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# Occupational Health Care Workers in Pandemic Conditions

## Profesionalni rizik zdravstvenih radnika u pandemijskim uslovima

Alma Mizdrak<sup>1</sup>, Amina Lučkin<sup>2</sup>, Amina Herić<sup>1</sup>, Jasmina Hadžić<sup>1</sup>, Mirsada Čustović<sup>3</sup>, Dženana Halilović<sup>1</sup>

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### ABSTRACT

**Introduction:** Risk is defined as the likelihood or possibility of loss, injury, or other adverse or undesirable circumstances. Health professionals are on the front line in battling against epidemics and pandemics and as such are exposed to occupational risks of infection.

**Aim:** to assess the risk of health workers who are in direct contact with COVID-19.

**Materials and methods:** this study included 604 respondents, health professionals of all profiles employed in the Sarajevo Canton health institutions. A survey instrument was a questionnaire, modified based on the following three questionnaires: *COVID-19 Health Worker's Perception Survey*, *Surveillance questionnaire for SARS-CoV-2 infection among health workers*, *Questionnaire on Risk Perception and Behavior of Public Health Emergencies*. The research was conducted in the period from 30 November 2021 to 31 May 2022.

**Results:** out of the total of 604 subjects, 82.3% were women. 344 (56.95%) respondents stated that they were part of a team working mostly with

COVID-19 patients, while 240 (39.74%) respondents did not work with the COVID-19 patients. 274 (45.36%) respondents stated that the complete protective equipment was continuously available for the treatment of patients with COVID-19. 330 (54.64%) respondents stated that the equipment was available, but not all the necessary equipment. The analysis of occupational risks of healthcare workers during the COVID-19 pandemic did not reveal the existence of a significant statistical difference in relation to the level of professional qualifications ( $p=0.115$ ). However, the analysis of occupational risk in relation to the level of health care showed a statistically significant difference, with patients at the tertiary level, who also worked with the most difficult patients ( $p<0.001$ ), and were subsequently exposed to the highest risk. Also, there was a significant statistical risk difference in relation to the type of job and position ( $p<0.001$ ).

**Conclusion:** occupational risk did not differ significantly between educational levels, but it was found that respondents in primary and tertiary healthcare levels had slightly more moderate risk and a lower proportion of high exposure risk.

**Keywords:** occupational risk, healthcare workers, pandemic, COVID-19

## SAŽETAK

**Uvod:** rizik definiran kao vjerovatnoća ili mogućnost da dođe do gubitka, ozljede ili druge nepovoljne ili nepoželjne okolnosti. Zdravstveni profesionalci nalaze se na prvoj liniji odgovora na epidemije i pandemije te su kao takvi izloženi profesionalnim opasnostima od infekcije.

**Cilj:** procijeniti rizik rada zdravstvenih radnika koji su direktnom kontaktu sa oboljelim od COVID-19.

**Materijali i metode:** u svrhu provođenja istraživanja, anketirana su 604 ispitanika, zdravstvena profesionalaca svih profila, a koji rade u zdravstvenim ustanovama na području Kantona Sarajevo. Kao instrument istraživanja korišten je anketni upitnik, čija je modifikacija nastala na osnovu tri upitnika. Kreirani upitnik je nastao na osnovu idućih upitnika: *COVID-19 Health Worker's Perception Survey*, *Surveillance questionnaire for SARS-CoV-2 infection among health workers*, *Questionnaire on Risk Perception and Behavior of Public Health Emergencies*. Istraživanje je provedeno u periodu od 30.11.2021. do 31.05.2022. godine.

**Rezultati:** od 604 ispitanika, 82,3% su bile žene. Da su dio tima koji radi većinom sa COVID-19 pacijentima navodi 344 (56,95%) ispitanika, dok sa COVID-19 pacijentima većinom ne radi 240 (39,74%) ispitanika. Da je kompletna zaštitna oprema kontinuirano dostupna za tretman pacijenata sa COVID-19 navodi 274 (45,36%) ispitanika. Da je neophodna oprema dostupna, ali ne sva oprema navodi 330 (54,64%) ispitanika. Analizom profesionalnih rizika zdravstvenih radnika u vrijeme COVID pandemije u ovom istraživanju, nije utvrđeno postojanje značajne statističke razlike u odnosu na nivo stručne spreme ( $p=0,115$ ). Međutim analizom profesionalnog rizika u odnosu na nivo zdravstvene zaštite uočena je statistički značajna razlika pri čemu najveći rizik imaju pacijenti na tercijarnom nivou, koji i rade sa najtežim pacijentima ( $p<0,001$ ). Također, utvrđeno je postojanje značajne statističke razlike u riziku u odnosu na vrstu radnog mjesta i poziciju ( $p<0,001$ ).

**Zaključak:** profesionalni rizik se nije značajno razlikovao između nivoa stručne spreme, ali je utvrđeno da ispitanici sa primarnog i tercijarnog nivoa zdravstvene zaštite imaju nešto više umjerenog rizika i manji udio visok rizik izlaganja.

**Cljučne riječi:** profesionalni rizik, zdravstveni radnici, pandemija, COVID-19

## INTRODUCTION

Risk defined as the likelihood or possibility of loss, injury or other adverse or undesirable circumstances, based on the Oxford Dictionary (1), has acquired particular significance during the COVID-19 pandemic. In January 2020, the World Health Organization declared that the novel coronavirus was a global threat. The virus was spreading to the countries of the European Union, new outbreaks were emerging, and the first case of coronavirus in Sarajevo was recorded in March. As the number of cases in the world had grown, the global risk of the virus increased, and on 11 March 2020 the World Health Organization declared a global pandemic due to coronavirus (2). The COVID-19 pandemic, considered one of the worst pandemics in human history, had an impact on living conditions and mortality. Globally, as of February 2022, more than 400 million cases of COVID-19 had been confirmed, including nearly 6 million deaths, even though more than 10 billion vaccine doses had been administered (4).

The literature indicates that many countries encountered a shortage of health professionals to treat a large number of patients with COVID-19, and countries' responses to the COVID-19 pandemic differed due to their capacity and sustainability. According to Keeley C. measures in the USA included the redeployment and training of existing staff, the hiring of private employment agencies, and the involvement of volunteers (5,6). Health professionals were on the front line of the response to the COVID-19 epidemic and as such were exposed to the dangers of infection. Hazards included exposure to pathogens, long working hours, psychological distress, fatigue, burnout, stigma, and physical and psychological violence (7).

In response to the COVID-19 pandemic, most employers were implementing measures such as hand washing, the use of hand sanitizer, job closures

at office locations, and social distancing through risk management. Many had also adopted hybrid and remote work arrangements (8), which allowed employees to be geographically distributed and physically distant. While hybrid and remote work seemed to have become the new normal in many corporations, employees in sectors, such as healthcare, had to increase their working hours and physical presence, to enable the smooth delivery of services. Most healthcare workers, especially nurses, became extremely mentally burdened and overworked. Some employees also began to display negative performance outcomes, such as burnout, disengagement, psychological stress, and low morale (9).

The COVID-19 pandemic primarily caused psychological consequences for healthcare workers because healthcare workers were more vulnerable, as they worked in an environment where COVID-19 infection was more likely to occur (8,10). As a result, healthcare workers experienced emotional fatigue, aggression, and depersonalization (10).

Otherwise, staff should have been protected from chronic stress and poor mental health. That way, they would have the ability to fulfill their roles. Healthcare staff needed regular up-to-date information and communication to avoid confusion and additional stress. Healthcare workers were among the people most at risk of disease. A particular level of stress and restlessness was noticeable when colleagues were sick or someone familiar with a ventilator in intensive care due to contact with COVID-19 (11).

### AIM

The aim of this study was to assess the risk of health workers who were in direct contact with COVID-19.

### MATERIALS AND METHODS

The study included 604 respondents, health professionals of all profiles employed in the Sarajevo Canton health institutions. The research included health professionals of both sexes, employed in health institutions of primary, secondary and tertiary healthcare level with over a year of work experience. After obtaining the consent of the competent Chambers,

the questionnaires were electronically distributed to the respondents in Google Forms. A survey instrument was a questionnaire, modified based on the following three questionnaires: *COVID-19 Health Worker’s Perception Survey, Surveillance questionnaire for SARS-CoV-2 infection among health workers, Questionnaire on Risk Perception and Behavior of Public Health Emergencies*. The research was conducted in the period from 30 November 2021 to 31 May 2022.

After conducting research with the help of Google Forms, the collected data were entered into an electronic database created in Microsoft Office Excel 365. The statistical program IBM SPSS Statistics 27.00 (IBM Corporation, Armonk, New York) was used for statistical data processing.

### RESULTS

Out of the total of 604 respondents, 82.3% were women. The majority of respondents, 34.1% of them, were aged 41-50. Most of the respondents, 40.2% of them, worked as nurses. Graduate nurses accounted for 19.9% of the sample, 41.7% of the respondents worked in primary health care, 29.5% in secondary health care, and 28.8% worked in tertiary health care.

Table1 **Exposure to the SARS-CoV-2 virus.**

If you have had symptoms (n=323), do you know if you have been in contact with:	Reply	N	%
<i>A confirmed case of COVID-19</i>	No	98	30.34%
	I do	225	69.66%
<i>Healthcare workers with symptoms of COVID-19 infection</i>	No	151	46.75%
	I do	172	53.25%
<i>A patient with confirmed COVID-19</i>	Not	95	29.41%
	Also	228	70.59%
<i>Confirmed or suspected case of COVID-19 in the household</i>	Not	192	59.44%
	Also	131	40.56%
<i>Another</i>	Not	272	84.21%
	Also	51	15.79%

14 days prior to the onset of symptoms, a total of 323 respondents reported symptoms, 225 (69.66%) respondents reported contact with a confirmed COVID-19 case, 172 (53.25%) respondents had contact

with a healthcare worker with COVID-19 symptoms infection, and 228 (70.59%) respondents had contact with patients with confirmed COVID-19 disease. A total of 131 (40.56%) respondents were in contact with a confirmed or suspected case of COVID-19 in the household. Some other forms of contact with a confirmed or suspected case were experienced by 51 (15.79%) respondents.

**Table 2 COVID-19 confirmed cases in the workplace.**

Question	Reply	N	%
<i>Are there any confirmed cases of COVID-19 in your department in a healthcare institution?</i>	No	62	10.26%
	Unknown	52	8.61%
	Yes	490	81.13%
<i>Do you have separate rooms and departments for COVID-19 confirmed cases in your institution?</i>	No	61	10.10%
	Unknown	33	5.46%
	Yes	510	84.44%
<i>Are you part of a team that works mostly with COVID-19 patients?</i>	No	240	39.74%
	Unknown	20	3.31%
	Yes	344	56.95%

490 (81.13%) respondents stated that they have confirmed COVID-19 patients in the department in the health institution where they work, while 52 (8.61%) respondents are uncertain, and 62 (10.26%) respondents deny that they have confirmed COVID-19 cases in the institution. 510 (84.44%) respondents state that they have separate rooms and departments for COVID-19 in the institution, while 61 (10.10%) respondents deny the same. 344 (56.95%) respondents state that they are part of a team that works mostly with COVID-19 patients, while 240 (39.74%) respondents mostly do not work with COVID-19 patients.

**Table 3 Availability of protective equipment.**

Question	Reply	N	%
<i>Is the necessary personal protective equipment continuously available for the treatment of patients with COVID-19?</i>	Yes	274	45.36%
	Yes, but not all the equipment.	330	54.64%
	Surgical/medical masks are always available.	428	70.86%
	N95 or FFP3 is always available.	365	60.43%
	One-time departments are always available	391	64.74%
	Gloves are always available.	417	69.04%
	Eye protection is always available	378	62.58%

274 (45.36%) respondents stated that complete protective equipment was continuously available for the treatment of patients with COVID-19. 330 (54.64%) respondents stated that the necessary equipment was available, but not all necessary equipment. The majority of respondents, 428 of them (70.86%) stated that surgical/medical masks were always available, and 365 (60.43%) respondents stated that N95 or FFP3 masks were always available. Furthermore, 391 (64.74%) respondents stated that disposable suits were always available, and 417 (69.04%) respondents stated that gloves were always available. According to 378 (62.58%) respondents, eye protection was always available.

**Table 4 Duration of exposure to the virus.**

Question	Reply	N	%
<i>If you are caring for a patient with COVID-19, how long was your longest exposure to the virus, within 1 meter distance of the patient.</i>	<2 minuta	33	5.5%
	2 to 5 minutes	60	9.9%
	5 to 15 minutes	112	18.5%
	>15 minutes	282	46.7%
	Not applicable	117	19.4%

The longest exposure, within 1 meter of the patient, lasted less than 2 minutes according to 33 (5.5%) respondents. The exposure from 2 to 5 minutes lasted in 60 (9.9%) respondents, and from 5 to 15 minute in 112 (18.5%) respondents. Exposure longer than 15 minutes was recorded in 282 (46.7%) respondents. 117 (19.4%) respondents stated that the exposure issue was not applicable.

**Table 5 Analysis of occupational risk in relation to the professional qualification of the respondents.**

Level of education	High risk of exposure		Moderate risk of exposure		Low risk of exposure		x2	p
	N	%	N	%	N	%		
HS	14	4.3	163	50.3	147	45.4	7.428	0.115
College of Applied Sciences	1	2.8	16	44.4	19	52.8		
University degree	3	1.2	140	57.4	101	41.4		

An analysis of occupational risks of healthcare workers during the COVID-19 pandemic established that 147 (45.4%) respondents with high school education had a low exposure risk. 163 (50.3%) respondents with high school education had a moderate risk and 14 (4.3%) subjects had a high exposure risk. Among the respondents with college degree, 19 (52.8%) respondents had a low occupational risk, 16 (44.4%) had moderate risk of exposure, and 1 (2.8%) had a high exposure risk. Among the respondents with a university degree, 101 (41.4%) had a low occupational risk, 140 (57.4%) respondents had moderate risk, and 3 (1.2%) respondents had a high exposure risk. No significant statistical difference was found ( $\chi^2=7.428$ ;  $p=0.115$ ) based on the education level of the respondents.

**Table 6 Occupational risk analysis in relation to the level of health care.**

Level of health care	High risk of exposure		Moderate risk of exposure		Low risk of exposure		x2	p
	N	%	N	%	N	%		
PZZ	4	1.6	149	59.1	99	39.3	26.207	<0.001
SZZ	2	1.1	85	47.8	91	51.1		
TZZ	13	7.5	89	51.1	72	41.4		

An analysis of occupational risks of healthcare workers during the COVID-19 pandemic revealed that 99 (39.3%) respondents at the primary healthcare level had a low risk of exposure. 149 (59.1%) respondents in primary healthcare had a moderate risk, and 4 (1.6%) respondents had a high exposure risk. Among subjects at the secondary level of health care, 91 (51.1%) respondents had a low occupational risk, 85 (47.8%) moderate risk of exposure, and 2 (1.1%) respondents had a high exposure risk. Among the respondents

from the tertiary level of health care, 72 (41.4%) had a low occupational risk, 89 (51.1%) moderate risk, and 13 (7.5%) respondents had a high exposure risk. A significant statistical difference was found ( $\chi^2=26.207$ ;  $p<0.001$ ) based on level of healthcare.

**Table 7 Occupational risk analysis in relation to the workplace.**

Workplace	High risk of exposure		Moderate risk of exposure		Low risk of exposure		x2	p
	N	%	N	%	N	%		
<i>Nurse/ Technician</i>	9	3.7	95	39.1	139	57.2	59.155	<0.001
<i>Laboratory Technician</i>	1	1.9	31	58.5	21	39.6		
<i>Pharmacy Technician</i>	2	4.2	36	75.0	10	20.8		
<i>Physiotherapist</i>	2	4.3	32	69.6	12	26.1		
<i>Registered Nurse</i>	3	2.5	59	49.2	58	48.3		
<i>Radiology Engineer</i>	1	1.6	50	82.0	10	16.4		
<i>Graduate Nurse-Head Nurse of a Ward or Hospital</i>	0	0.0	16	48.5	17	51.5		

In relation to the workplace, it was found that 139 (57.2%) respondents employed as nurses had a low risk of exposure. In the same group, 95 (39.1%) respondents had a moderate occupational risk, and 9 (3.7%) respondents had a high exposure risk. Among laboratory technicians, 1 (1.9%) respondent had a high occupational risk. Among pharmacy technicians, 2 (4.2%) respondents had a high exposure risk. Among physiotherapists, 2 (4.3%) respondents had a high occupational risk.

In the graduate nurses group, 58 (48.3%) respondents had a low risk of exposure, 59 (49.2%) moderate risk, and 3 (2.5%) respondents had a high exposure risk. A high risk of occupational exposure was experienced by 1 (1.6%) respondent employed as radiology engineer. None of the respondents performing a duty of the department or hospital head nurses was found to be at high risk of occupational exposure, and 16 (48.5%) respondents were at moderate risk. A significant statistical difference was found in relation to the type of job and position ( $\chi^2=63.198$ ;  $p<0.001$ ).

## DISCUSSION

The COVID-19 pandemic dictated countries to prepare their healthcare professionals for the sudden changes caused by a large influx of patients. Planning for the health workforce, its capacity, and skill mix during the pandemic were limited in pandemic response plans. Actions during the peak of the pandemic varied significantly between countries, and were carried out on an ad hoc basis and with limited planning (12).

In the context of the data provided, key elements regarding the organization and resources in health institutions were highlighted, especially in the context of dealing with the COVID-19 pandemic. Infrastructure and organization of health institutions: indicated that 84.44% of respondents confirmed the existence of separate rooms and departments for patients with confirmed COVID-19 infection. 56.95% of respondents, stated that they were members of teams mostly working with COVID patients. The availability of protective equipment showed all the risks, with only 45.36% of respondents stating that complete protective equipment was always available for the treatment of COVID-19 patients. Of these, the most common were surgical/medical masks, which were always available according to 70.86% of respondents, while N95 or FFP3 masks were always available according to 60.43% of respondents. The majority of respondents (69.04%) reported that gloves were always available, and safety glasses were always available according to 62.58% of respondents. In their daily work, 88.7% of respondents used gloves, while masks were used by as many as 98.5% of respondents. Disposable covers, suits and aprons were part of everyday equipment for 80.2% of respondents, while safety glasses were used by 64.5% of respondents.

Healthcare workers were at risk of infection while providing healthcare services because patients used to hide their medical history and disobey safety rules, including physical distancing. Moreover, inadequate procurement of protective equipment, fear of infection, risk to family members, and persecution by neighbors were quite common. This situation eventually led to the development of mental stress and anxiety (13). The precarious work environment during the COVID-19 pandemic simultaneously affected the physical and emotional health of all healthcare workers.

The study analysis of occupational risks of healthcare workers during the COVID-19 pandemic did not reveal the existence of a significant statistical difference in relation to the level of professional qualifications ( $p=0.115$ ). However, the analysis of occupational risk in relation to the level of health care showed a statistically significant difference, with patients at the tertiary level, also working with the most difficult patients ( $p<0.001$ ), having the highest risk. In relation to the workplace, it was found that 57.2% of respondents who perform the work of a nurses had a low risk of exposure. In the same group, 39.1% of respondents had moderate occupational risk, and 3.7% of respondents had high exposure risk. Among laboratory technicians, 1.9% of respondents had a high occupational risk. Among pharmacy technicians, 4.2% of respondents had a high risk of exposure. Among physiotherapists, 2 to 4.3% of respondents had a high occupational risk. In the group of registered nurses, 48.3% of respondents had a low risk of exposure, 49.2% had a moderate risk of exposure, and 2.5% of subjects had a high exposure risk. 1.6% of respondents who performed the work of radiology engineers had a high risk of occupational exposure. None of the respondents who performed the duties of the department or hospital head nurses was found to be at high risk of occupational exposure, and 48.5% of respondents were under moderate risk. There was a significant statistical risk difference in relation to the type of job and position ( $p<0.001$ ).

Bielicki JA, et al. (14) investigated the risk profile of exposure to SARS-CoV-2. In certain COVID-19 wards or hospitals, healthcare workers were at high risk of infection. Potential exposure to SARS-CoV-2 was inherent in their work and prevented only by excellent adherence to all individual protective measures, including the use of appropriate protective equipment. There was uncertainty about what was optimal personal protective equipment, but it was clear that standardized and rigorous application of this and other individual measures could dramatically reduce nosocomial transmissions. Healthcare workers were likely to be in contact with patients and colleagues who had atypical, few or no symptoms and were still highly contagious. A high proportion of such individuals should be present in hospital, including areas with insufficient awareness or an established need for measures, as the virus spreaded. Particular attention should be paid to healthcare professionals caring for

patients who were highly dependent and live in long-term care facilities, which might be built to resemble home environments, compromising the possibility of applying strict PPE and other IPC measures. They also found that the presence of asymptomatic healthcare workers infected with SARS-CoV-2 in situations during which PPE was not usually applied, such as scheduled meetings, large circles, educational events, and rest periods, would become more likely as the pandemic progresses. The same later turned out to be true.

Compared to the general population, healthcare workers report a higher perception of risk, as shown in the study of Simone L, et al. They found that exposure to the risk of infection, due to living space or work, increased perceived stress and anxiety (i.e., medical staff in Northern Italy were stressed and more anxious compared to medical and non-medical participants from the Centre and Southern Italy) (15).

Policymakers often conceptualize risk as the probability of contracting a disease multiplied by the magnitude of the consequences. Nevertheless, our findings, as well as the findings of the studies which results were compared, represent evidence of how people, health care workers perceived the risk of COVID-19. The perception of COVID-19 risk consistently correlated with a range of experiential and socio-cultural factors, workplace and personal protective equipment. More specifically, we showed that the perception of risk was higher in people with direct personal experience of the virus, as well as in those who had more prosocial worldviews. In that regard, those who got information about the virus from friends and family, those who thought their government's action was not effective, and those who stated they thought to be important for governments to intervene and take collective action, all were under higher risk. Communication messages about health risk therefore tend to be most effective when they include information about the effectiveness of measures designed to protect people from disease on both a personal and societal level (16).

## CONCLUSION

Occupational risk did not differ significantly between education levels, but it was found that respondents from the primary and tertiary healthcare levels had slightly more moderate risk and a lower proportion of high exposure risk.

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# Success of Autologous Stem Cell Transplantation in Patients With Multiple Myeloma

## Uspješnost autologne transplantacije matičnih ćelija kod pacijenata sa multiplim mijelomom

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### ABSTRACT

**Introduction:** multiple myeloma is a malignancy of plasma cells (a type of white blood cell) that develops in the bone marrow, causing uncontrolled proliferation of cancerous cells that suppress normal blood cells and produce abnormal antibodies (M-protein). This leads to symptoms such as bone pain, anemia, recurrent infections, and renal impairment (CRAB symptoms: calcium elevation, renal dysfunction, anemia, bone disease). Although a serious condition, multiple myeloma can be managed as a chronic disease, with advances in therapy significantly improving quality of life and survival.

**Materials and methods:** this retrospective study included 128 patients with multiple myeloma who underwent autologous hematopoietic stem cell transplantation at the Clinic of Hematology, Clinical Center of the University of Sarajevo (CCUS), during the 2021-2024 period. Medical records were used as the primary data source.

**Aim:** to present the effectiveness of treating multiple myeloma using autologous stem cell transplantation and to analyze factors influencing favorable survival outcomes.

**Results:** the results indicate that targeted therapeutic protocols combined with autologous stem cell transplantation continue to play a central role

in the modern treatment of multiple myeloma. The CCUS results confirm that this demanding therapeutic procedure can be successfully implemented in regional centers, achieving outcomes comparable to those of leading international institutions.

**Conclusion:** autologous hematopoietic stem cell transplantation remains the gold standard in the treatment of multiple myeloma in patients under 70 with preserved functional status, offering a significant opportunity for long-term remission and improved quality of life.

**Keywords:** multiple myeloma, autologous stem cell transplantation

### SAŽETAK

**Uvod:** multipli mijelom je rak plazma stanica (vrsta bijelih krvnih stanica) koji se razvija u koštanoj srži, uzrokujući nekontrolisano razmnožavanje kancerogenih ćelija koje potiskuju zdrave krvne ćelije i proizvode abnormalna antitijela (M-protein). To dovodi do simptoma poput bolova u kostima, anemije, čestih infekcija i oštećenja bubrega (CRAB simptomi: Calcium, Renal, Anemia, Bone). Iako je ozbiljna, bolest se može liječiti kao hronična, uz napredak u terapijama koji poboljšavaju kvalitetu života i preživljavanje.

**Materijali i metode:** istraživanje je provedeno kao retrospektivna metoda koja je obuhvatila 128 pacijenata oboljelih od multiplog mijeloma kojima je urađena autologna transplantacija matičnih ćelija hematopoeze na Klinici za hematologiju KCUS u periodu od 2021. do 2024. godine. Kao izvor podataka korištene su historije bolesti.

**Cilj:** prikazati uspješnost liječenja multiplog mijeloma primjenom autologne transplantacije matičnih ćelija kao i analizirati faktore koji utiču na povoljan život.

**Rezultati:** ukazuju da ciljani terapijski protokoli uz autolognu transplantaciju matičnih ćelija će zadržati centralnu ulogu u savremenom pristupu liječenja ove bolesti. Rezultati KCUS-a potvrđuju da se ovaj zahtjevniji terapijski postupak može uspješno provoditi i u centrima regiona, sa ishodima koji su na razini najbolje svjetske prakse.

**Zaključak:** autologna transplantacija matičnih ćelija hematopoeze ostaje zlatni standard u liječenju multiplog mijeloma kod pacijenata mlađih od 70 godina sa očuvanim funkcionalnim statusom, pružajući značajnu mogućnost za dugotrajnu remisiju i poboljšanje kvaliteta života.

**Ključne riječi:** multipli mijelom, autologna transplantacija matičnim stanicama

## INTRODUCTION

Multiple myeloma, also known as the “disease with a thousand faces,” is a malignant disorder of the bone marrow, originating from plasma cells that infiltrate the bone marrow, suppress normal hematopoiesis, and cause bone destruction known as osteolysis (1). Multiple myeloma accounts for approximately 10% of all hematological malignancies and about 1% of all cancers overall (2). The median age at diagnosis is 69-70 years, and only about 15% of patients diagnosed with multiple myeloma are younger than 65 years (3).

Osteolytic bone changes weaken bone structure, making bones prone to fractures and resulting in pathological fractures (4). This leads to bone pain, increased susceptibility to infections, anemia, elevated erythrocyte sedimentation rate, hypercalcemia, and

impaired renal function. The diagnosis of multiple myeloma has traditionally been based on the presence of end-organ damage known as the CRAB criteria (Calcium hypercalcemia, Renal-renal insufficiency, Anemia-anemia, Bone-bone lesions) (5). In 2014, the International Myeloma Working Group (IMWG) updated the diagnostic criteria by adding three new biomarkers (the SLiM criteria), enabling earlier diagnosis before the development of organ damage (6).

The disease is chronic and currently incurable, but long-term remissions are possible. Diagnosis is specific, and treatment is complex and individualized according to the clinical presentation. There are two main treatment approaches, particularly in symptomatic disease. The first approach involves intensive myeloablative chemotherapy supported by autologous hematopoietic stem cell transplantation. This treatment strategy is intended for patients younger than 70 years, with good performance status and preserved organ function (7,8).

The second approach is applied to patients older than 70 years who cannot tolerate myeloablative therapy due to toxicity and hematological complications; these patients are treated with less intensive conventional chemotherapy. However, it is important to emphasize that chronological age alone is no longer sufficient to determine transplant eligibility, physiological age and overall patient condition are the key factors (9,10).

## Transplantation procedure

Autologous stem cell transplantation uses healthy blood stem cells from the patient’s own body to replace diseased or damaged bone marrow. The concept of high-dose therapy (HDT) followed by autologous stem cell transplantation (ASCT) was developed in the 1980s (11). The Intergroupe Francophone du Myeloma (IFM) was the first to conduct a randomized study demonstrating the superiority of HDT/ASCT over conventional chemotherapy in patients younger than 65 years, in terms of response rates, event-free survival (EFS), and overall survival (OS) (12). These findings were subsequently confirmed by the UK Medical Research Council (MRC Myeloma VII) study (13).

More than 30 years after its introduction, autologous stem cell transplantation remains the standard of care for younger patients with newly diagnosed multiple myeloma (1,11). The advent of novel agents such as immunomodulatory drugs (IMiDs), proteasome inhibitors (PIs), and monoclonal antibodies has not replaced ASCT, but rather reinforced its central role as a standard treatment approach (14,15).

The use of a patient's own cells in stem cell transplantation offers advantages over donor-derived stem cells. Patients undergoing autologous stem cell transplantation do not face concerns related to donor–recipient incompatibility (16). Furthermore, autologous transplantation is associated with lower transplant-related mortality compared with allogeneic transplantation (17,18). Autologous stem cell transplantation is most commonly used in the treatment of Hodgkin lymphoma, multiple myeloma, non-Hodgkin lymphoma, and plasma cell disorders (1).

## Preparation for transplantation

Once stem cells have been collected, the patient undergoes a process known as the preparative regimen, which lasts until the day of transplantation and is also referred to as conditioning or cytotoxic therapy. The standard conditioning regimen for ASCT consists of melphalan at a dose of 200 mg/m<sup>2</sup>; however, a reduced dose of 140 mg/m<sup>2</sup> may be administered in cases of renal impairment (18). During this phase, physicians use chemotherapy, with or without radiotherapy, to eradicate malignant cells.

The collected stem cells are then reinfused into the patient's bloodstream. Over the following days and weeks, the transplanted stem cells migrate to the bone marrow niches, where they gradually begin to produce new blood cells. Newly formed blood cells typically become detectable in the patient's peripheral blood within two to three weeks after hematopoietic stem cell transplantation (1).

## Apheresis

Apheresis represents the first phase of the collection, cryopreservation, and storage of hematopoietic stem cells. The patient is admitted to the

hospital, where over a period of two days they receive high-dose cyclophosphamide chemotherapy as part of a bone marrow stem cell mobilization protocol. The primary goal of this protocol is to reduce the number of blood cells in the peripheral blood and bone marrow. Following completion of the chemotherapy regimen, treatment with a long-acting granulocyte colony-stimulating factor (G-CSF) is initiated, administered 24 hours after the end of chemotherapy. An increase in leukocyte counts, and consequently the mobilization of hematopoietic stem cells from the bone marrow into the peripheral blood, is typically expected around the eighth day (1).

In 2008, the U.S. Food and Drug Administration (FDA) approved plerixafor (Mozobil®) for stem cell mobilization in combination with growth factors, and in 2023 motixafortide (Aphexda™) was approved for the mobilization of hematopoietic stem cells for ASCT (1). The patient's complete blood count is monitored daily, and once adequate values are achieved, a cytological assessment is performed to determine the absolute number of CD34+ stem cells. If the patient meets the required stem cell count, they are transported, accompanied by a nurse, to the Institute of Transfusion Medicine for stem cell collection.

The goal is to collect a sufficient number of cells for one or two transplantations (≥6 million CD34+ cells/kg) (14,19). In patients with multiple myeloma, two transplantations are often performed, depending on the decision of the medical board and patient-specific characteristics. If the second transplantation is planned within six months of the first, this is referred to as tandem transplantation (2).

The collection of stem cells from peripheral blood is performed using a cell separator. Prior to leukapheresis, accurate patient identification, informed consent for leukapheresis, consent for central venous catheter placement, and verification of laboratory test results are essential. A central venous catheter, most commonly placed in the subclavian vein, is inserted. Through this catheter, the patient's blood is circulated through the cell separator, where the fraction containing stem cells is collected, while the remaining blood components are simultaneously returned to the patient. The procedure lasts approximately 4-5 hours, yielding about 250 mL of product containing hematopoietic stem cells. Apheresis is performed over

one or two days with the aim of collecting enough cells for two transplantations.

Following leukapheresis, a recovery period ensues, along with preparation for transplantation. The patient receives instructions regarding lifestyle measures and preparation for further treatment, including admission to a sterile room equipped with HEPA filtration. Stem cell storage involves processing and preservation of the collected graft, which is cryopreserved and stored in liquid nitrogen at  $-190^{\circ}\text{C}$  (14,19).

## Reinfusion

After several weeks, the patient is rehospitalized for the administration of intensive chemotherapy aimed at eradicating any remaining malignant cells in the body. The transfusion (reinfusion) of stem cells lasts approximately 15-20 minutes, during which continuous monitoring of the patient's condition is required before, during, and after the procedure. The patient remains in a sterile unit until hematologic recovery, typically for a total of 21 days (1).

During this period, patients require special protection against infections. Anyone entering the patient's room must wear protective gloves and a mask and wash their hands with antiseptic soap. The risk of infection is particularly high during the second to third week after transplantation, until the infused stem cells are able to produce sufficient numbers of white blood cells to provide adequate immune protection (20,21).

## Post-transplant course

A trained nurse represents the most important link in the post-transplant course. The critical period following stem cell reinfusion requires continuous monitoring and care, during which the nurse directly influences patient safety, timely recognition of complications, and the overall effectiveness of treatment (22). The most common adverse effects that may occur during the reinfusion procedure include an unusual smell and taste in the mouth, a tingling sensation in the throat, cough irritation, nausea, vomiting, facial warmth, flushing and burning of the skin, and hypotension. Early adverse effects of stem cell transplantation are similar to those associated with

chemotherapy, although they may be more severe due to the high doses used (14,21). Complications such as neutropenia, infections, and mucositis are generally transient and manageable with adequate supportive care and modern nursing approaches. Studies have demonstrated a significant decline in mortality related to myeloma, infections, and cardiovascular diseases over the past 25 years. Transplant-related mortality has been dramatically reduced from approximately 10% to less than 1-2% (2). It is also essential that all procedures are performed in strict accordance with aseptic and antiseptic principles. The role of the nurse includes continuous monitoring of vital signs, hematological surveillance, prevention and control of infections, care of the central venous catheter, support with nutrition and hydration, skin and mucosal care, as well as psychosocial support (23).

## AIM

The aim of this study was to demonstrate the success and effectiveness of autologous bone marrow stem cell transplantation in patients with multiple myeloma, which has a positive impact on prolonging survival and improving quality of life.

## MATERIALS AND METHODS

The study was conducted as a retrospective analysis and included 128 patients diagnosed with multiple myeloma who underwent autologous hematopoietic stem cell transplantation at the Clinic of Hematology, Clinical Center University of Sarajevo (CCUS), in the 2021-2024 period. Medical records were used as the primary data source.

## RESULTS

### Year 2021

During 2021, a total of 30 patients diagnosed with hematological malignancies were recorded and classified into three main categories: Hodgkin's disease (HD), Non-Hodgkin lymphoma (NHL), and Multiple Myeloma (MM). Analysis of the disease structure revealed clear differences in the frequency of the said diagnoses.

The lowest number of cases was observed in Hodgkin's disease, with 3 registered patients, accounting for 10% of the total analyzed population. Although Hodgkin's disease is a malignant disorder of the lymphatic system, it showed the lowest prevalence in 2021. Non-Hodgkin lymphoma, which comprises a broad group of lymphoproliferative malignancies, was diagnosed in 7 patients, accounting for 23.3% of all cases. This proportion indicates a notable, though still moderate, presence of NHL compared to other diagnoses.

The highest number of patients and the most dominant diagnosis in 2021 was Multiple Myeloma, with a total of 20 recorded cases, accounting for as much as 66.7% of the overall disease structure. This high prevalence highlights MM as the primary health challenge among hematological malignancies during the observed period. Overall, the data demonstrate a markedly uneven distribution of hematological diseases in 2021, with MM clearly predominating. Such a distribution may reflect different epidemiological patterns, diagnostic trends, or specific characteristics of the analyzed population.

Regarding gender distribution, there were 16 male patients (53.3%) out of the total analyzed population, and 14 female patients (46.7%). Although the proportion of women was slightly lower, the difference between sexes was not significant, suggesting that both genders were almost equally affected.

In 2021, the total of 30 patients was analyzed across four age categories. The data indicate a predominance of older age groups among affected individuals. The smallest number of patients was recorded in the group under 40, 3 patients (10%), suggesting that younger age groups were considerably less affected. In the 40-50 and 51-60 age groups, 6 patients were recorded in each category, representing 20% per group. These two age categories show equal representation and mark the age range in which disease occurrence begins to increase.

The highest number of patients was observed in the oldest analyzed age group, 61-70, with a total of 15 patients, accounting for 50% of all cases in 2021. This high frequency confirms the expected trend of hematological malignancies increased risk with advancing age. Overall age distribution clearly showed that the majority of cases occurred in patients over

60, while younger age groups were significantly less represented.

## Year 2022

In 2022, a total of 32 patients were recorded. The disease structure showed a significant dominance of Multiple Myeloma (MM), while Hodgkin's disease (HD) and Non-Hodgkin lymphoma (NHL) were significantly less frequent. The lowest proportion of patients was observed in HD, with only 1 registered case, accounting for 3.1% of all hematological diseases in 2022. In the group of patients with NHL, 8 cases were recorded, accounting for 25.0% of the total number. NHL thus occupied an intermediate position in the disease distribution, with a substantially higher prevalence compared to HD.

The most dominant disease in 2022 was MM, with a total of 23 registered cases, accounting for 71.9% of all patients. This exceptionally high frequency confirmed the continued trend of MM dominance among hematological malignancies. Overall distribution clearly indicated that MM was the leading cause of hematological disease in 2022, while HD and NHL represented a smaller, yet epidemiologically relevant, proportion of cases.

Gender distribution revealed a significant presence of female patients. Women accounted for the vast majority, with a total of 24 patients (75.0%), while men represented 25.0% of the total patient population.

Age distribution data showed a clear concentration of disease in middle-aged and older groups, with significantly lower representation of younger patients. The lowest incidence was recorded in the group under 40, only 2 patients (6.25%). In the 40-50 age group, 5 patients were registered (15.6%), indicating a gradual increase in disease frequency with entry into middle age. The highest number of patients was observed in the 51-60 age group, with 15 patients, accounting for 46.9% of all cases in 2022. This group represents nearly half of the total population and clearly identifies the age between 51 and 60 as the highest-risk period for the occurrence of hematological diseases. The 61-70 age group included 10 patients (31.25%), which, although slightly lower than the previous category, still represented a substantial proportion of older patients.

## Year 2023

In 2023, a total of 34 patients with diagnosed hematological diseases were recorded. The overall distribution clearly indicated that MM remained the most prevalent disease during 2023, while HD and NHL constituted a considerably smaller, yet epidemiologically relevant, proportion of patients. The lowest prevalence was observed in HD, with 3 registered cases, accounting for 8.9% of the total number of patients in 2023. In the NHL category, 6 patients were recorded (17.6%), placing NHL at a moderate level of representation within the overall structure of hematological diseases for that year. The highest number of patients was diagnosed with MM, with a total of 25 cases, representing 73.5% of all hematological diseases in 2023. This very high proportion confirmed the continuation of the trend in which MM remained the dominant hematological malignancy.

Gender distribution analysis in 2023 showed a slight predominance of male patients. Men constituted the majority, with 19 patients (55.9%), while there was 14 female patients (41.1%) out of the total population.

Age-related data indicate that the majority of cases occurred in middle-aged and older populations, while the representation of younger patients was minimal. The lowest proportion was recorded in the under 40 age group, only 2 patients (5.9%), suggesting that younger individuals were rarely affected during the observed year. In the 40-50 and 61-70 age groups, 10 patients were registered in each category, accounting for 29.4% per group. These groups represented a significant proportion of affected patients and indicated increased disease frequency in both middle and older age. The highest number of patients was observed in the 51-60 age group, with 12 patients (35.3%), making this age category the most affected and clearly identifying it as the highest-risk group for hematological diseases in 2023.

## Year 2024

In 2024, a total of 32 patients with diagnosed hematological diseases were recorded. Analysis of disease distribution shows a continuation of the trend of MM dominance, with a moderate increase

in the incidence of NHL, while HD remained rare. The lowest number of patients was observed in HD, with 1 registered case, accounting for 3.1% of the total number of patients in 2024. This proportion confirmed that HD remained the least prevalent disease in the observed group. A total of 11 patients were diagnosed with NHL, representing 34.4% of all cases. Compared with previous years, NHL accounted for a substantial share and emerged as the second most frequently diagnosed hematological disease in 2024. The highest incidence was again observed for MM, with 20 registered patients, accounting for 62.5% of the total sample. Despite a slight decrease in proportion compared to the previous year, MM retained its dominant position in the overall disease structure.

Gender distribution showed an equal representation of men and women. The most prevalent age group was 61-70, including 13 patients (40.6% of the total sample). This was followed by the 51-60 age group, with 10 patients (31.3%). Patients under 50 accounted for a smaller proportion of the population; 5 individuals under 40 (15.6%) and 4 individuals aged 40-50 (12.5%). These data indicated that disease incidence increased with age, which was expected given the nature of hematological disorders.

## 2021-2024 period

In the period from 2021 to 2024, MM was the most prevalent hematological disease among patients, followed by NHL, while HD remained rare. MM was predominant among older patients, indicating that the incidence of this disease increased with age. NHL was also more common in middle-aged and older age groups, whereas HD occurred sporadically and mainly in younger patients.

Gender distribution was generally balanced, with an approximately equal number of male and female patients. The majority of patients belonged to older age groups, particularly those aged 61-70 and 51-60, demonstrating that hematological malignancies are more frequent in later decades of life. Younger patients (under 40 years and between 40 and 50) constituted a smaller proportion of the overall patient population. The age structure combined with disease type suggests that the older population requires particular attention and timely diagnostics, especially due to the high prevalence of MM.

## Treatment Outcomes for Hematological Diseases in the 2021-2024 period

During the 2021-2024 period, a total of 128 patients were treated. Out of that number, 4 patients (3.1%) died, while 124 patients (96.9%) achieved recovery. These data indicated a high treatment success rate, suggesting that the applied therapeutic protocols were effective. The relatively low number of fatal outcomes reflected the quality of healthcare delivery and timely diagnosis.

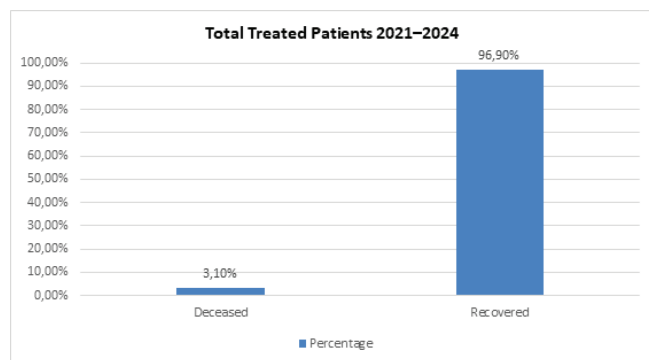


Figure 1 Treatment outcomes in the 2021-2024 period.

## Treatment Outcome of Transplanted Patients with Multiple Myeloma (2021-2024)

In the period from 2021 to 2024, a total of 88 patients with multiple myeloma (MM) underwent transplantation. Out of that number, 4 patients (4.5%) died, while 84 patients (95.5%) achieved a successful treatment outcome.

These data indicate that transplantation represents an effective treatment modality for MM, with a high rate of success. The 4.5% mortality rate can be considered relatively low given the complexity of the procedure, reflecting appropriate patient selection, high-quality medical care, and thorough monitoring during and after the transplantation process.

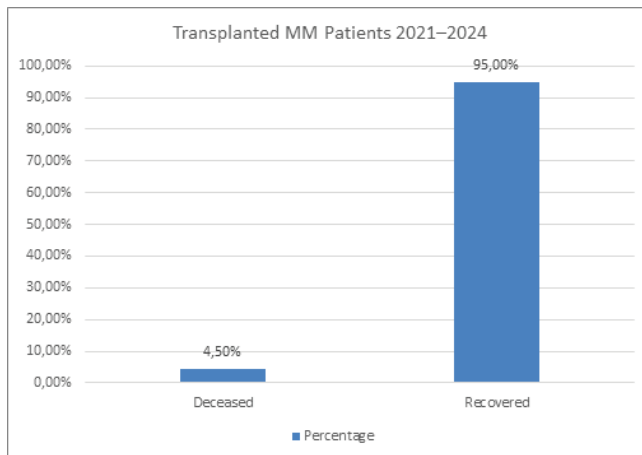


Figure 2 Treatment outcomes of transplanted patients with MM in the 2021-2024 period.

During the observation period, a total of 26 isolates were analyzed. The most common samples were from urine, accounting for 11 isolates (42.3%), indicating a high prevalence of urinary tract infections among patients. Sputum samples accounted for 4 isolates (15.4%), blood cultures for 4 isolates (15.4%), central venous catheters (CVC) for 3 isolates (11.5%), nasal swabs for 2 isolates (7.7%), and wound samples for 2 isolates (7.7%). These data showed that urinary and respiratory samples were the most frequent sources of isolates, while isolates from blood, CVC, nasal swabs, and wounds were less common. This information is important for monitoring hospital-acquired infections and infections in immunocompromised patients.

## DISCUSSION

The results of our study conducted at the Hematology Clinic of the CCUS in the period from 2021 to 2024 demonstrated extremely favorable outcomes of autologous hematopoietic stem cell transplantation (ASCT) in patients with multiple myeloma (MM). Out of the total of 88 transplanted patients with MM, 84 patients (95.5%) were successfully treated, while 4 patients (4.5%) died. This 4.5% mortality rate represented an excellent outcome and in some aspects even better than the results of leading international transplant centers.

Comparison with international centers showed that our results were competitive with the best institutions worldwide. The Bone Marrow Transplant Program of British Columbia, the only center performing stem

cell transplants in a province with a population of 5.1 million, reported an early mortality rate of 4.3% among 962 transplanted patients from 2007 to 2019. Multivariate analysis identified factors associated with early mortality, including anemia, hypercalcemia, high-risk cytogenetics, and elevated lactate dehydrogenase (24). Our 4.5% mortality rate was practically identical to these results, confirming the high quality of the transplant program at the CCUS.

A study conducted at Southwest Hospital in Chongqing, China, including 30 MM patients transplanted between 2011 and 2016, reported a one-year overall survival of 93.3% and three-year survival of 76.7%. More than 60% of patients (n=19) achieved complete remission after transplantation (25). Our results, with a 95.5% treatment success rate, suggested excellent efficacy of the protocols applied at the CCUS.

The MD Anderson Cancer Center in Texas, one of the world's leading oncology centers, published data on long-term survivors after ASCT. Among 2,176 patients transplanted between 1988 and 2015, 28% survived more than 10 years. Their analysis indicated that the duration of remission after transplantation was the strongest predictor of long-term survival, with age under 65 and standard-risk cytogenetics as additional favorable factors (26). Our data showed that most patients (50% in 2021) were aged 61-70, representing an older population, yet excellent outcomes were achieved.

The Canadian Myeloma Research Group analyzed 3,821 patients transplanted between 2007 and 2021. Median progression-free survival (PFS) was 35.4 months, and median overall survival (OS) was 126 months for patients receiving a single ASCT. The study highlighted the importance of maintenance therapy, with patients receiving lenalidomide demonstrating significantly better outcomes (27).

The Dana-Farber Cancer Institute reported in the *New England Journal of Medicine* that patients receiving early autologous transplantation after triple therapy (RVd protocol) had a median PFS of 68 months, compared to 48 months in non-early transplant patients. However, overall survival was similar in both groups, approximately 85% after a 76-month follow-up (26). These results reinforce the role of autologous transplantation as the standard approach for MM.

A 2020 Blood Advances study showed continuous improvement in outcomes for patients treated with ASCT, with potential cure rates ranging from 6.3% to 31.3% depending on the year of treatment. Patients treated from 2014 onward had significantly better overall survival (hazard ratio 0.35) compared to those treated before 1997 (27). Our 2021-2024 study fits within this era of improved outcomes due to advances in induction therapy, transplantation techniques, and supportive care.

The Blood or Marrow Transplant Survivor Study, following 1,906 patients over a median of 9.2 years, reported a ten-year overall survival of 45% among patients who survived the first two years post-transplant. The study also documented a significant temporal decline in mortality related to myeloma, infections, and cardiovascular disease over the past 25 years (24).

Regarding demographics of our cohort, MM was the dominant disease, accounting for 66.7%-73.5% of all hematologic disorders annually. This high prevalence aligns with epidemiological data indicating that MM represents approximately 10% of all hematologic malignancies (12).

Gender distribution was generally balanced, consistent with published literature. Most patients were older (51-70 years), as expected given the median age at MM diagnosis was 69 years in the general population (8).

A study from MD Anderson Cancer Center on long-term remission (>8 years without progression) after ASCT found that 15% of patients achieved this remarkable outcome. Factors associated with long-term remission included younger age, standard-risk cytogenetics, <50% plasma cells in the bone marrow, and receiving maintenance therapy (19). These data suggest that proper patient selection and application of maintenance therapy can significantly improve long-term outcomes.

Our microbiological analysis showed that urinary samples were the most common source of isolates (42.3%), followed by sputum and blood cultures (each 15.4%), and CVCs (11.5%). These findings align with the literature, which indicates that urinary and respiratory infections are the most frequent infectious

complications in immunocompromised post-transplant patients (23). Proper infection prevention and early treatment are critical to reducing morbidity and mortality in the post-transplant period.

It is important to note that the literature consistently shows that transplantation-related mortality (TRM) for autologous transplantation is significantly lower than for allogeneic transplantation. The Mayo Clinic reported a one-year TRM of 23.5% for allogeneic MM transplants, while TRM for autologous transplantation is generally below 5% (27). Our 4.5% mortality rate confirmed the safety of autologous transplantation as a therapeutic option.

The role of the nurse in the transplantation process is crucial. Continuous monitoring of vital signs, hematological surveillance, infection prevention and control, care of central venous catheters, nutritional and hydration support, and psychosocial care are fundamental components of successful post-transplant care. Education of medical staff and a multidisciplinary approach contribute to improved treatment outcomes and reduced complications.

## CONCLUSION

Based on data from the Hematology Clinic of the CCUS (2021–2024), autologous hematopoietic stem cell transplantation (ASCT) is a safe and highly effective treatment for multiple myeloma (MM). The observed success (95.5%) and mortality (4.5%) rates are comparable to those reported by leading international transplant centers. MM was the most frequent hematologic malignancy, predominantly affecting patients aged 51-70 years, with no significant gender differences. Favorable outcomes were supported by appropriate patient selection, effective induction therapy, timely stem cell mobilization, and comprehensive post-transplant care. Nursing care plays a vital role throughout the transplantation process, particularly in monitoring and prevention of infectious complications. ASCT remains the gold standard for eligible MM patients, and the CCUS results confirm that outcomes comparable to international standards can be achieved in regional centers.

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# Generational Differences in the Perception of Telemedicine: A Comparative Analysis of Baby Boomers and Generation X

## Generacijske razlike u percepciji telemedicine: komparativna analiza generacije Baby Boomera i generacije X

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### ABSTRACT

**Introduction:** telemedicine, as a digital form of healthcare delivery, is becoming increasingly prominent in contemporary healthcare systems. This study examines the perception of telemedicine among Baby Boomers and Generation X, analyzing the influence of demographic factors such as gender and education level on shaping attitudes toward this innovation.

**Aim:** to examine the perception of telemedicine among Baby Boomers and Generation X and determine the extent to which demographic factors such as generation, gender, and education level influence attitudes toward digital healthcare services

**Materials and methods:** the research was conducted online in the period from March to July 2025 using a structured questionnaire. The study included a total of 712 respondents (95 Baby Boomers and 617 members of Generation X). Data were analyzed using descriptive statistics, the Mann-Whitney U test, Spearman's correlation, independent-samples t-test, ANOVA, and regression analysis.

**Results:** the findings revealed no significant differences in the perception of telemedicine between Baby Boomers and Generation X ( $p = 0.447$ ), or between men and women ( $p = 0.276$ ). However, a significant

positive correlation was identified between education level and attitudes toward telemedicine ( $p = 0.315$ ;  $p = 0.001$ ). Regression analysis further confirmed that education significantly predicted the perception of telemedicine ( $\beta = 0.209$ ;  $p < 0.001$ ;  $R^2 = 0.044$ ).

**Conclusion:** the study demonstrates that education, rather than gender or generational affiliation, shapes the perception of telemedicine. Future implementation strategies should therefore focus on enhancing digital literacy and patient awareness to strengthen trust and encourage the use of telehealth services.

**Keywords:** telemedicine, Baby Boomers, Generation X, perception, education

### SAŽETAK

**Uvod:** telemedicina, kao digitalni oblik pružanja zdravstvene skrbi, sve je prisutnija u suvremenim zdravstvenim sustavima. Ovo istraživanje ispituje percepciju telemedicine među generacijama Baby Boomers i Generacije X, s posebnim naglaskom na utjecaj demografskih obilježja poput spola i stupnja obrazovanja na oblikovanje stavova prema ovoj zdravstvenoj inovaciji.

**Cilj:** ispitati percepciju telemedicine među pripadnicima generacije Baby Boomers i Generacije X te utvrditi u kojoj mjeri demografski čimbenici, uključujući generacijsku skupinu, spol i razinu obrazovanja, utječu na stavove prema digitalnim zdravstvenim uslugama.

**Materijali i metode:** istraživanje je provedeno online od ožujka do srpnja 2025. godine, koristeći strukturirani anketni upitnik. U istraživanje je bilo uključeno ukupno 712 ispitanika (95 ispitanika iz skupine Baby Boomers i 617 iz Generacije X). Podaci su analizirani primjenom deskriptivne statistike, Mann-Whitney U testa, Spearmanove korelacije, t-testa za nezavisne uzorke, ANOVA-e i regresijske analize.

**Rezultati:** rezultati su pokazali da ne postoje statistički značajne razlike u percepciji telemedicine između generacijske skupine Baby Boomers i Generacije X ( $p = 0.447$ ), kao ni između muškaraca i žena ( $p = 0.276$ ). Međutim, utvrđena je statistički značajna pozitivna korelacija između razine obrazovanja i stavova prema telemedicini ( $\rho = 0.315$ ;  $p = 0.001$ ). Regresijska analiza dodatno je potvrdila da obrazovanje značajno predviđa percepciju telemedicine ( $\beta = 0.209$ ;  $p < 0.001$ ;  $R^2 = 0.044$ ).

**Zaključak:** istraživanje pokazuje da percepciju telemedicine prvenstveno oblikuje razina obrazovanja, dok spol i generacijska pripadnost nemaju značajniji utjecaj. Strategije buduće implementacije telezdravstvenih usluga trebale bi se stoga usmjeriti na jačanje digitalne pismenosti i informiranosti pacijenata kako bi se potaknulo povjerenje i veća uporaba telemedicinskih usluga.

**Ključne riječi:** telemedicina, Baby Boomers, Generacija X, percepcija, obrazovanje

## INTRODUCTION

Telemedicine, defined as the provision of healthcare services remotely through digital technologies, is gaining increasing importance within modern healthcare systems (1). This innovation allows patients to access medical services without the need for a physical visit to a physician, thereby improving accessibility and optimizing healthcare delivery (2). With the growing use of telemedicine, it is essential to understand how different generations perceive such

services, considering their specific attitudes, biases, and concerns (3).

The Baby Boomer generation, encompassing individuals born between 1946 and 1964, witnessed significant societal changes, including the rise of materialism and individualism. This generation is often skeptical toward telemedicine and other novel approaches in healthcare, as their expectations of medical care are rooted in personal contact and empathy. Such expectations may raise concerns about the quality of care delivered through digital platforms (4). Although they may recognize the benefits of telemedicine, such as time savings and improved accessibility, their preference for traditional models of care can hinder the acceptance of new technologies (3).

In contrast, Generation X, born between 1965 and 1980, represents an important demographic group that matured during periods of profound technological and social change. This generation is frequently described as independent and adaptable, with a critical stance toward authority, which influences their approach to healthcare, including telemedicine (5). Due to their familiarity with digital technologies, Generation X is often more open to healthcare innovations. Telemedicine solutions provide them with greater flexibility and easier access to services. Nevertheless, skepticism about the efficiency and safety of telemedicine may persist, potentially shaping their perception and willingness to engage with such services.

Telemedicine is applied across a wide range of healthcare contexts, with benefits and challenges varying according to patient needs and healthcare system capacities. For instance, in rural areas, telemedicine enables patients to access specialized services that would otherwise be unavailable due to geographic distance (6). Teleconsultations with cardiologists or dermatologists facilitate faster diagnosis and treatment, reducing the need for long hospital visits (7). However, challenges such as inadequate infrastructure and weak internet connectivity may impede effective communication between patients and healthcare providers.

In the context of mental health, telemedicine has demonstrated significant potential for delivering psychological support. Many therapy platforms

enable patients to access professional care via video consultations, thereby reducing the stigma associated with visiting a psychiatrist and facilitating access to necessary treatment (8). Nonetheless, concerns about privacy and data security may affect patients' trust in such services.

Finally, telemedicine is increasingly used for chronic disease management, such as diabetes and hypertension, through wearable devices that monitor vital signs and allow physicians to respond promptly to changes (9). The challenge lies in ensuring patients' technical literacy and access to the necessary technology, which can act as a barrier, particularly among older populations (10). These examples demonstrate how telemedicine can enhance healthcare delivery while also underscoring the importance of addressing the challenges associated with its implementation.

This study examines the attitudes, beliefs, and concerns of two generational cohorts toward telemedicine and remote healthcare delivery, to understand how each generation perceives this innovation and how their experiences shape the acceptance of digital health solutions.

## AIM

This study aimed to examine the perception of telemedicine among Baby Boomers and Generation X and to determine the extent to which demographic factors such as generation, gender, and education level influence attitudes toward digital healthcare services. Furthermore, the study sought to analyze key factors shaping the perception of telemedicine, including concerns related to personal contact, technical difficulties, and service quality, to develop effective strategies to increase the acceptance of telemedicine across different generational groups.

### ***Hypotheses***

H1: There is a difference in the perception of telemedicine between Baby Boomers and Generation X.

H2: Higher education is associated with a more positive perception of telemedicine.

H3: There is a difference in the perception of telemedicine between men and women.

H4: Education level can serve as a predictor of the perception of telemedicine.

## MATERIALS AND METHODS

The study was conducted online in the period from March to July 2025 using a web-based questionnaire. Participants were recruited through social media platforms, online communities, and health forums to ensure representativeness of the two targeted generational cohorts: Baby Boomers and Generation X. The study included a total of 712 respondents, specifically 95 Baby Boomers (born between 1946 and 1964), and 617 members of Generation X (born between 1965 and 1980).

The questionnaire consisted of statements rated on a five-point Likert scale, where 1 represented "strongly disagree" and 5 represented "strongly agree." The scale allowed for quantitative measurement of respondents' level of agreement with various aspects of telemedicine. The questionnaire covered several categories: accessibility, quality of service, personal contact, technological reliability, time efficiency, and data security.

In order to be eligible for the study, participants were required to meet the following criteria:

1. Belong to one of the two generational cohorts: Baby Boomers (born 1946–1964) or Generation X (born 1965–1980).
2. Have a basic understanding of telemedicine and its core concepts.
3. Complete the online survey during the study period (March-July 2025).

Quantitative data collected via the Likert scale were analyzed using descriptive statistical methods. To examine differences in the perception of telemedicine between Baby Boomers and Generation X (H1), the Mann-Whitney U test was employed, as the data did not follow a normal distribution. Differences between men and women (H3) were analyzed using the independent-samples t-test, with Levene's test for homogeneity of variances applied to ensure the validity of assumptions. The relationship between education level and telemedicine perception (H2) was

assessed using Spearman’s rank correlation, which evaluates the direction and strength of associations between ordinal variables. Furthermore, to test whether education level could predict perceptions of telemedicine (H4), a simple linear regression analysis was conducted, examining the predictive value of education in explaining variance in attitudes toward telemedicine.

All data analyses were performed using SPSS, and results are presented in Tables.

## RESULTS

### **Demographic distribution by generation and gender**

Before analyzing the perception of telemedicine, the demographic structure of the respondents was examined. The objective was to understand the distribution of participants across generations and gender, and to determine whether the sample was balanced.

The analysis of generational and gender distribution showed that the majority of respondents belonged to Generation X (86.7%), while Baby Boomers represented 13.3% of the sample. Regarding gender, 68.1% of participants were women, and 31.9% were men (Table 1).

**Table 1 Demographic distribution of respondents by generation and gender.**

Category	Frequency (N)	Percentage (%)
<b>Generation</b>		
Baby Boomers	95	13.3
Generation X	617	86.7
Total	712	100.0
<b>Gender</b>		
Male	227	31.9
Female	485	68.1
Total	712	100.0

### **Comparison of telemedicine perception: results of the Mann-Whitney U test**

*(Hypothesis 1 – H1: There is a difference in the perception of telemedicine between Baby Boomers and Generation X).*

After establishing the demographic characteristics of the participants, their attitudes toward telemedicine were analyzed. The first step was to examine whether Baby Boomers and Generation X differed significantly in their perception of telemedicine. In addition to general attitudes, specific aspects considered important by participants when forming opinions about telemedicine use were assessed. The most frequently reported advantages included accessibility, quality of service, and time efficiency, while the most common concerns related to lack of personal contact, technical problems, and doubts about the quality of telemedicine services.

Descriptive statistics showed that Baby Boomers and Generation X expressed similar average attitudes toward telemedicine. The mean score among Baby Boomers was  $M = 3.09$  ( $SD = 1.437$ ), while for Generation X,  $M = 2.98$  ( $SD = 1.403$ ). The median score for both groups was 3.00, suggesting that perceptions were centered around a neutral response. Minimum and maximum values ranged from 1 to 5, indicating the full range of responses on the Likert scale (Table 2).

**Table 2 Descriptive statistics of telemedicine attitudes among Baby Boomers and Generation X.**

Generation	Mean	Median	Stand. deviation	Minimum	Maximum
Baby Boomers	3.09	3.00	1.44	1	5
Generation X	2.98	3.00	1.40	1	5

Although Baby Boomers reported slightly higher mean scores, the difference was not statistically significant, indicating that both generations shared similar attitudes toward telemedicine.

To examine potential differences in the perception of telemedicine between Baby Boomers and Generation X, a Mann-Whitney U test was used, as the data did not follow a normal distribution. The analysis revealed no statistically significant difference between Baby Boomers and Generation X in their perception

of telemedicine ( $U = 27,917$ ,  $Z = -0.761$ ,  $p = 0.447$ ). The mean ranks indicate that the attitudes of both generations were comparable (Table 3).

**Table 3 Results of the Mann-Whitney U test comparing telemedicine attitudes between Baby Boomers and Generation X.**

Group	Number of respondents (n)	Mean rank	Sum of ranks
Baby Boomers	95	371.14	35,258
Generation X	617	354.25	218,570

***Relationship between education level and perception of telemedicine: Results of Spearman’s correlation***

(Hypothesis 2 – H2: Higher education is associated with a more positive perception of telemedicine.)

In addition to generational differences, the study examined whether there was an association between education level and attitudes toward telemedicine. Since education represents an ordinal variable, Spearman’s rank correlation coefficient was applied. The most frequently reported reasons for using telemedicine services were also analyzed. Regardless of education level, the most common motivations were service accessibility, time efficiency, and scheduling flexibility. However, respondents with higher education expressed greater trust in the quality of telemedicine services and more frequently emphasized the advantages of digital healthcare, while those with secondary education demonstrated greater skepticism toward the reliability and effectiveness of such solutions.

The results of Spearman’s correlation, presented in Table 4, indicate a significant positive association between education level and attitudes toward telemedicine ( $\rho = 0.315$ ;  $p = 0.001$ ). This finding suggests that individuals with higher education levels had more positive attitudes toward telemedicine and were more inclined to use it.

**Table 4 Results of Spearman’s correlation between education level and attitudes toward telemedicine.**

Variable	Education level	Telemedicine attitudes
Education level	1.000	0.315
Telemedicine attitudes	0.315	1.000
Sig. (2-tailed)	—	0.001
N	712	712

These results indicate that individuals with higher education demonstrate significantly more positive attitudes toward telemedicine.

***The impact of gender on the perception of telemedicine: Independent-samples t-test***

(Hypothesis 3 – H3: There is a difference in the perception of telemedicine between men and women.)

To examine whether there was a significant difference in attitudes toward telemedicine between men and women, an independent-samples t-test was used. This analysis allowed for comparison of the mean scores of the two groups and assessment of whether gender differences in telemedicine perception were statistically significant. Descriptive statistics showed that men had a slightly lower mean score of telemedicine perception ( $M = 2.91$ ,  $SD = 1.387$ ) compared to women ( $M = 3.03$ ,  $SD = 1.416$ ). To determine whether this difference was significant, an independent-samples t-test was applied (Table 5).

**Table 5 Results of the independent-samples t-test for telemedicine attitudes by gender.**

Gender	N	M	SD	SE
Men	227	2.91	1.387	0.092
Women	485	3.03	1.416	0.064

*N = number of respondents, M = mean, SD = standard deviation, SE = standard error.*

Although women had a slightly higher mean score than men, the difference was not statistically significant.

Levene’s test for equality of variances indicated no significant difference between the groups ( $F = 0.403, p = 0.526$ ). Therefore, results from the “equal variances assumed” row of the t-test were used. The t-test results showed that there was no statistically significant difference in telemedicine perception between men and women ( $t(710) = -1.091, p = 0.276$ ). This suggests that gender is not a key factor in shaping attitudes toward telemedicine (Table 6). Additionally, the Cohen’s  $d$  value ( $-0.088$ ) indicated a negligible effect size, confirming that the difference between genders was minimal.

**Table 6 Results of the independent-samples t-test: gender differences in telemedicine attitudes.**

Leveneov test	T-test (Equal variances assumed)	df	p-value (2-tailed)	Mean difference	95% CI (lower, upper)
<b>F = 0.403</b>	t = -1.091	710	0.276	-0.123	(-0.346, 0.099)

*The impact of gender and education: Results of ANOVA analysis (Combined testing of H2 and H3)*

To further explore whether there was an interaction between gender and education in the perception of telemedicine, a one-way ANOVA was conducted. This allowed for the simultaneous assessment of the effect of gender (H3), education (H2), and their combined influence. Levene’s test showed no significant differences in variances across groups ( $p = 0.348$ ), indicating that the assumptions for conducting ANOVA were met. Table 7 presents the mean scores of telemedicine perception across the groups by gender and education. The results indicate that women generally reported slightly higher mean scores than men, although these differences were not significant.

**Table 7 Descriptive statistics of telemedicine perception by gender and education.**

Gender	Education level	N	M	SD
Men	Secondary education	113	2.88	1.374
	Post-secondary education	50	2.98	1.421
	University degree	28	3.11	1.343
	Semi-qualified	2	3.10	1.483
	Qualified	16	2.25	1.291
Total (Men)		227	2.91	1.387
Women	Secondary education	276	3.11	1.430
	Post-secondary education	107	3.13	1.435
	University degree	38	3.03	1.461
	Semi-qualified	34	2.35	1.252
	Qualified	30	2.73	1.143
Total (Women)		485	3.03	1.416

The results of the ANOVA are presented in Table 8. Education level had a statistically significant effect on the perception of telemedicine ( $F(4,702) = 4.659, p = 0.003$ ), although the effect size was very small ( $\eta^2 = 0.028$ ), explaining only 2.8% of the total variance in attitudes. In addition, a significant interaction between gender and education was found ( $F(4,702) = 2.250, p = 0.045$ ), but with an even smaller effect size ( $\eta^2 = 0.014$ ). This indicates that the combined effect of gender and education exists but is practically negligible.

**Table 8 Results of the ANOVA for telemedicine perception by gender and education.**

Source of variation	SS	df	MS	F	p	$\eta^2$
Gender	0.003	1	0.003	0.002	0.968	0.000
Education	32.451	4	8.113	4.659	0.003	0.028
Interaction (Gender × Education)	15.678	4	3.920	2.250	0.045	0.014
Error	1223.214	702	1.742	—	—	—

In summary, the results confirm that education has a statistically significant but practically very small effect on the perception of telemedicine. Gender alone was not a significant factor, and the combined effect of gender and education was also minimal.

**Regression analysis: The impact of education on the perception of telemedicine**

To test Hypothesis 4 (Education can predict the perception of telemedicine), a simple linear regression analysis was conducted.

The results show that education level significantly predicted attitudes toward telemedicine ( $F(1,710) = 32.604, p < 0.001$ ). However, the  $R^2$  value of 0.044 indicates that education explained approximately 4.4% of the total variance in attitudes, representing a weak but statistically significant predictive effect. The correlation coefficient ( $R = 0.209$ ) indicates a low association, while the Durbin-Watson statistic (1.975) confirmed that no significant autocorrelation was present in the residuals.

**Table 9 Regression model summary.**

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. error of the estimate	Durbin-Watson
1	0.209	0.044	0.043	1.219	1.975

Table 10 presents the results of the ANOVA for the regression model. The model was statistically significant ( $F(1,710) = 32.604, p < 0.001$ ), indicating that education had a significant, although weak, impact on the perception of telemedicine.

**Table 10 ANOVA for the regression model.**

Model	Sum of squares	df	Mean square	F	p-value
Regression	48.753	1	48.753	32.604	0.000
Residual	1061.412	710	1.495	—	—
Total	1110.165	711	—	—	—

Table 11 presents the regression coefficients. The results demonstrate that higher education was positively associated with more favorable perceptions of telemedicine ( $\beta = 0.209, p < 0.001$ ). The 95% confidence interval (0.120 – 0.298) further supports the stability and reliability of these findings.

**Table 11 Regression model coefficients.**

Model	Constant	Education ( $\beta$ )	p-value	95% CI (lower)	95% CI (upper)
1	2.514	0.209	0.000	0.120	0.298

In conclusion, higher education positively influenced the perception of telemedicine ( $\beta = 0.209, p < 0.001$ ), although the model explained only a relatively small proportion of the variance ( $R^2 = 0.044$ ).

**DISCUSSION**

The results of this study showed that demographic factors such as generational affiliation and gender do not have a statistically significant effect on the perception of telemedicine, whereas education level demonstrates a significant, albeit relatively small, association with its acceptance. These findings provide important insights into patterns of telemedicine adoption among Baby Boomers and Generation X in Croatia and complement existing international literature on the factors shaping patient and user attitudes toward digital health services.

**Hypothesis analysis**

The findings allowed for the testing of all four hypotheses. Hypothesis H1, which assumed that there are differences in the perception of telemedicine between Baby Boomers and Generation X, was rejected since no statistically significant differences were identified between these two generations. Hypothesis H2, which posited that higher education is associated with more positive perceptions of telemedicine, was confirmed, as a positive correlation between education level and attitudes toward telemedicine solutions was established. Hypothesis H3, which assumed differences between men and women, was also rejected because gender did not have a significant impact. Hypothesis H4, which proposed that education level could predict the perception of telemedicine, was confirmed, but with the caveat that it represents a weak predictor ( $R^2 = 0.044$ ). This indicates that while education contributes to shaping attitudes, it explains only a small portion of the total variance, suggesting that additional factors must also be taken into account.

### ***Generational differences in telemedicine perception***

It was expected that Generation X, due to greater exposure to digital technologies throughout life, would demonstrate more positive attitudes toward telemedicine compared to Baby Boomers. However, the results did not confirm this assumption, suggesting that generational affiliation alone does not explain the perception of telemedicine. These findings are consistent with Taylor ML, et al. (2022), who emphasized that experience with digital tools and the level of trust in technology play a greater role than generational identity itself (11). Furthermore, Kong SS, et al. (2021) noted that older patients, regardless of their generation, often face barriers such as limited access to technology (12), which may reduce their inclination toward telemedicine. Conversely, the study by Umayam KAD, et al. (2022) confirmed that generations raised in the digital era demonstrate greater satisfaction with digital health services (13). Although differences between Baby Boomers and Generation X were not statistically significant in this study, exposure to and experience with digital tools remain key explanatory factors, as also reflected in the work of Pramudita E, et al. (2023), who found that Generation X expressed higher satisfaction compared to younger generations (14). The COVID-19 pandemic further accelerated the digitalization of healthcare, and the research of Sánchez-Guillén L, et al. (2024) confirmed that older patients remain less inclined to adopt digital solutions, underscoring the need for tailored implementation strategies (15).

### ***Education and telemedicine perception***

One of the key findings of this study is the confirmation that higher education is significantly correlated with a more positive perception of telemedicine. This finding is consistent with Tan JY, et al. (2024), who reported that individuals with higher education levels expressed greater trust and were more frequent users of digital health services (16), as well as with Moulaei K, et al. (2023), who demonstrated that patients with greater digital literacy emphasized the advantages of telemedicine, such as accessibility, time savings, and quality of care (17). However, while the effect of education is statistically significant, the effect size ( $\eta^2 = 0.028$ ;  $R^2 = 0.044$ ) indicates that it is a relatively weak predictor. This means that although education

influences attitudes, most variability arises from other factors, including digital literacy, prior experience with telemedicine, and trust in the healthcare system. These findings highlight that education is important but not sufficient to fully explain the acceptance of telemedicine.

### ***Gender and telemedicine perception***

The analysis did not reveal statistically significant differences between men and women, leading to the rejection of H3. However, women demonstrated slightly more positive attitudes toward telemedicine than men, which aligns with previous studies, although without statistical confirmation. This can be explained by the fact that women are generally more involved in health management, both personal and family-related, and therefore show greater interest in new forms of healthcare. Nonetheless, since the differences were not statistically significant, gender cannot be considered a key determinant of telemedicine perception.

### ***Implications for practice***

The practical implications of these findings primarily relate to patient education and the development of strategies to enhance digital literacy. Since education was confirmed as a significant but weak predictor of attitudes, healthcare systems should focus on creating training programs and technical support mechanisms to ensure telemedicine is accessible and useful for all patients, regardless of their formal education level. This includes public education campaigns, the introduction of technical assistance, and the design of simple, user-friendly digital platforms for healthcare delivery. At the same time, concerns regarding data privacy and security must be addressed, as they remain key challenges for the broader implementation of telemedicine, as also highlighted by Jiang JX, et al. (2024) (18).

### ***Implications for future research***

This study demonstrates the need for more complex models to explain attitudes toward telemedicine. Future research should combine quantitative and qualitative methods, for instance, conducting in-depth interviews and focus groups to identify subjective barriers and personal experiences of users. Such approaches would allow a deeper understanding of

individual obstacles that quantitative methods often fail to capture. Additionally, longitudinal studies would provide valuable insights into how attitudes evolve over time, particularly in the context of the ongoing digitalization of healthcare and the development of new technologies.

### ***Limitations of the study***

Several limitations must be acknowledged. First, the sample was collected online, which may have introduced bias, as individuals with low digital literacy or without internet access were excluded. Second, the sample distribution was unbalanced, with a much larger number of Generation X respondents, which may have limited the ability to detect genuine generational differences. Third, the cross-sectional design of the study prevents the establishment of causal relationships, limiting conclusions to correlations only. Finally, the reliance on self-reported data may have introduced subjective bias.

### **CONCLUSION**

This study provided insight into the perception of telemedicine among Baby Boomers and Generation X, showing that demographic factors did not have a significant impact on the acceptance of this technology. These findings highlight the importance of individual experiences and the level of digital literacy as key determinants in understanding users' attitudes toward telemedicine services. Considering the global trend of healthcare digitalization, the results point to the need for implementation strategies that focus on a personalized approach to users, rather than generalized models based solely on demographic characteristics. Education and empowerment of users in utilizing digital health solutions are crucial for increasing acceptance and ensuring the long-term sustainability of telemedicine as a standard form of healthcare delivery. Future research should focus on specific barriers and facilitators in the adoption of telemedicine services, including data security, technical support, and patient experiences in real-world settings. Additionally, longitudinal studies could provide deeper insights into changes in attitudes over time and help develop tailored solutions that enhance trust and the effectiveness of telemedicine in daily clinical practice.

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# The Importance of People Education and the Significance of Lay Cardiopulmonary Resuscitation

## Važnost edukacije laika i značaj laičke kardiopulmonalne reanimacije

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### ABSTRACT

**Introduction:** Cardiopulmonary resuscitation (CPR) provided by lay people is critical to surviving out-of-hospital cardiac arrest. A person experiencing out-of-hospital cardiac arrest is twice as likely to survive when witnesses perform CPR while emergency personnel are en route. Data from the two largest cardiac arrest registries in North America, the Consortium for Resuscitation Outcomes and the Cardiac Arrest Registry to Improve Survival, show an average incidence of lay resuscitation of 39% to 44% for people of all ages experiencing out-of-hospital cardiac arrest treated in EDs.

**Aim:** to determine the level of knowledge of citizens about basic first aid techniques in case of sudden cardiac arrest and their readiness to initiate resuscitation until the arrival of emergency medical personnel.

**Materials i methods:** the workshops and survey were conducted on the territory of the Federation of Bosnia and Herzegovina. Two questionnaires were distributed to all participants - one before the workshop and the other after the workshop.

**Results:** the results of the survey clearly indicate a significant improvement in the knowledge and awareness of citizens of the Federation of Bosnia and Herzegovina about the importance of providing first aid in cases of sudden cardiac arrest. The success of the organization of this practical workshop is confirmed by the fact that after the workshop, 65% of participants stated that they had excellent knowledge of first aid techniques for sudden cardiac arrest, 28% responded very well, 5% good, and only 0.1% said they had average knowledge of first aid for sudden cardiac arrest, and there were no responses that they had poor knowledge of first aid for sudden cardiac arrest.

**Conclusion:** the key piece of information, and at the same time the greatest motivation for further engagement in organizing practical workshops, is that more than 99% of participants, after completing the workshop, responded that they were ready to begin resuscitation if necessary.

**Keywords:** cardiopulmonary resuscitation, lay resuscitation

## SAŽETAK

**Uvod:** kardiopulmonalna reanimacija (KPR) koju pružaju laici ključna je za preživljavanje srčanog zastoja izvan bolnice i osoba koja doživi srčani zastoj izvan bolnice ima dvostruko veće šanse za preživljavanje kada svjedoci izvode KPR dok je osoblje hitne pomoći na putu. Podaci iz dva najveća registra srčanog zastoja u Sjevernoj Americi, Konzorcija za ishode reanimacija i Registra srčanog zastoja za poboljšanje preživljavanja, pokazuju prosječnu incidencu oživljavanja od strane laika od 39% do 44% za osobe svih dobnih skupina koje dožive srčani zastoj izvan bolnice, liječenih u hitnim medicinskim službama.

**Cilj:** utvrditi koliko građani poznaju osnovne tehnike pružanja prve pomoći kod iznenadnog srčanog zastoja i spremnost za započinjanje reanimacije do dolaska osoblja Hitne medicinske pomoći.

**Materijal i metode:** radionice i anketno istraživanje su provedeni na teritoriji Federacije Bosne i Hercegovine. Svim učesnicima su distribuirana dva upitnika - jedan prije održavanja radionice, a drugi nakon završene radionice.

**Rezultat:** provedenog anketnog istraživanja jasno ukazuju na značajan napredak u znanju i svijesti građana Federacije Bosne i Hercegovine o važnosti pružanja prve pomoći u slučajevima iznenadnog srčanog zastoja. Uspješnost organizacije ove praktične radionice potvrđuje podatak da je nakon završene radionice 65% učesnika izjasnilo da izvrsno poznaju tehnike pružanja prve pomoći kod iznenadno srčanog zastoja, 28% je odgovorilo vrlo dobro, 5% dobro, samo 0,1% da ima osrednje znanje iz pružanja prve pomoći kod iznenadnog srčanog zastoja, a odgovora da loše poznaju pružanje prve pomoći kod iznenadnog srčanog zastoja nije bilo.

**Zaključak:** ključni podatak, a istovremeno najveći motiv za dalji angažman u organizacijama praktičnih radionica jeste da je više od 99% učesnika, nakon završene radionice, odgovorilo da su spremni započeti reanimaciju.

**Ključne riječi:** kardiopulmonalna reanimacija, laička reanimacija

## INTRODUCTION

Cardiopulmonary resuscitation by laypersons is essential for survival from out-of-hospital cardiac arrest, and a person experiencing out-of-hospital cardiac arrest has twice the chance of survival when bystanders perform cardiopulmonary resuscitation while emergency medical personnel are en route (1).

The results of numerous studies show that the ideal target time for an emergency medical team to respond to resuscitation is between 7 to 8 minutes in urban areas and 30 minutes in rural areas. The European average is 12 minutes, the American average is 15 minutes, and the Asian average is 9 minutes. In most urban areas, the median emergency medical service response time is 8 to 11 minutes. During the waiting time for the emergency medical team, the quality of the resuscitation and the survival of the victim depend entirely on the actions of laypersons. A one-minute delay in defibrillation reduces survival to discharge by 10-12%, but providing lay cardiopulmonary resuscitation automatically increases survival (2,3).

Data from the two largest cardiac arrest registries in North America, the Consortium for Resuscitation Outcomes and the Cardiac Arrest Registry to Improve Survival, show an average incidence of lay resuscitation of 39% to 44% for people of all ages experiencing out-of-hospital cardiac arrest treated in emergency medical services (4).

There are a number of options for cardiopulmonary resuscitation training, including standard multi-hour courses, workshops, video tutorials, the use of mobile apps, etc (5).

European and global days of themes and early activities change each year, with aim to raise awareness of cardiac arrest and the importance of first aid and cardiopulmonary resuscitation among the general public (6).

Resuscitation guidelines require governments and local authorities to participate in marking World Resuscitation Day and to train citizens in cardiopulmonary resuscitation measures (7).

A 30-minute cardiopulmonary resuscitation training session has been shown to be as effective

in training laypeople and maintaining skills after six months as a standard multi-hour course (8).

Despite the proven benefits of lay cardiopulmonary resuscitation, many states still face challenges in the number of lay people willing to attend to a person with sudden cardiac arrest and perform cardiopulmonary resuscitation. The reasons for the low number of people who are ready to help the victims before the arrival of the emergency medical team lie in the insufficient education of the lay people, the fear of the lay people of causing even greater harm to the victims, lack of self-confidence and various other cultural and social obstacles in society (9).

### AIM

The aim of the survey was to determine how much citizens know basic first aid techniques in sudden cardiac arrest and their readiness to initiate resuscitation until the arrival of the emergency medical team.

### MATERIALS AND METHODS

The workshops and the survey were conducted on the territory of the Federation of Bosnia and Herzegovina. The workshops were held as part of the official global action of the International Liaison Committee on Resuscitation Council (ILCOR) and European Resuscitation Council (ERC).

Two questionnaires were distributed to all participants - one before the workshop, and the other after the workshop.

In order to raise awareness among citizens of the Federation of Bosnia and Herzegovina about the importance of initiating early cardiopulmonary resuscitation until the arrival of the emergency medical team. Members of the Association of Emergency Medical Technicians of the Federation of Bosnia and Herzegovina, as part of marking October 16<sup>th</sup> - World Resuscitation Day under the motto "All Citizens of the World Can Save a Life", organized a workshop on initiating early resuscitation, and conducted a survey on knowledge of basic first aid techniques in sudden cardiac arrest before and after the workshop.

### RESULTS

A total of 211 citizens participated in the survey, 44% men and 56% women.

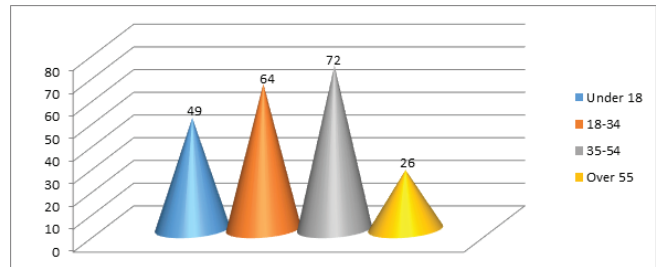


Figure 1 Age structure of participants.

The results of the research show that 23% of the participants were under 18, 33% were between 18-34, 34% of the participants were between 35-54 and 33% of them were over 55.

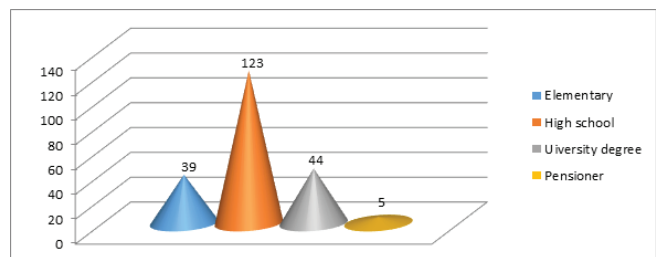


Figure 2 Educational level of participants.

Figure 2 shows that the majority of the participants had at least secondary education (58%), 21% had university degree, and given that a large number of participants were of school age, 18% of participants had primary school education and 2% of the participants were senior citizens.

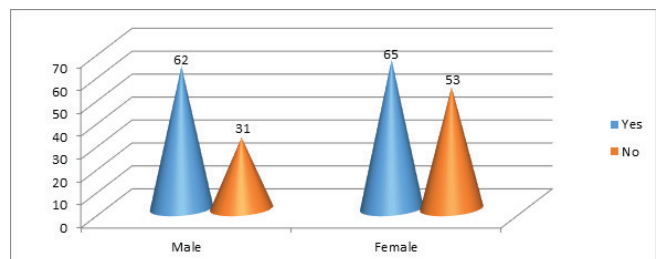


Figure 3 Completed first aid course/education by gender of respondents.

The results of the survey show that 60% of participants had previously completed first aid course/

workshop, while 40% of them had never completed first aid training. Considering that a higher percentage of women participated in the workshop and survey, the results of the survey show that almost equal percentage of both women and men had previously completed first aid course/training.

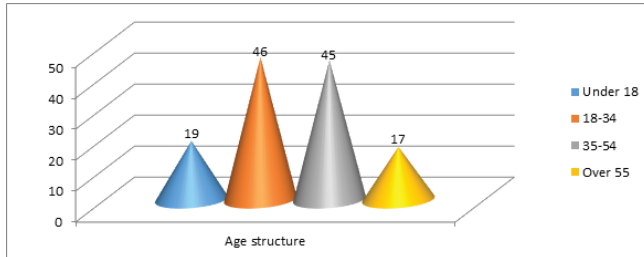


Figure 4 Completed first aid course/education by age structure of respondents.

Based on the age structure, the research results show that a higher percentage of younger respondents had completed first aid course/training (15% under 18 years of age, 36% between 18-34, 35% between 35-54 and only 14% over 55).

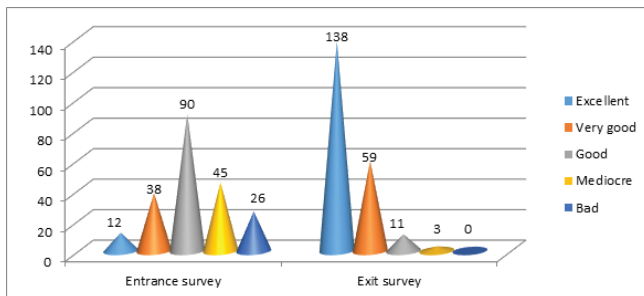


Figure 5 How would you rate your knowledge of first aid?

The results of the research show that before the workshop, only 6% of the respondents stated that they had excellent knowledge of first aid, 18% believed that they had very good knowledge, 43% that they had good knowledge, 22% that they had average knowledge of first aid, while 12% of the participants believed that they had poor knowledge of the first aid techniques.

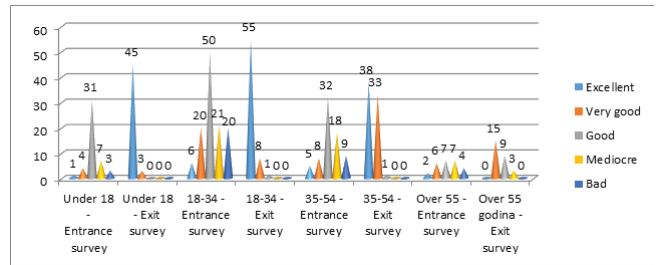


Figure 6 Knowledge regarding first aid according to age structure.

The results of the research show that all participants in the workshop fully adopted practical knowledge and a huge percentage stated that their knowledge of providing first aid was excellent, with the exception of the majority of the participants over 55 years of age, who after the workshop stated that their knowledge was good, which was not the case before the workshop.

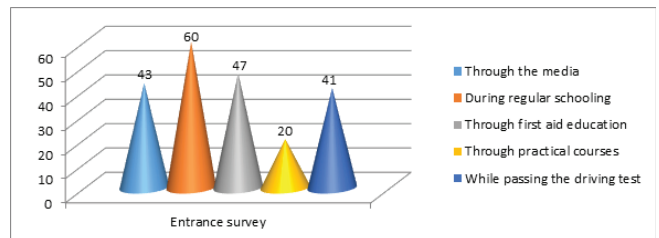


Figure 7 Are you familiar with first aid?

Figure 7 shows that most respondents acquired knowledge during regular education (29%), 22% through first aid courses, 20% through the media, 19% while taking the driving test, and 10% through practical workshop.

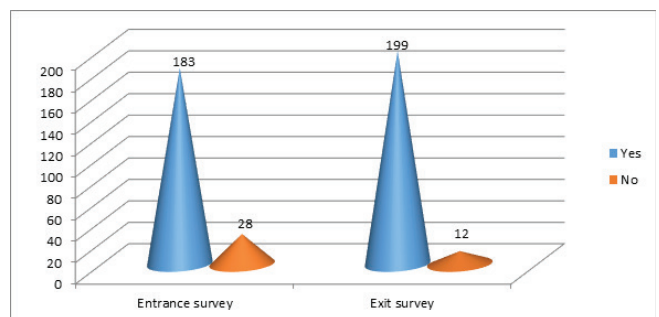


Figure 8 If you were in the situation, would you give first aid to an unconscious person?

The results of the survey show that before the workshop, the majority of participants (87%) stated that they would not provide assistance to an unconscious person, whereas after the workshop, a higher percentage (94%) provided affirmative answers to this question.

By analyzing the responses to this question, we found that almost equal percentages of both women and men answered this question.

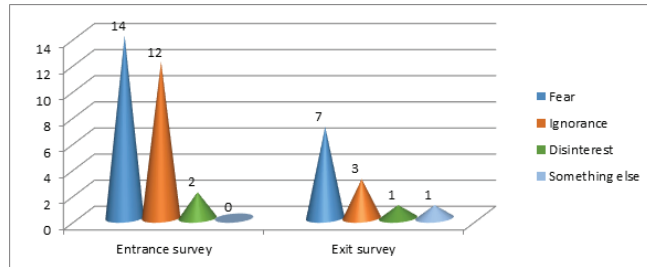


Figure 9 Why would you not provide assistance to an unconscious person?

The results of the survey show that before the workshop, 28 participants (13%) stated that they would not provide assistance to an unconscious person.

Based on the responses of these 28 participants, 14 of them (50%) stated that they would not do that due to fear, 43% due to ignorance, and 7% due to lack of interest.

The results of the exit survey (after the workshop) show that only 12% of participants maintained their position that they would not provide assistance to an unconscious person (58% due to fear, 25% due to ignorance, and 8% due to lack of interest or other reasons).

Based on the responses by the students' gender, the results show that almost equal percentages of both women and men answered this question.

Based on the responses by age structure, the results show that only those over 55 stated that they would not provide assistance to an unconscious person even after participating in the workshop (12 participants).

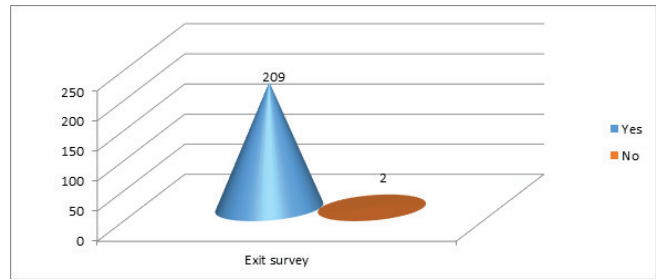


Figure 10 After participating in this practical workshop, I feel fully prepared to provide first aid to a potentially vulnerable person if it occurs in my vicinity?

Figure 10 shows that 99% of the participants responded that after participating in the practical workshop, they were ready to start cardiopulmonary resuscitation, and less than 1% (two women aged between 35-54) stated that they would not start cardiopulmonary resuscitation.

## DISCUSSION

The results of the survey clearly indicate a significant improvement in the knowledge and awareness of citizens of the Federation of Bosnia and Herzegovina about the importance of providing first aid in cases of sudden cardiac arrest after the workshop entitled "All Citizens of the World Can Save a Life".

According to the German Resuscitation Registry, the rate of lay resuscitation increased from approximately 16% in 2008 to 40% in 2020, due to similar actions and campaigns (10,11).

The Kingdom of Norway introduced BLS into the school curriculum in 1961, which reduced the incidence of mortality from sudden cardiac arrest by 25% (12).

Before the workshop, the participants' knowledge of first aid techniques was average (only 6% of respondents considered themselves to have excellent knowledge, while as many as 12% rated their knowledge as poor). However, after the workshop, there was a significant increase in citizens' self-confidence and readiness to act in emergency situations. Almost all participants (99%) stated that now they could apply the learned techniques and begin resuscitation if found in such a situation.

Also, it is interesting to note that younger participants (especially those under 34) showed greater initiative and previous knowledge in the field of first aid, which can be connected to education during school or preparation for the driving test. However, the older population (especially those over 55) reported lower levels of self-confidence even after the workshop. This indicates the need for adapted educational approaches that would include this age group and motivate them for active participation.

The results of the survey show that before the workshop, 28 participants (13%) stated that they would not provide assistance to an unconscious person. Based on the responses of these 28 participants, 14 of them (50%) stated that they would not do that due to fear, 43% due to ignorance, and 7% due to lack of interest. The results of the exit survey (after the workshop) show that only 12% of participants maintained their position that they would not provide assistance to an unconscious person (58% due to fear, 25% due to ignorance, and 8% due to lack of interest or other reasons). Based on the responses by gender of the students, the results show that both women and men answered this question in almost equal percentages. Based on the responses by age structure, the results show that only those over 55 stated that they would not provide assistance to an unconscious person even after participating in the workshop (12 participants).

One of the key challenges identified during the research was fear as the main reason why some participants would not provide first aid. Although the workshop succeeded in reducing the number of respondents who feel insecure, 12% of participants still referred to fear as an obstacle to act. This suggests the need for additional workshops not only to empower participants educationally, but also to build emotional resilience and security in crisis situations.

An anonymous questionnaire conducted as part of the final thesis in the Koprivnica - Križevci County by author Šoštarić in 2019 showed that the population's level of information was relatively high. The research states that 55% of the respondents stated that they would not provide help or cardiopulmonary resuscitation to an injured person due to self-awareness about insufficient knowledge of its application. The aforementioned research showed that the public had a developed awareness of insufficient knowledge, so

they showed a great interest in education about basic life support measures.

## CONCLUSION

The success of the organization of this practical workshop was confirmed by the fact that after the workshop, 65% of the participants stated that they had excellent knowledge of first aid techniques for sudden cardiac arrest, 28% responded very well, 5% well, only 0.1% had an average knowledge of first aid for sudden cardiac arrest, and there were no responses related to poor knowledge of first aid for sudden cardiac arrest. After participating in the workshop, 7% of the participants changed their opinion and answered that they would provide assistance to an unconscious person if they found themselves in such a situation. We emphasize that the majority of the participants answered this question affirmatively. Thus, through the workshop we managed to convince the smaller percentage of participants to provide assistance to an unconscious person, who before the workshop stated that they would not do that. The key data, and at the same time the greatest motivation for further engagement in the organization of practical workshops, was that more than 99% of the participants, after the workshop, responded that they were ready to begin resuscitation.

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# Characteristics of Patients with Increased Risk of Post-stroke Mortality

## Karakteristike pacijenata koji imaju povišen rizik od smrti nakon moždanog udara

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### ABSTRACT

**Introduction:** at the global level, among noncommunicable disorders, stroke is the second leading cause of death and the third leading cause of death and disability combined.

**Aim:** to determine the sociodemographic and health characteristics of patients who died within six months after hospital treatment for ischemic stroke.

**Materials and methods:** this cross-sectional prospective study was conducted among 84 participants using a systematic random sampling method of patients discharged after hospital treatment for stroke in the period from 18 May to 18 July 18 2023. Data were collected through medical history and physical examination during home visits. The modified Rankin Scale was used to assess overall disability, and the Charlson Comorbidity Index was used to assess comorbidities.

**Results:** out of the total 84 participants, 18 died within six months of the follow-up. Among the deceased participants, there were 4 men (22.2%) and 14 women (77.8%), aged 64 to 94, with a mean age of 81.39 years ( $\pm 7.82$ ). The length of hospital stay ranged from a minimum of 10 to a maximum of 29 days, with a mean duration of 16.61 days ( $\pm 4.89$ ). With regard to whether the ischemic stroke (IS) was a first or recurrent episode, 13 participants (72.2%) had a recurrent IS, while the

remaining 5 (27.8%) experienced the first episode. The mean modified Rankin Scale (mRS) score for the deceased participants after hospital discharge was 4.78 ( $\pm 0.55$ ), with a range of 3 to 5 points, all belonging to the significant neurological deficit category (mRS score 3-5). The mean Charlson Comorbidity Index (CCI) score was 3.56 ( $\pm 2.04$ ). Two participants had a CCI score less than 2 (low to moderate comorbidity), while the remaining 16 participants (88.9%) had a CCI score  $\geq 2$ , indicating a high to very high level of comorbidity.

**Conclusion:** the results confirm a higher risk of death among women and individuals with high and very high levels of comorbidity, and longer follow-up of participants may help to better understand the characteristics of individuals who are at increased risk of death after an ischemic stroke.

**Keywords:** ischemic stroke, death, modified Rankin Scale, comorbidities

### SAŽETAK

**Uvod:** na globalnom nivou, među nezaraznim poremećajima, moždani udar je drugi vodeći uzrok smrti i treći vodeći uzrok smrti i invaliditeta zajedno.

**Cilj:** utvrditi socio-demografske i zdravstvene

karakteristike pacijenata koji su preminuli unutar šest mjeseci nakon bolničkog liječenja ishemijskog moždanog udara.

**Materijali i metode:** presječno prospektivno istraživanje među 84 ispitanika metodom slučajnog sistematskog uzorka pacijenata otpuštenih nakon bolničkog liječenja moždanog udara u periodu 18. Maja do 18. jula 2023. godine. Podaci su prikupljeni nakon uzimanja anamneze i obavljenog fizikalnog pregleda u kućnoj posjeti. Korištena je modificirana Rankin skala za procjenu opšte invalidnosti i Charlson indeks za procjenu komorbiditeta.

**Rezultati:** od ukupno 84 ispitanika, 18 je preminulo unutar šest mjeseci praćenja. Među ispitanicima koji su preminuli bilo je zastupljeno 4 muškarca (22,2%) i 14 žena (77,8%), dobi od 64 do 94 godina, prosječne starosti 81,39 godina ( $\pm 7,82$ ). Broj dana hospitalizacije je iznosio od minimalnih 10 do maksimalnih 29 dana sa prosječnom vrijednošću od 16,61 ( $\pm 4,89$ ) dana. Obzirom da li se radilo o prvoj ili ponovnoj epizodi ishemijskog moždanog udara (IMU), nađeno je da su 13 (72,2%) ispitanika imali ponovljeni IMU, a kod preostalih 5 (27,8%) se radilo o prvoj epizodi IMU. Prosječan skor modificirane Rankin skale za uzorak preminulih ispitanika nakon otpusta iz bolnice je bio 4,78 ( $\pm 0,55$ ) sa rasponom između 3 i 5 bodova, te su svi spadali u kategoriju sa značajnim neurološkim deficitom (mRS skor 3 do 5). Prosječan skor CCI je iznosio 3,56 ( $\pm 2,04$ ). Manje od 2 boda na CCI skali su imala 2 ispitanika (niski i umjereni nivo komorbiditeta), a preostalih 16 ispitanika (88,9%)  $\geq 2$  boda što predstavlja visoki i vrlo visoki nivo komorbiditeta.

**Zaključak:** rezultati potvrđuju veći rizik od smrti kod žena i osoba sa visokim i vrlo visokim nivoom komorbiditeta, a praćenje ispitanika duži period može pomoći u boljem razumijevanju karakteristika osoba koje su u povišenom riziku od smrti nakon ishemijskog moždanog udara.

**Cljučne riječi:** ishemijski moždani udar, smrt, modificirana Rankin skala, komorbiditeti

## INTRODUCTION

The number of people who experience a stroke (SU), die from it, or live with disability following a

stroke has increased significantly worldwide between 1990 and 2021: incident strokes by 70%, stroke-related deaths by 44%, with the majority of the global stroke burden occurring in low- and lower-middle-income countries (1).

The WSO/Lancet Neurology Commission on Stroke predicts that globally, between 2020 and 2050, the number of stroke-related deaths will increase by 50% (from 6.6 million people per year to 9.7 million), with the largest share of the burden (77% of prevalent strokes, 87% of fatal strokes, and 89% of DALYs (Disability-Adjusted Life Years) due to stroke) occurring in low- and middle-income countries (2).

The number of people who die from stroke or live with stroke-related disability has nearly doubled over the past three decades, and worldwide, stroke is the second leading cause of death, the third leading cause of death and disability combined (DALYs), and one of the major causes of dementia (1-3).

## AIM

The aim of the study was to determine the socio-demographic and health characteristics of patients who died within six months after hospital treatment for ischemic stroke (IS).

## MATERIALS AND METHODS

A cross-sectional prospective study was conducted among 84 participants using a random systematic sampling method of patients discharged after hospital treatment for ischemic stroke (IS) during the period from 18 May to 18 July 2023. Data were collected based on medical history and physical examinations conducted during home visits. The modified Rankin Scale was used to assess overall disability, and the Charlson Comorbidity Index was used to evaluate comorbidities.

## RESULTS

Out of the total of 84 participants, 18 died within six months of follow-up. Among those who died, 4 were men (22.2%) and 14 were women (77.8%), aged

between 64 and 94 years, with a mean age of 81.39 years ( $\pm 7.82$ ).

Regarding education level, 9 participants (50%) had completed secondary school, while 3 participants (16.7%) had no formal education, 3 (16.7%) had completed primary school, and 3 (16.7%) had a university degree. All 18 deceased participants were retired.

Concerning living arrangements, 4 participants (22.2%) lived alone, 9 (50%) lived with a family, and 5 (27.8%) resided in a long-term care facility for elderly and frail. A negative family history of stroke was reported in 16 deceased participants (88.9%), while 2 participants (11.1%) had a positive family history.

Two participants (11.1%) were smokers, and none of the deceased participants consumed alcohol.

Seven deceased participants (38.9%) were hospitalized at the Neurology Clinic of the Clinical Center University of Sarajevo, while 11 (61.1%) were treated at the Department of Neurology of the Public Institution General Hospital "Prim. dr. Abdulah Nakaš."

The length of hospitalization ranged from 10 to 29 days, with a mean of 16.61 days ( $\pm 4.89$ ). Regarding whether the ischemic stroke episode was a first or recurrent event, 13 participants (72.2%) had a recurrent stroke, and 5 participants (27.8%) experienced their first stroke episode.

The side of the body affected by neurological deficits was the right side in 11 cases (61.1%), the left side in 5 cases (27.8%), and both or neither in one participant each.

The mean NIHSS score for the deceased participants at the first visit was 15.78 ( $\pm 4.76$ ), ranging from 6 to 22 points, indicating moderate to severe disability (NIHSS score  $\geq 6$ ) in all participants.

The mean FIM score at the first visit was 26.11 ( $\pm 14.70$ ), ranging from 18 to 70 points, with all participants classified as moderately to completely dependent in daily living activities.

The mean modified Rankin Scale score at the first visit was 4.78 ( $\pm 0.55$ ), ranging from 3 to 5, indicating

significant neurological deficit in all participants (mRS score 3–5).

The mean Charlson Comorbidity Index (CCI) score at the first visit was 3.56 ( $\pm 2.04$ ). Two participants had a CCI score below 2 (low to moderate level of comorbidity), while the remaining 16 participants (88.9%) had a score of  $\geq 2$ , representing a high to very high level of comorbidity.

Table 1 Assessment of stroke severity and functional status.

Scale	M	SD	Range of scores	Category
NIHSS 1	15.78	$\pm 4.76$	6 - 22	Moderate to severe disability
FIM 1	26.11	$\pm 14.70$	18 - 70	Moderate to complete dependence in activities of daily living (ADL)
mRS	4.78	$\pm 0.55$	3 - 5	Significant neurological deficit
CCI 1	3.56	$\pm 2.04$	1 - 8	High and very high level of comorbidity

## DISCUSSION

Our research included 84 participants who received AIMU treatment at the Public Health Institution, Health Center of the Sarajevo Canton. Out of the total number of participants included at the first visit, 18 (21.4%) died within the following six months.

In 2020, there were 7.08 million deaths worldwide attributed to cerebrovascular disease. Out of this number, 3.48 million deaths were due to ischemic stroke, 3.25 million deaths due to intracerebral hemorrhage, and 0.35 million due to subarachnoid hemorrhage. Eastern Europe and Central Asia have the highest mortality rates attributable to cerebrovascular disease. There are significant geographical differences in the distribution of cerebrovascular diseases globally, in Europe, and even within individual countries. At the global level, the greatest burden is in low-income

countries. Globally, the proportion of deaths caused by cerebrovascular disease increased by 47% in 2021 compared to 1990, and among neighboring countries, North Macedonia and Montenegro were among the top ten countries with the highest cerebrovascular mortality rates per 100,000 inhabitants. According to the Global Burden of Disease study, in 2019 ischemic stroke accounted for 62.4% of all stroke incidence, hemorrhagic stroke 27.9%, and subarachnoid hemorrhage 9.7%. If current trends continue, by 2050 there will be approximately 200 million stroke survivors, 25 million new cases annually, and 13 million deaths from stroke each year (4-7).

According to data from the Public Health Institute of the Federation of Bosnia and Herzegovina (FBiH), the 2022 Health Statistical Yearbook shows that the epidemiological situation mirrors the global trend. In FBiH, 23,187 people died in 2022. The leading causes of death were circulatory system diseases, and the waning pandemic, COVID-19 infection ranked second among the leading causes of death in FBiH in 2022. The five leading causes of death in FBiH in 2022 were acute myocardial infarction (2,438), confirmed COVID-19 (1,926), stroke - cerebral infarction (1,755), essential (primary) hypertension (1,553), and malignant neoplasms of the bronchi and lungs (1,037). Among women, stroke was the second leading cause of death with a mortality rate of 89/100,000, while among men it ranked fourth with a rate of 69/100,000. Circulatory system diseases (I00-I99) were the second leading group of diseases, conditions, and injuries in FBiH in 2022, after respiratory system diseases (J00-J99), while among chronic non-communicable diseases registered in primary healthcare in FBiH in 2022, they ranked first with a rate of 1,466/10,000 inhabitants. The leading causes of death in FBiH and Sarajevo Canton are from the group of non-communicable diseases (8,9).

The situation is similar in neighboring countries. In Croatia, cerebrovascular disease has been the second leading cause of death for years. In Serbia, about 1.3% of the population experienced stroke in 2019, with stroke being slightly more common in men (1.5%) than in women (1.0%). Circulatory system diseases, accounting for 47.3% of all causes of death, were the leading cause of mortality in Serbia in 2022, with ischemic heart disease and cerebrovascular diseases together being the leading causes of death within this group (10-13).

Although incidence, prevalence, mortality, and DALY rates decreased from 1990 to 2017, the absolute number of people experiencing new strokes, dying, surviving, or living with disability due to stroke nearly doubled. The highest mortality rates from cerebrovascular disease are observed in Serbia, Russia, and other Eastern European countries (90 -124/100,000) (14).

## CONCLUSION

The results confirm a higher risk of death among women and individuals with high and very high levels of comorbidity, and longer-term follow-up of participants may help to better understand the characteristics of people with the increased risk of death after ischemic stroke.

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# The Impact of the COVID - 19 Pandemic on Verbal and Physical Attacks against Healthcare Professionals in Hospitals in the Federation of Bosnia and Herzegovina

## Uticaj pandemije COVID - 19 na verbalne i fizičke napade na zdravstvene profesionalce u bolnicama u Federaciji Bosne i Hercegovine

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### ABSTRACT

**Introduction:** The Agency for Quality and Accreditation in Healthcare of the Federation of Bosnia and Herzegovina (AKAZ) is the only competent institution responsible for developing optimal safety and quality standards, and monitoring quality and safety indicators in healthcare institutions. Officially, over fifty percent of the Federation of Bosnia and Herzegovina hospitals do not meet the optimal safety standards, whereas the safety of healthcare professionals and the reporting incident situations system remain at an unsatisfactory level. The COVID-19 pandemic has changed the world, and healthcare professionals, as the first line of defense against the virus, have faced numerous challenges in their noble efforts, the consequences of which are still present.

**Aim:** to determine whether during the course of the pandemic there was an increase or decrease in the number of verbal and physical assaults on healthcare professionals in the Federation of Bosnia and Herzegovina hospitals based on publicly available AKAZ data on quality and safety indicators, and to draw conclusions regarding the reporting of incident situations in the healthcare system of the Federation

of Bosnia and Herzegovina relying on the same publicly available data.

**Results:** based on the review of publicly available reports on quality and safety indicators in the Federation of Bosnia and Herzegovina hospitals, an increase in the number of verbal and physical attacks on healthcare professionals in hospitals was established compared to 2019, specifically by 15.60% in 2020, 24.27% in 2021, and 8.38% in 2022. Additionally, the analysis of the reports revealed that high percentages of institutions did not report incident and adverse events, indicating that a significant number of attacks on healthcare professionals and other incident situations, in fact, remained undocumented.

**Conclusion:** healthcare professionals employed in the Federation of Bosnia and Herzegovina hospitals were exposed to a higher number of physical and verbal attacks during the COVID-19 pandemic compared to the period before the pandemic.

**Keywords:** COVID-19, attacks on healthcare professionals, certification, incident situations, adverse events in hospitals

## SAŽETAK

**Uvod:** Agencija za kvalitet i akreditaciju u zdravstvu u Federaciji Bosne i Hercegovine (AKAZ) jedini je nadležni organ za razvoj optimalnih standarda sigurnosti i kvaliteta, kao i praćenje indikatora kvaliteta i sigurnosti u zdravstvenim ustanovama. Više od pedeset procenata bolnica u Federaciji Bosne i Hercegovine zvanično ne zadovoljava optimalne standarde sigurnosti, a sigurnost zdravstvenih profesionalaca i sistem prijavljivanja incidentnih situacija na nezadovoljavajućem su nivou. Pandemija COVID - 19 virusa promijenila je svijet, a zdravstveni profesionalci kao prva linija odbrane svijeta od ovog virusa pretrpili su mnogo poteškoća u svojoj plemenitoj borbi, čije posljedice se osjete i danas.

**Cilj istraživanja:** na osnovu javno dostupnih podataka AKAZ-a o indikatorima kvaliteta i sigurnosti utvrditi da li je u toku trajanja pandemije došlo do povećanja ili smanjenja broja verbalnih i fizičkih napada na zdravstvene profesionalce u bolnicama u Federaciji Bosne i Hercegovine, te na osnovu istih javno dostupnih podataka izvesti zaključke o prijavljivanju incidentnih situacija u zdravstvenom sistemu Federacije Bosne i Hercegovine.

**Rezultati:** na osnovu pregleda javno dostupnih izvještaja o indikatorima kvaliteta i sigurnosti u bolnicama u Federaciji Bosne i Hercegovine utvrđeno je uvećanje broja verbalnih i fizičkih napada na zdravstvene profesionalce u bolnicama u odnosu na 2019. godinu, i to 15,60% za 2020. godinu, 24,27% za 2021. godinu i 8,38% za 2022. godinu. Također, analizom navedenih izvještaja utvrdili smo i visoke procenat ustanova koje ne prijavljuju incidentne i nepovoljne događaje shodno, što upućuje na činjenicu da je veliki broj napada na zdravstvene profesionalce i druge incidentne situacije zapravo nedokumentovan.

**Zaključak:** zdravstveni profesionalci zaposleni u bolnicama u Federaciji Bosne i Hercegovine u toku trajanja pandemije COVID - 19 virusa bili su izloženi većem broju fizičkih i verbalnih napada u odnos na period prije pandemije.

**Ključne riječi:** COVID-19, napadi na zdravstvene profesionalce, certifikacija, incidentne situacije, nepovoljni događaji

## INTRODUCTION

Quality and safety in the healthcare system of the Federation of Bosnia and Herzegovina is exclusively under the jurisdiction of the Agency for Quality and Accreditation in Healthcare of the Federation of Bosnia and Herzegovina (AKAZ), being established on the Law on the System for Quality Improvement, Safety, and Accreditation in Healthcare. According to the same law (1), AKAZ, among other responsibilities, is tasked with developing optimal safety standards for the certification process of healthcare institutions, developing optimal quality standards for the accreditation process, and annual monitoring of quality and healthcare institutions safety indicators at all levels of organized healthcare within the Federation of Bosnia and Herzegovina. The safety of healthcare professionals and patients is a key dimension and a prerequisite for establishing a quality system in healthcare institutions. In other words, there is no quality without the safety of patients and healthcare professionals. Although AKAZ has existed for twenty years and spent seven million BAM from public funding during this period, quality and safety in the healthcare system of the Federation of Bosnia and Herzegovina still remains at an unsatisfactory level, with more than fifty percent of healthcare institutions officially failing to meet the minimum optimal safety standards, that is, holding certified status (2). Such data, although alarming under "normal" circumstances, represent just another in a series of poor indicators of the rule of law in the Federation of Bosnia and Herzegovina healthcare system. However, in emergency situations, such as the COVID-19 pandemic, they become obstacles for the functioning of the system as a whole, and such emergency conditions fully expose the lack of safety for patients and healthcare professionals in our healthcare system, when most needed.

A prime indicator for such claims is the official AKAZ data on the increase in verbal or physical attacks on hospital staff during the pandemic years (2020, 2021 and 2022) compared to 2019 and 2023, while various studies (3,4,5) clearly indicate that the COVID-19 pandemic period significantly affected the mental and physical health of healthcare professionals. This is not the first such case in world history, as healthcare professionals are always the first line of defense against all possible epidemics and emergent situations in healthcare. In Bosnia and Herzegovina,

from March 2020, the enactment of the Order declaring the COVID-19 infectious disease epidemic (6), until the Order terminating the COVID-19 epidemic (7), more than 16,000 people lost their lives, and over 400,000 cases of infection were recorded (8). During the peaks of the pandemic in the Federation of Bosnia and Herzegovina, as well as at its very beginning, the treatment of the most severely ill patients and the initial response to all pandemic challenges primarily fell on the entity hospitals and clinical centers. Although the initial public attitude towards healthcare professionals was positive, given all the challenges they faced during this period, publicly available data on the number of verbal and physical attacks on healthcare professionals (9, 10, 11, 12, 13) clearly indicated a trend of increasing attacks at the peak of the pandemic (2020 and 2021) compared to the post-pandemic period in 2023. It is also important to take into account the high degree of non-standardization in the healthcare system of the Federation of Bosnia and Herzegovina and the low level of reporting incident situations to AKAZ, as confirmed by the low percentage of certified institutions (2), as well as publicly available data on quality and safety indicators regarding adverse events in the Federation of Bosnia and Herzegovina hospitals (9, 10, 11, 12, 13). This leads to the conclusion that the overall level of safety for healthcare professionals in the Federation of Bosnia and Herzegovina is low, and under conditions of high uncertainty in emergency situations, this problem is particularly serious.

## AIM

Based on the circumstances and facts presented in the introduction, the aim of this study was to determine whether the number of attacks on healthcare professionals in hospitals increased or decreased during the COVID-19 pandemic based on publicly available data on the number of verbal and physical attacks on healthcare professionals. Furthermore, using the same publicly available data, the study aimed at drawing conclusions regarding the reporting of incident situations in the Federation of Bosnia and Herzegovina healthcare system, specifically through the official reporting of the Federation hospitals on quality and safety indicators. Additionally, the aim of the study was to assess the current state of safety in healthcare institutions by reviewing publicly available registries, regarding the compliance with

legal standards related to optimal safety standards, and regarding the official certification status of the Federation of Bosnia and Herzegovina hospitals.

## MATERIALS AND METHODS

For the purposes of this study, publicly available reports on quality and safety indicators in the Federation of Bosnia and Herzegovina hospitals from 2019 to 2023 were used as the primary source of information, with particular focus on the “verbal or physical attack on staff” indicator. Based on the AKAZ Methodological Guidelines for the Collection of Hospital Quality and Safety Indicators, the “verbal or physical attack on staff” indicator is defined as a safety domain indicator, which is a part of a set of indicators related to adverse events that must be reported. This indicator may reflect suboptimal working conditions and refers to the total number of staff attacks during the reporting year (14). Based on the review of publicly available reports intended for quality coordinators, specifically:

- Review of quality and safety indicators for 2019 for hospitals in the Federation of Bosnia and Herzegovina (9)
- Review of quality and safety indicators for 2020 for hospitals in the Federation of Bosnia and Herzegovina (10)
- Report on quality and safety indicators for hospitals in the Federation of Bosnia and Herzegovina for 2021 (11)
- Report on quality and safety indicators for hospitals in the Federation of Bosnia and Herzegovina for 2022 (12)
- Report on quality and safety indicators for hospitals in the Federation of Bosnia and Herzegovina for 2023 (13)

we conducted a comparative analysis of the safety-domain indicator reported values for 2019, 2020, 2021, 2022, and 2023, and using quantitative methods, identified any deviations in the reported number of attacks on healthcare professionals. Subsequently, based on the induction and deduction methods, conclusions were made on the number of attacks on healthcare professionals employed in hospitals during the COVID-19 pandemic. Based on publicly available data from the Registry of Accredited/Certified

Institutions (2), general conclusions were made on the overall state of the safety system implementation in the Federation of Bosnia and Herzegovina hospitals.

## RESULTS

**Table 1 Overview of the values of the ‘verbal or physical attack on staff’ indicator for the period from 2019 to 2023 (9, 10, 11, 12, 13).**

Verbal or physical attack on hospital staff					
Year	2019	2020	2021	2022	2023
Minimal value	0 (x9)	0 (x6)	0 (x3)	0 (x2)	0 (x10)
Maximum value	42	41	45	32	20
Average value	6.92	8.00	8.60	7.50	3.86

Note: numbers in brackets indicate the number of hospitals reporting the given value.

Table 1 presents a comparative overview of the number of verbal and physical attacks in the Federation of Bosnia and Herzegovina hospitals for the period from 2019 to 2023. According to the “Overview of Quality and Safety Indicators for 2019 for Hospitals in the Federation of Bosnia and Herzegovina” (9), out of the total of 22 Federation of BiH hospitals participating in providing data on quality and safety indicators, 14 hospitals submitted requested data, whereas 8 of them did not provide any data for the required period. In 2019, the average number of verbal or physical attacks on staff was 6.92, nine hospitals did not report any incidents of this type, and the highest reported value was 42 attacks on healthcare professionals during the 2019 reporting year. According to the “Overview of Quality and Safety Indicators for 2020 for Hospitals in the Federation of Bosnia and Herzegovina” (10), out of the total of 22 hospitals participating in providing data, 13 submitted requested data, whereas 9 did not provide any data for the required period. The average number of verbal or physical attacks on staff in 2020 was 8.00, six hospitals did not report any incidents of this type, and the highest reported value was 41 attacks on healthcare professionals during the 2020 reporting year. Based on the “Report on Quality and Safety Indicators for Hospitals in the Federation of Bosnia and Herzegovina for 2022” (12), out of the total

of 23 hospitals in the Federation of BiH participating in providing data on quality and safety indicators, 15 hospitals submitted requested data, whereas 8 did not provide any data for the given period. The average number of verbal or physical attacks on staff in 2022 was 7.50, two hospitals did not report any incidents of this type, and the highest reported value was 32 attacks on healthcare professionals during the 2022 reporting year. According to the “Report on Quality and Safety Indicators for Hospitals in the Federation of Bosnia and Herzegovina for 2023” (13), out of the total of 26 hospitals in the Federation participating in providing data, 21 hospitals submitted requested data, whereas 6 did not provide any data for the given period. The average number of verbal or physical attacks on staff in 2023 was 3.86, ten hospitals did not report any incidents of this type, and the highest reported value was 20 attacks on healthcare professionals during the 2023 reporting year.

**Table 2 Number of hospitals which did not submit data on indicator values for adverse events (9, 10, 11, 12, 13).**

Number of hospitals which did not submit data on indicator values for adverse events					
Year	2019 (14/8)	2020 (13/9)	2021 (13/9)	2022 (15/8)	2023 (21/26)
Postoperative wound infection (proportion per 1000 patients)	3	4	4	4	7
Decubitus - pressure ulcer (proportion per 1000 patients)	2	4	3	3	5
Patient burns (proportion per 1000 patients)	4	4	3	3	3
Transfusion reaction (proportion per 1000 patients)	5	5	4	4	7
Maternal death related to childbirth (proportion per 1000 patients)	6	6	6	7	11
Suicide in hospital (proportion per 10,000 patients)	4	2	2	2	4
Attempted suicide in hospital (proportion per 10000 patients)	4	3	2	2	4
Surgical procedure performed on the wrong patient	1	4	6	8	10
Surgical procedure performed on the wrong body part or organ	1	4	6	8	10
Instrument or item left at the surgical site requiring a new operation or additional procedure	1	4	6	8	8
Verbal or physical attack on staff in hospitals	3	3	3	3	6

Note: numbers in brackets under the year refer to the number of hospitals which submitted data on quality and safety indicators / the number of hospitals that did not submit data on quality and safety indicators

Based on Table 2, “Number of hospitals that did not submit data on indicator values for adverse events,” it is evident that a large number of hospitals in the Federation of Bosnia and Herzegovina do not monitor the set of indicators related to adverse events. This may indicate a low level of standardization and reporting of incident and adverse events in the Federation of Bosnia and Herzegovina hospitals, which further suggests that the values presented in Table 1 are approximate rather than actual values. If reporting were complete, the numbers would likely be higher, although even the reported figures represent alarming indicators regarding the safety of healthcare professionals in the Federation of Bosnia and Herzegovina hospitals. A similar conclusion regarding the level of standardization in the healthcare system of the Federation of Bosnia and Herzegovina can be drawn from the publicly available Registry of Accredited/Certified Institutions (2), which shows that only 8 hospitals and few departments and clinics within hospitals meet the legally required optimal safety standards. This represents less than fifty percent of all hospitals in the Federation of Bosnia and Herzegovina, given that a comprehensive registry of all healthcare institutions authorized to perform hospital activities in the Federation, de facto, does not exist.

## DISCUSSION

Based on our research, we can conclude that the highest number of reported verbal or physical attacks on healthcare professionals occurred in 2021, the peak year of the COVID-19 pandemic in Bosnia and Herzegovina. Compared to 2019, the year before the pandemic, there was an increase in attacks on healthcare professionals over the following three years of the pandemic, as follows:

- 15.60% more verbal or physical attacks on staff in 2020 compared to 2019
- 24.27% more verbal or physical attacks on staff in 2021 compared to 2019
- 8.38% more verbal or physical attacks on staff in 2022 compared to 2019

In 2023, the year in which the official Order terminating the COVID-19 epidemic was enacted (7), an average of 3.86 verbal or physical attacks on staff was recorded, representing 44.21% decrease compared to 2019. When analyzing these results, it is important to take into account that a large number of hospitals report minimal values for this indicator in all the observed years. This does not necessarily reflect the actual situation in hospitals, given the low number of institutions with developed safety systems and reporting adverse events mechanisms, as evident from the data presented in Table 2 and the Registry of Accredited/Certified Institutions. Although being a key part of the healthcare system in responding to emergency situations such as the COVID-19 pandemic, healthcare professionals in the Federation of Bosnia and Herzegovina hospitals were exposed to a higher number of verbal and physical attacks during the pandemic despite all the challenges they faced. This finding was further supported by other studies (3,4,5), which showed that healthcare professionals experienced significant difficulties, both during and after the pandemic, with lasting consequences for a substantial portion of them. Overall, compliance with optimal safety standards in the Federation of Bosnia and Herzegovina is still at discouraging level, and the actual situation on the ground, due to inadequate reporting of adverse events and incidents, is likely to be even worse regarding the actual number of attacks on healthcare professionals.

## CONCLUSION

Based on the data presented in this study, it could be concluded that healthcare professionals employed in the Federation of Bosnia and Herzegovina hospitals were exposed to a higher number of physical and verbal attacks during the COVID-19 pandemic compared to the pre-pandemic period; that the highest number of reported attacks on healthcare professionals was recorded in 2021, the peak of the pandemic year, with a reported increase of 24.27% in verbal and physical attacks on healthcare professionals compared to 2019; and that the healthcare system of the Federation of Bosnia and Herzegovina has a low level of standardization regarding compliance with optimal safety standards, and the system for reporting adverse and incident events is out-of-date, resulting in lack of such events actual number.

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# Significance of the BioFire FilmArray® Platform for Rapid Detection of the Causative Agents of Meningitis/Encephalitis and Sepsis

## Značaj BioFire FilmArray® platforme za brzu detekciju uzročnika meningitisa/encefalitisa i sepse

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### ABSTRACT

**Introduction:** bacterial meningitis or sepsis can result in severe organ damage or even death. Correct treatment depends on the quick identification of the causative agent, both bacteria and viruses and fungi. Obtaining rapid results of specific pathogens causing meningitis/encephalitis or sepsis using the *BioFire FilmArray*® advanced diagnostic platform can greatly assist in ruling out the diagnosis of suspected meningitis or sepsis and in selecting appropriate antimicrobial therapy.

**Materials and methods:** the BioFire ME and BioFire BCID2 panels were used to detect Meningitis/encephalitis and sepsis pathogens. The Meningitis/Encephalitis Panel (BioFire ME) FilmArray is an integrated test that targets 14 of the most common bacterial, viral, and fungal pathogens of Meningitis/encephalitis. The BIOFIRE® Blood Culture Identification 2 (BCID2) Panel detects 43 pathogens associated with sepsis, including bacteria and yeasts, as well as 10 antimicrobial resistance genes in positive blood culture specimens. A 0.2 ml sample of cerebrospinal fluid (CSF)/blood culture was used for analysis.

**Results:** the study included a total of 364 samples taken in the course of 2024, of which 68 were cerebrospinal fluid samples and 296 blood culture samples. Out of the total number of the tested

cerebrospinal fluid samples, 32.4% (22/68) were positive, and 89.9% of blood cultures (250/296). The most frequently detected bacteriological pathogens from cerebrospinal fluid samples were *Streptococcus pneumoniae*, *Neisseria meningitidis*, and from viruses, *enteroviruses* and *Herpes simplex virus*. Pathogens isolated from blood culture samples were *Acinetobacter baumannii*, *Klebsiella pneumoniae*, *Escherichia coli*, *Coagulase-negative staphylococcus (CoNS)* and *Staphylococcus aureus*. *Candida parapsilosis* was the most prevalent pathogen from the yeast group.

**Conclusion:** compared to conventional microbiological diagnostic methods, BioFire is an advanced diagnostic platform enabling rapid and accurate identification of the causative agents of meningitis/encephalitis and sepsis, multiple bacterial, viral and fungal nucleic acids, as well as certain genetic determinants associated with antimicrobial resistance, which allows for diagnosis in a short time frame of 1.5 hours.

**Keywords:** *BioFire*, meningitis, sepsis, antimicrobial resistance

## SAŽETAK

**Uvod:** bakterijski meningitis ili sepsa mogu imati za posljedicu teška oštećenja organa ili čak dovesti do smrtnog ishoda. Pravilno liječenje ovisi o brznoj identifikaciji uzročnika, kako bakterija, tako virusa i gljiva. Dobivanje brzih rezultata specifičnih patogena uzročnika meningitisa/encefalitisa ili sepse pomoću *BioFire FilmArray*® napredne dijagnostičke platforme može uveliko pomoći za isključivanje dijagnoze kod sumnje na meningitis ili sepsu kao i u odabiru odgovarajuće antimikrobne terapije.

**Materijali i metode:** za detekciju uzročnika meningitisa/encefalitisa i sepse korišteni su paneli *BioFire ME* i *BioFire BCID2*. Panel test za meningitis/encefalitis (*BioFire ME*) FilmArray je integrisani test koji cilja na 14 najčešćih bakterijskih, virusnih i gljivičnih uzročnika meningitisa/encefalitisa. *BIOFIRE*® *Blood Culture Identification 2 (BCID2) Panel* detektuje 43 uzročnika povezanih sa sepsom, uključujući bakterije i kvasnice, kao i 10 gena povezanih s rezistencijom na antimikrobne lijekove u pozitivnim uzorcima hemokulture. Za analizu smo koristili uzorak od 0,2 ml cerebrospinalne tečnosti (likvora) / hemokulture.

**Rezultati:** studija je obuhvatila ukupno 364 uzorka, od čega je bilo 68 uzoraka likvora i 296 uzoraka hemokulture tokom 2024. godine. Od ukupnog broja testiranih uzorka likvora, pozitivnih je bilo 32,4% (22/68), a hemokultura 89,9% (250/296). Najčešće detektovani bakteriološki patogeni iz uzoraka likvora bili su *Streptococcus pneumoniae*, *Neisseria meningitidis*, a od virusa enterovirusi i *Herpes simplex virus*. Patogeni izolovani iz uzoraka hemokulture su *Acinetobacter baumannii*, *Klebsiella pneumoniae*, *Eschericia coli*, *Coagulase-negative staphylococcus* (CoNS) i *Staphylococcus aureus*. *Candida parapsilosis* bio je najzastupljeniji patogen iz grupe kvasnica.

**Zaključak:** u odnosu na konvencionalne metode mikrobiološke dijagnostike, *BioFire* je napredna dijagnostička platforma koja omogućava brzu i preciznu identifikaciju uzročnika meningitisa/encefalitisa i sepse više bakterijskih, virusnih i gljivičnih nukleinskih kiselina, kao i pojedinih genetskih determinanti povezanih s antimikrobnom rezistencijom koja u kratkom vremenskom okviru od 1.5h omogućava uspostavljanje dijagnoze.

**Cljučne riječi:** *BioFire*, meningitis, sepsa, antimikrobna rezistencija

## INTRODUCTION

Bacterial meningitis and sepsis are medical emergencies and potentially life-threatening conditions which, if not diagnosed and treated in a timely manner, may lead to severe complications, permanent organ damage, or death (1).

Despite advances in modern medicine, the mortality rate associated with sepsis remains high, particularly among immunocompromised and hospitalized patients (2).

A key factor in the successful treatment of these conditions is the early and accurate identification of the causative infectious agent. Conventional microbiological methods, although considered the gold standard, often require a longer time to produce results, which may delay the initiation of targeted antimicrobial therapy (3).

The development of molecular diagnostic methods has enabled rapid detection of pathogens directly from clinical specimens. *BioFire FilmArray*® is an automated, syndromic diagnostic platform that allows simultaneous detection of a wide range of bacterial, viral, and fungal pathogens, as well as certain genes associated with antimicrobial resistance, within approximately 1.5 hours (4,5).

*BioFire TORCH* represents the latest advancement in the molecular diagnosis of infectious diseases. It is an automated in vitro diagnostic system intended for use in combination with reagent pouches specific to individual tests, designed to detect multiple nucleic acid targets present in clinical specimens. The system processes the reagents contained in the pouches to purify nucleic acids and amplify target nucleic acid sequences using nested multiplex polymerase chain reaction (PCR) in a closed system (4,5).

The *BioFire* system offers ease of use, requiring only about two minutes of hands-on time and providing results in approximately one hour. Training requirements are minimal, and the software guides the user through the entire molecular testing process.

The BioFire® Blood Culture Identification 2 (BCID2) Panel is a multiplex nucleic acid–based test intended for use with the BioFire® FilmArray® TORCH system for the simultaneous qualitative detection and identification of multiple bacterial and fungal nucleic acids, as well as selected genetic determinants associated with antimicrobial resistance. The test is performed directly from blood culture samples that have been identified as positive by a continuous blood culture monitoring system (Bact/Alert Virtuo). Results should be interpreted in conjunction with Gram stain findings (5).

### BioFire ME Panel

Bacterial meningitis can be fatal in healthy individuals within 24 to 48 hours. Appropriate treatment depends on the rapid identification of the causative agent, whether bacterial, viral, or fungal. The BioFire ME Panel is an FDA-approved syndromic test that targets 14 of the most common bacterial, viral, and fungal pathogens responsible for infections of the central nervous system.

The BioFire® FilmArray® Meningitis/Encephalitis (ME) Panel is a qualitative, multiplex, in vitro diagnostic test based on nucleic acid detection and is intended for use with the BioFire® FilmArray® system. It enables the simultaneous detection and identification of multiple bacterial, viral, and fungal nucleic acids directly from cerebrospinal fluid (CSF) specimens obtained by lumbar puncture from individuals presenting with signs and/or symptoms of meningitis and/or encephalitis (4,5).

## MATERIALS AND METHODS

The study included blood samples (positive blood cultures) and cerebrospinal fluid (CSF) samples taken from patients from various departments of the Clinical Center University of Sarajevo, which were received at the Clinical Microbiology Unit. A total of 364 clinical samples were included in the study during the period from 1 January 2024 to 31 December 2024.

For the detection of causative agents of meningitis/encephalitis, the BioFire ME Panel was used, targeting 14 of the most common pathogens responsible for meningitis and encephalitis. For the detection of sepsis-causing pathogens, the BioFire BCID Panel was

used, which enables the detection of 43 pathogens and 10 resistance genes associated with sepsis.

For the analysis, a volume of 0.2 mL of cerebrospinal fluid (CSF) and the same volume of blood (positive blood cultures) was used.

## RESULTS

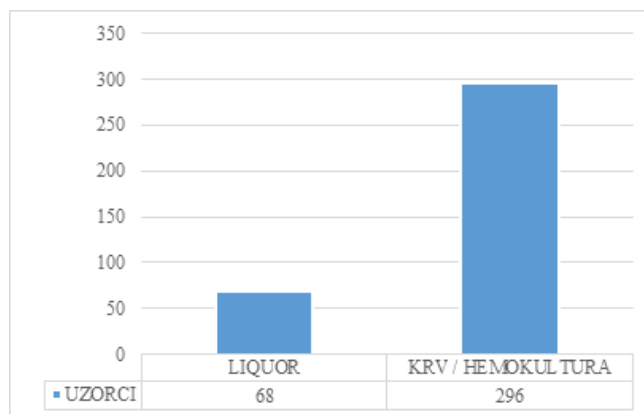


Figure 1 Number of liquor and blood samples received.

The study included a total of 364 samples, specifically 68 cerebrospinal fluid samples and 296 blood culture samples, taken in the course of 2024.

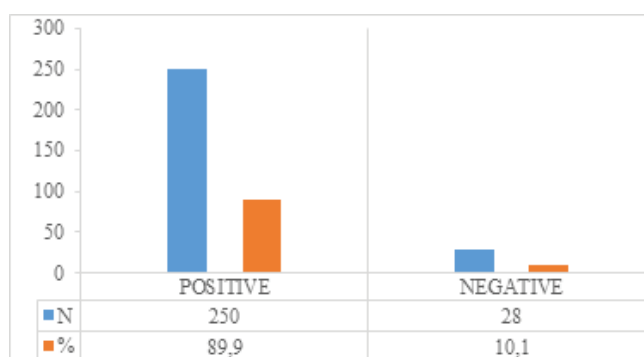


Figure 2 Ratio of positive and negative blood samples.

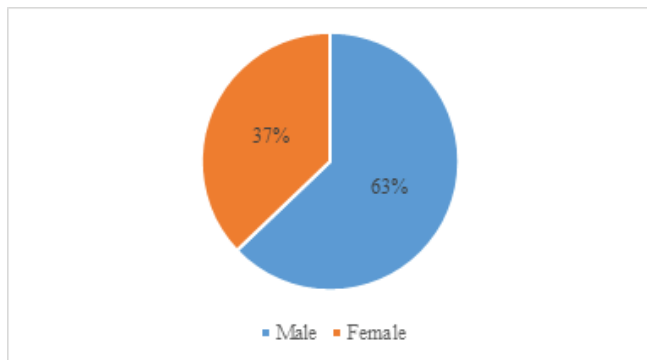


Figure 3 Review of respondents in relation to gender.

In the study, the male population dominated with a total of 63% of respondents compared to the female population, which accounted for 37%. There were a total of 250 positive samples, and a total of 28 negative samples, as shown in (Figure 1).

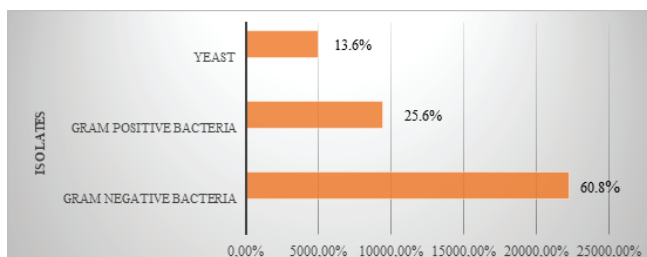


Figure 4 Ratio of number of isolates detected.

In relation to the number of detected isolates (Figure 4), the most prevalent were Gram-negative bacteria, which accounted for as much as 60.8%, followed by Gram-positive bacteria with 25.6% and the least represented were yeasts with only 13.6%.

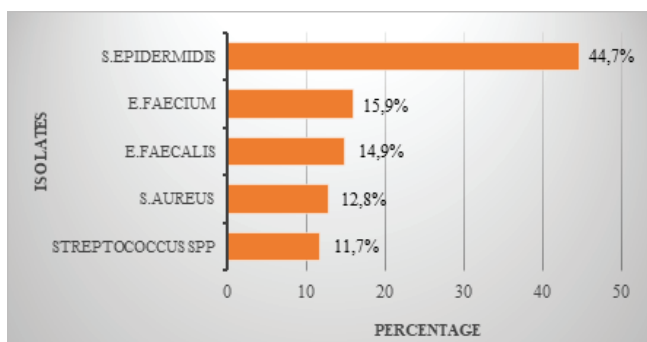


Figure 5 Representation of isolates in Gram positive bacteria.

Figure 5 shows the representation of Gram-positive bacteria, of which the most represented was Staphylococcus epidermidis 44.7%, Enterococcus faecium 15.9%, Enterococcus faecalis 14.9%, Staphylococcus aureus 12.8% and the least represented was Streptococcus spp 11.7%.

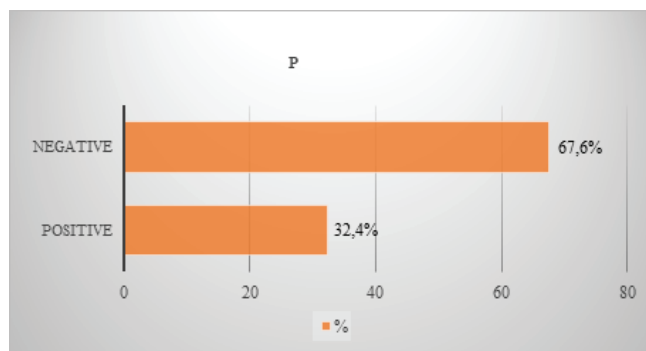


Figure 6 The ratio of the number of positive and negative Liquor samples.

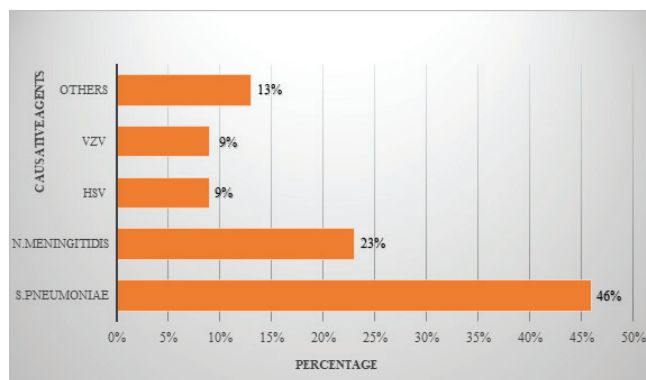


Figure 7 Prevalence of detected pathogens from cerebrospinal fluid.

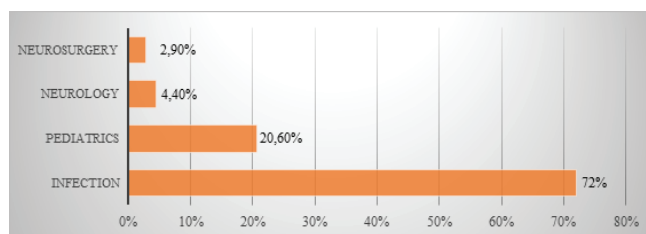


Figure 8 Representation of isolates by clinics.

Figure 8 shows the prevalence of isolates by individual clinics. The highest percentage, (72%), was recorded in the Infectious Diseases Clinic, slightly lower in the Pediatrics Clinic, (20.60%), followed by the Neurology Clinic (4.40%), and the lowest percentage was recorded in the Neurosurgery Clinic (2.90%).

## DISCUSSION

The results of this study indicate that the BioFire FilmArray® system represents a highly efficient diagnostic method for the rapid identification of the causative agents of meningitis and sepsis. An overall proportion of positive samples, 89.9% indicates high sensitivity of syndromic PCR panels in detecting clinically significant pathogens, which is consistent with the findings of both earlier and more recent studies (4,5).

The most frequently detected causative agents of meningitis in cerebrospinal fluid samples, *Streptococcus pneumoniae* and *Neisseria meningitidis*, are in line with global epidemiological data showing that these bacteria remain the leading causes of bacterial meningitis (1,6). Rapid identification of these pathogens enables timely initiation of targeted therapy and reduces the risk of severe neurological complications. The BioFire ME panel demonstrated high sensitivity and specificity, as confirmed by systematic reviews and meta-analyses reporting specificity greater than 95% for most targeted pathogens (7).

The ability to detect resistance genes using the BioFire BCID2 panel represents a significant advantage over conventional methods, as it allows for more rapid adjustment of antimicrobial therapy (5,7).

In blood samples, a predominance of Gram-negative bacteria was observed, particularly *Acinetobacter baumannii* and *Klebsiella pneumoniae*, which are frequently associated with hospital-acquired infections and pronounced antimicrobial resistance (7,8).

Nevertheless, some studies warn of the possibility of false-negative results for certain pathogens, emphasizing the importance of interpreting results in correlation with the patient's clinical presentation (9).

One of the key advantages of the BioFire FilmArray® platform is the short turnaround time, approximately 1.5 hours. Numerous studies have shown that early identification of the causative agents of sepsis significantly reduces mortality, shortens the length of hospital stay, and enables more rational use of antibiotics (2,9).

Although molecular methods offer numerous advantages, they cannot completely replace conventional microbiological methods. Culture remains indispensable for determining phenotypic antibiotic susceptibility and monitoring epidemiological trends; therefore, the optimal diagnostic approach is based on a combination of molecular and classical methods (3,9)

Based on the obtained results, it can be concluded that integrating the BioFire FilmArray® system into routine clinical practice has significant potential to improve the diagnosis and treatment of patients with suspected meningitis and sepsis, leading to improved clinical outcomes (10).

## CONCLUSION

Compared to conventional microbiological diagnostic methods, BioFire is a modern diagnostic platform that enables rapid and accurate detection of the causative agents of meningitis/encephalitis and sepsis, including multiple bacterial, viral, and fungal nucleic acids, as well as certain genetic determinants associated with antimicrobial resistance. The BioFire BCID2 panel is used as an aid in the diagnosis of specific bloodstream infection pathogens, and the results of this test should be interpreted in combination with other clinical and laboratory findings. Obtaining rapid results for specific pathogens causing meningitis/encephalitis can assist in selecting appropriate therapy.

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# The Role and Importance of Corporate Communication in Preventing Stress Among Employees in Healthcare Institutions

## Uloga i značaj korporativnog komuniciranja u preveniranju stresa zaposlenih u zdravstvenim ustanovama

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### ABSTRACT

Corporate communication represents a specific frame for joint action of those who have significant practical experience, as well as of those expert-theorists from within the field of communication (marketing, management and organizational), which in its base represents a possibility of implementing integrated communication message as one of the most important conditions in competitive companies business. Time in which our domestic companies do business is still burdened by different understandings of value and use of communication in general, as well as corporate communication, which represents additional difficulties in their companies business. Corporate communication is a permanent process of communicating messages that company sends towards different target groups in its internal and external public, choosing different convenient means for it like conferences, interviews, reporting, corporate advertising, direct mails, online communication etc. Especially interesting field of communication is crisis communication.

**Keywords:** corporate communication, crisis communication, stress management.

### SAŽETAK

Korporativno komuniciranje predstavlja svojevrsan okvir za zajedničko djelovanje kako onih koji imaju značajna praktična iskustva, tako i onih stručnjaka-teoretičara iz područja komunikacija (marketinške, upravljačke i organizacijske), što u osnovi predstavlja mogućnost provođenja integrirane komunikacijske poruke kao jednog od najvažnijih uslova u konkurentskom poslovanju kompanija. Vrijeme u kojem posluju naše domaće kompanije još uvijek je opterećeno različitim shvatanjima vrijednosti i upotrebe komuniciranja uopšte, a samim time i korporativnog komuniciranja, što predstavlja dodatne poteškoće u poslovanju njihovih kompanija. Korporativno komuniciranje je u stvari trajan proces komuniciranja porukama koje kompanija odašilje prema različitim ciljnim skupinama u njenoj unutrašnjoj i vanjskoj javnosti, birajući različite za to pogodne

načine kao što su konferencije, intervjui, izvještavanje, korporativno oglašavanje, direktnu poštu, online komunikaciju i sl. Posebno interesantno područje komunikacija jeste krizno komuniciranje.

**Ključne riječi:** korporativno komuniciranje, krizno komuniciranje, upravljanje stresom.

## INTRODUCTION

Until recently, corporate communication involved sending messages primarily toward the company's internal and external publics, which resulted in fragmented, inconsistent, and even unrecognizable communication, creating major operational problems for the company. Contemporary trends in the development of corporate communications are oriented toward a strategic role in managing a company's business processes. Trends in the development of corporate communication strategies and their implementation at the company level should be directed toward introducing an active corporate management program, rather than merely providing support to executive staff, as was previously the case.

Among employees, it is necessary to ensure an adequate level of understanding and acceptance of the company's core communication messages so that the company can successfully fulfill its mission. The trend in the development and use of corporate communications should ensure regular contact and the exchange of information between executive staff, that is, management, and employees within the company. In this sense, future trends in corporate communication should provide an appropriate employee reward system aligned with their contribution to business success, the development of new communication channels between management and employees, and the establishment of a corporate image portraying the company as a stable, innovative, and desirable employer among both internal and external corporate publics.

One of the fundamental factors in respecting established organization and hierarchy in healthcare management is a high level of professional communication among all components of the healthcare structure. The deterioration of interpersonal relationships among employees, especially during crisis

situations, can lead to a decline in the quality of work in healthcare management, which may jeopardize overall managerial performance and the functionality of institutions.

Corporate communication represents a specific framework for joint action by both practitioners with significant practical experience and expert theorists in the field of communications (marketing, managerial, and organizational). Fundamentally, this represents the possibility of implementing an integrated communication message as one of the most important prerequisites for competitive business operations. Only a small number of managers in Bosnian and Herzegovinian companies have understood the role and importance of corporate communications and placed it at the very top of business decision-making; even then, it is still insufficiently utilized, and the power and influence of corporate communications in integrating all communication activities at the company level remain misunderstood.

For better understanding and more effective application of corporate communication, we will present only a few definitions reflecting different authors' approaches to their understanding and definition of corporate communication.

One definition of corporate communications emphasizes that they represent an integrated approach to all communication carried out by a company and directed toward target communication groups (1).

Others understand corporate communications as the overall "voice" of a company, that is, the image it projects of itself to the public on the global market stage, populated by diverse listening and viewing audiences.

Within their scope, corporate communications thus integrate areas such as corporate reputation, corporate advertising, internal employee communication, investor relations, government relations, media management, and crisis communication (2).

Furthermore, corporate communication represents an ongoing process of communicating messages that a company sends to various target groups within its internal and external publics, using different appropriate methods such as conferences, interviews,

reporting, corporate advertising, direct mail, online communication, and the like (1).

From the above definitions, one can observe the complexity and multidisciplinary nature of the concept itself, as well as its influence on business processes within the company and its environment.

Considering the field of corporate communications in the scientific work of European and American scholars, it is indisputable that they all agree on one point: corporate communication is a managerial function of strategic importance, and those responsible for corporate communications should have a place in the company's governing bodies, that is, they must belong to top management (3).

Corporate communications encompass a wide spectrum of a company's communications with its internal and external environment, and their operation is predominantly influenced by the characteristics of management, the organizational structure, and the organizational culture of the company in which they operate.

### ***Corporate Communication in Crisis Situation***

Almost every company may experience a crisis situation or an event that can be perceived negatively by the public. In such situations, company management, through employees in the public relations department, attempts to identify potential disasters and establish a plan for communicating bad news to various stakeholders or individuals (4).

In order to adequately explain the newly arisen situation or damage, company management should appoint a qualified person (a spokesperson) to respond to all questions posed by the interested public, including those from potential victims, lawyers, government officials, and others (5).

Failure to manage a crisis properly can be more damaging than the incident itself, because the way the error is addressed and problems are resolved is often communicated more intensely than the incident that occurred (6).

Crisis situations most often damage a company's reputation, but proper public relations management can save it from such consequences.

In crisis situations, strategic thinking is extremely important. A company in crisis must focus on monitoring threats to its reputation. It is also important for the company to use the opportunity to gain media attention in order to explain its vision, intentions, and operations to the public (6).

In crisis communication, it is essential to acknowledge the existence of the crisis and take control, rather than deny the situation, because denial can backfire. Timely action is crucial, including establishing a crisis communication team and preparing a crisis communication center where journalists will have access to all relevant information and communication technology. A person responsible for communicating with the media must be appointed. This raises the question of how to communicate with the media (7).

In today's information society, rapid response is essential. Crisis communication is the most important activity during and around a crisis. What a company says and does in a crisis has a long-term impact on its reputation. The key to successful crisis communication is controlling the crisis (8).

To achieve this, three basic prerequisites must be met: having complete information about the event, being prepared in advance, and communicating proactively. An organization must have a developed system (who does what, why, and when) immediately before a crisis breaks out and during its duration, as well as pre-prepared and well-developed scenarios with solutions for potential crises that may arise during business operations (9).

The internal public consists of individuals with whom the organization regularly communicates through daily operations, such as employees, shareholders, suppliers, marketing intermediaries, and current or loyal customers. The external public includes people with whom the organization communicates but does not have regular or particularly close relationships, such as the media, the local community, local government, governments at other state levels, government agencies and institutions, financial organizations, special-interest groups, potential customers, employees, and investors (10).

Stress management in organizations is one of the most important thematic areas. It is essential

to conceptually define stress and to manage stress among managers and employees. Stress as a concept is relatively new, and its impact on managers and employees is still largely unknown, despite its significant influence on company performance. Stress management is among the newer areas in economics and remains insufficiently researched as a phenomenon. Without a solid understanding of stress management issues, a healthy work climate cannot exist, nor can sustainable long-term business success be achieved. Stress at the workplace can cause a range of harmful physiological, psychological, and behavioral reactions when job demands are not aligned with an individual's abilities, capacities, and needs. Stress represents physical and mental strain experienced by an individual as a result of environmental factors. It is often associated with demands and resources: demands refer to responsibilities, pressures, obligations, and uncertainties encountered in the work environment, while resources are elements under an individual's control that can be used to address those demands.

For organizational management, work-related stress is particularly significant, as it has the most substantial impact on people's overall behavior and lives due to the length of time spent at work. Some managers and employees cope with stress better than others, although everyone should be familiar with this topic. There is also a common belief that managers should cope with stress better than employees. Since stress is almost impossible to avoid, understanding stress is essential in order to manage it more effectively in both work processes and everyday life.

Stress management involves learning or acquiring skills to recognize stress and manage one's life despite ongoing stressors, by controlling and mitigating their impact. Skills learned through appropriate training enable individuals to effectively cope with difficult situations, feel better, and regain a sense of control over their lives. It is widely agreed that intellectual capital is a company's greatest asset. However, deadlines, competition, confrontation, and conflict raise the question of whether business organizations truly keep stress under control (11).

Any situation requiring adaptation can be considered stressful. "Managerial disease" is a term frequently used today to describe a set of symptoms

resulting from prolonged exposure to workplace stress, which has become an unavoidable part of modern life. Career success requires not only self-discipline, competence, and systematic work, but also the ability to control negative emotions such as stress and tension. Stress management includes techniques that help individuals successfully cope with stress at work and in daily life.

Within overall risk management, organizations use crisis management tools to address stress as well. Crisis management can be understood as "a special form of company management of the highest priority, whose task is to avoid or overcome all processes that could substantially threaten or even prevent the continued survival of the company." (12).

Anticipatory crisis management primarily involves preventive activities, timely identification of early crisis symptoms, and decisive responses to their emergence. Managers and employees experience stress when they perceive an imbalance between demands placed upon them and the resources available to meet those demands. Training and professional development programs are particularly useful as preventive measures (13).

Developing knowledge and skills contributes to better alignment and adaptability. Training should include professional knowledge as well as conceptual and organizational skills, and should also incorporate relaxation techniques and stress-avoidance methods.

Organizational culture can be described through six basic dimensions: (14)

1. **Work organization** – the level of organizational structure and efficiency in performing tasks and procedures.
2. **Standards** – the extent to which management pressures employees to achieve excellent results and high standards.
3. **Commitment** – the degree to which employees feel dedicated to organizational goals.
4. **Responsibility** – the extent to which employees feel accountable for achieving goals without constant supervision.
5. **Recognition** – the degree to which employees feel their achievements are acknowledged rather than punished for mistakes.
6. **Esprit de corps** – the extent to which employees

experience team spirit, cohesion, and the benefits of collective work.

Stress prevention is strongly influenced by organizational culture and interpersonal relationships within a company. These should be nurtured through trust, openness, and readiness for direct communication. Such a climate provides support, enables participation in decision-making, and facilitates the setting of shared goals. Organizational harmony is also strengthened by connections between the company and employees' families. While stress cannot be completely avoided in life and business, it is essential that management and employees know how to reduce its intensity and harmful effects, both individually and organizationally.

Accordingly, two types of strategies form a stress management program: individual strategies and organizational strategies (15).

These strategies are compatible and cannot be separated from one another.

#### ***Organizational strategies:***

1. Encouraging greater organizational communication among employees to prevent conflict.
2. Encouraging employee participation in decision-making.
3. Providing greater autonomy, meaningful feedback, and responsibility.
4. Setting realistic, motivating, and specific goals with adequate feedback.
5. Promoting decentralization.
6. Ensuring fairness in reward distribution and pay structures.
7. Promoting job rotation and job enrichment.
8. Creating a fair and safe working environment.
9. Establishing effective recruitment and orientation procedures.
10. Evaluating staff success based on achieving and exceeding set goals.

#### ***Individual strategies:***

1. Creating daily task lists, prioritizing, planning, and scheduling regular breaks.
2. Maintaining healthy work habits without sacrificing family or health.

3. Engaging in physical exercise.
4. Promoting a healthy lifestyle, including proper sleep, hydration, nutrition, and relaxation techniques.
5. Maintaining an optimistic approach to work.
6. Developing emotional intelligence.
7. Building social support networks.
8. Consulting with employees to raise awareness of strengths and weaknesses.
9. Releasing stress through humor, sports, or games.
10. Shifting focus toward helping others.

The goal of stress management is the timely development of methods and behavioral models that minimize the negative effects of stress on both individuals and organizations as a whole (15).

#### ***The Role and Importance of Public Relations in Communication and the Operations of Healthcare Institutions***

Today, there is broad agreement among researchers that healthcare is a distinctive business system with a special public interest. When analyzing the competencies of individuals who manage this system, theorists believe that managerial knowledge and skills are universal and can be applied equally across many business processes. In practice, however, healthcare managers are most often successful individuals with basic clinical experience. The reason for this lies in the specific characteristics of healthcare that distinguish it from management in other fields. These characteristics include knowledge of healthcare services, their hierarchy, values, and culture (16).

An evident advantage of healthcare managers is that they understand medical services, are familiar with medical terminology, and possess knowledge of epidemiology. Without this understanding, they would not be able to plan effectively, set priorities, or develop healthcare organizations and systems. The content of a professional medical meeting changes significantly if it is led by a manager without medical knowledge. A healthcare manager discusses budgets, staffing, and reorganization, and conversation topics must be a logical reflection of cost-management policies. They also participate in discussions on medical development, changes in treatment methods, the introduction of new technologies, current epidemiological issues, population changes, and similar matters. Healthcare

managers gradually assumed this role as the development of medical services and population needs dynamically increased. The topics addressed by healthcare managers determine system development and represent a vital part of healthcare management (17).

It is not sufficient to know only one's profession in order to become a competent manager. Healthcare systems must be managed by interdisciplinary teams of experts. The development and profiling of such teams worldwide has become one of the leading themes of modern and advanced healthcare systems in Western countries, where one of the key challenges is respect for human values and the cultivation of interpersonal relationships.

Healthcare services are provided to users within a complex value system characterized by diverse religions, races, political and national affiliations, and similar factors. Among all values, the fundamental one is humanity - the willingness to provide the best possible care to every individual. At its core, this value is entirely opposed to market principles. The market is governed by competition, profit generation, and, above all, the "law of survival of the fittest".

The market is characterized by a different value system and business ethics that cannot be directly applied to healthcare. In healthcare, the patient always comes first. The duty of every physician is to maintain a humane, social, ethical, and above all professional atmosphere within healthcare institutions, ensuring optimal interpersonal relations and creating the best possible environment for patients. This awareness is instilled in healthcare workers during their education and internship. A healthcare manager must take this into account when managing human resources.

Healthcare professionals strive to achieve the highest academic standards throughout their careers; this is their life goal. In addition, the nature of their work forces them to constantly make decisions - about diagnoses, treatment, and care. Therefore, such human resources cannot be managed using simple techniques. Moreover, healthcare professionals have strong professional organizations and are governed by laws regulating their professions. All of this indicates the special conditions under which healthcare managers operate and make decisions.

All healthcare organizations exhibit a certain organizational culture, generally similar to that of military organizations. There is a strict hierarchical structure based on experience and academic knowledge. Doctors occupy the top positions, followed by nurses and then other employees. There is a defined level of respect among departments, with surgeons often holding precedence. Culture and a sense of belonging change over time, for better or worse, but a specific culture exists that must be understood in order to manage healthcare organizations successfully and efficiently (18).

Hospitals and other healthcare systems are predominantly managed by physicians rather than professionals from other fields. Becoming a manager represents a major change for someone trained to work based on objective findings and scientifically grounded diagnoses. As a manager, one must begin to manage often emotionally charged - groups of people within the organization. In addition, the priority shifts from the individual patient to the healthcare institution as a whole. Not every clinician is a successful manager. There is often a natural fear of making incorrect decisions, particularly financial ones, as well as fear of alienating colleagues or losing friendships formed before assuming managerial roles.

When representing and promoting the interests of healthcare institutions, managers enter entirely new relationships with political, economic, and other centers of power, where the rules differ significantly from those they are accustomed to. Management is a different activity that requires extensive knowledge, skills, dexterity, familiarity with multiple languages, rules, and norms. A clinician's professional language typically follows a clear sequence: identification, situational analysis, planning, implementation, and evaluation, with implementation facilitated by patient trust. Management, however, is far more complex. Managers cannot control environmental factors and must rely on cooperation with numerous stakeholders within and beyond the community. Some solutions depend on financial circumstances, political relations, and priorities. Managers must align the interests of healthcare institutions with those of owners and political actors, which is not always simple. Clinicians often require managerial education but lack time or perceive it as unnecessary. Nevertheless, without changing priorities, successful management is impossible (18).

The core skills of healthcare managers have evolved over time and today include leadership skills, team management, information management, quality management, resource allocation, business decision-making, goal planning, delegation, and human resource management. In addition to these core skills, knowledge of strategic planning is essential. Strategic plans operate at the level of principles and are less detailed than operational plans. Effective strategic planning requires understanding environmental elements such as political, economic, and demographic changes, as well as scientific and technological advances. Managers with medical education may have an advantage in this regard. Epidemiological characteristics are also changing, with some diseases emerging as others decline, all of which must influence strategic planning.

Healthcare management faces continuous pressure from healthcare reforms and the need to find additional resources to align development with patient needs. There is a stereotype that managers are dynamic, professional, organized, decisive, and rational; however, reality is often different. A manager's day is interrupted by numerous phone calls, unnecessary inquiries, additional explanations of simple matters, and attendance at ceremonies and formal openings. Nevertheless, managers must remain focused on achieving goals, improving communication skills, and making sound decisions.

Problems faced by healthcare management are often invisible or involve individuals who obstruct healthcare professionals' initiatives. Additional challenges include poor status, inadequate compensation in some countries, conflicts with clinicians, and issues of qualification. Healthcare management often operates with unclear notions of "profit" or "loss" (especially in the public sector), chronic shortages of quality information, and obligations to provide services to the population while responding to government and policy-maker demands. Healthcare management replaces traditional administration but is far more complex, as it addresses critical business issues, brings together top experts, differentiates and rewards them systematically, and continuously develops knowledge and potential. Management also involves aligning the interests and goals of owners, managers, and employees, managing conflict situations, and supporting employees in resolving personal problems.

This approach is based on the assumption of mutual satisfaction of organizational and individual needs and goals.

In many Western healthcare organizations, human resources managers hold exceptionally high positions because they determine strategic development directions. Recruitment services are among the fastest-growing industries worldwide. Organizational structures are also changing, as operations increasingly rely on smaller, self-managed teams characterized by strong flexibility.

The role of human resources units within both formal and informal healthcare structures represents a major responsibility for healthcare management (19).

Healthcare managers play a specific role in evaluating individual and organizational performance. Motivation and management are inseparable concepts. Modern motivational strategies suggest that unmotivated employees are not interested in service quality, cannot identify with the organization, and are indifferent to organizational problems, development, and success. Consequently, healthcare employees cannot be expected to be satisfied with their jobs or institutions if managers themselves lack interest in organizational progress or show little commitment to their roles.

Experiences from healthcare institutions in Bosnia and Herzegovina indicate that poor management has led to deteriorated interpersonal relations, abrupt changes in formal organizational structures, and reduced authority within hierarchical systems. When the organizational climate is supportive, employees are treated as individuals with careers. Recognizing employees' psychological types, interests, preferences, and decision-making styles enables healthcare managers to build effective teams and organizational climates that ensure success.

Research in Bosnia and Herzegovina shows that healthcare employees have high motivational potential but lack encouragement from management and the work environment to improve professional, interpersonal, and collegial relationships. Studies across Europe indicate that employees may be physically present at work without being psychologically engaged. Bringing personal problems to work, unresolved private issues,

lack of rest, and constant pressure for productivity can cause healthcare workers to behave incorrectly, irresponsibly, or even rudely toward colleagues and patients.

Factors contributing to poor communication, damaged interpersonal relations, and weakened hierarchy in healthcare institutions include undesirable employee behaviors such as fear of disciplinary measures, self-doubt, lack of commitment, fear of being labeled unambitious, poor time management, incompetence, desire for additional income, and avoidance of complex personal situations. Good healthcare managers create positive organizational climates, anticipate dissatisfaction, and respond accordingly. They maintain continuous interaction with superiors, patients, clients, and subordinates, recognizing the importance of understanding team dynamics.

Healthcare organizations in Bosnia and Herzegovina must effectively manage change and become “masters of change” in today’s dynamic environment. A major challenge is identifying and planning future changes. Healthcare policy establishes norms and rules affecting all stakeholders and creates models for modernization. Managers must adapt to Western management standards to respond effectively to environmental dynamics they cannot control but can leverage to create favorable work climates full of opportunities for employees and service users.

Healthcare employees must avoid allowing personal problems to interfere with task performance and career development. They must perform their duties loyally, kindly, and responsibly, while institutions must ensure working conditions free from fear, neglect, doubt, depression, pressure, violence, mobbing, and other negative experiences. Healthcare managers will face complex but solvable challenges; only adaptable, flexible, and responsible managers can successfully balance humanity, professionalism, formality, organization, and hierarchy.

### ***Proposed Measures for Preventing Stress in Healthcare Institutions***

To improve stress management in organizations, the following activities are proposed:

1. Activities aimed at improving the perception of stress triggers and their prevention: regular employee surveys, monitoring and maintaining work systems, holding regular staff meetings, assessing stakeholder satisfaction, involving employees in decision-making, organizing training sessions, and clarifying roles and responsibilities.
2. Activities aimed at improving the recognition of stress symptoms and managing positive stress: creating an effective early warning system, connecting employees and managers to enable faster responses to problems, maintaining employee motivation through higher-level goals, and providing bonuses for meeting deadlines.
3. Activities aimed at eliminating negative stress: developing intervention strategies, outdoor activities, informal meetings, organizing socially responsible activities, sports activities, yoga, relaxation techniques, and engaging psychologists.
4. Activities aimed at improving high-quality performance under unavoidable stress: fostering a sense of group belonging, showing empathy toward employees, encouraging creativity, and promoting an open organizational culture.
5. Activities related to organizational learning from stressful experiences: organizing workshops, transferring important experiences, critically analyzing past experiences, and benchmarking.
6. Healthcare managers should communicate with both internal and external publics about budgets, staffing, and organizational restructuring. Discussion topics should include all issues of interest to internal and external stakeholders that contribute to a positive image of the healthcare institution, improve internal and external relations, and support effective operations. Management should participate in discussions on medical development, changes in treatment methods, the introduction of new technologies, current epidemiological issues, and population changes, with particular attention to corporate communication.
7. It is necessary to first conduct research among healthcare employees to examine how they assess the quality of communication, interpersonal and collegial relations in the work environment; how they perceive the importance of formal and informal organizational structures; who they consider the leading authority in the workplace and how much

attention they give to it; how they would describe authority and subordination; and whether they understand and value the hierarchical structure and the importance of respecting it.

8. Healthcare employees should perform their duties more loyally, kindly, and responsibly, while being provided with all necessary conditions to ensure that, upon coming to work and during their work, they do not experience fear, neglect, doubt, depression, pressure, disappointment, oppression, endangerment, violence, aggression, mobbing, or other negative feelings and events. Along this path, healthcare managers will face complex but solvable challenges. Only adaptable, flexible, and responsible managers can successfully address serious challenges and establish a balance between humanity, professionalism, formality, organization, and hierarchy.
9. A marketing-oriented approach is needed in the development and implementation of clinical pathways, patient pathways, and guidelines, as their absence or poor design and implementation have for years been associated with almost all major problems, complications, uncertainties, and proposed solutions in healthcare systems. These elements are linked, in one way or another, to the quality of healthcare, strengthening the role of patients, costs, access to healthcare, professional autonomy, legal responsibility of healthcare professionals, rationalization, competition, benefits, variations in practice, healthcare management, and corporate communication.

Corporate communications encompass a wide spectrum of a company's communications with its internal and external environment, and their effectiveness is predominantly influenced by the characteristics of management, the organizational structure, and the organizational culture of the company in which they operate. Corporate communication further represents an ongoing process of conveying messages that a company sends to various target groups within its internal and external publics, using different appropriate methods such as conferences, interviews, reporting, corporate advertising, direct mail, online communication, and similar channels.

Daily changes occurring in the business environment inevitably impose the need to abandon

traditional modes of communication, as well as the need to integrate all communication activities in order to ensure tailored communication messages intended for end consumers. Changes in consumer behavior, caused by broader social changes as well as technological advances, have resulted in an increasing need for the integration of all communication activities and for modified, fully consumer-oriented communication messages. The imperative for companies to be as market-oriented as possible has forced them not only to create products and services based on consumer needs and desires, but also to design marketing communication programs in which the customer–user is both the starting point and the ultimate focus.

In addition to established forms of product or service promotion ranging from economic advertising, sales promotion, direct marketing, various forms of promotional communication, and publicity there are other, no less important, forms of organizational communication. These include public relations, corporate advertising, corporate social responsibility, crisis communication, internal corporate communication, and managerial communication, which relates to the process of managing business operations at the company level. For all these reasons, corporate communication has particular importance in achieving communication objectives with business partners, service users, employees, and the overall business environment, generating greater business effects through interactive relationships with them.

Communication is equally important in the development of internal relationships within a company, because even the best intentions are ineffective if they are not communicated properly. It has been established that most conflicts within companies arise precisely from poor internal communication. Internal communication plays a particularly important role at the lowest levels of the organizational structure among employees and their supervisors but in recent times it has increasingly developed toward the highest levels of management, especially in the process of gathering information for making the most important business decisions. To make employees feel important in achieving business processes and contributing value to the company, management must ensure internal communication that relaxes communication relations between management and employees, enabling

shared responsibility and shared rewards for overall business performance.

However, effective internal communication between employees and management can only be ensured by managers who are able to skillfully establish modern communication relationships that serve the achievement of overall company goals. In this process, in addition to modern trends, communication skills, and managerial willingness to communicate, all other employees must also be prepared to participate in and contribute to successful communication at the company level. What may be concerning is the lack of initiative and willingness among employees and even managers to engage in active internal communication at all levels, which directly affects the business success of every company.

Almost every company may experience a crisis situation or an event that can be perceived negatively by the public. In such situations, company management, through public relations professionals, seeks to identify potential threats and establish a plan for communicating bad news to various stakeholders or individuals.

## CONCLUSION

Trends in the development of corporate communication strategies and their implementation at the company level should be oriented toward introducing an active corporate management program, rather than merely providing support to executive staff, as has been the case so far. Furthermore, it is necessary to ensure that employees achieve an adequate level of understanding and acceptance of the company's core communication messages so that the company can successfully accomplish its mission. Additionally, the development and use of corporate communications should ensure regular contact and the exchange of information between executive staff - management - and employees within the company. The emergence of stress in individuals at the workplace can be caused by a range of harmful physiological, psychological, and behavioral reactions to situations in which job demands are not aligned with an individual's abilities, capacities, and needs. Stress represents the physical and mental strain experienced by an individual as a result of environmental influences. It is often

associated with demands and resources. Demands refer to responsibilities, pressures, obligations, and uncertainties encountered in the work environment, while resources are elements under an individual's control that can be used to address those demands. It can be concluded that stress represents a real or potential threat to an individual's physiological or psychological integrity.

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# The Evolution of Marketing in Healthcare and the Measurement of Market Orientation in the Healthcare Industry

## Evolucija marketinga u zdravstvu i mjerenje tržišne orijentacije u zdravstvenoj industriji

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### ABSTRACT

The role and functioning of healthcare in contemporary society are of great importance. Over time, medical practice has evolved in accordance with societal perceptions of health, and today it is expected to meet increasingly high and diverse demands for healthcare services. Healthcare organizations operate in a dynamic and competitive environment in which customers-patients are increasingly informed and empowered, and therefore demand that their needs be adequately met. The new healthcare economy, competition for attracting talented physicians, acquisition activities, the entry of new competitors, and the escalation of consumer expectations pose challenges even for the most developed healthcare systems. In developing countries such as Bosnia and Herzegovina, where private healthcare practice has expanded over recent decades, increased competition makes market orientation an important strategy for ensuring the future growth of healthcare institutions. The potential for the successful application of the marketing concept in healthcare is considerable. Marketing principles can help contemporary healthcare

organizations learn how to utilize market mechanisms to anticipate future changes and achieve their strategic objectives.

**Keywords:** healthcare, marketing, market orientation

### SAŽETAK

Uloga i djelatnost zdravstva u savremenom društvu vrlo je značajna. Tokom vremena medicinska praksa se mijenjala, ovisno o društvenom poimanju zdravlja, da bi danas bila u mogućnosti udovoljiti visokim i brojnim zahtjevima zdravstvene potražnje. Zdravstvene organizacije posluju u dinamičnom konkurentskom okruženju gdje su kupci - pacijenti sve više informisani, osnaženi i kao takvi zahtijevaju da njihove potrebe budu zadovoljene. Nova ekonomija zdravstvene zaštite, nadmetanje za privlačenjem talentovanih liječnika, aktivnosti akvizicije, ulazak novih konkurenata i eskalacija očekivanja potrošača, predstavljaju izazove

i za najrazvijenije zdravstvene sisteme. U zemljama u razvoju kao što je Bosna i Hercegovina u kojima je privatna zdravstvena praksa imala ekspanziju u proteklim decenijama, povećana konkurencija čini tržišnu orijentaciju važnom strategijom za osiguranje budućeg rasta zdravstvenih ustanova. Mogućnosti uspješne primjene marketing koncepta u zdravstvu su velike. Principi marketinga pomoći će savremenim zdravstvenim organizacijama da nauče koristiti mehanizam tržišta u anticipiranju budućih promjena i postizanju svojih ciljeva.

**Ključne riječi:** zdravstvo, marketing, tržišna orijentacija

## INTRODUCTION

The role and function of healthcare in contemporary society are of great importance. Over time, medical practice has evolved in line with societal perceptions of health, enabling it today to meet increasingly high and diverse demands for healthcare services.

Healthcare organizations operate in a dynamic and competitive environment in which customers-patients are becoming increasingly informed and empowered and therefore expect their needs to be adequately addressed. The new healthcare economy, competition for attracting talented physicians, acquisition activities, the entry of new competitors, and the escalation of consumer expectations pose challenges even for the most advanced healthcare systems (1).

A substantial body of research has addressed the issue of measuring market orientation in healthcare, particularly its impact on organizational performance. Numerous studies have demonstrated that poor performance in the hospital industry is a consequence of weak market orientation. Examples., among others, include studies conducted by Narver JC, et al., (1990); Raju PS, et al. (2000); Gopalakrishna P, et al., (2014); Schalk AP, et al., (2008) and Sin Leo YM, et al. (2013) (2,3,4,5,6).

Similarly, studies examining the effects of weak marketing strategies on healthcare performance have been conducted by Ahmad AMK, et al. (2013) and Mwangi E, et al., (2013), as well as research analyzing the impact of a lack of market orientation

and marketing strategies on performance, such as the work of Heiens RA, et al. (2011) (7,8,9).

Since the concept of marketing was introduced into the healthcare provider sector during the 1970s, this field has experienced periods of growth, decline, workforce reductions, and subsequent recovery. With the exception of certain healthcare organizations related to retail and the supply of pharmaceuticals and medical equipment-which primarily relied on product promotion, most hospitals at that time did not adopt the marketing concept as a core business philosophy. Among marketing-related activities, only public relations functions aimed at communication with the external environment-regarding patients, equipment, staff, and related issues were relatively developed. The focus was primarily on media relations, including the dissemination of press releases, responding to information requests, and managing press relations in the event of adverse or negative incidents. Large hospitals also maintained organizational units responsible for monitoring legislation and disseminating relevant environmental information, with the aim of lobbying and influencing governmental authorities. Consequently, marketing was largely limited to a two-way communication function, implemented through formal and informal promotional activities (such as hospital-organized seminars and open-house events).

Marketing as a business philosophy is generally considered to have been introduced into the healthcare sector only in the early 1970s in the United States, coinciding with the rise of self-actualization, the rapid development of consumer society, and the expansion of healthcare services (e.g., psychotherapy, cosmetic surgery). Undoubtedly, the overall growth of the service economy significantly influenced the healthcare sector, particularly given the specific characteristics of services marketing.

With the advent of the 21st century, the process of digitalization has become a dominant paradigm across all industries, including marketing in general and healthcare marketing in particular. Through the use of the internet, consumers-patients can now easily search for, compare, and purchase products, while social media platforms enable them to share experiences and opinions related to healthcare products and services. Additionally, consumers use websites to obtain information about healthcare services, capacities, and

prices, just as healthcare institutions use the internet and social media to contact and communicate with their patients. The significant achievements of healthcare marketing in developed countries pose a challenge to healthcare organizations worldwide to understand and adopt its principles and potential applications.

From an evolutionary perspective, healthcare marketing in the United States has developed through the following phases (10):

**Table 1 The evolution of the marketing in healthcare.**

Business orientation	Organizational goal	Expected outcome
Production	To produce a high-quality product	To deliver high-quality service
Sales	To increase volume	To achieve full bed occupancy
Marketing	To meet the needs and expectations of customers/patients	To meet the needs and expectations of customers/patients

Although it can be argued that the marketing era began in the 1950s, this business philosophy emerged in the healthcare sector several decades later. If any activities could be classified as marketing-related in healthcare at that time, they primarily involved promotional efforts by pharmaceutical companies directed at physicians and by insurance companies focused on selling health insurance packages to customers. Hospitals and physicians generally considered the application of marketing to be inappropriate and even unethical. Given that demand for medical and hospital services was inelastic, little attention was paid to the characteristics of patients and potential consumers. The emphasis was placed on the provision of quality care, while hospitals enjoyed monopolistic or oligopolistic positions that protected them from competition.

As the healthcare services sector expanded during the 1960s, the role of public relations also grew. Physicians played a key role, as they were responsible for decisions regarding patient referrals to healthcare institutions, as did donors who contributed charitable funds. Consumers-patients were still not regarded as relevant, due to the dominant role of physicians.

As noted, the public relations function continued to strengthen, with communication primarily conducted through print and electronic media (radio and television). During this period, certain segments of the healthcare industry not directly involved in healthcare delivery entered Phase 2 (sales orientation), particularly pharmaceutical companies and insurance organizations, which organized their sales forces around selling drugs to physicians and market-oriented health insurance policies to individual consumers.

In the United States, two major programs-Medicare and Medicaid were introduced during the administration of President Lyndon B. Johnson, leaving a lasting impact on healthcare delivery and the structure of the healthcare system. Medicare is a unified national public health insurance program for elderly and disabled individuals. Administered by the federal government, it represents the largest health insurer in the country. The primary objective of Medicare is to increase access to high-quality healthcare for older adults, covering nearly the entire population aged 65 and over. Medicare is divided into Parts A, B, C, and D (11).

The second type of public health insurance program is Medicaid, which represents the largest public health insurance program for low-income populations. It provides healthcare coverage for specific economically disadvantaged groups, such as individuals with low income and limited assets, and is jointly financed by federal and state governments (11,12).

By the early 1970s, competition for patients among hospitals intensified, and market rivalry became increasingly stronger. The stability of the Medicare program contributed to the emergence of profit-oriented hospitals and a continuous growth in demand. Various forms of healthcare service advertising began to appear, alongside growing interest in market research. Regulatory restrictions on healthcare advertising and promotion were lifted, marking the beginning of the marketing era for hospitals. By the mid-1970s, some hospitals had adopted mass advertising strategies for their programs. The objective of marketers was to persuade potential patients of the benefits of specific hospital services compared to those of competitors (13). Although the importance of targeted communication and patient satisfaction research was acknowledged, the marketing function still did not receive adequate recognition in most healthcare organizations.

Healthcare marketing reached maturity in the 1980s, when the healthcare industry evolved from a seller's market to a buyer's market—a shift that significantly shaped the future development of healthcare marketing. This transition strengthened the role of employers and individual consumers as purchasers of healthcare services while weakening the role of physicians in referral decision-making. Employers and the hospital industry continued to expand throughout the 1980s, alongside the growth of healthcare systems (both for-profit and non-profit), national hospital chains, nursing homes, and other healthcare agencies. Changes in reimbursement patterns required marketers to reshape their target audiences. Hospitals began developing new products and services aimed directly at consumers (e.g., obstetrics, cosmetic surgery, outpatient care), thereby increasing revenue and market share.

Despite growing acceptance of marketing in healthcare, the industry suffered from a lack of professionally trained marketing personnel. Many marketers had little or no healthcare experience, and marketing was still often perceived as a costly gimmick inappropriate for healthcare. Nevertheless, investments in advertising increased dramatically; between 1983 and 1986 alone, advertising expenditures rose from USD 50 million to USD 500 million.<sup>13</sup> This legacy persists today, as marketing is still frequently equated with advertising. Over time, however, rising total and promotional costs and their effectiveness came under scrutiny, leading to significant cost reductions, with marketing budgets and staff often being the first affected. While the marketing function was not entirely eliminated, it was frequently repositioned within development or strategic planning units. In some healthcare organizations, marketing disappeared as a corporate function and was never reinstated. Conversely, this downsizing enabled healthcare marketers to reassess the field and focus on developing foundational data to support the revitalization of marketing activities.

During the 1990s, healthcare became increasingly market-driven, and the marketing function gained prominence. Market-based decision-making became indispensable, and hospitals competed intensively for consumer attention. Advertising resurged, and the mid-1990s saw a wave of hospital mergers and consolidations. Patients were placed at the center

and increasingly viewed as customers. Marketing became more integrated into healthcare operations, while consumers grew more educated and assertive in their demands. The rise of the internet significantly enhanced patients bargaining power. Market research and patient satisfaction studies expanded, database analysis techniques were adopted, and marketing assumed a more strategic role. By the late 1990s, healthcare had entered the third stage of marketing evolution, becoming more complex and competitive.

In the 2000s, marketing became fully established as a core function in healthcare. A trend emerged toward recruiting younger marketing professionals from other profit-oriented industries, thereby broadening marketing perspectives within hospitals. By the first decade of the 21st century, hospital marketing activities increasingly resembled those of for-profit firms (e.g., pharmaceutical and medical device companies). Typical hospital marketing departments employed five or more staff members and operated with multimillion dollar budgets. Marketing directors were increasingly promoted to vice-presidential positions, earning salaries comparable to other senior executives. Beyond advertising and sales, healthcare marketers adopted new tools such as market segmentation and targeting, effective public and media relations, customer support, reputation management, and customer relationship management. Consumers came to be viewed as key drivers of success, and patient engagement became a central concept.

This new healthcare environment required a different approach to marketing healthcare services, incorporating a population health perspective focused on community health rather than individual patients. The emergence of social media during this decade played a crucial role in healthcare marketing. By the end of the 20th century, nearly all healthcare providers had established an online presence; for many, the internet became not only a key marketing channel but also a medium for interaction with consumers and potential consumers. The expansion of electronic communication was further accelerated by social media, enabling patients to communicate both with one another and with healthcare professionals. Monitoring online discussions thus became an important area of interest for healthcare marketers.

During the 2010s, the U.S. healthcare system continued to undergo restructuring and realignment. Trends initiated in previous decades such as mergers and acquisitions intensified through vertical integration. From a marketing perspective, emphasis on consumer engagement persisted, alongside continued use of digital and social media channels.

The most significant development in healthcare since 2010 has been the introduction of the Affordable Care Act (ACA). The ACA made quality health insurance more accessible to tens of millions of Americans and imposed substantial limitations on insurer practices. The establishment of a national health insurance marketplace and tiered coverage levels led to increased marketing activity. Traditional insurers gained access to millions of previously uninsured consumers, requiring a deeper understanding of new consumer segments, appropriate pricing strategies, and the needs of newly covered populations (12).

Another major innovation in the U.S. healthcare system is the emergence of pay-for-performance models, which require hospitals and healthcare institutions to possess significantly more information about current and future patients in order to manage care processes effectively. Additionally, the population health model is expected to have substantial implications for the future of U.S. healthcare. Population health focuses on assessing the health status of defined populations rather than individual patients and employs innovative tools to measure health outcomes beyond traditional epidemiological metrics. This approach emphasizes social determinants of health, reducing the relative impact of pathology and genetics while highlighting the importance of clinical care in improving population health outcomes (12).

All of these trends have important implications for healthcare marketing and underscore its growing importance in contemporary healthcare systems. There is an increasing need to understand patient and consumer characteristics, particularly non-clinical factors as well as group attributes, lifestyles, motivations, and social determinants of health. Such information is essential for anticipating future healthcare challenges and demand for services. In this context, marketers, alongside medical professionals, will play a key role in defining health quality and the status of target populations in the future.

The adoption of information and communication technologies has also led to the emergence of the Health 2.0 concept, which has contributed to patient empowerment and education. Health 2.0, introduced in the mid-2000s, represents a subset of health technologies aligned with the broader Web 2.0 movement. It encompasses social media, user-generated content, cloud-based technologies, and mobile communication (14). Some supporters view Health 2.0 as a means of empowering patients, increasing control over their own healthcare, and reducing medical paternalism. Critics, however, have raised concerns regarding misinformation and patient privacy breaches. Health 2.0 platforms enable the creation of electronic medical profiles accessible across locations, including the import of existing electronic health records from partner institutions. They also facilitate access to information on diseases, diagnoses, and medications, as well as locating physicians, specialists, pharmacies, and healthcare services—raising significant ethical concerns, particularly regarding data access by pharmaceutical companies and medical advertisers (14).

All these developments have intensified the focus of healthcare institutions on implementing market orientation in healthcare, with the aim of creating, communicating, and delivering superior value to customers more effectively than competitors. Consequently, Health 2.0 is rightly regarded as a manifestation of market orientation in healthcare.

## CONCLUSION

Market orientation helps healthcare institutions become more responsive to patient needs, better understand patient attitudes, provide higher-quality services, and more effectively fulfill their mission. In developing countries such as Bosnia and Herzegovina, where private healthcare practice has expanded in recent decades, increased competition makes market orientation an important strategy for ensuring the future growth of healthcare organizations. The potential for successfully applying marketing concepts in healthcare is considerable. Marketing principles can assist contemporary healthcare organizations in leveraging market mechanisms to anticipate future changes and achieve their strategic objectives.

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# The Role of Nurses in the Hospital Information System in Bosnia and Herzegovina

## Uloga medicinskih sestara u bolničkom informacionom sistemu u Bosni i Hercegovini

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### ABSTRACT

**Introduction:** the healthcare digital transformation brings significant changes in the way of healthcare organization, data management and provision of healthcare services. Integral health information systems (IHIS) represent unique digital platforms that connect all levels of health care - primary, secondary and tertiary - as well as all key actors of the health system, including health institutions, ministries, institutes and educational institutions. Their main purpose is to improve the management of health data, patients, services and resources. The hospital information system (BIS), as a key component of IZIS, enables the management of the patient's electronic health record containing medical findings, therapies, diagnoses, prescriptions, referrals, operative procedures, discharge letters and administrative documentation. BIS represents the basis for statistical and analytical data processing and clinical and management decision-making. Nurses occupy a central place in this process.

**Aim:** to analyze the role of nurses in BIS, the advantages that information systems bring to their work, but also the challenges in terms of increased administrative workload.

**Materials and methods:** the work was based on descriptive analysis and the author's professional experience gained during many years of work on projects for the establishment and implementation of health information systems in Bosnia and Herzegovina and the countries of the region. An analysis of practical examples of BIS implementation was used, as well

as the experiences of healthcare workers, with a special focus on the role of nurses in daily work with information systems.

**Conclusion:** nurses have one of the most important and dynamic roles in the integral health information system. Their daily involvement in BIS directly affects the safety of patients, the continuity of health care and the efficiency of the health system as a whole. The establishment and further development of hospital information systems should be aimed at strengthening the role of nurses through continuous education, technical support and optimization of work processes, in order that the digitization of healthcare could fully achieve its goals.

**Keywords:** nurse, hospital information system (HIS), digitalization of healthcare

### SAŽETAK

**Uvod:** digitalna transformacija zdravstva donosi značajne promjene u načinu organizacije zdravstvene zaštite, upravljanja podacima i pružanja zdravstvenih usluga. Integralni zdravstveni informacioni sistemi (IZIS) predstavljaju jedinstvene digitalne platforme koje povezuju sve nivoe zdravstvene zaštite - primarnu, sekundarnu i tercijarnu - kao i sve ključne aktere zdravstvenog sistema, uključujući zdravstvene ustanove, ministarstva, zavode i obrazovne institucije. Njihova osnovna svrha je unapređenje upravljanja

zdravstvenim podacima, pacijentima, uslugama i resursima. Bolnički informacijski sistem (BIS), kao ključna komponenta IZIS-a, omogućava vođenje elektronskog zdravstvenog kartona pacijenta koji sadrži medicinske nalaze, terapije, dijagnoze, recepte, uputnice, operativne zahvate, otpusna pisma i administrativnu dokumentaciju. BIS predstavlja osnovu za statističku i analitičku obradu podataka te donošenje kliničkih i upravljačkih odluka. Medicinske sestre zauzimaju centralno mjesto u ovom procesu.

**Cilj:** analizirati ulogu medicinskih sestara u BIS-u, prednosti koje informacijski sistemi donose njihovom radu, ali i izazove u pogledu povećanog administrativnog opterećenja.

**Materijal i metode:** rad je zasnovan na deskriptivnoj analizi i profesionalnom iskustvu autora stečenom tokom višegodišnjeg rada na projektima uspostave i implementacije zdravstvenih informacijskih sistema u Bosni i Hercegovini i zemljama regiona. Korištena je analiza praktičnih primjera implementacije BIS-a, kao i iskustva zdravstvenih radnika, s posebnim fokusom na ulogu medicinskih sestara u svakodnevnom radu sa informacijskim sistemima.

**Zaključak:** medicinske sestre imaju jednu od najvažnijih i najdinamičnijih uloga u integralnom zdravstvenom informacijskom sistemu. Njihova svakodnevna uključenost u BIS direktno utiče na sigurnost pacijenata, kontinuitet zdravstvene njege i efikasnost zdravstvenog sistema u cjelini. Uspostava i daljnji razvoj bolničkih informacijskih sistema trebaju biti usmjereni na jačanje uloge medicinskih sestara kroz kontinuiranu edukaciju, tehničku podršku i optimizaciju radnih procesa, kako bi digitalizacija zdravstva u potpunosti ostvarila svoje ciljeve.

**Ključne riječi:** medicinska sestra, bolnički informacijski sistem (BIS), digitalizacija zdravstva

## INTRODUCTION

The digital transformation of healthcare brings significant changes in the way of organization of healthcare, data management and provision of healthcare services. Integral health information systems (IHIS) represent unique digital platforms that connect all levels of health care - primary, secondary

and tertiary - as well as all key actors of the health system, including health institutions, ministries, institutes and educational institutions. Their main purpose is to improve the management of health data, patients, services and resources (1,2).

The Hospital Information System (BIS), as a key component of IZIS, enables the management of the patient's electronic health record containing medical findings, therapies, diagnoses, prescriptions, referrals, operative procedures, discharge letters and administrative documentation. BIS represents the basis for statistical and analytical data processing and making clinical and management decisions (3,4).

Within these systems, the roles of all users - patients, nurses, doctors and management structures - are clearly defined. A particularly important role is played by nurses, whose daily work takes place to a large extent through BIS (5). Since the beginning of the informatization of healthcare in Bosnia and Herzegovina after 2008, the role of nurses has become increasingly complex, and their systemic involvement was comprehensively presented for the first time at the IV Symposium on Intensive Care Medicine and Healthcare in 2012.

Nurses occupy a central place in this process. As the most numerous professional group in healthcare institutions and the patient's first point of contact with the healthcare system, they play a key role in ensuring the accuracy, timeliness and availability of medical data. Their involvement in BIS is not only a technical issue, but a strategic factor that directly affects the safety of patients, the quality of healthcare and the efficiency of the work of the entire healthcare team (5,6).

Without the active and competent involvement of nurses, BIS cannot achieve its full function of connecting people, processes and technology into a single, patient-centered whole (5).

## AIM

The aim of this study was to analyse the role of nurses in BIS, the advantages that information systems bring to their work, but also the challenges related to the increased administrative burden.

## MATERIALS AND METHODS

The paper was based on a descriptive analysis and the author’s professional experience gained during many years of work on projects for the establishment and implementation of health information systems in Bosnia and Herzegovina and the countries of the region.

An analysis of practical examples of BIS implementation was used, as well as the experiences of healthcare workers, with a special focus on the role of nurses in daily work with information systems.

**“Nurses are not only users of the system - they are its carriers”**

The digital transformation of healthcare is changing the way patients are cared for. Hospital information systems (BIS) as part of Integral Health Information Systems become a central tool for organizing data, monitoring processes and improving the quality of health services. In this process, nurses have a key role. They are the most numerous professional group in hospitals and are in every day direct contact with patients. Their involvement in the information system ensures that data are accurate, timely and available to all members of the healthcare team, and their involvement in BIS is not just a mere technical issue, but strategic planning as a factor that affects all relevant data about the patient, the very efficiency of work and the standardization of documentation (5,6).

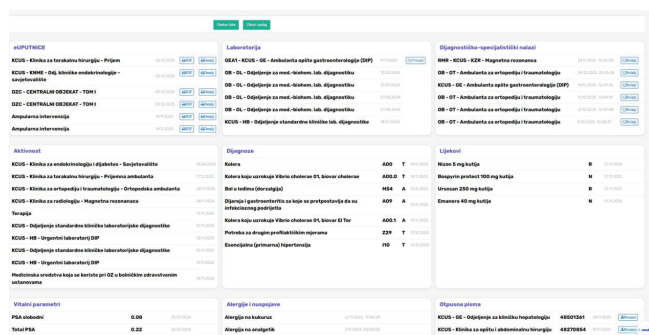


Figure 1 Electronic patient health record.

Before the digitalization of the healthcare system, nursing documentation was kept entirely on paper. Vital signs, therapies, interventions and notes were entered manually, which was often slow, confusing and prone to errors. This way of working made it difficult to

access information and slowed down communication between departments and institutions.

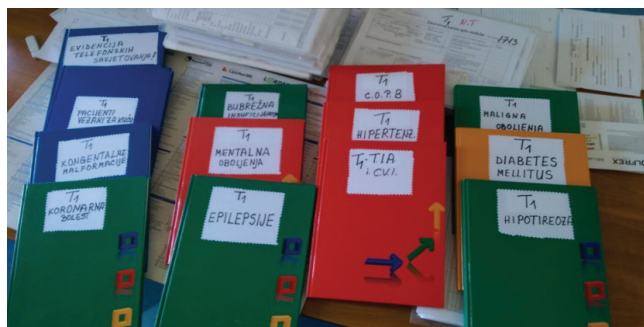


Figure 2 The role of the nurse - paper data entry.

Paper medical documentation, although formally available, was of limited use in practice - both for patients and the healthcare system, whose needs grew daily with the development of medicine and the increase in the volume of data.

Such a way of working made it difficult to access information, slowed down communication between departments and institutions, and significantly burdened nurses with administrative tasks.



Figure 3. Archive of paper documentation.

With the introduction of hospital information systems, nursing documentation acquires a new, digital dimension. Nowadays, nurses directly enter data into the system, record vital parameters, monitor therapies through digital reminders, record patient education and plan health care in a standardized way.

All information becomes available in real time, which significantly increases patient safety, reduces the possibility of errors and improves the quality of healthcare.

The nurse in the integral health information system has one of the most important and dynamic roles, given that she is usually the first point of the patient’s contact with the health system.

The role of the nurse in the integrated health information system (IZIS) includes the following key activities:

1. **Data entry and updating:** records on patient admission, medical history, vital parameters, therapies and nursing interventions directly in the electronic medical record.
2. **Coordination:** connecting the patient with doctors, diagnostic services, other departments and pharmacies.
3. **Therapy monitoring:** monitoring the use of drugs, vaccines, dialysis and other procedures, with automatic controls and reminders.
4. **Documentation:** creation and maintenance of standardized forms (nursing documentation, care plan, reports).
5. **Patient’s safety:** insight into allergies, contraindications and previous therapies, thus reducing the risk of medical errors.
6. **Communication:** exchange of information with other healthcare workers and institutions through the information system.

The implementation of BIS brings numerous advantages in the work of nurses:

- reduction of paperwork and more time for patients,
- faster access to information without searching for paper documents,
- automatic data analysis and report generation,
- increased safety of patients and reduction of errors in therapy,
- standardization of documentation and procedures,
- greater visibility and importance of nursing documentation within the unified system.

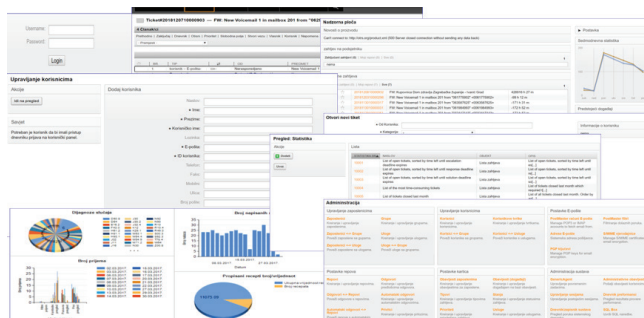


Figure 4 Analysis of medical data to BIS.

Despite numerous advantages, digitization also brings certain challenges:

- the need for continuous education and development of digital skills,
- the dual role of a nurse as a clinical worker and data administrator,
- the obligation of strict protection and confidentiality of sensitive health information.

The role of the nurse can be clearly presented through a simple workflow:

1. Patient - data source.
2. Nurse - collects and enters data into the system.
3. Hospital Information System (BIS) - centralizes and distributes data.
4. Doctor - uses data for diagnosis and therapy plan.
5. Nurse - administers therapy and updates documentation.
6. Management - uses unified data for planning and management.

The nurse is twice present in the process - as a data entry and as an executor of therapeutic decisions - thereby closing the circle between the patient, the doctor and the management structures.

The implementation of integral health information systems was realized in several cantons in Bosnia and Herzegovina, including the Sarajevo, Tuzla, Zenica-Doboj, Una-Sana and Central Bosnia cantons (7,8). These systems enabled the standardization of documentation, the reduction of the volume of paper administration, the automation of analyzes and the improvement of data availability (9,10).

Experiences from the region additionally confirm the importance of digitization, including the establishment of diagnostic information systems in healthcare institutions in the Republic of Croatia and the implementation of electronic prescriptions in the Republic of Serbia (11).

Through BIS, nurses gained better insight into medical documentation, therapeutic plans and patient treatment history, which contributed to greater patient safety and better quality health care (12). At the same time, an increase in administrative duties was recorded, which indicated the need for further optimization of the system (13,14).

## CONCLUSION

Nurses have one of the most important and dynamic roles in the integral health information system. Their daily involvement in BIS directly affects the safety of patients, the continuity of health care and the efficiency of the health system as a whole. The establishment and further development of hospital information systems should be aimed at strengthening the role of nurses through continuous education, technical support and optimization of work processes, in order that the digitization of healthcare could fully achieve its goals.

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- Kao monoterapija u pacijenata u kojih je metformin neprikladan zbog kontraindikacija ili nepodnošenja.
- U kombinaciji s drugim lijekovima za liječenje dijabetesa, uključujući inzulin, kad oni ne pružaju adekvatnu glikemijsku kontrolu.

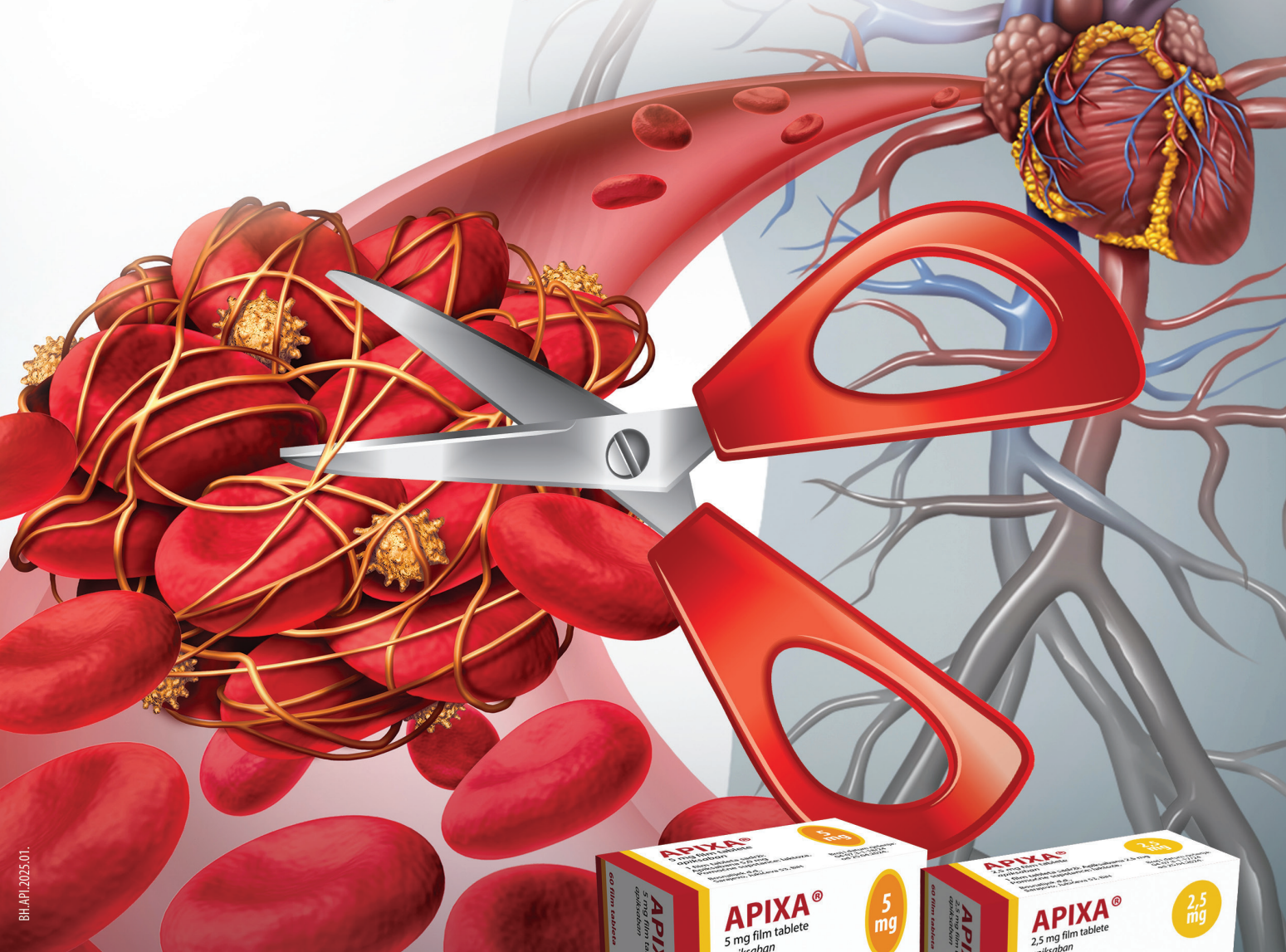
**KONTRAINDIKACIJE:** Preosjetljivost na aktivnu supstancu ili na bilo koju od pomoćnih supstanci. **NEZELJENA DJELOVANJA:** Infekcija gornjih disajnih puteva, omaglica, glavobolja, tremor, zamućen vid, konstipacija, mučnina, gastroezofagealna refluksna bolest, dijareja, bol u abdomenu, uključujući gornji dio, povraćanje, hiperhidroza, osip, svrbež, dermatitis, artralgija, mijalgija, astenija, periferni edem. **POSEBNA UPOZORENJA I MJERE OPREZA PRI PRIMJENI:** Lijek nije zamjena za inzulin u pacijenata koji trebaju inzulin. Ne treba se primjenjivati u pacijenata sa dijabetes melitusom tipa 1 ili za liječenje dijabetičke ketoacidoze. Oprez je potreban kod pacijenata u terminalnom stadiju bubrežne bolesti koji su na hemodijalizi. Ne treba se primjenjivati u pacijenata s oštećenjem jetre. Jetrenu funkciju treba pratiti tokom liječenja u intervalima od tri mjeseca tokom prve godine liječenja, te povremeno nakon toga. U pacijenata koji razvijaju žuticu ili druge znakove koji upućuju na disfunkciju jetre treba prekinuti liječenje. Ne preporučuje se primjena u pacijenata s NYHA funkcionalne klase IV. Preporučuje se praćenje kožnih poremećaja u dijabetičkih pacijenata. Potreban je oprez u pacijenata s anamnezom akutnog pankreatitisa. Pacijenti s rijetkim nasljednim poremećajem nepodnošenja galaktoze, potpunim nedostatkom laktaze ili malapsorpcijom glukoze i galaktoze ne bi smjeli uzimati ovaj lijek. Lijek ne treba primjenjivati tokom trudnoće i dojenja. **DOZIRENJE I NAČIN UPOTREBE:** Odrasli Kada se primjenjuje kao monoterapija, u kombinaciji s metforminom, u kombinaciji s tiazolidindionom, u kombinaciji s metforminom i sulfonilurejom, ili u kombinaciji s inzulinom (sa ili bez metformina), preporučena dnevna doza vildagliptina je 100 mg, primijenjena kao jedna doza od 50 mg ujutro i jedna doza od 50 mg navečer. Kada se primjenjuje u dvojnjoj kombinaciji sa sulfonilurejom, preporučena doza vildagliptina je 50 mg jedanput na dan, a primjenjuje se ujutro. Kada se primjenjuje u kombinaciji sa sulfonilurejom, niža doza sulfonilureje se može razmotriti kako bi se smanjio rizik od hipoglikemije. Ne preporučuju se doze veće od 100 mg. U starijih pacijenata i pacijenata s blagim oštećenjem bubrega (klirens kreatinina  $\geq 50$  ml/min) nije potrebno prilagođavati dozu. Lijek se može uzimati uz obrok ili bez obroka

Za sve detaljnije informacije o lijeku koristiti posljednji odobreni Sažetak glavnih karakteristika lijeka i Uputstvo o lijeku.

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## KONAČNO SLOBODA!

Pakovanje:  
APIXA® film tablete 60 x 2,5 mg:  
(br. rješenja: 04-07.3-1-17/24 od 25.04.2024.)  
APIXA®, film tablete 60 x 5 mg:  
(br. rješenja: 04-07.3-1-18/24 od 25.04.2024.)

Lijek se izdaje uz lješkarski recept.  
Bosnalijek, farmaceutska i hemijska industrija, dioničko društvo, Jukićeva 53, Sarajevo, BiH.

**ODOBRENE INDIKACIJE:** Apixa 2,5 mg: Prevencija venskih tromboembolijskih događaja (VTE) u odraslih pacijenata podvrgnutih elektivnom hirurškom zahvatu ugradnje umjetnog kuka ili koljena.  
Apixa 2,5 mg i Apixa 5 mg: Prevencija moždanog udara i sistemske embolije u odraslih pacijenata s nevalvularnom fibrilacijom atrija (NVAF), koji imaju jedan ili više faktora rizika, poput, pretrpljenog moždanog udara ili tranzitorne ishemijske atake (TIA), dobi  $\geq 75$  godina, hipertenzije, šećerne bolesti, simptomatskog zatajenja srca (NYHA kategorija  $\geq$  II). Liječenje duboke venske tromboze (DVT) i plućne embolije (PE), te prevencija ponavljajućih DVT i PE u odraslih. **KONTRAINDIKACIJE:** Preosjetljivost na aktivnu supstancu ili na neku od pomoćnih supstanci. Aktivno, klinički značajno krvarenje. Bolest jetre povezana s koagulopatijom i klinički relevantnim rizikom od krvarenja. Lezija ili stanje koje se smatra značajnim faktorom rizika za veliko krvarenje (trenutno ili nedavno gastrointestinalnu ulceraciju, prisutnost malignih neoplazmi kod kojih postoji veliki rizik od krvarenja, nedavne ozljede mozga ili kičme, nedavni hirurški zahvat na mozgu, kralježnici ili očima, nedavno intrakranijalno krvarenje, utvrđene ili suspektne varikozitete jednjaka, arteriovenske malformacije, vaskularne aneurizme ili velike intraspinalne ili intracerebralne vaskularne abnormalnosti). Istovremeno liječenje bilo kojim antikoagulantom, npr. nefrakcioniranim heparinom, heparinima niske molekulske težine (enoksaparin, dalteparin itd.), derivatima heparina (fondaparinuks itd.), oralnim antikoagulantima (varfarin, rivaroksaban, dabigatran itd.), osim pri specifičnim okolnostima promjene antikoagulantne terapije, kada se nefrakcionirani heparin daje u dozama neophodnim za održavanje centralnog venskog ili arterijskog katetera otvorenim ili kada se nefrakcionirani heparin daje tokom kateterske ablacije zbog fibrilacije atrija. **POSEBNA UPOZORENJA I MJERE OPREZA:** Preporučuje se pažljiva primjena kod bolesti praćenih povećanim rizikom od krvarenja. Primjenu apiksabana treba prekinuti ako se dogodi teško krvarenje. Istovremena primjena apiksabana s antitrombotičnim lijekovima povećava rizik od krvarenja. Oprez je potreban ako se pacijenti istovremeno liječe selektivnim inhibitorima ponovnog preuzimanja serotonina (SSRI) ili inhibitorima ponovnog preuzimanja serotonina i noradrenalina (SNRI), ili nesteroidnim antiinflamatornim lijekovima (NSAIL), uključujući i acetylsalicylnu kiselinu (ASK). U pacijenata s fibrilacijom atrija i sa stanjima koja zahtijevaju monoterapiju ili dvojni terapiju antitrombotičnim lijekovima, potrebno je provesti pažljivu procjenu potencijalnih koristi naspram potencijalnih rizika prije kombiniranja takve terapije s apiksabanom. **NEŽELJENA DJELOVANJA:** Anemija, krvarenje u oku, krvarenje hematom, hipotenzija (uključujući hipotenziju tokom procedure), epistaksa, mučnina, krvarenje u probavnom sistemu, rektalno krvarenje, krvarenje iz gingive, povećana gama-glutamilttransferaza, hematurija, kontuzija. **DOZIRANJE I NAČIN UPOTREBE:** Apixa 2,5 mg: Prevencija VTE (VTEp): elektivni hirurški zahvatu ugradnje umjetnog kuka ili koljena: Preporučena doza apiksabana je 2,5 mg oralno, dva puta na dan. Početnu dozu treba uzeti 12 do 24 sata nakon hirurškog zahvata. Preporučeno trajanje liječenja u pacijenata podvrgnutih hirurškom zahvatu ugradnje umjetnog kuka je 32 do 38 dana, a za ugradnju umjetnog koljena je 10 do 14 dana. Apixa 2,5 mg i Apixa 5 mg: Prevencija moždanog udara i sistemske embolije u odraslih pacijenata s nevalvularnom fibrilacijom atrija (NVAF): Preporučena doza apiksabana je 5 mg oralno, dva puta na dan. Liječenje treba biti dugotrajno. Liječenje duboke venske tromboze (DVT) i plućne embolije (PE): Preporučena doza apiksabana je 10 mg oralno dva puta na dan, tokom prvih 7 dana, nakon čega slijedi 5 mg oralno dva puta na dan. U skladu s dostupnim medicinskim smjernicama, kratko trajanje liječenja (najmanje 3 mjeseca) treba temeljiti na prolaznim faktorima rizika. Prevencija ponavljajućih DVT i PE: Preporučena doza apiksabana je 2,5 mg oralno dva puta na dan. Kada je indicirana prevencija ponavljajućih DVT i PE, treba započeti s dozom od 2,5 mg dva puta na dan, a nakon završetka 6-mjesečnog liječenja apiksabanom u dozi 5 mg dva puta na dan ili s drugim antikoagulantom.

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