

Volume 20 / Number 1 / 2026

ISSN 1840-2291

HealthMED

Journal of Society for development in new net environment in B&H



ISSN 1840-2291



9 771840 229005

HealthMED

Journal of Society for development in new net environment in B&H

EDITORIAL BOARD

Editor-in-chief	<i>Mensura Kudumovic</i>
Associate Editor	<i>Azra Kudumovic</i>
Technical Editor	<i>Eldin Huremovic</i>
Cover design	<i>Eldin Huremovic (OREATE Ai)</i>
Members	<i>Paul Andrew Bourne (Jamaica)</i> <i>Nicolas Zdanowicz (Belgique)</i> <i>Xiuxiang Liu (China)</i> <i>Chao Chen (China)</i> <i>Farah Mustafa (Pakistan)</i> <i>Yann Meunier (USA)</i> <i>Maizirwan Mel (Malaysia)</i> <i>Diaa Eldin Abdel Hameed Mohamad (Egypt)</i> <i>Budimka Novakovic (Serbia)</i> <i>Aleksandar Dzakula (Croatia)</i> <i>Ramadan Dacaj (Republic of Kosova)</i> <i>Sadeta Hamzic (Bosnia & Herzegovina)</i> <i>Broza Saric Kundalic (Austria)</i>
Address	Bolnicka bb, 71 000 Sarajevo, Bosnia and Herzegovina.
Editorial Board	e-mail: healthmedjournal@gmail.com web page: http://www.healthmed.ba
Published by	DRUNPP, Sarajevo
Volume 20	Number 1, 2026
ISSN	1840-2291 e-ISSN 1986-8103

HealthMED Journal is covered or selected for coverage in the following:

- EBSCO Academic Search Complete
- EBSCO Academic Search Premier,
- EMBASE,
- SJR Scopus,
- Index Copernicus,
- Universal Impact Factor: Impact Factor is 1.0312 (UIF 2012)
- Electronic Social and Science Citation Index (ESSCI),
- Direct Science,
- ISI - institute of science index,
- SCImago Journal and Country Rank,
- ISC Master Journal List,
- Genamics Journal Seek,
- World Cat,
- Research Gate,
- CIRRIE,
- getCITED and etc,
- Academic Resource Index /Research Bib.

Sadržaj / Table of Contents

HOMA-IR as a secondary diagnostic parameter in the diagnosis and differentiation of the PCOS phenotypic subgroups	3
<i>Elmira Hajder, Jasmina Pasic, Alma Halilbasic, Jusuf Hodzic, Mithad Hajder</i>	
Clinical and clinicopathological characteristics of basal cell carcinoma and their association with tumor localization	10
<i>Nermina Kurtalic, Alim Samardzic, Sadat Kurtalic, Lejla Hodzic, Eldina Malkic Salihbegovic, Dinela Sejdinovic</i>	
Antimicrobial Resistance of the Most Common Bacterial Pathogens Isolated from Skin, Mucosal, and Wound Swabs in Outpatients in Sarajevo Canton (March–June 2024)	16
<i>Azra Kudumovic, Sadeta Hamzic</i>	
Acinetobacter baumannii - a modern challenge in clinical microbiology	22
<i>Azra Besic</i>	
Communication, Patient Participation, and Informed Consent as Indicators of the Quality of Hospital Healthcare	27
<i>Nermina Kurtalic, Lejla Hodzic, Sadat Kurtalic, Alim Samardzic, Huska Jukic</i>	
Instructions for the authors.....	34

DOI: 10.18421/1986-8103.2026.20.1.3

HOMA-IR as a secondary diagnostic parameter in the diagnosis and differentiation of the PCOS phenotypic subgroups

Elmira Hajder¹, Jasmina Pasic², Alma Halilbasic², Jusuf Hodzic², Mithad Hajder¹

¹ Private health institution, Institute for human reproduction „Dr. Hajder“ Tuzla, Bosnia and Herzegovina,

² University clinical Center Tuzla Internal clinic, Bosnia and Herzegovina.

Abstract

Introduction: Polycystic ovary syndrome (PCOS) is a multisystemic endocrine, metabolic and reproductive disorder. The Homeostasis Model Assessment (HOMA-IR), as a clinical marker of insulin resistance (IR), is not included in the Rotterdam diagnostic criteria for the diagnosis of PCOS. The aim of this study was to determine the diagnostic value of HOMA-IR in the diagnosis of PCOS and in the differentiation of its phenotypic forms.

Subjects and Methods: A retrospective case-control study was conducted including 99 women of reproductive age diagnosed with PCOS and 27 women without PCOS, selected according to the ESHRE/ASRM criteria from 2003. All participants were between 21 and 40 years of age. Women with PCOS were classified into four phenotypic groups according to the Rotterdam criteria. The Mann-Whitney U test was used for comparisons between two groups, while the Kruskal-Wallis test was applied for comparisons among more than two groups. Spearman's correlation test was used to analyze correlations between parameters within the groups.

Results: The median HOMA-IR value in women with PCOS was significantly higher compared with the control group without PCOS (2.26 vs. 1.48; $p < 0.001$). All PCOS phenotypic subgroups showed significantly higher HOMA-IR values than the control group: PCOS type A (2.75 vs. 1.48; $p < 0.001$), PCOS type B (2.14 vs. 1.48; $p < 0.001$), PCOS type C (2.22 vs. 1.48; $p < 0.001$), and PCOS type D (2.03 vs. 1.48; $p < 0.001$). A statistically significant difference in median HOMA-IR values was observed among the four PCOS phenotypic subgroups ($\chi^2 = 8.086$; $df = 3$; $n = 99$; $p < 0.04$). A significant positive correlation ($p < 0.05$) was found between HOMA-IR and insulin, glucose, testoster-

one and body mass index (BMI), while a negative correlation was observed between HOMA-IR and sex hormone-binding globulin (SHBG).

Conclusions: HOMA-IR is a useful additional diagnostic parameter in women with PCOS. When combined with the Rotterdam criteria, it may aid in the differentiation of the PCOS phenotypic forms.

Keywords: *polycystic ovary syndrome; phenotypic forms; homeostasis model assessment (HOMA-IR)*

Introduction

Polycystic ovary syndrome (PCOS), the most common endocrine disorder in women of reproductive age, is characterized by menstrual irregularities, polycystic ovarian morphology and hyperandrogenemia. It is also associated with insulin resistance (IR), chronic inflammation and oxidative stress, which may contribute to the development of autoimmunity (1). Approximately 70% of affected women are subfertile (1), and the prevalence of PCOS ranges from 6% to 20% across different countries (2). From a pathophysiological perspective, PCOS is characterized by chronic oligo-anovulation, elevated circulating androgen levels, polycystic ovarian morphology (PCOM), disordered gonadotropin secretion, insulin resistance/hyperinsulinemia and a frequent association with obesity (3). Women with PCOS are at increased risk of developing type 2 diabetes mellitus and metabolic syndrome (4).

At the Third Amsterdam Consensus Workshop in 2012, the definition of PCOS was redefined. PCOS is now considered an endocrine disorder of reproductive-age women, characterized by menstrual dysfunction, anovulatory infertility, dysfunction of gonadotropin secretion, hyperandrogenism

and insulin resistance, the latter being regarded as a key factor in the development of PCOS (5).

Metabolic insulin resistance arises from serine phosphorylation rather than tyrosine phosphorylation, following insulin binding to the insulin receptor.

Adipocytes, derived from adipose tissue, secrete endocrine and paracrine hormones and metabolites. Free fatty acids and tumor necrosis factor- α (TNF- α), produced by adipocytes, contribute to the development of insulin resistance with subsequent compensatory hyperinsulinemia (6,7).

Clinically, insulin resistance can be assessed using the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR), calculated according to the following formula:

$$\text{HOMA-IR} = \text{fasting insulin } (\mu\text{U/mL}) \times \text{fasting glucose (mmol/L)} / 22.5 \text{ (8)}.$$

Clinical manifestations of insulin resistance include fasting hyperinsulinemia ($>10 \mu\text{IU/mL}$), decreased levels of sex hormone-binding globulin (SHBG) and non-alcoholic fatty liver disease (NAFLD) (9).

The aim of this study was to determine the clinical significance of HOMA-IR as a marker of insulin resistance in the diagnosis of PCOS phenotypic forms.

Study design

This retrospective case-control study included 99 women of reproductive age diagnosed with PCOS (study group) and 27 women of reproductive age without a PCOS diagnosis (control group), selected according to the ESHRE/ASRM criteria established in 2003. The study was conducted between May 2022 and December 2024 at the private healthcare institution "PZU Dr. Hajder" in Tuzla.

Study protocol. Inclusion criteria comprised infertile women aged 21–40 years with a diagnosis of PCOS who voluntarily provided written informed consent. Exclusion criteria included women older than 40 years and those with diagnosed endocrinopathies. The PCOS group was further classified into four phenotypic forms (A, B, C, and D) according to the ESHRE/ASRM diagnostic criteria. For all participants, with and without PCOS, the following parameters were analyzed: age, body weight, fasting plasma glucose and in-

ulin levels, HOMA-IR, testosterone, sex hormone-binding globulin (SHBG), free androgen index (FAI) and anti-Muellerian hormone (AMH).

Definition of parameters. Biochemical hyperandrogenemia was defined as a total testosterone level $> 2.5 \text{ nmol/L}$. Insulin resistance was defined as HOMA-IR > 2.0 (10). The free androgen index (FAI) was calculated using the formula:

$$\text{FAI} = [\text{testosterone (nmol/L)} / \text{SHBG (nmol/L)}] \times 100 \text{ (11)}.$$

An FAI value > 3 indicated hyperandrogenemia. Body mass index (BMI) was calculated as follows:

$$\text{BMI (kg/m}^2\text{)} = \text{weight (kg)} / \text{height}^2 \text{ (m}^2\text{)}.$$

Methods

Body weight and height, as well as BMI, were assessed during physical examination. Hormonal parameters, including glucose, insulin, testosterone, SHBG, and AMH, were measured. Age at menarche and menstrual cycle length were also analyzed. Insulin concentrations were measured using the Elecsys Insulin assay (Mannheim, Germany) and AMH levels were determined using the Elecsys AMH assay (Rotkreuz, Switzerland). All laboratory analyses were performed at the Dia Lab laboratory in Bijeljina, Bosnia and Herzegovina.

Statistical analysis. Data analysis was performed using SPSS statistical software (version 22.0; SPSS Inc., Chicago, IL, USA). As the parameters did not follow a normal distribution, results were expressed as nonparametric variables and presented as medians with interquartile ranges. The nonparametric Mann-Whitney U test was used for comparisons between two groups, while the Kruskal-Wallis test was applied for comparisons among more than two groups. In all analyses, a p -value < 0.05 was considered statistically significant. Spearman's rank correlation coefficient was used for bivariate correlation analyses, with $p < 0.05$ also considered statistically significant.

Results

The biggest subgroup was the phenotypic subgroup A and the smallest subgroup the subgroup C.

PCOS type A accounted for 40 (40.40%), PCOS B for 16 (19.19%), PCOS-type C for 14 (14.14%) and PCOS-type D for 29 (29.29%) of the patients (Figure 1).

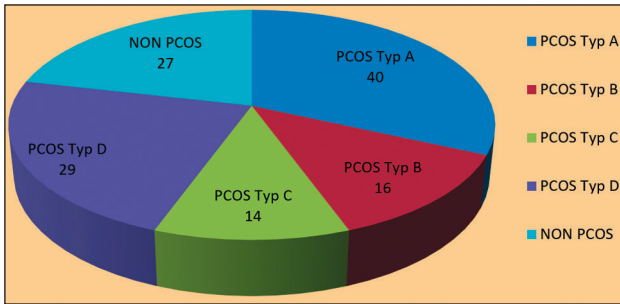


Figure 1. PCOS phenotypes and the non-PCOS group

In PCOS women had a longer menstrual cycle length and earlier menarche. There were no significant differences in age when comparing the PCOS with the control group without PCOS. BMI (26.30 vs. 22.74, $p < 0.001$), insuline (10.30 vs. 7.20, $p < 0.001$), fasting glucose (5.80 vs. 4.82, $p < 0.009$), HOMA-IR (2.26 vs. 1.48, $p < 0.001$), testosterone (2.20 vs. 1.3, $p < 0.001$), FAI (6.21 vs. 1.83, $p < 0.001$) and AMH (5.20 vs. 2.90, $p < 0.001$) were significantly higher in the PCOS when compared with the non-PCOS group, the SHBG (35.30 vs. 62.30, $p < 0.001$) was significantly lower in the PCOS group compared to the non-PCOS group (Table 1).

Patients with PCOS had a significantly higher HOMA-IR median (2.26 vs. 1.48, $p < 0.001$) when compared with the non-PCOS group (table 1). All phenotypic PCOS subgroups had significantly

higher HOMA-IR medians ($p < 0.05$) when compared with the non-PCOS group. PCOS subgroup A had a significantly higher HOMA-IR (2.75 vs. 1.48, $p < 0.001$), PCOS subgroup B a significantly higher HOMA-IR (2.14 vs. 1.48, $p < 0.001$), PCOS subgroup C a significantly higher HOMA-IR (2.22 vs. 1.48, $p < 0.001$) and the subgroup D a significantly higher HOMA-IR (2.03 vs. 1.48, $p < 0.001$) when compared with the non-PCOS group (Figure 2). The highest HOMA-IR median was in the PCOS-phenotype A (2.74 vs. 2.03, $p < 0.008$) when compared with the lowest in PCOS-phenotype D. There were no significant differences between the phenotypes B, C and D (Figure 2).

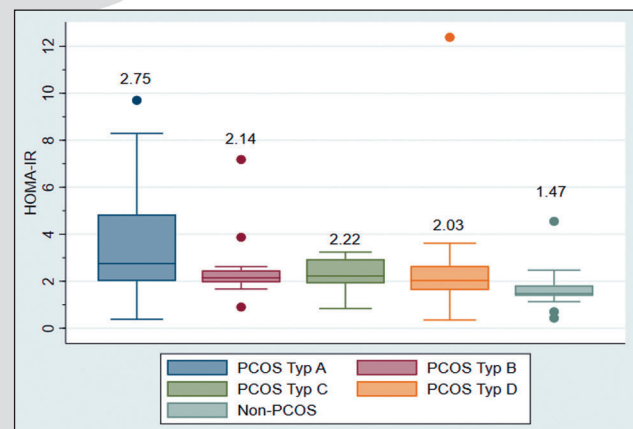


Figure 2. Comparative HOMA-IR analysis in the phenotypic PCOS-subgroups of and the non-PCOS subgroup

Legend: HOMA-IR, Homeostasis Model Assessment For Insulin Resistance Index; $p = 0.008$ for PCOS Type A vs. PCOS Type D; $p = 0.001$ for PCOS Type A vs. Non-PCOS; $p = 0.001$ for PCOS Type B vs. Non-PCOS; $p = 0.001$ for PCOS Type C vs. Non-PCOS; $p = 0.027$ for PCOS Type D vs. Non-PCOS.

Table 1. Basal parameter comparison between the PCOS and the non-PCOS group

Parameters	PCOS (n = 99)	Non-PCOS (n = 27)	p-value
	Median (Q1-Q3)	Median (Q1-Q3)	
Testosterone (nmol/L)	2.20 (1.4-2.9)	1.30 (0.9-1.5)	0.001
SHBG (nmol/L)	35.30 (29.6-51.2)	62.30 (51.6-74.3)	0.001
FAI	6.21 (2.6-9.1)	1.83 (1.3-2.8)	0.001
Insuline (µIU/ml)	10.30 (8.30-13.50)	7.20 (6.30-8.20)	0.001
Glucose (mmol/L)	5.80 (5.2-6.2)	4.82 (4.18-5.32)	0.009
HOMA-IR	2.26 (1.8-3.2)	1.48 (1.38-1.81)	0.001
Menstrual cycle (days)	35.00 (25.1-41.2)	29.00 (28.0-34.0)	0.001
BMI (kg/m ²)	26.30 (23.4-30.0)	22.74 (21.2-25.2)	0.001

Legend: Parameters are expressed as median (range Q1-Q3); FAI, free androgenic index, SHBG, sex hormone binding globuline; BMI, Body Mass Index; HOMA-IR, Homeostasis Model Assessment For Insulin Resistance Index. Two-sample Wilcoxon rank-sum (Mann-Whitney) test, $p < 0.05$, PCOS vs. non-PCOS; 1 ng/dl = 28.65 nmol/l.

All four PCOS phenotypes showed the presence of insulin resistance (IR), expressed by HOMA-IR values ≥ 2 . The highest prevalence of IR shown through the HOMA-IR parameter was 77.50% in PCOS phenotype A and the lowest was 51.72% in PCOS phenotype D (Figure 3).

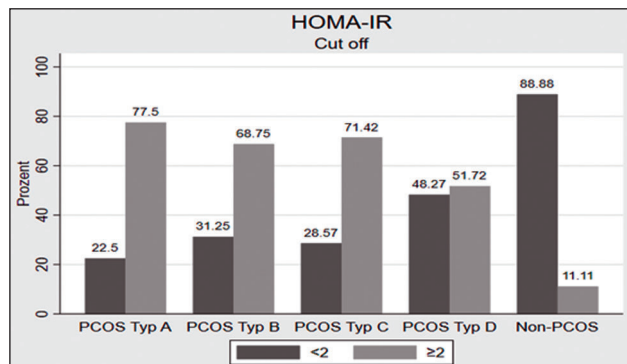


Figure 3. HOMA-IR results in the PCOS phenotypes and the non-PCOS group

Legend: PCOS, Polycystic Ovary syndrome; HOMA-IR, Homeostasis Model Assessment for Insulin Resistance Index.

Table 2. shows the comparison of the HOMA-IR parameters in the 4 phenotypic PCOS subgroups. Kruskal-Wallis test has shown a statistically significant difference in the HOMA results in the 4 phenotypic PCOS-subgroups (n = 40, PCOS subgroup A, n = 16, PCOS subgroup B, n = 14, PCOS subgroup C, n = 29, PCOS subgroup D, X² = 8.086 (Total n = 99, p < 0.044).

In women with PCOS, a strong positive correlation was observed between HOMA-IR and BMI ($\rho = 0.635$, n = 99, p < 0.001). A strong positive correlation was also found between HOMA-IR and fasting glucose levels ($\rho = 0.598$, n = 99, p < 0.001), as well as between HOMA-IR and insulin levels ($\rho = 0.980$, n = 99, p < 0.001). In addition, HOMA-IR showed a strong positive correlation with testosterone levels ($\rho = 0.312$, n = 99, p <

0.001) and with the free androgen index (FAI) ($\rho = 0.551$, n = 99, p < 0.001). Conversely, a strong negative correlation was observed between HOMA-IR and sex hormone-binding globulin (SHBG) levels ($\rho = -0.580$, n = 99, p < 0.001) (Table 3).

Table 3. Spearman-Rho correlation between the HOMA-IR parameter and other PCOS parameters Parameters

Parameters PCOS	HOMA-IR	
	rho	p-value
BMI (kg/m ²)	0.635**	0.001
Insuline	0.980**	0.001
Menarche (years)	0.19**	0.048
Glucose	0.598*	0.001
Testosterone	0.312**	0.001
SHBG	-0.580**	0.001
FAI	0.55**	0.001

Legend: BMI, body mass index; HOMA-IR, homeostasis model assessment for insulin resistance index; FAI, free androgen index; * weak correlation; ** strong correlation; Spearman rho correlation *p < 0.05.

Discussion

The key diagnostic parameters of PCOS according to the Rotterdam criteria include clinical and/or biochemical hyperandrogenism (HA), irregular menstrual cycles due to oligo/anovulation (OA) and polycystic ovarian morphology (PCOM). The diagnosis is based on the ESHRE/ASRM criteria and requires the presence of at least two of the three criteria, after exclusion of PCOS-like disorders. The presence of two out of three clinical parameters defines four phenotypic forms of PCOS (A, B, C, and D). At the same ESHRE/ASRM consensus meeting in 2003, four PCOS phenotypes and a PCOM-like phenotype were proposed and remain under consideration today: PCOS phenotype A (HA + OA + PCOM), pheno-

Table 2. Comparison of the HOMA-IR in the 4 PCOS phenotypes

Parametar	Subgroup	n	Mean rank	Chi Square	df	p-value
HOMA-IR	PCOS Type A	40	59.43	8.086	3	0.044
	PCOC Type B	16	45.63			
	PCOC Type C	14	48.32			
	PCOC Type D	29	40.22			
	Kohorta PCOS	99				

Legend: Values are median (range, Q1-Q3), PCOS, Polycystic Ovary Syndrome; n- number of patients; HOMA-IR, homeostasis model assessment for insulin resistance index; Kruskal-Wallis equality-of-populations rank test, p < 0.0001.

type B (HA + OA), phenotype C (HA + PCOM), phenotype D (OA + PCOM) and the PCOM-like phenotype (12). From the three clinical parameters (OA, HA, PCOM), seven different clinical combinations are possible, which complicates the diagnosis of PCOS (13). Although insulin resistance (IR) is a primary disorder with a high prevalence among women with PCOS, it was not included in the Rotterdam diagnostic criteria (12). The prevalence of IR in women with PCOS has been reported to be approximately 70% (14).

There is still no consensus regarding the optimal cut-off value for HOMA-IR. A recently published study reported that a HOMA-IR cut-off value ≥ 2.5 indicates insulin resistance and detects cardiometabolic risk in the general population (15). For women with metabolic syndrome defined by IDF criteria, HOMA-IR cut-off values of 2.11 for those under 30 years of age, 2.05 for those up to 50 years, and 2.37 for those over 70 years have been proposed (16). A HOMA-IR cut-off value ≥ 2.0 has also been recommended for young women with PCOS, and this threshold is used by the European Group for the Study of Insulin Resistance (10). The results of the present study demonstrated that insulin resistance was significantly more prevalent in women with PCOS compared with non-PCOS women (HOMA-IR, $p < 0.01$). All PCOS phenotypic subgroups showed significantly higher HOMA-IR values ($p < 0.05$) than non-PCOS women. The highest HOMA-IR values were observed in phenotype A and were significantly higher ($p < 0.05$) compared with phenotypes B, C, and D. These findings confirm the association between insulin resistance/hyperinsulinemia and hyperandrogenism, which is consistent with the pathogenesis of PCOS. Insulin resistance leads to compensatory hyperinsulinemia, which stimulates pituitary luteinizing hormone (LH) secretion and increases the LH/FSH ratio. Through activation of the enzyme P450c17 α , ovarian and adrenal steroidogenesis is enhanced, resulting in hyperandrogenism and irregular menstrual cycles (3). Activation of cytochrome P450c17 (CYP17) due to hyperinsulinemia leads to increased adrenal androgen steroidogenesis (progesterone, 17 α -hydroxyprogesterone, and testosterone) compared with normal theca cells (7). Insulin resistance and hyperinsulinemia further

increase ovarian androgen production directly and indirectly by reducing the synthesis of sex hormone-binding globulin (SHBG), thereby contributing to hyperandrogenism and estrogen excess in women with PCOS (8). A recently published Indonesian study involving 125 women of reproductive age with PCOS diagnosed according to the Rotterdam criteria (mean age 29.6 years) reported significantly elevated HOMA-IR levels across all PCOS phenotypic subgroups. HOMA-IR values were 4.2 in phenotype A, 3.2 in phenotype B, 2.9 in phenotype C and 2.0 in phenotype D, with a positive correlation between HOMA-IR and AMH levels (17). Panidis et al. (2012), in a Greek study of 1,212 women with PCOS diagnosed according to the Rotterdam criteria, reported that 50% of PCOS women had an increased BMI. Women with phenotypes A and B exhibited significantly greater insulin resistance compared with controls, as reflected by higher insulin and HOMA-IR levels. In contrast, women with phenotype C did not differ from the control group in any insulin resistance markers, while women with phenotype D had borderline higher HOMA-IR values compared with controls ($p < 0.016$) (18). Alebić et al. (2015), in a retrospective analysis of 284 Croatian/French women with PCOS, reported that insulin resistance was significantly present in phenotypic subgroups A and D compared with controls. The highest median HOMA-IR values were observed in phenotype A (3.0) and phenotype D (2.3), while the lowest value was recorded in phenotype C (1.9). Phenotype B was not analyzed due to a small sample size ($n = 12$). No positive correlation between HOMA-IR and AMH was found (19).

Al-Jefout et al. (2017), in an analysis of 159 women with PCOS from Jordan diagnosed according to the Rotterdam criteria, reported that median HOMA-IR values were significantly higher in women with PCOS compared with infertile non-PCOS women. A statistically significant difference ($p < 0.006$) was observed among PCOS phenotypic subgroups. HOMA-IR values were 3.11 in the total PCOS group, 3.38 in phenotype A, 2.86 in phenotype B, 2.95 in phenotype C, and 2.85 in phenotype D. Insulin resistance was most pronounced in phenotype A and lowest in phenotype D (20). Overall, the results of the present study and previously published studies are

largely consistent regarding HOMA-IR values in the overall PCOS population; however, differences exist among individual PCOS phenotypes B, C, and D (17–20).

Conclusion

Insulin resistance is prevalent in women with PCOS and is closely associated with hyperandrogenism, resulting in a complex metabolic–endocrine disorder. HOMA-IR represents a valuable adjunct clinical parameter, alongside Rotterdam criteria and AMH, for the diagnosis of PCOS and its phenotypic forms, particularly for identifying women with PCOS who are at increased cardiometabolic risk.

References

1. Kwiatkowski J, Akpang N, Zaborowska L, Ludwin A. Antinuklearna antitijela u sindromu policističnih jajnika: Sustavni pregled opservacijskih studija. *Int. J. Mol. Sci.* 2025; 26: 9493. <https://doi.org/10.3390/ijms26199493>.
2. March WA, Moore VM, Willson KJ, Phillips DI, Norman RJ, Davies MJ. The prevalence of polycystic ovary syndrome in a community sample assessed under contrasting diagnostic criteria. *Hum Reprod.* 2010; 25(2): 544–512; 27: 3067–3073.
3. Tsilchorozidou T, Overton C, Conway GS. The pathophysiology of polycystic ovary syndrome. *Clin. Endocrinol.* (2004; Oxf). 60: 1–17.
4. Moran LJ, Misso ML, Wild RA, Norman RJ. Impaired glucose tolerance, type 2 diabetes and metabolic syndrome in polycystic ovary syndrome: a systematic review and meta-analysis. *Hum Reprod Update.* 2010; 16(4): 347–63.
5. Fauser BC, Tarlatzis BC, Rebar RW, Legro RS, Balen AH, et al. Consensus on women's health aspects of polycystic ovary syndrome (PCOS): the Amsterdam ESHRE/ASRM-Sponsored 3rd PCOS Consensus Workshop Group. *Fertil Steril.* 2012; 97(1): 28–38.
6. Jung UJ, Choi MS. Obesity and Its Metabolic Complications: The Role of Adipokines and the Relationship between Obesity, Inflammation, Insulin Resistance, Dyslipidemia and Nonalcoholic Fatty Liver Disease. *Int J MolSci.* 2014; Apr; 15(4): 6184–6223.
7. Dunaif A. Insulin Resistance and the Polycystic Ovary Syndrome: Mechanism and Implications for Pathogenesis. *Endocr. Rev.* (1997); 18(6): 774–800.
8. Wallace IR, McKinley MC, Bell PM, Hunter SJ. Sex hormone binding globulin and insulin resistance. *Clin Endocrinol (Oxf).* 2013; 78(3): 321–9.
9. Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC. Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. *Diabetes Care.* 2002; 25(10): 1891–2.
10. Jensterle M, Weber M, Pfeifer M, Prezelj J, Pfutzner A, Janez A. Assessment of insulin resistance in young women with polycystic ovary syndrome. *Int. J. Gynaecol. Obstet.* 2008; 102(2): 137–140.
11. Carter GD, Holland SM, Alaghband-Zadeh J, Rayman G, Dorrington-Ward P, Wise PH. Investigation of Hirsutism: Testosterone is Not Enough. *International Journal of Laboratory medicine.* 1983; Volume: 20 issue: page(s): 262–263.
12. The Rotterdam ESHRE/ASRM-Sponsored PCOS consensus workshop group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS). *Hum Reprod.* 2004; 19: 41–47.
13. Dewailly D, Gronier H, Poncelet E, et al. Diagnosis of polycystic ovarian syndrome (PCOS): revisiting the threshold values of follicle count on ultrasound and the serum AMH level for definition of polycystic ovaries. *Hum Reprod* 2011; 26(11): 3123–9.
14. Moghetti P, Tosi F, Bonin C, Di Sarra D, Fiers T, Kaufman JM, et al. Divergences in insulin resistance between the different phenotypes of the polycystic ovary syndrome. *J. Clin. Endocrinol. Metab.* (2013); 98(4): 628–637.
15. Yildiz BO, Bozdogan G, Yapici Z, Esinler I, Yarali H. Prevalence, phenotype and cardiometabolic risk of polycystic ovary syndrome under different diagnostic criteria. *Hum Reprod.* 2012; 27: 3067–3073.
16. Gayoso-Diz P, Otero-González A, Rodríguez-Alvarez MX, Gude F, García F, De Francisco A, Quintela AG. Insulin resistance (HOMA-IR) cut-off values and the metabolic syndrome in a general adult population: Effect of gender and age: EPIRCE cross-sectional study. *BMC Endocr Disord.* 2013; 16(13): 47.
17. Wiweko B, Indra I, Susanto C, Natadisastra M, Hestiantoro A. The correlation between serum AMH and HOMA IR among PCOS phenotypes. *BMC Res.* 2018; Notes. 11(1): 114.
18. Panidis D, Tziomalos K, Misichronis G, Papadakis E, Betsas G, et al. Insulin resistance and endocrine characteristics of the different phenotypes of polycy-

stic ovary syndrome: a prospective study. Hum. Reprod. 2012; 27: 541–549.

19. *Alebic MŠ, Stojanovic N, Duhamel A, Dewailly D. The phenotypic diversity in per-follicle anti-Mullerian hormone production in polycystic ovary syndrome. Hum. Reprod. 2015; 30: 1927–1933.*
20. *Al-Jefout M, Alnawaiseh N, Al-Qtaitat A. Insulin resistance and obesity among infertile women with different polycystic ovary syndrome phenotypes. Sci. Rep. 2017; 7: 5339.*

Corresponding Author

Elmira Hajder,

Private health institution,

Institute for human reproduction „Dr. Hajder“,

Tuzla,

Bosnia and Herzegovina,

E-mail: dr.hajder.neplodnost@gmail.com



DOI: 10.18421/1986-8103.2026.20.1.10

Clinical and clinicopathological characteristics of basal cell carcinoma and their association with tumor localization

Nermina Kurtalic¹, Alim Samardzic², Sadat Kurtalic¹, Lejla Hodzic², Eldina Malkic Salihbegovic³, Dinela Sejdinovic⁴

¹ Cantonal Hospital "Dr. Irfan Ljubijankic", Bihac, Bosnia and Herzegovina,

² University of Bihac, Faculty of Health Studies, Bihac, Bosnia and Herzegovina,

³ Health Medical Center, Zivinice, Bosnia and Herzegovina,

⁴ Health Medical Center, Lukavac Bosnia and Herzegovina.

Abstract

Background: Basal cell carcinoma (BCC) is the most common malignant skin tumor and is strongly associated with chronic exposure to ultraviolet radiation. The relationship between clinicopathological features and anatomical localization remains incompletely defined.

Research objective: To assess the association between demographic and clinical characteristics and tumor localization in patients with BCC.

Subjects and methods: This prospective cross-sectional observational study included 56 subjects with histologically confirmed BCC. Demographic and clinical variables were analyzed, including sex, age group, living and working environment, skin type, sun exposure, clinical tumor subtype, and presence of precancerous lesions. Tumor localization was classified as photo-exposed or non-photo-exposed. Chi-square test and binary logistic regression were used.

Results: The majority of subjects were women, older than 65 years, and had tumors in photo-exposed areas. No significant association was found between tumor localization and sex, age group, living environment, work environment, skin type, sun exposure, or clinical tumor subtype. The presence of precancerous lesions was significantly associated with localization, with tumors occurring more frequently in photo-exposed areas in these subjects. In logistic regression, patients with precancerous lesions had higher odds of photo-exposed tumor localization, whereas sex and age group were not significant predictors.

Conclusion: Precancerous lesions were the only factor significantly associated with light-exposed tumor localization in this cohort, supporting the clinical significance of chronic photodamage in the distribution of basal cell carcinoma.

Keywords: *basal cell carcinoma, BCC, tumor localization, photo-exposed areas, precancerous lesions, ultraviolet radiation, clinical and epidemiological characteristics*

Introduction

Basal cell carcinoma (BCC) is the most common malignant skin tumor and is the most common malignancy among fair-skinned populations worldwide [1,2]. Its incidence has been continuously increasing in recent decades, especially among the elderly, making BCC an important public health and dermatological problem [2,3]. Although BCC rarely metastasizes, its locally invasive growth pattern can lead to significant tissue destruction, functional impairment, and cosmetic morbidity if not recognized and treated promptly [2].

Ultraviolet (UV) radiation is considered a major etiological factor in the development of BCC [1,4]. Chronic cumulative sun exposure contributes to DNA damage, immunosuppression, and molecular changes involved in cutaneous carcinogenesis [4]. Consequently, BCC most commonly occurs in photo-exposed anatomical areas, particularly the head and neck [2,5]. However, tumors can also develop in non-photo-exposed areas, suggesting that additional environmental, genetic, and host-related factors contribute to tumor distribution and clinical presentation [6].

Several demographic and clinical characteristics are associated with the occurrence of basal cell carcinoma, including older age, male sex, lighter skin phototype, occupational exposure to UV radiation, and the presence of precancerous skin lesions [2,4,7]. Precancerous lesions, particularly actinic keratoses, are considered markers of chronic photodamage and may indicate increased susceptibility to UV-induced skin carcinogenesis [8]. In addition, the different histopathological subtypes of BCC demonstrate variable anatomical distribution patterns and biological behavior [2].

Despite the large number of studies investigating BCC risk factors and epidemiology, relatively limited data are available on the association between clinical and epidemiological characteristics and tumor localization, especially in regional populations. A better understanding of these associations may contribute to better identification of high-risk patients, earlier diagnosis, and more effective preventive strategies targeting chronically sun-exposed areas.

Therefore, the aim of this study was to analyze the association between demographic and clinical characteristics of patients with basal cell carcinoma and tumor localization, with special emphasis on photo-exposed and non-photo-exposed anatomical areas.

Respondents and methods

This study was designed as a prospective cross-sectional observational study conducted during 2024. A total of 56 subjects with histologically confirmed basal cell carcinoma were included. Subjects were consecutively recorded during routine dermatological examinations at the specialist dermatology clinic of the Cantonal Hospital “Dr. Irfan Ljubijankić” and the private dermatology outpatient clinic “Dr. Kurtalić”. Data were collected during a three-month period, from May to August 2024.

Demographic and clinical data were collected directly during the clinical examination of the subjects and included sex, age group, living environment, work environment, skin type, sun exposure, tumor localization, clinical subtype of BCC, and presence of precancerous lesions.

Age was categorized into three groups (<60 years, 60–69 years, and ≥ 70 years). Tumor localization was classified as photo-exposed or non-pho-

to-exposed. Clinical tumor subtypes were grouped into superficial, nodular, and other types.

Statistical analysis was performed using SPSS 31.0 (IBM Corp., 2026) software. Categorical variables were presented as frequencies and percentages. Associations between variables were assessed using the chi-square test. Additionally, binary logistic regression was performed to assess independent associations with tumor localization. Statistical significance was set at $p < 0.05$.

The study was conducted in accordance with ethical standards and approved by the relevant institutional ethics committee.

Results

Demographic characteristics

Female respondents dominated (75.0%), while males made up 25.0% of the sample. The majority of respondents were aged ≥ 70 years, followed by those aged 60 to 69 years, while the smallest proportion was younger than 60 years.

Most of the respondents were from urban areas, and slightly more than half worked indoors. Lighter skin phototype was present in most of the respondents. Sun exposure was reported in most cases.

Table 1. Demographic characteristics of the study population (n = 56)

Characteristics	Category	n	%
Sex	Female	42	75.0
	Male	14	25.0
Age group (years)	<60	8	14.3
	60–69	18	32.1
	≥ 70	30	53.6
Living environment	Urban	37	66.1
	Rural	19	33.9
Working environment	Indoor	30	53.6
	Outdoor	26	46.4
Skin type	Lighter	38	67.9
	Darker	18	32.1
Sun exposure	Yes	46	82.1
	No	10	17.9

Clinical characteristics

- The most common clinical type of BCC was the superficial subtype, followed by nodular, while other types were less common. Most tumors were located in photo-exposed areas.

Precancerous lesions were present in more than half of the subjects.

Table 2. Clinical characteristics of the study population (n = 56)

Characteristics	Category	n	%
Clinical type of BCC	Superficial	31	55.4
	Nodular	11	19.6
	Other types	14	25.0
Precancerous lesions	Yes	34	60.7
	No	22	39.3

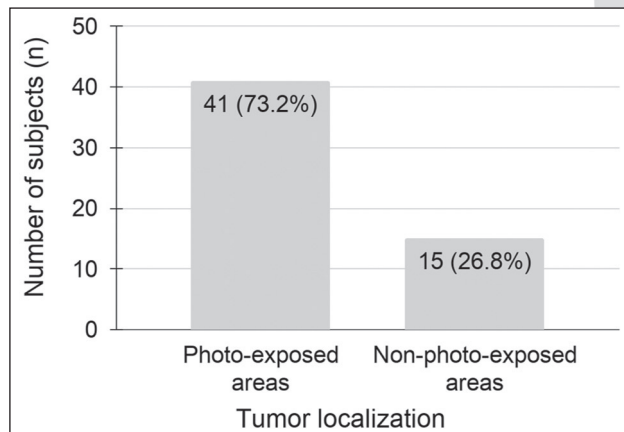


Figure 1. Tumor distribution according to localization

Association analysis

No statistically significant association was found between tumor localization and demographic variables, including sex, age group, living environment, working environment, skin type, and sun exposure ($p > 0.05$).

No significant association was observed between the clinical type of tumor and its localization.

However, the presence of precancerous lesions showed a statistically significant association with tumor localization ($p = 0.011$), with tumors in these subjects being more frequently located in photo-exposed areas.

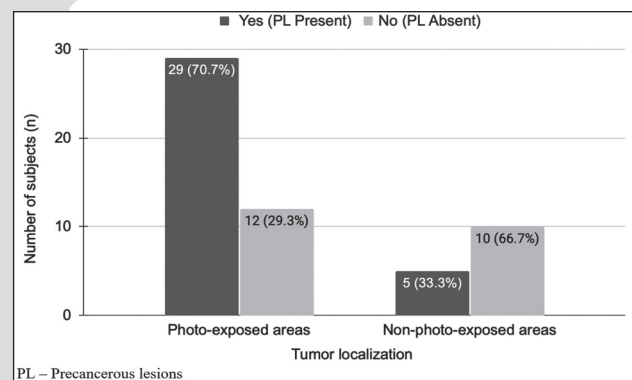


Figure 2. Association between precancerous lesions and tumor localization

Table 3. Association between clinical and demographic characteristics and tumor localization

Characteristics	Category	Localization		p-value
		PE n (%)	NPE n (%)	
Sex	Female	29 (70.7)	13 (86.7)	0.223
	Male	12 (29.3)	2 (13.3)	
Age group (years)	<60	6 (14.6)	2 (13.3)	0.745
	60–69	12 (29.3)	6 (40.0)	
	≥70	23 (56.1)	7 (46.7)	
Living environment	Urban	26 (63.4)	11 (73.3)	0.488
	Rural	15 (36.6)	4 (26.7)	
Working environment	Indoor	22 (53.7)	8 (53.3)	0.983
	Outdoor	19 (46.3)	7 (46.7)	
Skin type	Lighter	27 (65.9)	11 (73.3)	0.596
	Darker	14 (34.1)	4 (26.7)	
Sun exposure	Yes	34 (82.9)	12 (80.0)	0.800
	No	7 (17.1)	3 (20.0)	
Clinical type	Superficial	20 (48.8)	11 (73.4)	0.256
	Nodular	9 (22.0)	2 (13.3)	
	Other types	12 (29.2)	2 (13.3)	
Precancerous lesions	Yes	29 (70.7)	5 (33.3)	0.011
	No	12 (29.3)	10 (66.7)	

PE – photo-exposed areas; NPE – non-photo-exposed areas

Logistic regression

Binary logistic regression analysis showed that the presence of precancerous lesions was significantly associated with tumor localization in photo-exposed areas ($p = 0.013$). Subjects with precancerous lesions were approximately six times higher odds of developing tumors in photo-exposed regions compared to subjects without precancerous lesions (OR = 5.98; 95% CI: 1.45–24.67).

Sex and age group were not significantly associated with tumor localization.

Discussion

This study evaluated the association between demographic and clinical characteristics of subjects with basal cell carcinoma and tumor localization, with particular emphasis on photo-exposed and non-photo-exposed anatomical areas. Basal cell carcinoma is strongly associated with cumulative UV exposure and chronic photo-damage, which explains its predominance in sun-exposed skin areas [2,4].

A predominance of female subjects was observed in the study population. This result is in contrast to numerous epidemiological studies reporting a higher incidence of BCC among men, which is commonly attributed to higher occupational and recreational UV exposure among men [2,3]. The observed predominance of women in this cohort may reflect regional population characteristics, health care-seeking behavior, or variability associated with the relatively small study sample. Nevertheless, sex was not significantly associated with tumor localization, suggesting that gender distribution within the study population did not influence whether tumors occurred in photo-exposed or non-photo-exposed anatomical areas.

The majority of subjects were older, supporting the well-established view that cumulative UV exposure significantly contributes to the development of BCC over time [3,5]. Previous studies have shown an increase in the incidence of BCC with age due to prolonged exposure to environmental factors and progressive impairment of cellular DNA repair mechanisms [5,9]. However, in this study, no statistically significant association was found between age group and tumor localization, suggesting that age may contribute to overall susceptibility to BCC without necessarily determining the anatomical distribution of tumors.

Similarly, living environment and work environment were not significantly associated with tumor localization. Although subjects from rural areas and those with predominantly outdoor occupations showed a slightly higher proportion of tumors in photo-exposed areas, these differences did not reach statistical significance. Occupational exposure to UV radiation remains a recognized risk factor for keratinocyte carcinomas, especially among individuals with chronic exposure to outdoor environments [7]. However, the lack of statistical significance in this study may be explained by the relatively homogeneous exposure profile of subjects already diagnosed with BCC, together with the limited sample size.

No statistically significant association was found between skin type, reported sun exposure, and tumor localization. This finding should be interpreted with caution given the well-established etiological role of UV radiation in the pathogenesis of basal cell carcinoma [2,4]. Self-reported sun exposure may inadequately reflect cumulative lifetime UV exposure, occasional intense exposure, exposure patterns during childhood, or use of photoprotective measures. Furthermore, sim-

Table 4. Binary logistic regression analysis of factors associated with tumor localization

Variable	Category	B	S.E.	OR (Exp(B))	95% CI	p-value
Precancerous lesions	Present vs absent	1.79	0.72	5.98	1.45–24.67	0.013
Sex	Male vs female	0.51	0.90	1.67	0.29–9.71	0.569
Age group	<60 years vs ≥ 70 years	0.82	1.02	2.27	0.31–16.65	0.418
Age group	60–69 years vs ≥ 70 years	-0.49	0.73	0.61	0.15–2.54	0.497

Dependent variable: tumor localization (0 = non-photo-exposed area; 1 = photo-exposed area)

Reference categories: absence of precancerous lesions, female sex, age ≥ 70 years

Abbreviations: B – regression coefficient; S.E. – standard error; OR – odds ratio; CI – confidence interval

plified categorical assessments of skin type and UV exposure may not fully capture the biological complexity of individual susceptibility to photo-damage and cutaneous carcinogenesis [10].

The clinical subtype of BCC also did not show a statistically significant association with tumor localization. However, nodular and infiltrative subtypes were more common within photo-exposed anatomical areas. Previous studies have shown that nodular BCC usually develops on chronically sun-exposed skin, especially on the head and neck, although superficial BCC has often been described in less chronically exposed areas such as the trunk [2,11]. The lack of statistical significance in this study most likely reflects the relatively small cohort size and the fragmentation of subgroups after stratification into multiple histopathological categories.

The most important result of this study was a statistically significant association between precancerous lesions and tumor localization. Subjects with precancerous lesions showed a significantly higher probability of developing tumors in photo-exposed areas. Logistic regression analysis confirmed this association independently of sex and age group. Subjects with precancerous lesions were approximately six times more likely to develop basal cell carcinoma in photo-exposed anatomical areas compared to subjects without precancerous lesions (OR = 5.98; 95% CI: 1.45–24.67; $p = 0.013$).

This finding strongly supports the established biological link between chronic UV exposure, actinic skin damage, and cutaneous carcinogenesis [4,8]. The coexistence of precancerous lesions and BCC within photo-exposed anatomical areas likely reflects common pathogenic mechanisms associated with cumulative photodamage and field carcinogenesis [12]. Precancerous lesions, particularly actinic keratoses, are widely recognized as markers of chronic UV-induced skin injury and increased carcinogenic potential [8,12].

Identification of precancerous lesions as significant markers of photo-exposed tumor localization may have practical clinical implications in routine dermatological screening. Patients with actinic skin damage and precancerous lesions may represent a subgroup that requires closer surveillance due to the increased likelihood of UV-related skin cancer.

Several limitations should be considered when interpreting the results of this study. The relatively small sample size may have reduced statistical power and limited the detection of weaker associations. In addition, the prospective observational design without long-term follow-up limited the assessment of patterns of recurrence and disease progression. Certain variables, particularly sun exposure, were based in part on patient-reported data, which introduced the possibility of recall bias. Furthermore, simplified categorical variables may not fully capture the complexity of environmental and behavioral risk factors associated with cumulative UV exposure.

Despite these limitations, this study provides clinically relevant insights into the epidemiological and clinical characteristics of basal cell carcinoma (BCC) and highlights the importance of precancerous lesions as markers of chronic UV-induced skin damage. The results may contribute to better identification of high-risk patients and support preventive dermatological screening strategies targeting photo-exposed anatomical areas.

Conclusion

This study showed that precancerous lesions were significantly associated with photo-exposed basal cell carcinoma localization, further supporting the important role of chronic ultraviolet radiation exposure in the pathogenesis of basal cell carcinoma. Recognition of precancerous skin changes may therefore contribute to improved identification of patients at increased risk of UV-related cutaneous carcinogenesis.

Reference

1. Naik PP, Desai MB. Basal cell carcinoma: a narrative review on contemporary diagnosis and management. *Oncol Ther* 2022; 10: 317-335.
2. Cameron MC, Lee E, Hibler BP, et al. Basal cell carcinoma: epidemiology, pathophysiology, clinical and histological subtypes, and disease associations. *J Am Acad Dermatol* 2019; 80(2): 303-317.
3. Verkouteren JAC, Ramdas KHR, Wakkee M, Nijsten T. Epidemiology of basal cell carcinoma: scholarly review. *Br J Dermatol* 2017; 177(2): 359-372.

4. Teng YT, Wang Y, He M, et al. Ultraviolet radiation and basal cell carcinoma: an environmental perspective. *Front Public Health* 2021; 9: 666528.
5. Backman E, Oxelblom M, Gillstedt M, Dahlen Gyllencreutz J, Paoli J. Basal cell carcinoma: epidemiological impact of clinical versus histopathological diagnosis. *J Eur Acad Dermatol Venereol* 2023; 37: 521-527.
6. Niculet E, Craescu M, Rebegea L, et al. Basal cell carcinoma: comprehensive clinical and histopathological aspects, novel imaging tools and therapeutic approaches (Review). *Exp Ther Med* 2022; 23: 60.
7. Wendt A, Möhner M. Occupational solar exposure and basal cell carcinoma: a review of epidemiologic literature with meta-analysis. *Eur J Epidemiol* 2024; 39(1): 13-25.
8. George CD, Lee T, Hollestein LM, Asgari MM, Nijsten T. Global epidemiology of actinic keratosis in the general population: a systematic review and meta-analysis. *Br J Dermatol* 2024; 190(4): 465-476.
9. Leiter U, Keim U, Garbe C. Epidemiology of skin cancer: update 2019. *Adv Exp Med Biol* 2020; 1268: 123-139.
10. Didona D, Paolino G, Bottoni U, Cantisani C. Non melanoma skin cancer pathogenesis overview. *Bio-medicines* 2021; 9(8): 936.
11. Thamm J, Welzel J, Schuh S. Diagnosis and therapy of actinic keratosis. *J Dtsch Dermatol Ges* 2024; 22: 675-690.
12. Thamm JR, Schuh S, Welzel J. Epidemiology and risk factors of actinic keratosis: what is new for the management for sun-damaged skin. *Dermatol Pract Concept* 2024; 14(3 S1): e2024146S.

Corresponding Author

Nermina Kurtalic,

Cantonal Hospital "Dr. Irfan Ljubijankic",

Bihac,

Bosnia and Herzegovina,

E-mail: sadatku@hotmail.com

DOI: 10.18421/1986-8103.2026.20.1.16

Antimicrobial Resistance of the Most Common Bacterial Pathogens Isolated from Skin, Mucosal, and Wound Swabs in Outpatients in Sarajevo Canton (March–June 2024)

Azra Kudumovic, Sadeta Hamzic

University of Sarajevo, Faculty of Medicine, Sarajevo, Bosnia and Herzegovina.

Abstract

Background: Antimicrobial resistance (AMR) is one of the greatest challenges of modern medicine and significantly affects the successful treatment of bacterial infections. Continuous surveillance of resistance patterns enables more rational antibiotic use and improvement of empirical therapy.

Objective: To analyze the prevalence of the most common bacterial pathogens isolated from skin, mucosal, and wound swabs, and to determine their antimicrobial resistance patterns in outpatients in Sarajevo Canton.

Materials and Methods: A retrospective analysis was performed on microbiological data from skin, mucosal, and wound swabs collected from outpatients in Sarajevo Canton. Identification of bacterial isolates and antimicrobial susceptibility testing were conducted using standard microbiological methods in accordance with EUCAST guidelines. The analysis included the most frequently isolated bacterial species and their resistance patterns to tested antibiotics.

Results: *Staphylococcus aureus* was the dominant pathogen in skin (73.5%) and wound swabs (52.1%), while *Escherichia coli* was most frequently isolated from mucosal swabs (34.7%). MRSA accounted for 7.2% of skin isolates and 5.3% of wound isolates. *S. aureus* showed very high resistance to penicillin G (92.3%) but retained high susceptibility to cefoxitin (99.5%) and trimethoprim-sulfamethoxazole (99.7%). All analyzed MRSA isolates were resistant to cefoxitin and penicillin G, while full susceptibility was observed for trimethoprim-sulfamethoxazole. ESBL- and carbapenemase-producing *Klebsiella pneumoniae* isolates were also detected in wound swabs.

Conclusion: *Staphylococcus aureus* remains the leading causative agent of skin and wound infections in outpatients, while the emergence of multidrug-resistant organisms highlights the need for continuous AMR surveillance and rational antibiotic use.

Keywords: antimicrobial resistance, *Staphylococcus aureus*, MRSA, *Escherichia coli*, antibiotic, outpatients

Introduction

Antimicrobial resistance (AMR) represents one of the most significant global public health challenges of the 21st century. The increasing prevalence of resistant bacterial isolates significantly complicates infection treatment, prolongs hospitalization, increases healthcare costs, and contributes to higher mortality. According to the World Health Organization (WHO), AMR threatens the effectiveness of standard antibiotic therapy and poses a serious risk to patient safety.

Skin, soft tissue, and wound infections are among the most common indications for microbiological diagnostics in outpatient healthcare. The most frequent causative agents include *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella spp.*, *Proteus spp.*, and other opportunistic microorganisms. Their ability to develop multiple resistance mechanisms, including extended-spectrum β -lactamases (ESBL) and carbapenemases, represents an increasing therapeutic challenge.

Of particular epidemiological importance is methicillin-resistant *Staphylococcus aureus* (MRSA), one of the most important pathogens causing skin, wound, and soft tissue infections. Monitoring MRSA prevalence and resistance patterns is essen-

tial for selecting appropriate empirical therapy and implementing infection control measures.

Local AMR data are of special importance because resistance patterns vary between geographic regions and healthcare settings. Regular surveillance enables the development of local antibiotic guidelines, supports antimicrobial stewardship, and helps preserve antibiotic effectiveness.(1,2,3,4)

Aim of the Study

The aim of this study was to analyze the prevalence of the most common bacterial pathogens isolated from skin, mucosal, and wound swabs in outpatients in Sarajevo Canton and to determine their antimicrobial resistance patterns, with special emphasis on *Staphylococcus aureus* and MRSA isolates.

Table 1. Bacterial Isolates According to Sample Type

Smear	Causative agent	N	%
Skin	<i>Staphylococcus aureus</i>	1935	73.5%
	<i>Staphylococcus aureus</i> MRSA	189	7.2%
	<i>Pseudomonas</i> species	86	3.3%
	<i>Klebsiella</i> species	53	2.0%
	<i>Escherichia coli</i>	183	6.9%
	<i>Acinetobacter</i> species	7	0.3%
	<i>Proteus</i> species	126	4.8%
	<i>Streptococcus</i> β haemolyticus-gr. A	16	0.6%
	<i>Enterobacter</i> species	16	0.6%
	<i>Streptococcus</i> grupa C	3	0.1%
	<i>Streptococcus pneumoniae</i>	7	0.3%
	<i>Enterobacter</i> spp. ESBL	13	0.5%
	Mucous membrane	<i>Staphylococcus aureus</i>	170
<i>Staphylococcus aureus</i> MRSA		23	3.3%
<i>Klebsiella</i> species		19	2.7%
<i>Escherichia coli</i>		245	34.7%
<i>Proteus</i> species		31	4.4%
<i>Streptococcus</i> β haemolyticus-gr. A		20	2.8%
<i>Enterobacter</i> species		24	3.4%
<i>Streptococcus</i> β haemolyticus-gr. B		149	21.1%
<i>Enterococcus faecium</i> / <i>faecalis</i>		20	2.8%
<i>Morganella morganii</i>	5	0.7%	
Wound	<i>Staphylococcus aureus</i>	963	52.1%
	<i>Staphylococcus aureus</i> MRSA	97	5.3%
	<i>Pseudomonas</i> species	224	12.1%
	<i>Klebsiella</i> species	101	5.5%
	<i>Escherichia coli</i>	104	5.6%
	<i>Acinetobacter</i> species	47	2.5%
	<i>Proteus</i> species	84	4.5%
	<i>Enterobacter</i> species	51	2.8%
	<i>Streptococcus</i> grupa C	4	0.2%
	<i>Enterococcus faecium</i> / <i>faecalis</i>	8	0.4%
	<i>Morganella morganii</i>	6	0.3%
	<i>Klebsiella pneumoniae</i> ESBL	13	0.7%
	<i>Klebsiella pneumoniae</i> CRE	30	1.6%
	<i>Escherichia coli</i> ESBL	10	0.5%
	<i>Klebsiella</i> species KPS (karbapenemaza producing strain)	13	0.7%
<i>Klebsiella</i> species ESBL	92	5.0%	

Materials and Methods

A retrospective study was conducted using laboratory data obtained from microbiological samples collected from outpatients in Sarajevo Canton. Skin, mucosal, and wound swabs yielding the most common bacterial pathogens were included in the analysis.

Bacterial identification was performed using standard microbiological methods, while antimicrobial susceptibility testing was carried out using the disk diffusion method and interpreted according to current EUCAST guidelines. Results were categorized as susceptible (S), intermediate (I), or resistant (R).

Data were analyzed using descriptive statistical methods and presented as absolute and relative frequencies (%).

Results

During the study period, numerous bacterial pathogens were isolated from skin, mucosal, and wound swabs of outpatients. The most frequently identified organisms across all sample types were *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas spp.*, and *Klebsiella spp.*

In skin swabs, *Staphylococcus aureus* was the predominant isolate, accounting for 73.5% of all isolates. MRSA was detected in 7.2% of cases, while *Escherichia coli* (6.9%), *Proteus spp.* (4.8%), and *Pseudomonas spp.* (3.3%) were less frequently isolated. Other pathogens, including *Klebsiella spp.*, *Enterobacter spp.*, *Acinetobacter spp.*, and β -hemolytic streptococci, each accounted for less than 3% of isolates.

In mucosal swabs, *Escherichia coli* was the dominant pathogen (34.7%), followed by *Staphylococcus aureus* (24.1%) and Group B β -hemolytic streptococci (21.1%). Other isolates were significantly less frequent.

In wound swabs, *Staphylococcus aureus* again predominated (52.1%), followed by *Pseudomonas spp.* (12.1%), *Escherichia coli* (5.6%) and *Klebsiella spp.* (5.5%) were present in similar proportions. Notably, multidrug-resistant *Klebsiella pneumoniae* isolates, including ESBL (0.7%), CRE (1.6%), and carbapenemase-producing strains (0.7%), were detected, indicating the presence of highly resistant bacteria in the outpatient population.

Antimicrobial Resistance of *Staphylococcus aureus*

Antibiogram analysis demonstrated that *Staphylococcus aureus* retains high susceptibility to most antibiotics used in the treatment of skin and soft tissue infections.

The highest resistance was observed to penicillin G (92.3%), confirming widespread β -lactamase production among isolates. Elevated resistance was also observed for erythromycin (37.5%) and clindamycin (30.3%).

In contrast, very high susceptibility was recorded for cefoxitin (99.5%), trimethoprim-sulfamethoxazole (99.7%), and chloramphenicol (99.1%). Good activity was also observed for gentamicin (78.7%) and tobramycin (77.4%).

Overall, the resistance pattern indicates that narrow-spectrum β -lactams, particularly penicillin G, have lost therapeutic value in *S. aureus* infections, while trimethoprim-sulfamethoxazole and aminoglycosides remain effective treatment options.

Antimicrobial Resistance of MRSA Isolates

All analyzed MRSA isolates were resistant to cefoxitin and penicillin G (100%), confirming their methicillin-resistant phenotype.

Discussion

Staphylococcus aureus showed high resistance to penicillin G (92.3%) while maintaining high susceptibility to cefoxitin (99.5%) and trimethoprim-sulfamethoxazole (99.7%). MRSA isolates demonstrated 100% resistance to cefoxitin and penicillin G.

ESBL- and CRE-producing *Klebsiella pneumoniae* isolates were also detected in wound swabs, indicating the presence of highly resistant strains in the outpatient population.

The results confirm that *Staphylococcus aureus* is the leading cause of superficial bacterial infections in outpatients, consistent with reports from the European Centre for Disease Prevention and Control (ECDC) and the World Health Organization (WHO). Its high prevalence in skin and wound samples highlights its dominant role in skin and soft tissue infections.

Table 2. Antimicrobial Resistance in *Staphylococcus aureus*

Causative agent		resistance			Total	
		I	R	S		
antibiotic	Cefoxitin	Count	1	1	374	376
		Expected Count	44.7	93.1	238.1	376.0
		% Within antibiotic	0.3%	0.3%	99.5%	100.0%
		Standardized Residual	-6.5	-9.5	8.8	
	Chloramphenicol	Count	0	1	113	114
		Expected Count	13.6	28.2	72.2	114.0
		% Within antibiotic	0.0%	0.9%	99.1%	100.0%
		Standardized Residual	-3.7	-5.1	4.8	
	Ciprofloxacin	Count	362	11	2	375
		Expected Count	44.6	92.9	237.5	375.0
		% Within antibiotic	96.5%	2.9%	0.5%	100.0%
		Standardized Residual	47.5	-8.5	-15.3	
	Clindamycin	Count	0	96	221	317
		Expected Count	37.7	78.5	200.8	317.0
		% Within antibiotic	0.0%	30.3%	69.7%	100.0%
		Standardized Residual	-6.1	2.0	1.4	
	Erythromycin	Count	1	141	234	376
		Expected Count	44.7	93.1	238.1	376.0
		% Within antibiotic	0.3%	37.5%	62.2%	100.0%
		Standardized Residual	-6.5	5.0	-3	
	Gentamicin	Count	0	80	295	375
		Expected Count	44.6	92.9	237.5	375.0
		% Within antibiotic	0.0%	21.3%	78.7%	100.0%
		Standardized Residual	-6.7	-1.3	3.7	
	Penicillin G	Count	0	347	29	376
		Expected Count	44.7	93.1	238.1	376.0
		% Within antibiotic	0.0%	92.3%	7.7%	100.0%
		Standardized Residual	-6.7	26.3	-13.6	
	Rifampicin	Count	0	0	8	8
		Expected Count	1.0	2.0	5.1	8.0
% Within antibiotic		0.0%	0.0%	100.0%	100.0%	
Standardized Residual		-1.0	-1.4	1.3		
Tetracycline	Count	0	0	8	8	
	Expected Count	1.0	2.0	5.1	8.0	
	% Within antibiotic	0.0%	0.0%	100.0%	100.0%	
	Standardized Residual	-1.0	-1.4	1.3		
Tobramycin	Count	0	83	285	368	
	Expected Count	43.8	91.2	233.1	368.0	
	% Within antibiotic	0.0%	22.6%	77.4%	100.0%	
	Standardized Residual	-6.6	-9	3.4		
Trimethoprim - Sulfamethoxazole	Count	1	0	374	375	
	Expected Count	44.6	92.9	237.5	375.0	
	% Within antibiotic	0.3%	0.0%	99.7%	100.0%	
	Standardized Residual	-6.5	-9.6	8.9		
Total	Count	365	760	1943	3068	
	Expected Count	365.0	760.0	1943.0	3068.0	
	% Within antibiotic	11.9%	24.8%	63.3%	100.0%	

Table 3. Antimicrobial Resistance in MRSA Isolates

Causative agent		resistance			Total	
		I	R	S		
antibiotic	Cefoksitin	Count	0	37	0	37
		Expected Count	4.1	15.4	17.5	37.0
		% Within antibiotic	0.0%	100.0%	0.0%	100.0%
		Standardized Residual	-2.0	5.5	-4.2	
	Chloramphenicol	Count	0	1	9	10
		Expected Count	1.1	4.2	4.7	10.0
		% Within antibiotic	0.0%	10.0%	90.0%	100.0%
		Standardized Residual	-1.0	-1.6	2.0	
	Ciprofloxacin	Count	34	3	0	37
		Expected Count	4.1	15.4	17.5	37.0
		% Within antibiotic	91.9%	8.1%	0.0%	100.0%
		Standardized Residual	14.8	-3.2	-4.2	
	Clindamycin	Count	0	12	20	32
		Expected Count	3.5	13.4	15.1	32.0
		% Within antibiotic	0.0%	37.5%	62.5%	100.0%
		Standardized Residual	-1.9	-.4	1.3	
	Erythromycin	Count	0	20	17	37
		Expected Count	4.1	15.4	17.5	37.0
		% Within antibiotic	0.0%	54.1%	45.9%	100.0%
		Standardized Residual	-2.0	1.2	-.1	
	Gentamicin	Count	0	8	29	37
		Expected Count	4.1	15.4	17.5	37.0
		% Within antibiotic	0.0%	21.6%	78.4%	100.0%
		Standardized Residual	-2.0	-1.9	2.8	
	Penicillin G	Count	0	37	0	37
		Expected Count	4.1	15.4	17.5	37.0
		% Within antibiotic	0.0%	100.0%	0.0%	100.0%
		Standardized Residual	-2.0	5.5	-4.2	
	Rifampicin	Count	0	0	4	4
		Expected Count	.4	1.7	1.9	4.0
		% Within antibiotic	0.0%	0.0%	100.0%	100.0%
		Standardized Residual	-.7	-1.3	1.5	
	Tetracycline	Count	0	1	2	3
		Expected Count	.3	1.3	1.4	3.0
		% Within antibiotic	0.0%	33.3%	66.7%	100.0%
		Standardized Residual	-.6	-.2	.5	
	Tobramycin	Count	0	10	27	37
Expected Count		4.1	15.4	17.5	37.0	
% Within antibiotic		0.0%	27.0%	73.0%	100.0%	
Standardized Residual		-2.0	-1.4	2.3		
Trimethoprim - Sulfamethoxazole	Count	0	0	37	37	
	Expected Count	4.1	15.4	17.5	37.0	
	% Within antibiotic	0.0%	0.0%	100.0%	100.0%	
	Standardized Residual	-2.0	-3.9	4.7		
Vancomycin	Count	0	0	1	1	
	Expected Count	.1	.4	.5	1.0	
	% Within antibiotic	0.0%	0.0%	100.0%	100.0%	
	Standardized Residual	-.3	-.6	.8		
Total	Count	34	129	146	309	
	Expected Count	34.0	129.0	146.0	309.0	
	% Within antibiotic	11.0%	41.7%	47.2%	100.0%	

The increased frequency of *Escherichia coli* in mucosal samples is expected due to its natural colonization of the gastrointestinal tract and its pathogenic potential.

The presence of MRSA in approximately 7% of isolates highlights the need for continuous microbiological surveillance and rational antibiotic use in outpatient settings. (1,2,3,4,5,6)

Conclusion

Staphylococcus aureus is the dominant bacterial pathogen in skin and wound infections among outpatients in Sarajevo Canton.

The most common isolates across all sample types were *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas spp.*, and *Klebsiella spp.*

In skin swabs, *S. aureus* predominated (73.5%), while MRSA accounted for 7.2%. In mucosal swabs, *E. coli* was most frequently isolated (34.7%), whereas *S. aureus* again dominated wound swabs (52.1%).

The distribution of bacterial species varies significantly depending on the sample type, emphasizing the importance of local microbiological surveillance and continuous monitoring of antimicrobial resistance to optimize therapy.

References

1. Kudumović A, Hamzić S. Characterization of microbiological pathogens and antimicrobial resistance profiles in skin and mucosal infections among outpatients in Sarajevo Canton, Q1 2024. *HealthMED*. 2025;19(1):35–39.
2. Kudumović A, Hamzić S. Genotypic analysis and characterization of *Staphylococcus aureus* (MRSA) isolates from skin and mucosal infections in outpatient patients in Sarajevo Canton (January–June 2024). In: *Proceedings of the FEBS3 Congress*. Belgrade; 2025.
3. World Health Organization. *Antimicrobial resistance*. Geneva: WHO; 2023.
4. European Committee on Antimicrobial Susceptibility Testing (EUCAST). *Clinical breakpoints – version 14.0*. Växjö: EUCAST; 2024.
5. European Committee on Antimicrobial Susceptibility Testing (EUCAST). *Guidance documents*. Växjö: EUCAST; 2024.
6. Clinical and Laboratory Standards Institute (CLSI). *Performance standards for antimicrobial susceptibility testing*. Wayne, PA: CLSI.
7. World Health Organization. *Global action plan on antimicrobial resistance*. Geneva: WHO.
8. Murray CJ, Ikuta KS, Sharara F, et al. *Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis*. *Lancet*. 2022;399:629–655.
9. O'Neill J. *Tackling drug-resistant infections globally: final report and recommendations*. London: Review on Antimicrobial Resistance; 2016.

Corresponding Author
Azra Kudumovic,
University of Sarajevo,
Faculty of Medicine,
Sarajevo,
Bosnia and Herzegovina,
E-mail: azrakudumovic@yahoo.com

DOI: 10.18421/1986-8103.2026.20.1.22

Acinetobacter baumannii - a modern challenge in clinical microbiology

Azra Besic

University of Sarajevo, Faculty of Medicine, PhD student, Sarajevo, Bosnia and Herzegovina.

Abstract

Acinetobacter baumannii bacteria is gram-negative, multidrug-resistant opportunistic bacterium. It is on the list of critical priorities that require new antibiotics and one of the leading causes of hospital infections in the 21st century. A PCR test is essential for precise identification. The results of antibiotic sensitivity tests showed that there is resistance to a large number of antibiotics. The only sensitivity was shown on the Costylin E test. The most common route of transmission is contact with colonized or infected patients, contaminated surfaces or medical devices, especially ventilators. Infections caused by *Acinetobacter baumannii* are primarily hospital-acquired infections.

Keywords: *Acinetobacter baumannii*, multidrug-resistant, Costylin, hospital infection

Introduction

Acinetobacter baumannii bacterium was named after the American bacteriologists Paul and Linda Baumann. It is a gram-negative, multidrug-resistant opportunistic bacterium that is considered among the most important multidrug-resistant pathogens in modern medicine. (1) It holds a special place within the group of causative agents of serious infections better known by the acronym "ESKAPE", which includes microorganisms responsible for most infections associated with health care. It is marked as a "red alert" pathogen, it means it is on the list of critical priorities that require new antibiotics. (2) It was first recognized as a clinically significant pathogen during the 1960s and 1970s, especially in intensive care units. During the 1990s, it was confirmed as a common cause of infection in wounded soldiers in Iraq, where it was nicknamed "iraqibacter". The specific conditions of the wartime environment, including the dry and hot desert climate and the limited possibilities

of implementing infection prevention measures, contributed to the development and spread of antimicrobial resistance. (3) Today, *Acinetobacter baumannii* is considered as one of the leading causes of hospital infections in the 21st century. Numerous studies are focused on their epidemiology, resistance mechanisms and possibilities of controlling the spread of this pathogen. Clinical isolates of *Acinetobacter baumannii* show a high level of resistance to antibiotics, with resistance to carbapenems being one of the most significant and globally widespread problems. (4,5)

Objectives

Infections caused by *Acinetobacter baumannii* are associated with approximately 400,000 deaths annually globally. We analyzed a large number of data that we obtained outside of hospital conditions. (6) We focused on multidrug-resistant bacteria with a special focus on *Acinetobacter baumannii*. We came to the conclusion that the risk of infection is significantly higher in the hospital environment compared to the general population, which makes this bacterium a serious problem for healthcare institutions. Patients hospitalized in intensive care units, patients on mechanical ventilation, people with chronic diseases (such as diabetes, HIV infection or chronic lung diseases) and patients with malignant diseases are particularly at risk. (7) The goal of numerous modern researches is to clarify the entry routes of multidrug-resistant strains of *Acinetobacter baumannii* into the hospital environment, as well as identification potential natural reservoirs of this microorganism. Epidemics of infections are most often associated with contamination of the hospital environment and the transfer of bacteria within healthcare institutions. (8)

Methodology

The presence of *Acinetobacter baumannii* is confirmed by microbiological analysis of clinical samples, after which a sensitivity test to antimicrobial drugs is carried out.

A PCR test is essential for precise identification. PCR is a molecular test for rapid identification of the genus and species of *Acinetobacter baumannii* as well as the detection of antibiotic resistance genes. CR stands for “carbapenem resistant”, and CP stands for “carbapenemase producing”. The designation CP means that carbapenemases production has been proven in the isolate. CP complements the CR designation in isolates that produce carbapenemases. The common designation of isolates is CR (bacteria designation) - CP. When we confirm that the isolate is resistant to carbapenem and that it produces carbapenemase, we give the isolate a label for this, because it has priority over the CR label over the results of the antibiogram. CRAb is the label of the isolate that confirms that it is *Acinetobacter baumannii* and that it is resistant to carbapenems, and in this case complete isolation of the patient is recommended. CRAb-CP is the designation for carbapenemase-secreting *Acinetobacter baumannii* isolates, and complete patient isolation is required in these patients. In both cases, consultation with an infectious disease specialist or a clinical microbiologist is recommended. (9)

In our research, 7 microbiological samples were confirmed of *Acinetobacter baumannii*. Antibiotics to which we performed sensitivity tests are Tobramycin, Amikacin, Gentamicin, Ciprofloxacin, Meropenem and Imipenem. The results of antibiotic sensitivity tests showed that there is resistance to a large number of antibiotics. The only sensitivity was shown on the Costylin E test.

Li-Kuang and colleagues analyzed clinical isolates of *Acinetobacter baumannii*. They found that 73.6% of such isolates were resistant to quinolones (ciprofloxacin and levofloxacin), 71.3% to sulfonamides, and more than half (50–70%) to cephalosporins (cefazidime and cefepime), b-lactamase/beta-lactamase inhibitor combinations (tazobactam-piperacillin) and carbapenems (doripenem, imipenem, and meropenem). It should be noted that only 26.7% showed resistance

to the glycine antibiotic tigecycline. (10) Studies conducted in Saudi Arabia and Greece also had a high degree of bacterial resistance, about 89%, to the above-mentioned antibiotics. Some studies indicate that costillin is the only remaining choice for the treatment of infections caused by *Acinetobacter baumannii* because its resistance is less than 7.9%, however, the bad news is that this bacterium is starting to develop worldwide resistance to costillin. No costillin resistance was observed in Taiwan in this study. (11,12)

Said D. and colleagues published a study in which they analyzed 43,948 clinical isolates of *Acinetobacter baumannii* using data from the German antimicrobial resistance control system from 2014 to 2018. It is interesting to note that the proportion of carbapenem resistance in clinical isolates of the complex *Acinetobacter baumannii* decreased from 7.6% in 2014 to 3.5% in 2018. Compared to other regions worldwide, the proportions of carbapenem resistance among clinical isolates of *Acinetobacter baumannii* are relatively low in Germany and have been declining in recent years. This is the result of continued efforts in antibiotic stewardship and infection prevention and control to prevent the spread of carbapenem-resistant *Acinetobacter baumannii* complex in Germany. (13)

The results we obtained through our research in Sarajevo Canton confirmed the opinion that it is primarily a hospital-acquired infection.

A study on *Acinetobacter baumannii* was done at the Microbiology Department at IQ Medical Center Hospital in Durangapur, Western India. A large number of samples were examined, including 15,800 hospital samples, of which 289 were positive, of which 115 (39.79%) were isolated from the endotracheal tube in intensive care. The prevalence of *Acinetobacter baumannii* in clinical samples in hospital conditions is from 5.1% to 12.4%, while the percentage is higher in intensive care units. The distribution according to sample type is that the frequency of respiratory was the highest 40-50%, followed by blood 10-20%, wound or pus 10-25%, urine 10-25% and cerebrospinal fluid less than 10%. (14)

This bacterium has developed exceptional resistance thanks to various mechanisms, including the production of enzymes that inactivate antibiotics, the presence of efflux pumps that actively

expel antibiotics from the bacterial cell, as well as reduced permeability of the outer membrane for the passage of drugs due to the presence of very small pores. This bacteria is very dangerous because it can quickly develop and transmit genetic resistance. (15)

A particularly worrying form is carbapenem-resistant *Acinetobacter baumannii* (CRAB-Carbapenem-Resistant *Acinetobacter baumannii*). It is estimated that more than a million infections caused by this bacterium occur annually, with a mortality rate of approximately 35%. CRAB strains show resistance to almost all available antibiotics, including carbapenems. Carbapenems are highly effective antibiotics. They are used to treat infections caused by bacteria that are multi-resistant to drugs, especially in hospitalized patients. They are broad-spectrum drugs that are used as the last line in the treatment of severe infections caused by multidrug-resistant bacteria.

Due to the seriousness of the threat it represents, CRAB is at the top of the list of pathogens for which, according to the World Health Organization, priority development of new antimicrobial drugs is necessary. (16)

Results

Acinetobacter baumannii has a pronounced ability to colonize and infect open wounds, and is a frequent cause of surgical wound infections, bacteremia (sepsis) and pneumonia. It is most often isolated from the endotracheal tube in intensive care, but it is often isolated from infections of the urinary system, especially in patients with a urinary catheter, as well as from skin and eye infections. It is estimated that the mortality of patients with *Acinetobacter baumannii* infection in intensive care units can be over 75%, especially if the entry point of the bacteria is the respiratory or vascular system. (17) The most common route of transmission is contact with colonized or infected patients, contaminated surfaces or medical devices, especially ventilators. The bacterium has the ability to form a biofilm that is extremely resistant to disinfectants and antibiotics, which makes eradication even more difficult.

Acinetobacter baumannii can obtain on the patient's skin without visible signs of illness,

which allows the bacterium to be transmitted unnoticed between patients and health care workers. (18)

The irrational and indiscriminate use of antimicrobial drugs significantly contributes to the development, survival and spread of multidrug-resistant isolates of the bacterium *Acinetobacter baumannii*. This leads to the selection of strains with adaptive mechanisms of bacterial resistance to a large number of antibiotics.

These infections cause severe and often fatal outbreaks in hospitals and long-term care facilities. There are questions to which we are still seeking answers. Although the hospital environment is considered the main reservoir of this pathogen, it is still an open question whether *Acinetobacter baumannii* has a natural habitat outside healthcare institutions. (19)

Conclusion

Infections caused by *Acinetobacter baumannii* are primarily hospital-acquired infections. The occurrence of this infection outside of hospital conditions is present, but to a significantly lesser extent.

The lack of adequate programs for the rational use of antibiotics (AMS - Antimicrobial Stewardship Programs) leads to the excessive use of broad-spectrum antibiotics and the accelerated development of antimicrobial resistance. At the same time, insufficiently developed measures for the prevention and control of hospital infections in everyday clinical practice significantly contribute to the spread of multidrug-resistant strains of *Acinetobacter baumannii*.

Effective hospital infection control measures must include on time identification and isolation of colonized patients, continuous education of health personnel, as well as strict implementation of hand hygiene. Special focus should be placed on proper cleaning and disinfection of hospital premises, medical equipment and devices used in patient care. Strict hand hygiene, washing with soap and water or using an alcohol disinfectant before and after contact with patients or medical equipment is of crucial importance for healthcare personnel.

In daily clinical practice, it is necessary to insist on the prevention of infections, constant epidemi-

ological control, especially in intensive care units, and on a rational and responsible policy of prescribing antimicrobial drugs.

References

- Vázquez-López R, Solano-Gálvez SG, Vignon-Whaley JJJ, Vaamonde JAA. *Acinetobacter baumannii* Resistance: A Real Challenge for Clinicians. *Antibiotics (Basel)*. 2020 Apr 23; 9(4): 205. doi: 10.3390/antibiotics9040205
- Álvarez-Ainza ML, Fong-Coronado PA, Ruiz-Bustos E, Castellón-Campaña LG, Quintero-Reyes IE, et al. Antibiotic resistance of ESKAPE group-microorganisms in health institutions from Hermosillo and Ciudad Obregón, Sonora, México. *Front Cell Infect Microbiol*. 2024 Mar 7; 14: 1348093. doi: 10.3389/fcimb.2024.1348093. PMID: 38516533; PMCID: PMC10955632.
- Howard A, O'Donoghue M, Feeney A, Sleator RD. *Acinetobacter baumannii*: an emerging opportunistic pathogen. *Virulence*. 2012 May 1;3(3):243-50. doi: 10.4161/viru.19700. Epub 2012 May 1. PMID: 22546906; PMCID: PMC3442836.
- Yehya A, Ezzeddine Z, Chakkour M, Dhaini Z, Bou Saba MS, et al. The intricacies of *Acinetobacter baumannii*: a multifaceted comprehensive review of a multidrug-resistant pathogen and its clinical significance and implications. *Front Microbiol*. 2025 May 12; 16: 1565965. doi: 10.3389/fmicb.2025.1565965. PMID: 40444001; PMCID: PMC12121509.
- Vázquez-López R, Solano-Gálvez SG, Juárez Vignon-Whaley JJ, Abello Vaamonde JA, Padró Alonzo LA, et al. *Acinetobacter baumannii* Resistance: A Real Challenge for Clinicians. *Antibiotics (Basel)*. 2020 Apr 23;9(4):205. doi: 10.3390/antibiotics9040205. PMID: 32340386; PMCID: PMC7235888.
- Eb-Rejón JDR, Paniagua-Sierra JR, Gracida-Osorno C, Molina-Salinas GM. Hospital-Acquired Infections Caused by *Acinetobacter baumannii*: A Comparative Analysis of Risk Factors with Other ESKAPE-E Pathogens in a Third-Level IMSS Hospital in Yucatan Mexico. *Diseases*. 2025 Nov 26;13(12):384. doi: 10.3390/diseases13120384. PMID: 41439925; PMCID: PMC12732213.
- Shacho E, Yilma D, Goshu AT, Ambelu A. Adult intensive care unit nosocomial infections related deaths in Jimma medical center: a cause specific cox regression analysis. *BMC Infect Dis*. 2025 Dec 29;25(1):1745. doi: 10.1186/s12879-025-12199-1. PMID: 41462128; PMCID: PMC12752084.
- Fahy S, O'Connor JA, Lucey B, Sleator RD. Hospital Reservoirs of Multidrug Resistant *Acinetobacter* Species-The Elephant in the Room! *Br J Biomed Sci*. 2023 Mar 20; 80: 11098. doi: 10.3389/bjbs.2023.11098. PMID: 37020476; PMCID: PMC10069268.
- Mottaghiyan Z, Esmaeili D, Ahmadi MH, Niakan M. Designing a Multiplex PCR for Rapid and Accurate Detection of Metallobetalactamases Resistant Genes from *Acinetobacter baumannii* Isolates in Tehran City, Iran. *Iran J Pathol*. 2023;18(4):449-455. doi: 10.30699/IJP.2023.2007142.3144. Epub 2023 Oct 15. PMID: 38024550; PMCID: PMC10646741.
- Chen L.-K., Kuo S.-C., Chang K.-C., Cheng C.-C., Yu P.-Y., et al. Clinical Antibiotic-resistant *Acinetobacter baumannii* Strains with Higher Susceptibility to Environmental Phages than Antibiotic-sensitive Strains. *Sci. Rep*. 2017; 7: 6319. doi: 10.1038/s41598-017-06688-w.
- Benmerzouga I, Al-Zammy SA, Al-Shammari MM, Alsaif SA, Alhaidan TM, Aljofan M. Practices of patients consuming antibiotics and knowledge about antibiotic resistance in Hail region - Saudi Arabia. *Future Sci OA*. 2019 Sep 27; 5(10): FSO420. doi: 10.2144/fsoa-2019-0054. PMID: 31827890; PMCID: PMC6900975.
- Maraki S, Mantadakis E, Mavromanolaki VE, Kofteridis DP, Samonis G. A 5-year Surveillance Study on Antimicrobial Resistance of *Acinetobacter baumannii* Clinical Isolates from a Tertiary Greek Hospital. *Infection & chemotherapy*. 2016; 48: 190–198. doi: 10.3947/ic.2016.48.3.190.
- Said, D., Willrich, N., Ayobami, O. et al. The epidemiology of carbapenem resistance in *Acinetobacter baumannii* complex in Germany (2014–2018): an analysis of data from the national Antimicrobial Resistance Surveillance system. *Antimicrob Resist Infect Control* 10, 45 (2021). <https://doi.org/10.1186/s13756-021-00909-8>
- Mukhopadhyay H, Bairagi A, Mukherjee A, Prasad AK, Roy AD, Nayak A. Multidrug resistant *Acinetobacter baumannii*: A study on its pathogenesis and therapeutics. *Curr Res Microb Sci*. 2024 Dec 6; 8: 100331. doi: 10.1016/j.crmicr.2024.100331. PMID: 39802320; PMCID: PMC11718326.
- Vivekanandan KE, Kumar PV, Jaysree RC, Rajeshwari T. Exploring molecular mechanisms of drug resistance in bacteria and progressions in CRISPR/Cas9-based genome expurgation solutions. *Glob Med Genet*. 2025 Feb 16;12(2):100042. doi: 10.1016/j.gmg.2025.100042. PMID: 40051841; PMCID: PMC11883354.

16. Thacharodi A, Vithlani A, Hassan S, Alqahtani A, Pugazhendhi A. Carbapenem-resistant *Acinetobacter baumannii* raises global alarm for new antibiotic regimens. *iScience*. 2024 Nov 12;27(12):111367. doi: 10.1016/j.isci.2024.111367. PMID: 39650735; PMCID: PMC11625361.
17. Rangel K, De-Simone SG. Treatment and Management of *Acinetobacter* Pneumonia: Lessons Learned from Recent World Event. *Infect Drug Resist*. 2024 Feb 8;17:507-529. doi: 10.2147/IDR.S431525. PMID: 38348231; PMCID: PMC10860873.
18. Bouhrour N, Nibbering PH, Bendali F. Medical Device-Associated Biofilm Infections and Multi-drug-Resistant Pathogens. *Pathogens*. 2024 May 8;13(5):393. doi: 10.3390/pathogens13050393. PMID: 38787246; PMCID: PMC11124157.
19. Kyriakidis I, Vasileiou E, Pana ZD, Tragiannidis A. *Acinetobacter baumannii* Antibiotic Resistance Mechanisms. *Pathogens*. 2021 Mar 19;10(3):373. doi: 10.3390/pathogens10030373. PMID: 33808905; PMCID: PMC8003822.

Corresponding Author

Azra Besic,
University of Sarajevo,
Faculty of Medicine, PhD student,
Sarajevo,
Bosnia and Herzegovina,
E-mail: azraxbesic@gmail.com

DOI: 10.18421/1986-8103.2026.20.1.27

Communication, Patient Participation, and Informed Consent as Indicators of the Quality of Hospital Healthcare

Nermina Kurtalic¹, Lejla Hodzic², Sadat Kurtalic¹, Alim Samardzic², Huska Jukic²

¹ Cantonal Hospital "Dr. Irfan Ljubijankic", Bihac, Bosnia and Herzegovina,

² University of Bihac, Faculty of Health Studies, Bosnia and Herzegovina.

Abstract

Background: The quality of healthcare is increasingly assessed through patients' experiences and perceptions. The contemporary concept of patient-centered healthcare emphasizes the importance of effective communication, patient involvement in decision-making, respect for patient autonomy, and the provision of individualized care.

Objective: The aim of this study was to assess hospitalized patients' perceptions of the quality of hospital healthcare, with particular emphasis on communication with healthcare professionals, access to information, participation in decision-making, informed consent, and privacy protection.

Methods: A cross-sectional descriptive study was conducted among 100 hospitalized patients at the Cantonal Hospital "Dr. Irfan Ljubijankić" in Bihać. Data were collected using an anonymous questionnaire specifically designed for the purposes of this study and analyzed using descriptive statistical methods.

Results: Participation in treatment-related decision-making was reported by 76% of respondents, while 79% stated that their wishes and opinions were respected during treatment. Informed consent prior to medical procedures was confirmed by 90% of respondents, and 79% positively evaluated the protection of their privacy. The lowest-rated aspect of healthcare was related to organizational and infrastructural conditions of hospitalization, with 52% of respondents expressing dissatisfaction with this component of healthcare services.

Conclusion: The findings indicate that communication with healthcare professionals, patient involvement in decision-making, and adequate

information provision are essential components of high-quality hospital healthcare. Although interpersonal aspects of care were generally evaluated positively, the results highlight the need for improvements in organizational and infrastructural conditions in order to enhance overall patient satisfaction.

Keywords: *patient-centered care; healthcare quality; communication; informed consent; patient participation; patient satisfaction*

Introduction

The quality of healthcare is no longer assessed solely through the effectiveness of diagnostic and therapeutic procedures, but also through patients' experiences during treatment. The contemporary concept of patient-centered healthcare emphasizes respect for patients' needs, values, and rights, as well as their active involvement in decisions concerning their own health [1,2].

Communication between healthcare professionals and patients represents one of the most important components of quality healthcare. Clear and understandable communication contributes to a better understanding of disease and treatment, strengthens patients' trust, and facilitates the establishment of an effective therapeutic relationship. In contrast, inadequate information and poor communication may lead to uncertainty, dissatisfaction, and reduced patient cooperation during treatment [1,3,4].

Patients' right to information forms the foundation of their active participation in the treatment process. Well-informed patients are better able to understand their health condition, available tre-

atment options, and potential risks associated with medical interventions. In this context, informed consent occupies a central role and is now regarded not only as a legal and ethical requirement but also as an important form of communication between patients and healthcare professionals [5,6].

Modern healthcare is increasingly based on the concept of shared decision-making, which promotes a partnership between patients and healthcare professionals. This approach enables patients to actively participate in selecting treatment options and contributes to greater satisfaction with care, improved understanding of medical recommendations, and increased trust in the healthcare system [7–9].

In addition to communication and patient participation, respect for privacy and dignity represents an important indicator of healthcare quality. Hospitalization is often associated with uncertainty, anxiety, and an increased need for support, making the protection of privacy and recognition of individual patient needs essential for maintaining a sense of security and satisfaction during treatment [10].

Although the principles of patient-centered healthcare are increasingly promoted within contemporary healthcare systems, their implementation in everyday hospital practice may be limited by organizational, staffing, and infrastructural challenges. Evidence regarding the experiences of hospitalized patients in Bosnia and Herzegovina remains relatively limited, particularly with respect to communication with healthcare professionals, participation in decision-making, and the realization of patients' rights during treatment [11].

Therefore, the aim of this study was to assess hospitalized patients' perceptions of the quality of hospital healthcare through the evaluation of communication with healthcare professionals, patient information, informed consent, privacy protection, and involvement in treatment-related decision-making.

Materials and Methods

A cross-sectional descriptive study was conducted among hospitalized patients at the Cantonal Hospital "Dr. Irfan Ljubijankić" in Bihać. The aim of the study was to assess patients' percepti-

ons of the quality of hospital healthcare through the evaluation of communication with healthcare professionals, access to information, informed consent, involvement in decision-making, and respect for privacy during hospitalization.

A total of 100 respondents were included in the study. The majority of the sample consisted of hospitalized patients (90%), while the remaining 10% were parents or legal guardians of hospitalized minor patients.

Data were collected using an anonymous questionnaire developed specifically for the purposes of this study. The questionnaire included items related to respondents' sociodemographic characteristics, as well as their experiences and perceptions regarding communication with healthcare professionals, access to information about their disease and treatment, informed consent, participation in decision-making, respect for privacy and dignity, satisfaction with hospitalization conditions and healthcare facility infrastructure, and awareness of basic patient rights.

Prior to completing the questionnaire, all respondents were informed about the purpose of the study. Participation was voluntary and anonymous.

The study was conducted in accordance with the ethical principles of medical research and the provisions of the Declaration of Helsinki. All participants received information regarding the purpose and procedures of the study, and confidentiality and anonymity of the collected data were ensured.

The collected data were analyzed using descriptive statistical methods. Categorical variables were presented as absolute and relative frequencies (n, %), while the results were summarized in tables and interpreted descriptively. The analysis focused on key indicators of healthcare quality, including communication with healthcare professionals, access to information, participation in decision-making, informed consent, respect for privacy, and satisfaction with the infrastructural conditions of the healthcare institution.

Results

Sociodemographic Characteristics of Respondents

A total of 100 respondents hospitalized at the Cantonal Hospital “Dr. Irfan Ljubijankić” in Bihać participated in the study. Patients accounted for 90% of the sample, while parents or legal guardians of hospitalized patients accounted for 10%.

The mean age of respondents was 47 years. The most represented age group was 41–60 years (63%), followed by the 21–40 years age group (17%) and respondents older than 60 years (15%). Respondents younger than 21 years accounted for 5% of the sample.

Regarding educational attainment, the largest proportion of respondents had completed secondary education (52%), while 28% had attained higher education. Lower educational attainment was reported by 20% of respondents.

Table 1. Sociodemographic Characteristics of Respondents

Characteristic	n (%)
Patients	90 (90.0)
Parents/guardians	10 (10.0)
41–60 years	63 (63.0)
21–40 years	17 (17.0)
>60 years	15 (15.0)
16–20 years	4 (4.0)
<16 years	1 (1.0)
Secondary education	52 (52.0)
Higher education	28 (28.0)
Lower educational level	20 (20.0)

Communication with Healthcare Professionals

The analysis of communication-related aspects of healthcare revealed predominantly positive per-

ceptions among respondents. Positive communication experiences with healthcare professionals during hospitalization were reported by 68% of respondents, whereas 32% expressed dissatisfaction with this aspect of care.

Timeliness of healthcare services received the highest rating, with 80% of respondents stating that examinations and medical procedures were performed on time. Adequate time for examinations and communication with healthcare professionals was reported by 76% of respondents.

Information regarding disease and treatment was positively evaluated by 69% of respondents, while the same percentage positively assessed the courtesy and professionalism of healthcare staff. Negative evaluations of these aspects were reported by 31% of respondents.

Patient Participation and Informed Consent

The results demonstrated a high level of patient involvement in the treatment process. Participation in treatment-related decision-making was reported by 76% of respondents, while 79% stated that their wishes and opinions were respected during treatment.

The highest proportion of positive responses was recorded for informed consent. Prior to medical procedures or therapeutic interventions, informed consent had been obtained from 90% of respondents, whereas 10% reported that such consent had not been requested.

Respect for privacy during hospitalization was positively evaluated by 79% of respondents, while one-fifth of respondents considered their privacy to be inadequately protected.

Table 2. Indicators of Communication with Healthcare Professionals

Variable	Positive response n (%)	Negative response n (%)
Positive communication with healthcare staff	68 (68.0)	32 (32.0)
Sufficient information about illness	69 (69.0)	31 (31.0)
Sufficient time for examination	76 (76.0)	24 (24.0)
Examination performed on time	80 (80.0)	20 (20.0)
Courtesy and professionalism of staff	69 (69.0)	31 (31.0)

Table 3. Patient Participation and Informed Consent

Variable	Yes n (%)	No n (%)
Participation in decision making	76 (76.0)	24 (24.0)
Respect for patients' wishes	79 (79.0)	21 (21.0)
Informed consent	90 (90.0)	10 (10.0)
Respect for privacy	79 (79.0)	21 (21.0)

Key Indicators of Healthcare Quality

Comparison of the analyzed indicators revealed that informed consent (90%), timeliness of healthcare services (80%), respect for privacy (79%), and respect for patients' wishes (79%) received the most favorable evaluations.

Conversely, the lowest ratings were observed for overall communication with healthcare professionals (68%) and information provided regarding illness and treatment (69%). The greatest dissatisfaction was associated with the infrastructural conditions of the healthcare institution, where only 48% of respondents reported satisfaction.

Table 4. Key Indicators of Healthcare Quality

Indicator	Positive response n (%)
Informed consent	90 (90.0)
Examination performed on time	80 (80.0)
Respect for privacy	79 (79.0)
Respect for patients' wishes	79 (79.0)
Sufficient time for examination	76 (76.0)
Participation in decision-making	76 (76.0)
Sufficient information about illness	69 (69.0)
Courtesy and professionalism of staff	69 (69.0)
Positive communication with healthcare staff	68 (68.0)
Satisfaction with infrastructure	48 (48.0)

Discussion

The findings of this study indicate that hospitalized patients generally reported positive perceptions of communication with healthcare professionals, informed consent, respect for privacy, and participation in treatment-related decision-making. Informed consent received the highest

positive rating (90%), whereas satisfaction with the infrastructural and organizational conditions of hospitalization was the lowest-rated aspect of healthcare quality (48%). These findings suggest that patients evaluate healthcare quality not only through clinical outcomes but also through interpersonal, ethical, and organizational dimensions of care.

In the present study, 68% of respondents reported positive experiences regarding communication with healthcare professionals, 69% considered the information provided about their health condition and treatment to be adequate, and 76% believed that sufficient time had been devoted to examinations and communication. Furthermore, 69% of respondents positively evaluated the courtesy and professionalism of healthcare staff. Although these results indicate generally favorable perceptions of communication, the fact that approximately one-third of respondents expressed dissatisfaction highlights the need for continuous improvement in this area. Notably, satisfaction with communication was lower than satisfaction with informed consent and participation in decision-making, suggesting that while formal aspects of patient rights are largely respected, everyday communication remains an area requiring further attention.

The importance of effective communication has been widely documented in the literature. Street et al. reported that communication between healthcare professionals and patients contributes to a better understanding of illness, improved decision-making, and greater trust in the healthcare system [4]. Similarly, Kwame and Petrucka emphasized that effective communication encompasses empathy, emotional support, active listening, and respect for individual patient needs [1]. More recent evidence has demonstrated that patient-centered communication positively influences trust and overall satisfaction with healthcare services [12]. The findings of the present study further support the view that communication is a fundamental component of patient-centered healthcare and a key determinant of perceived healthcare quality.

The highest proportion of positive responses in this study was related to informed consent, which was confirmed by 90% of respondents. This finding indicates that most patients were adequately informed and actively involved before undergoing

medical procedures or therapeutic interventions. Informed consent is widely recognized as one of the principal indicators of respect for patient autonomy and ethical medical practice. Akkad et al. found that patients perceive informed consent as an important component of communication, particularly when the nature of the procedure, expected outcomes, and potential risks are clearly explained [13]. Likewise, Hall et al. argued that informed consent should not be viewed merely as a formal administrative requirement but rather as a continuous communication process between healthcare professionals and patients [6]. The high level of positive responses observed in this study may therefore reflect a relatively successful implementation of patient autonomy principles in routine hospital practice.

Patient participation in treatment-related decision-making was reported by 76% of respondents, while 79% stated that their wishes and preferences were respected during treatment. These findings indicate that most patients were not merely passive recipients of healthcare services but active participants in their own care. Active patient involvement is considered a core principle of contemporary patient-centered healthcare.

The present findings are consistent with those reported by Siebinga et al., who demonstrated that patient-centered communication and shared decision-making significantly contribute to patient satisfaction [7]. The importance of patient participation is further supported by the systematic review conducted by Shay and Lafata, which concluded that shared decision-making improves patients' understanding of treatment options, enhances satisfaction, and strengthens the relationship between healthcare professionals and patients [9]. These findings are also aligned with the perspective of Barry and Edgman-Levitan, who identified shared decision-making as one of the defining characteristics of patient-centered healthcare [8].

Respect for privacy during hospitalization was positively evaluated by 79% of respondents. Although this represents a relatively high level of satisfaction, one in five respondents reported concerns regarding the protection of privacy. This finding underscores the importance of privacy and dignity as essential components of healthcare quality that require continuous attention from he-

althcare professionals. Similar conclusions were reported by Akyüz and Erdemir, who identified privacy as one of the most important indicators of respect for patient dignity during healthcare delivery [10]. According to their findings, adequate privacy protection contributes to feelings of security, trust, and satisfaction with care. The results of the present study support these observations and further demonstrate that healthcare quality extends beyond the successful completion of medical procedures.

The least favorable evaluations in this study were related to the infrastructural and organizational conditions of hospitalization. Only 48% of respondents expressed satisfaction with healthcare infrastructure, while 52% reported dissatisfaction. Unlike communication-related and ethical aspects of healthcare, where positive evaluations predominated, infrastructure was the only domain in which dissatisfaction exceeded satisfaction. This finding suggests that improvements in healthcare quality depend not only on the performance of healthcare professionals but also on investments in organizational capacity and physical resources.

Rathert et al. emphasized that patient satisfaction is influenced by a combination of interpersonal and organizational factors, with healthcare delivery conditions playing an important role in shaping patient experiences [11]. Similar conclusions were reported by Aliman and Mohamad, who highlighted the impact of organizational conditions, resource availability, and service environments on patients' perceptions of healthcare quality and satisfaction [14]. These findings may explain why infrastructure emerged as the weakest-rated component of healthcare quality in the present study.

Overall, the results indicate that respondents most positively evaluated those aspects of healthcare associated with respect for patient rights and active involvement in treatment. In contrast, organizational and infrastructural factors received less favorable evaluations. This pattern suggests that healthcare quality is determined not only by the competence and professionalism of healthcare workers but also by the conditions under which healthcare services are delivered.

Several limitations of this study should be acknowledged. First, the study was conducted in

a single healthcare institution and included a relatively small sample size, which may limit the generalizability of the findings. Second, the data were based on self-reported perceptions and may therefore be subject to response bias and subjective interpretation. Despite these limitations, the study provides valuable insights into hospitalized patients' perceptions of healthcare quality and highlights important factors influencing patient experiences during hospitalization.

Conclusion

The perception of hospital healthcare quality among respondents was primarily shaped by experiences related to communication with healthcare professionals, access to information, participation in decision-making, and respect for patients' rights during treatment. The most positively evaluated aspects of healthcare were informed consent, privacy protection, and respect for patients' preferences, indicating the presence of important elements of patient-centered care in everyday hospital practice.

At the same time, the findings demonstrate that patient satisfaction is not determined solely by medical procedures and professional competence. Organizational and infrastructural conditions of hospitalization emerged as the least favorably evaluated aspect of healthcare quality, highlighting the importance of environmental and organizational factors in shaping patients' overall experiences.

These results emphasize the need for continuous improvement of healthcare professionals' communication competencies, greater patient involvement in treatment-related decision-making, and the creation of conditions that support more accessible, responsive, and patient-centered healthcare. Particular attention should be directed toward improving organizational processes and hospital infrastructure, as these factors may substantially influence patients' perceptions of healthcare quality.

Future studies should include a larger number of healthcare institutions and participants to provide a more comprehensive understanding of patient experiences and to identify the factors that most strongly contribute to improving the quality of hospital healthcare.

References

1. Kwame A, Petrucka PM. *A literature-based study of patient-centered care and communication in nurse-patient interactions: barriers, facilitators, and the way forward.* *BMC Nurs.* 2021; 20(1): 158. doi:10.1186/s12912-021-00684-2.
2. *Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington (DC): National Academy Press; 2001.
3. Woldermichael BT, Weldehaweria NB, Ghebremedhin MW, Tesfay FH, Gebremeskel YT, Berhe GK, et al. *Patient satisfaction with communication and associated factors among hospitalized patients.* *Patient Prefer Adherence.* 2023; 17: 1457-1468. doi:10.2147/PPA.S404993.
4. Street RL Jr, Makoul G, Arora NK, Epstein RM. *How does communication heal? Pathways linking clinician-patient communication to health outcomes.* *Patient Educ Couns.* 2009; 74(3): 295-301. doi:10.1016/j.pec.2008.11.015.
5. Shah P, Thornton I, Turrin D, Hipskind JE. *Informed Consent.* Treasure Island (FL): StatPearls Publishing; 2024.
6. Hall DE, Prochazka AV, Fink AS. *Informed consent for clinical treatment.* *CMAJ.* 2012; 184(5): 533-540. doi:10.1503/cmaj.112120.
7. Siebinga VY, Driever EM, Stiggelbout AM, Brand PLP. *Shared decision making, patient-centered communication and patient satisfaction: a cross-sectional analysis.* *Patient Educ Couns.* 2022; 105(7): 2322-2328. doi:10.1016/j.pec.2022.03.012.
8. Barry MJ, Edgman-Levitan S. *Shared decision making—the pinnacle of patient-centered care.* *N Engl J Med.* 2012; 366(9): 780-781. doi:10.1056/NEJMp1109283.
9. Shay LA, Lafata JE. *Where is the evidence? A systematic review of shared decision making and patient outcomes.* *Med Decis Making.* 2015; 35(1): 114-131. doi:10.1177/0272989X14551638.
10. Akyüz E, Erdemir F. *Surgical patients' and nurses' opinions and expectations about privacy in care.* *Nurs Ethics.* 2013; 20(6): 660-671. doi:10.1177/0969733012468462.
11. Rathert C, Wyrwich MD, Boren SA. *Patient-centered care and outcomes: a systematic review of the literature.* *Med Care Res Rev.* 2013; 70(4): 351-379. doi:10.1177/1077558712465774.

12. Elkefi S, Asan O. Patient-centered communication's association with trust, satisfaction, and technology perception among newly diagnosed cancer patients. *Front Commun.* 2024; 9: 1391981. doi:10.3389/fcomm.2024.1391981.
13. Akkad A, Jackson C, Kenyon S, Dixon-Woods M, Taub N, Habiba M. Patients' perceptions of written consent: questionnaire study. *BMJ.* 2006; 333(7567): 528. doi:10.1136/bmj.38922.516204.55.
14. Aliman NK, Mohamad WN. Linking patient satisfaction, patient trust, and service quality perceptions in Malaysian public hospitals. *Int J Econ Manag.* 2016; 10(S2): 257-267.

Corresponding Author

Nermina Kurtalic,

Cantonal Hospital "Dr. Irfan Ljubijankic",

Bihac,

Bosnia and Herzegovina,

E-mail: sadatku@hotmail.com



Instructions for the authors

All papers need to be sent to e-mail: healthmedjournal@gmail.com

Preparing Article for HealthMED Journal

First Author¹, Second Author², Third Author³

¹ First affiliation, Address, City, Country,

² Second affiliation, Address, City, Country,

³ Third affiliation, Address, City, Country.

Abstract

In this paper the instructions for preparing camera ready paper for the Journal are given. The recommended, but not limited text processor is Microsoft Word. Insert an abstract of 50-100 words, giving a brief account of the most relevant aspects of the paper. It is recommended to use up to 5 key words.

Key words: Camera ready paper, Journal.

Introduction

In order to effect high quality of Papers, the authors are requested to follow instructions given in this sample paper. Regular length of the papers is 5 to 12 pages. Articles must be proofread by an expert native speaker of English language. Can't be accepted articles with grammatical and spelling errors.

Instructions for the authors

Times New Roman 12 points font should be used for normal text. Manuscript have to be prepared in a two column separated by 5 mm. The margins for A4 (210×297 mm²) paper are given in Table 1.

Table 1. Page layout description

Paper size	A4
Top margin	20 mm
Bottom margin	20 mm
Left margin	20 mm
Right margin	18 mm
Column Spacing	5 mm

Regular paper may be divided in a number of sections. Section titles (including references and acknowledgement) should be typed using 12 pt fonts with **bold** option. For numbering use Times New Roman number. Sections can be split in subsection, which should be typed 12 pt *Italic* option. Figures

should be one column wide. If it is impossible to place figure in one column, two column wide figures is allowed. Each figure must have a caption under the figure. Figures must be a resolution of 300 DPI, saved in TIFF format, width 10 cm min. For the figure captions 12 pt *Italic* font should be used. (1)

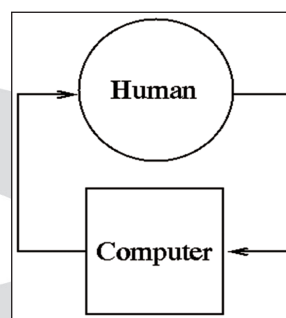


Figure 1. Text here

Conclusion

Be brief and give most important conclusion from your paper. Do not use equations and figures here.

Acknowledgements (If any)

These and the Reference headings are in bold but have no numbers.

References

1. Sakane T, Takeno M, Suzuki N, Inaba G. Behcet's disease. *N Engl J Med* 1999; 341: 1284-1291.
2. Stewart SM, Lam TH, Beston CL, et al. A Prospective Analysis of Stress and Academic Performance in the first two years of Medical School. *Med Educ* 1999; 33(4): 243- 50.

Corresponding Author
Name Surname,
Institution,
City,
Country,
E-mail: