e-ISSN 2544-1620


MEDICAL SCIENCE
**PULSE**
University of Opole

Scientific Quarterly
July–September 2021,
Vol. 15, No. 3
e-ISSN 2544-1620

**Publisher:**
University of Opole

**Sources of funding:**
statutory activity
of the Institute of Health
Sciences, University of Opole

Tasks: "Purchase of digital object identifiers for electronic documents; Purchase of software to manage editorial and publishing works; Purchase of anti-plagiarism programme; Linguistic correction of scientific articles in the journal; Improvement of substantive level of reviews; Dissemination of information about the journal" are financed by the Ministry of Science and Higher Education de minimis programme within the framework of "Support for scientific journals" project – contract number 147/WCN/2019/1.

**EDITORIAL OFFICE:**
ul. Katowicka 68,
45-060 Opole
tel. +48 77 442 35 46
e-mail: mspjournal@wsm.opole.pl

**Contact:**
Deputy Editor –
Bożena Ratajczak-Olszewska
tel. +48 77 442 35 46
e-mail: bozena.ratajczakolszewska@uni.opole.pl

The editors reserve the right to shorten and edit texts submitted.

The issue is closed: 30.09.2021



The publisher does not offer subscriptions.
The journal appears in the original electronic version on the website: www.medicalsciencepulse.com

**Editorial, graphics, composition:**
Jolanta Brodziak
Wydawnictwo Uniwersytetu Opolskiego
ul. R. Dmowskiego 7–9, 45-365 Opole
e-mail: jbrodziak@uni.opole.pl
tel. +48 77 401 66 85

# TABLE OF CONTENTS

## Original papers

JORGE ANGEL ALMEIDA VILLEGAS, HAROLD MONDRAGON REYES, MARIANA AGUILAR SÁNCHEZ, MARIA FERNANDA CRUZ ROSAS, REGINA SANCHEZ MONROY, JESUS EMMANUEL BERNAL ZAMUDIO, ANA PAULA PALACIOS RODRIGUEZ
Identification of *Escherichia coli* strains in the vaginal cultures of healthy women and their patterns of antibiotic resistance . . . . . 4

MAGDALENA DZIURKA, MARZENA BUCHOLC, ANNA PILEWSKA-KOZAK, BEATA DOBROWOLSKA
Course of pregnancy, labor, and women's satisfaction with life in the early postpartum period. . . . . 10

IWONA WILK, ELŻBIETA RAJKOWSKA-LABON, MARTA SOBIECH, GABRIELA KOŁODYŃSKA, BARBARA NOWAK, WŁODZIMIERZ DOROSZKIEWICZ, WALDEMAR ANDRZEJEWSKI, KRZYSZTOF KASSOLIK
Therapeutic massage in women with stress urinary incontinence: A pilot study . . . . . 16

MARIA FLORKIEWICZ, ANNA TOBOLSKA, GRAŻYNA BĄCZEK
Knowledge of prevention and treatment of human papillomavirus (HPV) infections among young men . . . . . 24

BOŻENA MAJCHROWICZ, KATARZYNA TOMASZEWSKA, EDYTA GUTY
Societal attitudes toward death and awareness of death confirmation: an internet survey . . . . . 31

ANTONINA KACZOROWSKA, AGATA MROCZEK, EWELINA LEPSY, MAGDALENA KORNEK, AGNIESZKA KACZOROWSKA, MONIKA KACZOROWSKA, KAROLINA LEPSY
Musculoskeletal pain in professional symphony orchestra musicians . . . . . 38

## Case reports

MONIKA CIECHANOWSKA, JAN STACHURSKI
Differentiating stroke,transient ischemic attack, or hemiplegic migraine in a teenager: a case report . . . . . 44

ANTONINA KACZOROWSKA, JOLANTA KABOTH, EWELINA LEPSY, AGATA MROCZEK
The effects of physiotherapy using proprioceptive neuromuscular facilitation techniques on the gait of patients after hip and knee arthroplasty: a case report . . . . . 49

## Reviews

ALEKSANDRA SIDOR, MONIKA SOCZEWKA, DAMIAN SKRYPNIK
Natural preparations supporting the treatment of coronary heart disease: a narrative review. . . . . 56

DOROTA STEFANICKA-WOJTAS, DONATA KURPAS
Personalized medicine – challenge for healthcare system: a perspective paper. . . . . 63

Dear Readers, Authors, Reviewers, Members of the Scientific Committee, Thematic Editors, Members of the Editorial Board, and all Enthusiasts of Medical Science Pulse!

At the start of the new academic year 2021/2022 we are pleased to introduce the third issue of Medical Science Pulse in 2021. This issue also features our new logo on its cover. We hope that the interesting content of the articles will become a starting point for scientific discussion in the academic community. Medical Science Pulse publishes a wide range of articles covering a broad range of issues, and we are confident that all readers will find something of interest. The third issue addresses a wide range of topics in health science. The issue opens with an original research paper discussing the identification of Escherichia coli producer and non-producer of Extended Spectrum Beta-lactamases and their patterns of resistance to antibiotics in vaginal cultures of healthy women. The article was written by Jorge Villegas from Professional School of Nutrition, Nursing and Gerontology, IUEM University, Mexico. Question of life satisfaction among women after delivery based on selected characteristics concerning the course of pregnancy and labor was addressed by Dziurka, Bucholc and colleagues. A case report by Ciechanowska and Stachurski discuss differential diagnosis between stroke, transient ischemic attack, and first episode of hemiplegic migraine in a teenager with alarming focal symptoms. The study by Jachrowicz and Tomaszewska examines social attitudes towards death and the level of awareness concerning its confirmation. This issue includes a series of articles on physiotherapy. We particularly recommend the article by Wilk on therapeutic massage in women with stress urinary incontinence and the study by Kaczorowska, aimed at evaluating the effects of physiotherapy using PNF techniques on the gait of patients after hip and knee arthroplasty. The article by Kaczorowska and Kaboth examines methods to assess and compare pain in professional Polish musicians and the relationships between the intensity and frequency of pain and the time spent playing per week and the experience of playing the instrument. The article by Florkiewicz studies the associations between knowledge of prevention and treatment of human papillomavirus (HPV) infections in young men and another one describes societal attitudes toward death and awareness of death confirmation. This issue closes with two particularly interesting articles: a study by Stefanicka-Wojtas and Kurpas addressing the challenge of personalized medicine for health care. The aim of this work was to identify barriers, and to take systematic actions to remove as many as possible, to create a future where personalized medicine is fully integrated in real-life settings. The study by Procek examines the legal and ethical challenges of physicians working during COVID-19 pandemic. We all know how difficult this year is due to the continued COVID-19 pandemic. Nonetheless, we hope that you will be able to find some time to read this new issue of our quarterly. Prof. Donata Kurpas MD, PhD Editor-in-Chief Andrei Shpakou MD, PhD Deputy Editor Bożena Ratajczak-Olszewska MSc Deputy Editor Dear Readers, Authors, Reviewers, Members of the Scientific Committee, Thematic Editors, Members of the Editorial Board, and all Enthusiasts of Medical Science Pulse! Medical Science Pulse 2021 (15) 3 Editorial 3 In the new academic year 2021/2020, the editors of MSP wish the entire academic community good health, success in their didactic and research work, along with successful completion of their objectives. We also wish the students perseverance and motivation in acquiring knowledge, qualifications, and skills for their profession. We invite you to publish your scientific work in MSP and deepen your academic interests as well as to join our editorial team and the group of authors!

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Original papers

Published online: 30 September 2021

DOI: 10.5604/01.3001.0015.4250

# IDENTIFICATION OF *ESCHERICHIA COLI* STRAINS IN THE VAGINAL CULTURES OF HEALTHY WOMEN AND THEIR PATTERNS OF ANTIBIOTIC RESISTANCE

Jorge Angel Almeida Villegas[1,2 A,E]
• ORCID: 0000-0002-3804-9550

Harold Mondragon Reyes[2 E,F]
• ORCID: 0000-0002-8815-1510

Mariana Aguilar Sánchez[2 E,F]
• ORCID: 0000-0001-9293-3235

Maria Fernanda Cruz Rosas[2 B,C]
• ORCID: 0000-0002-6797-9263

Regina Sanchez Monroy[2 B,C]
• ORCID: 0000-0003-2621-4237

Jesus Emmanuel Bernal Zamudio[2 C,D]
• ORCID: 0000-0002-5834-9278

Ana Paula Palacios Rodriguez[3 B,C]
• ORCID: 0000-0003-2687-3208

[1] Professional School of Nutrition, Nursing and Gerontology, IUEM University, Mexico

[2] School of Biological Pharmaceutical Chemistry, University of Ixtlahuaca CUI, Ixtlahuaca, Mexico

[3] Laboratory of Environmental Microbiology and Biotechnology, National University of San Marcos, Peru

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** Bacterial vaginosis is the most common cause of vaginitis in women of childbearing age, and it predominantly affects young sexually active women. *Escherichia coli* is one of the most common bacteria found in the genital tract of non-pregnant (9–28%) and pregnant women (24–31%). *E. coli* strains can colonize the vaginal and endocervical regions in pregnant women, and may lead to the development of urinary tract, intra-amniotic or puerperal infections.

**Aim of the study:** Isolation and identification of the antibiotic resistance patterns of extended spectrum beta-lactamase (ESBL)-producing and non-producing *E. coli* in the vaginal cultures of healthy women.

**Material and methods:** Vaginal samples were taken from 55 healthy women. For the bacterial identification and resistance patterns, automated equipment from Beckman Coulter was used. Phenotypic techniques were used to confirm the presence or absence of ESBL.

**Results:** Fifty-five cultures developed *E. coli*, with the rest of the strains corresponding to different bacteria. Of the 55 *E. coli* cultures, 35 (63.63%) were ESBL-producing and 20 (36.36%) did not produce ESBL. There was an 80% resistance to penicillin, and a 76.4% and 65.5% resistance to the first and fourth generation cephalosporins, respectively. A 45.5% resistance was observed for the fluoroquinolones, 52.7% for trimethoprim/sulfamethoxazole, and 100% sensitivity to carbapenemics and amikacin.

**Conclusions:** A large presence of vaginal ESBL-producing *E. coli* was observed in healthy women, which increases the risk of therapeutic failure due to high levels of antibiotic resistance.

**KEYWORDS:** *E. coli*, antibiotic resistance, vaginal culture

## Background

Vaginal infections are a frequent reason for primary healthcare consultations around the world, but their prevalence and etiology vary in different populations. The proper clinical diagnosis of these infections is necessary to establish an effective therapy, and this is fundamentally associated with recognizing the etiology [1]. Female urogenital infections are highly prevalent. Vaginal infections affect 70% of women during their lifetimes and account for millions of annual doctors' visits [2]. Vaginal ecology is influenced by factors such as the glycogen content in epithelial cells, glucose, pH, hormone levels, trauma caused by sexual intercourse, contraceptive methods, age, and antimicrobial treatments [3].

The vaginas of women of different ethnicities are inhabited by a variety of microorganisms, known as the vaginal microbiota, in varying quantities and proportions. Among these, *Lactobacillus* spp., in particular *L. crispatus, L. jensenii*, and *L. inners*, are the most prevalent bacteria in the vaginal ecosystem of healthy Caucasian women. According to the World Health Organization, probiotics are "live microorganisms which when administered in adequate amounts confer a health benefit on the host". Lactobacilli that colonize the human vagina produce antimicrobial substances that counteract the growth of pathogenic microorganisms. Nevertheless, for reasons not completely elucidated, the vaginal microbiota composition can change, and this alteration of the ecosystem can lead to vaginal dysbiosis and infections associated with various adverse health outcomes [4]. The vaginal microbiota provides the first line of defense against sexually transmitted infections (STIs). *Lactobacillus* spp. produce lactic acid and other antimicrobial compounds that maintain a protective environment, and the absence of these bacteria is associated with an increased risk of contracting STIs. Recent large-scale molecular surveys of the vaginal microbiota have revealed five broad vaginal bacterial community-state types (CSTs). Four CSTs are dominated by *Lactobacillus* spp., while a fifth is deficient in *Lactobacillus* and comprised of a diverse set of strict and facultative anaerobes [5].

Vaginal infections represent a significant female health problem due to issues such as a high recurrence rate, drug resistance, and the emergence of persistent strains. Improvements in the therapeutic efficacy of conventional formulations intended for vaginal delivery remain as a challenge due to anatomy and physiology of the vagina, since the secretion and renewal of vaginal fluids contribute to removal of the therapeutic agent. Vaginal disorders can be categorized according to their etiologic agent into bacterial, fungal, or parasitic infections. Thus, it is important to understand the clinical and pathological features, as well as the main challenges involved in the treatments, for each type of vaginal infection [6].

Currently, vaginal infections are mainly caused by pathogenic or commensal microorganisms that, due to immunosuppression, can become pathogenic agents for humans. Bacterial vaginosis (BV), candidiasis, and trichomoniasis are responsible for the majority of vaginal infections in women of reproductive age. Abnormal vaginal discharge, itching, burning sensations, irritation and discomfort are frequent complaints among patients who visit obstetrics and gynecological clinics. However, several vaginal infections present with few or no symptoms [7].

BV is the most common cause of vaginitis in women of childbearing age. This condition predominantly affects young sexually active women but can also occur in the absence of sexual intercourse [8]. A group of microorganisms is present simultaneously in the vaginas of women with BV. The main members of this group are *Gardnerella vaginalis,* anaerobic gram-negative rods belonging to the genera *Prevotella, Porphyromonas*, and *Bacteroides*, *Peptostreptococcus* species, *Mycoplasma hominis, Ureaplasma urealyticum,* and *Mobiluncus* species. In addition, facultative species of *Lactobacillus* tend to be present in lower concentrations compared to women with a normal vaginal exam [9].

*Escherichia coli* is reported as one of the most common organisms found in the genital tracts of non-pregnant (9–28%) and pregnant women (24–31%). Vaginal *E. coli* can colonize the vaginal and/or endocervical regions in pregnant women, and can lead to the development of urinary tract, intra-amniotic and puerperal infections through 'fecal-vaginal-urinary/neonatal' transmission [10].

## Aim of the Study

The aim of this study is to isolate and identify antibiotic resistance patterns in extended spectrum beta-lactamase (ESBL)-producing and non-producing *E. coli* in the vaginal cultures of healthy women.

## Material and methods

### Study population and data collection

The study group was comprised of 55 patients that attended an outpatient clinic in the Toluca Valley in Mexico. Vaginal cultures were taken from healthy women, whose only exclusion criterion was presenting with a sign or symptom of vaginal infection in the week or days prior. The age of the participants was not an exclusion criterion as one of the objectives was to identify the age at which the highest prevalence of

bacterial growth is discovered and whether there is a presence of ESBL-producing *E. coli*.

To take the culture, a swab was made and was placed in Stuart transport medium for 5 hours after sampling. Sheep blood agar and chromogenic agar were used for the cultures, which were incubated for 24 hours at 37 °C. The petri dish with chromogenic agar was used for a reseeding with standard medium, and an OD of 0.5 on the MacFarland scale was used to perform bacterial identification in a panel for gram negative bacteria, as well as for the susceptibility tests. This was done using Beckman Coulter equipment. For the determination of minimum inhibitory concentrations (MIC) in the antibiogram, the concentrations established by the Clinical and Laboratory Standards Institute (CLSI) were used. The confirmation of ESBL was made using a disk synergy test with ceftazidime and clavulanic acid [11].

## Variables

Age, presence of ESBL, and resistance to fluoroquinolones.

## Statistical analyses

The statistical analyses were performed using IBM SPSS v. 22 software. To establish the relationship between the variables "Bacteria ESBL" and "Age", Chi squared tests and point-biserial correlations were used. The null hypothesis (Ho) was "the presence of ESBL bacteria is not related to the age of the women" and the alternate hypothesis (Ha) was "the presence of ESBL bacteria is related to the age of the women." The 55 patients from whom vaginal culture samples were collected were subjected to hypothesis testing. In addition, the phi coefficient was used to establish the correlation between the variables "Bacteria *E. coli* ESBL" and "resistance to fluoroquinolones".

## Results

One hundred and ten cultures were obtained from healthy women of different ages, of which only 100 cultures showed microbial growth. Fifty-five cultures developed *E. coli* and the rest of the strains corresponded to different bacteria. Of the 55 cultures of *E. coli*, 35 63.63% (35) were strains that produced ESBL, and 20 36.36% (20) were strains that did not produce ESBL but may have had the presence of AmpC beta-lactamases.

The average age of the participants was 33.94 years, an middle of 29, with the lowest age being 17 years and the highest 70 years. All samples were obtained from healthy women with an absence of vaginal, cervicovaginal or urinary tract infections.

The patterns of resistance to the different antibiotics are shown in Table 1, where the number of sensitive and resistant *E. coli* cultures are listed.

Table 1. Antibiotic resistance patterns in *E. coli* isolates (n=55)

| Antibiotic | ***E. coli* Resistant (n/%)** | *E. coli* **Sensitive (n/%)** |
|---|---|---|
| Ampicillin | 44/80 | 11/20 |
| Ampicillin/Sulbactam | 27/49.1 | 28/50.9 |
| Amoxicillin/Clavulanic acid | 21/38.2 | 34/61.8 |
| Cefalothin | 42/76.4 | 13/23.6 |
| Cefepime | 36/65.5 | 19/34.5 |
| Ceftriaxone | 40/72.7 | 15/27.3 |
| Ceftazidime | 40/72.7 | 15/27.3 |
| Cefotaxime | 40/72.7 | 15/27.3 |
| Cefuroxime | 39/70.9 | 16/29.1 |
| Piperacillin/Tazobactam | 6/10.9 | 49/89.1 |
| Imipenem | 0/0 | 55/100 |
| Meropenem | 0/0 | 55/100 |
| Ertapenem | 0/0 | 55/100 |
| Tigecycline | 12/21.8 | 43/78.2 |
| Tetracycline | 29/52.7 | 26/47.3 |
| Amikacin | 0/0 | 55/100 |
| Gentamicin | 16/29.1 | 39/79.9 |
| Levofloxacin | 25/45.5 | 30/54.5 |
| Ciprofloxacin | 25/45.5 | 30/54.5 |
| Trimetroprim/Sulfametoxazol | 29/52.7 | 26/47.3 |

For penicillin derivatives, 80% resistance was observed, which is to be expected due to the presence of 63.3% of ESBL-producing strains. However, the presence of other beta-lactamases such as AmpC is also reflected in the number of strains resistant to this antibiotic. Cephalosporins from the first to fourth generations had percentages of 76.4% (42) and 65.5% (36) for cefalothin and cefepime, respectively. Ampicillin/sulbactam had a resistance of only 49.1% (27), while amoxicillin/clavulanic acid exhibited a resistance of 38.2% (21), a lower percentage than ampicillin alone.

Carbapenemics meropenem, imipenem and ertapenem had a sensitivity of 100% for all drugs, which indicates an absence of carbapenemase production. In the case of the aminoglycoside amikacin, it also had a sensitivity of 100%, but gentamicin from the same family had a 29.1% (16) resistance.

Fluroquinolones, ciprofloxacin and levofloxacin had a resistance of 45.5% (25) for both drugs, which represents a high rate. For tetracycline and trimethoprim with sulfamethoxazole, there was a resistance of 52.7% (29). High resistance rates were also observed for other drugs such as tigecycline with 21.8% (12), and beta-lactams with beta-lactamase inhibitors such as piperacillin/tazobactam with 10.9% (6).

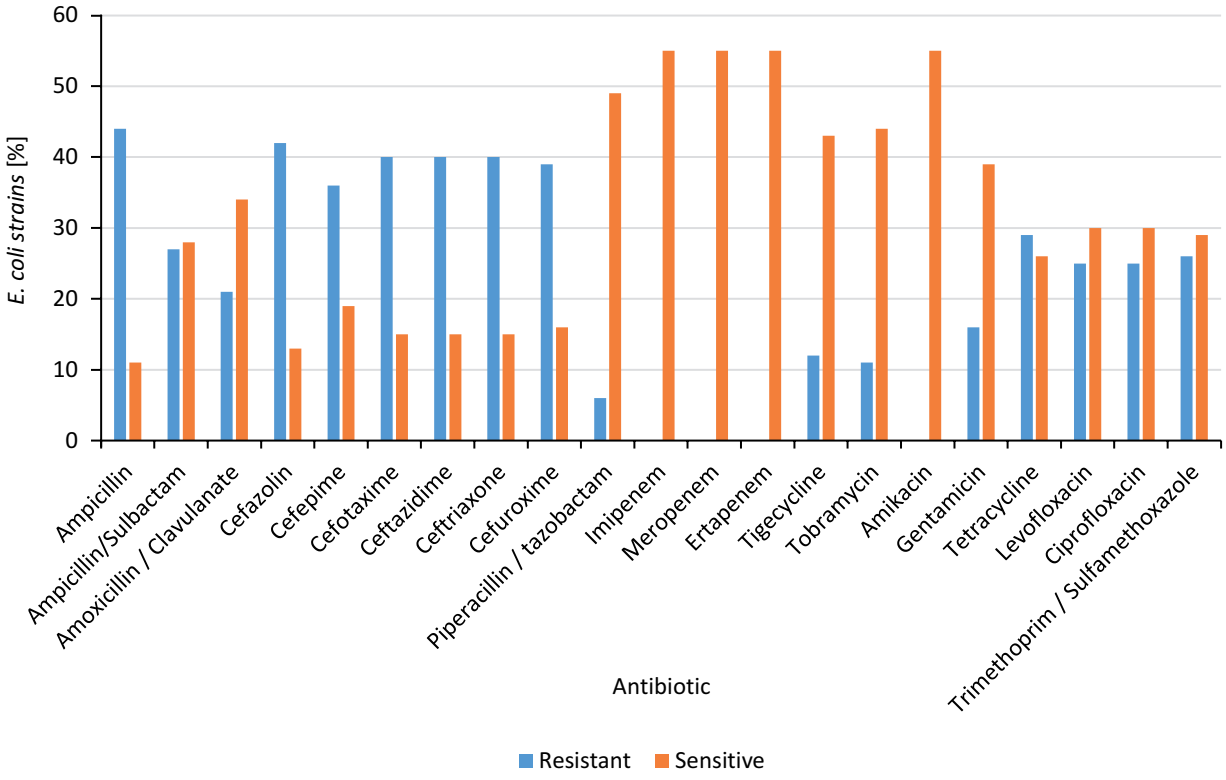


Figure 1. Antibiotic resistance patterns in *E. coli* isolates

Figure 1 shows these resistance trends and the comparisons between those strains sensitive and resistant to the drugs evaluated in the study.

### ESBL-producing bacteria and Age

A Chi-squared test indicated that there was no significant association between the presence of ESBL-producing bacteria and the age of the patients ($\chi^2$=29.648, p=0.484).

The point-biserial correlation (r=-0.055, p=0.05) indicated an inverse relationship between the variables, which means the older the patients, the lower the probability of the presence of ESBL-producing bacteria.

### ESBL-producing bacteria and fluoroquinolone resistance

The phi coefficient ($\phi$=0.311, p=0.021) indicated a significant association between ESBL-producing bacteria and resistance to fluoroquinolones.

## Discussion

### Key results

A high level of ESBL was detected by the biochemical tests, this was reflected in the high index of resistance (80%) for ampicillin, which is hydrolyzed by these enzymes. The high resistance rate also indicates a high number of AmpC-producing strains, as there were only 35 ESBL-producing strains. In the case of first-generation cephalosporins, such as cephalothin, there was a resistance seen in 42 strains (76.4%), which also implies the existence of AmpC-producing strains. A similar pattern of results was observed for cefuroxime with 39 resistant strains (70.9%), and 40 strains were resistant to third generation cephalosporins (72.7%).

### Interpretation

Both AmpC and ESBL do not have the ability to hydrolyze beta-lactamase inhibitors, so there was little resistance to amoxicillin/clavulanate (61.8%, 34), ampicillin/sulbactam 50.9% (28), and piperacillin/tazobactam 89.1%, (49) [12,13]. On the other hand, a high percentage of resistance to tetracyclines was observed. Tetracycline and tigecycline showed resistance rates of 52.7% (29) and 21.8% (12), respectively. Bacterial resistance to tetracycline is usually mediated by energy-dependent pumping of tetracycline out of the bacterial cell. The genes tet (A), (B), (C), (D), (E), (Y) and (I) in gram-negative bacteria encode these efflux systems [14].

In the case of quinolones, a resistance pattern of 45.5% (25) was observed for both levofloxacin and ciprofloxacin. In *E. coli*, resistance to quinolones frequently occurs through mutations in the gyrA gene

and, less often, in the gyrB gene, which catalyze ATP dependent DNA supercoiling. Other mechanisms of *E. coli* resistance to quinolones and fluoroquinolones are through efflux pumps and reduced drug accumulation in the bacteria due to changes in the purine protein [15].

## Conclusions

There is a high presence of vaginal *E. coli* strains that produce ESBL and AmpC-type beta-lactamases in apparently healthy women. In addition, a high degree of resistance to antibiotics such as quinolones, tetracyclines and trimethoprim with sulfamethoxazole was observed for these strains. These families of antibiotics, along with the beta-lactam drugs, are first line therapeutics for infections of this nature, which will lead to therapeutic failure. The relationship between the presence of ESBL and resistance to quinolones also indicates a risk of failure in therapy with these antibiotics.

## Code of ethics

The ethics committee of Pasteur Laboratories approved this study. This research did not compromise the security and identity of the participants as samples collected are considered routine.

## Acknowledgments

We are grateful to all the participants who provided a sample, as well as to the institutions that allowed for sample collection and carrying out of the experiments.

## References

1. Villaseca R, Ovalle A, Amaya F, Labra B, Escalona N, Lizana P, Montoya M, et al. Infecciones vaginales en un Centro de Salud Familiar de la Región Metropolitana. Chile Rev Chilena Infectol 2015; 32(1): 30-36. (In Spanish).
2. Gazziano R, Sabbatini S, Roselletti E, Perito S, Monari C. Saccharomyces cerevisiae-based probiotics as novel antimicrobial agents to prevent and treat vaginal infections. Front Microbiol 2020; 21(11): 718.
3. Machado R, Tomas M, Oliveira A, Oliveira J, Oliveira R. The vaginal sheet: an innovative form of vaginal film for the treatment of vaginal infections. Drug Dev Ind Pharm 2020; 46(1): 135-145.
4. Superti F, De-Seta F, Warding O. Recurrent yast and bacterial vaginal infections: lactoferrin and lactobacilli. Microorganisms 2020; 8(1): 130.
5. Tamarelle J, Ma B, Gajer P, Humphrys M, Terplan M, Marck K. Non-optimal vaginal microbiota after azithromycin treatment for Chlamydia trachomatis infection. J Infect Dis 2020; 221(4): 627-635.
6. Dos-Santos A, Carvalho S, Araujo V, Carvalho G, Gremiao M, Chorilli M. Recent advances in hydrogels as strategy for drug delivery intended to vaginal infections. Int J Pharm 2020; 590: 119867.
7. Mulu W, Yimer M, Zenebe Y, Abera B. Common causes of vaginal infections and antibiotic susceptibility of aerobic bacterial isolates in women of reproductive age attending at Felegehiwot Referral Hospital, Ethiopia: a cross sectional study. BMC Women´s Health 2015; 13(15): 42.
8. Sobel J. Bacterial vaginosis. Ann Rev Med 2000; 51: 349-356.
9. Hill G. The microbiology of bacterial vaginosis. Am J Obstet Gynecol 1993; 169(2): 450-454.
10. Saéz-López E, Guiral E, Fernandez-Orth D, Villanueva S, Gonce A, Lopez M, et al. Vaginal versus obstetric infection Escherichia coli isolates among pregnant women: antimicrobial resistance and genetic virulence profile. Plos One 2016; 11(1): 16-28.
11. Babic M, Hujer A, Bonomo R. What´s new antibiotic resistance? Focus on beta-lactamases. Drug Resist Updates 2006; 9: 142-156.
12. Jacoby G. AmpC $\beta$-Lactamases. Clin Microbiol Rev 2009; 22(1): 161-182.
13. Guenther S, Ewers C, Wieler L. Extended-spectrum beta-lactamases producing E. coli in wildlife, yet another form of environmental pollution? Front Microbiol 2011; 2: 246.
14. Karami N, Nowrouzian F, Adlerberth I, Wold A. Tetracycline resistance in Escherichia coli and persistence in the infantile colonic microbiota. Antimicrob Agents Chemother 2006; 50(1): 156-161.
15. Almeida-Villegas J, Estrada I, Garcia-Contreras R, Peña S. Quinolone resistance in different uropathogens isolated from urine cultures in patients with urinary tract infection [serial online] 2020 [cit. 12.10.2020]. Avilable 2020 Sep [cited 04.09.2020]. Available from URL: https://www.researchgate.net/publication/344734055_Quinolone_resistance_in_different_uropathogens_isolated_from_urine_cultures_in_patients_with_urinary_tract_infection.

Word count: 1979 • Tables: 1 • Figures: 1 • References: 15

**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Almeida Villegas JA, Mondragon Reyes H, Aguilar Sánchez M, Cruz Rosas MF, Sanchez Monroy R, Bernal Zamudio JE, Palacios Rodriguez AP.
Identification of *Escherichia coli* strains in the vaginal cultures of healthy women and their patterns of antibiotic resistance.
Med Sci Pulse 2021; 15 (3): 4-9. DOI: 10.5604/01.3001.0015.4250.

**Correspondence address:**
Jorge Angel Almeida Villegas
Professional School of Nutrition,
Nursing and Gerontology,
IUEM University, Mexico
E-mail: angel.almeida@uicui.edu.mx

Received: 18.04.2021
Reviewed: 10.09.2021
Accepted: 11.09.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Original papers

Published online: 15 July 2021

DOI: 10.5604/01.3001.0015.0615

# COURSE OF PREGNANCY, LABOR, AND WOMEN'S SATISFACTION WITH LIFE IN THE EARLY POSTPARTUM PERIOD

Magdalena Dziurka[1] A-F
• ORCID: 0000-0001-7371-1418

Marzena Bucholc[2] A-E

Anna Pilewska-Kozak[3] A,B,D,E
• ORCID: 0000-0003-4562-2295

Beata Dobrowolska[1] A,D-F
• ORCID: 0000-0001-9178-9534

[1] Department of Management in Nursing, Faculty of Health Sciences, Medical University of Lublin, Poland

[2] Department of Obstetrics, Gynaecology and Obstetric-Gynaecological Nursing, Medical University of Lublin, Poland

[3] Chair and Department of Gynaecology and Gynaecological Endocrinology, Faculty of Health Sciences, Medical University of Lublin, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** The postpartum period, including hospitalization after a birth, requires the woman in puerperium to adjust to her new social role. The subject of satisfaction with life (SWL) in women in the early postpartum period has been rarely addressed in the literature and requires up-to-date, thorough research.

**Aim of the study:** The present study aimed to evaluate the level of SWL among women after delivery according to selected characteristics concerning the course of pregnancy and labor.

**Material and methods:** The study included 128 females who after delivery were hospitalized at maternity units in Lublin, Poland. The participants were administered the Satisfaction With Life Scale (SWLS) and a questionnaire to collect data on the course of pregnancy and labor.

**Results:** It was found that 88 (68.75%) women had a high level of life satisfaction after childbirth, 27 (21.09%) had an average level, and 13 (10.16%) had a low level. Among the analyzed variables, a marginally significant increase in SWL was found for women in the early postpartum period that experienced skin-to-skin contact with the newborn immediately after delivery (p=0.054). The strength of the observed effect, as measured by Cohen's d coefficient, was low (0.37).

**Conclusions:** The current research contributes to the identification of factors occurring during pregnancy and labor that determine postpartum SWL. These results may enable the early elimination of variables that negatively affect postpartum SWL and place a focus on factors with a positive impact. The use of preventive measures designed to improve SWL are likely to aid in reducing the risk of mood disorders in the later postpartum period.

**KEYWORDS:** satisfaction with life, labor, delivery, postpartum, pregnancy

## Background

The postpartum period, including hospitalization after birth, requires the woman in puerperium to adapt to her new social role and to learn motherhood. Shin and Johnson (1978) state that satisfaction with life (SWL) is an overall assessment of the quality of life compared against self-selected criteria [1]. The individual nature of this phenomenon, its moderate dynamics, and relative persistence have been discussed by Venenhoven (2009) [2]. SWL is determined by both short-term (current mood), medium-term (life events), and long-term (personality traits) components [3]. The subject of SWL in women in the early postpartum period has been rarely addressed in the literature [4,5,6] and requires up-to-date, thorough research conducted within an extensive group. It is much more common in the literature to find reports

on a women's satisfaction with childbirth [7-10,11-13], or quality of life following childbirth [14-17].

Numerous scientific studies have demonstrated the positive effects of skin-to-skin contact with a newborn immediately after birth, both for the child's and mother's health. Contact with the newborn baby during the first hours after birth enables the new mother to initiate a relationship that will develop throughout the child's life, and provides a sense of love and closeness.

There are reports in the literature showing variation in the levels of satisfaction with delivery depending on its course. Nahaee et al. (2020) investigated the predictors of childbirth satisfaction using the Iranian Persian Birth Satisfaction Scale before and during labor among 647 women. It was reported that low levels of childbirth satisfaction were associated with postpartum women who delivered vaginally with perineal rupture/incisions, had emergency caesarean sections, were administered oxytocin for induction and during labor, and did not attend birthing classes [8]. Similar conclusions were reached by Falk et al. (2019) in a Swedish study examining the impact of interventions and obstetric complications on satisfaction with childbirth among 16,000 women. The main factors contributing to low satisfaction with childbirth were emergency caesarean section, induction of labor, postpartum hemorrhage, instrumental vaginal delivery, and postpartum anal sphincter injury [9]. In contrast, Hamm et al. (2019), using the Birth Satisfaction Scale-Revised, revealed that women having a caesarean section compared to those delivering vaginally were three times more likely to have a lower satisfaction with childbirth. Similar findings have been observed for primiparous and multiparous women, with the former experiencing a lower sense of satisfaction with childbirth [10].

However, no research has been conducted on women in the early postpartum period that has examined the effects of the course of pregnancy and delivery on SWL using the Satisfaction with Life Scale (SWLS; Diener et. al. 1985). The current study aims to address this research gap. This research may help to identify the factors occurring during pregnancy and childbirth that determine postpartum SWL. These findings may also enable the early elimination of variables that negatively affect postpartum SWL and place a focus on the factors with a positive impact. This should aid in the design of preventive measures to improve SWL and reduce the risk of mood disorders in the later postpartum period.

## Aim of the study

The aim of this study was to evaluate the level of SWL in women after delivery and during early postpartum period with respect to selected variables characteristic of the course of pregnancy and labor.

## Material and methods

### Study design, setting, and duration

The study was carried out from December 2019 to March 2020 before the COVID-19 pandemic in Poland. The study was anonymous and voluntary, conducted in accordance with the Declaration of Helsinki, and after obtaining consent from the board of the Faculty of Health Sciences, Medical University of Lublin, and the hospitals' management.

### Study population

The study included 128 women after labor and in early postpartum admitted to the maternity ward at several hospitals in Lublin, Poland. The inclusion criteria were as follows: informed consent, early postpartum (first 7 days after childbirth), and hospitalization in a maternity ward. The exclusion criterion was the respondents' lack of consent to participate in the study.

### Research instruments

The SWLS designed by Diener et al. (1985), in its Polish adaptation by Z. Juczyński [18], and a questionnaire of our own design were used to collect data on life satisfaction and the course of pregnancy and delivery. The SWLS measures the level of satisfaction with one's accomplishments and living standards. It consists of five statements concerning a woman's life, rated on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree), with a possible range of scores from 5 to 35 points. The higher the score obtained, the higher the level of life satisfaction. The results should follow the properties characterizing the sten scale, where 1–4 stens (5–17 points) equals low SWL, 5–6 stens (18–23 points) indicates an average SWL, and 7–10 stens (24–35 points) shows a high SWL [19,20].

### Statistical analyses

The results were statistically analyzed using the IBM SPSS Statistics 23 software suite. Basic descriptive statistics, Pearson's $r$ coefficient correlations, Spearman's $\rho$ rank correlations, Kolmogorov-Smirnov tests, one-way between-group analyses of variance, and Student's $t$-tests for independent samples were

performed. A threshold of $\alpha$=0.05 was considered the level of significance. Alpha values at 0.05<p<0.1 were interpreted as significant at the level of a statistical trend.

## RESULTS

### Characteristics of the study group

The study included 128 (100%) postpartum women hospitalized in a maternity ward. The age of the respondents ranged from 18 to 43 years, with a mean age of 30.76 years and a standard deviation of 5.74. Detailed data on the sociodemographic characteristics of the postpartum women are shown in Table 1.

Table 1. Sociodemographic characteristics of the respondents

| Sociodemographic variables | | Frequency (N) | Percentage (%) |
|---|---|---|---|
| Education | Primary or vocational | 13 | 10.2 |
| | Secondary | 37 | 28.9 |
| | Higher | 78 | 60.9 |
| Marital status | Single | 24 | 18.8 |
| | Married | 94 | 73.4 |
| | Divorced | 10 | 7.8 |
| Place of residence | Urban area | 85 | 66.4 |
| | Rural area | 43 | 33.6 |
| Professional status | Employed | 83 | 64.8 |
| | Unemployed | 45 | 35.2 |
| Financial situation | Very good | 37 | 28.9 |
| | Good | 89 | 69.5 |
| | Bad | 2 | 1.6 |

### Main results

Based on the results obtained using the SWLS, it was found that 88 (68.75%) women had a high level of life satisfaction, 27 (21.09%) had an average level, and 13 (10.16%) had a low level during the early postpartum period. The minimum score obtained for the SWLS was 9 points and the maximum 35, with a standard deviation of 5.61, skewness –0.76, kurtosis 0.57, Kolmogorov-Smirnov test 0.12, and statistical significance p=0.001.

There was no statistically significant difference between the mean SWL value after delivery in the early postpartum period in the group of respondents hospitalized during pregnancy and those not hospitalized during pregnancy (Table 2). The type of vaginal delivery (spontaneous or induced) also did not significantly affect the mean SWL values after delivery, (p=0.076; Table 2). However, a marginal statistically significant difference was found between SWL levels and skin-to-skin contact with the newborn after delivery (p=0.054; Table 2). Respondents who had been provided an opportunity for such contact reported a higher level of life satisfaction. The strength of the observed effect, as measured by Cohen's *d* coefficient, was low.

The research also showed no statistically significant correlations between SWL level after delivery in the early postpartum period and the week of pregnancy completion, the number of pregnancies, the number of miscarriages, the number of vaginal deliveries, and the number of caesarean sections (Table 3).

No statistically significant differences were found between participation in birthing classes during the most recent pregnancy (p=0.201), mode of pregnancy completion (p=0.128), perineal incision during vaginal delivery (p=0.994), perineal suturing (p=0.350), mode of caesarean section (p=0.234), family's presence during delivery (p=0.234), and women's SWL after delivery in the early postpartum period.

Table 2. Satisfaction with life after delivery and selected characteristics of the course of pregnancy and labor

| Variable | | 95% CI | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | M | SD | t | p | LL | UL | Cohen's d |
| Hospitalization during pregnancy (n=128) | Yes (n=49) | 24.76 | 5.84 | –0.85 | 0.399 | –2.89 | 1.16 | 0.15 |
| | No (n=79) | 25.62 | 5.48 | | | | | |
| Skin-to-skin contact with newborn after delivery (n=128) | Yes (n=89) | 25.92 | 4.94 | 1.95 | 0.054 | –0.03 | 4.19 | 0.37 |
| | No (n=39) | 23.85 | 6.76 | | | | | |
| Type of vaginal delivery (n=58) | Spontaneous (n=32) | 27.13 | 4.47 | — | 0.076 | — | — | — |
| | Induced (n=26) | 24.88 | 4.94 | | | | | |

M – mean; SD – standard deviation; t – result of Student's t-test; p – statistical significance; CI – confidence interval; LL – lower limit; UL –upper limit.

Table 3. Correlations between satisfaction with life after delivery in the early postpartum period, week of pregnancy completion, and variables associated with the number of pregnancies

| Variable | Pearson's r | Significance (p) |
|---|---|---|
| Week of pregnancy completion | 0.080 | 0.368 |
| Number of pregnancies | 0.076 | 0.396 |
| Number of vaginal deliveries | 0.144 | 0.104 |
| Number of caesarean sections | 0.050 | 0.575 |
| Number of miscarriages | –0.102 | 0.252 |

## Discussion

The current study aimed to evaluate the level of SWL in women after delivery and during early postpartum period with respect to selected variables characteristic of the course of pregnancy and labor.

The study conducted by Aasheim et al. (2014) in Norway to assess postpartum SWL using the SWLS, depending on the week of pregnancy and 6 months and 3 years postpartum, found that, among Norwegian pregnant and postpartum women, SWL was higher during pregnancy and at 6 months postpartum than among the general Norwegian female population. In addition, SWL was demonstrated to increase 6 months after delivery, as compared to pre-delivery levels [4]. Similar results were reported by Dyrdal et al. (2014), where the highest level of SWL was found in the postpartum period and returned to pre-pregnancy levels within 2 years after childbirth [5].

Gebuza et al. (2018) showed no statistically significant differences with respect to life satisfaction across the studied groups of women and their mode of pregnancy completion, and found that caesarean section did not provide a greater SWL after childbirth. However, respondents that underwent a caesarean section received more social support from their partners in the postnatal period than women experiencing a vaginal delivery [6].

During a non-systematic review of the literature, no studies examining the correlations between the pregnancy and delivery factors selected for analysis in this study and women's SWL following delivery in the early puerperium were identified. Kahalon et al. (2021) point out that, as far as labor satisfaction is concerned, there is a significant difference in the effect of skin-to-skin contact with the newborn between women who gave birth vaginally and those who delivered with a caesarean section. The latter group, who had not been provided an opportunity for such contact, was more likely to report lower satisfaction with their delivery as compared to women delivering vaginally. In addition, for each type of childbirth (vaginal, instrumental, through caesarean section), a higher level of satisfaction was found in women who were given the opportunity for skin-to-skin contact with the newborn immediately after delivery [7].

Shorten et al. (2012) examined satisfaction with birth experiences using a 10-point visual analogue scale in 165 women at 6 to 8 weeks after birth following a previous caesarean section. It was reported that the mode of pregnancy completion was the most important determinant of satisfaction with the birth experience and health in postnatal period. Moreover, respondents who experienced a spontaneous vaginal birth after a caesarean section in a previous pregnancy were the most satisfied group of participants. Women who elected to receive a repeat caesarean section were also highly satisfied. The least satisfied with their childbirth experience were respondents who received an emergency caesarean section and those who did not achieve what they had planned before delivery [11].

A review of the literature also showed that satisfaction with birth is associated with a short labor time (less than 6 hours) [12]. Bitew et al. (2015) also found that 95% of respondents were satisfied with the helpfulness of health care providers and positions of their choice during delivery [12]. Similar results were obtained by Kempe et al. (2020). In addition to duration of labor, mode of birth, epidural anesthesia and oxytocin augmentation are also significantly related to satisfaction with the birthing experience. Respondents with a longer delivery declared a lower mean satisfaction with the birth experience than participants with a shorter childbirth. Also, women who received epidural anesthesia or oxytocin augmentation over course of their deliveries had a lower mean satisfaction with the birthing experience than respondents who did not receive these treatments [13].

Nahaee et al. (2020) also reported that low birth satisfaction is associated with insufficient support from health care workers, vaginal birth with episiotomy and tear, labor dystocia, emergency caesarean section, labor induction and labor augmentation with oxytocin, primiparous, preference for cesarean section, and no attendance at pregnancy classes [8].

The results of the current study and the associated literature review indicate that there is a need to conduct further research in this area. In particular, studies with a larger research group are required to gain a better understanding of women's SWL in the postpartum period and to identify its determinants.

## Limitations

The current study had a relatively small sample size and was conducted over a short period of time.

For future studies, the inclusion of a larger population would be beneficial.

## Conclusions

A higher level of life satisfaction in postpartum women during the early puerperium was reported by respondents who were allowed skin-to-skin contact with the newborn immediately after birth. Therefore, in clinical practice during labor and delivery, future mothers should be provided with customized care adapted to the pace of labor and their preferences, in order to reduce the medicalization of labor and to allow them to take responsibility for delivery by adopting the principles of psychoprophylaxis of childbirth.

The current research contributes to the identification of factors occurring during pregnancy and childbirth that determine women's postpartum SWL. These results may enable the early elimination of variables that negatively affect women's postpartum SWL. Special consideration should also be given to factors with a positive impact on postpartum SWL and to their subsequent use in preventive measures designed to improve women's SWL levels. These measures may be helpful in reducing the risk of mood disorders in the later postpartum period.

## References


1. Shin DC, Johnson DM. Avowed happiness as an overall assessment of the quality of life. Soc Indic Res 1978; 5: 475–492.
2. Veenhoven, R. Healthy happiness: effects of happiness on physical health and the consequences for preventive health care. J Happiness Stud 2008; 9: 449–469.
3. Basińska MA, Sucharska-Draż A, Wolszczak K. Satysfakcja z życia osób bezdomnych. In: Basińska MA, editor. Osoby bezdomne. Psychologiczne aspekty ich funkcjonowania. Bydgoszcz: Fundacja Salvus, 2014: 149-168. (In Polish).
4. Aasheim V, Waldenström U, Rasmussen S, Espehaug B, Schytt E. Satisfaction with life during pregnancy and early motherhood in first-time mothers of advanced age: a population-based longitudinal study. BMC Pregnancy Childbirth 2014; 14: 86.
5. Dyrdal GM, Lucas R. Reaction and adaptation to the birth of a child a couple-level analysis. Dev Psychol 2013; 49(5): 749.
6. Gebuza G, Kaźmierczak M, Mieczkowska E, Gierszewska M. Wsparcie społeczne jako determinant zadowolenia z życia w okresie ciąży i po cięciu cesarskim. Psychiatr Pol 2018; 5(6): 585-598. (In Polish).
7. Kahalon R, Preis H, Benyamini Y. Who benefits most from skin-to-skin mother-infant contact after birth? Survey findings on skin-to-skin and birth satisfaction by mode of birth. Midwifery 2021; 92: 102862.
8. Nahaee J, Mohammad-Alizadeh-Charandabi S, Abbas-Alizadeh F, Martin CR, Hollins Martin CJ, Mirghafourvand M, et al. Pre- and during-labour predictors of low birth satisfaction among Iranian women: a prospective analytical study. BMC Pregnancy Childbirth 2020; 20(1): 408-418.
9. Falk M, Nelson M, Blomberg M. The impact of obstetric interventions and complications on women's satisfaction with childbirth: a population based cohort study including 16,000 women. BMC Pregnancy Childbirth 2019; 19(1): 494-452.
10. Hamm RF, Srinivas SK, Levine LD. Risk factors and racial disparities related to low maternal birth satisfaction with labor induction: a prospective, cohort study. BMC Pregnancy Childbirth 2019; 19(1): 530-538.
11. Shorten, A. Shorten, B. The importance of mode of birth after previous cesarean: success, satisfaction, and postnatal health. J Midwifery Womens Health 2012; 57: 126-132.
12. Bitew K, Ayichiluhm M, Yimam K. Maternal satisfaction on delivery service and its associated factors among mothers who gave birth in public health facilities of Debre Markos town, Northwest Ethiopia. Biomed Res Int 2015; 460767.
13. Kempe P, Vikström-Bolin M. Women's satisfaction with the birthing experience in relation to duration of labour, obstetric interventions and mode of birth. Eur J Obstet Gynecol Reprod Biol 2020; 246: 156-159.
14. Rezaei N, Tavalaee Z, Sayehmiri K, Sharifi N, Daliri S. The relationship between quality of life and methods of delivery: a systematic review and meta-analysis. Electron Physician 2018; 10(4): 6596-6607.
15. Tel H, Ertekin Pinar S, Daglar G. Effects of home visits and planned education on mothers' postpartum depression and quality of life. J Clin Exp Invest 2018; 9(3): 119-125.
16. Martínez-Galiano JM, Hernández-Martínez A, Rodríguez-Almagro J, Delgado-Rodríguez M, Rubio-Alvarez A, Gómez-Salgado J. Women's quality of life at 6 weeks postpartum: influence of the discomfort present in the puerperium. Int J Environ Res Public Health 2019; 16(2): 253-261.
17. Martínez-Galiano JM, Hernández-Martínez A, Rodríguez-Almagro J, Delgado-Rodríguez M. Quality of life of women after giving birth: associated factors related with the birth process. J Clin Med 2019; 8(3): 324-333.
18. Juczyński Z. Narzędzia pomiaru w promocji i psychologii zdrowia. Warszawa: Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego; 2001. (In Polish).
19. Pavot W, Diener E. Review of the satisfaction with life scale. Psychological Assessment 1993; 5: 164–171.
20. Pavot W, Diener E. Review of the satisfaction with life scale. In: Diener E. editor. Assessing well-being. Netherlands: Springer, 2009: 101-117.

Word count: 2363 • Tables: 3 • Figures: 0 • References: 20

**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Dziurka M, Bucholc M, Pilewska-Kozak A, Dobrowolska B.
Course of pregnancy, labor, and women's satisfaction with life in the early postpartum period.
Med Sci Pulse 2021; 15 (3): 10-15. DOI: 10.5604/01.3001.0015.0615.

**Correspondence address:**
Magdalena Dziurka
Department of Management in Nursing Faculty of Health Sciences,
Medical University of Lublin, Poland
E-mail: md.dziurka@gmail.com

Received: 17.03.2021
Reviewed: 16.06.2021
Accepted: 30.06.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Original papers

Published online: 27 July 2021

DOI: 10.5604/01.3001.0015.0630

# THERAPEUTIC MASSAGE IN WOMEN WITH STRESS URINARY INCONTINENCE: A PILOT STUDY

Iwona Wilk[1,2] D,E
• ORCID: 0000-0003-4914-8391

Elżbieta Rajkowska-Labon[3] D
• ORCID: 0000-0003-1630-4335

Marta Sobiech[1] B

Gabriela Kołodyńska[1] F
• ORCID: 0000-0001-7921-7058

Barbara Nowak[4] B

Włodzimierz Doroszkiewicz[1] C,G
• ORCID 0000-0002-1772-9602

Waldemar Andrzejewski[1] D
• ORCID 0000-0002-0010-3021

Krzysztof Kassolik[1] A
• ORCID: 0000-0003-2836-3703

[1] Department of Physiotherapy, University School of Physical Education in Wroclaw, Poland

[2] Higher Medical School in Klodzko, Poland

[3] Department of Physiotherapy, Faculty of Health Sciences, Medical University of Gdańsk, Gdańsk, Poland

[4] Family Doctor Practice, Wrocław , Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** Stress incontinence affects 25–60% of women of all ages and causes constant discomfort, significantly lowering quality of life. The most common causes of urinary incontinence are weakened sphincter muscles or bladder failure.

**Aim of the study:** The aim of this study was to assess the effectiveness of therapeutic massage therapy for stress urinary incontinence and to determine whether therapeutic massage can restore the normal function of the bladder sphincters.

**Material and methods:** The study involved eleven women with a diagnosis of primary stress urinary incontinence, aged 50–79 years. The women attended therapeutic massage sessions twice a week for four weeks. A sanitary pad test was performed before starting and immediately after ending the therapy to verify its effectiveness.

**Results:** In eight women, the amount of urine that leaked decreased after therapy. This result was statistically significant (p = 0.02). In three cases, urine leakage was reduced to zero.

**Conclusions:** Therapeutic massage, acting locally, improves the function of the bladder sphincters, their flexibility and the ability to contract and relax. Massage eliminates or significantly reduces the symptoms of stress urinary incontinence.

**KEYWORDS:** stress urinary incontinence, therapeutic massage, physiotherapy, women

## Background

Urinary incontinence (UI) can be classified as stress urinary incontinence (SUI), urgency urinary incontinence (UUI), mixed urinary incontinence (MUI), and overflow urinary incontinence (OUI), depending on the circumstances under which the incontinence occurs [1]. The first type is associated with physical

effort; the second with a strong, sudden need to urinate and an overactive bladder (OAB); the third is a combination of these two; and the fourth is caused by incomplete emptying of the bladder, resulting in a spillover of small amounts of urine [2-4].

Stress urinary incontinence is involuntary urine leakage during various activities and movements, such as coughing, sneezing, jumping, heavy lifting, and exercising [1,5]. It is mainly caused by the weakening of the pelvic floor muscles (PFM) or the urethral sphincter muscles [5].

Involuntary urine leakage occurs when the pressure inside the bladder is higher than the intraperitoneal pressure without a simultaneous detrusor muscle spasm. Increased pressure in the bladder is associated with the elevation of intra-abdominal pressure, caused by physical effort and other factors [6, 7]. There are three stages of stress urinary incontinence:

– stage I: urinary incontinence occurs when the intra-abdominal pressure (IAP) substantially and suddenly increases, as during laughing, coughing, and sneezing;

– stage II: urine constantly leaks during physical effort associated with tensing the abdominal muscles (for example, climbing stairs with a load),

– stage III: urinary incontinence occurs even when lying, when abdominal pressure only slightly increases – for example, when changing position from one side to the other [3].

Although urinary incontinence mostly affects women (25%–60% of the female population) over a broad age range of 25–65 years [7-9] it is also observed in men of different ages, and is sometimes estimated as affecting as many as 39% of the male population [10]. The incidence of urinary incontinence rises with age, and advanced age is when it reaches its peak incidence. Urinary incontinence is a problem young women suffer from, usually after giving birth [11]. The pathophysiology underlying this health condition results from two mechanisms: excessive mobility of the urethra (urethral hypermobility) and of the bladder neck, as well as weakening, dysfunction, and failure of the sphincter and overactivity of the detrusor muscle [6-7,10]. Risk factors for urinary incontinence include obesity and overweight, past pregnancy, the use of stimulants (e.g., cigarettes), a history of surgery of the pelvis and perineum, and anatomical dysfunctions. Ethnic origin, hormone replacement therapy, and impairment of motor and cognitive function are also mentioned as potential contributors to the problem [5].

In the case of the dysfunction discussed here, it is essential to diagnose and precisely define the nature of urinary incontinence – to establish whether it is a chronic or transitory form, how severe it is, and whether other diseases that potentially cause urine leakage (for example, prolapse of the pelvis or fistula) have been excluded [12]. Correct diagnosis enables quick intervention tailored to the needs of the patient. Taking appropriate therapeutic measures early also depends on the patient. It often happens that women do not report the problem of urinary incontinence to the doctor because of feelings of shame or embarrassment. This makes quick and accurate diagnosis difficult, and early therapy is practically impossible. It is thus extremely important to raise awareness throughout society of the necessity of reporting symptoms of urinary incontinence, especially as this symptom causes constant discomfort and the need to protect oneself (using sanitary pads), which has a negative impact on the quality of women's lives in all spheres: physical, social, sexual, and psychological [2,11,13-14]. There are many treatment methods, both conservative and surgical, for stress urinary incontinence, and these are continuously undergoing modification and refinement. Among them are pharmacotherapy, physiotherapy, and surgery. Pharmacotherapy aims to improve urine outflow and, at the same time, inhibit detrusor overactivity [10,15]. Rehabilitation includes daily personal hygiene, lifestyle modification, strengthening exercises for the pelvic floor muscles (SEPFM), activity of the pelvic floor muscles, pelvic floor muscle training (PFMT), controlled tension of the transverse abdominal muscle (TrA), superficial electrical stimulation (IES), intravaginal electrical stimulation, biofeedback (BFB), intravaginal laser therapy, and magnetic field therapy [3,13-14,16-19]. The possibility of using massage in urinary incontinence has long been written [20-21]. The possibility of using massage in urinary incontinence has been reported before [20-23].

Two studies demonstrated that massage was an effective therapy in women with stress incontinence. The presented massage procedure had a positive effect on the amount of urinary leakage on effort immediately after the therapy and a few-month follow-up therapy produced complete relief from the distress [24-25].

Surgical treatments for stress urinary incontinence include filling substances, the construction of a supportive sling, onabotulinum toxin A, implantation of tension-free vaginal tapes (TVT), diaphragms, neuromodulators, and special supporting sutures [3,5,26-27]. Surgical treatment is only recommended if the conservative treatment has had no therapeutic effect [8,11].

The main purpose of physiotherapy is to improve muscle endurance, to alleviate urinary incontinence and, above all, to improve quality of life. Regularity, repetitiveness, long-term use of particular methods, as well as specialist equipment and a qualified therapist are indispensable, regardless of the type of therapeutic method. The broad range of methods for

dealing with urinary incontinence shows that there is no uniquely effective treatment. Among the very important, or even crucial elements are patient cooperation, modification of lifestyle (avoiding addictive substances, weight loss, a well-balanced diet, appropriate fluid intake), habits associated with urinating, and consistent behavior [12].

## Aim of the study

The aim of this study was to assess the effectiveness of therapeutic massage therapy for stress urinary incontinence

## Material and methods

### Settings

The research was conducted at the Faculty of Physiotherapy, the University of Physical Education in Wrocław, where the participants were referred to by primary care physicians. The cooperation between the doctor and the physiotherapist was carried out under a partnership agreement concluded between the Primary Healthcare Center and the university.

### Participants

The study involved eleven women with a diagnosis of primary stress urinary incontinence, qualified by a family practitioner on the basis of the inclusion and exclusion criteria (Table 1)

Table 1. Inclusion and exclusion criteria for research

| Inclusion criteria for research | Exclusion criteria for research |
|---|---|
| Stress Urinary Incontinence I stage | Stress Urinary Incontinence II and III stage |
| Age ≥50 years | Age >80 years |
| No participation in other therapy (currently) | Urgency Urinary Incontinence (UUI) |
| No abdominal surgery | Mixed Urinary Incontinence (MUI) |
| Cancer diseases of internal organs treated 5 years ago | Currently treated cancer diseases of internal organs |
| | Abdominal tumors |

The women were aged between 50 and 79. The mean values for the basic morphological characteristics of the study group are presented in Table 2. Prior to entering the therapy, the women had not used any other therapeutic methods. They had been struggling with urinary incontinence for periods of times ranging from several months to several years. None of the patients had previously reported the problem to a family practitioner. The women had previously only protected themselves with sanitary pads and by avoiding factors that could provoke urine leakage, such as physical effort, stress, and urgent situations requiring sudden physical effort for example, running to a bus or tram stop. The International Physical Activity Questionnaire (IPAQ) – a standardized self-report measure of physical activity – was not used in this study, but we did determine that the patients had not systematically practiced any form of physical activity. We calculated the body mass index (BMI) of our patients (Table 2) and the average of the group indicated overweight, only three participants had their BMI > 30 kg/m$^2$ which qualifies them as obese.

Table 2. Characteristics of the study group

| Study group | Age M±SD | Weight [kg] M±SD | Height [cm] M±SD | BMI [kg/m$^2$] M±SD |
|---|---|---|---|---|
| N=11 | 64±10.7 | 71±12.04 | 160±3.81 | 27±4.39 |

The patients emphasized that their need to avoid physical activity, as well as social and intimate life, had contributed to a significant decline in the quality of their lives.

### Study design

*Methodology of massage*

Massage was performed twice a week over a period of four weeks, with each session lasting 20 minutes. 40 minutes before each massage, the women drank half a liter of mineral still water in order to fill the bladder. Next, they adopted a position lying on their back with a roll under the head to relax the sternocleidomastoid muscle, and with wedges placed under the shoulder girdles to relax the superficial muscles of the chest. Wedges were placed under lower limbs along the shanks to help raise the lower limbs to obtain bending in the hip and knee joints. The above position permits normalization of the tension of the iliopsoas and abdominal wall muscles. The massage consisted of three stages:

The initial stage involved superficial stroking of the abdominal wall with a brush (Fig. 1).

Next, deep stroking was performed along the blood vessels from the umbilicus to the saphenous opening and the groin (Fig. 2).

In the next step, stroking and friction (rubbing) of the pyramidalis muscle from the umbilicus towards inguinal pits was performed, kneading indirectly through the straight abdominal muscle. At the end of this stage, we kneaded along the abdominal oblique

Figure 1. Superficial stroking of the abdominal wall

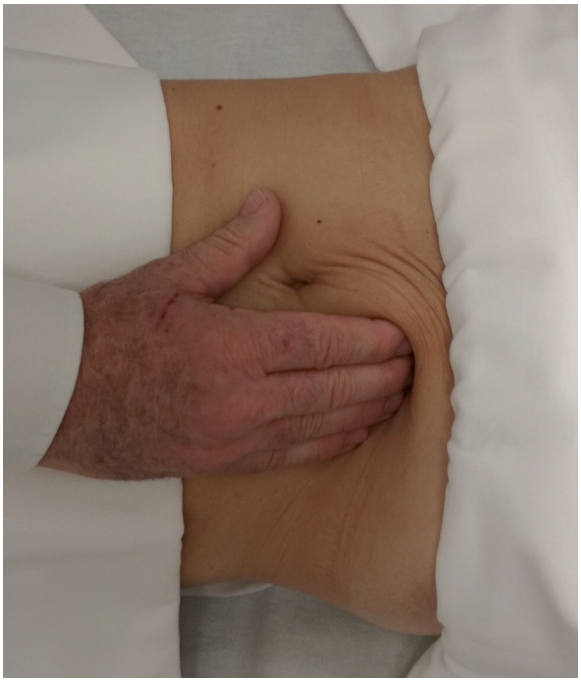

Figure 2. Deep stroking towards the saphenous opening with the palm

muscles. The number of repetitions for each technique was 7–8 movements. Several stroking movements the abdominal skin were always made before moving onto the next techniques. The purpose of this method was to normalize the tension of the arrector pili (AP) muscles in the area of the skin innervated by the genitofemoral nerve and the lateral femoral cutaneous nerve, to increase venous blood outflow from the superficial epigastric vein, and to normalize tension of the pyramidalis and abdominal wall muscles.

In the main part, the linea alba was slowly pulled from the pubic symphysis towards the umbilicus using four fingers. This movement was intended to produce modulated tension of the umbilical ligaments which fix the bladder to the linea alba (Fig. 3).

This approach resulted in a slight deformation of the filled bladder wall, causing a gradually increasing urge to urinate. The task of the patient during this movement was to signal the urge to urinate, and to focus on not allowing micturition. At that time, the stimulation (pulling the linea alba) was stopped until the urge to urinate had subsided. This activity was repeated five times.

In the final stage, superficial stroking of the lower part of the abdomen was used to reduce neuromuscular tension (Fig. 4).

*Data sources/measurement*

A sanitary pad test – recommended by the International Continence Society (ICS) to estimate the amount of urine leaking out during physical effort – was performed before the first massage session and after the whole series of massages. The pad test methodology is as follows: women drink 500 ml

Figure 3. Pulling the linea alba

Figure 4. Final superficial stroking

water before exercise, after drinking water, women resting for 15 minutes. After resting, they do exercises for 30 minutes, including: walking (2 × the length of the corridor), climbing up and down one flight of stairs (4 ×), standing-up from sitting (10 ×), coughing vigorously (10 ×), running on the spot for 1 minute, bending to pick up an object from the floor (5 ×) and washing hands for 1 minute in running water [28].

The test provides information about the severity of the patient's baseline urine leakage, and shows the difference in the results before and after a series of massages. The sanitary pad is weighed before and immediately after effort. The results are interpreted as follows: an increase in the weight of the sanitary pad after effort of less than 1 g is taken as representing dryness; an increase of 1–10 g means slight involuntary urine leakage; an increase of 11–50 g means heavy urine leakage; and an increase of >50 g is very heavy urine leakage [3,28]. The sanitary pads were weighed using an electronic scale. The amount of urine was given in grams.

### Statistical analysis

Statistical analysis was performed using Statistica 9. The results of sanitary pad tests before and after therapy were compared using the Wilcoxon signed rank test (nonparametric test for dependent groups). This test was used due to the small size of the experimental group and the nonnormal variable distribution, as assessed by the Shapiro–Wilk test. Statistical significance was set at $p < 0.05$.

## Results

### Descriptive data

Comparison of the sanitary pad test results obtained before starting and immediately after ending the therapy demonstrated statistically significant changes. The mean amount of leaked urine in the entire study sample before therapy was 2.25 g (SD±0.69 g). After four weeks of the therapy, the amount of urine had reduced to 1.23 g (SD±1.40 g).

It must be emphasized that before entering the therapy, the smallest amount of urine leaked in a sanitary pad test was 0.77 g; this was recorded in one patient. The greatest amount of urine was 2.80 g, also observed in one patient.

After the therapy a statistically significant ($p=0.02$) decrease in the amount of urine leaked was noted in eight women, in three of whom it was reduced to zero. In other three, this parameter did not change.

## Discussion

*Key results*

Therapeutic massage improves the functioning of bladder sphincters, it makes them more flexible, improving their contraction and relaxation.

Massage eliminates or significantly reduces the symptoms of stress urinary incontinence.

The elimination of symptoms of stress urinary incontinence could lead to improvement in the quality of life and could enable taking up physical activity.

*Interpretation*

It has recently been recommended in the physiotherapeutic management of stress urinary incontinence to combine therapies, such as biofeedback with pelvic floor muscle training, biofeedback with simultaneous tension of the transverse abdominal muscle, or manual nerve and muscle therapy with mechanical and acoustic vibrations. The methods are then more effective than when they are applied alone [13-14,26,29-30].

Moreover, it is increasingly frequently emphasized that patients need to be educated on micturitional habits, personal hygiene, and elements of self-therapy that can help to maintain therapeutic effects. One study demonstrated that pelvic floor muscle training performed in the outpatient clinic in the presence of a therapist was more effective than training done by the patient herself at home. Nevertheless, the authors of this study underlined the fact that self-reported satisfaction with therapy, quality of life, and functioning in everyday life – taking into account the number of urine leakage episodes – were similar in both groups [31]. This shows the need for different forms of self-therapy: even if physical symptoms subside more slowly, patients' mental well-being will be better, and that is what contributes to their quality of life.

Noninvasive and minimally invasive treatment methods are desirable. There are many effective ways of treating urinary incontinence, such as electrostimulation, laser, and biofeedback therapy, which however require specialist equipment and qualified staff if they are to be used, not mentioning the surgical procedures. Conservative treatment methods are safe, much cheaper than surgery, and highly effective, but they do require patients' involvement and cooperation, as well as longer continuance than surgical methods.

The small number of reports describing the use of massage in stress urinary incontinence motivated us to undertake research into this issue. The use of manual massage can be a valuable complement to therapy

and a therapeutic tool in the treatment of unpleasant ailments.

During massage of the abdomen and indirectly of the bladder, local congestion of the body occurs. Histamine is released from mastocytes, causing vasodilation. The bladder becomes better nourished and more oxygenated, which speeds up the regeneration of muscle cells. These processes make the muscles more flexible, improving their firmness and ability to contract and relax [32-33]. Massage improves the functioning of the abdominal wall auxiliary muscles, which carry the viscera and support the pelvic floor, thus improving the work of the bladder [32]. The bladder consists of smooth muscles, connective tissue, and the network of blood vessels, owing to which we can indirectly affect its structure using various massage techniques. Thus, local and indirect manipulation of the bladder improves the functioning of the sphincter muscles [33]. Massage normalizes the tension of the ligament apparatus and restores the normal distribution of the venous blood and lymph in the bladder area, which explains how the function of the bladder improved after massage therapy in the group of the women.

Massage could serve as a supplementary method in the treatment of stress urinary incontinence – a method that is noninvasive, safe, easy to repeat, and comfortable for the patient. Nonetheless, a positive therapeutic outcome depends on the severity and duration of the disease, as well as on body weight and BMI (the higher these are, the more difficult the process of rehabilitation). This form of therapy is recommended alongside other methods used as part of conservative treatment for urinary incontinence, but requires further research with a greater number of patients (including men) [1]. The massage methodology is simple, easy to repeat, and can be performed not only by massage therapists and physiotherapists, but also community nurses and medical staff employed in nursing homes.

This therapy should not be thought of as applicable exclusively to the aged and elderly. There are a growing number of comprehensive programs of care and rehabilitation for young women to prevent, for example, postpartum stress urinary incontinence [34]. Work is also ongoing on modern conservative treatment strategies and their implementation in clinical practice [35]. This requires the collaboration and integration of practice of medical professionals and physiotherapists, but allows for therapy that would be tailored to individual needs and oriented toward long-lasting therapeutic effects.

## Conclusions

The authors' observations show that manual massage, acting locally, improved the function of the bladder sphincters, their flexibility and the ability to contract and relax. In the study group, in some patients, the use of massage contributed to the remission or significant reduction of incontinence symptoms in the case of their moderate intensity. Therapeutic massage can be a valuable complement to the conservative treatment of stress urinary incontinence. However, the use of massage as a therapeutic method for stress urinary incontinence requires further research in more participants.

## Limitations

The main limitation of this study was the small size of the group that underwent massage therapy. There was also no control group which makes it impossible to compare the study and control group and only allows the presentation of data about the study group.

We did not use questionnaires concerning physical activity or quality of life; obtaining this information would allow for a more accurate description of the participants and more in-depth analysis of the subject and factors predisposing to urinary stress incontinence. We plan to use such questionnaires in our further investigation, to expand the size of the study sample, and to the compare results to those achieved in the control group.

## Declarations

*Registration:* The project titled "Using massage in stress urinary incontinence (SUI)" was approved by our university's Bioethical Committee (no. 3/2018).

## References


1. Pang R, Chang R, Zhou XY, Jin CL. Complementary and alternative medicine treatment for urinary incontinence. In: Synopsis in the management of urinary incontinence. 2017: 39-49. doi: 10.5772/66705.
2. Aoki Y, Brown HW, Brubaker L, Cornu JN, Daly JO, Cartwright R. Urinary incontinence in women. Nat Rev Dis Primers 2017; 6(3): 17042. doi: 10.1038/nrdp.2017.42.
3. Purs D, Rasala A. Method of treating urinary incontinence. European Journal of Medical Technologies 2015; 3(8): 29-38.
4. Robinson D, Cardozowan L. Urinary incontinence in the young woman: treatment plans and options available. Womens Health (Lond) 2014; 10(2): 201-217. doi: 10.2217/whe.14.1.

5. Ozdemir OC, Surmeli M. Physiotherapy in women with urinary incontinence. In: Synopsis in the management of urinary incontinence. 2017: 51-74. doi: 10.5772/66705.
6. Oliveira M, Ferreira M, Azevedo MJ, João Firmino-Machado J, Santos PC. Pelvic floor muscle training protocol for stress urinary incontinence in women: a systematic review. Rev Assoc Med Bras 2017; 63(7): 642-650. doi: 10.1590/1806-9282.63.07.642.
7. Sangsawang B, Sangsawang N. Stress urinary incontinence in pregnant women: a review of prevalence, pathophysiology, and treatment. Int Urogynecol J 2013; 24(6): 901-912. doi: 10.1007/s00192-013-2061-7.
8. Lukacz ES, Santiago-Lastra Y, Albo ME, Brubaker L. Urinary incontinence in women: a review. JAMA. 2017; 318(16): 1592-1604. doi: 10.1001/jama.2017.12137.
9. Lowenstein LI, Dooley Y, Kenton K, Rickey L, FitzGerald MP, Mueller E, Brubaker L. The volume at which women leak first on urodynamic testing is not associated with quality of life, measures of urethral integrity or surgical failure. J Urol 2007; 178(1): 193-196.
10. Matuszewski M. Modern methods of treating urinary incontinence in men. Prz Urol 2013; 1(77): 21-24.(In Polish).
11. Jovan HD, Uroš B, Aleksandar A, Miodrag A, Milan R, Bogomir M, Tomisla P, Zoran D. Etiopathogenesis, diagnostics and history of surgical treatment of stress urinary incontinence. Acta Chir Iugosl 2014; 61(1): 85-90.
12. Hu JS, Pierre EF. Urinary incontinence in women: evaluation and management. Am Fam Physician 2019; 100 (6): 339-348.
13. Bertotto A, Schvartzman R, Uchôa S, Wender MCO. Effect of electromyographic biofeedback as an add-on to pelvic floor muscle exercises on neuromuscular outcomes and quality of life in postmenopausal women with stress urinary incontinence: a randomized controlled trial. Neurourol Urodyn 2017; 36(8): 2142-2147. doi: 10.1002/nau.23258.
14. Ptak M, Brodowska A, Ciećwież S, Rotter I. Quality of life in women with stage 1 stress urinary incontinence after application of conservative treatment: a randomized trial. Int J Environ Res Public Health 2017; 14(6): E577. doi: 10.3390/ijerph14060577.
15. Wiedemann A, Becher K, Bojack B, Ege S, von der Heide S, Kirschner-Hermanns R. Urinary incontinence in geriatric patients: pharmacological therapy. Aktuelle Urol 2019; 50(4): 424-440. doi: 10.1055/a-0914-7346.
16. Moroni RM, Magnani PS, Haddad JM, Castro Rde A, Brito LG. Conservative treatment of stress urinary incontinence: a systematic review with meta-analysis of randomized controlled trials. Rev Bras Ginecol Obstet 2016; 38(2): 97-111. doi: 10.1055/s-0035-1571252.
17. Conté C, Jauffret T, Vieillefosse S, Hermieu JF, Deffieux X. Laser procedure for female urinary stress incontinence: a review of the literature. Prog Urol 2017; 27(17): 1076-1083. doi: 10.1016/j.purol.2017.09.003.
18. Nie XF, Ouyang YQ, Wang L, Redding SR. A meta-analysis of pelvic floor muscle training for the treatment of urinary incontinence. Int J Gynaecol Obstet 2017; 138(3): 250-255. doi: 10.1002/ijgo.12232.
19. Moser H, Leitner M, Baeyens JP, Radlinger L. Pelvic floor muscle activity during impact activities in continent and incontinent women: a systematic review. Int Urogynecl J 2018; 29(2): 179-196; doi: 10.1007/s00192-017-3441-1.
20. Ratajczak B, Kassolik K, Andrzejewski W, Steciwko A, Tyrka-Gomułkiewicz D, Bujnowska-Fedak M. A trial to apply medical massage in the treatment of urinary incontinence. Pol Med Rodz 2003; 5(2): 173-176. (In Polish).
21. Bujnowska-Fedak M, Kassolik K, Steciwko A. Physiotherapeutic methods in the conservative treatment of urinary incontinence in the practice of a family doctor. Pol Med Rodz 2003; 5(3): 565. (In Polish).
22. Bujnowska-Fedak M, Kassolik K, Steciwko A. The use of electrical stimulation and medical massage in conservative treatment of patients with urinary incontinence. Pol Med Rodz 2004, 6 (3): 1357-1361. (In Polish).
23. Bujnowska-Fedak M, Kassolik K, Andrzejewski W, Steciwko A. Nietrzymanie moczu. In: Steciwko A, editor. Fizjoterapia w chorobach układu moczowo-płciowego. Wrocław: Wydaw. AWF; 2004: 74-97. (In Polish).
24. Kassolik K, Andrzejewski W, Wilk I, Brzozowski M, Świątek M. Effective use of massage in stress urinary incontinence. Rahabil Prakt 2012, 1: 46-50. (In Polish).
25. Kassolik K, Kurpas D, Andrzejewski W, Wilk I, Swiatek M. The effectiveness of massage in stress urinary incontinence-case study. Rehabil Nurs 2013; 38(6): 306-14. doi: 10.1002/rnj.91.
26. Nunes EFC, Sampaio LMM, Biasotto-Gonzalez DA, Nagano RCDR, Lucareli PRG, Politti F. Biofeedback for pelvic floor muscle training in women with stress urinary incontinence: a systematic review with meta-analysis. Physiotherapy 2019; 105(1): 10-23. doi: 10.1016/j.physio.2018.07.012.
27. Padmanabhan P, Dmochowski R. Urinary incontinence in women: a comprehensive review of the pathophysiology, diagnosis and treatment. Minerva Ginecol 2014; 66(5): 469-478.
28. Ferreira CHJ, Bo K. The pad test for urinary incontinence in women. J Physiother 2015; 61: 98.
29. Bauer RM, Bastian PJ, Gozzi C, Stief CG. Postprostatectomy incontinence: all about diagnosis and management. Eur Urol 2009; 55(2): 322-333. doi: 10.1016/j.eururo.2008.10.029.
30. Barassi G, Bellomo RG, Frondaroli F, Frondaroli S, Santarelli A, Di Felice PA, Supplizi M, Palermo T, Saggini R. Integrated rehabilitation approach with manual and mechanic-acoustic vibration therapies for urinary incontinence. Adv Exp Med Biol 2019; 1211: 41-50. doi: 10.1007/5584_2019_436.
31. Fitz FF, Gimenez MM, de Azevedo Ferreira L, Matias MMP, Bortolini MAT, Castro RA. Pelvic floor muscle training for female stress urinary incontinence: a randomised control trial comparing home and outpatient training. Int Urogynecol J 2019; 23: 1-10. doi: 10.1007/s00192-019-04081-x.
32. Halski T, Halska U, Pasternok M, Pasternok M. Physiotherapy in SUI. Rehabil Prakt 2008; 1: 37-39. (In Polish).
33. Kassolik K, Andrzejewski W, Bujanowska-Fedak MM, Steciwko A. Possibility the use of medical massage in the re-education of bladder sphincters. Rehabil Prakt 2010; 4: 31-34.(In Polish).

**34.** Qi X, Shan J, Peng L, Zhang C, Xu F. The effect of a comprehensive care and rehabilitation program on enhancing pelvic floor muscle functions and preventing postpartum stress urinary incontinence. Medicine (Baltimore) 2019; 98(35): e16907. doi: 10.1097/MD.0000000000016907.

**35.** Titman SC, Radley SC, Gray TG. Self-management in women with stress incontinence: strategies, outcomes and integration into clinical care. Res Rep Urol 2019; 17(11): 111-121. doi: 10.2147/RRU.S177826.

Word count: 3163 • Tables: 2 • Figures: 4 • References: 35

**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Wilk I, Rajkowska-Labon E, Sobiech M, Kołodyńska G, Nowak B, Doroszkiewicz W, Andrzejewski W, Kassolik K. Therapeutic massage in women with stress urinary incontinence: a pilot study.
Med Sci Pulse 2021; 15 (3): 16-23. DOI: 10.5604/01.3001.0015.0630.

**Correspondence address:**
Correspondence address:
Iwona Wilk
Physiotherapy Group
University School of Physical Education in Wroclaw
I. J. Paderewskiego 34 Ave.
Wrocław, Poland
E-mail: iwona.wilk@awf.wroc.pl

Received: 16.05.2021
Reviewed: 22.06.2021
Accepted: 12.07.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Original papers

Published online: 22 September 2021

DOI: 10.5604/01.3001.0015.2832

# KNOWLEDGE OF PREVENTION AND TREATMENT OF HUMAN PAPILLOMAVIRUS (HPV) INFECTIONS AMONG YOUNG MEN

Maria Florkiewicz[1 A-F]
• ORCID: 0000-0002-4659-6458

Anna Tobolska[1 A-F]
• ORCID: 0000-0002-8112-2397

Grażyna Bączek[2 A-F]
• ORCID: 0000-0001-7897-9499

[1] Students' Scientific Organization of Midwifes, Faculty of Health Sciences, Medical University of Warsaw, Poland

[2] Department of Obstetrics and Gynecology Didactics, Supervisor of the Students' Scientific Organization of Midwifes, Faculty of Health Sciences, Medical University of Warsaw, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** Today, human papillomavirus (HPV) infection has become the most common sexually transmitted disease worldwide. Major consequences of contracting the virus include both mild skin lesions and a range of cancers, the most frequent of which are cervical cancer, penile cancer, oral cavity cancer, throat cancer, and anal cancer, undoubtedly demonstrating its high oncogenic potential.

**Aim of the study:** The objective of this study is to determine the level of knowledge among men aged 18–26 years with regard to HPV prevention and treatment.

**Material and methods**: An online survey was conducted using a questionnaire developed by the authors. The questionnaire was comprised of 16 closed-ended questions and 5 questions pertaining to demographics. Chi-squared tests or Spearman's rank correlation coefficients were used for the statistical analysis.

**Results:** Only 27.5% of the respondents correctly answered a question regarding the number of types of the virus, and 33% correctly determined the percentage of the cases where an active infection turns into a chronic state. However, a high level of awareness of the routes of infection was demonstrated, with more than half of the respondents (63%) answering this question correctly. Additionally, more than two-thirds (67.9%) of the men indicated correctly that one of the factors facilitating infection is a young age at the time of the first contact with the virus. Nearly all respondents (90%) indicated that using condoms is an effective form of prevention.

**Conclusions:** The results expressly indicate an insufficient level of knowledge regarding HPV among young men. Due to the high level of sexual activity in this age group, increased education with regard to the prevention of sexually transmitted diseases is needed.

**KEYWORDS:** human papillomavirus, cervical cancer, prevention

## Background

Human papillomavirus (HPV) belongs to the papillomavirus family that includes over 100 types [1]. The genetic material of this virus is characterized by circular double-stranded DNA [2]. The HPV virus is transmitted through contact with either the skin or mucosa of an infected individual, or via so-called autoinoculation (i.e., scratching and rubbing) [1]. HPV infection is the most common sexually transmitted disease in the world, and it is believed that up to 40 types of the virus have oncogenic

potential [3]. The HPV types with a low oncogenic potential include 6, 11, and 42, whereas those with a high oncogenic potential include 16, 18, and 31 [4]. A HPV infection may lead to mild skin lesions (i.e., warts), flat condyloma, and genital warts, or, depending on the oncogenicity of the virus, can lead to malignant neoplasms (e.g., cervical cancer) [5]. According to statistical data, cervical cancer is the third most frequent malignant neoplasm in women worldwide and second when it comes to the number of deaths caused [6]. Thus, HPV infection one of the most serious problems that modern gynecology faces. The first screening techniques for cervical cancer, based on the Pap smear, were introduced in the 1960s, and these methods have been continuously improved over subsequent decades, which has undoubtedly has helped to fight the disease [7]. Another potential consequence of contracting the HPV virus is cancer of the anogenital area, as well as head and neck cancer [3].

In 1983, it was suggested for the first time that HPV might have an impact on the carcinogenesis of the above-mentioned cancers [8]. According to numerous studies, HPV is now believed to be a main cause of these diseases, particularly among the inhabitants of developed countries [9]. It has also been shown that the oncogenetic process occurs more often in individuals with decreased immunity and in those with a state of chronic infection. According to data, up to half of the human population will experience a HPV infection at some point in their lives [10]. In many European Union countries, HPV vaccines are included in the basic vaccination program and are publically funded [11]. In Poland, vaccination against HPV is not obligatory, but it is included in the group of recommended vaccinations. HPV vaccination in Poland is funded by local government units under preventative programs or by the household budgets [12]. Despite the fact that the etiology of cancers of the reproductive organs is well-known, HPV deserves special attention and should be treated separately in further research related to routes of infection, treatment, prevention, and diagnostics [13].

## Aim of the study

This study aims to determine the level of knowledge among men aged 18–26 with regard to both the prevention and treatment of HPV infections. The following detailed question was raised: Do the men covered by the study have basic knowledge concerning the prevention and treatment of HPV infections? It was assumed that the knowledge among young men with regard to HPV infection, prevention, and diagnosis is insufficient.

## Material and methods

### Study design

This study was cross-sectional in nature.

### Setting

An electronic survey comprised of questions relating to both the prevention and treatment of HPV infection was disseminated.

### Participants

In total, 328 men aged 18–26 years completed the questionnaire. The demographics of the study population are summarized in Table 1.

### Data sources/measurement

The questionnaire, developed by the authors, was based on a review of the current literature. It consisted of 16 closed single-choice questions regarding HPV-related knowledge and 5 demographics questions. The survey was conducted anonymously. The surveyed men came from different localities, and had different levels of education and marital status.

### Statistical methods

IBM SPSS Statistics 26 was used for the statistical analysis. In order to examine relationships between the data, chi-squared tests or Spearman's rank correlation coefficients were used (due to the lack of normal distribution in the data). The significance level was set at $p<0.05$.

## Results

### Descriptive data

The largest group among the respondents comprised men aged between 22–23 years, living in a city of over 250,000 inhabitants. In most cases, these were single men who currently study or have studied courses unrelated to medicine. The detailed characteristics of the sample are presented in Table 1.

The results allowed for the examination of selected fragments of HPV-related knowledge in the group surveyed. Only 27.5% of the respondents correctly indicated the number of HPV types (over 100), and only 13.5% were able to approximate the number of

Table 1. Characteristics of the sample (n=328)

| Variable | | Number (n) | Percentage (%) |
|---|---|---|---|
| Age (in years) | 18 | 12 | 3.7 |
| | 19 | 13 | 4.0 |
| | 20 | 17 | 5.2 |
| | 21 | 44 | 13.4 |
| | 22 | 74 | 22.6 |
| | 23 | 69 | 21.0 |
| | 24 | 45 | 13.7 |
| | 25 | 15 | 4.6 |
| | 26 | 34 | 10.4 |
| | No data available | 5 | 1.4 |
| Place of residence | Village | 65 | 19.8 |
| | Town <50,000 | 66 | 20.1 |
| | Town <100,000 | 44 | 13.4 |
| | Town ≤250,000 | 33 | 10.1 |
| | City >250,000 | 115 | 35.2 |
| | No data available | 5 | 1.4 |
| Marital status | Single | 301 | 91.9 |
| | Married | 12 | 3.6 |
| | Separated | 4 | 1.2 |
| | Divorced | 4 | 1.2 |
| | Widower | 1 | 0.3 |
| | No data available | 6 | 1.8 |
| Education | Elementary | 3 | 0.9 |
| | Junior high | 5 | 1.4 |
| | Vocational | 17 | 5.2 |
| | High | 184 | 56.1 |
| | Higher | 113 | 34.6 |
| | No data available | 6 | 1.8 |
| | Does/did not study | 73 | 22.3 |
| | Studies/studied a medical course | 63 | 19.2 |
| | Studies/studied a non-medical course | 185 | 56.4 |
| | No data available | 7 | 2.1 |

individuals in the population experiencing infection with the virus (half of the population). Only one-third (33%) of the respondents were able to correctly determine the percentage of cases where an active infection turns into a chronic form (20% of the infected).

Regarding the respondents' knowledge of how HPV is transmitted, more than half of the respondents (63%) answered this question correctly. A detailed distribution of correct answers broken down by age, education, and place of residence is presented in Table 2. While some differences were observed, they were not statistically significant.

The results allow also for an examination of additional elements regarding the respondents' HPV-related knowledge. One-fourth of the group surveyed (24.2%) knew that an infection usually takes place at the age of 20–24 years. More than two-thirds (67.9%) of all respondents knew that the factors facilitating infection include a young age when first contact with the virus occurs. More than half (52.6%) of the respondents also correctly indicated that the risk of contracting an oncogenic HPV type is borne by a woman from the moment of sexual initiation through the entire period of her sexual activity.

An important question from the perspective of prevention is knowledge of HPV vaccination. 147 respondents provided the correct answer to a question regarding vaccination. Table 3 presents a detailed

Table 2. Knowledge of routes of infection broken down by education, age, and place of residence

| Variable | | Correct answer | | Wrong answer | | p-value |
|---|---|---|---|---|---|---|
| | | N | % | n | % | |
| Education | Elementary | 1 | 33.3 | 2 | 66.7 | 0.487 |
| | Junior high | 3 | 60.0 | 2 | 40.0 | |
| | Vocational | 9 | 52.9 | 8 | 47.1 | |
| | High | 123 | 66.8 | 61 | 33.2 | |
| | Higher | 68 | 60.2 | 45 | 39.8 | |
| Age | 18 | 8 | 66.7 | 4 | 33.3 | 0.264 |
| | 19 | 8 | 61.5 | 5 | 38.5 | |
| | 20 | 13 | 76.5 | 4 | 23.5 | |
| | 21 | 28 | 63.6 | 16 | 36.4 | |
| | 22 | 40 | 54.1 | 34 | 45.9 | |
| | 23 | 39 | 56.5 | 30 | 43.5 | |
| | 24 | 33 | 73.3 | 12 | 26.7 | |
| | 25 | 10 | 66.7 | 5 | 33.3 | |
| | 26 | 26 | 76.5 | 8 | 23.5 | |
| Place of residence | Village | 36 | 55.4 | 29 | 44.6 | 0.468 |
| | Town <50,000 | 40 | 60.6 | 26 | 39.4 | |
| | Town <100,000 | 28 | 63.6 | 16 | 36.4 | |
| | Town ≤250,000 | 22 | 66.7 | 11 | 33.3 | |
| | City >250,000 | 79 | 68.7 | 36 | 31.3 | |

Table 3. Knowledge of vaccination broken down by education, age, and place of residence

| Variable | | Correct answer | | Wrong answer | | p-value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| Education | Elementary | 2 | 66.7 | 1 | 33.3 | 0.301 |
| | Junior high | 4 | 80.0 | 1 | 20.0 | |
| | Vocational | 5 | 29.4 | 12 | 70.6 | |
| | High | 82 | 44.6 | 102 | 55.4 | |
| | Higher | 53 | 46.9 | 60 | 53.1 | |
| Age | 18 | 8 | 66.7 | 4 | 33.3 | 0.140 |
| | 19 | 7 | 53.8 | 6 | 46.2 | |
| | 20 | 4 | 23.5 | 13 | 76.5 | |
| | 21 | 16 | 36.4 | 28 | 63.6 | |
| | 22 | 35 | 47.3 | 39 | 52.7 | |
| | 23 | 26 | 37.7 | 43 | 62.3 | |
| | 24 | 26 | 57.8 | 19 | 42.2 | |
| | 25 | 8 | 53.3 | 7 | 46.7 | |
| | 26 | 16 | 47.2 | 18 | 52.9 | |
| Place of residence | Village | 26 | 40.0 | 39 | 60.0 | 0.267 |
| | Town <50,000 | 25 | 37.9 | 41 | 62.1 | |
| | Town <100,000 | 23 | 52.3 | 21 | 47.7 | |
| | town ≤250,000 | 13 | 39.4 | 20 | 60.6 | |
| | City >250,000 | 59 | 51.3 | 56 | 58.7 | |

Table 4. Knowledge of the diagnostic methods for HPV infection broken down by education, age, and place of residence

| Variable | | Correct answer | | Wrong answer | | p-value |
|---|---|---|---|---|---|---|
| | | n | % | n | % | |
| Education | Elementary | 0 | 0 | 3 | 100 | 0.036 |
| | Junior high | 0 | 0 | 5 | 100 | |
| | Vocational | 2 | 11.8 | 15 | 88.2 | |
| | High | 44 | 23.9 | 140 | 76.1 | |
| | Higher | 34 | 30.1 | 79 | 69.9 | |
| Age | 18 | 0 | 0 | 12 | 100 | 0.005 |
| | 19 | 3 | 23.1 | 10 | 76.9 | |
| | 20 | 4 | 23.5 | 13 | 76.5 | |
| | 21 | 6 | 13.6 | 38 | 86.4 | |
| | 22 | 16 | 21.6 | 58 | 78.4 | |
| | 23 | 20 | 29.0 | 49 | 71.0 | |
| | 24 | 16 | 35.6 | 29 | 64.4 | |
| | 25 | 5 | 33.3 | 10 | 66.7 | |
| | 26 | 10 | 29.4 | 24 | 70.6 | |
| Place of residence | Village | 14 | 21.5 | 51 | 78.5 | 0.522 |
| | Town < 50,000 | 15 | 22.7 | 51 | 77.3 | |
| | Town < 100,000 | 16 | 36.4 | 28 | 63.6 | |
| | Town ≤ 250,000 | 4 | 12.1 | 29 | 87.9 | |
| | City > 250,000 | 31 | 27.0 | 84 | 73 | |

analysis of the breakdown of answers by sociodemographic variables. The differences observed proved to be statistically insignificant.

Bearing in mind that health behaviors are of particular importance for effective prevention, this variable was studied as well. Most of the respondents (67.4%) possessed knowledge of asymptomatic HPV infection and were aware that the virus may be transmitted to other people. However, only one-third (34.6%) of the respondents knew that HPV infections can resolve without medical intervention between 12 and 24 months after initial infection. Nearly all of the respondents (90%) indicated that using a condom is an effective preventative measure against infection.

With regard to knowledge of the diagnostic methods for HPV infection, eighty respondents (25%) correctly indicated the main diagnostic method. Statistically significant differences were observed upon analysis. Older men ($p = 0.005$) and men with higher education ($p = 0.036$) chose the correct answer more frequently. A detailed analysis of the distribution of answers broken down by the selected variables is presented in Table 4.

## Discussion

In 2008, Harald zur Hausen provided strong evidence connecting HPV infection with the development of cervical cancer. In addition, he co-developed a vaccine against various types of the virus, particularly the oncogenic types [4]. Today, we know that this discovery was a breakthrough and contributed to a great number of changes in modern gynecologic oncology. Vaccination against HPV is now the main preventative measure taken against this virus on a global scale. According to the research conducted by Arbyn et al., which was published in 2018, vaccination against HPV effectively reduces the risk of contracting cervical cancer in adolescent girls and women aged between 15 and 26 [14].

Various studies have assessed women's knowledge of HPV, its prevention and treatment, both among schoolgirls and older or pregnant women. In contrast, there are few published studies on men's knowledge. It is important to emphasize that gender awareness plays a key role in the prevention, early diagnosis, and treatment of HPV infection.

The current study surveyed 328 men aged between 18 and 26 years. The largest age group was comprised of men aged 22 (22.9% of all respondents) and the sample was dominated by inhabitants of cities with over 250,000 people (34.6%). More than half of the respondents (57.6%) did not take any medical courses. The knowledge of the respondents regarding HPV appeared to be insufficient.

### Key results

Many people start to gain basic knowledge related to HPV as late as at the moment they decide to get vaccinated. Research by Krawczyk et al. indicates a relationship between the motivation to get vaccinated against HPV and respondents' basic knowledge of the virus, and the possibility of any adverse effects occurring afterwards [15].

Most articles published in the Polish scientific literature are related to women's knowledge of HPV infections. Due to the potential routes of infection, including hazardous sexual intercourse, using the personal hygiene objects of an infected person and contact with the skin, awareness among men is equally crucial. According to various studies, on average, individuals in Poland experience their first sexual intercourse at the age of 18 [12], and the stage of early adulthood is associated with an increased incidence of hazardous sexual behavior. Therefore, information about HPV should be particularly distributed among this age group. The most common age of onset of HPV infection is between 20 and 24 years. According to the current survey, almost a quarter of the respondents gave the correct answer in response to a question on this fact.

A study conducted on a group of high school students aged between 18 and 19 in Bydgoszcz, which was published in 2016, indicated that 40% of participants had already engaged in sexual activities. The authors reported that as many as 83% of the respondents believed that using condoms is one of the ways of preventing sexually transmitted diseases [11]. The results obtained in the current study confirm this – when asked about behaviors facilitating prevention of HPV infection, more than 87% of the respondents indicated the use of condoms during a sexual intercourse. In addition, according to the current survey, more than two-thirds (67.9%) of the respondents cited exposure to the virus at a young age as a factor that increases the risk of getting the disease.

### Interpretation

A previous study examining knowledge of the prevention of HPV among youth indicated a low level of knowledge among boys attending high school. Only 45.23% of the respondents correctly indicated that protective vaccinations against HPV are available for both girls and boys [5]. The results of the current study indicate a similar level of knowledge. More than 45% of the respondents claimed that there are vaccines against HPV that are available irrespective of sex. The prior study, published in 2012, also analyzed the level of knowledge among boys on how HPV is transmitted, and only 29.76% of the respondents were familiar with this matter [9]. In the present survey, as many as

63% of the respondents chose correct answers related to the possible ways of contracting HPV.

The risk of contracting HPV is borne by all sexually active persons, irrespective of their sexual orientation, gender, or biological sex. A study conducted in 2018 by Grace et al. indicates that most men suffering from HIV were not aware of the fact that HPV vaccines are available to everyone, irrespective of sex. The respondents also did not deem HPV to be a serious health issue, despite the viral disease that they had already contracted [16]. Similar results were obtained in a study conducted by Gillis et al., where it was confirmed that the level of HPV knowledge among men who have been diagnosed with HIV is insufficient [17]. On the other hand, as per the current survey, the majority of the respondents (67.4%) had knowledge regarding asymptomatic HPV infection and were aware that it can be transmitted to others.

## Generalizability

The present study indicates that the level of HPV-related knowledge among men aged 18–26 years is insufficient and requires improvement. Increasing knowledge in this respect could lead to a reduction in the number of dangerous sexual activities undertaken and improvements in the awareness of methods that can prevent sexually transmitted diseases. A study published in 2013 indicates considerable differences in the level of HPV-related knowledge among women and men, with women being more aware of HPV than men [18]. Therefore, the education of young people in this area is crucial and matters considerably when it comes to passing appropriate values and knowledge to future generations.

## Limitations of the study

The main limitation of the current study concerns the method used for data collection. As the survey was conducted in an online and anonymous form, doubts may be raised about the reliability of the results.

## Conclusions

Young men do not possess sufficient basic knowledge of HPV and knowledge related to the prevention of HPV infection is fragmentary. The study sample is presumed to have the highest levels of sexual activity and likely the greatest number of sexual partners. Therefore, knowledge of sexually transmitted diseases, in particular HPV, is extremely crucial and should be improved among young people.

## References


1. Mądry E, Gibas M, Adamczak-Ratajczak A, et al. HPV – wirus o wielu twarzach. Fam Med & Prim Care Rev 2009; 11(3): 702. (In Polish).
2. Starzyńska A, Ragin K, Gulczyński J, et al. HPV – pozytywny rak jamy ustnej – etiologia i czynniki ryzyka. Forum Med Rodz 2018; 12(3):102-106. (In Polish).
3. Wiciński M, Leis K, Malinowski B, et al. Papillomawirusy: HPV jako czynnik etiologiczny nowotworów głowy i szyi. Post Mikrobiol 2018; 57(1): 33-40. https://doi.org/10.21307/PM-2018.57.1.033. (In Polish).
4. Broniarczyk J, Koczorowska MM, Durzyńska J, et al. Struktura i właściwości wirusa brodawczaka ludzkiego. Biotechnologia 2010; 3(90): 127. (In Polish).
5. Sokołowska B, Zasadzka M, Kulik A, et al. Ocena stanu wiedzy na temat zakażeń HPV wśród inhabitants powiatu bialskiego i parczewskiego. Wybrane problemy kliniczne. Via Medica 2015; 9(3): 200. (In Polish).
6. Pasławska A, Mrożek - Budzyn D, Majewska R. Wiedza młodych kobiet na temat znaczenia badań cytologicznych w profilaktyce raka szyjki macicy. Probl Hig Epidemiol 2014; 95(1): 170-174. (In Polish).
7. Maździarz A, Wyględowski J, Osuch B, et al. New directions in cervical cancer prophylaxis worldwide and in Poland: case study of the Polish rural female population. Ann Agric Environ Med 2017; 24 (4): 592-595. https://doi.org/10.5604/12321966.1232093.
8. Arcimowicz A, Bruzgielewicz A, Ocuch-Wójcikiewicz E, et al. Zakażenie wirusem HPV jako czynnik nowotworzenia w rakach głowy i szyi. Pol Prz Otorynolaryngol 2013; 2: 11-14. http://dx.doi.org/10.1016/j.ppotor.2013.03.002. (In Polish).
9. Jurczak A, Rosińska J, Karakiewicz B, et al. Analiza wiedzy młodzieży dotyczącej profilaktyki zakażeń wirusem brodawczaka ludzkiego. Fam Med & Prim Care Rev 2012; 14(2): 160-162. (In Polish).
10. Kwaśniewska A, Wawrzeńczyk A, Brus – Sawczuk K, et al. Uwaga problem – wirus onkogenny HPV a nowotwory jamy ustnej i gardła. Nowa Stomatol 2019; 24 (4): 133-137. https://doi.org/10.25121/NS.2019.24.4.133. (In Polish).
11. Cianciara D, Dudzik K, Rdzany R, et al. Szczepienia przeciwko HPV w samorządowych programach zdrowotnych. Porównanie z programami szczepień w innych krajach europejskich. Hygeia Public Health 2015; 50 (1): 112-118. (In Polish).
12. Augustynowicz A, Bojar I, Borowska M, et al. Self – government HPV vaccination programmes in Poland, 2009-2016. Ann Agric Environ Med 2020; 27(3): 379-383. https://doi.org/10.26444/aaem/109620.
13. Kaźmierczak M, Gebuza G, Gierszewska M, et al. Choroby przenoszone drogą płciową – wiedzy młodzieży licealnej.

Przegląd naukowo-metodyczny. Edukacja dla bezpieczeństwa 2016; 3 (32): 469-482. (In Polish).

**14.** Arbyn M, Xu L, Simoens C, Prophylactic vaccination against human papillomaviruses to prevent cervical cancer and its precursors. Cochrane Database Syst. Rev 2020; 3: 37-38. https://doi.org/10.1002/14651858.CD009069.pub3.

**15.** Krawczyk A, Stephenson E, Peres S, et al. Deconstructing Human Papillomavirus (HPV) Knowledge: Objective and Perceived Knowledge in Males' Intentions to Receive the HPV Vaccine. Am J Health Educ 2013; 44 (1): 26-31. https://doi.org/10.1080/19325037.2012.749714.

**16.** Grace D, Gaspar M, Paquette R, et al. HIV – positive gay men's knowledge and perceptions of Human Papillomavirus (HPV) and HPV vaccination: a qualitative study. PLoS ONE 2018; 13(11): 1-14. https://doi.org/10.1371/journal.pone.0207953.

**17.** Gillis JL, Grennan T, Grewal R, et al. Low human papillomavirus (HPV) knowledge related to low risk perception among men living with HIV: implications for HPV – associated disease prevention. Preventive Medicine 2020; 141:1-9. https://doi.org/10.1016/j.ypmed.2020.106274.

**18.** Marlow LAV, Zimet GD, McCaffery KJ, et al. Knowledge of human papillomavirus (HPV) and HPV vaccination: an International comparison. Vaccine 2013; 31 (5): 763-769. https://doi.org/10.1016/j.vaccine.2012.11.083.

Word count: 2705 • Tables: 4 • Figures: 0 • References: 18

**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Florkiewicz M, Tobolska A, Bączek G.
Knowledge of prevention and treatment of human papillomavirus (HPV) infections among young men.
Med Sci Pulse 2021; 15 (3): 24-30. DOI: 10.5604/01.3001.0015.2832.

**Correspondence address:**
Grażyna Bączek
E-mail: gbaczek@wum.edu.pl

Received: 10.06.2021
Reviewed: 23.08.2021
Accepted: 21.09.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Original papers

Published online: 22 September 2021

DOI: 10.5604/01.3001.0015.2816

# SOCIETAL ATTITUDES TOWARD DEATH AND AWARENESS OF DEATH CONFIRMATION: AN INTERNET SURVEY

Bożena Majchrowicz[1 A-C,]
• ORCID: 0000-0003-3203-1407

Katarzyna Tomaszewska[2 C-F]
• ORCID: 0000-0002-2129-9107

Edyta Guty[1 A,B]
• ORCID: 0000-0002-9902-8198

[1] East European State Higher School in Przemyśl, Poland

[2] Bronisław Markiewicz State Higher School of Technology and Economics, Jarosław, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** The progress and development of treatment methods and techniques have made the previous criteria for recognizing human death imprecise and insufficient. Thus, a medical line had to be drawn between life and death. Attitudes towards death and awareness concerning its confirmation, although often marginalized, undergo significant changes over time depending on the social space they concern.

**Aim of the study:** The aim of the study was to examine social attitudes towards death and the level of awareness concerning its confirmation.

**Material and methods:** This research on attitudes and knowledge regarding brain death involved 400 randomly selected respondents who were Internet users. The research was conducted from September 2019 to January 2020 using the CAWI method and a proprietary questionnaire.

**Results:** An older age, a higher level of education, and less frequent religious practice were significantly associated with knowledge of brain death. Of particular note, more complete knowledge of brain death was associated with greater support for organ transplantation, and this relationship was most evident in individuals willing to donate their own organs.

**Conclusions:** There is a clear variation in the level of knowledge about brain death. At least a high level of knowledge was held by 40.3% (161) of the respondents, and the same percentage was seen for those with at most a low level of knowledge (40.3%, 161). Regardless of who would be the organ donor, whether a loved one or a stranger, the respondents overwhelmingly supported organ transplantation after death. Acceptance of organ donation was higher when respondents had more knowledge of what brain death is.

**KEYWORDS:** brain death, societal attitudes, transplantation, level of knowledge

## Background

The modern approach to the phenomenon of death has changed noticeably. In earlier centuries, people became familiar with death, and tried to learn about it and the process of dying. It gave them an opportunity to sort out thoughts and feelings accompanying the loss of their loved ones. Death was a natural phenomenon affecting every family, an important element of life and a kind of ritual, beginning at the moment of dying and ending with mourning [1]. Today, people very often die anonymously in hospital. The traditional model has broken down, and the time of saying goodbye to loved ones in familiar surroundings has been replaced by loneliness, alienation, and a screen of intimacy [2].

The limitation of life is one of the basic determinants of human existence. Thus, any consideration of human death is very important from a personal and social point of view. Since the dawn of history, people have tried to address the issues of life, death and passing, although these topics have never been easy

for them. Often, while struggling with everyday life, a person does not think about death and does not consider it. However, as the German proverb states, "death has not forgotten anyone yet." Despite many efforts to forget about death, modern individuals – consciously or subconsciously – necessarily attempt to confront his/her attitudes with the experience of his/her own and others' passings, as well as with the relativity of all existence [3].

Thinking about death is a cognitive element of individual activity. It allows one to be aware of oneself and the social environment, which, in turn, leads to a proper encounter with reality. On the other hand, the fear of death, which is an important element of the emotional component of the attitude, develops as a component of the general interaction between the level of maturation of the individual and the characteristic events of life. According to J. Makselon, it is legitimate to distinguish thinking about death from fear of death, even though there are situations in which thinking about death can stimulate fear toward it and vice versa. Thinking is associated with reflection and distance from the phenomenon of death, while anxiety is defined as a specific emotional reflex [4].

Human attitudes toward death are determined by at least seven factors. These include cultural context, different developmental experiences, worldview, resistance to stressors, current life situation, lifestyle, preferred values, and the likelihood of death of a loved one or one's self. The processes of attention, memory, information processing, and the formation of concepts and judgments are involved in the formation of attitudes toward death, and a person's attitude toward death depends on the subjective properties of his or her functioning. The authors of various studies understand the attitude to death as the fear of death, the intensity of thinking about death and dying, the operation of defense mechanisms in this attitude, and acceptance or indifference to the phenomenon of dying [5].

## Aim of the study

The aim of this paper is to examine the social attitudes towards death and the level of awareness of its confirmation, and to find out whether they are differentiated depending on selected variables such as gender, age, education or attitude towards work.

## Material and methods

### Study design

This study of attitudes and knowledge about brain death was carried out from September 2019 to January 2020 and involved 400 Internet users who were Polish citizens. This latter characteristic was an inclusion criterion for participation in the study.

### Ethical considerations

This study was carried out in compliance with the ethical norms set out in the relevant version of the Declaration of Helsinki (64th WmA General Assembly, Fortaleza, Brazil, October 2013) and is in line with Polish legal regulations.

### Settings and participants

273 (68.3%) women and 127 (31.8%) men with an average age of 33 +/– 16.63 years participated in the study. The minimum age was 14 years and the maximum age was 78 years. Considering the location of residence, 65% (260) of the respondents resided in the city. 21.3% (85) of the respondents had a primary/high school education, 50% (200) had a vocational/secondary education, and 28.8% (115) had a higher education. 40% (160) of the respondents were pupils/students, 39% (156) were economically active, 11% (44) were unemployed, and 10% (40) were pensioners. 97% (388) of the respondents were not medically related. 36.5% (146) of the respondents were practicing believers, 24.3% (97) were believers that rarely practiced, 24.8% (99) were non-practicing believers, and 14.5% (58) were non-believers.

The apparent gender and age disparity may be due to the fact that the subject matter is of greater interest to women than men, and there is still an uneven distribution of Internet use among the population, with a larger proportion of users being young people and those living in more urban areas. Given the study design, it was not possible to confirm the age and gender of the respondents. Due to the inaccuracy of the CAWI method, taking these elements into account, the maximum sampling error, where the population consists of Internet users interested in the topic of brain death, was about +/- 5% for the assumed confidence level of 95%.

### Data collection

The survey was conducted using the CAWI method, where invitations were sent to a randomly selected group of respondents on the basis of specialized mailing lists. The survey questionnaire consisted of 15 closed questions, which concerned knowledge about brain death and attitudes towards organ donation, and a metric to collect sociodemographic data. Participation in the study was anonymous and voluntary.

## Statistical analysis

For the analyses of variables built on nominal scales the Chi-squared the test was used, as well as the symmetrical measures phi and Cramér's V to examine relationship strength. For ordinal variables, Kendall's Tau-b correlation coefficients (for tables with the same number of columns and rows) and Kendall's Tau-c (for tables with different number of columns and rows) were used. The level of test probability "p" was estimated by the asymptotic method and the more accurate Monte Carlo method (especially recommended in cases of few samples and when, for example, the conditions of using Chi-squared test are not fulfilled). The null hypothesis of no relationship between the variables is rejected when the value of test probability "p" is less than or equal to 0.05. Calculations were performed using the SPSS 27.0 statistical package with the Exact test module.

## Results

The topic of death was encountered by 56.3% (225) of respondents, while the experience of death of a loved one affected the vast majority of respondents – 89% (356) – and was increased when respondents were older and retired. Associations with age (p=0.010, Monte Carlo p=0.010, Chi-square=14.99, df=5, Cramér's V=0.194) and attitude to work (p=0.031, Monte Carlo p=0.030, Chi-square=8.90, df=3, Cramér's V=0.149) were found to be statistically significant, although the strength of the association was not significant.

3.9% of respondents (22) experienced the death of a loved one as a result of an accident and 4.4% (25) as a result of illness before the age of 18. The remaining respondents (91.7%) experienced a death in their family as an adult. 33% (132) of the respondents said they had been in immediate danger of their lives as a result of illness or, for example, a traffic incident.

According to the respondents, the topic of death was raised on social media (30.4%, 126), on the Internet (33.3%, 138), when talking to friends (17.9%, 74), and during education at school or college (13.5%, 56). However, the opinion of the respondents in this regard was not clear.

87% (348) of the respondents believed that they knew what brain death is, while a significantly lower percentage of affirmative answers was visible in the group of the youngest respondents aged 14 to 17 years – 75.7%. The relationship between age and the question "do you know what brain death is" was statistically significant, but the strength of the relationship was insignificant. Also, level of education (p<0.001, Monte Carlo p<0.001, Chi-square=33.60, df=2, Cramér's V=0.29) and attitude to work (p=0.019, Monte Carlo p=0.016, Chi-square=9.90, df=3, Cramér's V=0.157) significantly differentiated respondents' answers (Table 1).

Table 1. Which statement captures the respondents' belief about the moment of human death?

| Respondents' awareness of the moment of human death | | Frequency | Percentage | Percentage of valid | Cumulative percentage |
|---|---|---|---|---|---|
| Valid | 1. Human death occurs when the brain irreversibly stops working, even though the heart is still beating | 116 | 29.0 | 33.3 | 33.3 |
| | 2. Human death occurs only when the brain stops working and the heart stops beating | 202 | 50.5 | 58.0 | 91.4 |
| | 3. It is difficult to say | 30 | 7.5 | 8.6 | 100.0 |
| | Total | 348 | 87.0 | 100.0 | |
| Lack of data | 999 | 52 | 13.0 | | |
| Total | | 400 | 100.0 | | |

Source: the authors.

Clearly, respondents with higher levels of education and those who were working believed that they had more knowledge regarding brain death. However, as mentioned above, this is subjective knowledge. A comparison was made between subjective knowledge and objective knowledge about brain death (Table 2), and it was found that, of those respondents who claimed to know what brain death is, 31.4% had at most a low level of knowledge, while 46.3% had at least a high level of knowledge. The relationship between the variables was found to be statistically significant with a significant strength of association (p<0.001, Monte Carlo p<0.001, Chi-square=194.57, df=4, Cramér's V=0.697).

An older age (p=0.001, Monte Carlo p=0.001, Kendall's Tau-c=0.127.), a higher level of education (p=0.001, Monte Carlo p<0.001, Kendall's Tau-c=0.158), and less frequent religious practices (p<0.001, Monte Carlo p=0.001, Kendall's Tau-c=0.145) were significantly associated with a higher knowledge about brain death, but the values of the correlation coefficients show a rather weak strength

Table 2. Objective level of knowledge about brain death depending on subjective assessment of knowledge of what brain death is

| Subjective evaluation of knowledge of what brain death is | | | Do you know what brain death is? | | Total |
|---|---|---|---|---|---|
| | | | 1. Yes | 2. No | |
| Level of knowledge about brain death | very low (0) | N | 42 | 52 | 94 |
| | | % | **12.1** | **100.0** | **23.5** |
| | low (1) | N | 67 | 0 | 67 |
| | | % | **19.3** | **0.0** | **16.8** |
| | medium (2) | N | 78 | 0 | 78 |
| | | % | **22.4** | **0.0** | **19.5** |
| | high (3) | N | 103 | 0 | 103 |
| | | % | **29.6** | **0.0** | **25.8** |
| | very high (4) | N | 58 | 0 | 58 |
| | | % | **16.7** | **0.0** | **14.5** |
| Total | | N | 348 | 52 | 400 |
| | | % | **100.0** | **100.0** | **100.0** |
| Cramér's V | 0.697 | 194.571 | 4 | 0.000 | 0.000 |
| **coefficient** | **value** | **Chi-square** | **df** | **p** | **Monte Carlo p** |

Source: the authors.

of association. Respondents working in nursing or related professions had a higher level of knowledge about brain death compared to other respondents, but two respondents (16.7%), despite working in health care, did not know the answer to any of the four questions in the survey. The relationship between the variables was statistically significant (p=0.009, Monte Carlo p=0.008, Chi-square=13.52, df=4) and had a strength of association at Cramér's V=0.184.

It was also shown that the level of knowledge about brain death was not significantly dependent on gender (p=0.281, Monte Carlo p=0.289), place of residence (p=0.752, Monte Carlo p=0.755), attitude toward work (p=0.544, Monte Carlo p=0.545), experience of death of a loved one (p=0.654, Monte Carlo p=0.662), or having ever been in immediate danger of life (p=0.705, Monte Carlo p=0.709).

An attitude is primarily a disposition to a certain type of behavior, thinking, and feeling about something called the object of the attitude. The phenomenon of death evokes various, usually negative emotions in respondents, regardless of whether it involves a loved one or a random person (Figure 1).

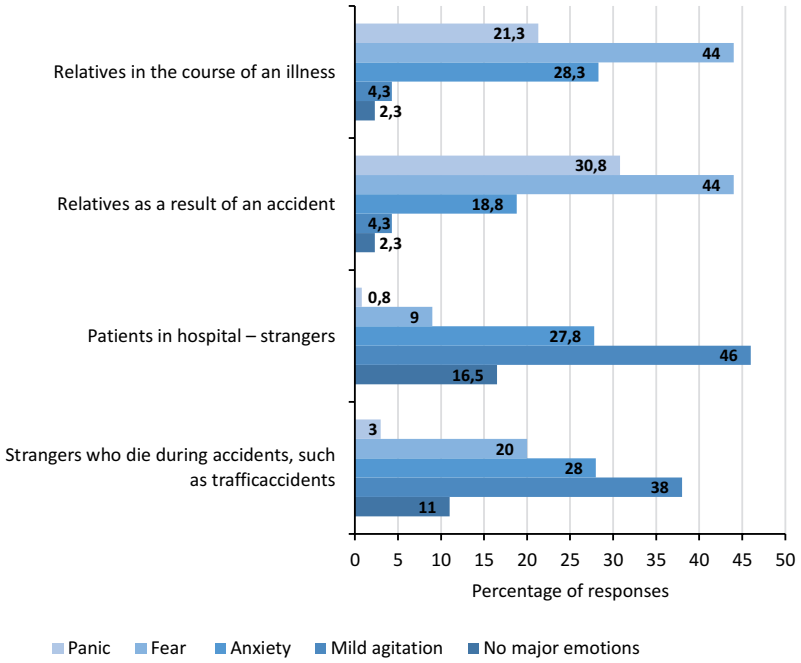


Figure 1. Type of emotions that accompany respondents when other people die
Source: the authors.

Also extremely important to the topic of the study is the respondents' attitudes toward organ donation at the time of brain death. Regardless of who would be the organ donor, be it a loved one or a stranger, the respondents overwhelmingly supported organ transplantation after death. It was also shown that a higher level of knowledge about brain death is associated with greater support for transplantation and this is most evident when willing to donate one's own organs (Table 3). Although the correlation coefficient value was quite weak (Kendall's Tau-b=–0.20), it is significantly different from 0 (p<0.001, Monte Carlo p<0.001).

Table 3. Ratio of support for donation of own organs after death according to level of knowledge about brain death

| What is your attitude toward supporting the donation of organs after death that belong to: | | | Level of knowledge about brain death | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | | very low (0) | low (1) | medium (2) | high (3) | very high (4) | |
| 3. My own person | 1. I strongly support | N | 39 | 34 | 39 | 61 | 44 | 217 |
| | | % | **41.50** | **50.70** | **50.00** | **59.20** | **75.90** | **54.30** |
| | 2. I rather support | N | 27 | 12 | 18 | 27 | 13 | 97 |
| | | % | **28.70** | **17.90** | **23.10** | **26.20** | **22.40** | **24.30** |
| | 3. It is hard to say | N | 19 | 16 | 17 | 10 | 1 | 63 |
| | | % | **20.20** | **23.90** | **21.80** | **9.70** | **1.70** | **15.80** |
| | 4. I rather not support | N | 4 | 3 | 1 | 3 | 0 | 11 |
| | | % | **4.30** | **4.50** | **1.30** | **2.90** | **0.00** | **2.80** |
| | 5. I definitely not support | N | 5 | 2 | 3 | 2 | 0 | 12 |
| | | % | **5.30** | **3.00** | **3.80** | **1.90** | **0.00** | **3.00** |
| Total | | N | 94 | 67 | 78 | 103 | 58 | 400 |
| | | % | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |
| Kendall's Tau-b | –0.200 | 0.038 | –5.169 | 0.000 | 0.000 | | | |
| **coefficient** | **value** | **standard error** | **approx. T** | **p** | **Monte Carlo p** | | | |

Source: the authors.

In Poland, the vast majority of the population identifies with the Catholic Church, but more than half of the respondents with varying degrees of religious practice do not know whether the church to which they belong accepts organ transplants after death. It was also observed that lower religiosity was associated with a higher belief that the Catholic Church does not accept organ transplants after death. The correlation between the variables was statistically significant (p<0.001, Monte Carlo p<0.001) and had a strength of association at Kendall's Tau-c level=0.228.

## Discussion

The fact of death is empirically experienced, for it ends the biological rhythm of life. Death itself in modern society is a taboo subject, a natural phenomenon experienced in isolation. However, despite the fact that it is inevitable and we do not consider its existence, we try to postpone it as much as possible. Still, the most controversial questions are: when does human death occur and is it possible to precisely determine its moment? This is "the most debatable issue in modern bioethics, raising serious doubts in the minds of ordinary people: when can a person be considered to have died with certainty?" [6]

The presented study aimed to find out the level of knowledge of the respondents about brain death and their awareness about its determination. The results showed an apparent variation in the level of knowledge about brain death. At least a high level of knowledge was possessed by 40.3% of the respondents, and the same percentage (40.3%) showed at most a low level of knowledge. The results of the current study are consistent with the studies of other authors, of which, unfortunately, there are few. Rabiu, Oshola and Adebayo conducted a survey among neurosurgical patients assessing their knowledge of brainstem death. According to the authors, this was the first study of its kind among the neurosurgical patient population in Nigeria. A total of 127 respondents participated in the study and awareness of brainstem death was low among them, although most of them would agree with the doctor if given such a diagnosis [7].

Strupp et al. conducted a representative online survey (N=997) on aspects of end of life. The study found that the public was open to dealing with the topic of death, and attitudes and perceptions were related to age, subjective health status, religion, and gender [8]. Leclerc et al. in their publication stated

that death should be better understood, accepted, and prepared for with a mature attitude. Social attitudes towards death are to some extent based on faith, ethnicity, education, and other socio-economic and religious characteristics [9].

Xu et al. conducted a survey among 357 nurses in China on attitudes toward death. Data were collected on demographic characteristics and attitudes toward death in five domains, including fear of death, death avoidance, natural acceptance, approach acceptance, and escape acceptance. Compared to norms, nurse interns scored significantly higher in the domains of death avoidance, approach acceptance, and death anxiety, but showed significantly lower scores in the domains of natural acceptance and escape acceptance. Religious belief, experience of a deceased relative in the family, death education, and a family atmosphere of death discussion were positively associated with one or more of the death attitude domains. Ratings of attitudes toward death among the Chinese nurses surveyed were at a moderate level and required expansion of death education [10]. Another cross-sectional study was conducted among 213 randomly selected nurses working in one of the first level university hospitals in Nigeria. Attitudes towards death and dying were collected using the Frommelt Attitude Care of the Dying and Death Attitude Profit-Revised questionnaires. The study showed that most of the nurses had negative attitudes towards the concept of death. Also, nurses' age and professional qualifications were significantly related to their attitudes towards death [11].

Majchrowicz and Kalita studied the opinion of inhabitants of the Podkarpacie region on the problem of transplantation and showed that respondents expressed positive attitudes towards transplantation as a method of treatment. The data analysis found that gender was statistically significant in the decision to donate organs from a loved one in the event of death ($Z=-2.37$, $p=0.02$). Men were more likely to donate a loved one's organs for transplantation (mean 2.75) compared to women (mean 2.37). Women were more likely than men (women – mean 3.45, men – mean 3.18) to believe that a person has the right to choose and can decide on the purpose of their organs and body both during life and after death ($Z=2.40$, $p=0.02$) [12]. A study conducted by Majder et al. involved 200 students of the University of Rzeszow. The authors showed that a higher level of knowledge about transplantation was found among medical students ($p<0.001$). Students of humanities were more skeptical about the intention to donate organs in the case of death of a loved one who did not object during life ($p<0.001$). A total of 44% affirmed their consent to be an organ/tissue donor [13].

Longbottom and Slaughter presented very interesting conclusions concerning the shaping of knowledge and attitudes towards death after examining sources of children's knowledge about death and dying. The authors claim that modern children have limited access to realistic information about death and dying. In addition to socio-cultural trends that have removed death from everyday life, many adults espoused attitudes of protecting children from the reality of death. Moreover, it seems that parents tend to underestimate what their children know about death and often discuss the topic using euphemisms that actually deny the biological facts. Although media exposure has an increasing impact on children's learning, to date there has been no research examining how media representations affect children's developing conceptions of death [14]. These considerations lead to the conclusion that further research on this topic should be conducted among specific populations.

### Limitations of the study

Our initial intention was to survey a larger number of respondents, but the epidemiological situation in our country resulted in significant limitations in contacting a wider group of respondents. The selected CAWI interview method does not guarantee the determination of a representative target group, and sometimes it is very difficult to ensure that the respondents meet selection criteria. Due to a marked decrease in the number of transplants related to the pandemic and a long waiting list for transplantation, continuous education, especially among young people, about death and organ transplantation is of great importance.

### Key results

Thematic topics in the field of death were encountered when using social media, the Internet, or during education at school or university. However, the opinion of the respondents in this respect was not clear. An older age, a higher level of education, and less frequent religious practices were significantly associated with knowledge of brain death. Of particular note, a more complete knowledge of brain death was associated with greater support for organ transplantation. There is a need for widespread public education related to the topic of death.

## Conclusions

Attitudes formed as a result of personal experience with their object are stronger, more secure, less prone to change, and more likely to control a person's actions than attitudes formed from secondhand information. However, not all objects lie within the reach of direct experience. Consequently, we acquire

most of our attitudes in a more or less ready form from other people [15]. Death is a multidimensional and existential category because it belongs to the basic properties of human destiny. Regardless of the individual's views on the spiritual life after death, the very fact of dying and leaving is deeply existential for both the dying person and the environment in which he/she lives. In addition, the passing away of a loved one or the approaching inevitably of one's own death, includes the tendency for reflection or provokes to one to undertake specific behaviors associated with certain attitudes [16].

## References


1. Kerrigan M. Historia śmierci. Zwyczaje i rytuały pogrzebowe od starożytności do czasów współczesnych. Warszawa: Wydawnictwo Bellona; 2009. (In Polish).
2. Ogryzko-Wiewiórowska M. Umieranie w szpitalu. Pielęgniarstwo 2000, 1999; 6(47):27-34, 23. (In Polish).
3. Jankowska M. Psychologiczne aspekty postaw wobec śmierci. Kwartalnik Naukowy Fides Et Ratio 2018; 36(4):372-394. (In Polish).
4. Zawiślak A. Postawy pielęgniarek hospicyjnych wobec śmierci własnej i bliskich osób. Piel Zdr Publ 2016; 6, 3:197–203. (In Polish).
5. Izdebski P, Jurga M, Kosiol M. Bilans życiowy a postawa wobec śmierci w późnej dorosłości. Gerontol Pol 2012; 20, 4:155–159. (In Polish).
6. Jan Paweł II, Poszukiwania naukowe muszą szanować godność każdej ludzkiej istoty. (Przemówienie do uczestników Kongresu Światowego Towarzystwa Transplantologicznego). L'Osservatore Romano 11-12/2000, 38:4.
7. Rabiu TB, Oshola HA, Adebayo BO. Survey of the knowledge of brainstem death and attitude toward organ donation among relations of neurosurgical patients in Nigeria. Transplant Proc 2016 Jul-Aug;48(6):1898-903.
8. Strupp J, Köneke V, Rietz C, Voltz R. Perceptions of and Attitudes Toward Death, Dying, Grief, and the Finitude of Life-A Representative Survey Among the General Public in Germany. Omega (Westport). 2019 Oct 15:30222819882220. DOI: 10.1177/0030222819882220. Epub ahead of print. PMID: 31615342.
9. Leclerc BS, Lessard S, Bechennec C, Le Gal E, Benoit S, Bellerose L. Attitudes toward death, dying, end-of-life palliative care, and interdisciplinary practice in long term care workers. J Am Med Dir Assoc 2014 Mar;15(3):207-213.
10. Xu F, Huang K, Wang Y, Xu Y, Ma L, Cao Y. A Questionnaire Study on the Attitude towards Death of the Nursing Interns in Eight Teaching Hospitals in Jiangsu, China. Biomed Res Int. 2019 Sep 16;2019:3107692. doi: 10.1155/2019/3107692. PMID: 31637256; PMCID: PMC6766148.
11. Faronbi JO, Akinyoola O, Faronbi GO, Bello CB, Kuteyi F, Olabisi IO. Nurses' attitude toward caring for dying patients in a Nigerian Teaching Hospital. SAGE Open Nurs 2021;7.
12. Majchrowicz B, Kalita K. Postawy wybranych grup społecznych wobec świadomej zgody na pobieranie narządów do przeszczepów. Przegląd Medyczny Uniwersytetu Rzeszowskiego i Narodowego Instytutu Leków w Warszawie 2012; 1:86-97. (In Polish).
13. Majder K, Więch P, Zaleska J, Sałacińska I, Bazaliński D. Organ transplantology – opinions and attitudes of medical and humanities students. Medical Science Pulse 2020 (14); 4: 25-30.
14. Longbottom S, Slaughter V. Sources of children's knowledge about death and dying. Philos Trans R Soc Lond B Biol Sci 2018; 373(1754).
15. Strelau J. Psychologia, podręcznik akademicki. T. 3, Gdańsk: Wydawnictwo Psychologiczne; 2005. (In Polish).
16. Levine S. Kto umiera? Sztuka świadomego życia i świadomego umierania. Poznań: Wydawnictwo Media Rodzina; 2015. (In Polish).


Word count: 3622 • Tables: 3 • Figures: 1 • References: 16

**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Majchrowicz B, Tomaszewska K, Guty E.
Societal attitudes toward death and awareness of death confirmation: an internet survey.
Med Sci Pulse 2021; 15 (3): 31-37. DOI: 10.5604/01.3001.0015.2816.

**Correspondence address:**
Katarzyna Tomaszewska
E-mail: tomka8@wp.pl

Received: 05.05.2021
Reviewed: 16.08.2021
Accepted: 30.08.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Original papers

Published online: 29 July 2021

DOI: 10.5604/01.3001.0015.0633

# MUSCULOSKELETAL PAIN IN PROFESSIONAL SYMPHONY ORCHESTRA MUSICIANS

Antonina Kaczorowska[1] A,B,D,E
• ORCID: 0000-0002-0488-8583

Agata Mroczek[1] A,C,E
• ORCID: 0000-0002-5246-0792

Ewelina Lepsy[1] A,D,F
• ORCID: 0000-0003-3663-9888

Magdalena Kornek[1] A,B,F
• ORCID: 0000-0003-3278-7453

Agnieszka Kaczorowska[2] C,D
• ORCID: 0000-0002-2076-6201

Monika Kaczorowska[3] D,F
• ORCID: 0000-0001-5665-540X

Karolina Lepsy[4] DF
• ORCID: 0000-0001-5453-2254

[1] Institute of Health Sciences, University of Opole, Poland

[2] Department of Physiotherapy, University School of Physical Education in Wrocław, Poland

[3] Faculty of Medicine, Medical University of Lodz, Poland

[4] Faculty of Medicine, Wroclaw Medical University, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** A musician's many years of professional experience may contribute to the development of pain and musculoskeletal disorders. There are a few studies in Poland on gender differences in musculoskeletal pain among adult professional musicians.

**Aim of the study:** This study aimed to assess and compare pain in Polish women and men who are professional musicians, as well as to analyze the relationships between the intensity and frequency of pain and the time spent playing each week and the experience of playing the instrument in years.

**Material and methods:** Sixty professional musicians were examined (26 men and 34 women). Pain intensity was assessed using the visual analog scale (VAS). Participants reported the frequency of musculoskeletal system ailments, the location of the pain, the number of hours of playing the instrument per week, and the playing experience in years. In addition, body weight and height were measured and body mass index (BMI) was calculated.

**Results:** Most of the participants (94% of women and 69% of men) reported pain in the musculoskeletal system (p=0.010). Women experienced significantly greater pain in the musculoskeletal system assessed using the VAS (p=0.036), and also declared pain significantly more often compared to men (p=0.002). Significant positive correlations were found between frequency of symptoms per week with the number of hours of playing per week (r=0.28), year of playing the instrument (r=0.38), and pain assessment on the VAS (r=0.57). Moreover, negative correlations were found between frequency of symptoms per week with body height (r=–0.45) and body mass (r=–0.36).

**Conclusions:** Musculoskeletal disorders are very common among professional musicians, especially among women. In general, the greater the number of hours playing per week and the longer the history of playing, the greater the pain intensity. Future research should aim to evaluate the prevalence and risk factors of musculoskeletal disorders associated with playing an instrument in different groups of musicians.

**KEYWORDS:** musculoskeletal disorders, musicians, pain, orchestra, occupational health

## Bacground

Specific occupational requirements are increasingly recognized as a cause of various types of work-related health ailments. One highly specialized group of professionals is musicians who, due to their work, experience various health problems related to the musculoskeletal system [1]. The latest research in Europe confirms the occurrence of musculoskeletal disorders in 70–90% of the studied musicians [2-4]. The prevalence of work-related health problems is an important issue from the perspective of the individual worker who has the potential to "lose" health and, consequently, the ability to work. However, it is also important from economic and organizational perspectives due to more frequent or prolonged absences, sick leave, and even the permanent inability to work [5].

Playing an instrument may overload the musculoskeletal system, both in terms of statics and dynamics [6]. When playing, individual sections of the musician's body are in a forced position. Mastering the playing of an instrument involves daily practice – often many hours – so the period of being in a forced body position is quite long [6,7]. Performing repetitive movements for a long time and engaging the same muscle groups may lead to pathological changes in the musculoskeletal system [8]. Playing an instrument also requires effort in carrying the instrument, which especially applies to musicians playing the violin, cello, and clarinet. These loads translate into symptoms in the musculoskeletal system [9]. Pain is often the first warning sign that changes have occurred, but may be disregarded in the beginning [8]. Some musicians believe that the pain associated with playing an instrument is an acceptable and normal symptom in their profession [10, 11].

Previous studies have noted a difference between the sexes in terms of pain, such that female musicians have greater musculoskeletal problems than male musicians [8,12]. The most common studies on the differences in the musculoskeletal system problems between the sexes concern students at music schools or a population including musicians of various levels [12, 13, 2]. A small number of studies have examined pain in men and women who are professional musicians.

Despite medical advances, the prevalence of musculoskeletal ailments has remained at the same level for many years [9]. Although research on musculoskeletal disorders in musicians has been systematically conducted in Europe, the number of studies conducted in Poland is limited. Increasing musicians' knowledge of risk factors and methods of preventing these conditions would be of significant importance for reducing ailments of the musculoskeletal system.

## Aim of the study

This study aimed to assess the frequency of pain in Polish men and women who are professional musicians, as well as to analyze the relationships between the intensity and frequency of pain and the time spent playing an instrument each week and the number of years of professional experience playing an instrument.

The research questions are:

1) Does the frequency of pain in the musculoskeletal system differ between men and women who are professional musicians?

2) Does the pain level, measured using the visual analog scale (VAS), differ between men and women?

3) Do time spent playing weekly and years of experience affect the level and frequency of musculoskeletal pain?

## Material and methods

### Sample

This research was conducted in January and February 2020 at the institutions for artistic activity in Opolskie Voivodeship. This work is part of research registered on the ISRCTN platform under number 37451, which has been discontinued since March 2020 due to the COVID-19 pandemic. A total of 60 musicians were examined (26 men and 34 women) from the Symphony Orchestra of the Opole Philharmonic Józef Elsner and the Princely Symphony Orchestra in Brzeg. The inclusion criteria were: (1) a minimum of five years of experience playing an instrument and (2) written consent to participate in the study. The exclusion criteria were: (1) infections, (2) acute injuries, (3) tumors, (4) pregnancy in women, and (5) lack of written consent to participate in the study.

The participants were divided into two groups: men and women. Each group included violinists, cellists, and musicians playing wind instruments. In the group of women, there were 14 violinists, 11 cellists, and 1 musician playing a wind instrument. The group of men consisted of 3 violinists, 4 cellists, and 10 musicians playing wind instruments.

### Methods

The research with the musicians was conducted at the Opole Philharmonic and at the City Hall in Brzeg in the afternoon. The research technique was a questionnaire. The VAS was used to assess pain intensity on a scale from 0 to 10, where 0 meant minimal pain and 10 meant intense, unbearable pain [14]. The respondents also reported the frequency of

musculoskeletal ailments (number of days per week) and the location of pain. The questionnaire was supplemented with questions about the number of hours spent playing the instrument per week and the playing experience in years. In addition, body weight and height were measured and participants' body mass index (BMI) was calculated.

## Ethics

This study was carried out in accordance with the guidelines of the Declaration of Helsinki and Good Clinical Practice. All procedures were approved by the Bioethical Commission at Opole Medical School (permission no. KB/240/FI/2020). All participants gave written informed consent after thorough explanation of the procedures involved.

## Statistical analyses

Descriptive statistics were calculated, including the mean (M), median (Me), standard deviation (SD), minimum (Min), and maximum (Max). The distribution of variables was assessed for normality using the Shapiro-Wilk test. Non-parametric methods were used. The Mann-Whitney U-test was used to assess the significance of differences between the groups of women and men. Spearman's rank correlation was used to assess the relationships between the number of hours of playing and years of experience with the intensity and frequency of pain. All analyses were performed using Statistica version 13.3 (TIBCO Inc., Tulsa, United States). A p-value ≤ 0.05 indicated statistical significance.

# Results

## Descriptive data

The mean participant age was 31.32±11.24 for women and 34.03±14.68 for men. The women were shorter, weighed less, and had a lower BMI compared to the men. The differences between men and women for the age and somatic variables (height, weight, BMI) were statistically significant. Respondents' demographic characteristics and somatic variables are presented in Table 1.

Table 1. Descriptive statistics of age and somatic variables in the groups of women and men musicians

| Variable | Group | M±SD | Me | Min-Max | Z | p |
|---|---|---|---|---|---|---|
| **Age [years]** | Women | 31.32±11.24 | 29 | 16–59 | –0.365 | 0.714 |
| | Men | 34.03±14.68 | 32.5 | 19–67 | | |
| **Body height [cm]** | Women | 166.00±7.27 | 168 | 152–178 | –5.400 | <0.001* |
| | Men | 177.69±5.58 | 178 | 167–191 | | |
| **Body mass [kg]** | Women | 61.02±14.54 | 58 | 43–120 | –5.273 | <0.001* |
| | Men | 81.15±11.17 | 83 | 61–101 | | |
| **BMI [kg]/m$^2$]** | Women | 22.00±4.17 | 21.04 | 16.69–40.09 | –4.057 | <0.001* |
| | Men | 25.71±3.48 | 25.72 | 18.31–31.02 | | |

Note: M – mean; SD – standard deviation; Me – median; Min – minimum; Max – maximum; Z – Mann-Whitney U test, p – p value, *p<0.05.

## Main results

Of the total sample, 32 women (94%) and 18 men (69%) reported musculoskeletal system pain (p=0.010; Table 2). In the groups of men and women, pain was most often localized in the lumbar spine (46% vs. 94%), cervical spine (27% vs. 50%), and upper limbs (27% vs. 50%). Pain was very rarely localized in the lower limbs in men and women (7.5% vs. 3%). The differences between the sexes were not statistically significant (Table 3).

The results of the intensity and frequency of pain differed significantly between women and men. Women experienced significantly greater pain in the musculoskeletal system, assessed on the VAS (p=0.036), and also experienced pain significantly

Table 2. The occurrence of pain in women and men musicians

| Group | n (%) |
|---|---|
| **Women** | 32 (94%) |
| **Men** | 18 (69%) |

Note: Pearson's Chi$^2$ p= 0.01037.

Table 3. Typical localization of pain in professional musicians

| Group | Cervical spine n (%) | Lumbar spine n (%) | Upper limb n (%) | Lower limb n (%) |
|---|---|---|---|---|
| **Women** | 17 (50%) | 23 (94%) | 17 (50%) | 1 (3%) |
| **Men** | 7 (27%) | 12 (46%) | 7 (27%) | 2 (7.5%) |

Note: Pearson's Chi$^2$ p<0.05.

Table 4. Statistical characteristics of pain and playing an instrument in groups of women and men musicians

| Variable | Group | M±SD | Me | Min-Max | Z | p |
|---|---|---|---|---|---|---|
| **Pain assessment on the VAS scale [n]** | Women | 4.52±2.21 | 5 | 0–8 | 2.095 | 0.036* |
| | Men | 3.07±2.75 | 3 | 0–8 | | |
| **The frequency of symptoms per week [n]** | Women | 3.73±2.35 | 3 | 0–7 | 2.968 | 0.002* |
| | Men | 1.96±2.05 | 2 | 0–7 | | |
| **Hours of playing per week [hours]** | Women | 28.94±15.37 | 28 | 4–70 | 1.529 | 0.126 |
| | Men | 22.92±11.78 | 20 | 4–42 | | |
| **Experience of playing an instrument [years]** | Women | 23.02±9.89 | 22 | 5–42 | 0.716 | 0.473 |
| | Men | 22.53±15.70 | 19 | 5–57 | | |

Note: M – mean; SD – standard deviation; Me – median; Min – minimum; Max – maximum; Z – Mann-Whitney U test, p – p value, * p<0.05.

Table 5. Correlation of Spearman's ranks in musicians

| Variable | BH [cm] | BM [kg] | BMI [kg/m²] | Hours of playing per week [hours] | Experience of playing an instrument [years] | Pain assessment on the VAS scale [n] | The frequency of symptoms per week [n] |
|---|---|---|---|---|---|---|---|
| **BH [cm]** | | **0.78** | **0.49** | **–0.26** | –0.00 | –0.18 | **–0.45** |
| **BM [kg]** | 0.78 | | **0.90** | –0.18 | 0.10 | –0.10 | –0.36 |
| **BMI [kg/m²]** | 0.49 | 0.90 | | –0.08 | 0.13 | –0.01 | –0.21 |
| **Hours of playing per week [hours]** | **–0.26** | –0.18 | –0.08 | | 0.22 | **0.38** | **0.28** |
| **Experience of playing an instrument [years]** | –0.00 | 0.10 | 0.13 | 0.22 | | 0.45 | 0.38 |
| **Pain assessment on the VAS scale [n]** | –0.18 | –0.10 | –0.01 | **0.38** | **0.45** | | 0.57 |
| **The frequency of symptoms per week [n]** | **–0.45** | **–0.36** | –0.21 | **0.28** | **0.38** | **0.57** | |

Note: BH – body height, BM – body mass; significant differences with p <0.05 is marked in bold.

more often compared to men (p=0.002). The number of hours spent playing the instrument per week and years of playing experience were similar in both groups and the differences were not statistically significant (Table 4).

In the study group, significant positive correlations were found for the frequency of symptoms per week with the number of hours spent playing per week (r=0.28), years of experience playing an instrument (r=0.38), and pain assessment on the VAS (r=0.57). Moreover, negative correlations between frequency of symptoms per week with body height (r=–0.45) and body mass (r=–0.36) were found (Table 5).

## Discussion

The aim of this study was to assess and compare the intensity and frequency of musculoskeletal system pain between men and women who are professional musicians in Poland. The results showed that women reported significantly more pain and greater intensity of pain. These observations are consistent with other research conducted among musicians and students at music universities in different countries. Research confirms that women are more prone to pain in the musculoskeletal system [8,2,15-19]. These differences are already present in young musicians attending a music school, with girls reporting musculoskeletal pain much more often than boys [13].

The greater frequency of pain and intensity of pain in women may be related to sex differences in the structure and proportions of the body. Adult women are on average 7–8% shorter and 25–20% lighter than men. The muscle mass of women is also lower than that of men. By the age of 20–24, muscle mass accounts for about 36% of body weight in women and about 45% of body weight in men. Women are also characterized by lower bone mass, which amounts to approximately 12% of body weight; by contrast, this value in men is 15% [20]. Men also have greater absolute strength compared to women [21], while women are characterized by lower endurance of the joints and ligaments. Playing an instrument often requires carrying a heavy instrument and keeping the instrument in a forced position for a long time [9]. Therefore, due to differences in body proportions and physiology between men and women, pain in the

musculoskeletal system in women may be more frequent and intense.

Among the surveyed musicians, positive relationships were found between the number of hours spent playing per week and playing experience, and the degree of pain intensity and the frequency of ailments. It can be concluded that the degree of pain intensity and frequency of ailments depend on the number of hours spent playing per week and the number of years of playing the instrument. An interesting relationship was also observed between body height and body weight and the frequency of pain symptoms: the shorter and lighter the participants were, the more often they experienced pain. Keeping an instrument in one position for a long time while playing and carrying the instrument may overburden the musician's body. Of note, the sizes of the instruments for adults were similar. Perhaps for shorter and lighter people, activities related to playing require more effort, and therefore more frequent pain in the musculoskeletal system.

The relationship between years of experience playing an instrument and time spent playing has also been emphasized by other researchers. A long playing time and more hours of play have been reported to increase pain [2, 18, 19, 22]. Gomez-Rodriguez et al. conducted a study among 213 Spanish musicians and showed that spending more than 14 hours a week playing an instrument was a risk factor associated with symptoms of musculoskeletal disorders [2]. In the present study, the average number of hours spent playing per week in each group was over 20 hours. Perhaps that is why such a large percentage of respondents reported pain in the musculoskeletal system.

The concordance of the results of studies on the prevalence of musculoskeletal disorders among musicians proves that these symptoms constitute a serious health problem that warrants attention in this professional group. Research by Raymond et al. involving American classical orchestra musicians found that musicians reported limited formal training and education about health risks in the workplace. Risk information was only provided late in their professional development. This is particularly worrying due to the age at which music training begins [23].

More awareness and knowledge about health risks among musicians are needed, and strategies to prevent overload and ailments related to playing an instrument should be introduced during their studies in order for musicians to pursue a healthy career. Education about the potential effects of risks associated with being a professional musician should also apply to teachers, doctors, and physical therapists working with musicians. Musicians' working conditions, i.e., requirements regarding the position and movements of the body while playing the instrument, can only be modified to a certain extent. It thus follows that a key to supporting the health of musicians is to find solutions to alleviate the pain and musculoskeletal ailments associated with work that will not affect the ability to play the instrument.

## Limitations

This work is subject to several limitations. The study covered a small number of musicians from two orchestras in the Opolskie Voivodeship. Therefore, when interpreting the results, it is worth remembering that participants are only representative of musicians in this region of Poland. In addition, this study considered only a few risk factors for musculoskeletal pain in musicians. Further research should include a much larger number of musicians from different regions of Poland and analyze other risk factors, such as the type of instrument, low level of physical activity, and stress. Future research into the epidemiology of musculoskeletal disorders in musicians should focus on related risk factors and the prevention of work-related problems.

## Conclusions

Playing-related musculoskeletal disorders were significantly more common in women and in musicians with lower body height and weight.

The greater the number of hours spent playing per week and the longer the period of experience, the greater the pain intensity.

Future research should aim to evaluate the occurrence and risk factors of playing-related musculoskeletal disorders in other groups of musicians.

## References


1. Nawrocka A, Mynarski W, Powerska A, Grabara M, Groffik D, Borek Z. Health-oriented physical activity in prevention of musculoskeletal disorders among young Polish musicians. Int J Occup Med Environ Health 2014; 27(1): 28-37.
2. Gómez-Rodríguez R, Díaz-Pulido B, Gutiérrez-Ortega C, Sánchez-Sánchez B, Torres-Lacomba M. Prevalence, disability and associated factors of playing-related musculoskeletal pain among musicians: a population-based cross-sectional descriptive study. Int J Environ Res Public Health 2020; 17(11): 3991.
3. Sousa CM, Machado JP, Greten HJ, Coimbra D. Occupational diseases of professional orchestra musicians from Northern Portugal: a descriptive study. Med Probl Perform Art 2016; 31(1): 8-12.
4. Jacukowicz A, Wężyk A. Dolegliwości mięśniowo-szkieletowe, słuchowe i skórne związane z grą na instrumencie. Med Pr 2018; 69(4): 383-394. (In Polish)

5. Pęciłło M. Selected aspects of absence at work and work-related health problems in Polish enterprises. Int J Occup Saf Ergon 2015; 21(3): 268–275.
6. Janiszewski M, Gałuszka G, Ochwanowska A, Gąciarz A, Hak A, Ochwanowski P, et al. Analiza biomechaniczna dynamiki i statyki narządu ruchu u muzyków instrumentalistów. Med Pr 2005; 56(1): 25-33. (In Polish).
7. de Souza Moraes GF, Papini Antunez A. Musculoskeletal disorders in professional violinists and violists: a systematic review. Acta Ortop Bras 2012; 20(1): 43-47.
8. Paarup HM, Baelum J, Holm JW, Manniche C, Wedderkopp N. Prevalence and consequences of musculoskeletal symptoms in symphony orchestra musicians vary by gender: a cross-sectional study. BMC Musculoskelet Disord 2011; 12: 223.
9. Rickert DL, Barrett MS, Halaki M, Driscoll T, Ackermann BJ. A study of right shoulder injury in collegiate and professional orchestral cellists: an investigation using questionnaires and physical assessment. Med Probl Perform Art 2012; 27(2): 65-73.
10. Rickert DL, Barrett MS, Ackermann BJ. Are music students fit to play? A case study of health awareness and injury attitudes amongst tertiary student cellists. Int J Music Educ 2015; 33(4): 426–441.
11. Pichardo JD. Musculoskeletal problems in pianists and their influence on professional activity. Med Probl Perform Art 2017; 32(2): 118-122.
12. Hagberg M, Thiringer G, Brandstrom L. Incidence of tinnitus, impaired hearing and musculoskeletal disorders among students enrolled inacademic music education: a retrospective cohort study. Int Arch Occup Environ Health 2005; 78: 575-583.
13. Nawrocka A, Mynarski W, Powerska-Didkowska A, Grabara M, Garbaciak W. Musculoskeletal pain among Polish music school students. Med Probl Perform Art 2014; 29(2): 64-69.
14. Jamison RN, Gracely RH, Raymond SA, Levine JG, Marino B, Herrmann TJ, et al. Comparative study of electronic vs. paper VAS ratings: a randomized, crossover trial using healthy volunteers. Pain 2002; 99(1-2): 341-347.
15. Leaver R, Harris EC, Palmer KT. Musculoskeletal pain in elite professional musicians from British symphony orchestras. Occup Med 2011; 61(8):549–555.
16. Steinmetz A, Scheffer I, Esmer E, Delank KS, Peroz I. Frequency, severity and predictors of playing-related musculoskeletal pain in professional orchestral musicians in Germany. Clin Rheumatol 2014; 34: 965–973.
17. Kok LM, Huistede BMA, Voorn WMA, Schoones JW, Nelissen RGHH. The occurrence of musculoskeletal complaints among professional musicians: a systematic review. Int Arch Occup Environ Health 2016; 89: 373–396.
18. Rodriguez-Romero B, Pérez-Valiño C, Ageitos-Alonso B, Pértega-Díaz S. Prevalence and associated factors for musculoskeletal pain and disability among Spanish music conservatory students. Med Probl Perform Art 2016; 31(4): 193-200.
19. Kochem FB, Silva JG. Prevalence and associated factors of playing-related musculoskeletal disorders in Brazilian violin players. Med Probl Perform Art 2017; 32(1): 27-32.
20. Jaskólski A, Jaskólska A. Podstawy fizjologii wysiłku fizycznego z zarysem fizjologii człowieka. Wrocław: Wydawnictwo AWF Wrocław; 2006. (In Polish).
21. Kubo K, Kanehisa H, Fukunaga T. Gender differences in the viscoelastic properties of tendon structures. Eur J Appl Physiol 2003; 88: 520-526.
22. Kaufman-Cohen Y, Ratzon N.Z. Correlation between risk factors and musculoskeletal disorders among classical musicians. Occup Med 2011; 61(2): 90-95.
23. Raymond DM, Romeo JH, Kumke KV. A pilot study of occupational injury and illness experienced by classical musicians. Workplace Health Saf 2012; 60(1):19-24.


Word count: 2136 • Tables: 5 • Figures: 0 • References: 23


**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Kaczorowska A, Mroczek A, Lepsy E, Kornek M, Kaczorowska A, Kaczorowska M, Lepsy K. Musculoskeletal pain in professional symphony orchestra musicians. Med Sci Pulse 2021; 15 (3): 38-43. DOI: 10.5604/01.3001.0015.0633.



**Correspondence address:**
Agata Mroczek
University of Opole, Institute of Health Sciences
pl. M. Kopernika 11a
45-040 Opole
E-mail: agata.mroczek@uni.opole.pl



Received: 08.06.2021
Reviewed: 18.07.2021
Accepted: 20.07.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Case reports

Published online: 29 July 2021

DOI: 10.5604/01.3001.0015.0631

# DIFFERENTIATING STROKE, TRANSIENT ISCHEMIC ATTACK, OR HEMIPLEGIC MIGRAINE IN A TEENAGER: A CASE REPORT

Monika Ciechanowska[1] A,D,E,F
• ORCID: 0000-0002-5258-017X

Jan Stachurski[2] B,D,E
• ORCID: 0000-0001-7097-4466

[1] Research Association of Pediatric Emergency Medicine, Medical University of Warsaw, Poland

[2] Department of Pediatric Emergency Medicine, Faculty of Health Sciences, Medical University of Warsaw, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** The symptoms of stroke in the pediatric population are less evaluated than in adults. Although certain indicators are characteristic of stroke – acute drooping of the mouth corners, hemiparesis, and headache – they are not pathognomonic. Other diseases may manifest with similar symptoms, such as the first episode of hemiplegic migraine, and should be differentiated from stroke at an emergency department.

**Aim of the study:** We present the differential diagnosis between stroke, transient ischemic attack, and first episode of hemiplegic migraine in a teenager with alarming focal symptoms.

**Case report:** We present a case of 15-year-old patient with acute headache, drooping of the right mouth corners, and hemiparesis of the right upper and lower limb. He was brought by ambulance to the emergency department under suspicion of a stroke. A series of diagnostic tests performed at the Emergency Department did not reveal any vascular incident. Further diagnosis was performed at the Neurology Department. The patient was discharged from the hospital with a suspicion of first attack of hemiplegic migraine or transient ischemic attack.

**Conclusions:** Differentiating stroke from other conditions in young patients is a significant challenge. The stroke diagnostic process in children requires further research to support accurate diagnosis and, if necessary, treatment as rapidly as possible.

**KEYWORDS:** pediatrics, hospital emergency service, migraine disorders, stroke

## Background

Pediatric stroke is a rare diagnosis, affecting 1.3–13 per 100,000 children [1-3]. Nevertheless, it is among the top 10 of causes of death among children (3.3–10% of affected children die [1, 3, 4]). Moreover, survivors may experience lifelong disabilities [5]. Up to 24.7% of patients had moderate to severe neurological impairment for two years after childhood ischemic stroke according to a study by Felling *et al.* [4]. Stroke can affect motor, cognitive, and behavioral function [6]. The number of pediatric patients with stroke is constantly increasing (35% increase in cases in the period 1990 to 2013 [5]), due to higher survival of children with risk factors and better diagnostic methods [2]. While the common etiology of stroke in adults is long-term acquired cardiovascular disease, in children it may be infection, hematologic pathologies, neoplasm, vascular abnormalities (mainly hemorrhagic stroke), or toxins [1]. However, coexisting conditions as risk factors are present in only 30% of pediatric ischemic stroke and 29% of hemorrhagic stroke cases [6]. The most common risk factors for ischemic stroke are congenital heart disease, head trauma, meningitis or encephalitis, sepsis, and sickle-cell disease [6]; for hemorrhagic stroke, they are congenital heart disease, arteriovenous malformations, and sepsis [6]. Pediatric

stroke affects boys more often and the median age is 8.4 years at the time of diagnosis [1, 6]. It is crucial to diagnose stroke as rapidly as possible to enable time-limited reperfusion therapies [5].

Transient ischemic attack (TIA) is rarely described in children [7]. The definition of TIA recently changed from a self-resolving focal cerebral ischemia with symptoms lasting < 24 h to transient neurological deficits of any duration with no evidence of acute brain tissue infarction [8]. Impairment after TIA, such as as cognitive deficits, fatigue, inability to generate quick and accurate voluntary movements, and abnormal gait, may persist for a long time after symptom resolution [8]. In an analysis by Adil *et al.* [7], TIA was associated with sickle cell disease (about 20% of cases), migraine (about 12% of cases), congenital heart disease (about 11% of cases), moyamoya disease, and stroke. In < 6% children affected by stroke, comorbidities such as anemia, coagulopathy, diabetes, hypertension, and obesity were present [7]. However, TIA with the identified risk factors is observed in only 60% of pediatric cases of this condition [7].

Clinical differentiation of stroke from its mimics is the first step of diagnosis. The most common childhood stroke mimic is migraine with aura, followed by seizure and infections of the brain [3,9]. According to a retrospective study by Toldo *et al.* [10], the mean age of onset of hemiplegic migraine (HM) was 10.5±3.8 years. Typical onset occurs in the second decade of life, but can occur in people ranging from 1–45 years [11]. The first episode should be differentiated from other plausible conditions such as stroke, mass lesions, metabolic disturbances, demyelinating disease, infection, and inflammatory diseases [11, 12].

The Recognition of Stroke in the Emergency Room (ROSIER) and Cincinnati Prehospital Stroke Scale (CPSS) are widely used by first-line healthcare providers to estimate the probability of acute stroke in adults; however, they are less accurate in children [13]. These tools are specific to ischemic stroke. In children, hemorrhagic stroke is responsible for higher percent of vascular incidents [13].

## Aim of the study

This study presents the differential diagnosis between stroke, TIA, and first episode of HM in a teenage patient with alarming focal symptoms.

## Material and methods

Data for this case report were collected on the basis of medical records from the Pediatric Teaching Clinical Hospital University Clinical Centre of the Medical University of Warsaw. The appropriate consent was obtained from the Director of the Hospital. The study followed the provisions of the Polish Act on Patient Rights and the Patient's Rights Ombudsman. In accordance with the Helsinki Declaration, the case report was fully anonymized and none of the data could be used to identify the patient. Photos are not presented to increase the degree of anonymity. The presentation of this case does not require the consent of the Bioethics Committee, in accordance with the requirements of Polish law.

## Case report

### Patient information

A 15-year-old boy was brought to the Emergency Department by Emergency Medical Service ambulance with headache, drooping of the right mouth corners, and hemiplegia of the right side of the body. A few hours earlier at school he reported scotoma and a headache 6/10 on the Numeric Rating Scale (NRS). He had received ibuprofen from a school nurse and thiethylperazine from the paramedics. He had nausea and vomited twice. He reported a tingling sensation and numbness in his right upper limb. The family history revealed that his father had high blood pressure diagnosed at the age of 32 and that his mother suffered from migraine with aura. The grandfather on the patient's dad's side died of stroke at age 69 and the grandmother on the mother's side died suddenly at age 48.

### Clinical findings

On admission to the Emergency Department of the Pediatric Teaching Clinical Hospital University Clinical Centre of the Medical University of Warsaw, the patient reported a headache with a NRS score of 5/10 in NRS in the frontal region. He denied photophobia and dizziness. Physical examination revealed central paresis of VII nerve, speech impediment, aphasia (a problem with finding proper words), temporal confusion, hemiparesis of upper and lower right limbs, a positive Babinski's sign on the right side, and negative meningeal symptoms. The peripheral lymph nodes were in normal size. In auscultation normal heart beating and breathing sounds. The liver and spleen were not enlarged. The patient's skin showed no pathological changes, his body temperature was 37 °C, blood pressure was 127/81, heart rate was 74, oxygen saturation was 100%, and capillary return was < 2 s. Fifteen minutes after examination, the patient's focal symptoms (drooping mouth corners, hemiplegia) subsided. During neurological examina-

tion 2 h after admission, the patient was conscious and oriented, but with temporary confusion, and received 15 points on the Glasgow Coma Scale (GCS). The patient's pupils were circular, reactive, and with slight asymmetry – the right pupil was wider than the left one. Sensation of the skin of the face was preserved and symmetrical. Symmetry of face muscles during movement and at rest was observed. The palatal arch tension was proper, the uvula was in the middle, and the tongue was normal. Slight asymmetry of muscle strength was present, with low muscle tone in the distant parts of the right upper and lower limbs. The finger-to-nose test was without pathology, the knee reflex was normal on the left side and negative on the right side, and the Achilles tendon reflex was stronger on the left side. The heel-to-knee test was bilaterally negative. The station test was negative. Free gait was normal. The patient could stand on their tiptoes and on their heels, but with difficulty on the right leg. Babinski's sign was bilaterally negative. Tension and sensation were preserved.

### Timeline

The patient reported that incidents of headaches had occurred before, with a recent frequency of once per week, but with no need for analgesics. There were two incidents of stronger headaches with vomiting in the last month, but without focal symptoms. The patient did not connect the headaches with exertion or emotional stress. He did not suffer from any chronic disease.

### Diagnostic assessment

Computed tomography (CT) without contrast was performed and revealed brain without any focal changes, no displacement of central structures, no evidence of fresh intracranial hemorrhage, and a symmetric ventricular system that was not extended. Coagulation test results were normal. On electrocardiography (ECG), the sinus rhythm was 68–85/minute, indicating sinus arrhythmia. Intraventricular conduction disturbances in V1 were observed. After cardiological consultation, it was qualified as a variant of the norm. In the evening on the day of admission, there was improvement in the patient's general state and reduced headache. On neurological examination, there was a lack of symptoms without focal damage of the brain. Deep tendon reflexes were present and symmetric.

A panel of diagnostic tests was ordered in order to exclude stroke and the patient was admitted to the Neurological Department. Laboratory tests were ordered, including Borrelia antibodies, ANA, ANCA, lipoprotein profile, TSH, fibrinogen, activity of protein C and S, homocysteine, genetic test for Leiden mutation, Ca, P, and vitamin D3. In addition, EEG, magnetic resonance imaging (angio–MRI), Doppler USG of carotid arteries, and chest X-ray were scheduled. MRI showed brain with no pathological changes, normal size ventricles, and no pathology in the intracranial arteries. Alert and sleeping EEG and Doppler USG of carotid arteries showed no pathological changes. On Doppler USG, the common carotid arteries, internal and external carotid arteries spectrum, and flow velocities were within the normal range. The vertebral arteries showed symmetrical, cephalic blood flow with a right diameter of 3.2 mm and a left diameter of 4 mm. The patient was discharged from the hospital with suspicion of HM or an episode of childhood TIA with motion sickness and referred to ambulatory neurological care for further investigation.

### Therapeutic intervention

Ibuprofen was administered by a school nurse. The patient received 0.9% intravenous NaCl and 6.5 mg thiethylperazinum from the Emergency Medical Service paramedics. During the stay in the hospital, the patient received intravenous acetaminophen and 0.9% NaCl.

### Follow-up and outcomes

All of the symptoms, including hemiparesis, headache, and nausea, subsided. Furthermore, CT, MRI, EEG, Doppler USG of carotid arteries, and laboratory tests showed no abnormalities. Follow-up was not assessed in this study.

## Discussion

Our patient presented with alarming symptoms of stroke: rapid focal neurological deficit as hemiplegia, speech disturbances, and headache [2, 5]. In the neonatal period, seizures are the most common presentation of ischemic stroke, while in older children – hemiparesis [4]. Hemiparesis was present in 90% of childhood stroke cases in an analysis by Bonfert *et al.* [3]. The first diagnostic step is to exclude stroke. CT is the test of first choice in the Emergency Department and should be performed within 1 hour, in accordance with the 2017 UK Guidelines for suspicion of stroke [14]. However, CT has poor sensitivity for early ischemic infarction, which is why the patient was referred for MRI [5]. Investigation of the etiology of the stoke is important, mostly to prevent recurrence in the future. It is crucial to perform vascular imaging

(e.g., MRI) to find possible malformations or rule out vasculitis or moyamoya disease [12]. For our patient, the onset of congenital heart disease was unlikely at the age of 15; nevertheless, ECG was performed and revealed no pathology. Blood morphology enabled us to exclude leucostasis in leukemia or infection (in children associated with strokes are acute varicella and herpes simplex infection [5]). Prothrombotic factors, including Factor V Leiden, prothrombin, lipoprotein a, protein C deficiency, and antiphospholipid antibodies, were controlled as a probable risk factor in ischemic stroke [2, 5]. Differentiating strokes from mimics has been well evaluated in adults; however, in children there is a need for further research. In a multivariable logistic regression model by Mackay *et al*. [9], arm weakness was the neurological sign with the higher odds ratio of stroke, but with wide (95%) confidence intervals. Other symptoms associated with increased odds ratio were being well the week before diagnosis, inability to walk, face weakness, and speech disturbance [9]. In pediatric populations, seizures and loss of consciousness are not independently associated with diagnosis of mimics – seizures are present in 11–52% of ischemic stroke cases and about 37–41% of hemorrhage stroke cases [9]. Visual symptoms, as presented by our patient, are not independently associated with stroke diagnosis, but may also indicate aura in migraine [9]. Aura affects 0.25 –0.33% of patients with migraine diagnosis [11, 12]. Aura in a migraine is classified as 'prolonged' when the duration is longer than 1 h but less than 7 days, and 'persistent' when lasting more than 7 days [12]. In the present case, the symptoms of suspected aura lasted for about 10 h. HM is a rare subtype of migraine that occurs in sporadic, familial, and inherited autosomal dominant forms. HM is characterized by motor aura – hemiparesis or motor weakness, or by non–motor aura symptoms such as visual, aphasic, and basilar type/brainstem symptoms, headache, photophobia, phonophobia, nausea, and vomiting [10]. There is a wide range of symptoms from pure HM to severe early-onset forms of recurrent comas, cerebral edema, or cerebellar ataxia [11]. Characteristic of different aura symptoms is slow progression over 20–30 min, typically beginning with visual symptoms followed by sensory, motor, aphasic, and basilar disturbances [11]. Visual symptoms can manifest as positive features, like flickering spots or zigzag lines, or as negative features like scotoma [11]. In the present case, scotoma was the only visual symptom; however, HM may also present in this way. Sensory symptoms combine positive features, such as pins and needles, pain, or a cold sensation, or negative symptoms such as numbness [11]. Our patient reported a tingling sensation and numbness of the right upper limb. Motor weakness typically starts in one hand and spreads to the arm and face, but can also spread to one whole side of the body [11], as in our case. The mean duration of motor aura is 3.5 h (range 5 min to 48 h) [10], and in our patient it was about 6 h. According to the International Classification of Headache Disorders III (ICHD III), the duration of motor aura should be <72 h and all aura symptoms should be fully reversible. Paraphasia or difficulty finding words impairs 52–66% of patients [11]. Our patient presented with temporal confusion and difficulty with finding proper words. HM can be sporadic or familial (in case of affected first-degree or second-degree relatives) [11]. Familial hemiplegic migraine (FHM) is divided into three subtypes based on underlying mutations in ion transportation genes: *CACNA1A* in FHM1, *ATP1A2* in FHM2, and *SCN1A* in FHM3. Sporadic cases can be caused by *de novo* mutations in these genes or by the inheritance of genetic mutations from a parent with no symptoms [11].

Our patient was discharged from the hospital with suspicion of first attack of HM or TIA, which did not present on CT or MRI imaging. The new definition of TIA is based on CT findings or, preferably, MRI scan, which better images TIA and minor strokes [3, 8]. When taking family history, it is crucial to ask about epilepsy, migraine, or hypercoagulability [12]. Adults with aura migraine have a higher risk of stroke than the general population; however, the risk is still low [12]. There are some differences in symptoms between HM and TIA, which are summarized in Table 1. In our patient, the symptoms progressed from visual to sensory and motor. The symptoms included positive sensory symptoms like tingling in the upper limb, which are more likely to suggest HM. However, this kind of headache and concomitant symptoms occurred for the first time and thus need to be observed in the future. CT and MRI scans revealed no vascular risk; however, this possibility should be further investigated.

Table 1. Differences in symptoms between hemiplegic migraine and transient ischemic incident [11, 12].

| Feature compared | Hemiplegic migraine | Transient ischemic incident |
|---|---|---|
| symptoms | progressive and successive positive and negative symptoms | abrupt negative symptoms |
| headaches | occurring regularly | rare |
| vascular risk factors | absent | present |

## Limitations

The biggest limitation of this study is the lack of follow-up. Diagnosing a patient with either TIA or HM requires longer observation, as other incidents with similar symptoms in the future can help establish the diagnosis.

## Conclusions

Pediatric stroke is rare condition; nevertheless, it should always be considered in patients with alarming symptoms. Although there are differences in the symptoms of stroke and hemiplegic migraine, the most important task in the Emergency Department is to exclude the most serious disorders. CT remains the mainstay of imaging in pediatric patients with stroke suspicion to exclude intracranial hemorrhage. Further diagnostics should include MRI and laboratory tests, depending on the clinical presentation of the patient and the pathologies considered in the differential diagnosis.

## References


1. Gumer LB, Del Vecchio M, Aronoff S. Strokes in children: a systematic review. Pediatr Emerg Care 2014; 30(9): 660-4.
2. Rajani NK, Pearce K, Campion T, Salpietro V, Planells M, Chong W, et al. Pediatric stroke: current diagnostic and management challenges. Quant Imaging Med Surg 2018; 8(10): 984-91.
3. Bonfert MV, Badura K, Gerstl J, Borggraefe I, Heinen F, Schroeder S, et al. Childhood stroke: awareness, interest, and knowledge among the pediatric community. Front Pediatr 2018; 6: 182.
4. Felling RJ, Rafay MF, Bernard TJ, Carpenter JL, Dlamini N, Hassanein SMA, et al. Predicting recovery and outcome after pediatric stroke: results from the international pediatric stroke study. Ann Neurol 2020; 87(6): 840-52.
5. Medley TL, Miteff C, Andrews I, Ware T, Cheung M, Monagle P, et al. Australian Clinical Consensus Guideline: the diagnosis and acute management of childhood stroke. Int J Stroke 2019; 14(1): 94-106.
6. Lo W, Stephens J, Fernandez S. Pediatric stroke in the United States and the impact of risk factors. J Child Neurol 2009; 24(2): 194-203.
7. Adil MM, Qureshi AI, Beslow LA, Jordan LC. Transient ischemic attack requiring hospitalization of children in the United States: kids' inpatient database 2003 to 2009. Stroke 2014; 45(3): 887-8.
8. Simmatis LER, Scott SH, Jin AY. The impact of tansient ischemic attack (TIA) on brain and behavior. Front Behav Neurosci 2019; 13: 44.
9. Mackay MT, Yock-Corrales A, Churilov L, Monagle P, Donnan GA, Babl FE. Differentiating childhood stroke from mimics in the emergency department. Stroke 2016; 47(10): 2476-81.
10. Toldo I, Brunello F, Morao V, Perissinotto E, Valeriani M, Pruna D, et al. First attack and clinical presentation of hemiplegic migraine in pediatric age: a multicenter retrospective study and literature review. Front Neurol 2019; 10: 1079.
11. Russell MB, Ducros A. Sporadic and familial hemiplegic migraine: pathophysiological mechanisms, clinical characteristics, diagnosis, and management. Lancet Neurol 2011; 10(5): 457-70.
12. Gelfand AA, Fullerton HJ, Goadsby PJ. Child neurology: migraine with aura in children. Neurology 2010; 75(5): 16-9.
13. Mackay MT, Churilov L, Donnan GA, Babl FE, Monagle P. Performance of bedside stroke recognition tools in discriminating childhood stroke from mimics. Neurology 2016; 86(23): 2154-61.
14. Royal College of Paediatrics and Child Health. Stroke in childhood: clinical guidelines for diagnosis, management and rehabilitation [serial online] 2017 May [cited 15.04.2021]. Available from URL: https://www.rcpch.ac.uk/resources/stroke-in-childhood-clinical-guideline.


Word count: 2662 • Tables: 1 • Figures: 0 • References: 14

**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Ciechanowska M, Stachurski J.
Differentiating stroke, transient ischemic attack, or hemiplegic migraine in a teenager: a case report.
Med Sci Pulse 2021; 15 (3): 44-48. DOI: 10.5604/01.3001.0015.0631.

**Correspondence address:**
Monika Ciechanowska
Department of Pediatric Emergency Medicine
Faculty of Health Sciences
Medical University of Warsaw
ul. Żwirki i Wigury 63a
02-091 Warszawa
E-mail: nika.ciechanowska@gmail.com

Received: 15.04.2021
Reviewed: 12.07.2021
Accepted: 15.07.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Case reports

Published online: 9 September 2021

DOI: 10.5604/01.3001.0015.2789

# THE EFFECTS OF PHYSIOTHERAPY USING PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION TECHNIQUES ON THE GAIT OF PATIENTS AFTER HIP AND KNEE ARTHROPLASTY: A CASE REPORT

Antonina Kaczorowska[1] A,D,E,F
• ORCID: 0000-0002-0488-8583

Jolanta Kaboth[1] A,B,D
• ORCID: 0000-0003-1206-5381

Ewelina Lepsy[1] A,D,F
• ORCID: 0000-0003-3663-9888

Agata Mroczek[1] A,D,E
• ORCID: 0000-0002-5246-0792

[1] Institute of Health Sciences, University of Opole, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

**Background:** Gait disturbances are a major problem for patients after arthroplasty. After the surgery, walking speed, the rhythm of locomotion, and the length of the steps are significantly reduced. One of the therapeutic methods used in gait re-education is proprioceptive neuromuscular facilitation (PNF).

**Aim of the study:** This study aimed to evaluate the effects of physiotherapy using PNF techniques on the gait of patients after hip and knee arthroplasty.

**Case report:** A 60-year-old woman with advanced osteoarthritis that received bilateral hip and right knee arthroplasties was examined. Before and after the therapy, the following tests were performed: measurement of the range of motion (ROM) of hip and knees joints in the sagittal plane using a goniometer, assessment of the symmetry of the lower limbs loading using the two scales test, assessment of the risk of falls using the "Timed Up and Go" test, assessment of balance and gait using the Tinetti test, and assessment of pain intensity using the visual analogue scale (VAS). Rehabilitation was comprised of 15 PNF therapies, including scapular and pelvic PNF patterns. The stabilization of the upper and lower trunk, lifting, shifting of the body's weight from one foot to another, gait cycle (the stance phase and the swing phase), walking forward, backward, and sideways, and walking up/down the stairs were also used. After the therapy, the flexion ROM in both hip and knees joints was improved. The lower limb symmetry index decreased from 1.167 to 1.121, and the sum of the points obtained in the Tinetti test increased from 22 to 26. Pain in the joints also decreased from 6 on the VAS scale to 4. However, the result obtained in the "Timed Up and Go" test after the therapy was increased by 0.5 s compared to before the therapy.

**Conclusions:** After hip and knee arthroplasties, physiotherapy using PNF techniques improved the gait and functional status of the patient. Continuation of this research using a larger number of patients is needed.

**KEYWORDS:** proprioceptive neuromuscular facilitation, knee arthroplasty, hip arthroplasty, functional gains, gait pattern, physiotherapy

## Background

The last decade has seen an exponential rise in the number of arthroplasties performed globally, and a sharp increase in the percentage of young patients hoping to improve their quality of life and return to physically demanding activities [1]. Hip arthroplasty and total knee arthroplasty are safe, and are among the most successful and cost-effective procedures in orthopedics for patients with osteoarthritis [1,2]. Hip and knee replacements are effective treatments for symptomatic, end-stage hip and knee osteoarthritis, aiming to relieve pain and restore joint function. However, their effects on clinical outcome and the rates of implant revision in patients undergoing joint replacement are still unclear [3]. The demand for implants of the large joints of the lower extremities is constantly increasing and the number of total hip and knee replacements will only continue to grow over the next decade. Although hip and knee arthroplasties are considered to be common elective and cost-effective operations, up to one-quarter of patients are not satisfied with the operation [4].

During the implantation of an artificial joint, doctors strive to both minimize the removal of damaged bone elements and install the prosthesis such that the subsequent movements perfectly reflect those that occur physiologically in a properly functioning joint [5, 6]. Degenerative changes in the joints can cause disturbances in the phases of gait, especially in the stance phase and the initial swing. In addition, degenerative changes reduce the range of motion (ROM), including extension, flexion, and abduction of the limb qualified for surgery compared to the second lower limb. This should be taken into account in the physiotherapy plan after surgery [7].

One of the therapeutic methods used in the re-education of the gait is proprioceptive neuromuscular facilitation (PNF). PNF practices promote multiple-plane joint movements, which relieve pain and increase joint ROM. The PNF intervention is also a successful method for relieving the symptoms of knee osteoarthritis. This treatment relieves pain without increasing knee adduction moment, enhances passive ROM, increases active knee flexion ROM, and increases hip adduction moment during stair descent in the elderly with knee osteoarthritis [8].

## Aim of the study

The current study aims to evaluate the effects of physiotherapy with PNF on the gait of patients after hip and knee arthroplasty through the presentation of a case report. As the number of patients receiving endoprosthesoplasty of the joints is increasing, it is worth assessing the effectiveness of PNF therapy on the quality of the gait, balance, symmetry of lower limb loading, ROM in hips and knees joints, and pain following surgery.

## Case report

### Patient characteristics

The patient was a 60-year-old woman with advanced osteoarthritis that had received bilateral hip and right knee arthroplasty surgery. The woman gave written consent for the publication of rehabilitation results and photos, and the research was approved by the Bioethic Commission of the Opole Medical School in Opole, Poland (consent no.: KB/204/Fi/2019).

At the time of the study, the arthroplasty of the left hip joint was carried out eight years earlier, and the right four years earlier. In both hips joints, uncemented fixation was used. Arthroplasty of the knee joint took place a year before the described rehabilitation. For the treatment of the knee joint, endoprosthesis elements with a cemented fixation was used. After these procedures, the patient went through rehabilitation and then independently performed isometric exercises, exercises using flexible tapes, and rode a stationary bicycle regularly. Despite performing these exercises, the functional condition was not satisfactory.

### Diagnostics before and after therapy

Before the therapeutic intervention, an examination was carried out that started with completing the examination card recommended by International Proprioceptive Neuromuscular Facilitation Association (IPNFA). The patient examination was documented in accordance with the International Classification Guidelines, Disability and Health (ICF). The history of the current disease and co-existing diseases were recorded. The patient's limitations in everyday functioning and the main goal of the patient were determined.

The main problem for the patient was pain in both hip joints and the right knee joint during long walks, walking up/down the stairs, and when lifting heavy objects (e.g., heavier shopping bags). In other activities of everyday life, such as personal hygiene, dressing, cooking, and cleaning, the patient was independent. Together with the patient, an analysis of facilitators and barriers among both personal and environmental factors, as well as opportunities and limitations in the level of participation and activity, was performed. For the personal factors, the main facilitators were the patient's motivation and relatively young age for people receiving arthroplasty,

The main facilitating environmental factors were installed handrails at the stairs and in the bathroom, and the possession of a stationary bicycle for exercise. The main barriers were the inactive lifestyle of the patient, even before the endoprosthesis procedures, the large number of stairs at home, and the lack of a shower.

Both before and after therapy the following tests were performed:

1. *Measurement of the ROM in the sagittal plane for the hip and knee joints using a goniometer*. For the hip joints, the range of active extension was measured in the supine position, the axis of rotation of the goniometer was the greater trochanter, the fixed arm ran parallel to the ground, and the movable arm along the long axis of the measured thigh. In the supine position, the range of active flexion in the right and left hip joints was measured, with the position of the goniometer as in the extension measurement. In the knee joints, the extent of active knee flexion was measured in the supine position with the lower limbs straightened. For this measurement, the axis of rotation of the goniometer was the lateral epicondyle of the femur, the fixed arm ran along the long axis of the thigh, and the movable arm along the long axis of the lower leg. There was no hyperextension in both knee joints. The obtained results were recorded using the adopted SFTR system. The name of this method is derived from first letters of the planes of movement that are measured (S – Sagittal, F – Frontal, T – Transverse, R – Rotation). In the sagittal plane (S – sagittal), the extension movement is recorded first, the starting position second, and the flexion movements third [9].

2. *Assessment of the symmetry of lower limb loading using the two scales test*. The patient was examined in a standing position, with the feet placed at an equal distance on two scales standing next to each other, the upper limbs lowered along the trunk, and the eyes directed straight ahead. The measurement was performed on a scale with an accuracy of 0.1 kg. On the basis of the obtained data, the loading symmetry index of the lower limbs was calculated as the quotient of the greater value to the lower value. This indicator should be in the range of 1.0–1.15 [10].

3. *Assessment of the risk of falling using the "Timed Up and Go" test*. The patient starts in a seated position, stands up upon therapist's command, walks 3 meters, turns around (180°), walks back to the chair, and sits down. The result of the test is the time it takes to perform these actions [11]. The interpretation of the results is based on the following values: < 10 seconds – normal, functional efficiency correct; 10–19 seconds – within normal limits for frail elderly and disabled patients, the patient can go outside on their own, does not need auxiliary walking equipment, patient is independent in most everyday activities, but an in-depth assessment of the risk of falls is recommended (e.g., using the Tinetti test); 20–29 seconds – the person needs assistance outside and indicates further examination and intervention, functional ability partially limited; ≥30 seconds – significantly reduced functional capacity, auxiliary equipment for walking is commissioned.

4. *Assessment of balance and gait using the Tinetti test*. The scale consists of two parts to assess balance and gait. The first part consists of 9 tasks. During the test, balance is assessed when sitting, standing up, immediately after getting up, while standing, while trying to nudge with eyes open and closed, turning 360°, and sitting down [12]. In the gait section, 7 elements are assessed: gait initiation, stride length and height (left and right feet), stride symmetry, gait continuity, walking path, swaying, and heel position when walking. For the individual tasks, 0, 1 or 2 points can be obtained, depending on the degree of irregularity found. The balance portion of the test can receive a maximum of 16 points, and the gait part 12 points. The interpretation of the results is based on the following values: 26–28 points – no risk of falls; <26 points – there is a risk of falls; <19 points – the risk of falls increases fivefold.

5. *Assessment of pain intensity using the Visual Analogue Scale (VAS)*. This scale enables assessment of the pain level on a scale from 0 to 10, where 0 is no pain at all and 10 is the maximum imaginable [13].

## Therapy applied

The patient's rehabilitation consisted of 15 PNF treatments. Each physiotherapy session lasted 45 minutes. There were two days off between the sessions, during which the patient performed homework (exercises) ordered by the therapist. The therapy was individually matched to the patient's skills and well-being, as well as pain symptoms on a given day. During the physiotherapeutic process, elements of the PNF techniques were performed (Table 1).

The patient did homework once a day for at least 20 minutes. This task included two exercises. The first included exercises on bathroom scales, where the patient stood on two bathroom scales (one foot on one scale) and tried to evenly load her lower limbs. The difficulty in this exercise was closing the eyes. In this case, in order to control the load distribution, the patient used the help of a third party. The second exercise involved touching a step with the foot, with independent repetition of the gait phases learned during the therapy, and paying particular attention to the correct body posture. In order to exclude compensation by the trunk of the body, this exercise was performed in front of a mirror. A 20 cm high step was used.

Table 1. Elements of the proprioceptive neuromuscular facilitation (PNF) techniques used in patient therapy

| Elements of therapy | Facilitation methods |
|---|---|
| Pelvic patterns: anterior elevation, posterior depression, posterior elevation, anterior depression (Figure 1) | Rhythmic Initiation |
| Symmetrical reciprocating exercises: scapula anterior elevation, pelvic posterior depression | Rhythmic Initiation |
| Stabilization of the upper trunk | Stabilizing Reversals |
| Lifting: exercise in a sitting position, one lower limb in contact with the ground | Replication |
| Mat exercises: glute bridge, stabilization/rotation of the lower trunk | Combination of Isotonics |
| Shifting of the body's weight from one foot to another | Rhythmic Initiation<br>Rhythmic Stabilization |
| Exercise in gait support phase: initial contact, loading response, mid stance, terminal stance | |
| Facilitation of swing phase: pre swing, initial swing, mid swing, terminal swing (Figure 2) | |
| Walking forward, backward, and sideways<br>Walking up/down the stairs (Figures 3–5) | Replication<br>Repeated Stretch from Beginning of Range, Repeated Stretch through Range |

Figure 1. Pelvic patterns – Rhythmic Initiation

Figure 2. Facilitation of Swing Phase

Figure 3. Gait training – Walking forward

Figure 4. Gait training – Walking backward

Figure 5. Walking sideways

## Results of the therapy

The patient's results before and after the therapy are presented in Table 2. After the therapy, the range of flexion motion in both hip and knee joints improved. The greatest difference was seen in the flexion movement of the left hip joint and amounted to 13°.

Table 2. Results of the patient's tests before and after the therapy.

| Variables | Before therapy | After therapy |
|---|---|---|
| Range of Motion:<br>Left hip joint<br>Right hip joint<br>Left knee joint<br>Right knee joint | <br>S 10°-0°-70°<br>S 10°-0°-80°<br>S 0°-0°-95°<br>S 0°-0°-83° | <br>S 10°-0°-83°<br>S 10°-0°-85°<br>S 0°-0°-97°<br>S 0°-0°-90° |
| Two Scales Test – lower limb loading symmetry index | 1.167 | 1.121 |
| "Timed Up and Go" Test | 12.64 [s] | 13.14 [s] |
| Tinetti Test | 22 | 26 |
| Visual Analogue Scale (VAS) | 6 | 4 |

The lower limb loading symmetry index before the therapy amounted to 1.167 and pointed to asymmetry, with the patient putting a greater load on the right lower limb. After the therapy, the index decreased to 1.12 and was within the normal range. The obtained result indicates that the asymmetry of lower limb loading was reduced.

The result obtained in the "Timed Up and Go" test after the therapy was increased by 0.5 s compared to before the therapy. However, it was observed that the patient walked during the test without noticeably swinging her entire torso, and the duration of the support phase on each lower limb was similar. The results of the "Timed Up and Go" test before and after the therapy were within the range of 10–19 s, which shows that the patient was able to go outside on her own and was independent in everyday activities.

The sum of the points obtained in the Tinetti test before the therapy was 22, and after the therapy it was 26. Both results show that there was a risk of falling. After the therapy, the results indicated that the patient could get up and sit down on her own without using the upper limbs. In addition, there was a reduction in pronounced swaying.

Physiotherapy with the PNF method also had a positive effect on the symmetry of the gait. In contrast to the patient's steps before treatment, the steps performed by both the left and right foot after therapy were of comparable length. The support phase of the gait after therapy was correct in terms of initial contact, loading response, and mid stance. The support phase of gait on the left and right foot also lasted a similar amount of time. The element that did not change after the applied rehabilitation was the patient's condition on a broad basis in order to maintain balance. An additional positive effect of the therapy was a reduction in pain from the joints. Before the therapy, the patient assessed her pain as 6 on the VAS, and after therapy as 4 (Table 2).

## Discussion

The aim of this study was to assess the gait, balance, symmetry of lower limb loading, ROM in the hip and knee joints, and pain before and after PNF therapy in a patient with bilateral hip and right knee arthroplasty. After the therapy, the ROM of the hips and knee joints in the sagittal plane improved, the asymmetry of the lower limb loading decreased, and balance measured with the Tinetti test improved. Although the time of "Timed Up and Go" test increased slightly, the test results indicated that the patient was in the group of people who are independent in their daily activities. In addition, the swaying of the entire trunk of the body during walking was reduced and the symmetry of the gait improved. Pain was also reduced, which was extremely important for the patient.

The techniques used in the PNF method are often used in the treatment of orthopedic patients. Rhythmic initiation of movement is a technique that is helpful in learning appropriate movement patterns at the beginning of rehabilitation. The replication technique also allows the patient to be taught the final position of movement. The combination of isotonic contractions on healthy limbs and trunk causes irradiation within the synergistic muscles of the exercised limb. Rhythmic stabilization is used to stabilize the newly achieved position by the patient (e.g., one-legged knee on the affected lower limb, standing, midstance phase on the affected limb), to approximate the affected lower limb, and to improve balance and overall endurance. Stabilizing reversals are also used to stabilize the newly achieved position by the patient, to improve balance in problematic positions, and to improve overall endurance. Repeated stretch applied to healthy limbs will also strengthen the irradiation to synergistic muscles on the exercised limb [14].

Many studies have analyzed the functional efficiency, structures, and activity of patients before and after lower limb arthroplasty. However, there are few reports on the effectiveness of the PNF method in patients with endoprosthesis. Jaczewska-Bogacka et al. investigated the effectiveness of PNF physiotherapy in patients after knee replacement prosthesis. After 4 days of standard postoperative rehabilitation, the group of patients underwent a 3-week rehabilitation using the PNF method. After the therapy, the patient's gait kinematics improved, including shortening the stance phases, gait cycle duration, and double support phase, and prolonging swing phase veloc-

ity, gait velocity, cadence, step length, and gait cycle length. Moreover, walking speed and stride length improved, and postoperative pain decreased [15]. Alaca et al. also conducted studies of patients after total knee arthroplasty. Apart from the standard rehabilitation program, the first group underwent PNF therapy and the second group received passive motion therapy. In both groups, the time needed to achieve the required ROM was similar. On the other hand, in the PNF group, there was an earlier improvement in the functional indicators of gait [16]. Other studies have examined the effectiveness of preoperative physiotherapy, including PNF therapy, on functional parameters after total knee replacement surgery. In the group that used preoperative physiotherapy, an increase in the level of physical activity was found after surgery compared to those who did not receive preoperative physiotherapy [17].

The current therapeutic results for the described patient confirm the effectiveness of the PNF method in the rehabilitation of patients after arthroplasty of the hip and knee joints. Due to the fact that the number of people receiving arthroplasty continues to increase, more research is needed on the effectiveness of various methods of rehabilitation following these surgeries.

## Conclusions

The number of total hip and knee replacements will increase in the next decade. Physiotherapy with the PNF method improved the gait and functional status of the patient after hip and knee arthroplasty. A continuation of this research with a larger number of patients is needed.

## References


1. Fontalis A, Epinette JA, Thaler M, Zagra L, Khanduja V, Haddad FS. Advances and innovations in total hip arthroplasty. SICOT J 2021; 7: 26.
2. Papalia R, Campi S, Vorini F, Zampogna B, Vasta S, Papalia G, Fossati C, Torre G, Denaro V. The role of physical activity and rehabilitation following hip and knee arthroplasty in the elderly. J Clin Med 2020 9; 9(5): 1401.
3. Daigle ME, Weinstein AM, Katz JN, Losina E. The cost-effectiveness of total joint arthroplasty: a systematic review of published literature. Best Pract Res Clin Rheumatol 2012; 26(5): 649-58.
4. Arden N, Altman D, Beard D, Carr A, Clarke N, Collins G, et al. Lower limb arthroplasty: can we produce a tool to predict outcome and failure, and is it cost-effective? An epidemiological study. Southampton (UK): NIHR Journals Library; 2017 Jun PMID: 28678462.
5. Sieczka Ł, Bohatyrewicz A, Pituch Sz. Prostheses of the hip arthroplasty yesterday and today. Forum Reumatologiczne 2017; 3(4): 216–221.
6. Tejszerska D, Długoszewski T, Gąsiorek D. Analiza wytrzymałościowa endoprotezy stawu kolanowego. Aktualne Problemy Biomechaniki 2010; 4: 213-218. (In Polish).
7. Srokowski G, Bułatowicz I, Kaźmierczak U, Tyma R, Radzimińska A, Strojek K, et al. Ocena jakościowa chodu oraz badanie funkcji biodra pacjentów zakwalifikowanych do zabiegu endoprotezoplastyki stawu biodrowego. Now Lek 2010; 79(3): 183-190. (In Polish).
8. Song Q, Shen P, Mao M, Sun W, Zhang C, Li L. Proprioceptive neuromuscular facilitation improves pain and descending mechanics among elderly with knee osteoarthritis. Scand J Med Sci Sports 2020; 30(9): 1655-1663.
9. Skolimowski T (ed.). Badania czynnościowe narządu ruchu w fizjoterapii. Wrocław: Wydawnictwo AWF Wrocław; 2012. (In Polish).
10. Czesak J, Szczygiel A, Żak M. Wpływ postępowania fizjoterapeutycznego na wskaźnik symetryczności obciążenia kończyn dolnych u osób po 65. roku życia – badanie pilotażowe. Gerontol Pol 2011; 19(3-4): 171-175. (In Polish).
11. Bohannan RW. Reference values for the timed up and go test: a descriptive meta-analysis. J Geriatr Phys Ther 2006; 29: 64-68.
12. Tinetti M. Performance-oriented assessment of mobility problems in elderly patients. J Am Geriatr Soc 1986; 34: 119-126.
13. Jamison RN, Gracely RH, Raymond SA, Levine JG, Marino B, Herrmann TJ, et al. Comparative study of electronic vs. paper VAS ratings: a randomized, crossover trial using healthy volunteers. Pain 2002; 99(1-2): 341-347.
14. Zelek M. Wykorzystanie koncepcji PNF po amputacjach kończyn dolnych. [The PNF concept aplication to lower limbs amputations].Rehabilitacja w Praktyce 2014; 4: 18-24. (In Polish).
15. Jaczewska-Bogacka J, Stolarczyk A. Improvement in gait pattern after knee arthroplasty followed by proprioceptive peuromuscular facilitation physiotherapy. Adv Exp Med Biol 2018; 1096: 1-9.
16. Alaca N, Atalay A, Güven Z. Comparison of the long-term effectiveness of progressive neuromuscular facilitation and continuous passive motion therapies after total knee arthroplasty. J Phys Ther Sci 2015; 27(11): 3377-80.
17. Graenischer P, Stöggl T, Fucentese SF, Adelsberger R, Swanenburg J. Preoperative exercise in patients undergoing total knee arthroplasty: a pilot randomized controlled trial. Arch Physiother 2020; 10: 13.

Word count: 2927 • Tables: 2 • Figures: 5 • References: 17

**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Kaczorowska A, Kaboth J, Lepsy E, Mroczek A.
The effects of physiotherapy using proprioceptive neuromuscular facilitation techniques on the gait of patients after hip and knee arthroplasty: a case report.
Med Sci Pulse 2021; 15 (3): 49-55. DOI: 10.5604/01.3001.0015.2789.

**Correspondence address:**
Agata Mroczek
University of Opole, Institute of Health Sciences
pl. M. Kopernika 11a
45-040 Opole
E-mail: agata.mroczek@uni.opole.pl

Received: 02.05.2021
Reviewed: 06.07.2021
Accepted: 30.07.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Reviews

Published online: 24 September 2021

DOI: 10.5604/01.3001.0015.2815

# NATURAL PREPARATIONS SUPPORTING THE TREATMENT OF CORONARY HEART DISEASE: A NARRATIVE REVIEW

Aleksandra Sidor[1 A,B, D-F]
• ORCID: 0000-0001-9902-8502

Monika Soczewka[1 A,B, D-F]
• ORCID: 0000-0003-1718-3715

Damian Skrypnik[2 A,D,E]
• ORCID: 0000-0001-5643-6899

1 Student Scientific Club of Clinical Dietetics, Department of Treatment of Obesity, Metabolic Disorders and Clinical Dietetics, Faculty of Medical Sciences, Poznan University of Medical Sciences, Poznan, Poland

2 Department of Treatment of Obesity, Metabolic Disorders and Clinical Dietetics, Poznan University of Medical Sciences, Poznan, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

Coronary heart disease (CHD) is currently the most common cause of death in the world. Diet plays a significant role in the treatment of CHD. The purpose of this review is to present the current knowledge on natural products, including soybeans, garlic, black coffee, tea, and monounsaturated fatty acids, as well as components of the Mediterranean diet and Portfolio diet in supporting the treatment of CHD. A literature search was carried out in a scientific search engine database. Combinations of the following terms were used: "coronary heart disease", "ischemic heart disease", and "natural preparation of CHD". Scientific publications were systematically examined to identify both direct and indirect evidence that met the aims of this review. Only articles that considered human subjects were included. After the selection process, a total of 28 articles were included in the review. The main findings were as follows: garlic ameliorates the function of the endothelium, blood pressure parameters, and lipid profiles. Coffee improves glucose metabolism and shows antioxidant and anti-inflammatory properties. Tea ameliorates the lipid profile. Monounsaturated fatty acids show antioxidant properties. The Mediterranean diet has antihypertensive and antioxidant properties and reduces inflammation. The Portfolio diet shows lipid-lowering and antioxidant properties. Diet in CHD is an extremely important factor supporting treatment and can significantly modify the parameters of cardiovascular risk. However, there is still a need for more research on the properties of natural products and their health effects.

**KEYWORDS:** coronary heart disease, prevention, natural preparations, diet

## Background

Ischemic heart disease (IHD) is a disease entity comprising eight subtypes according to the ICD-10 classification (International Statistical Classification of Diseases and Related Health Problems 10th Revision) defined as all states of myocardial ischemia regardless of the pathomechanism [1]. Coronary artery disease (CAD), which is one of the eight subtypes of IHD, is an abnormal process of plaque formation in the epicardial arteries that can constrict and close the vessels. CAD is divided into the following types: stable coronary syndromes (chronic coronary disease), stable angina pectoris, microvascular angina, angina associated with the muscle bridges over the coronary arteries, vasospastic angina (synonym: Prinzmetal angina), and acute coronary syndromes (ACS). On the basis of the baseline electrocardiogram (ECG), ACS is further divided into ST-elevated myocardial infarction (STEMI) and non-ST-elevated myocardial infarction (NSTEMI). Based on the clinical picture, ECG and biochemical indicators of myocardial damage in ACS include unstable angina, NSTEMI, STEMI, unspecified myocardial infarction, and sudden cardiac death [2].

The most common pain symptoms related to cardiac ischemia are located in the chest in the area of the sternum, but can cover the entire area from the upper abdomen to the mandible, the space between the shoulder blades, and both upper limbs, including the wrists and fingers. They are usually depicted as a feeling of pressure, squeezing, weight, choking, burning, or tightening. Dyspnea or discomfort in the chest is common along with fatigue, pre-syncope, burning, anxiety, or the feeling of impending death [2].

Patients with stable CAD are those in whom symptoms are absent or controlled by medication or revascularization. Especially in this group of patients, treatment of comorbidities, including type 2 diabetes and hypertension, should be optimized to minimize cardiovascular risk. Beta blockers are drugs that significantly slow down the heartrate. It has been shown that the use of this group of drugs significantly prolongs the life of patients [3, 4]. Cholesterol-lowering drugs, including statins, along with antiplatelet drugs have been used for many years to reduce the incidence and severity of IHD [3].

Coronary heart disease (CHD) is currently the most common cause of death in the world. After the age of 75, the frequency of CHD diagnosis is comparable in both sexes. Epidemiological studies clearly indicate that the elimination of risk factors, such as alcohol abuse, smoking, unhealthy and irregular eating habits, stress, and lack of physical activity, significantly ameliorates the prevalence of CHD [1].

Diet plays an extremely important role in the treatment of IHD. Another important element is proper weight control, avoiding overweight and obesity. In order to properly control blood pressure, it is recommended that consumption of table salt is limited to 5 g per day (one teaspoon). A minimum amount of alcohol should be consumed. The traditional Mediterranean diet is considered to be the most effective diet for patients with IHD. With the application of this diet, a patient's lipid profile can be significantly improved [4, 5]. Natural preparations are secondary metabolites synthesized and used by organisms for defensive and adaptive purposes. [6, 7]. In common understanding, natural preparations are also various types of dietary supplements, the raw materials for which are obtained from the natural environment. Natural preparations are used as healing substances and are an important source of new therapeutic agents [6, 7].

## Purpose of the analysis

The aim of the study is to present findings on the use of natural preparations and ingredients in the treatment of IHD.

## Materials and Methods

A literature search was carried out in a scientific search engine database (PubMed). The following terms were used in combination: "coronary heart diseases" and "soy bean" or "green tea" or "coffee" or "Mediterranean diet" or "Portfolio diet" or "garlic" or "monounsaturated fatty acids" or "natural products".

Articles published in English since 2015 were included. Papers from earlier years were included if they contained key information unavailable elsewhere. Articles that presented both human and animal studies were included. Observational and intervention studies were included. Case reports were excluded.

In total, 10,027 titles were found in the PubMed database. After reading the headings, 9,803 abstracts were excluded. The remaining 224 articles were analyzed and 173 were excluded, leaving 51 articles (Fig. 1). All articles are public information available through the PubMed search engine.

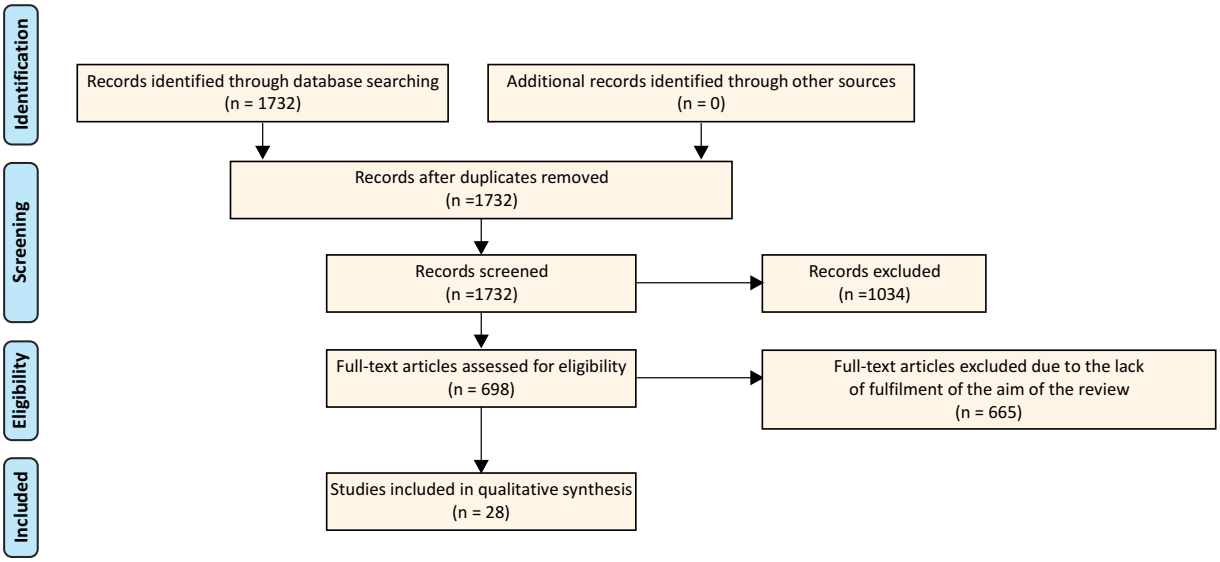


Figure 1. Flow chart of study selection

## Natural preparations

### *Soy*

Soybean (*Glycine max*) has been cultivated for almost 5,000 years on the Asian continent, first in China and then in Japan. It was introduced to Europe in the 18th century and to the United States of America (USA) in the 19th century. Currently, the USA is the leading producer of soybeans and supplies 30% of the world's production. Over the past decades, the popularity of soy products in North America has increased, especially after the US Food and Drug Administration (FDA) made a health claim that foods that contain soy protein minimize the risk of CHD. Soybean is a plant rich in high-quality proteins and low in saturated fatty acids. Epidemiological studies clearly show the preventative effects of soy consumption in chronic diseases such as obesity, cardiovascular diseases, insulin resistance, certain types of cancer, type 2 diabetes, and autoimmune disorders [8]. Proteins and related phytochemicals and isoflavones are responsible for the beneficial effects of soy on health. Over the past decade, studies have shown the health benefits of soy consumption. Many soy peptides that lower blood triglycerides and cholesterol and block lipid synthesis and storage have been identified. Soybean is a source of peptides that show a wide range of biological activities, such as antihypertensive, anticancer, antioxidant, anti-inflammatory, immunostimulatory, and neuromodulatory properties. These properties were proven in a study by Chatterjee et al. [8]. In a meta-analysis by Lou D. et al., it was found that the consumption of soy isoflavone was inversely proportional to the occurrence of stroke and CAD [9]. A study by Sathyapalan et al. showed that in postmenopausal women, the risk of cardiovascular diseases was reduced after using soy and soy isoflavones. Thanks to the use of these preparations, the risk of death due to cardiovascular diseases was reduced by as much as 42% and the probability of myocardial infraction was reduced by 37%. It was also shown that the risk of developing IHD was reduced by 27% in 10 years [10]. Studies are still needed to investigate the effects of soy in patients with IHD.

In summary, soybeans lower lipids, reduce triglyceride levels in the blood, and have anti-cancer, anti-inflammatory, antioxidant, immunostimulatory, and neuromodulatory effects.

### *Garlic*

Garlic (*Allium sativum* L.) is a herb used in natural therapies [11]. It is also one of the most popular vegetables around the world and a frequently used spice in the Mediterranean and Asia. It is characterized by the content of flavonoids and organic sulfur compounds [12]**.** However, the main active ingredient found in fresh and powdered garlic is allicin, an inactive biological precursor. The conversion of alliin to allicin is influenced by the enzyme allinase, which is found in fresh garlic and dried garlic powder tablets. From tablets, allinase is released only after dissolving in the gastrointestinal tract. The authors of a randomized trial found that daily consumption of 800 mg of powdered garlic tablets improved the function of the vascular endothelium and lowered C reactive protein (CRP) levels in patients with elevated CRP and IHD after angioplasty [11]. Garlic preparations are also used to lower the concentration of total cholesterol (TC), but the decrease is clearly greater in people with hypercholesterolemia and the greatest benefit is recorded during the first three months of use. The effect of garlic on the high density lipoprotein cholesterol (HDL-cholesterol) fraction is insignificant. However, the consumption of garlic oil resulted in the most noticeable increase in the HDL-cholesterol fraction. The effect of garlic on the low density lipoprotein cholesterol (LDL-cholesterol) fraction is still debatable, and the level of triacylglycerols, in turn, significantly decreased in many studied groups in response to garlic intake. Garlic supplementation also influences the regulation of blood pressure – both systolic and diastolic blood pressure decreased significantly after the use of a garlic supplement [12]. Garlic is considered a safe substance. However, in the event of gastrointestinal problems due to intolerance, use of an odorless preparation is recommended [11]. Side effects of garlic supplementation are limited to bad breath, body odor, unpleasant taste, and allergic reactions (e.g., skin rash) and are very rare [12].

In summary, garlic improves vascular endothelial function and the lipid profile and regulates blood pressure parameters.

### *Black coffee*

Coffee is a complex infusion containing over 1000 compounds, many of which are biologically active, including caffeine, a central nervous system stimulant and a bronchodilator drug; diterpenes, which can increase blood cholesterol levels; chlorogenic acid, which improves glucose metabolism; melanonidins, quinides, lignans, which show antioxidant and anti-inflammatory properties [14]. It is recommended to consume 2–3 cups of black coffee per day. In one meta-analysis analyzing studies on the risk of myocardial infarction, it was shown that consumption of > 4 cups of black coffee per day significantly increases the risk of myocardial infraction. Therefore, in patients with IHD, consumption of black coffee should not exceed 3 cups per day [15]. Coffee consumption – up to 6 cups

per day – has been shown not to be associated with an increased risk of developing high blood pressure. Caffeine is metabolized by cytochrome P450 1A2 (*CYP1A2*). People homozygous for the *CYP1A2**1A allele metabolize caffeine rapidly while people with the *CYP1A2**1F allele tend to metabolize caffeine slowly, so the latter group is more likely to develop hypertension and IHD with higher coffee consumption (especially >6 cups a day). An epidemiological study showed that coffee consumption may reduce the likelihood of obesity. Especially among people genetically predisposed to obesity, higher coffee consumption correlates with a lower body mass index [16]. Adverse effects on the lipid profile were observed in the presence of previous dyslipidemias or the consumption of unfiltered coffee, and in people who drink >6 cups of coffee per day. Unfiltered coffee contains the bioactive particle cafestol, which inhibits cholesterol 7-α-hydroxylase, which is involved in the synthesis of bile acids. Thus, this enzyme adversely affects the lipid profile. In contrast, filtered coffee does not have this effect, as the filter paper retains the oil drops containing diterpenes [15].

In summary, coffee consumption is associated with a lower risk of developing IHD [17]. Moreover, coffee has antioxidant and anti-inflammatory effects and improves glucose metabolism.

*Tea*

Black tea is one of the most consumed beverages in the world. Polyphenols, especially tea flavonoids, have an inhibitory effect on the oxidation reactions caused by free radicals and prevent or delay atherosclerosis. Flavonoids also have antithrombotic, anti-inflammatory, and endothelial protective properties. According to recent studies, chronic inflammation and oxidative stress play an important role in the pathogenesis of arterial hypertension [18]. In arterial hypertension, the production of various pro-inflammatory cytokines is increased, including interleukin-1 (IL-1), interleukin-17 (IL-17), interleukin-6 (IL-6), and tumor necrosis factor (TNF-α) [19]. CRP also indicates the presence of increased inflammation. Studies have shown a relationship between elevated CRP levels and blood pressure [20, 21]. Catechins are the most effective polyphenol compounds in green tea and constitute about 78% of the polyphenol fraction. They effectively eliminate free radicals and prevent atherosclerosis and arterial hypertension, thus preventing cardiovascular diseases [22]. Daily consumption of tea may be associated with a reduced risk of developing IHD [23]. A cohort study of healthy people showed that tea consumption slowed decline in HDL-cholesterol levels compared to people who did not drink tea**.** Moderate consumption of tea during the day – around 2–3 cups – may be beneficial for the development of atherosclerosis and reducing heart failure, arrhythmia, and overall mortality [15]. A study by Li [24] showed that drinking 4 cups of green tea per day for 4 weeks significantly decreased CRP levels in a group of smokers, suggesting anti-inflammatory effects of catechins [25, 26]. The same researchers proved that epigallocatechin gallate (EGCG), which is contained in tea, inhibits CRP synthesis induced by angiotensin II and IL-6, and thus reduces the production of free oxygen radicals [24]. Ponteza et al. [27] demonstrated comparable antihypertensive effects of the pharmacological treatment enalapril and the consumption of green tea (4 g of green tea extract), which resulted in lower blood pressure in rats with essential hypertension. Green tea also has a beneficial effect on the lipid profile. A study by Stepien M et al. [28] showed that supplementation with green tea extract lowered both serum LDL cholesterol and total cholesterol.

In summary, tea has anticoagulant, anti-inflammatory, and antioxidant effects and improves the lipid profile.

## Monounsaturated fatty acids and polyunsaturated fatty acids

Monounsaturated fatty acids (MUFA) contribute significantly to the improvement of the blood lipid profile in interventional studies. Omega-3 fatty acids, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), which are all present in fish oil, help prevent CHD. A lower omega-6 to omega-3 ratio is beneficial for avoiding inflammation in chronic diseases. A 4:1 ratio of omega-6 to omega-3 fatty acids in the diet reduces the mortality from IHD by 70%. A study conducted in the Dutch population showed that low levels of EPA and DHA consumption (40–150 mg/dl) are not important to avoid developing IHD [29]. Unlike polyunsaturated fatty acids (PUFA), MUFAs come from various plant and animal sources and have many beneficial health properties. A study by Zong G et al. found a beneficial relationship between MUFA consumption and the risk of CHD. The researchers noted a noticeably low risk of CHD in patients consuming a diet in which trans fats and refined carbohydrates were replaced with MUFAPs. The beneficial effects of MUFA in the long-term prevention of CHD can be seen in patients whose primary source of MUFA is plant-derived products such as vegetable oils, nuts, and other related food products [30, 31].

In summary, monounsaturated fatty acids have anti-inflammatory and antioxidant effects and reduce the risk of CHD.

## Components of the Mediterranean diet

The Mediterranean diet is widely recognized as one of the healthiest diets in the world. The definition of the Mediterranean diet was set by Ancel Keys. Studies on health effects of the Mediterranean diet began in the 1960s in Greece and southern Italy. Numerous scientific studies suggest that its use may lower the risk of developing various diseases such as cardiovascular diseases [32]. To date, it has not been established whether the individual components of the Mediterranean diet or the Mediterranean diet as a whole are supportive. The traditional Mediterranean diet is rich in fresh vegetables, olive oil monounsaturated fatty acids, whole grains, nuts, pulses, fish, and seafood with moderate alcohol consumption. The consumption of fish has positive effects on the lipid profile and blood coagulation process, has an antihypertensive effect, and reduces inflammation [33, 34]. Currently, it is recommended to eat fish 1–2 times per week or 40–60 g per day, especially in people at high risk of cardiovascular diseases. Fish should find a permanent place in the diet of this group of people, either as an independent product or as an integral part of the Mediterranean diet. Fish are characterized by a high concentration of omega-3 acids [33]. The consumption of olive oil increases the concentration of HDL-cholesterol. Due to the presence of phenolic compounds, it is an effective antioxidant. Olive oil also reduces systemic inflammation and improves endothelial function. Due to the abundance of vegetables and fruits, the Mediterranean diet has an antihypertensive effect. In addition, vegetables are a rich source of micronutrients and dietary fiber and have antioxidant properties. The American Heart Association (AHA) guidelines indicate that the consumption of whole grains rich in dietary fiber significantly improves the lipid profile and lowers blood pressure, thus reducing morbidity and mortality due to cardiovascular diseases. The AHA recommends that the diet should contain about 25–30 g of dietary fiber daily from various sources [33, 34]. Research shows the beneficial effects of consumption of whole grains on body mass index (BMI) and waist circumference. In addition, studies found significant improvement in CRP levels and lipid profiles in the group of people consuming whole grain carbohydrates for 12 weeks. Subsequently, a randomized clinical trial was conducted in a group of 230 patients. It has been hypothesized that carbohydrate products from whole oat grains result in significant improvement in blood pressure and lipid profiles [33].

In summary, the Mediterranean diet improves the lipid profile, blood coagulation, and vascular endothelial function and also has hypotensive, anti-inflammatory, and antioxidant effects.

## Portfolio diet ingredients

The Portfolio diet is a nutritional benchmark created in the early 2000s as a "portfolio" of four food products that have been certified to reduce blood cholesterol levels by the US FDA, Health Canada, and the European Food Safety Authority. The 2000 kcal diet contains 42 g of nuts; 50 g of vegetable protein derived from legumes; 20 g of soluble fiber from oats, barley, psyllium, eggplant, oranges, okra, or apples; and 2 g of plant sterols. A variant of the Portfolio diet was tested in which MUFA monounsaturated fat was replaced with carbohydrates. Each ingredient has been shown to lower LDL cholesterol. Current evidence suggests that the Portfolio diet reduces the estimated 10-year risk of CHD [35].

In summary, the Portfolio diet lowers lipids and has an antioxidant effect.

Table 1. Postulated properties of selected dietary components

| Dietary component | Properties | References |
|---|---|---|
| Soybeans | lipid-lowering, reduces the level of triglycerides in the blood, anti-cancer, anti-inflammatory, antioxidant, immunostimulating, neuromodulating | [8, 9, 10] |
| Garlic | improvement of vascular endothelial function, improvement of the lipid profile, regulation of blood pressure parameters | [11, 12] |
| Coffee | antioxidant, anti-inflammatory, improvement of glucose metabolism | [14, 15, 16, 17] |
| Tea | anticoagulant, anti-inflammatory, antioxidant, improvement of the lipid profile | [18, 20] |
| Monounsaturated fatty acids | anti-inflammatory, antioxidant, reduces the risk of CHD | [29, 30] |

Table 2. Postulated properties of selected diets

| Diet | Properties | References |
|---|---|---|
| Mediterranean diet | improvement of the lipid profile, improvement of the blood coagulation process, hypotensive, anti-inflammatory, antioxidant, improvement of vascular endothelial function | [33, 34] |
| Portfolio diet | lipid-lowering, antioxidant | [35] |

## Conclusions

CHD is a medical condition that requires diet therapy. There is ample evidence to suggest positive health effects from the consumption of natural products. Their regular intake is a factor that significantly modifies the parameters of cardiovascular risk. Soy has a lipid-lowering effect. It lowers the

level of triglycerides in the blood and has anti-cancer, anti-inflammatory, antioxidant, and immunostimulating properties. Garlic improves the functions of the vascular endothelium, improves the lipid profile, and improves blood pressure parameters. Coffee improves glucose metabolism and shows antioxidant and anti-inflammatory properties. Tea is characterized by anti-inflammatory and antioxidant properties and improves the lipid profile. Monounsaturated fatty acids have anti-inflammatory and antioxidant properties and lower the risk of CHD. The Mediterranean diet improves the lipid profile and blood-clotting process; reduces inflammation; has antihypertensive, anti-inflammatory and antioxidant properties; and improves the functions of the vascular endothelium. The Portfolio diet shows lipid-lowering and antioxidant properties. However, there is still a need for more research on the properties of these dietary products and the health effects of their consumption.

## References


1. Kasprzyk M, Wudarczyk B, Czyz R, Szarpak L, Jankowska-Polanska B. Ischemic heart disease – definition, epidemiology, pathogenesis, risk factors and treatment. Post Nauk Med 2018; 31(6): 358-360.
2. Brignole M, et al. ESC Guidelines for the diagnosis and treatment of chronic coronary syndromes (2019); Working Group of the European Society of Cardiology (ESC) for the management of chronic coronary syndromes. [cited: 11.05.2020] Available from URL: http://gdansk.ptkardio.pl/files/articles/99/wytyczne_esc_dotyczace_rozpoznawania_i_leczenia_omdlen_2018.pdf
3. Wan Q, Qian S, Huang Y, Zhang Y, Peng Z, Li Q, et al. Drug Discovery for Coronary Artery Disease. Adv Exp Med Biol 2020; 1177: 297-339.
4. Cruz Rodriguez JB, Alkhateeb H. Beta-Blockers, Calcium Channel Blockers, and Mortality in Stable Coronary Artery Disease. Curr Cardiol Rep 2020 Jan 29; 22(3): 12.
5. Houston M. The role of noninvasive cardiovascular testing, applied clinical nutrition and nutritional supplements in the prevention and treatment of coronary heart disease. Ther Adv Cardiovasc Dis 2018 Mar; 12(3): 85-108.
6. Chatterjee C, Gleddie S, Xiao CW. Soybean Bioactive Peptides and Their Functional Properties. Nutrients. 2018 Sep 1; 10(9): 1211.
7. Bernardini S, Tiezzi A, Laghezza Masci V, Ovidi E. Natural products for human health: an historical overview of the drug discovery approaches. Nat Prod Res 2018 Aug; 32(16):1926-1950.
8. All natural. Nat Chem Biol. 2007 Jul; 3(7): 351.
9. Lou D, Li Y, Yan G, Bu J, Wang H. Soy Consumption with Risk of Coronary Heart Disease and Stroke: A Meta-Analysis of Observational Studies. Neuroepidemiology 2016; 46(4): 242-52.
10. Sathyapalan T, Aye M, Rigby AS, Thatcher NJ, Dargham SR, Kilpatrick ES, et al. Soy isoflavones improve cardiovascular disease risk markers in women during the early menopause. Nutr Metab Cardiovasc Dis 2018 Jul; 28(7): 691-697.
11. Varshney R, Budoff MJ. Garlic and Heart Disease. J Nutr 2016 Feb; 146(2): 416S-421S.
12. Schwingshackl L, Missbach B, Hoffmann G. An umbrella review of garlic intake and risk of cardiovascular disease. Phytomedicine 2016 Oct 15; 23(11): 1127-33.
13. Mahdavi-Roshan M, Mirmiran P, Arjmand M, Nasrollahzadeh J. Effects of garlic on brachial endothelial function and capacity of plasma to mediate cholesterol efflux in patients with coronary artery disease. Anatol J Cardiol 2017 Aug; 18(2): 116-121.
14. Baspinar B, Eskici G, Ozcelik AO. How coffee affects metabolic syndrome and its components. Food Funct 2017 Jun 21; 8(6): 2089-2101.
15. Voskoboinik A, Koh Y, Kistler PM. Cardiovascular effects of caffeinated beverages. Trends Cardiovasc Med 2019 Aug; 29(6): 345-350.
16. O'Keefe JH, DiNicolantonio JJ, Lavie CJ. Coffee for Cardioprotection and Longevity. Prog Cardiovasc Dis 2018 May-Jun; 61(1): 38-42.
17. Noh HM, Park YS, Kim JH. Coffee consumption and coronary heart disease risk using the Framingham risk score. Asia Pac J Clin Nutr 2017; 26(5): 931-938.
18. Baszczuk A, Kopczyński Z, Degerowska P, et al. Assessment of laboratory markers of inflammation in patients with primary hypertension. Arterial Hypertens 2011; 15(4): 251-257.
19. Guzik T. Role of immune system in arterial hypertension. Post N Med 2011; 3:36–45.
20. Głuszek T, Kosicka J. Is there arterial hypertension chronic inflammatory disease? Arterial Hypertens 2011; 15 (6): 363-370.
21. Hage FG. C-reactive protein and hypertension. J Hum Hypertens 2014 Jul; 28(7): 410-5.
22. Maciążek-Jurczyk M, Maliszewska M, Szkudlarek-Haśnik A, et al. Preventionaction of green tea in coronary artery disease. Postępy Fizjoterapii 2011; 1:58–64.
23. Li X, Yu C, Guo Y, Bian Z, Si J, Yang L, et al. China Kadoorie Biobank Collaborative Group. Tea consumption and risk of ischaemic heart disease. Heart 2017 May; 103(10): 783-789.
24. Li M, Liu JT, Pang XM, Han CJ, Mao JJ. Epigallocatechin-3-gallate inhibits angiotensin II and interleukin-6-induced C-reactive protein production in macrophages. Pharmacol Rep 2012; 64(4): 912-8.
25. Tąpolska M, Spałek M, Skrypnik D, Bogdański P, Owecki M. The influence of meal frequency on lipid profile in the Polish population. Neuro Endocrinol Lett 2019 Dec; 40(7-8): 325-328.
26. Miczke A, Suliburska J, Pupek-Musialik D, Ostrowska L, Jabłecka A, Krejpcio Z, et al. Effect of L-arginine supplementation on insulin resistance and serum adiponectin concentration in rats with fat diet. Int J Clin Exp Med 2015 Jul 15; 8(7): 10358-66.

**27.** Potenza MA, Marasciulo FL, Tarquinio M, Tiravanti E, Colantuono G, Federici A, et al. EGCG, a green tea polyphenol, improves endothelial function and insulin sensitivity, reduces blood pressure, and protects against myocardial I/R injury in SHR. Am J Physiol Endocrinol Metab 2007; 292 (5): E1378-87.

**28.** Stepien M, Kujawska-Luczak M, Szulinska M, Kregielska-Narozna M, Skrypnik D, Suliburska J, et al. Beneficial dose-independent influence of Camellia sinensis supplementation on lipid profile, glycemia, and insulin resistance in an NaCl-induced hypertensive rat model. J Physiol Pharmacol 2018 Apr; 69(2): 275-282.

**29.** Ajith TA, Jayakumar TG. Omega-3 fatty acids in coronary heart disease: Recent updates and future perspectives. Clin Exp Pharmacol Physiol 2019; 46(1): 11-18.

**30.** Zong G, Li Y, Sampson L, Dougherty LW, Willett WC, Wanders AJ, et al. Monounsaturated fats from plant and animal sources in relation to risk of coronary heart disease among US men and women. Am J Clin Nutr 2018 Mar 1; 107(3): 445-453.

**31.** Ren J, Fu L, Nile SH, Zhang J, Kai G. *Salvia miltiorrhiza* in Treating Cardiovascular Diseases: A Review on Its Pharmacological and Clinical Applications. Front Pharmacol 2019 Jul 5; 10: 753.

**32.** Davis C, Bryan J, Hodgson J, Murphy K. Definition of the Mediterranean Diet; a Literature Review. Nutrients 2015 Nov 5; 7(11): 9139-53.

**33.** Widmer RJ, Flammer AJ, Lerman LO, Lerman A. The Mediterranean diet, its components, and cardiovascular disease. Am J Med 2015 Mar; 128(3): 229-38.

**34.** Mattioli AV, Palmiero P, Manfrini O, Puddu PE, Nodari S, Dei Cas A, et al. Mediterranean diet impact on cardiovascular diseases: a narrative review. J Cardiovasc Med (Hagerstown) 2017 Dec; 18(12): 925-935.

**35.** Chiavaroli L, Nishi SK, Khan TA, Braunstein CR, Glenn AJ, Mejia SB, et al. Portfolio Dietary Pattern and Cardiovascular Disease: A Systematic Review and Meta-analysis of Controlled Trials. Prog Cardiovasc Dis 2018 May-Jun; 61(1): 43-53.


Word count: 3139 • Tables: 2 • Figures: 1 • References: 35


**Sources of funding:**
The research was funded by the authors.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Sidor A, Soczewka M, Skrypnik D.
Natural preparations supporting the treatment of coronary heart disease: a narrative review.
Med Sci Pulse 2021; 15(3): 56-62. DOI: 10.5604/01.3001.0015.2815.



**Correspondence address:**
Aleksandra Sidor
E-mail: aleksandrasidor13@o2.pl



Received: 01.05.2021
Reviewed: 06.07.2021
Accepted: 03.09.2021

e-ISSN 2544-1620

**Medical Science Pulse** 2021 (15) 3

Reviews

Published online: 9 September 2021

DOI: 10.5604/01.3001.0015.2648

# PERSONALIZED MEDICINE – CHALLENGE FOR HEALTHCARE SYSTEM: A PERSPECTIVE PAPER

Dorota Stefanicka-Wojtas[1] D-G
• ORCID: 0000-0002-8162-7299

Donata Kurpas[2] D-G
• ORCID: 0000-0002-6996-8920

[1] Clinical Trial's Department, Wroclaw Medical University, Wroclaw, Poland

[2] Family Medicine Department, Wroclaw Medical University, Wroclaw, Poland

**A** – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

**ABSTRACT**

Personalized Medicine is a challenge for healthcare systems in Central and Eastern Europe if they are to provide patients with personalized diagnosis and treatment. Personalized medicine (PM) is about tailoring a treatment as individualized as the disease. [1] Integrated care involves receiving care along a continuum of health promotion, disease prevention, diagnosis, treatment, disease-management, rehabilitation and palliative care services, coordinated across the different levels and sites of care within and beyond the health sector, and according to the needs of patients throughout the life course. [2]

Personalized Medicine and Integrated Care are among the most important concepts related to the management and organization of healthcare systems. This article intends to identify challenges to the adoption of personalized medicine and stimulate fruitful dialogue and debate about the evaluation of barriers and facilitators within the implementation of personalized medicine interventions, identify the barriers and take systematic actions to remove as many of them as possible to create a future where PM is fully integrated into real-life settings.

**KEYWORDS:** personalized medicine, integrated care, interregional cooperation, barriers, healthcare systems

## Context and aim

Personalized medicine, which is also called precision or individualized medicine, is an evolving field in which physicians use diagnostic tests to determine which medical treatments will work best for each patient or use medical interventions to alter molecular mechanisms that impact health. By combining data from diagnostic tests with an individual's medical history, circumstances and values, health care providers can develop targeted treatment and prevention plans with their patients. [3] PM is the inverse of, and complement to, modern medicine. Traditional medicine is a top-down, population-based approach of randomized controlled trials (RTC) and evidence-based medicine (EBM). [4-5] PM is a bottom-up approach starting with the mechanisms of genetic or systemic disorders. Identifying the mechanisms of a disorder before it becomes an advanced, pathology-defined disease is needed for targeted, personalized therapy. While the high-level concepts are becoming clear, many barriers remain in terms of information, integration, translation, logistics and acceptance, particularly in Central and Eastern Europe, that will need to be addressed by future, well-designed basic and clinical research projects. [6]

Integrated care is a part of PM and one of the most important concepts related to the management and organization of healthcare systems.

Integrated care entails the provision of seamless, effective and efficient care that reflects the whole of a person's health needs: from prevention through to end of life, across both physical and mental health, and in partnership with the individual, their carers and family. It necessitates greater focus on a person's needs; better communication and connectivity between healthcare providers in primary care, community and hospital settings; and better access to community-based services close to home. [7]

According to the Quadruple Aim, the outcomes of integrated care policies should improve the individual experience of care, the health of populations, reduce the per capita cost of healthcare and improve the experience of providing care (the importance of physicians, nurses and all employees finding joy and meaning in their work). [8] Integrated care, though increasingly recognized as a critical adjunct to healthcare delivery and patient management, may be seen as a step in the process of healthcare systems and healthcare delivery becoming completer and more comprehensive. [9] The role of the relationship between health and social care is being increasingly highlighted. [10]

Unfortunately, despite the steady increase in the number of clinically useful molecular diagnostic methods and targeted therapies, the healthcare system has been slow to integrate PM into clinical practice [11-13].

Evidence suggests that in most cases, PM is not even discussed at the point of care. A recent public survey has shown that only four out of ten patients are aware of PM, and only 11% of patients say their doctor has discussed or recommended PM treatment options to them [14]. Behind this lag in clinical adoption are novel challenges that healthcare delivery systems are encountering as they adapt to the new requirements, practices and standards associated with the field [15].

This paper discusses the importance of the evaluation of barriers and facilitators within the implementation of personalized medicine interventions in Central and Eastern Europe which will be one of the outcomes in the Horizon 2020 project Regions4PerMed: "Interregional Coordination for aFast and Deep Uptake of Personalised Health" (a platform for the exchange of experience of experts from five European regions).[16]

## Brief Description of topic at hand

The goals of the Regions4PerMed project are to set up the first interregional cooperation on PM, align strategies and financial instruments and, most importantly, identify primary barriers in PM adoption in the healthcare system and take systematic actions to remove as many of these barriers as possible to create a future where PM is fully integrated into real-life settings.[17] PM is a challenge for healthcare systems in Central and Eastern Europe if they are to provide patients with personalized diagnostics and treatment.

The current population of patients with multimorbidities and co-morbidities requires a holistic, comprehensive approach with specialized and individualized treatment from different medical and paramedical specialties, as well as a management approach that commonly stretches across the classic healthcare silos. The complexity of the causes of impaired health status, that is, the number and severity of treatable traits, should be prioritized when making choices regarding which care provider should provide intervention, and where, when, and to which patients the intervention should be provided. Interprofessional and trans-organizational patient-centric care with common treatment plans is the key.[18]

The concept of integrated care can be traced to the aging societies of developed countries, the criticism of current healthcare systems by experts and patients and the idea of patient empowerment in the treatment process. Attempts to introduce integrated healthcare are motivated by the intention both to increase the quality and to reduce the costs of care. [10] PM fits perfectly into this trend. PM is an evolving field in which physicians use diagnostic tests to identify specific biological, often genetic, markers that help determine which medical treatments and procedures will work best for each patient. By combining this information with an individual's medical records and circumstances, PM allows doctors and patients to develop targeted treatment and prevention plans [3,19].

Standardization of the quality of diagnostic processes, optimization of diagnostic and therapeutic processes, and the priorities of PM, are the topics currently faced mainly by Central and Eastern Europe. The coordination of regional policies and innovation programs in PM to accelerate the employment of PM for citizens and patients is, therefore, the most important problem at this moment. [20] The latest developments in PM technologies, PM, and integrative medicine enable advances in personalized prevention, diagnosis, treatment, and rehabilitation.

## Discussion and reflections
## BARRIERS IN PM INTERVENTIONS

There are several challenges facing PM implementation if its full potential is to be harnessed. Below, we discuss those that present opportunities to improve implementation of PM with an integrated care approach in Central and Eastern Europe.

### The concept of PM

The term 'personalised medicine' is not yet in common use. Patients and even medical doctors are generally frequently unaware of the concept, they are often too traditional to open up to the

idea. When the concept is explained to patients, they tend to understand it, however, concerns are voiced about the privacy of data, the meaning of the relationship between patient and doctor, especially about an instrumentalized view of the human body as a functional entity in opposition to a holistic view of a person as an individual with health issues that go beyond the physical aspect and concern the whole person. Still, most important is that healthcare providers can provide direct contact with patients and better explain the benefits of a PM treatment to them. [21]

## Data in PM and Integrated Care

There is frequently a perception that there is not enough room for communication between doctors and patients and at first glance, the concept of PM which implies algorithm-based integration of multi-source data seems to be a further development along these lines. The concept needs to be thoroughly explained to the public and healthcare systems need to take this patientdemand for personal, and not only personalized, care into account. Among major problems are also medical secrecy, privacy and general transparency regarding the functioning of medical digital solutions. These must be increased to encourage patients to trust their healthcare professionals (HCPs). To get PM, patients will need to share a large amount of personal information with healthcare providers and the industry. GDPR and debates about privacy represent an obstacle. [21]

Healthcare is facing numerous challenges in an increasingly digital world. The availability of healthcare data is opening opportunities to improve, or fundamentally change, methods of healthcare delivery. Artificial Intelligence, PM and big data are all offering outstanding potential. However, all these potentialities are underpinned by good data, and by comprehensive data. Both are currently lacking. The path to good data relies on the efforts of clinicians to turn data traditionally recorded only in a human-readable format into a format that is also machine-readable. The next barrier are the attempts to merge the various levels of data held in disparate systems, across primary and secondary care, and across various institutions.[22]

## Technical and digital barriers in PM

Implementing PM across Europe will remove technical and legal barriers by harmonizing the processing of medical data. It will also provide mutual recognition for medical digital solutions published in different EU member states and a centralized evaluation system and transparency between reimbursement rates of national healthcare systems. Of utmost importance is the awareness of new opportunities, diffusion of patient-centered approaches, opportunities for rare disease treatment, availability of big data for real-world evidence methodologies and, most importantly, artificial intelligence technologies. [21]

## Education about PM

The current medical structures, on a large scale (healthcare systems) and an individual scale (the patient-doctor relationship etc.) have evolved over a long period. Education and discussion on the concept of personal health are needed for a large forum of politicians and citizens. A change of system, which will be needed if PM is to be implemented extensively, takes an effort on many levels. These are currently being addressed, but it does take time and a long-time perspective. In Poland, in most of cases, people do not have access to PM in the public system. There is no education around the topic. Private healthcare systems will be the first movers here but there are no incentives from the public system to facilitate this process. [21]

## PM funding

More evidence needs to be generated to lead to PM reimbursement. There is no strategy or coordination of administrations and, therefore, no money to implement it. [23] The pharmaceutical industry is geared to produce standard products in very large quantities. The move to PM will require writing off the existing production infrastructure and building a new one from scratch. Current healthcare funding is not designed to cater for PM. [21] At the industry level, evaluation/reimbursement poses a major problem. This should not be seen as a must for medical digital solutions for which a classic B2B arrangement between the publisher and HCPs may be a better option. [21]

A centralized evaluation system and transparency between reimbursement rates of national healthcare systems would remove one of the main problems currently seen in PM. [21]

PM is becoming one of the most debated topics on public and private health agendas worldwide. It has supporters in the industry, patient organizations, healthcare professionals, academics, funders, and politicians. Devoting energy and resources to pursue (and hopefully realize) the promises of person-centered healthcare would seem to be a win-win strategy for a few stakeholders. [24]

**Table.** Expected barriers for, and facilitators of implementing the Quadruple Aim [8] in Central and Eastern Europe [21]

| Quadruple aim | Barriers for the implementation personalized medicine interventions | Facilitators of the implementation of personalized medicine interventions |
|---|---|---|
| Improving the individual experience of care | – lack of awareness of PM services<br>– lack of skills of elderly people | – increased number of training sessions/conferences showing the possibility of PM<br>– communications and informing citizens of the benefits of PM |
| Improving the health of populations | – mainly specialized and service-centered rather than patient-centered<br>– lack of a user-friendly technology<br>– access to individual data at the same time guaranteeing their security<br>– medical digital solutions are overly fragmented due to national legislations derogating GDPR / national evaluation<br>– conflicts between regional and national competencies | – diffusion of patient-centered approaches<br>– availability of personalized data as the basis for decision for a personalized diagnosis and treatment |
| Reducing the per capita cost of healthcare | – lack of financial incentives provided to HCPs to experiment with such solutions<br>– some of managed care executives feel that PM will increase the cost of prescription medicines | – mutual recognition for medical digital solutions published in other EU member states<br>– centralized evaluation system and transparency between reimbursement rates of national healthcare systems |
| Improving the experience of providing care (the importance of physicians, nurses and all employees finding joy and meaning in their work) | – lack of training for healthcare staff<br>– lack of investments in healthcare | – patient advocates and cooperation with researchers and open-minded physicians<br>– healthcare providers that can provide direct contact with patients and explain better the benefits of a PM treatment to them |

## Conclusion and recommendations

To create an environment in which PM can thrive for the best outcomes for patients, there is an urgent need for systematic actions to remove barriers [25], and identify such bariers in the implementation of innovative interventions in the field of eHealth at the micro-, meso- and macro-regional levels. The identification of potential costs is also needed.

The barriers often involve knowledge gaps, system-wide process obstacles and resistance to the cultural changes necessary to move toward a more personalized care paradigm. Often, PM programs are operated in isolation and therefore are not benefitting from the experiences of other healthcare delivery organizations. [26]

The evolution of healthcare delivery toward PM requires making new knowledge available, placing a greater emphasis on patient perspectives, recognizing the value of molecular pathways in guiding care, building new infrastructure and information management processes and reshaping healthcare delivery to ensure access to PM technologies and services. Overcoming challenges in these areas will likely require short-term strategies to implement programs that are straightforward and can provide clear solutions. It will also require long-term strategies that can drive systemic and cultural change. However, with a clear understanding of the set of challenges and the best strategies for overcoming those challenges, a roadmap for healthcare systems to advance the PM paradigm can be built.[26]

The introduction of radically new ways of promoting health and treating disease requires time on the part of healthcare professionals and patients. The awareness of, and evidence about the benefits of PM are key to its adoption on a large-scale but, so far, there is little of both. The communication about the benefits of PM must be drastically improved by public authorities and the industry alike, as well as by health insurance companies. Bonus and benefit schemes should reward the use of PM. For that to happen, PM needs to be accessible to the public in the form of products and services. [21]

The main specific challenge for both PM and integrated care in Central and Eastern European countries is, most importantly, the digital exclusion of elderly people and those living in poorer regions. In these countries, preferences for the old, established (traditional) prevention, treatment, and rehabilitation methods persist because of the lack of education for physicians and lack of awareness and motivation in the population.

Both facilitators and barriers are related to the governance, organization and functioning of (public) healthcare systems. PM solutions should work in synergy with the system to increase the value of healthcare provided to patients. Too often PM forms specific/individual silos not streamlined with the system that only increase the fragmentation of the system. [21]

Conducting research will allow identifying the best practices observed in European countries, it is also necessary to analyze the available literature and

documents provided by local governments within the partner countries of the Regions4PerMed Project, analysis of the reports prepared in the framework of the strategic areas of the R4PM Project provided by the coordinator, project partners and speakers. The Regions4PerMed project covers such issues as medical big data and electronic medical records, health technology in connected and integrated care, health industry, facilitation of the innovation flow in healthcare, socio-economic aspects.

This will allow to develop recommendations for reducing barriers in the implementation of the solutions in the above-mentioned strategic areas and to disseminate knowledge about the results of the research at the micro-, meso- and macro-regional level.

## Sources of funding

The Coordination and Support Action Regions4PerMed has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 825812.

## References


1. Mathur S, Sutton J. Personalized medicine could transform healthcare (Review). Biomedical Reports [serial online] 2017 June [cited 04.04.2021]. Available from URL: https://www.spandidos-publications.com/br/7/1/3.
2. Goodwin N. Understanding Integrated Care. International Journal of Integrated Care [serial online] 2016 Oct [cited 25.07.2021]. Available from URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5354214/.
3. Personalized Medicine Coalition. The Basis [cited 27.07.2021]. Available from URL: https://www.personalizedmedicinecoalition.org/Education/The_Basics.
4. Whitcomb DC. Primer on precision medicine for complex. Clin Transl Gastroenterol [serial online] 2019 Jul [cited 11.04.2021]. Available from URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6708660/.
5. Whitcomb DC. What is personalized medicine and what should it replace? Nature Reviews. Gastroenterology & Hepatology [serial online] 2012 May [cited 19.04.2021]. Available from URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3684057/.
6. Whitcomb DC. Barriers and research priorities for implementing precision medicine. Pancreas [serial online] 2019 Nov/Dec [cited 01.05.2021]. Available from URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6857715/.
7. NSW Health Integrated Care [cited 06.05.2021]. Available from URL: https://www.aci.health.nsw.gov.au/nhn/health-professionals/tools-and-resources/nsw-health-integrated-care.
8. Sikka R, Morath JM, Leape L. The Quadruple Aim: care, health, cost and meaning in work. BMJ Quality & Safety 2015; 24: 608-610..
9. Kodner DL. Integrated care: meaning, logic, applications, and implications – a discussion paper. International Journal of Integrated Care [serial online] 2002 Oct-Dec [cited 22.04.2021]. Available from URL : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1480401/.
10. Hermanowski T, Rutkowski J. Zeszyty Naukowe Politechniki Śląskiej 2015 Seria: Organizacja i Zarządzanie z. 83 Nr kol. 1941, Warszawski Uniwersytet Medyczny Zakład Farmakoekonomiki [cited 19.04.2021]. Available from URL: http://www.woiz.polsl.pl/znwoiz/z82/21%20-%20Hermanowski_T_Rutkowski_J_.pdf.
11. Aspinall MG, Hamermesh RG. Realizing the promise of personalized medicine. Harv Bus Rev. 2007; 85(10):108-17, 165.
12. Evans JP, Meslin EM, Marteau TM, Caulfield T. Genomics. Deflating the genomic bubble. Science. 2011; 331(6019):861-2.
13. American Chemical Society. Personalized Medicine: Moving Forward Slowly But Surely. ScienceDaily. ScienceDaily [serial online] 2008 Feb [cited 04.04.2021]. Available from URL: www.sciencedaily.com/releases/2008/02/080211094056.htm.
14. Miller AM, Garfield S, Woodman RC. Patient and provider readiness for personalized medicine. Pers Med Oncol 2016; 5(4): 158–167.
15. Manolio TA, Chisholm RL, Ozenberger B et al. Implementing genomic medicine in the clinic: the future is here. Genet Med [serial online] 2013 Apr [cited 19.04.2021]. Available from URL: https://pubmed.ncbi.nlm.nih.gov/23306799/.
16. D'Errico G, Cormio PG, Bello P, Duda-Sikuła M, Zwiefka A, Krzyżanowski D, Stegemann E-M, AllegueRequeijo B, Romero Fidalgo JM, Kurpas D. Interregional coordination for a fast and deep uptake of personalised health (Regions4Permed) – multidisciplinary consortium under the H2020 project. MSP [serial online] 2019 Nov [cited 21.04.2021]. Available from URL: https://medicalsciencepulse.com/resources/html/article/details?id=194509.
17. Balicza P, Terebessy A, Grosz Z, Varga NA, Gal A, Fekete BA, Molnar MJ. Implementation of personalized medicine in Central-Eastern Europe: pitfalls and potentials based on citizen's attitude. EPMA J. 2018; 9(1): 103-112.
18. Vanfleteren LEGW, van 't Hul AJ, Kulbacka-Ortiz K, Andersson A, Ullman A, Ingvar M. Challenges to the application of integrated, personalized care for patients with COPD - a vision for the role of clinical information. J Clin Med [serial online] 2020 May [cited 17.04.2021]. Available from URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7290491/
19. The Personalized Medicine Coalition. The case for personalized medicine [cited 29.04.2021]. Available from URL: www.personalizedmedicinecoalition.org/Resources/The_Case_for_Personalized_Medicine.
20. Stefanicka-Wojtas D, Duda-Sikuła M, Kurpas D. Personalised medicine – best practices exchange and personal health implementation in European regions – a qualitative study concept under the Regions4PerMed (H2020) project. MSP [serial

online] 2020 Jun [cited 21.04.2021]. Available from URL: https://medicalsciencepulse.com/resources/html/article/details?id=205647.

21. Data obtained from the survey "Barriers and facilitators of personalized medicine implementation- qualitative study under Regions4PerMed (H2020) Project". Author of the survey Dorota Stefanicka-Wojtas.
22. Pearce C, McCleod A, Ferrigi J. From linked data to patient centred data: using health data to improve patient outcomes. International Journal of Integrated Care [serial online] 2021 Feb [cited 17.04.2021]. Available from URL:https://www.ijic.org/articles/abstract/10.5334/ijic.s4039/.
23. Graham E. Improving outcomes through personalised medicine, working at the cutting edge of science to improve patients' lives [serial online] 2016 Sep [cited 17.04.2021]. Available from URL: https://www.england.nhs.uk/wp-content/uploads/2016/09/improving-outcomes-personalised-medicine.pdf.
24. Manca A, Iglesias C. Stratified, personalised and precision medicine [cited 16.04.2021]. Available from URL: https://www.york.ac.uk/che/research/teehta/personalised-medicine.
25. Horgan D, Jansen M, Leyens L, Lal JA, Sudbrak R, Hackenitz E, Bußhoff U, Ballensiefen W, Brand A. An index of barriers for the implementation of personalised medicine and pharmacogenomics in Europe. Public Health Genomics [serial online] 2014 Nov [cited 16.04.2021]. Available from URL: https://pubmed.ncbi.nlm.nih.gov/25401385/.
26. Pritchard DE, Moeckle F, Villa MS, Housman LT, McCarty CA, McLeod HL. Strategies for integrating personalized medicine into healthcare practice. Personalized Medicine [serial online] 2017 Jan [cited 28.04.2021]. Available from URL: https://www.futuremedicine.com/doi/full/10.2217/pme-2016-0064?rfr_dat=cr_pub++0pubmed&url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org.

Word count: 2617 • Tables: 1 • Figures: 0 • References: 26

**Sources of funding:**
Regions4PerMed has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 825812.

**Conflicts of interests:**
The authors report that there were no conflicts of interest.

**Cite this article as:**
Stefanicka-Wojtas D, Kurpas D.
Personalized medicine – challenge for healthcare system – a perspective paper.
Med Sci Pulse 2021; 15 (3): 63-68. DOI: 10.5604/01.3001.0015.2648.

**Correspondence address:**
Dorota Stefanicka-Wojtas
E-mail: dorota.stefanicka-wojtas@umed.wroc.pl

Received: 17.07.2021
Reviewed: 28.07.2021
Accepted: 29.07.2021