstrated that the Hawley retainer led to a significant increase in occlusal contacts on posterior teeth while maintaining anterior contacts. Conversely, the clear overlay retainer showed no significant change in either anterior or posterior contacts during retention. The retentive characteristics of these two retainers differ: the Hawley retainer permits relative vertical movement (settling) of posterior teeth, while the clear overlay retainer maintains teeth in their debanding position [Sauget]. The impact of retainers on speech is also crucial and can be evaluated using tools like Speech Analyzer [Hotori]. Sound distortion was noted in both the Hawley retainer group and the vacuum-formed retainer group, with more noticeable changes in articulation seen in the Hawley retainer group [Wan]. Similar studies found that the Hawley retainer had a more pronounced effect on articulatory movements in consonant-vowel combinations compared to the Essix retainer. Voice onset time in the Hawley group was shorter than normal, indicating rapid articulatory movement in the alveolar region [Atik].

Bruxism and Orthodontics:

Occlusal splints and orthodontic retainers indeed share similar designs but serve different purposes. Dealing with orthodontic patients with parafunctions like bruxism can be challenging. Research indicates

that around 38% of children at an average age of 8.1 years exhibit bruxism symptoms. Children with psychological disorders are 3.6 times more likely to have bruxism. A history of bruxism in either parent increases the likelihood of their child having bruxism by 1.8 times. Nighttime drooling is associated with a 1.7 times higher likelihood of bruxism, while sleep-talking children are 1.6 times more likely to brux [Cheifetz]. Sleep bruxism was observed in 27.3% of patients awaiting orthodontic treatment. Among those undergoing treatment, 36.4% had sleep bruxism before treatment, and 25% continued to experience it after receiving an orthodontic appliance. Of those who had bruxism prior to treatment, 75% reported that it ceased after the appliance was placed [Prado]. The modified Hawley mechanical retainer is simple and practical. It not only retains optimal corrective effects in patients with tooth clenching or bruxism after orthodontia but also effectively treats these conditions [Wen-Xian]. Invisible orthodontic devices differ from oral appliances commonly used in temporomandibular disorder (TMD) patients, as they are neither as rigid as conventional appliances nor as soft as over-the-counter devices [Wassel]. A study investigated the short-term effects of invisible orthodontic retainers on sleep-time masticatory muscle activity (sMMA) in 19 healthy individuals in a home environment. The study found that sMMA parameters did not significantly change over the four recording nights, suggesting that invisible orthodontic retainers do not have substantial effects on sMMA in healthy individuals during the short term [Manfredini]. Digital methods can be employed to combine an occlusal splint and a retainer, allowing for various occlusal surface designs such as raised to antagonist cusp tips, raised to antagonist plane, and raised ramp [Shopova, Shopova, Shopova].

Digital technologies:

In recent years, the field of dental medicine has experienced a significant shift towards constant innovation and the adoption of more efficient methods, largely driven by digitalization [Shopova]. Digital dentistry is a subset of teledentistry methods, which proved to be a valuable option during the COVID-19 pandemic [Shopova]. Around the world, modern materials and construction methods have garnered interest from dental professionals. The current technological landscape, along with the array of materials available, offers practitioners the flexibility to choose methods or combinations thereof based on patient conditions and preferences. Research in contemporary dentistry frequently incorporates digital technologies, although the application of specific materials related to these new technologies requires further investigation [Zaharia, Bakova]. Various digital methods can be effectively combined, such as articulators, facebows, cone-beam computer tomography, axiographs, and digital smile design [Taneva, Shopova, Kasnakova, Shopova]. Traditional vacuum-formed retainers are progressively being replaced by those made on 3D printed models rather than gypsum models. The shift is due to the demonstrated advantages in accuracy and stability offered by digitally produced working models compared to their analog counterparts. As a result, these models are now employed to craft numerous other orthodontic appliances, including aligners, expanders, and braces indirect fixation transfers [Sweeney, Kim, Darroudi]. Modern software applications enable the creation of various types of splints and retainers tailored to specific clinical cases. The integration of digital tools is transforming the field, offering enhanced precision, convenience, and customization for both dental professionals and patients. Notable software platforms in this domain include Exocad, 3Shape, and Sirona [exocad.com, 3shape.com, sicat.com], as shown in figure 4.

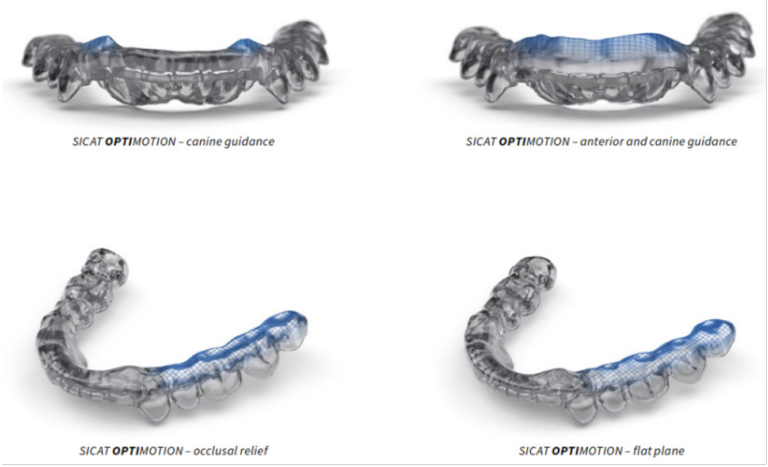

Figure 4. Different types of splints made by 3D technology (Sicat function, Dentsply, Sirona) [www.sicat.com/products/functional-dentistry/optimotion]

Splints and retainers in dentistry can be fabricated using different technological methods such as 3D printing or CAD/CAM milling. CAD/CAM technology, with historical mentions dating back to 1957, involves cutting objects from monolithic blocks or disks, and it gained official recognition in the literature by 1994 [Avinash, Edelhoff]. On the other hand, 3D printing technology aims to streamline construction intermediaries, creating objects layer by layer from soft materials, thus reducing costs and improving various aspects of dental practice, from models to maxillofacial prostheses [Zaharia, Bakova]. Creating 3D virtual retainers through user-friendly software presents an exciting prospect that could transform contemporary dental practice. This method offers simplicity, speed, accuracy, and patient satisfaction, potentially shaping the landscape of orthodontic appliance design in the digital orthodontic era [Nasef].

Conclusion:

Occlusal splints play a significant role in treating temporomandibular joint (TMJ) and masticatory system dysfunctions. By covering tooth surfaces, they protect against mechanical friction and prevent loss of hard tissues. Hard or soft braces help correct occlusal disharmony, immobilize teeth, and alleviate bruxism symptoms.

The Essix retainer, with its thin foil and aesthetic appeal, is almost invisible during speech and smiling. However, its mechanical properties are not entirely satisfactory, often necessitating frequent replacement. While printed retainers are not yet widely utilized in orthodontic practice, they possess potential advantages, even though they are less than 1 mm thick and can influence lower jaw positioning with beneficial effects.

Digital technologies enable precise design, ensuring equal offset between tooth surfaces and the inner surface of the splint. They also allow for pre-inspection in central occlusion and articulation. These technologies reduce the time required for scanning (typically 1 to 2 minutes for a full jaw scan) and enhance patient comfort during the initial clinical stage, as compared to traditional intraoral impressions that may induce nausea and discomfort when placing impression material in the mouth. As the field of dentistry continues to embrace digital advancements, new possibilities for treatment and patient care emerge.

Acknowledgments:

This research was funded by the Scientific program “Young scientists and postdoctoral researchers - 2”, Medical University - Plovdiv, Bulgaria.

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OCCUPATIONAL EXPOSURE TO NOISE DURING AIRPORT GROUND HANDLING - IMPACT AND RECOMMENDATIONS TO REDUCE THE OCCUPATIONAL RISK OF DAMAGE TO THE HEALTH OF WORKERS. CURRENT STATE OF LEGISLATION IN THE FIELD OF NOISE PREVENTION IN THE WORKPLACE IN BULGARIA

Dorina Manahilova[1*]

[1]University Hospital for Active Treatment "St. George", Plovdiv, Bulgaria,
e-mail: dmanahilova@abv.bg

Abstract: Those working in the ground handling of aircraft at the airport in the process of performing their activities are exposed to the impact of a complex of harmful and dangerous risk factors, including noise. Noise in the working environment above 85 dB(A) is one of the first unfavorable factors at the airport that affect the functional state of various organs and systems in the human body. Exposure to noise in the work environment at or above 85 dB(A) can cause a number of complaints related to the central and autonomic nervous systems, disorders in the vestibular and auditory apparatus up to permanent hearing loss, reduced work capacity, impaired concentration, fatigue, difficulty in verbal communication, the ability to hear warning signals, respond to environmental sounds, etc. All this affects the general safety and is a prerequisite for the occurrence of aviation accidents caused by the human factor. The purpose of the present study is to present the results of research conducted on noise at the airport itself and its impact on ground staff, by deriving good practices and examples, to make general conclusions and proposals with a practical orientation for the introduction of a standard for health monitoring and prevention of the risk of noise exposure among airport ground handling workers. The methods used are documentary, formal-logical with analysis of official documents, systematic review of articles and data in the surveyed area. The results of the survey show the lack of clear legal rules and standards in the Republic of Bulgaria regarding the health screening of hearing for those working in environments with excessive noise levels, including for ground handling operators at airports. Therefore, solutions to this problem must be implemented, in particular through the introduction of a standard and the introduction of clear criteria for health monitoring, engineering, ergonomic knowledge and preventive measures. Hearing prevention, early screening and health monitoring among workers at excessive levels of noise in the work environment should be a priority of every legislation, responsibility and obligation of every employer.

Keywords: aviation noise, ground personnel, noise-induced hearing loss, legislation, airports
Field: Medical Sciences and Health Care

1. INTRODUCTION

Airport ground handling workers are exposed to noise in the work environment. Sources of noise in the airport area are the aircraft itself (taxiing, landing, starting, take-off) and a number of ground operations such as the use of auxiliary equipment in preparing the aircraft for flight, engine tests, baggage handling equipment, maintenance activities at the airport, auxiliary power units, traffic to and from the airport, etc. Aviation noise can be characterized as broad-spectrum, non-constant, high-frequency /100-125 dBA/. Studies in this field indicate that long-term exposure of workers to this noise, without the use of protective equipment, adversely affects their organism. The negative influence of noise can be potentiated by other factors such as general vibrations, unfavorable microclimatic conditions when working outdoors during a transitional, cold and warm period of the year, emotional overstrain, working in an environment with a shortage of time, fatigue, etc. /1, 2,4,12/

A number of clinical studies conducted among workers in an environment with excessive noise levels show a direct impact and damage to the auditory analyzer of the sensorineural type during continuous work in this environment, limiting the worker's ability to hear high-frequency sounds, with a disturbance in the understanding of speech and impaired communication, psychological and physiological disorders, sleep disorders, poor cognitive ability, etc. Exposure to noise is thought to cause a response

*Corresponding author: dmanahilova@abv.bg

in the autonomic nervous system and the endocrine system, leading to increased secretion of the stress hormone, which can lead to an increased risk of hypertension, cerebrovascular disease, stroke, coronary heart disease./ 6/. A correlation was established between the mentioned changes and the degree of sensorineural hearing loss. /12/. Studies show that exposure to high levels of noise is associated with higher morbidity and mortality from cardiovascular diseases /3/ This important issue is not discussed enough even today.

Studies worldwide show that Noise-Induced Hearing Loss (NIHL) is one of the most common occupational diseases and is the second most common form of sensorineural hearing loss after presbyacusis / hearing loss associated with age changes/. The World Health Organization (WHO) defines NIHL as “a persistent reduction in hearing threshold levels (HTLs), with a characteristic reduction in hearing sensitivity at frequencies of 3–4 kHz and/or 6 kHz of more than 25 dB and relatively better hearing sensitivity at close frequencies (2 or 8 kHz) for 25 dB or less”. /10/

The National Institute for Occupational Safety and Health (NIOSH) has recommended that all worker exposures to noise should be controlled below a level equivalent to 85 dBA for eight hours to minimize occupational noise induced hearing loss.

The aim of the present study is to present results with conclusions and conclusions from research carried out at large airports in different strata on the impact of occupational noise on the health and safety of airport ground handling workers, by deriving good practices and examples, making generalizations conclusions and proposals with a practical orientation for the introduction of a standard for health monitoring and prevention of the risk of exposure to occupational noise among workers in the Republic of Bulgaria, including those working in ground handling at airports.

2. MATERIALS AND METHODS

The report preparation approach includes methods and tools for collecting and researching information from a variety of sources. A large number of publicly available regulatory documents, online database, articles from PubMed, Embase, Web of Science, Scholar Commons, Google Scholar and literature surveys were reviewed. The inclusion criteria for the review papers were “occupational noise exposure”, “hearing loss”, “relationship between occupational noise and hearing loss”, etc. The main methods of research are documentary, the methods of logical connection and sequence, which are used for the purpose of scientific systematization and summary of the facts related to the discussed topic. Worldwide, there have been many reported cases of occupational hearing loss in workers exposed to excessive noise levels in the workplace in more than four decades of findings. The dangers of exposure to occupational noise are recognized and documented in many countries. Therefore, solutions to this problem must be implemented, in particular through engineering, ergonomic knowledge, preventive and medical-prophylactic measures /3/

3. RESULTS AND DISCUSSIONS

A number of studies have been conducted on the prevalence of noise-induced hearing loss (NIHL) at several international airports.

The results of a study /2/, published 2019 on occupational noise exposure among ground handling workers at Sultan Ahmad Shah Airport, Kuantan, Malaysia, conducted through questionnaires and direct measurement of noise around Boeing 737-800 model aircraft, show:

- When 11 persons from the ground handling unit of the ramps, technician, operator of ground equipment, aviation security and general workers were studied, three of them reported hearing problems related to their work, and two of them had a professional work experience of more than 10 years .
- During the noise measurements during take-off, landing and servicing of the aircraft with the engines on, there are peak moments when noise values of 111.4 dBA were measured on average /in the part of the aircraft’s landing gear/.
- The average value for a total of 3 days of measurement is 94.2 dBA, which exceeds the permissible level of 85 dBA.

Given that at every landing and servicing of an aircraft, ground staff workers check the condition of the aircraft, including its undercarriage, there is a risk for workers of exposure to high levels of noise in the working environment. This gives grounds in the analysis to recommend the implementation of preventive measures, awareness and training of workers about safety rules when working in the aircraft service area. When applying HPD - internal antiphons / earplugs / the noise level can be reduced by about 30 - 36 dBA

and reach a protection level of 67.9 - 58.2 dBA, which is very effective for workers. /2/

In a survey in 2011 in a commercial airline in Sweden on the hearing status of aircraft maintenance workers found that the Equivalent Noise Exposure Level during working days was 70-91 dB(A) with a maximum noise level of 119 dB(A), which is above Swedish professional standards. /12/

For the period of July 2019 until August 2020 conducted a study of the prevalence and risk factors for NIHL among runway workers at Muscat International Airport in Oman. The methods used in the study are measuring the daily noise exposure level of the workers and questionnaires. The study covered 312 workers in the aircraft take-off and landing area. The results show that 22.30% of workers were exposed to high levels of noise at work. NIHL was found in 21.79% (n = 68), which is lower than the reported prevalence of NIHL in the literature, which is about 33.5-49.4%. / In a 2014 Korean study, the prevalence of NIHL was 49.4%/. /1/

In 2001 and 2018 published studies at a major urban airport in Seoul, Korea regarding factors associated with airport workers' hearing loss and the use of hearing protection devices (HPD). The results of the study showed that workers who regularly used HPDs had significantly lower levels of NIHL than individuals who did not wear HPDs or used HPDs less often. /5,6/

In Sudan Journal of Medical Sciences / Vol. 3 no. 3 (2008) published a study on the impact of noise and hearing loss NIHL among Khartoum International Airport Employees /Noise Induced Hearing Loss among Khartoum International Airport Employees/. The results showed that the prevalence of NIHL was 55% among employees who work in the high noise areas of the airport and who do not wear appropriate HPD hearing protection devices. In a 2018 study in Saudi Arabia at King Khalid Airport, the prevalence of NIHL among ground staff was 48% . /7/

In a 2018 study conducted at an airport in a large American city in South Florida, USA, showed increased levels of noise exposure for those working in the airport's ground staff work areas. This necessitates the implementation of Workers' Hearing Protection Programs, including the use of hearing protection devices HPD, which have a sufficiently high level of noise reduction /NRR/ . /11/ As early as 1970, the Occupational Safety and Health Act (OSHA) includes a noise standard for all US industries, making them mandatory to prevent occupational hearing loss.

In published report Zinkin V.N., & SHeshegov P.M.. (2021). Mehanizmy-deystviya-aviatsionnogo-shuma-na-professionalnuyu-rabotosposobnost-i-nadezhnost. Noise Theory and Practice, 7 (2 (24)), 165-182, clinical-audiological studies of the hearing analyzer in aviation specialists in civil aviation showed that sensorineural hearing loss was found in 33% of the subjects studied, as 47% of of them are employed by the engineering and technical staff, and 28% by the flight staff. /13/

Pure-tone tone threshold audiometry is used to detect and quantify hearing threshold reduction in frequencies of 16 -18 kHz at the earliest stage of exposure. This can be used as an early diagnostic sign of NIHL. At a later stage, hearing loss occurs around 4000 Hz. The main features of NIHL are symmetrical involvement, characteristic changes in high frequencies of 3000, 4000 or 6000 Hz with recovery at 8000 Hz. Late manifestations of NIHL affect the range of conversational speech in frequencies 500-2000 Hz. /13,14/

Studies of airport groundhandlers have shown that the first signs of permanent impairment in the auditory analyzer of the NIHL type appear from 2 to 5 years into aviation service. Nasir and Rampal stated that age over 45 years and working in a noisy environment for more than 5 years are two important risk factors that can cause permanent hearing loss Other factors that can affect the severity of NIHL and increase the risk is the presence of chronic diseases such as diabetes, hypertension, intake of ototoxic drugs, as well as household hazards such as smoking more than 20 packs per year. A higher rate of NIHL among smokers has been found in the literature and has been reported to be as high as 55% of enrolled smoking participants in some studies. /1,13/.

Studies have shown that the infrequent use of HPDs in environments with excessive noise levels may be a contributing factor to NIHL. In this regard, the Occupational Safety and Health Administration (OSHA) recommends that airport employers provide HPDs to all of their employees to be worn whenever noise exposure is equal to or greater than 85 dBA. Also implement a Hearing Protection Program. /1/

Our study on the health status of ground staff at an airport in the Republic of Bulgaria, conducted using a police method of studying morbidity through the analysis of temporary incapacity for work for the period 2017-2019, shows a higher burden of diseases with temporary incapacity and specific changes in the structure of diseases / a higher frequency of diseases from the group of diseases of the cardiovascular system, nervous system, diseases of the auditory analyzer, etc. / among those working related to the maintenance of the aircraft at the airport and with higher levels of noise exposure in the working environment, compared to the administrative structures of the airport and those working with low exposure and lower values of occupational noise. /9/

4. NIHL PREVENTION

A safe and healthy working environment is a basic requirement for all employers and workers. The main objective of prevention measures for NIHL include monitoring occupational noise exposure (e.g. through periodic noise measurements in the work environment), reducing workplace noise exposure (e.g. engineering control, administrative control and personal protective equipment for hearing loss), early detection of changes before permanent damage to the inner ear (eg routine audiometric examinations and health education) Noise prevention programs are an important preventive measure to prevent and reduce the incidence of NIHL among workers. / 3/

Eliminating or reducing noise below 80 dBA through engineering or administrative controls is the best way to prevent the risk of NIHL. The noise exposure limit recommended by the National Institute for Occupational Safety and Health (NIOSH) is a sound level of 85 dB for 8 hours per work day and for a 3 dB change in level (ie for every 3 dB increase at the noise level, the allowable exposure time is halved).

Organizational and administrative measures include reducing the time spent by airport workers in the area affected by high-intensity noise and controlling the wearing of HPD hearing protection devices./13/

Periodic monitoring of noise intensity, duration of exposure of airport ground handling workers, age, other risk factors such as diabetes mellitus, hypertension, intake of ototoxic drugs, smoking, use of hearing protection devices (HPD) are important in the assessment of the occupational risk for the health and safety of workers.

Health monitoring includes preliminary professional selection of workers in environments with excessive noise levels, periodic preventive medical examinations including the general condition of the body to identify persons with increased sensitivity and reduced resistance, susceptible workers / such as those who are older, with certain diseases or had more years of exposure to excessive noise/ and audiometric hearing test. The anamnestic data during the examination are important: family history of hearing loss; lived near the airport; engaged in hobbies with possibly high noise levels (such as riding a motorcycle, shooting a gun, or playing loud music); accompanying diseases that may affect hearing such as diabetes mellitus, hypertension or the use of medications that could affect hearing.

It has been established that in healthy people, after exposure to loud noise, hearing returns to the initial level within 24 hours ie. the temporary decrease in hearing threshold is within 24 hours. Hearing recovery time reflects the degree of fatigue of the hearing analyst and his adaptive capabilities. The temporary decrease in the hearing threshold can be used as a criterion in the occupational selection of personnel for aviation specialists in airport ground handling, to identify individuals with increased sensitivity and reduced resistance to noise.

Laboratory studies show that when exposed to noise with a sound pressure level of 100 dB for 1-6 hours, the magnitude of the temporary decrease in the hearing threshold increases to 7-17 dB, and the recovery time of the auditory analyzer 10-30 min. When the sound pressure level increases to 110 dB, the temporary decrease in the hearing threshold increases to 20 dB, and the recovery time to 2-3 hours. When the sound pressure level increases to 115 dB, the temporary decrease in the hearing threshold increases to 30 dB and the recovery time to 24 hours. /8, 13/

The pure audiometric screening test has a sensitivity of 92% and a specificity of 94% in detecting sensorineural hearing loss and in distinguishing between NIHL and presbyacusis (age-related hearing loss). It is important that periodic audiometric screening and training of hearing prevention workers be carried out in order to improve the good practices of aircraft ground handling personnel in order to detect and/or prevent future hearing loss. /1/

An important point in the prevention of NIHL in workers in environments with excessive noise levels is the provision of high-quality personal protective equipment for the hearing of workers, raising awareness of their importance and training in wearing personal protective equipment during work. Data from studies show that earplugs may not provide the regulated level of protection if employees are not instructed in their proper use Infrequent use of HPDs increases the risk of developing NIHL. Continuous training of workers on the proper use of HPDs in environments with excessive noise levels and the implementation of various strategies to encourage the wearing of HPDs is required. /3/

In Bulgaria, in the last 10-15 years, there have been no published data with the results of conducted studies on occupational noise at airports and its impact on the auditory analyzer of those working there. According to data from the National Insurance Institute for Recognized occupational diseases caused by noise for all branches of industry - in 2020. a total of 3 cases were registered in 2019. – 1 case, in 2018 - no registered cases, in 2017 - 3 cases.

The health monitoring of persons working in an environment with excessive noise levels is regulated in Section III of Ordinance No. 6/ 15.08.2005. on the minimum requirements for ensuring the

health and safety of workers at risks related to noise exposure in the work environment and is carried out under Ordinance No. 3/28.02.1987. for the mandatory preliminary and periodic medical examinations of workers. In Ordinance No. 3/1987 there are no clearly regulated requirements and criteria for evaluating changes in the auditory analyzer, accounting for changes in hearing with age, evaluating additional risk factors, evaluating the effectiveness of wearing HPD in workers in environments with excessive levels of occupational noise.

5. CONCLUSIONS AND RECOMMENDATIONS

The studies show that the predicted and measured noise values in the vicinity of the aircraft during its ground handling at airports report high noise values above the permissible norms for workers. This noise can significantly affect the health of workers if they are exposed for a long period of time without HPD hearing protection. Also, if workers ignore safety procedures and regulations, working in an environment with high levels of occupational noise can cause hearing problems, cardiovascular system and other diseases. NIHL has been found to be associated with and occur in workers with longer tenure, older age, and irregular wearing of HPD hearing protection.

The purpose of this report was to present results of studies conducted on aviation noise, the prevalence and prevention measures of NIHL. An integrated approach is important in managing the risk of damage to the health of workers in an environment with excessive levels of noise at workplaces. The analysis highlighted the importance of preventive measures, including regular audiometric screening for early detection of hearing loss and ongoing hearing protection programs. In addition, the study demonstrates the importance of administrative and engineering control./1,3/

Hearing loss caused by occupational noise (Occupational Noise-Induced Hearing Loss (ONIHL)) can be prevented. Prevention is the best approach to limit the deterioration of hearing and the extra-aural impact of noise on a person's body. It is important to introduce, apply and the observance of safe work practices, a comprehensive hearing conservation program among airport groundhandlers. The elimination of ONIHL worldwide is a major and long-term challenge at the level of the individual and the overall policy of the organization and the state. Applied measures to prevent ONIHL need from periodic evidence-based evaluations that can provide management with evidence of the effectiveness of ONIHL's Prevention and Control Programs implemented./3/.By implementing effective measures to prevent or reduce exposure to high levels of noise in the work environment at airport ground handling staff, efficient work can be ensured and maintained and the occupational risk of damage to workers' health can be reduced. Engagement of employers and workers is needed; well-defined hearing conservation goals and programs. Managing the occupational risk of exposure to aviation noise for aircraft groundhandling workers at airports would lead to increased safety and performance, staff motivation and the formation of a more favorable workplace environment, which in turn leads to prevention and reduction of the risk of accidents.

In the EU member states, incl. and in the Republic of Bulgaria the standard of the International Civil Aviation Organization ICAO is followed in order to achieve compliance on international standards and recommended practices for civil aviation SARP and policies in support of a safe, secure, efficient, responsible for the environment and working environment, economically sustainable sector of civil aviation, but in the Republic of Bulgaria it is necessary to introduce a standard with regulated criteria for assessing the health status and changes of the auditory analyzer for those working in an environment with excessive levels of occupational noise. It is important to introduce a legal framework and standards with a defined algorithm and clear criteria for personnel selection, dynamic monitoring of health status, including changes in hearing analyzer and risk prevention for workers in excessive noise environments, in order to detect early health effects of the noise impact, preserving the health and working capacity of the workers and the safety of the flights.

6. ACKNOWLEDGMENTS

Prof. Lubomir Alexiev,Ph.D Head of the Department of "Aviation and Maritime Medicine" and Eng. Krasimir Vatov, chief expert in the Department of "Military Medical Training and Support", Military Medical Academy - Sofia, for the help and support in the creation and correct structure of the article.

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UDK: 614.253.8:616.31(497.2)

EFFECTIVE DOCTOR-PATIENT COMMUNICATION A KEY FACTOR FOR ASSESSING PATIENT SATISFACTION WITH DENTAL SERVICES PROVIDED

Gergana Georgieva[1*]

[1]Medical University of Varna, Department of Dental Material Science and Prosthetic Dental Medicine, Faculty of Dental Medicine, Bulgaria, e-mail: Gergana.Georgieva@mu-varna.bg

Abstract: In recent years, great progress has been made in the communication between dental practitioners and their patients. In the 21 st century, communication has become an essential and necessary clinical skill for every dental professional. Communication skills are a skill that every medical professional must master in order to build the best possible relationships with patients. This includes the ability to form a certain idea about the patient's oral disease, altering the patient's mood (minimizing fear, anxiety, increasing confidence, hope for favorable treatment results), influencing the patient's lifestyle and behavior in order to carry out the recommendations given by the dental specialist treating him. They are described in the scientific literature the different models of the relationship between the doctor and the patient, as well as the research of authors regarding the importance of good communication about the patient's dental treatment procedure satisfaction.

Aim: The present study aims to investigate the impact of efficient communication towards patient satisfaction with the quality of dental services provided.

Materials and methods: Sociological survey has been carried out. For the respondents' convenience participating in the research, the opportunity to choose between two options for filling out the survey card is provided: a paper survey card and Online questionnaire created in Google Forms. A survey was conducted on a voluntary basis in May-July 2023. The results of the survey are presented in table and graphic form, which are accompanied by analyzes and conclusions. For the purposes of the research, 358 patients treated by fourth, fifth- and sixth year students in the facility of the Faculty of Dental Medicine at the Medical University of Varna - were surveyed.

Results: There is a positive correlation observed from the survey between effective doctor-patient communication and patient satisfaction with the quality of dental services provided. Good communication with the patient strengthens the trust in the dentist and helps the patient anxiety of the upcoming dental manipulations.

Conclusion: Quality dental services are the basis for the success of the diagnostic - treatment process of any dental practice. Communication with the patient and his relatives is the duty of every dentist, which is of great importance for preserving the mental health of the patient. Great attention is paid to the development of communication skills by dental practitioners. According to a number of studies, effective communication with patients is at the heart of the success of any dental practice. Following some basic rules in communication is a key factor in a good relationship between the dentist and the patient.

Keywords: communication, satisfaction, quality of dental services

1. INTRODUCTION

In recent years, great progress has been made in the communication between dental practitioners and their patients. In the 21 st century, communication has become an essential and necessary clinical skill for every dental professional. Communication skills are a skill that every medical professional must master in order to build the best possible relationships with patients. This includes the ability to form a certain idea about the patient's oral disease, altering the patient's mood (minimizing fear, anxiety, increasing confidence, hope for favorable treatment results), influencing the patient's lifestyle and behavior in order to carry out the recommendations given by the dental specialist treating him. They are described in the scientific literature the different models of the relationship between the doctor and the patient, as well as the research of authors regarding the importance of good communication about the patient's dental treatment procedure satisfaction. Within the doctor-patient communication relationship, the doctor must be able to recognize and correctly interpret the patient's verbal and non-verbal messages; to use the correct verbal and non-verbal means of communication to convey information to the patient, depending on the nature of the message and the context (severity of illness, type of patient, emergency, etc.) (1,8,11). Human motivation includes needs, reasons, interests, beliefs, tendencies, intentions, desires,

*Corresponding author: Gergana.Georgieva@mu-varna.bg

and aspirations. The dentist must consider the patient's level of competence when communicating with him.(9) Patient competence is the patient's ability to understand the information necessary to make a treatment decision and to reasonably assess the foreseeable consequences of a decision or failure to make a decision about dental treatment.(6) Health culture as a part of the general culture of the patient is a system of knowledge, values, habits, skills and behavior to satisfy the need for protection, restoration and strengthening of personal and public health. Continuously improving the health culture of patients, through screening and preventive campaigns, is the basis of analyzing and overcoming the risk factors for dental health. Communication plays an important role in patient motivation. Represents the ability to communicate with the patient to stimulate behavioral changes. The ability of the participants in the communication act - dental doctors and patients to understand each other with the same technical terms gives them the opportunity to better perceive information and carry out effective communication. (14) It is necessary for the dentist to treat the patients admitted for treatment at the dental clinic with respect and empathy. The factors that influence communication are accessibility, literacy, prior knowledge of patients related to dental health. (13) Benevolence, responsiveness and compassion on the part of the treating dentist lead to effective communication in dentistry. Patients have been shown to trust dentists who are able to understand their pain. (12) The authors conclude that the importance of communication skills along with related concepts is well documented in dentistry.(2,3,10) According to Enkling et al. patients evaluate the quality of the dental doctor mostly according to his interpersonal skills. (5) The desire of patients to be informed about the duration and type of treatment, their expectations of sympathy from the dental doctor who refers to their fear, shows the presence of a strong emotional component in the communication process between the dentist and the patient. Although there are different studies on communication skills, what they all have in common is that they all point to the ability of dentists to express themselves clearly and accurately as a key competency, using comprehensive language, ability to listen to patients and involve them in decision-making about their dental treatment. (4,7)

2. MATERIALS AND METHODS

Sociological survey has been carried out. For the respondents' convenience participating in the research, the opportunity to choose between two options for filling out the survey card is provided: a paper survey card and Online questionnaire created in Google Forms. A survey was conducted on a voluntary basis in May-July 2023. The results of the survey are presented in table and graphic form, which are accompanied by analyzes and conclusions. For the purposes of the research, 358 patients treated by fourth, fifth- and sixth-year students in the facility of the Faculty of Dental Medicine at the Medical University of Varna - were surveyed. Approval to start the research was received from the Research Ethics Commission (KENI) at Varna Medical University after preparing and presenting document worksheet on the subject of the research. The results of the survey were statistically analyzed to assess their reliability and representativeness. Data was processed with IBM statistical software SPSS Statistics v.23. The statistical methods used to process the results are descriptive statistics and correlation analysis.

3. RESULTS

The factor variables: age and gender were studied and analyzed. 358 patients with an average age of 47.5 ± 17.4

years (30-65 years) took part in the survey. Patients aged between 25 and 44 years are the largest survey participating group - 122 people, and most of the participants are 44 years old. (Fig.1)

Regarding the gender criterion, 227 (67%) of those who participated in the survey were women and 131 (36%) were men. The ratio of women: men is approximately 2 :1.

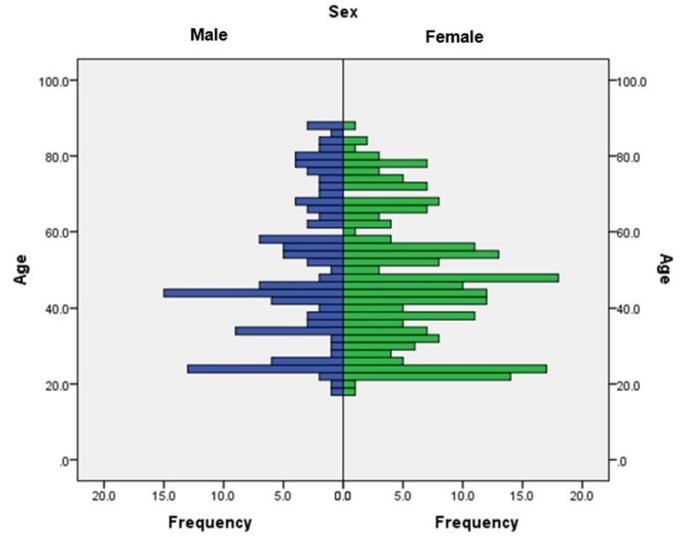

Fig. 1 Age pyramid according to gender

In the 60-74 age group fewer participants were involved -52 patients. The participants aged 75 and over were the least numerous, only 36 patients. The choice of communication approach between the dentist and the patient is related to the age of the patient.

Dental services for elderly patients are characterized by a number of features related to the vulnerability of this age group, which is affected by various co-morbidities and reduced physical, cognitive and financial capabilities. Finding ways to keep older patients visiting the dental office is possible by improving the dentist-patient relationship, effective communication between them and providing high quality dental care by increasing the self-esteem of the elderly and their place in society, by increasing the role of oral health in their quality of life, where we mean the pleasure of eating and normal diction. The dentist has the moral and professional obligation to create, from the first contact and during the entire diagnostic-treatment process of examination and care, the best climate for cooperation, based on conveying a sense of confidence regarding the positive development of the disease, its family and social reintegration. Self-esteem (behavior and attitude) is the basis of the doctor-patient relationship and is the first condition for therapeutic success. The dentist must recognize and correctly interpret the patient's verbal and non-verbal messages. Effective communication between the dental practitioner and the adult patient gives him faith and hope for the ultimate success of the dental treatment, brings confidence, strength and determination spirit in the patient.

Almost all surveyed patients 329 (91.9%) responded with complete agreement to the statement that the document they signed was clearly and comprehensibly explained to them. 20 people (5.6%) agreed with this statement, 7 (2%) of the patients answered that they had no opinion on this issue, 1 (0.3%) disagreed, and only 1 (0.3%)) respondent strongly disagreed. (Fig.2)

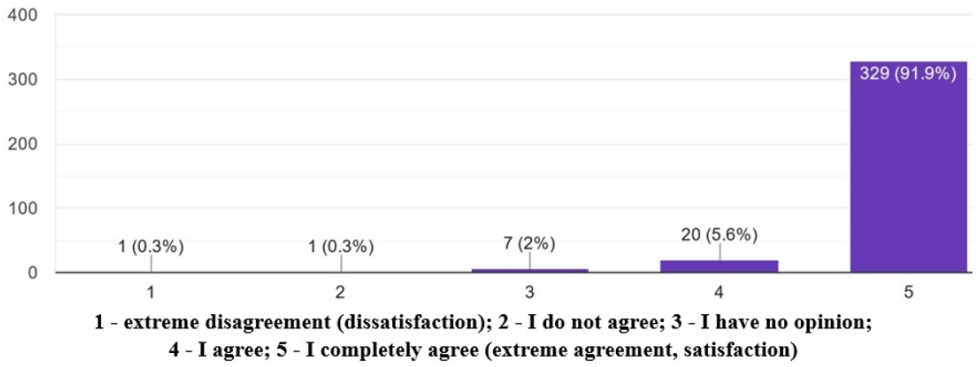

Fig. 2 The informed consent document that I undersigned was clearly and comprehensively explained

302 (84.4%) of the patients who took part in the study responded with full agreement (satisfaction) to the statement "I was informed about all the tests clarifying my exact diagnosis, about the risks they entail and about the way they are carried out." 10% responded that they agree, 14 (3.9%) have no opinion, a small fraction 4 (1.1%) disagree and a very small fraction 1 (0.3%) strongly disagree. (Fig.3)

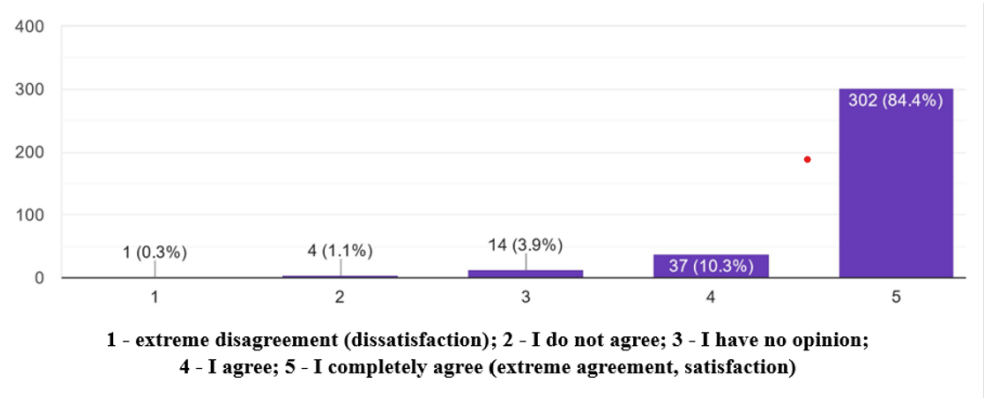

Fig. 3 I was informed about all the tests clarifying my exact diagnosis, about the risks they entail and about the way they are carried out

A large part of the surveyed patients 294 (82.1%) were completely satisfied with the information provided to them. Support the opinion that information about their current condition, potential risks and possible treatment alternatives is provided in a way that is clear and understandable to them. Only 1 patient, 0.3% of all participants in the survey strongly disagreed with this statement. (Fig.4)

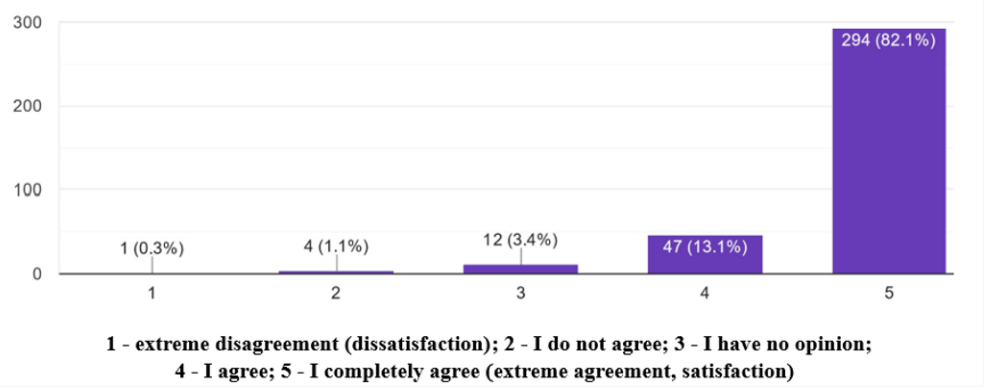

Fig. 4 I was provided information clearly and comprehensively about my current condition, potential risks and possible treatment alternatives

Of the responses indicated in the questionnaire, 299 (83.5%) confirmed that they were given the opportunity to ask questions about the risks and dangers associated with the procedures (diagnostic and therapeutic) that were applied to them, only three people 0.8% of all participants in the survey have the opposite opinion, and have answered that they strongly disagree. (Fig.5)

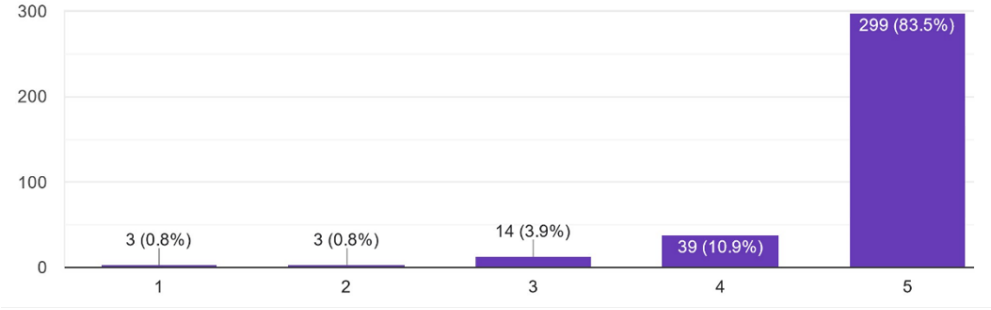

Fig. 5 I was given the opportunity to ask questions about the risks and dangers associated with the procedures (diagnostic and therapeutic) that were applied to me

The majority of patients 314 (87.7%) answered positively, expressing their final agreement (satisfaction) that during the diagnostic-treatment process they were informed about all performed dental manipulations. (Fig.6)

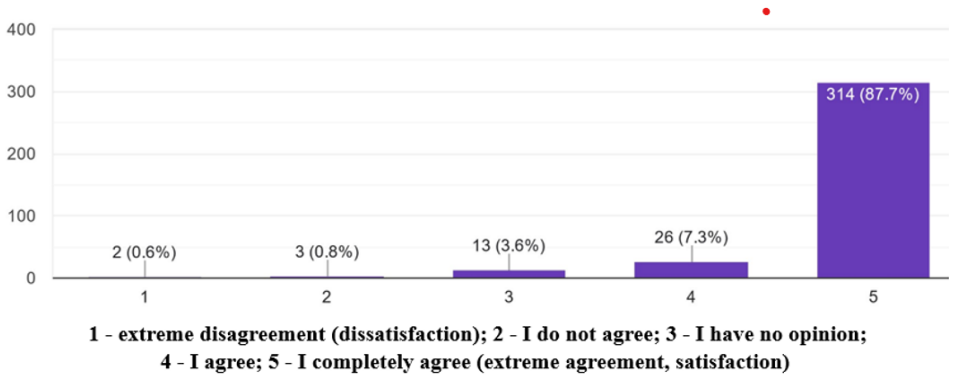

Fig.6 During the diagnostic-treatment process I was informed about all performed dental manipulations

A large proportion of the 344 participants, of whom 307 (85.8%) strongly agreed and 37 (10.3%) agreed, confirmed that they received all of the additional clarifications they requested regarding the treatment plan provided to them

Results of the conducted questionnaire were obtained, where a positive moderate correlation dependence was observed between the patient's awareness of the tests that specify the diagnosis, the risks that they entail and the way they are performed, and the patients' satisfaction with the quality of the dental services provided (Spearman $\rho = 0.417$, $p < 0.001$).

There is a directly proportional dependence, a positive moderate correlation dependence between the clearly and comprehensibly provided information and patient satisfaction with the quality of the provided dental services performed by students in the teaching facilities of the Faculty of Dental Medicine at Varna Medical University (Spearman $\rho = 0.335$, $p < 0.001$).

4. DISCUSSIONS

There is a positive correlation observed from the survey between effective doctor-patient communication and patient satisfaction with the quality of dental services provided. Good communication

with the patient strengthens the trust in the dentist and helps the patient anxiety for the upcoming dental manipulations. The ability of dental practitioners to accept the views and emotional state of patients is extremely important for effective communication between them. The information provided to the patient during the diagnostic and treatment process must be accurate and complete. The informed consent document that the patient signs must be explained to him in a clear and comprehensible way. The patient must be informed about all the tests specifying the exact diagnosis, about the risks they entail and about the way they are performed. In the course of the diagnostic and treatment process, the patient must be explained all the risks to his health when using anesthetics. The patient should be made aware of the potential risks and all possible treatment alternatives. The patient should be given the opportunity to ask questions about the risks and dangers associated with the procedures (diagnostic and therapeutic) performed on him. During the treatment process, the patient should be informed about all the manipulations performed. The dentist must provide any additional clarifications requested by the patient regarding the treatment plan.

Without effective communication, the efforts of the dental specialist will not have the necessary effect, because important information is exchanged in the communication process, relationships of mutual understanding, partnership and trust are built. In his daily contacts with patients, the dental doctor must be guided by many moral principles: To form an individual approach to the patient, consistent with his psychological and dental health. To relieve the patient - this requires continuous improvement of the dental technique used to perform the manipulations and procedures, with the aim of reducing pain and unpleasant sensations. Psychologically the patient should also be protected, avoiding the influence of iatrogenic factors. Using words to evoke patient's positive emotions is a healing factor. Encouraging the patient's numerous modern medical and diagnostic devices should be part of the medical worker's work. Respecting and honor the patient's privacy and keeping professional secrecy is a must. In order to achieve trust in the dentist-patient relationship, appropriate communication methods must be applied and each patient must be approached individually and according to their needs. The patient's trust in the dentist is an extremely important factor for effective communication and a favorable outcome of the treatment. Good communication can help set clear and realistic expectations and help achieve a better quality of dental care for the patient. Patient trust is built on transparency, openness, sincerity and good communication with the dentist and his team.

5. CONCLUSIONS

Quality dental services are the basis for the success of the diagnostic - treatment process of any dental practice. Communication with the patient and his relatives is the duty of every dentist, which is of great importance for preserving the mental health of the patient. Great attention is paid to the development of communication skills by dental practitioners. According to a number of studies, effective communication with patients is at the heart of the success of any dental practice. Following some basic rules in communication is a key factor in a good relationship between the dentist and the patient.

ACKNOWLEDGMENTS

The following study was able to be executed thanks to the Program "Young scientists and postdoctoral fellows-2" funded by the Bulgarian Ministry of Education and Science. The authors of the study express their gratitude to the academic board of directors of the Faculty of Dental medicine and Medical University – Varna.

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UDK: 614.253.5:37.091.214.18]:616.61-008.64-78(497.2)"2020/2022"

THE NEED FOR ADDITIONAL TRAINING OF NURSES WORKING IN THE DIALISIS TREATMENT FIELD

Galya Georgieva[1], Pavlinka Dobrilova[1]*

[1]"Prof. Dr. Ivan Mitev" branch of MU-Sofia in Vratsa, Department of Health Care, Bulgaria,
e-mail: g.georgieva@filialvratsa.mu-sofia.bg; p.dobrilova@filialvratsa.mu-sofia.bg

Abstract: According to the EU health strategy "Together for Health: A Strategic Approach for the EU", health care specialists have a crucial role in maintaining the proper function of the entire health care system. Today, the education system gives health care specialists the opportunity to develop in different professional fields. Nursing care for patients undergoing renal replacement therapy is specific and requires that nurses have excellent theoretical knowledge and practical skills in the field of nephrology and the extra-renal blood purification methods, and be qualified to administer intensive and specialized procedures. The goal of this research is to study the necessity for nurses working in dialysis facilities attaining additional knowledge and skills on dialysis treatment in this specific field. Materials and methods: For the purposes of this research, 78 nurses working in dialysis facilities in Northwest Bulgaria participated in a survey, which was conducted by distributing a self-developed anonymous questionnaire in the 2020-2022 period. Results: The activity of the nurses caring for dialysis treatment patients is different from the activity in other health care facilities. Conclusion: Dialysis treatment requires that health care professionals have specific knowledge and skills. Currently, it is a fact that this discipline is not being taught in higher education institutions. The research detected a need for additional training in the renal replacement therapy field.

Keywords: CKD, dialysis, additional training, health education
Field: Medical Sciences and Health Care

1. INTRODUCTION

Globally, nationally and regionally we are facing an ageing population and a rise in non-communicable chronic diseases like cardiovascular disease and diabetes, hypertension, prerequisite for the rising spread of Chronic Kidney Disease (CKD). In its end stage, chronic kidney disease (ECKD) necessitates that replacement therapy be performed using hemodialysis, peritoneal dialysis and a renal transplant, which is a challenge for the patient, as well as for the health system and the health care professionals.

In nephrology practice the nurse is a member of the multidisciplinary team. Nurses working in the nephrology sector who provide health care in outpatient and in-patient care, as well as in the specialised dialysis treatment clinics and centres, have a crucial role. High quality health care can be provided in any of the stages in nephrology practice by improving the population's informedness on renal diseases, early detection and delaying of CKD, in case of advanced CKF (together with the multidisciplinary team). In End Stage Kidney Disease (ESDD), preparing and realising the health care during replacement therapy - hemodialysis (HD) and peritoneal dialysis (PD). Providing care to transplant patients, realising healthcare in patients undergoing peritoneal dialysis (PD), etc. Realising the nurse' mission and role wouldn't be possible without consistent and high quality education, training and development. A series of legislative changes determine the importance and role of the nursing profession and its societal importance. After our country's joining the EU, given the recommendations for the EU directives, training nurses during the pre-accession programme of the ES under the chapter "Education" turns into the higher education degree "Bachelor's", "Health care" filed (Directive 2005/36/EO; The European qualifications framework (EQF). In Bulgaria the nursing profession is regulated, i.e. the training is held in accordance with the Unified State Requirements (USR), the European and the global standards outlined in the Higher Education Act. The foundational education nurses get is held in higher education institutions, which are accredited academic structures, under accredited programmes as full-time students, for a length of 4 years. Training is realised by a theoretical and clinic preparation in mandatory, elective and faculty disciplines in accordance with Art. 40, Art. 41 of the HEA and in accordance with Art. 1 (2) of the Regulation for USR with a workload of 4600 hours. The theoretical clinic preparation and the practical classes are directed toward acquiring specific knowledge, skills and competencies. Those are needed for completing tasks assigned by a physicians or independent tasks related to applying complex health care to improve physical and mental health

*Corresponding author: g.georgieva@filialvratsa.mu-sofia.bg

and to solve medical social problems. With Regulation № 1 from 08.02.2011 the professional activities performed by nurses and health care assistants can perform by assignment of individually. (Higher Education Act,1995/2022; Regulation № 1, 2015; National Qualifications Framework of the Republic of Bulgaria (NQF); Toncheva,2018)

The education system gives health care specialists the opportunity to develop in different professional fields in the healthcare system. Universities also provide rewarding training and the acquiring of a Master's Degree in the specialities Health Care Management and Public Health and Health Management, etc. This can lead to nurse developing their career as a chief nurse, a senior nurse, a lecturer in a universities and/or a hospital structure, as well as starting an independent practice. (Regulation № 1, 2011; Ordinance of Unified State Requirements for Acquiring Higher Education in the Nurse, Midwife and Physician Assistant specialities at the Bachelor's Degree level (amended and supplemented - SG 32, 2016; Chaneva, 2015)

When choosing to develop professionally in the dialysis treatment field, nurses need to use all scientific and professional knowledge, skills, experience and qualifications in their disposal to benefit the patients. The nursing of patients undergoing renal replacement therapy is specific and requires that nurses have excellent theoretical knowledge and practical skills in the field of nephrology and the extra-renal blood purification methods, and be qualified to administer intensive and specialized procedures. The development of a health care professional in the dialysis practice is a challenging and continuous process. Unlike in other fields, here the patient and the nurse are constantly interacting. (Chaneva & Stambolova, 2003; Yankova, 2020a) A significant volume of knowledge and skills on the methods and principles of renal replacement therapy, the basic processes, types and manners of dialysis is needed to realise the nurses' professional activities related to the renal replacement therapy. The role of a health care professional in the dialysis practice is a different and extremely dynamic. The nurse's main responsibility is to provide the vascular access impeccably and the master the rules for working with vascular access: arteriovenous fistula (AVF), arteriovenous prosthesis (AVP), central venous catheter (CVC) (temporary, permanent), peritoneal catheter. The preparation, attaching the patient to the dialysis machine, starting the hemodialysis procedure, anticoagulation, and completing the dialysis procedure require excellent technical knowledge. Working in emergency situation is often required. Additional knowledge can also be useful for learning the rules for medicament therapy, the methods for assessing the adequacy of hemodialysis and peritoneal dialysis, dialysis complications, safety and infection control, being aware of the contemporary asepsis and antiseptics principles, complication (non-infectious, infectious), drawing blood, dialysate for laboratory testing. One of the functions of nursing practice is the teaching the patients and giving them psychological and social support. The professional competency of a nurse in the sector of dialysis treatment is its most important capital. Dialysis treatment requires that health care professionals have specific knowledge and skills. Strengthening the mission, functions and the role of nurses makes improving their professional qualifications topical. Maintaining competency when faced with the specificity of the care, the technological progress and the high patient expectations requires that the practising professionals pursue long term continuous development. (Yankova & Dobrilova, 2017)

In Regulation № 41 from 24. 09. 2009 for establishing the "Dialysis treatment" Medical Standard, in the part concerning professional qualification - the personnel of the dialysis structure should have theoretical knowledge, practical experience and skills in the dialysis treatment field

When beginning their professional activity nurses possess fundamental knowledge and skills. Mentorship in the dialysis practice has a crucial role in process of training nurses in the dialysis wards. Introducing and training a new member of the team is a task trusted to the older, more experienced employees.

The European principles of continuous lifelong learning and the preparation of highly qualified health specialists are a condition for pursuing opportunities for post-graduate qualification, especially in the fields like dialysis treatment, which require specific knowledge and skills. After acquiring the right to exercise a profession (in accordance with Article 4, paragraph 1) nurses become members of the professional organization - the Bulgarian Association of Health Professionals in Nursing. BAHPN provides continuous training, in the form of courses, individual training, vocational qualification programmes for the acquisition of certain competences, distance learning programmes, which leads to new knowledge and skill acquisition and the improved competences. This happens in collaboration with universities and hospital structures.

There are different thematic courses provided in the dialysis treatment field, some of which even offer on-line training. All forms of continuous training are credited by the Unified Credit System of BAHPN. Participating in every course or scientific forum carries a certain amount of credit points. The credit system present is related with the professional card (a certificate for the quality of the health care) of the health care specialists. (BAHPN; Health Act / 2005; Chaneva, 2015)

Participating in seminars, congresses, conferences, symposiums, publishing in scientific publications, etc. is also considered to be continuous qualification. There are two main nephrology events in our country, which are organised annually by the Bulgarian Society of Nephrology: The Nephrology Academy and a conference/congress where nurses participate, where they have the opportunity to get informed of treatment and health care innovations and participate with their own research. The members of BAHPN receive a certificate for a higher level of professional competency. There is a crucial part of the professional development and continuous training of medical specialists which involves training through acquiring a specialised qualification. There is no such specialisation established in the dialysis treatment sector. (Dobrilova.& Zlatanova, 2012; Yankova, 2020b)

The goal of the current research is to study the necessity for nurses working in dialysis facilities attaining additional knowledge and skills on dialysis treatment in this specific field.

2. MATERIALS AND METHODS

For the purposes of this research, 78 nurses working in dialysis facilities in Northwest Bulgaria participated in a survey, which was conducted by distributing a self-developed anonymous questionnaire in the 2020-2022 period. All persons who participated in the survey gave their informed consent for the survey being held. In order to process the data, the mathematical and statistical methods included in the SPSS60 were used.

3. RESULTS AND DISCUSSION

78 nurses took part in the questionnaire survey. All of the participating health professionals were women with an average age of 49 years (from 24 to 69). The education systems provides nurses with the opportunities to improve their educational level to Bachelor's or Master's degrees in the Health Care Management speciality. The respondents' education level is shown on Figure 1, where it can be seen that the biggest relative share is that of the nurses who have a Bachelor's degree - 44.9 %, followed by the nurses who have received a post-secondary education - 29.5%. There are 10.3% with a Bachelor's in Health Care Management and 10.3% with a Master's in Health Care Management. There is a smaller share of nurses (5.1%) who have the qualification of "specialist"

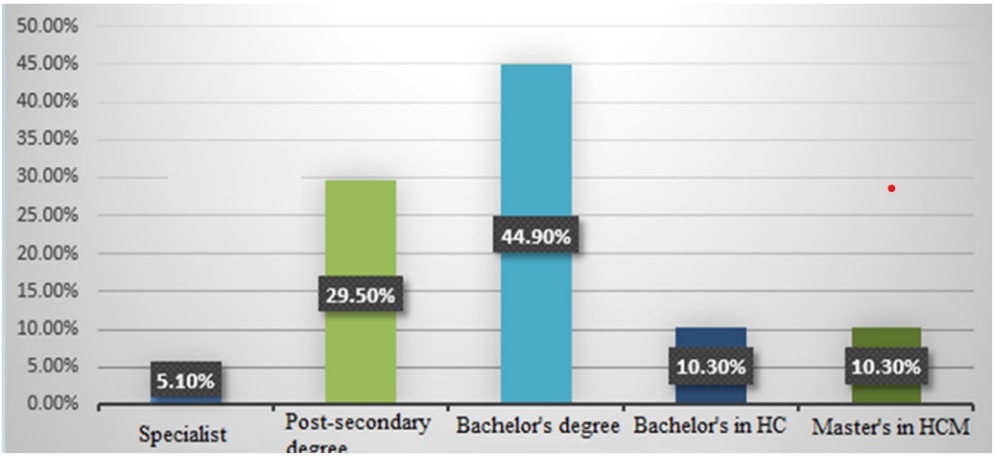

Figure 1. The nurses' distribution by education

Dialysis treatment requires that health care professionals have specific knowledge and skills. Currently, it is a fact that this discipline is not being taught in higher education institutions. When one begins working as a nurse in a dialysis structure, the question of training and adapting to the specific activities arises. The results show that all nurses, at the beginning of their work in a dialysis structure need different time periods to adapt to their workplace

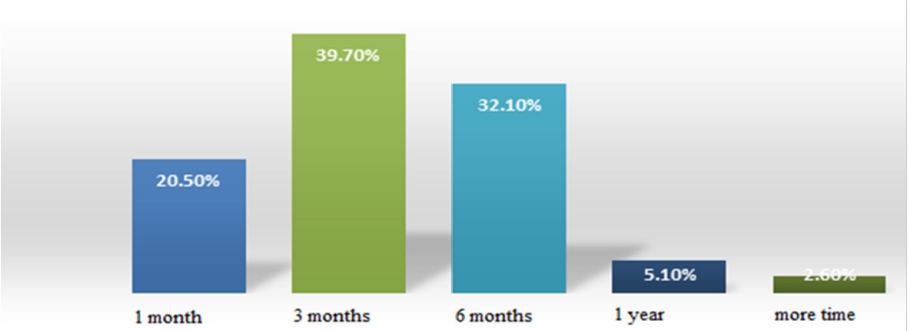

Figure 2. The nurses' distribution according to the time period needed for them to work independently in the dialysis structure.

It is apparent that 20.5% of the nurses participating in the survey needed the shortest training period - one month, 39.7 % started working independently after a three-month training period, while, for 32.1% of them, this adaptive period lasted for six moth, for 5.1% - one year, and for 2.6% the training at the workplace was longer than a full year.

In the course of the research, we studied the sources, which a nurses uses to gain the specific knowledge and skills needed. In 66.7% of the cases, nurses were trained by a nurse who is experienced and has a longer period of service, 21.8% were trained by the senior nurse, 6.4% believe that they managed on their own, 2.6% report being helped by a physician and only 2.6% underwent a preliminary course in the basics of dialysis treatment (Figure 3).

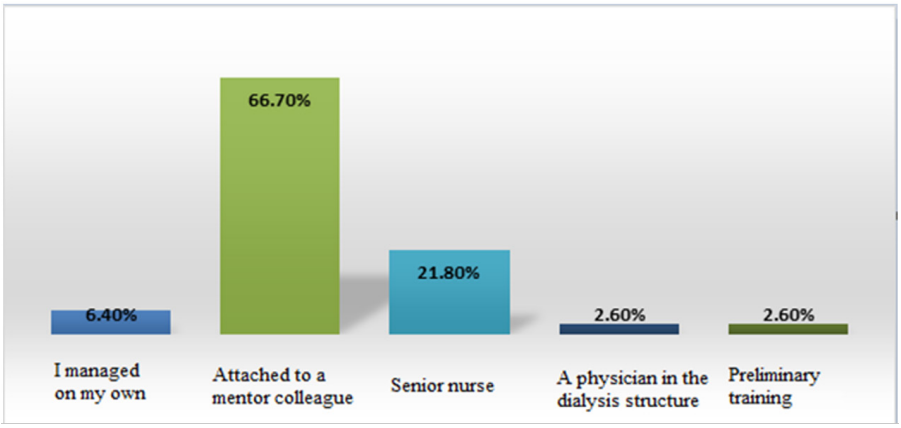

Figure 3 Distribution of the nurses according to the person who trained them to perform the specific activity at the beginning of their practice at dialysis structures.

The tasks of the nurses in dialysis structures are different from these in other health care facilities. This requires that they receive appropriate training and, in the process, learn the fundamental principles of the entire health care organisation. In order to competently exercise their activity, nurses need high quality basic and post-graduate education and training, which continues throughout their whole life. This necessitated studying their additional training for work in dialysis institutions. The data analysis shows that more than half of nurses (64.1%), have participated in additional qualification courses, even though all of them are required to complete a basics course in the first three years since beginning work. When comparing the share of nurses who have participated in those courses with the period of service in dialysis structures, a significant statistical dependence (p=0.02) was found, as see on Figure 4. A significant share of the nurse who got additional qualifications have a period of service of over eleven years on the position (from 81.8 % to 100%), and the share of nurses with a service period between 3 and 10 years who completed qualification courses is smaller (from 19.9 % to 32.2 %). The lower relative shares of nurses in this category can be explained with the fact that this training is not in the workplace, but is held in health care facilities accredited to train students and postgraduate students. Those are sometimes far away from the place of residence and may require addition expenses by those working in dialysis wards. It can also

be explained with the fact that staff shortages limit the opportunities for leave and participation in longer training courses, as well as with unsettled pay for higher academic qualifications.

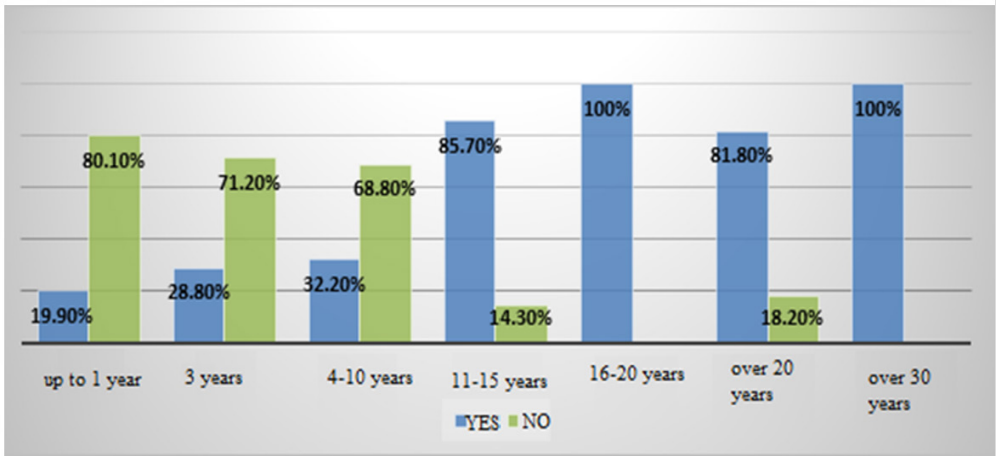

Figure 4. Distribution of the nurses by the additional qualifications they have required depending on their haemodialysis experience.

Specialized training and courses in dialysis treatment play a significant role in maintaining a high competence level and improving the qualifications of nurses working in this medical field. A significant proportion of nurses (98.7%) feel that additional training is necessary to improve their nursing qualifications. Of them 80.8% believe it was absolutely necessary and 17.9% see additional training as only necessary for some nurses. Merely 1.3% hold the opinion that there is no need for other training, but this percentage is not significant (Figure 5).

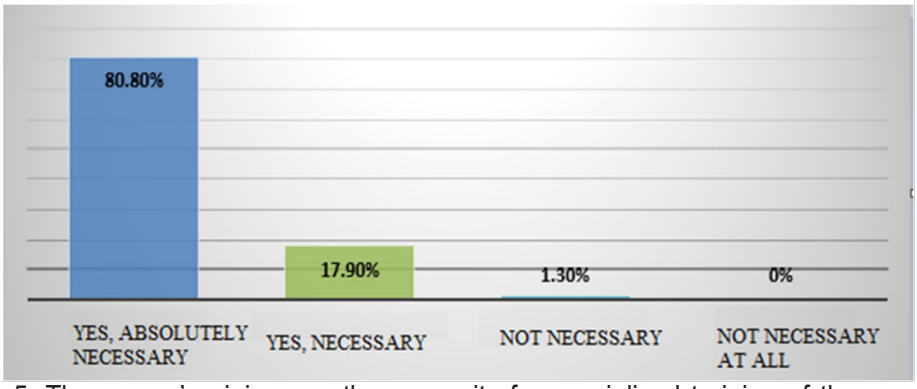

Figure 5. The nurses' opinions on the necessity for specialised training of those working in the dialysis treatment field.

The nurses' opinions on methods for improving their professional training and competencies in the dialysis treatment field was studied. 29.5% out of those who responded to the questionnaire believe that improving their training and competency in the dialysis treatment field can be achieved with additional post-graduate training courses, while 24.4% think that this training should be received during the foundational nursing education by implementing the subject of Specialised Nursing Care for Patients Undergoing Dialysis Treatment. 16.7% believe that there needs to be a more serious training taking the form of specialisation, 14.1% - that this can be achieved by acquiring a certain volume of information and experience from colleagues from national and international institutions in the field. 9% suggest participating in seminars and conferences, 5.1% - organising collegiums, and 1.3% - participating in and developing projects (Figure 6).

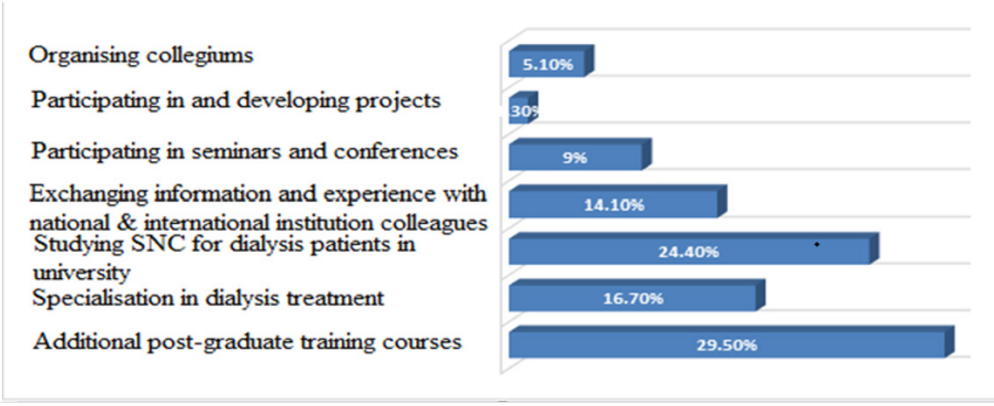

Figure 6. The nurses' opinions regarding the manner of improving the professional training and competency in the dialysis treatment field

Conclusions:

• All nurses (100%) report having needed additional training when beginning working in dialysis wards, and 66.7% of them were trained by a more experienced nurse, 21.8% by a senior nurse and as little as 2.6% report having finished a preliminary basics course.

• A significant share of the nurses who got additional qualifications have a period of service over eleven years (from 81.8 % to 100%), and the share of nurses with a service period between 3 and 10 years who completed qualification courses is smaller (from 19.9 % to 32.2 %).

• According to 98.7% of the nurses special training is needed to work with patients undergoing dialysis treatment, whereby 29.3% prefer additional post-graduate training courses, 24.4% believe this training should be included in university training, and 16.7% think it more there needs to be a more serious training taking the form of specialisation.

4. CONCLUSION

The professional development of nurses working in dialysis structures is a long-lasting process. Dialysis treatment offers a series of challenges to the nurses who have chosen to develop professionally in this field - specific knowledge, skills and competencies, activities during staff shortage conditions and chronic underfunding. There is a steady tendency towards stability and staff retention in this field despite its high demands, the weight of the pathology and the constant patient-nurse interactions. Providing high quality health care in dialysis practice demands that the nurse' knowledge should be constantly updated, expanded and improved. As a specialist, the nurse needs to acquire additional knowledge in the nephrology field and in dialysis treatment rather than rely on intuitive knowledge alone. This is made clear by the pronounced desire for progress. In Bulgaria, there are conditions present for supporting continuous nursing training. It is important for the healthcare system, and for dialysis structure in particular, as well as for society, that the medical specialists trained in Bulgaria have the motivation the develop themselves. This can be achieved sooner by creating beneficial conditions and stimuli.

ACKNOWLEDGMENTS

The present research is conducted in the execution on a scientifically research project which is financed by Consul of Medical Science in Medical University-Sofia, contract №: D-156/03.08.2023 г., from the "Young Researcher - 2023" competition on the topic: "Holistic care as a factor in improving the quality of life of dialysis patients."

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ASSESSMENT OF PATIENT SATISFACTION WITH THE QUALITY OF DENTAL SERVICES PROVIDED BY STUDENTS OF DENTAL MEDICINE

Gergana Georgieva[1*]

[1]Medical University of Varna, Department of Dental Material Science and Prosthetic Dental Medicine, Faculty of Dental Medicine, Bulgaria, e-mail: Gergana.Georgieva@mu-varna.bg

Abstract: In today's competitive world, the quality of dental services provided is extremely important. Dental service providers around the world consider patient satisfaction to be an important and fundamental factor in providing dental services. Patient satisfaction by the provided dental services is defined in the literature as the achieved match between the patient's expectations, his needs and the actual dental care provided to him/her. Understanding the importance of the concept dedicated to the quality of dental services and surveying the satisfaction of patients receiving these services is very important. Oral diseases are considered major health problems due to their high incidence and prevalence worldwide

Aim:. The aim of the present study was to assess patient satisfaction by dental services provided by dental students.

Materials and methods: Sociological survey has been carried out. For the respondents' convenience participating in the research, the opportunity to choose between two options for filling out the survey card is provided: a paper survey card and Online questionnaire created in Google Forms. A survey was conducted on a voluntary basis in May-July 2023. The results of the survey are presented in table and graphic form, which are accompanied by analyzes and conclusions. For the purposes of the research, 358 patients treated by fourth, fifth- and sixth year students in the facility of the Faculty of Dental Medicine at the Medical University of Varna - were surveyed.

Results: The results show a positive correlation between the quality of dental services provided by dental students and patient satisfaction.

Conclusion: Measuring the quality of dental services has an important role in managing the dental care provided, diagnosing the problem and evaluating the effectiveness of the service. Patient satisfaction is one of the key indicators in the quality of services provided in the dental practice. The results of the conducted study dedicated to patient satisfaction with the provided dental services are an indicator for evaluating the quality of dental care provided by dental medicine students, based on a survey of patients' attitudes and opinions.

Keywords: satisfaction, quality of dental services, dental medicine students

Field: Social sciences

1. INTRODUCTION

In today's competitive world, the quality of dental services provided is extremely important. Patient satisfaction is widely used to evaluate the quality of dental services.(7,8,14) The quality of healthcare services is a multidimensional concept in which one of the most important aspects is patient satisfaction. (5) Patient satisfaction is one of the key indicators of the quality of dental care provided.(2,6,16) Dental service providers around the world consider patient satisfaction to be an important and fundamental factor in providing of dental services.(15)

Patient satisfaction with the provided dental services in the literature sources is defined as the achieved match between the patient's expectations, his needs and the dental care actually provided to him. The measurement of patient satisfaction is one aspect of the overall assessment of the quality of the dental service provided. (10) In addition, patient satisfaction is an important indicator for evaluating the quality of the dental services provided. (12,18) The high level of quality of dental services results in high patient satisfaction, maintaining existing regular patients. (3,17) Understanding the importance of the concept dedicated to the quality of dental services and surveying the satisfaction of patients receiving these services is very important. Oral diseases are considered major health problems due to their high incidence and prevalence worldwide. (9,13) According to the results of the study by Dopeykar et al .the highest average value of patient expectations is related to confidence, which is consistent with the results of Aghamolaei et al. (1) and inconsistent with those of Güllü et al., according to whose study the aesthetic results of the treatment performed are the most important factor for the quality of the service. (11) Respect

*Corresponding author: Gergana.Georgieva@mu-varna.bg

for the privacy and personal space of patients, showing friendly and respectful attitude and explaining medical conditions and illnesses to patients can increase confidence and satisfaction and improve the quality of services provided.(4)

2. MATERIALS AND METHODS

Sociological survey has been carried out. For the respondents' convenience participating in the research, the possibility of choosing between two options for filling out a survey card is provided: a paper survey card and online questionnaire created in Google Forms. A survey was conducted on a voluntary basis in the months of May-July 2023. For the purposes of the research, 358 patients (131 men and 227 women) treated by fourth, fifth and sixth year students in the facility of the Faculty of Dental Medicine (FDM) at the Medical University-Varna were surveyed.

The results of the study are presented in table and graphical form and are accompanied by analyzes and conclusions. Each of the study participants filled out an informed consent form to participate in the study. Each of the respondents was provided with an information sheet for participating in the survey and a notice on the protection of personal data. Permission (approval) to start the research was received from the Research Ethics Commission (KENI) at Varna Medical University after preparing and presenting document worksheet on the subject of the research. The results of the survey were statistically analyzed to assess their reliability and representativeness. Data was processed with IBM statistical software SPSS Statistics v.23. The statistical method used to process the results are descriptive statistics and correlation analysis.

The questionnaire provided to the study participants consists of 22 questions, which are divided into 3 groups (table 1). The questions from the first group contain socio-demographic information about the surveyed patients: age, gender, year of study of the student who conducted their treatment. The questions from the second group explore the opinion and assessment of patients regarding the information provided to them during the diagnostic-treatment process. The third group of questions from the survey is related to Assessment of patient satisfaction with the provided dental treatment.

Table 1. Questions and statements included in the survey

I group	Information about surveyed patients	1. Age 2. Gender 3. Your dental treatment was performed by a student: fourth-, fifth- or sixth year student 4. Were you given a Declaration of Informed Consent to sign?
II group	Opinion and assessment of patients regarding the information provided to them during the diagnostic and treatment process	1. The informed consent document I signed was explained to me clearly and comprehensibly. 2. I was informed about all the tests clarifying my exact diagnosis, about the risks they entail and about the way they are carried out. 3. I am satisfied with the opportunity provided to carry out an X-ray examination at the Faculty of Dental Medicine. 4. I was given the necessary information in a clear and understandable way about my condition, potential risks and possible treatment alternatives. 5. I was explained all the risks to my health when using anesthetics. 6. I was given the opportunity to ask questions about the risks and dangers associated with the procedures (diagnostic and therapeutic) that were administered. 7. In the course of the diagnostic and treatment process, I was informed about all the performed manipulations. 8. I received all the additional clarifications I requested regarding the treatment plan. 9. The process of registration and admission for dental treatment at the Faculty of Dental Medicine is very well organized.
III group	Assessment of patient satisfaction with dental treatment provided	1. During treatment, pain and discomfort were minimized. 2. My treating student approached me with patience, empathy and respect throughout the treatment period. 3. I received courteous and professional treatment from all the Faculty of Dental Medicine staff involved in the treatment process. 4. The aesthetic results of the performed dental treatment meet my expectations. 5. I am satisfied with the quality of the materials used for my treatment. 6. During the course of the treatment and after its completion, I had the opportunity to turn to the student treating me and his assistant at any time I needed. 7. There is a published price list for all the fees I have paid for the dental treatment. 8. The fee for medical diagnostic services performed at the Faculty of Dental Medicine is very affordable. 9. I am satisfied with the quality of the provided dental services performed by students in the Faculty of Dental Medicine at MU-Varna.

3. RESULTS

The factor variables: age and gender were studied and analyzed. 358 patients with an average age of 47.5 ± 17.4 years (30-65 years) took part in the survey. The youngest patient participating in the study was 18 years old and the oldest was 88 years old. (Fig .1) Patients are divided into age groups. In the age group from 18 to 24 years, 50 patients participated, with the most numerous being 23 years old. Patients aged between 25 and 44 years are the largest survey participating group - 122 people, and most of the participants are 44 years old. There are 98 participants in the survey between the ages of 45-59. In the 60-74 age group fewer participants were involved - 52 patients. The participants aged 75 and over were the least numerous, only 36 patients.

The distribution of patients by age groups shows the importance of patients' age to their attitude to their own health, their attitude to health and health information in general, the degree of provision of health services and their absorption, cultural, geographical, socio-economic characteristics. From the conducted research, we came to the conclusion that the patients at a young age of 25 to 44 took the greatest part. This is explained by the fact that patients of this age have realized the need for dental care and prevention. They successfully take care of their dental health, have good oral hygiene and strictly follow instructions about treatment and visits to dental specialists.

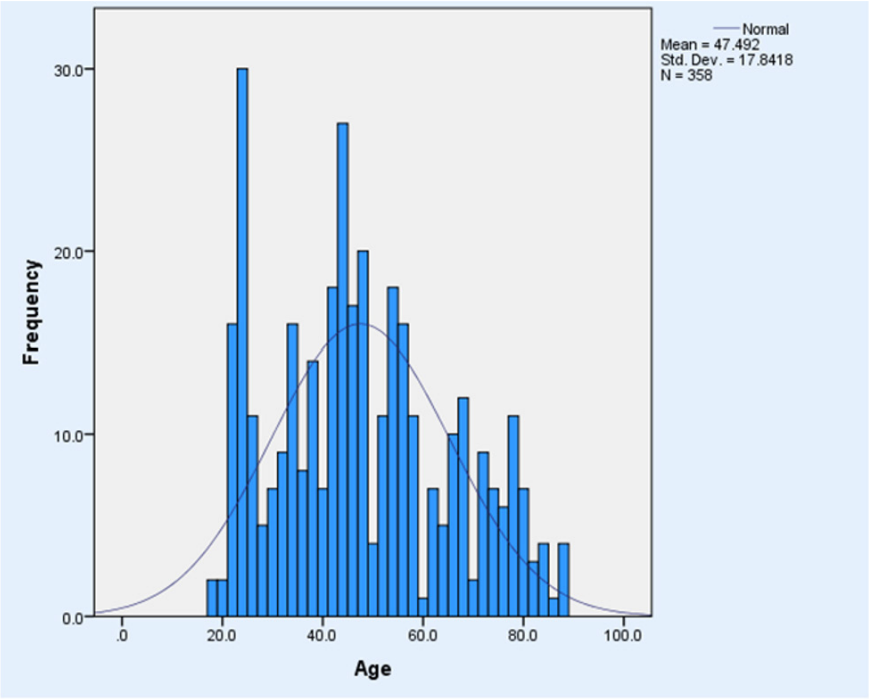

Fig.1 Distribution of patients by age

Regarding the gender criterion, 227 (67%) of those who took part in the survey were women and 131 (36%) were men. (Fig.2) The ratio of women : men is approximately 2 :1.

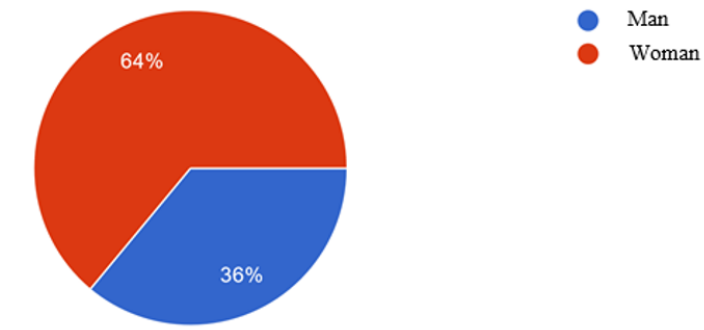

Fig.2 Distribution of patients by gender

The largest part of patients who participated in the survey answered that they were treated by sixth-year students - 47.8%, a small part of fifth-year students - 29.9%, and the smallest part of patients 22.3% have received dental care from fourth-year students. (Fig. 3) These results are explained by the desire of the students to be treated by students with more experience, and since the hours of internship and practical work of the sixth year are longer, the patients treated by sixth years complete the treatments in a shorter time, which is also one of the reasons they are preferred by patients.

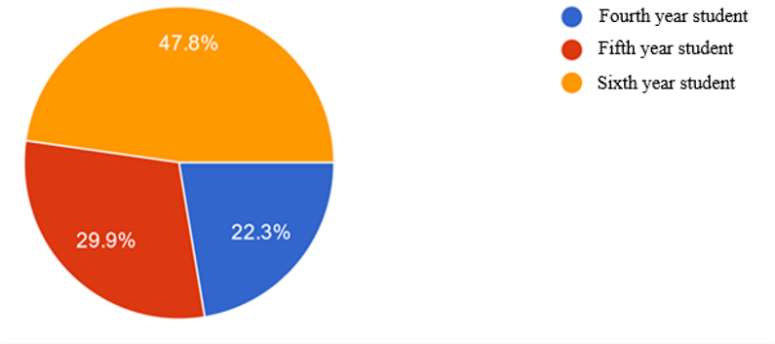

Fig.3 Students who performed the dental treatment:

The second main group of questions dedicated to researching the patients' opinion regarding the information provided to them during the diagnostic-treatment process shows the patients' attitudes regarding the need for effective communication and good information as a key factor for the provision of quality dental services.

The second main group of questions dedicated to researching the patients' opinion regarding the information provided to them during the diagnostic-treatment process shows the patients' attitudes regarding the need for effective communication and good information as a key factor for the provision of quality dental services.

Concerning the statement " All the risks to my health were explained to me when using local anesthetic": 314 (87.7%) patients answered that they fully agreed (satisfied), 25 (7%) expressed agreement, 16 (4.5%) have no opinion, only 1 (0.3%) patient expressed extreme disagreement (dissatisfaction). A positive moderate correlation was observed between the indicators of awareness of the risks in the use of local anesthetic and satisfaction with quality (Spearman $\rho = 0.417$, $p < 0.001$).

287 (80.2%) of the patients were satisfied with the dental treatment, in which pain and discomfort were minimized. A large part of the patients 303 (84.6%) noted in the questionnaire that the staff from the Faculty of Dentistry at Varna Medical University approached them with patience, empathy and respect throughout the entire period of treatment. 321 (87.9) answered that they received polite and professional treatment from all the staff of the Faculty of Dental Medicine involved in the treatment process. The satisfaction of the patients with the aesthetic results of the performed dental treatment and with the quality of the materials used is in close percentage ratios, 77.7% and 79.1%, respectively. In the questionnaire, 314 (87.7%) of the respondents expressed their satisfaction with the affordability of prices for dental services offered to patients.

The assessment of patient satisfaction with the quality of dental services provided by students in the teaching facilities of the Faculty of Dental Medicine at Varna Medical University is very high: 315 (88%) fully agree, strongly agree, satisfied while 33 participants (9.2%) agree and 14 patients (3.9%) do not have an opinion on this issue, 4 people (1%) disagree, and a very small part of the respondents 0.3% expressed extreme disagreement.(Fig.4)

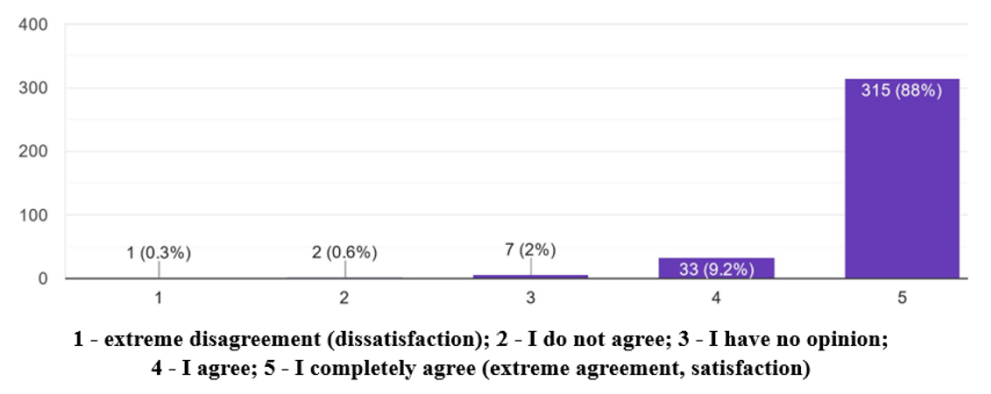

Fig.4 Patient's satisfaction with the quality of the provided dental services performed by students in the Faculty of Dental Medicine at MU-Varna

Given the opportunity for additional explanations regarding the treatment plan and the performed manipulations in the course of the diagnostic-treatment process gains the patient's trust in the student-future dental medicine doctor who treated him. The relationship between the level of awareness and satisfaction with the quality of dental services provided is directly proportional. The more information that is provided to the patient in a clear and accessible way, the more satisfied he/she is with the quality of the dental services provided. The strength of the dependence is moderate (Spearman $\rho = 0.485$, $p < 0.001$).

The results show a positive correlation between the quality of the materials used for the treatment, the aesthetic results obtained and the satisfaction of the patients with the dental services provided. Minimal pain during dental treatment, patience, empathy and respect on the part of the students also correlate with high patient satisfaction with the dental services provided.

4. DISCUSSIONS

Patient satisfaction by the provided dental services is an important factor for evaluating dental services quality. Improving patient satisfaction requires dental services to be patient oriented and obeying standard and efficient protocols. Analyzing patient satisfaction and understanding the weaknesses, opportunities and threats related to the dental services provided can improve the ability of dental practitioners to attract more patients. Identifying the main determinants of patient satisfaction and improving the quality of dental services are important for the proper functioning of dental patient care.

5. CONCLUSIONS

Measuring the quality of dental services has an important role in managing the dental care provided, diagnosing the problem and evaluating the effectiveness of the service. Patient satisfaction is one of the key indicators of the quality of services provided in the dental practice. The results of the conducted study dedicated to patient satisfaction by the provided dental services prove to be an indicator for evaluating the quality of dental care provided by dental medicine students, which is based on a patients' attitudes and opinions survey.

ACKNOWLEDGMENTS

The following study was able to be executed thanks to the Program "Young scientists and postdoctoral fellows-2" funded by the Bulgarian Ministry of Education and Science. The authors of the study express their gratitude to the academic board of directors of the Faculty of Dental medicine and Medical University – Varna.

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