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ASSESSMENT OF VIRTUAL HEALTHCARE: PREDICTORS OF ACCESS AND UTILIZATION BEFORE, DURING, AND AFTER THE COVID-19 PANDEMIC

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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: Societal needs highlighted by the ongoing COVID-19 pandemic have resulted in rapid tele-health development and implementation. The broadening of guidelines for practice by regulatory bodies have allowed providers to employ video-capable devices in the virtual delivery of services to physical- and mental-health clients located across a broad range of settings.

Aim of the study: This study examined use of synchronous, video-based, virtual healthcare before and during the COVID-19 pandemic. This included a comparison of: access for physical and mental health needs; differential assessment of service provision by professionals; consumer satisfaction; and, anticipated future use of virtual healthcare.

Material and methods: An online survey link was sent to three participant groups: college-aged students, adults, and retirement-aged persons. A total of 685 participants, varying in age, gender, ethnicity, and experience using tele-healthcare provided usable data for this study.

Results: Half of participants (49.2%; *n*=337) used virtual healthcare; more people used it during the pandemic (87.2%; *n*=294) than before (26.4%; *n*=89). Physical services (86.8%; *n*=291; primarily physicians) were more common than mental health services (25.6%; *n*=86; primarily counselors). Access was most common through laptop computers (60.7%; *n*=204). Participants were satisfied with virtual healthcare experiences (Mdn=5). Almost all participants (94.2%; *n*=645) believed that virtual healthcare would continue after the pandemic, but only two-thirds (61.3%; *n*=420) reported they would use virtual healthcare if available in the future. Both previous experience with ($p<0.001$) and satisfaction with ($p<0.001$) virtual healthcare positively predicted anticipated future use.

Conclusions: Tele-healthcare has experienced significant growth in the COVID-19 era. Emergency policy changes have resulted in services being developed and offered in the medical and mental health realms in conjunction with ongoing empirical evaluations of what does and does not work.

KEYWORDS: tele-healthcare, tele-medicine, virtual care, tele-mental healthcare

Background

When someone thinks of tele-health today, it is likely that their conceptualization is much different than that of just a couple years ago. Safety needs produced and highlighted by the ongoing COVID-19 pandemic have resulted in rapid tele-health development and implementation [1]. Supported by U.S.

federal emergency measures approved to assure continuity of healthcare [2], regulatory agencies and insurers have over the past year pushed toward broader definitions for scope of practice, reimbursement, and licensure [3,4]. Tele-techniques are now being used in most if not all areas of patient- and client-based healthcare service provision [5].

A flood of research on viability of health-service tele-practices has recently filled the pages of science journals, providing empirical insight into what works and what is probably still best handled in traditional face-to-face interactions. Tele-healthcare research has been available in the literature since the 1970s, but very few early reports constituted data-driven studies. Most articles appeared as commentaries and editorials, with anecdotal descriptions of telephone service delivery presented side-by-side with discussions of proof of concept and barriers to cross for tele-health to develop to implementation standards [6,7]. A review of the available research through the latter part of the twentieth century shows little movement by medical professionals toward developing and adopting tele-practices: research to support the viability of tele-care had not been undertaken for many areas of practice, and most physicians were not convinced that significant alterations of traditional face-to-face interactions in brick and mortar establishments were warranted [8]. This all began to change through the early 2000s, however, with the pairing of enhanced broadband access and the ubiquitous distribution of video-capable communication devices. Just as smartphone usage and video chats were becoming routinized parts of our lives, virtual capabilities increasingly reached into the healthcare realm to expand the range of service delivery options for healthcare providers. A literature search of a leading biomedical database – Pubmed.gov – shows an increasing availability of tele-healthcare research during this period, with 300+ articles published in 1995, 800+ in 2005, 2,500+ in 2015, and 3,800+ in 2019. A further big acceleration was seen in 2020, with the advent of COVID-19 and increased needs to quarantine and social distance, when close to 7,000 empirical studies examining tele-healthcare practices appeared in the medical and life sciences literature. This evidence of shifting priorities produced by the eminent challenges of the pandemic – from 'Does this work?' to 'Let's see how we can make this work.' – has continued into 2021, with tele-health citations on pace to exceed those of 2020.

This rapid expansion of virtual care is a product of three ongoing trends in patient-centered healthcare [1,9]. The first recognizes that tele-health offers convenience and the possibility of reduced costs for both providers and consumers [10]. Discussions of barriers for tele-health implementation prior to the advent of COVID-19 focused largely on service provider concerns [11,12,13]. Consumers, in turn, were limited by what healthcare professionals offered and made available in their geographic areas, but were nonetheless focused on cost and access; these barriers are arguably now less prohibitive given the wide implementation and availability of tele-care resulting from the pandemic. For a working parent, the advantages of lower costs for transportation and childcare, less time away from work for scheduled healthcare visits, flexibility for scheduling with tight time constraints, and less exposure to contagion have all made virtual appointments preferable and convenient [14]. The second trend promoting virtual care is the ongoing shift in healthcare from treatment of acute conditions to management of chronic ailments, which often involve close consultations and monitoring through follow-up care after initial diagnoses and treatments [9]. This is particularly relevant in long-term care for older adults [15,16], and especially important for those who are homebound [17], but has also figured prominently in chronic treatments for disease conditions defined as leading causes of disability and death [18,19,20,21]. Virtual treatments of chronic conditions have also become critically important in mental health care, which has now been convincingly demonstrated through empirical research to be associated with medical healthcare outcomes [22]. The third trend in healthcare promoting use of virtual technologies can be found in its potential reach into rural areas, where there are few physicians and often no mental health providers [22,23]. This expansion of services into underserved areas using the tools of tele-healthcare has long been considered desirable, but the slow adoption of tele-care prior to the pandemic left this goal largely unrealized [24,25]. There had been some development of tele-mental services prior to the pandemic, particularly among psychologists and behavioral health providers, and especially in rural areas and among young adults and persons with restricted access to counseling provided by mental health practitioners [26]. This overall pre-covid movement toward broader provision of virtual mental health treatments was slow but nonetheless outpaced tele-service development by physicians [22]. The rapid increases in development now ongoing for both telemedicine and tele-mental healthcare did not really begin on a wide scale until the early months of the pandemic [1,27]. Research reports demonstrating efficacy and guidelines for medical care across practice settings [28,29] and similarities of mental health treatments received in clinics, in homes, and in person [30] have helped in this regard, and suggest that a continuation of tele-services beyond the pandemic may yet reach into remote areas to impact disparities in urban and remote healthcare services [26].

It now appears that, just as COVID-19 has presented healthcare challenges that are unprecedented, a true transformation of the tele-healthcare landscape in the U.S. is occurring. Indeed, editorials and commentaries now speak of the rapidly changing tele-health landscape, and how further growth of tele-health is expected to continue well into the future [1,31]. The question arises for whether the development of tele-healthcare prior to the pandemic had reached the critical mass necessary for widespread innovation diffusion or whether the safety-driven needs of the pandemic affected the prioritization and rapid development and dissemination of virtual healthcare information and opportunities [32]. Perhaps the pandemic has forced the issue: In an effort to maintain support for healthcare needs of vulnerable persons during a time of societal crisis, providers quickly adapted their practices to develop and scale-up tele-healthcare options [33,34]; consumers, in turn, with tele-healthcare options increasingly available, were made aware of and used virtual services and have now developed expectations for what they will and will not consider when seeking healthcare as time moves forward [35]. In any case, evidence specifically addressing this question will help determine what the tele-healthcare market for services will look like following the pandemic.

Aim of the study

The aim of the current study was to examine synchronous, video-based, virtual healthcare access and use before and during the COVID-19 pandemic. This included a comparison of virtual access for physical and mental health needs, differential assessment of service provision by healthcare professionals, consumer satisfaction with virtual healthcare experiences, and anticipated future use of virtual healthcare by consumers following the pandemic.

Material and methods

Participants

A total of 685 participants, varying in age, gender, ethnicity, and experience using tele-healthcare provided usable data for this study. All research participants were 18 years of age or older and accessed using a convenience sampling method. A summary of descriptive data for participants is shown in Table 1.

Invitations for voluntary and anonymous participation in the study, consisting of a brief description of tele-healthcare and a link to an online survey specifically designed to assess experience with tele-healthcare service(s), were made available to persons associated with Coastal Carolina University (CCU), a medium-sized, general comprehensive educational institution located on the Atlantic coast of South Carolina. Three types of persons were purposefully recruited through email send-outs: faculty and staff of CCU, selected from the university directory based on personal acquaintance with the researchers; university students, recruited initially through classes and mailing lists for majors and minors of the psychology department; and, members of the Osher Lifelong Learning Institute (OLLI), an organization administered through the CCU provost's office offering a wide-variety of on- and off-campus educational experiences for persons 55 and older. No incentives to participate were offered by the researchers, although it is possible that students of university classes were offered an incentive as extra-credit for a class assignment by a professor promoting the study. All invitations included an encouragement for participants to forward the survey link to additional parties, including family and friends who might have an interest in tele-healthcare. Feedback received via email from

Table 1. Demographic characteristics of the sample

Demographic Categories		*n*	%
Age (years)	College-Aged (18-25)	143	20.9
	Adult (26-59)	206	30.1
	Young-Old (60-74)	219	32.0
	Old-Old (75+)	85	12.4
	Did not identify	32	4.7
Gender Identity	Man / Male / Masculine	219	32.0
	Woman / Female / Feminine	454	66.3
	Gender Nonbinary	3	0.4
	Did not identify	9	1.3
Ethnicity	Asian American or Asian	19	2.8
	Black or African American	41	6.0
	Hispanic, Latinx, or Spanish Origin	9	1.3
	Middle Eastern, North African, or Mediterranean	1	0.1
	Native American or Native North American	3	0.4
	Native Hawaiian or Other Pacific Islander	0	0.0
	White, European American, or Other European	580	84.7
	Two or more ethnic identities	20	2.9
	Did not identify	12	1.8

The mean age of participants was 51.92±21.12, ranging from 18 to 94.

Note: Ethnicity is not proportionally distributed across age categories. Caucasian participants have a wide distribution with a small majority in the Young-Old category, whereas non-Caucasian participants are predominantly college-aged.

participants to the researchers indicated that further respondent-initiated provision of the link for on-campus and off-campus recruitment did occur; the extent of this distribution is unknown. Numerous unsolicited emails were received from participants expressing general excitement and providing elaborate descriptions of virtual tele-healthcare experiences, leading the study authors to conclude that the research was timely and important in the era of the ongoing COVID-19 pandemic.

Data source/measurement

The survey instrument was designed and made available to participants through a dedicated link embedded in the invitation. Using a yes/no forced choice format, the first question asked respondents whether they had a virtual, video-based interaction with a healthcare professional before and/or during the pandemic. A 'yes' response to the first question produced additional questions for when the interaction occurred, before and/or during the pandemic; the type of issue(s) and provider(s) involved; the type of internet-based device(s) used for the virtual communication; and, a rating of satisfaction for the tele-healthcare service interaction. Satisfaction was evaluated using a 6-point Likert scale (from 1=very dissatisfied to 6=very satisfied). Participants were asked two additional questions: their belief for whether virtual healthcare services would be available following the pandemic, and whether they would seek and use virtual services to meet future healthcare needs. In conclusion, participants were asked to provide demographic data for age, gender identity, and ethnicity. An answer to the first question of 'no' bypassed the provider interaction questions and sent participants directly to the questions addressing the future of tele-healthcare and the request for demographic information. A hard copy of the complete survey is available from the authors upon request.

Due to the timely nature of the study, descriptive statistical analysis is used for a number of comparisons to establish a current baseline and do not explore several subgroup comparisons. Statistical analysis is used to make several key comparisons and predictions; *p*-values are reported in the text, and statistical tests are reported in tables.

Ethical considerations

Materials for the study, including research methodology and protocol, the survey, and informed consent-disclosure statement were approved by the Coastal Carolina University (CCU) Institutional Review Board. There were no conflicts of interest for the authors in the planning and execution of the study.

RESULTS

Virtual healthcare use

Approximately half of participants (49.2%; *n*=337) had used virtual healthcare at the time of this study; among those who had used virtual healthcare, service use was more predominant during the COVID-19 pandemic (87.2%; *n*=294) than before the pandemic (26.4%; Table 2; *n*=89). This suggests that the majority of those who used virtual healthcare during the pandemic were new to these services.

The majority of participants used virtual healthcare exclusively for physical health services (74.3%; *n*=249), a smaller proportion exclusively for mental health services (13.1%; *n*=44), or for both physical and mental health services (12.5%; *n*=42; Table 2).

Table 2. Use of virtual healthcare before and during the pandemic, types of services and professionals, and types of devices used to access virtual healthcare

Variables		*n*	%
Use of Virtual Healthcare	Exclusively Before COVID	43	6.3
	Exclusively During COVID	248	36.2
	Both Before and During COVID	46	6.7
	Never	348	50.8
Types of Virtual Healthcare Services Used	Exclusively Physical Services	249	74.3
	Exclusively Mental Services	44	13.1
	Both Physical and Mental Services	42	12.5
Physical Health Professionals k	Physician	228	78.4
	Physician Assistant	58	19.9
	Nurse	30	10.3
	Nurse Practitioner	41	14.1
	Other	9	3.1
	Don't Know	11	3.8
Mental Health Professionals k	Psychologist	20	23.3
	Counselor	37	43.0
	Behavioral Health Provider	6	7.0
	Clinical Social Worker	8	9.3
	Psychiatrist	29	33.7
	Other	7	8.1
	Don't Know	3	3.5
Types of Devices k	Laptop Computer	204	60.7
	Tablet	46	13.7
	Smartphone	134	39.9
	Other	7	2.1

[k] Note: Frequencies and percentages are not mutually exclusive; participants could choose multiple options.

Professionals consulted virtually for physical health services included physicians (identified by 78.4% of participants; *n*=228), physicians' assistants (19.9%; *n*=58), nurses (10.3%; *n*=30), nurse practitioners (14.1%; *n*=41), and other practitioners (3.1%; *n*=9; e.g., specialists; Table 2). A small number of participants did not know the specific occupation of their physical health practitioner (3.8%; *n*=11). About one-fourth of participants (24.1%; *n*=70) who used virtual healthcare for physical health services consulted with multiple types of professionals.

Professionals consulted virtually for mental health services included counselors (43.0%; *n*=37), psychiatrists (33.7%; *n*=29), psychologists (23.3%; *n*=20), behavioral health providers (7.0%; *n*=6), clinical social workers (9.3%; *n*=8), and other practitioners (8.1%; *n*=7; e.g., primary care physician; Table 2). A small number of participants did not know the specific occupation of their mental health practitioner (3.5%; *n*=3). Again, about one-fourth of participants (24.4%; *n*=21) who used virtual healthcare for mental health services consulted with multiple types of professionals.

Participants virtually consulted with practitioners using laptop computers (60.7%; *n*=204), smartphones with video capabilities (39.9%; *n*=134), tablets (13.7%; *n*=46), or other means (2.1%; *n*=7; e.g., texting, remote examination stations, hospital internal communication systems; Table 2). Some participants (14.9%; *n*=50) used multiple types of devices.

Virtual healthcare satisfaction

Overall, participants were satisfied with their experiences with virtual healthcare services (Table 3). Based on participant satisfaction rating (or the median of their two ratings for participants who experienced virtual healthcare both before and during the COVID-19 pandemic), the median satisfaction rating was a 5, corresponding to a rating of 'satisfied' on our 6-point Likert scale.

Table 3. Satisfaction with virtual healthcare services

Time Period	Median Satisfaction	Test Statistic	*z*	*p*
Exclusively Before Pandemic	4	3982.5 a	2.72	0.007*
Exclusively During Pandemic	5			
Both Before and During Pandemic	5	66 b	0.87	0.384

* Statistically significant result.
[a] Mann-Whitney *U* Test.
[b] Wilcoxon Signed Ranks Test.

Participants who experienced virtual healthcare only during the pandemic had a statistically-significant higher median satisfaction rating (Mdn=5) than participants who experienced virtual healthcare only before the pandemic (Mdn=4; Table 3), as shown by a Mann-Whitney *U* test (p=0.007). However, for participants who experienced virtual healthcare both before and during the pandemic, there was no significant difference in median satisfaction rating (Mdn=5), as shown by a Wilcoxon Signed Ranks Test (p=0.384).

Predictions of future use

The vast majority of participants anticipated that virtual healthcare would continue to be available after the pandemic (94.2%; *n*=645; Table 4). This finding was consistent regardless of whether participants had previously used virtual healthcare and regardless of their past satisfaction rating.

Participants were asked whether they anticipate using virtual healthcare after the pandemic (Table 4). The majority of participants (61.3%; *n*=420) anticipated that they will use virtual healthcare for some of their future healthcare needs; the remainder anticipated that they will not use any virtual healthcare services in the future (38.5%; *n*=264) or did not respond (0.1%; *n*=1).

Previous experience with virtual healthcare positively predicted anticipated future use of virtual healthcare (Table 4), as shown by a Chi-Square test (p<0.001). Participants who had previously used virtual healthcare anticipated they would use it in the future (70.6%; *n*=238); participants who had not previously used virtual healthcare anticipated less future use (52.4%; *n*=182). If participants had previous experience with virtual healthcare, they were more likely to anticipate using it in the future.

Previous satisfaction with virtual healthcare also positively predicted anticipated future use of virtual healthcare (Table 4), as shown by a point biserial correlation (p<0.001). The more satisfied participants were with past virtual healthcare experience, the more likely they were to anticipate using virtual healthcare in the future.

Discussion

The 13% use of tele-healthcare prior to the pandemic reported here corresponds to a 2019 consumer survey [36] indicating that whereas 66% of Americans said they were willing to try tele-healthcare, only 8% had actually done so. Our data collected just two years later are similar, with 61.3% willingness, but show the percentage of participants with virtual experience rising to 49.2%. These data are also reflected in provider numbers reported by Pierce [37] showing

Table 4. Beliefs about future use and availability of virtual healthcare, and using past use and satisfaction to predict future anticipated use

Variables			*n*	%	Test Statistic	*p*
Anticipated Future Use	Yes		420	61.3	—	—
	No		264	38.5		
	Did not respond		1	0.1		
Predicted Future Availability	Yes		645	94.2	—	—
	No		37	5.4		
	Did not respond		3	0.4		
Correlation Between Past Use and Future Anticipated Use	Used Virtual Healthcare in Past	Will Use in Future	238	70.6	23.83[a]	<0.001*
		Will Not Use in Future	99	29.4		
	Did Not Use Virtual Healthcare	Will Use in Future	182	52.4		
		Will Not Use in Future	165	47.6		
Correlation Between Past Satisfaction and Future Anticipated Use	—	—	—	—	.30[b]	<0.001*
Correlation Between Past Use and Future Availability Beliefs	Used Virtual Healthcare in Past	Believe Will Be Available in Future	319	94.7	0.01[a]	0.924
		Believe Will Not Be Available in Future	18	5.3		
	Did Not Use Virtual Healthcare	Believe Will Be Available in Future	326	94.5		
		Believe Will Not Be Available in Future	19	5.5		
Correlation Between Past Satisfaction and Future Availability Beliefs	—	—	—	—	.06[b]	0.313

* Statistically significant result.
[a] Chi-Square Test for Independence.
[b] Point-Biserial Correlation.

that just over 7% of licensed psychologists had previous experience with tele-psychology, a percentage which rose to 85.53% during the pandemic; 35% expected to continue using tele-psychology techniques after the pandemic. Given the safety and security issues prevalent from Spring 2020 to Spring 2021, these significant increases support the argument that many healthcare professionals responded rapidly during COVID to develop and use tele-healthcare options that had not previously been available for clients. In the U.S., the National Emergencies Act declared in March 2019 [2] allowed providers, under good faith provisions, to ramp up and offer tele-health services: through widely-available communication devices, to patients in their homes and local clinics, across state lines, using video and/or audio (e.g., telephone), and to receive reimbursement at rates comparable to traditional visits [4]. This loosening of regulations is still in effect as of August 2021.

It is not surprising that services were used more often for physical health than mental health, but it is nonetheless interesting given increasing concerns over short-term and long-term mental health consequences of the pandemic [38]. The needs to feel safe and be safe may have created barriers for access to mental health and represent a disruption of treatment outcomes for consumers who need services but have been unable to maintain contact with providers [39]. Many mental health professionals in the U.S. operate independently, outside of larger healthcare systems financially able to acquire and operate tele-technologies, and may have been unable to smoothly transition into tele-mental health [22,37]. Perhaps physical health problems are simply harder to ignore than mental health issues, prompting more persons to seek tele-medical care. Conditions of mental health, such as anxiety, depression, and responses to trauma, often include escape and avoidance behaviors, leading those suffering to engage in extensive self-isolation, which is often more extreme than the social distancing promoted during the pandemic. This potential disruption of connections for mental health providers with clients' needs to be thoroughly and quickly investigated, especially in light of the rapid escalation of mental health problems for children now being discussed in the literature [40,41].

Our data show that participants were satisfied with their experiences with virtual healthcare overall. Satisfaction is known to be a health-service performance measure of quality of care [42] and a key indicator for whether client expectations are met [43]. We surmise from this study that client expectations were met, at least in part, which is consistent with previously gathered data [44,45]. When considering satisfaction alongside predictions of personal behavior regarding tele-healthcare use after the pandemic, a useful analysis emerges. Almost all of our study participants reported a belief that virtual healthcare in-

teractions would be available following the pandemic. This suggests that use of virtual communication devices has become a common enough part of daily life to be regarded as inevitable for healthcare. However, only two-thirds of participants reported they would seek virtual care if more traditional face-to-face options were on offer. This effect was moderated by previous use and by satisfaction, as independent observations: people who had used a virtual service before and people who were more satisfied with a previous experience were more likely to predict using it in the future. This suggests that taking that first step to use a virtual service, perhaps for convenience or from having no other alternative during the pandemic, is critical to opening the door for future use. Satisfaction, as a multi-faceted variable, could be similarly influenced by convenience or from other aspects of treatments, such as outcome or cost. Future research can more specifically address convenience of services and which components of virtual healthcare interactions are most likely to lead to satisfaction.

A limitation of the study is that it uses a convenience sample of academic or academic-adjacent participants who have access to technology to complete an online study. This may bias results toward individuals already familiar with and comfortable with technology, and thus who are more likely to be favorable toward tele-health services. Although we find informative and meaningful patterns, future research should more directly investigate tele-health use in a more diverse population, including those who have more limited access to technology. This provides justification for directly investigating tele-healthcare use in rural populations and the differential service needs and technological access and availability in these populations [22,23].

This study confirms that tele-services will figure prominently in the future for physical and mental healthcare systems; as the pandemic is ongoing, however, the way forward is still unclear. What is needed are measures of the overall impact of the pandemic on physical and mental healthcare. There are still no reports for how many persons chose not to seek help because of fears of contamination; how many persons postponed needed but 'elective' (i.e., non-life threatening) surgical procedures; how many people could not afford to seek healthcare considering restrictions on businesses and the widespread unemployment that plagued economies; how many parents had to grapple with providing social and home-school experiences for children, often with no prior training, at the expense of self-care. It is clear that detailed measures of the mental and physical health tolls experienced during the pandemic, including the compounding effects of pandemic-induced stressors for pre-existing conditions, are needed to help define the future of tele-service options [41].

Conclusion

In the current study, tele-healthcare professionals responded to COVID-19 to develop virtually-delivered services that had been slow to develop prior to pandemic. About half the participants in this study had used virtual services, most for the first time during the pandemic, primarily for physical concerns, but also for mental health issues. Past use and satisfaction with virtual healthcare predicted a higher anticipated use of virtual healthcare in the future. The ongoing empirical evaluation of virtual service delivery is reshaping healthcare in the U.S.

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A MEDICAL DOCTOR AS A LEGAL EXPERT DURING THE COVID-19 PANDEMIC

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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: In Poland, the total number of SARS-CoV-2 infections since March 4, 2020 is 2,880,596, with 2,652,372 recoveries and 75,135 deaths. It may be assumed that such an unexpected event, apart from the health-related and economic consequences, will in the near future result in a wave of demands from those who have suffered as a result of COVID-19.

Aim of the study: The aim of this study is to assess the current legal status in the context of opinions issued by medical doctors with regard to COVID-19, with a particular emphasis on responsibility towards the employee and the employer.

Material and methods: A review was conducted using the database of legal acts (SIP LEX; accessed on 01.06.2021) based on the following words: labor code, civil procedures code, decisions of the Supreme Court, claims, employee health, health protection, COVID-19, and labor law.

Results: By searching the SIP LEX database and comparing the results with the legal standards of international law, the role and importance of the doctor as an expert on COVID-19 was established. The presented findings are based on judgments of the Supreme Court, the regulations of the Minister of Justice, announcements of the Marshal of the Sejm of the Republic of Poland, and the provisions of the Act on the Profession. It is certain that doctors will face another important task connected with COVID-19. It must be assumed that, in the near future, they will be forced to issue opinions on numerous and complicated cases regarding employer responsibility for damages incurred by employees due to COVID-19.

Conclusions: Medical experts will use knowledge and experience acquired during the struggle with the disease to evaluate whether it was highly probable that an employee illness was the result of an infection with the pathogen in the workplace, and then, furthermore, to specify the after-effects of this illness.

KEYWORDS: COVID-19, SARS-CoV-2, pandemic, infectious, occupational diseases

Background

Initial news of severe pulmonary inflammation caused by an unknown factor among vendors and suppliers at the Huanan marketplace in Wuhan dates back to December 31, 2019. On that day, the Representative Office of the World Health Organization (WHO) in China was notified. Next generation sequencing determined that the infection was caused by a new type of coronavirus that exhibits similarities to the severe acute respiratory syndrome virus (SARS-CoV-1). This novel coronavirus was called SARS-CoV-2

and, on February 11, 2020, the WHO termed the disease caused by this virus COVID-19. One month later, a worldwide pandemic was declared [1-3]. Previously known coronaviruses have also been associated with recent epidemics. Between 2002–04 a SARS epidemic was declared [4], and, in 2012 in the Middle East and in 2015 in South Korea, an epidemic was caused by the Middle East Respiratory Syndrome (MERS) [5].

The pandemic caused by the SARS-CoV-2 (COVID-19) virus has been characterized by a dynamic and unpredictable course, significantly influencing everyday life and national economics. In Poland, the total number of infections since March 4, 2020 has been 2,880,596, out of which 2,652,372 individuals recovered (92.1%) and 75,135 died (7.9%) [6]. Worldwide, 186,033,321 infections have been confirmed, with 170,214,024 recoveries (91.5%) and 4,020,869 deaths (8.5%) [7]. It may be assumed that such an unexpected event, apart from the direct health-related and economic consequences, will in the not-too-distant future cause a wave of demands from those who have suffered from the illness. The most significant demands will most likely be directed at employers, who are responsible for workplace conditions. Indeed, these actions are currently occurring in the United States and Great Britain, where they are seen as a very serious threat to the stable functioning of the economy. The current number of COVID-19-related lawsuits against employers in the USA due to alleged labor violations is 2879, with most (691) concerning the healthcare system [8]. In these lawsuits, the employee is responsible for providing evidence that they were infected with the SARS-CoV-2 virus in connection with employment and that there exists a particular risk of infection resulting from working conditions, which exceeds the risk for the general public. Therefore, the responsibility is conditioned by the need to formally prove two premises. The first must show that the disease in question was a result of the employment (the type and way of performing duties), while the second must prove that the disease in question was the result of, or was caused by, particular conditions at work, and is not "a common illness of everyday life" to which the general public is also susceptible. In order for these lawsuits to be settled, the medical knowledge of doctors is required. Therefore, important evidence to establish the premises of employer responsibility is obtained from opinions prepared by medical experts.

Aim of the study

The aim of this study is to assess the current legal status in the context of COVID-19-related opinions issued by doctors, with a particular emphasis on the responsibilities of employees and employers.

Material and methods

The SIP LEX is a complete, unified database that contains legal acts, including standardized versions of legal acts contained in the Journal of Laws and the Polish Monitor, and collections of judgments from Polish and European courts. Using the SIP LEX database, a review of legal acts and judgments was conducted (accessed on: 01.06.2021) based on the following words: labor code, civil procedures code, decisions of the Supreme Court, claims, employee health, health protection, COVID-19, and labor law. For this review, the dictionary function was used, which allows for a search for legal acts using words of interest. The review covered legal acts and the judgments of courts from 1996 to the present day. Pending and non-assessed acts available in the database were excluded from the analysis. In total, 13 legal acts and judgments were analyzed.

Results

By searching the legal acts and comparing them with the legal standards of international law, the role and importance of the doctor as an expert on COVID-19 was established. The presented findings are based on judgments of the Supreme Court, regulations of the Minister of Justice, announcements from the Marshal of the Sejm of the Republic of Poland, the provisions of the Act on the Professions of Doctor and Dentist, and specialist literature on the subject.

Most of the aforementioned lawsuits have centered on accusations that employees were infected with SARS-CoV-2 due to negligence in the workplace, which was the fault of the employer. In such cases, the employees generally accuse the employers of not following health agency guidelines aimed at preventing of the spread of the virus in the workplace, including appropriate disinfection procedures, mask wearing, and the implementation of protocols for social distancing [9].

Therefore, employee lawsuits have aimed for compensation due to damages incurred as the result of a long-lasting illness, loss of work, and, in certain cases, employee death. Apart from the typical cases regarding compensation for health impairments, the demands that employees have made also concern:

- the illegal termination of a contract or discrimination as far as dismissal from work, vacations, shortened working hours, remote work, and paid sick leave;
- mistreatment or employee harassment due to illness or suspicion of illness;
- unlawful disclosure of the identity of an infected employee or private medical information [10].

The increasing number of employee lawsuits has prompted employers to seek effective measures to secure their own interests. One of the proposals concerns the introduction of an act on civil immunity against actions connected with COVID-19. However, the key to effectively using this instrument is to show that the employer has undertaken reasonable measures and displayed goodwill in order to comply with all government regulations and guidelines in force. This means that the possibility of holding the employer at fault for their actions, or lack thereof, will exclude the possibility using the proposed immunity. Another possibility to secure employer interests is a statement of the release of possible claims connected with COVID-19 for the employee. However, such releases must be clear, unambiguous, and written in a language that is easy to understand. It must be emphasized that this action does not mean that the employer is released from responsibility for deliberate actions or omissions (intentional fault), or recklessness and gross negligence (unintentional fault) [11].

Taking into account the tendencies observed in the USA and Great Britain, attempts should be made to characterize the lawsuits putting particular emphasis on the role of doctors as medical experts in settling such cases. Therefore, in applying this knowledge to the predicted claims directed towards employers based on the provisions of the Civil Code [12], we must emphasize the similarities of the basis of tort liability (due to tortious acts) of the previously described regulations, as well as those which function in the Polish legal framework. It must also be added that, in taking legal action for the compensation of damages to the person which were caused by an infectious disease, the claimant must prove all premises of liability of damages of the defendant, meaning:

- the responsibility of the employer for the unlawful act (on basis of guilt – e.g., art. 415 of the Civil Code, or risk – art. 435 of the Civil Code), meaning the unlawful behavior (act, or omission) of the employer;
- incurred damage (personal injury), most often in the form of health impairment or death;
- a common cause relationship between the unlawful act of the employer and the damage to the employee [13].

It must be underlined that tort responsibility for working in conditions that risk infection or effects on an infection have been entrenched in the judicial decisions of the Polish Supreme Court for many years. This means – in the opinion of the authors – that the views of the Supreme Court expressed in rulings from April 19, 2013 (regarding hepatitis) [14] and from April 22, 2015 (regarding Lyme disease) [15] may be applied in the evaluation of employee "COVID claims" with the use of the provisions of the Civil Code applied on the basis of art. 300 of the Labor Code [16].

Therefore, it must be stated that employer responsibility based on guilt (art. 415 of the Civil Code) for the effects of an infection is conditioned by the proof of an employee during the case that, under specific actual circumstances, work had been inappropriately organized, which, as a consequence, led to the infection, or that real threats, which existed during the performance of employee duties, were not recognized by the employer, therefore the employee did not know of them, or that threats actually recognized were not eliminated by the employer and resulted in the risk of health impairments for the employee. Defined as such, COVID-19 as an infectious disease may be seen as a "work-related disease," meaning a disease that was not included in the catalog of occupational diseases, but which may be caused by working conditions [17].

In relation to the first of the mentioned premises of tort responsibility of the employer, it must be remembered that provisions of art. 24, art. 66 section 1, and art. 68 of the Constitution of the Republic of Poland [18], contain guarantees of protection of employment, including those that guarantee everyone the right to safe and hygienic working conditions, as well as health protection. The realization of these constitutional guarantees as far as employment protection and labor law is among art. 94, items 4 and 10 of the Labor Code, which levies upon the employer the obligation to ensure safe and hygienic working conditions. It is the employer who is tasked with ensuring safe and hygienic working conditions, as described in art. 207 § 2 of the Labor Code. In art. 226, item 2 and art. 227 of the Labor Code, these obligations are specified, requiring the employer to provide the employee with information regarding occupational hazards and means of prevention, especially with the aim of preventing occupational and work-related diseases. It must be emphasized that even in the title of the Act from March 2, 2020 on specific solutions related to the prevention, counteraction, and eradication of COVID-19 and other infectious diseases, and crisis situations caused by them (hereinafter referred to as the COVID Act) [19], by using the term "prevention" (meaning resistance to some action caused by another action) the lawmakers have included a hint as to the role fulfilled by the employer. In the text of art.2, section 2 of the COVID Act, it was assumed that in every instance the Act mentions "prevention of COVID-19," it is understood as all actions connected with the eradication of the infection, prevention of its spread, as well as combating its effects, including its socio-economic effects. As per the provisions of the Act, the principal form of COVID-19 prevention in the workplace is remote working (art. 3 of the COVID Act) [20]. On the other hand, the resolution

of the Council of Ministers regarding the establishment of limits, orders, and prohibitions, includes detailed and variable in time regulations regarding the principles of hygiene, covering the mouth and nose, as well as social distancing in the workplace [21]. However, it must be taken into account the fact that court rulings have moved the boundaries of the obligations specified by the above provisions ensuring the employee of safe and hygienic working conditions. The Supreme Court in a ruling from May 11, 2005 [22] showed that a healthcare facility as an employer is obliged to use all available organizational and technical means to protect the health of its employees (medical staff) against infectious diseases, highlighting the fact that the employer's responsibility is based on guilt. Due to this fact – in the circumstances of a given case –it may be assumed that it is the employer who is tasked with taking the employees' temperature before allowing them to work, or with organizing testing in the company offices and requiring employees to take a test for the presence of coronavirus antibodies or an antigen test. It must be noted that antigen tests guarantee high effectiveness and the possibility to obtain results in a few minutes. Thus, an employee with a positive test may immediately be isolated from healthy staff members. Referencing the obligations described in the text to the realities of tort responsibility, it must be concluded that violating them in any way may lead to the employer being held responsible for the health impairments or death of an employee.

It is more difficult for the employee to establish the premise of causation between a COVID-19 infection and the illegal behavior of an employer. In this case, it is possible to use previous court rulings regarding the responsibility for injuries or death caused by medical malpractice. The Supreme Court has numerous times underlined the fact that, in cases on the compensation for medical malpractice, due to the properties of the biological processes in question, it is extremely difficult, sometimes impossible, for the patient to establish the premises of responsibility of the healthcare facility. That is why, in reference to these kinds of cases, the judiciary has introduced particular legal constructions, which greatly alleviate the evidence stipulations required of the claimant. The Supreme Court has agreed to allow a high probability of occurrence as evidence of the existence of causation between damages to a person and the activity of people acting on behalf of an entity providing healthcare services [21]. In its ruling, the Supreme Court underlined the fact that it would be unreasonable to require that the patient provide strict proof as to the exact moment and method of infection. The basis of establishing a high probability of employee infection in the workplace is an inference based on the analysis of the facts (including proof of employer negligence), which does not include signs of arbitrariness, significant gaps, or contradictions.

During the trial, the issue of defining the infection mechanism and possible high probability of infection of employees in the workplace (meaning the method and time of infection), as well as effects of the infection, requires specific knowledge that is available solely to doctors in the appropriate fields (e.g., infectious diseases and workplace medicine).

The procedures regarding the performance of the profession of a doctor are regulated in the Act from December 5, 1996 on the medical and dental profession [22]. In general, this profession may be performed in Poland solely by a person possessing the right to perform said profession, which is granted by the District Medical Council and for whom the required qualifications (specified in art. 5 and ff. of the Act) have been confirmed.

The lawmakers have agreed that the basic duty of a doctor is to provide "healthcare services" (art. 2 section 1 of the Act on the medical and dental profession) [23]. At the same time, this term was not defined in the act, being limited to providing a sample list of activities that constitute these services [24]. The legal definition of a permissible form of performing a profession is an inherent feature of professions of public trust and regulated professions [25]. The catalog of activities treated as the provision of healthcare services includes, among others, the issuance of an opinion by a doctor, which is directly connected with the doctor appearing in court as a court-appointed medical expert. Enabling doctors to issue court opinions is possible based on specific provisions, in this case, the provisions of the Code of Civil Procedures (art. 278) [25].

An opinion expressed in such a scope is – performed with the use of the available knowledge and acquired experience – judgment about the medical event being evaluated and its connection with previously agreed-upon facts. Most often in such a context, the doctor examines and determines the connection of a specific activity or omission (e.g., working with risk of COVID-19) with death, bodily impairment, or illness.

As far as the provisions of civil procedures are concerned [26], the doctor in presenting evidence based on an opinion may appear in court in one of three roles:

- as a court-appointed expert;
- as an *ad hoc* expert;
- as a person preparing an opinion on behalf of a scientific or scientific research institute.

The right to perform the function of a court-appointed expert is acquired by the doctor upon fulfilling the conditions and exhausting the procedure specified in the provisions of the resolution of the Minister of Justice from January 24, 2005 on court-

appointed experts [27]. Upon appointment, the president of the regional court enters the medical expert onto the list of court-appointed medical experts, in accordance with the field that the doctor represents. While the provisions in force have been widely criticized, the benefits that result from having a list of court-appointed experts cannot be overlooked. Based on the entries onto the list, courts, organizations conducting preparatory proceedings (criminal), and both parties involved in a trial can obtain information regarding persons (proven experts in their fields) who are court-appointed experts.

As indicated, any other doctor (who is not a court-appointed expert) may be nominated by a judicial body for the position of a court-appointed expert (*ad hoc* expert*)* if, according to the judicial body, he/she possesses sufficient special knowledge and professional experience to issue a specific opinion. In such a situation, the judicial body – based on information that it possesses – issues a decision, by which it appoints a doctor, indicated by name, as an expert in the field in which the doctor has the appropriate knowledge (specialization) and professional experience. It is admissible, and practiced by both parties of the court dispute, to suggest specific persons who may, due to their specialized knowledge, be *ad hoc* experts.

Finally, a doctor may give an opinion on behalf of a scientific or scientific research institute. Generally, the function of such an institute is fulfilled by a university clinical hospital. In its rulings regarding evidence, the Supreme Court has underlined the particular procedural function of the evidence of an opinion of a scientific or scientific research institute, which is another form of evidence of an expert opinion. This evidence allows for the use of the intellectual potential and technical capabilities of such institutes, which have at their disposal high-level research means and issue opinions as a team after conducting joint research. Allowing evidence from such an opinion will therefore be purposeful and justifiable in a situation where the medical problem being evaluated by the court, due to its complexity, requires the explanation of specialists with a high level of theoretical preparation, when it is necessary to use the latest research results, or when it is impossible in any other way to address contradictions which have arisen in the available opinions. Such an opinion is to be made collectively and expresses the stance of the institute (clinic), and not individual persons who represent the institution. It means that the opinion should indicate the doctors who issued it, pointing out their posts and the fields in which they specialize. These doctors sign the opinion, while the annotation of the head of the clinic means that he/she saw the opinion, but it is not treated as an opinion that was issued with his/her involvement.

Of course, there are no obstacles for a doctor who is a court-appointed expert to prepare a private opinion commissioned by one of the parties involved in a trial. However, such an opinion does not constitute evidence from an opinion and may not be used as such. A party may present it during a trial only to support their own arguments presented to support their demands during the trial, or to show the need to use specialized knowledge with the use of the opinion of a medical expert.

As per art. 278 of the Civil Procedures Code, the court consults an expert in cases requiring specialized knowledge. Specialized knowledge means circumstances that go beyond the scope of the general knowledge of an educated person with appropriate life experience. In other words, specialized knowledge is knowledge that goes beyond average practical abilities [28].

Due to the above, it must be concluded that each court does not possess the specialized knowledge to allow for an individual evaluation of the mechanism of a SARS-CoV-2 infection or the effects of COVID-19. However, the court does possess a certain amount of convictions regarding the functioning of the human organism. These include the conviction about the integrality of the human organism, whose various systems, organs, and functions impact one another, as well as the conviction of the existence of synergy (the increased impact of several causes together on a retroactive effect) in relation to the general health of a person [29].

Taking into account the above, very general principles, the court – in order to explain the circumstances, for the evaluation of which medical knowledge is needed – uses the opinions of medical experts in the appropriate fields. Moreover, if the settlement of a case requires specialized knowledge, evidence from the opinion of a medical expert is a must [30].

Limitations of the study

It must be remembered that allowing evidence from the opinion of an expert, by issuing the appropriate decision, should take place at the moment when the case file includes factual evidence allowing the expert to issue an opinion, since the thorough analysis of the case and the evidence gathered up to that point (necessary medical documentation) is a condition required for the clear stating of doubts and the precise formulation of questions directed towards the expert in the evidence thesis. At the same time, the court may force the parties (especially if represented by attorneys or legal advisers) to present in the procedural writ detailed questions, which may be the basis of constructing the evidence thesis. Taking advantage of this opportunity minimalizes the

possibility of the accusation that the expert was not asked the appropriate questions, which has an influence on the evaluation of the opinion that he/she has prepared.

Conclusions

It must be explicitly underlined that doctors within the scope of their profession are entitled to prepare medical opinions. The increasing number of lawsuits where specialized knowledge is required has resulted in an increased need for medical opinions. Therefore, it is important for doctors to possess a thorough knowledge of their duties and rights, and the principles of preparing such opinions. In addition, it is certain that doctors are currently facing another important task connected with the effects of the COVID-19 pandemic. It must be assumed that, in the near future, doctors will be forced to issue opinions on numerous and complicated cases regarding employer responsibility for damages incurred by employees due to COVID-19. In order to issue such opinions, medical experts will use knowledge and experience acquired during the struggle with the disease to evaluate whether it was highly probable that the employee illness was the result of an infection with the pathogen in the workplace, and then, furthermore, to specify the after-effects of this illness (degree of discomfort connected with treatment, damage to the health, or the relation of employee death with such an illness). The knowledge that doctors possess is necessary for the court to make appropriate and just decisions.

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PARAMEDICS' KNOWLEDGE OF MEDICAL GUIDELINES AND PROCEDURES FOR PROTECTION AGAINST CORONAVIRUS DURING THE COVID-19 PANDEMIC: A PILOT STUDY

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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: Paramedics are the frontline workers of the healthcare profession. Thus, they need to be equipped with the relevant knowledge, skills, and protective gear against different forms of infection, including coronavirus disease 2019 (COVID-19).

Aim of the study: To determine the level of paramedics' knowledge about implementing medical guidelines and procedures to avoid coronavirus infection during the COVID-19 pandemic.

Material and methods: This study involved 101 paramedics employed in Emergency Medical Services in Legnica between November 2020 and January 2021. A diagnostic survey method and opinion polling technique were applied. A survey developed by the study authors was used.

Results: Overall, 38 (37.62%) paramedics had sufficient knowledge of medical guidelines and procedures preventing coronavirus infection, 28 (27.72%) had good knowledge, 23 (22.77%) had very good knowledge, and 12 (11.88%) had insufficient knowledge of the topic. Variables such as education (p=0.305), participation in any course on COVID-19 (p=0.650), frequency of emergency services for patients suspected to have COVID-19 infection or with confirmed COVID-19 infection (p=0.116), and job seniority (p=0.984) did not have a significant influence on interviewees' knowledge of this topic.

Conclusions: There is a need for organizing courses, workshops, or training events for paramedics concerning the code of conduct and good practice while working with patients who suffer from highly infectious diseases in order to improve safety in the work environment. It is particularly important as paramedics themselves opted to organize such courses. It is recommended that before organizing the course, one should obtain information from potential participants about the preferred format of the course.

KEYWORDS: paramedics, knowledge, COVID-19

Backround

Viruses from the corona family have been known by mankind for many years. In January 2020 an unknown type of coronavirus was isolated – a novel coronavirus (nCoV). Soon after the World Health Organization (WHO) declared a pandemic of "the new coronavirus" (SARS-COV-2) and the illness caused by it was called COVID-19 [1]. According to WHO reports, at the end of February 2020 the number of confirmed COVID-19 cases worldwide equaled 85,403 in 53 countries, and by the end of May 2020 it had increased to 5,934,936 cases worldwide [2]. The COVID-19 pandemic has become an urgent health crisis in communities worldwide [3].

A distinctive feature of coronaviruses is high contagiousness with a dominant aerogenic, droplet route of infection. The high rate of infections results from a long period of pathogen survival in the environment. [4]. The unique resistance of the new coronavirus to environmental conditions gives it the possibility to survive a few days on uncleaned surfaces. SARS-CoV-2 infection occurs mainly by contact with an infected patient's airway discharges or by touching contaminated surfaces. [5-7]. The most common symptoms in the initial stage of the illness are fever, coughing, shortness of breath, joint and muscle pains, tiredness, diarrhea, and smell and/or taste disorders. During the course of COVID-19, the induction of inflammatory reactions results in inflammatory cytokine release which triggers a 'cytokine storm' as a defense mechanism of damaged organs. The most common complications of SARS-COV-2 infection are acute respiratory failure, anemia, heart muscle disorder, and sub-infection [8, 9].

Due to the SARS-COV-2 pandemic onset and the real threat to medical professionals, medical procedures should be changed in order to minimize the risk of infection. The changes introduced by the European Resuscitation Council (ERC) concerned almost every stage of patient care [10]. The biggest changes in safety procedures and protection against potential infection related to performing medical rescuing actions and in emergency treatment and care. As a result, the system of State Emergency Medical Services faced a large organizational challenge. The significant number of new job responsibilities and new tasks have made medical personnel put a lot of effort into performing their tasks during the pandemic situation. In the event of a pandemic, only previously established medical procedures and guidelines and the latest knowledge coming from scientific research, which is updated all the time, are able to minimize the risk of COVID-19 infection and possible sickness [11].

Paramedics are the frontline workers of the healthcare profession. As a result, they need to be equipped with the relevant knowledge, skills, and protective gear against different forms of infection, including COVID-19 [12]. A lack of knowledge, inadequate availability of personal protective equipment (PPE), inadequate training, intensity of work, and long-term exposure to infected patients are the main reasons for COVID-19 spread among healthcare workers [13]. A prospective cross-sectional study conducted among 529 healthcare workers globally showed that a significant proportion of them had poor knowledge about COVID-19 transmission and symptom onset [14]. Considering the facts mentioned above, this study was performed to verify the level of paramedics' knowledge about medical procedures and guidelines applicable during the pandemic.

Aim of the study

The aim of this study was to determine the level of paramedics' knowledge about implementing medical guidelines and procedures aimed at avoiding coronavirus infection during the COVID-19 pandemic.

Material and Methods

Study design and setting

This study was performed between November 2020 and January 2021 among paramedics employed in Emergency Medical Services in Legnica. Permission to perform the research was given by the Chief of the Medical Services and Bioethical Committee of the University of Medical Sciences in Legnica (permission no. KB 2/2021). The STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology) were followed.

The first step of the study was distributing the questionnaire among paramedics working in different branches of Emergency Medical Services. Because paramedics have a specific type of work, the survey was left for them to complete at a suitable time and then collected from each branch after few days.

The inclusion criteria for this study were: having a professional job title of paramedic, employment in the Emergency Services in Legnica, and consent to participate in the study. People who did not meet abovementioned criteria were excluded from the analysis. Participants were informed about the aim of the research, the potential benefits of the obtained results, and the possibility to withdraw from the research at any stage.

Participants

The participants consisted of 101 paramedics (Table 1). The majority were male (76.24%; 77). The median age was 38 years (range: 30.00–45.00). Most participants had a bachelor's degree (48.51%; 49) and lived in cities (69.31%; 70). The median job seniority equaled 15 years (range: 5.00–20.00). Most participants stated that they attended to infected patients or patients suspected of having coronavirus infection every day (56.44%; 57).

Survey questions/knowledge measurement

A diagnostic survey method and opinion polling technique were applied. A survey created by the study authors consisting of 22 questions was used. The first eight questions were metrics. The remain-

Table 1. Characteristics of the paramedics participating in this study

Variable		Total (N=101)
Age (years)	M±SD	37.82±9.5
	Me	38
	Q1-Q3	30–45
Sex	Female	24 (23.76%)
	Male	77 (76.24%)
Place of residence	Town/city	70 (69.31%)
	Village	31 (30.69%)
Education	Secondary school	33 (32.67%)
	Bachelor's degree	49 (48.51%)
	Master's degree	18 (17.82%)
	PhD	1 (0.99%)
Job seniority as a paramedic (years)	M±SD	13.39±8.47
	Me	15
	Q1-Q3	5–20
Participation in a course about COVID-19	Yes	40 (39.60%)
	No	61 (60.40%)
Participation in COVID-19 academic conferences for medical staff	Yes	24 (23.76%)
	No	77 (76.24%)
Participation in one of the listed certified courses by ERC or AHA in the past 3 years*	ALS/ACLS	56 (55.45%)
	ITLS/PHTLS	26 (25.74%)
	EPALS/PALS	12 (11.88%)
	I did not take part	33 (32.67%)
Frequency of ambulance services for patients suspected of infection or COVID-19 infection identified	Every day	57 (56.44%)
	Several times a week	29 (28.71%)
	At least once a week	13 (12.87%)
	A few times in a month	2 (1.98%)

Legend: ERC – European Resuscitation Council, American Heart Association, ALS – Advanced Life Support Provider Course, ACLS – Advanced Cardiovascular Life Support, ITLS – International Trauma Life Support Provider Course, PHTLS – Prehospital Trauma Life Support, EPALS – European Pediatric Advanced Life Support, PALS – Pediatric Advanced Life Support, * – multiple choice questions (percentages do not sum up to 100), M – mean, SD – standard deviation, Me – median. Q1 – first quartile, Q3 – third quartile.

ing questions concerned the following: frequency of ambulance services for patients with confirmed or suspected COVID-19 infection, practical knowledge and behaviors of paramedics during situations of emergency treatment for patients suspected of having COVID-19 infection, self-assessment concerning knowledge of how to avoid coronavirus infection, and assessment of the need for courses and workshops to improve the level of knowledge and skills to avoid getting infected with highly contagious diseases.

The level of interviewees' knowledge was assessed based on their answers to questions 10–20. One point was given for every correct answer and no points were given for an incorrect answer. The maximum number of points was thus 11. To evaluate knowledge, the following school rating scale was used: 0–5 points (0–50% of possible score) – insufficient – F; 6 –8 points (50–75% of possible score) – sufficient – C; 9 points (75–90% of possible score) – good – B; and 10–11 points (90–100% of possible score) – very good – A.

Statistical analyses

For quantitative variables, the average, standard deviation, median, and quartiles were calculated; for qualitative variables, the number and percentage of each variable's occurrence were calculated. Comparison of quantitative variables between two groups was performed using the Mann–Whitney U test. Comparison of quantitative variables between three or more groups was performed using the Kruskal–Wallis test. In case of statistically significant differences, post-hoc analysis was carried out using Dunn's test to identify groups that were significantly different. Correlations between quantitative variables were analyzed using Spearman's correlation coefficient. $P<0.05$ was considered statistically significant. Analysis was performed using R software, version 4.0.4.

Results

Of the total 101 interviewees, 38 (37.62%) had sufficient knowledge of medical procedures and guidelines aimed at avoiding coronavirus infection during the COVID-19 pandemic, 28 interviewees (27.72%) had good knowledge, 23 interviewees (22.77%) had very good knowledge, and 12 interviewees (11.88%) had insufficient knowledge,

Most participants (83; 82.18%) correctly answered the question that in the event of an ambulance call for a 50-year-old man with hypertension who has the following symptoms – sudden shortness of breath, temperature of 38.5 °C, and olfactory anesthesia – a mask with N99 filter, protective goggles, face shield, protective suit, shoe guards, and two pairs of gloves have to be worn. Over half of interviewees (53.47%; 54) correctly stated that, after departing in PPE when a patient with identified COVID-19 infection stayed at the place of call, the paramedics cannot take off the PPE at the point where the emergency call was made. Proper knowledge of ambulance and medical equipment decontamination after seeing a patient suspected of having coronavirus infection or infected by the virus was possessed by 60.40% (n=61) of paramedics. The correct order of ambulance and medical equipment decontamination procedures after seeing

a patient suspected to have coronavirus infection or infected by the virus was known by 83.17% of interviewees (n=84). Furthermore, 86.14% (n=87) knew the code of conduct that can minimize the risk of infection while transporting a patient in an ambulance to hospital (Table 2).

Almost all interviewees (91.09%; 92) correctly answered that, while transporting a patient suffering from COVID-19 to hospital, nebulization should be avoided. Another question was: Does CPR generate aerosol? This question was answered correctly by 77.23% (n=78) of paramedics. There was also a question about the desirable ventilation technique with the use of a rebreathing bag. Slightly more than half of respondents (53.47%; 54) correctly answered that the two-hand technique has to be used. Correct knowledge of the fact that intubation is a procedure that generates aerosol and must be done by the person with the most experience in order to limit the number of people in a room was possessed by 55.45% (n=56) of participants. The interviewees were also asked about the most important activity while using PPE . Almost all respondents answered the question correctly – 94.06% (n=95). The last question asked about the correct order of removing PPE items, which was answered correctly by 77.23% (n=78) of respondents (Table 3).

Variables such as education (p=0.305), participation in any course/workshop connected with COVID-19 (p=0.650), frequency of ambulance departures to patients suspected of having coronavirus infection or with identified infection (p=0.116),

Table 2. Participants' answers to survey questions testing their knowledge about implementing medical guidelines and procedures aimed at avoiding coronavirus infection during the COVID-19 pandemic – part I

Questions:		
In the event of an ambulance call for a 50-year-old man with hypertension who has the following symptoms: sudden shortness of breath, temperature of 38,5 C, and olfactory anesthesia, the following personal protective equipment has to be worn:	**n**	**%**
Surgical mask, protective suit, face shield, 2 pairs of gloves, and shoe guards	9	8.91
N95 mask, protective goggles, face shield, long sleeve apron, shoe guards, 2 pairs of gloves	8	7.92
N99 mask, protective goggles, face shield, protective suit, shoe guards, 2 pairs of gloves	83	82.18
I won't wear any PPE mentioned above, as the emergency call is the same as other calls.	1	0.99
Can a paramedic take off their PPE at the place of emergency call when a patient with COVID-19 stays at that place?	**n**	**%**
Yes	10	9.90
No	54	53.47
Yes, unless it is done in an ambulance	0	0.00
Yes, unless it is done outdoors	35	34.65
No answer	2	1.98
While decontaminating the ambulance and medical equipment after seeing a patient suspected of having coronavirus infection or infected by the virus, paramedics should:	**n**	**%**
Spray disinfectant on the equipment and leave it to dry according to the product data sheet	11	10.89
Spray disinfectant on the equipment, wipe touched surfaces, and leave it to dry according to the product data sheet	28	27.72
Pour disinfectant on surfaces and wipe them	61	60.40
If the surface is dirty with blood or other secretions nothing has to be done	1	0.99
While decontaminating the ambulance and medical equipment after seeing a patient suspected of coronavirus infection or infected by the virus, paramedics should:	**n**	**%**
Take off PPE and move to the fogging procedures	2	1.98
Spray surface disinfectant and then take off PPE and move to the ozonating procedure	4	3.96
First disinfect the ambulance, then start the fogging procedure, and finally take off PPE	84	83.17
First disinfect the ambulance, then take off PPE, and finally start the fogging procedure	10	9.90
No answer	1	0.99
While transporting a patient to hospital, one should:	**n**	**%**
Turn on internal air circulation in the ambulance in order not to generate aerosol outside the car	8	7.92
Turn on air extraction in order to remover patient's aerosol outside the car	87	86.14
Turn on air conditioning, set ventilation to blow the aerosol to the back of the car	2	1.98
Setting ventilation doesn't matter. an ambulance window has to be opened	4	3.96

Table 3. Participants' answers to survey questions testing their knowledge about implementing medical guidelines and procedures aimed at avoiding coronavirus infection during the COVID-19 pandemic – part II

Questions		
While transporting a patient suffering from COVID-19, one has to avoid:	**n**	**%**
Passive oxygen therapy	4	3.96
Nebulization	92	91.09
Eye contact	2	1.98
Monitoring vital functions	0	0.00
No answer	3	2.97
CPR is a treatment:	**n**	**%**
Generating aerosol	78	77.23
Only generating aerosol while securing airways	13	12.87
Generating aerosol only while defibrillation	1	0.99
Not generating aerosol	6	5.94
No answer	3	2.97
While ventilating a patient with a rebreathing bag, one should:	**n**	**%**
Use the two hands technique	54	53.47
Use C+E technique	33	32.67
Oxygen source has to be cut off	0	0.00
Oxygen flow has to be set to the maximum available on reducer	12	11.88
No answer	2	1.98
Intubation procedure generates aerosol. That is why:	**n**	**%**
It has to be done as quickly as possible by the person closest to the patient's head	10	9.90
Before intubation the patient has to be oxygenated at the maximum by means of a rebreathing bag	26	25.74
It should be done by a person with the most experience, limiting the number of people in a room	56	55.45
It should be done by the person with the most experience by means of an armed tube	9	8.91
While using PPE, one of the most important activity is:	**n**	**%**
The way it is taken off	95	94.06
Putting on a few pairs of gloves (the more the better)	2	1.98
Putting it on in a sterile manner	0	0.00
To take them off right after handling the patient or leaving the place where the emergency medical team is called	4	3.96
While taking off the protective suit, it has to be put to its left side and put into a red garbage bag and then:	**n**	**%**
Take off the mask and goggles	11	10.89
Disinfect your hands	8	7.92
Disinfect gloves	78	77.23
Disinfect mask and goggles	2	1.98
No answer	2	1.98

and job seniority (p=0.984) did not have a significant influence on the level of interviewees' knowledge (Table 4).

One of the last questions of the survey was about the need for obligatory courses to improve the level of knowledge and skills that protect medical workers against highly infectious diseases in the future. It turned out that most paramedics were eager to take part in a course in the form of workshop (n=75; 74.26%), while 20.79% (n=21) would prefer theoretical training in the form of a lecture. Only small percentage of paramedics (n=5; 4.95%) stated that there is no need to organize such courses.

Discussion

Ahmad et al. claim that the availability of PPE, COVID-19–related training, and compliance with WHO recommended practices against COVID-19 are instrumental in protection against the infection and its spread [12]. In our research, we decided to focus on assessing the level of paramedics' knowledge about medical procedures aimed at avoiding coronavirus infection. We proved that this knowledge is either sufficient or good. The knowledge of only one-fifth of interviewees was at the very good level, whereas one-tenth had insufficient knowledge of the topic.

Table 4. Correlation between chosen variables and paramedics' knowledge of medical guidelines and procedures aimed at avoiding coronavirus infection

Knowledge level [points]	Education			p
	Secondary (N=33)	Bachelor's degree (N=49)	Master's degree, PhD (N=19)	
M±SD	7.79±1.95	8.2±1.91	8.58±1.5	p*=0.305
Me	8	9	9	
Q1-Q3	7–9	8–10	8–9	
Knowledge level [points]	**Have you taken part in any course/workshop on COVID-19?**			**p**
	Yes (N=40)	**No (N=61)**		
M±SD	8.05±1.97	8.2±1.8		p**=0.650
Me	8	9		
Q1-Q3	6.75–10	8–9		
Knowledge level [points]	**Frequency of ambulance departures to patients suspected of having COVID-19 infection or with identified infection**			**p**
	Every day (N=57)	**A few times a week (N=29)**	**At least once a week, a few time a month (N=15)**	
M±SD	7.82±1.97	8.59±1.55	8.47±1.85	p*=0.116
Me	8	9	9	
Q1-Q3	7–9	8–10	8–9.5	
Job seniority		**Spearman's correlation coefficient**		**p**
Knowledge level		–0.002		p=0.984

Legend: M – mean, SD – standard deviation, Me – median, Q1 – first quartile, Q3 – third quartile, * – test Kruskal-Wallis test, ** – Mann–Whitney U test.

According to Higginson et al. (2020), all respiratory infections should be considered COVID-19 until proven otherwise, so paramedics should wear PPE [15]. Updated ERC guidelines from April 2020 concerning COVID-19 put great emphasis on safety issues among health care professionals and recommend wearing PPE while treating every patient potentially infected by coronavirus [16]. Basic PPE that protects against droplets includes gloves, apron, fluid-resistant surgical mask, and face and eye protection [17]. In contrast, the basic kit of PPE protecting against airborne aerosol includes gloves, long-sleeved apron, FFP3 (N99) filter mask or FFP2 (N95) if FFP3 is not available, and face and eye protection. Valim et al. (2014) found that health professionals seem to be selective when supposedly following standard precautions and using PPE [19]. In a study conducted in Pakistan, 52% of healthcare professionals had awareness and 72% were practicing adequate measures to combat COVID-19 [20]. In the present study, the vast majority of interviewees knew what kind of PPE should be worn when responding to an emergency call for a patient with sudden acute suffocation, fever, and olfactory anesthesia. Almost all interviewees were aware of the fact that while taking off PPE it is important to follow the correct order of actions. However, about one-fourth of paramedics did not know at what stage gloves should be disinfected while removing the protective suit.

The International Liaison Committee of Resuscitation (ILCOR) suggests that pressing the chest and CPR are activities that potentially generate aerosol [21]. Three-quarters of interviewees were aware of this fact. It was also pointed out in the guidelines that medical professionals, while performing ventilation by means of a rebreathing bag and face mask, should use the two hand technique. This is supposed to improve tightness and limit the risk of aerosol spreading [16]. As far as our research is concerned, 47% of participants did not have that knowledge.

During the COVID-19 pandemic, while performing emergency action, the number of medical professionals and other people in a room should be limited to the minimum. The person who performs CPR should have the most experience from the whole emergency unit [22]. Correct knowledge of the topic was held by only half of the interviewees.

One of the questions in the survey concerned handling medical waste. In our study, nearly half of paramedics were aware of the fact that after performing emergency action in PPE after which a patient with identified COVID-19 stayed at the place of call, the paramedic unit cannot take off PPE at the place of call. According to Ministry of Health regulations, medical waste generated after providing medical treatment at the place of call should be collected in special containers or bags by medical

professionals and immediately taken to a room designed only for storing medical waste. These regulations have been in force since 2017 and are not new [23].

We also assessed knowledge about ambulance and medical equipment decontamination after seeing a patient suspected to have or infected by COVID-19. Only 60% of interviewees had the correct knowledge that one should pour disinfectant on touched surfaces and wipe them. However, paramedics had much better knowledge about the right order when decontaminating the ambulance and medical equipment – 83.17% answered correctly. A similar study was conducted in Turkey during the COVID-19 pandemic among 400 emergency medical service (EMS) workers (doctors, nurses, emergency medical technicians, paramedics, and ambulance drivers). Vatan et al. evaluated knowledge, attitude, and preventive behaviors for COVID-19 and found that 78% of participants had poor knowledge about floor and surface disinfection. In the study from Turkey, responders who were high school graduates had higher percentages of correct answers than those with a bachelor's degree ($p < 0.001$). Moreover, participants with less than 10 years of experience had many more wrong answers than participants with more than 10 years of experience ($p<0.001$) [24]. However, in our study, education, participation in any course/workshop connected with COVID, the frequency of ambulance departures to patients suspected of having coronavirus infection or with identified infection, and job seniority did not have a significant influence on the level of interviewees' knowledge.

A previous study conducted by Kotowska & Gawlik pointed to a significant relationship between training courses in the management of patients with COVID-19 and the sense of security among nurses and midwives. In this study, the respondents who did not take part in the training felt less secure more frequently than trained ones [24]. It is worth noting that almost all interviewees in our study were interested in courses to improve their level of knowledge and skills aimed at protecting medical professionals against highly infectious diseases in the future. They only had different opinions on the form of such courses (workshops vs. theoretical training in a form of a lecture). In the aforementioned study from Turkey, more than half of the participants said that an in-hospital training program on COVID-19 was beneficial [25].

Limitations of the study

One limitation of this study is assessing only a small group of paramedics in one medical facility. However, it should be noted that this is a pilot study. Its main asset is the fact that it is current and innovative. Another limitation is that we did not include the variable "type of work performed with emergency medical teams". The results of our future research will answer the question of whether the type of function performed by the surveyed emergency medical teams has a significant impact on the respondents' level of knowledge.

Conclusions

Paramedics' knowledge about applying medical guidelines and procedures aimed at protecting against coronavirus during the COVID-19 pandemic was generally sufficient or good. This result may suggest the need for organizing courses, workshops, or training events for paramedics concerning the code of conduct and good practice while working with patients who suffer from highly infectious diseases in order to improve safety in the work environment. It is particularly important as paramedics themselves are interested in such courses. It is recommended that before organizing the course, the potential participants express their opinion about the preferred form of such trainings as, according to our research, it can be different.

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NURSES' STRATEGIES FOR DEALING WITH STRESS DURING THE COVID-19 PANDEMIC

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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: In view of the SARS-CoV-2 coronavirus pandemic, it is important to study the activities undertaken by nurses to cope with stress.

Aim of the study: The study's main objective was to analyze strategies of coping with stress among nurses working in public and non-public medical institutions in Opolskie and Lubelskie provinces, Poland, during the COVID-19 pandemic.

Material and methods: The study group included a total of 155 nurses. The Mini-COPE questionnaire and the author's original questionnaire were used in the study.

Results: With increasing age, nurses coped with stress by using their sense of humor less often, seeking instrumental support, discharge of emotions, using psychoactive substances, and blaming themselves. Respondents with a master's degree were more likely to cope with stress by positive reevaluation, turning to religion, and seeking emotional and instrumental support. Examining the effect of job tenure on the level of coping strategies revealed significant variation for active coping (p=0.0355), sense of humor (p=0.0024), seeking emotional support (p=0.0209), seeking instrumental support (p=0.0062), preoccupation with something else (p=0.0383), discharge (p=0.0075), psychoactive substance use (p=0.0097), and blaming oneself (p=0.0155). There was no significant variation in the effect of place of employment on stress coping strategies.

Conclusions: During the pandemic, respondents managed stress mainly through active coping, planning, acceptance, positive reevaluation, and seeking instrumental support. As nurses age, they are more likely to use the strategy of turning to religion. Due to the growing problem of stress, it is necessary to identify and share information about ways to effectively cope with stress.

KEYWORDS: nurses, stress, pandemic, COVID-19

Background

Stress is a part of everyday life that is connected with both personal and professional life [1]. Some professions are more or less burdened by psychological stress. Nurses are undoubtedly more exposed to stressful factors than the majority of society, which is related to the nature of their work and the necessity to make quick decisions – sometimes associated with life-threatening situations [2,3]. Long-term exposure to emotionally difficult situations may lead to rapid professional burnout, impair mental and physical health [4,5], and negatively affect social well-being [6]. According to Marcysiak et al., the consequences of professional burnout may be physical, spiritual, and emotional exhaustion [5]. According to the National Labour Inspectorate, workplace stress "occurs when people – employees and employers – feel psychological discomfort concerning conditions and/or demands of work in a situation when, at a given

moment, these conditions and demands exceed their capabilities" [7].

In the face of the SARS-CoV-2 coronavirus pandemic, it has become increasingly important to study not so much the experience of stress but the activity undertaken by humans to cope with stressful events, which is referred to as stress coping [8]. Styles of coping with stress have been described by many authors, including Heszen-Niejodek and Sęk. They define coping with stress as an individual, characteristic set of strategies that is activated when confronted with a specific stressful situation [9]. Wrześniewski describes coping with stress as a process or a sequence of strategies changing over time that is related to changes in the psychophysical state of a person and the characteristics of a given situation. The use of a given coping strategy by a person depends on the coping style characteristic for this person; their gender, age, education, and current psychophysical state; the type of stressful situation; and personality components [10]. Schwarzer and Steffen noted that, in coping with stress, the time perspective and subjective certainty about the occurrence of upcoming events are important. Faced with these situations, a person can undertake a variety of coping behaviors that cannot be put into simple categories and strategies such as "fight or flight" or "relax" [11].

The situation of the pandemic caused by the SARS-CoV-2 virus cannot be assessed from a time perspective, as we do not know what tomorrow will bring; thus, the situation of medical personnel seems to be all the more difficult. The pandemic has affected all areas of human life, causing great anxiety and fear. To reduce the impact of these negative emotions, one can only seek to gain reliable knowledge about prevention, medical management and care of persons at risk of infection or ill with COVID-19. Due to the dynamically changing epidemic situation in Poland and worldwide during the SARS-CoV-2 pandemic, nursing care requires professional actions and decisions [12].

A review of 115 articles published in global journals up to April 20, 2020 confirms that healthcare workers are at high risk of developing physical/mental health effects resulting from the pandemic situation [13,14]. The COVID-19 pandemic highlights the need to focus on its impact on the mental health of healthcare workers (HCWs). Italian authors have shown that a high percentage of HCWs are at risk of developing post-traumatic stress disorder (PTSD) and post-traumatic stress symptoms (PTSS) [15].

Aim of the study

The aim of this study was to analyze stress coping strategies among nurses working in public and non-public medical institutions in the Opolskie and Lubelskie provinces of Poland during the COVID-19 pandemic.

Materials and methods

Study design and participants

This cross-sectional study was conducted from July to November 2020 in a group of 155 nurses (mean age 41.9±11.2 years) employed in medical institutions in the Opolskie and Lubelskie provinces in Poland. Written consent was obtained from the Bioethics Committee of the Medical School in Opole (KB-33/PI/2020). The criteria for inclusion were as follows: (i) performing professional work as a nurse during the COVID-19 pandemic and (ii) agreeing to participate in the study. The exclusion criteria were: (i) nurse practitioners who were not active at the time of the COVID-19 pandemic and (ii) not providing consent to participate in the study. This study was conducted online. The sample was selected purposively using snowball sampling. The questionnaire was initially sent and made available online to a small group of nurses in the Opolskie and Lubelskie voivodships, who then sent it to their friends who were nurses employed at public and non-public medical institutions in those voivodships. The beginning of the questionnaire included information about the purpose and anonymity of the study, as well as the opportunity to withdraw from the study at any stage.

Data collection

In order to assess nurses' stress coping strategies, the Mini-COPE questionnaire was used to examine the degree of coping with stress in a difficult situation. The Mini-COPE Questionnaire is the shortened version of Carver et al.'s COPE Questionnaire adapted into Polish by Juczynski and Oginska-Bulik [8]. The questionnaire consists of 28 statements that are part of 14 coping strategies, including active coping, planning, positive reappraisal, psychoactive substance use, cessation, blaming oneself, seeking emotional support, seeking instrumental support, dealing with something else, denial, discharge, turning to religion, acceptance, and humor. There are two assertions for each strategy. The respondent evaluates the assertions about behavior during a difficult situation on a scale of 0 to 3, where 0 indicates "I almost never act this way", 1 indicates "I rarely act this way", 2 indicates "I often act this way", and 3 indicates "I almost always act this way". Each strategy is evaluated separately based on the

average number of points obtained from the two statements assigned to it [8].

To assess the sociodemographic characteristics of the nurses, an interview questionnaire was administered that assessed sex, education, marital status, seniority, and place of employment.

Statistical methods

Statistical analysis was performed using R statistical software (version 13). For quantitative variables, the arithmetic mean and standard deviation (SD) were calculated. For nominal variables, frequency (i.e., percent) was determined. To assess statistically significant differences, due to the nature of the data, the non-parametric Mann Whitney U test, Kruskal-Wallis test, and Kruskal-Wallis post-hoc test were used. For correlation analysis, Spearman's rank correlation was used. For all analyses, $p < 0.05$ was considered to be statistically significant.

Results

Sociodemographic characteristics

The sociodemographic characteristics of the respondents are shown in Table 1.

Table 1. Characteristics of the surveyed nurses.

Variables	n	%
Gender		
Women	149	96.1
Men	6	3.9
Education		
Nursing High School	23	14.8
Bachelor of Nursing	64	41.3
Master of Nursing	68	43.9
Marital status		
Single	43	27.7
Married man/married woman	98	63.2
Divorced man/divorced woman	12	7.7
Widower/ widow	2	1.3
Seniority		
0–10 years	44	28.4
11–20 years	33	21.3
21–30 years	41	26.5
>30 years	37	23.9
Place of employment		
Surgery department	69	44.5
Conservative ward	86	55.5

Most of the respondents were female (96.1%, n=149), with up to 10 years of experience (28.4%, n=44) or 21–30 years of experience (26.5%, n=41), and working mainly in conservative wards (55.5%, n=86). The majority of respondents were married (63.2%, n=98). The lowest percentage of respondents had no higher education (14.8%, n=23).

Level of coping with stress (Mini-COPE)

For the individual methods of coping with stress on the Mini-COPE inventory scored from 0 to 3, where 3 indicates the most frequent behavior, the respondents indicated that they most often fight stress by active coping (2.45), i.e., taking action to improve the situation; planning (2.31), i.e., thinking about and planning what to do; acceptance (1.95), i.e., accepting the situation and learning how to live with it; positive reevaluation (1.93), i.e., seeing the situation in a more positive light; and seeking instrumental support (1.91), i.e., seeking and receiving advice and help from others (see Figure 1).

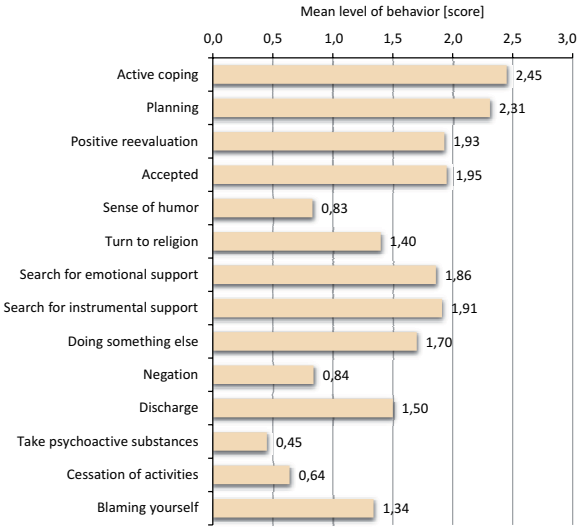

Figure 1. Scores for individual strategies for coping with stress (Mini-COPE) in the surveyed nurses. A higher value indicates a more frequently used behavior

Examining the relationship between age and coping strategies (Mini-COPE), significant effects were observed for sense of humor, turning to religion, seeking instrumental support, discharge, psychoactive substance use, and blaming oneself (Table 2). In all cases except for turning to religion, a significantly negative correlation was obtained: this means that, with age, the respondents used these strategies less frequently. In the case of turning to religion, a weak positive correlation was obtained, i.e., with age, the surveyed nurses more often fought stress through the use of religion.

Table 2. Correlation between age and scores for the individual coping strategies (Mini-COPE).

Variables	Spearman's r correlation coefficient
Active coping	0.15
Planning	0.04
Positive reevaluation	0.07
Acceptance	–0.04
Sense of Humor	**–0.23***
Turning to Religion	**0.16***
Search for Emotional Support	–0.16
Search for Instrumental Support	**–0.21***
Doing something else	–0.04
Negation	0.07
Discharge	**–0.19***
Take psychoactive substances	**–0.24***
Cessation of Activities	–0.08
Blaming yourself	**–0.21***

* significant relationship at p<0.05.

When examining the effect of education on the coping strategies (Mini-COPE), significant differ ences were observed for active coping (p=0.0341), positive reappraisal (p=0.0116), turning to religion (p=0.0150), seeking emotional support (p=0.0015), and seeking instrumental support (p=0.0011). Detailed analysis showed that respondents with a master's degree were more likely than those with a bachelor's degree to cope with stress through positive reevaluation and turning to religion; in contrast, nurses with a bachelor's degree and secondary medical education were more likely to cope with stress by seeking emotional support and seeking instrumental support (see Table 3)

Examining the effect of job tenure on the coping strategies (Mini-COPE), significant variation was identified for active coping (p=0.0355), sense of humor (p=0.0024), seeking emotional support (p=0.0209), seeking instrumental support (p=0.0062), preoccupation with something else (p=0.0383), discharge (p=0.0075), psychoactive substance use (p=0.0097), and blaming yourself (p=0.0155). Detailed analysis showed that respondents with the lowest seniority (up to 10 years) were more likely than those working over 30 years to cope with stress by feeling humorous, seeking emotional support, seeking instrumental support, and blaming themselves and to a higher extent than nurses and nurses with 21-30 years of seniority used a sense of humor and discharge (see Table 4).

When examining the effect of workplace on the coping strategies for stress (Mini-COPE), statistical analysis showed no significant variation in any of the cases analyzed (see Table 5).

Table 3. Relationships between particular coping strategies (Mini-COPE) and the education of the respondents

Variables	Education						Kruskal-Wallis Test		
	Nursing High School		Bachelor of Nursing		Master of Nursing				
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	H	p	Relationship
Active coping	**2.63**	**0.46**	**2.32**	**0.56**	**2.51**	**0.50**	**6.75**	**0.0341***	
Planning	2.26	0.54	2.29	0.60	2.35	0.55	0.37	0.8318	
Positive reevaluation	**1.87**	**0.55**	**1.78**	**0.61**	**2.10**	**0.58**	**8.92**	**0.0116***	**2-3****
Acceptance	1.83	0.56	1.97	0.58	1.96	0.61	0.36	0.8338	
Sense of humor	0.76	0.50	0.85	0.58	0.83	0.64	0.34	0.8434	
Turning to religion	**1.37**	**0.88**	**1.14**	**1.01**	**1.65**	**0.97**	**8.39**	**0.0150***	**2-3****
Search for emotional support	**1.54**	**0.77**	**1.71**	**0.80**	**2.10**	**0.63**	**13.03**	**0.0015***	**2-3, 1-3****
Search for instrumental support	**1.67**	**0.67**	**1.77**	**0.65**	**2.12**	**0.56**	**13.72**	**0.0011***	**2-3, 1-3****
Doing something else	1.70	0.63	1.70	0.74	1.69	0.62	0.02	0.9880	
Negation	0.93	0.66	0.83	0.75	0.82	0.76	0.87	0.6470	
Discharge	1.37	0.50	1.52	0.67	1.54	0.62	1.45	0.4848	
Take psychoactive substances	0.33	0.54	0.52	0.77	0.43	0.65	0.58	0.7479	
Cessation of activities	0.50	0.54	0.69	0.56	0.63	0.59	2.28	0.3194	
Blaming yourself	1.26	0.71	1.41	0.80	1.30	0.69	0.76	0.6845	

$\bar{x}$ – arithmetic mean, SD – standard deviation, H – value of Kruskal-Wallis test; * significant variation at p<0.05; ** variables between which there is a statistically significant difference in the Kruskal-Wallis post-hoc test.

Table 4. Relationship between strategies for coping with stress (Mini-COPE) and nurses' seniority

Variables	Seniority								Kruskal-Wallis Test		
	0–10 years		11–20 years		21–30 years		>30 years				
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	H	p	Relationship
Active coping	**2.38**	**0.58**	**2.29**	**0.52**	**2.61**	**0.51**	**2.50**	**0.46**	**8.57**	**0.0355***	
Planning	2.39	0.53	2.09	0.63	2.37	0.61	2.35	0.48	5.63	0.1310	
Positive reevaluation	2.06	0.66	1.79	0.53	1.89	0.63	1.96	0.56	5.02	0.1703	
Acceptance	2.06	0.56	1.94	0.54	1.94	0.58	1.82	0.66	2.68	0.4436	
Sense of humor	**1.14**	**0.69**	**0.76**	**0.47**	**0.70**	**0.57**	**0.68**	**0.46**	**13.64**	**0.0024***	**1-3,4****
Turning to religion	1.20	1.09	1.36	0.97	1.63	0.96	1.39	0.92	4.42	0.2200	
Search for emotional support	**2.13**	**0.68**	**1.73**	**0.75**	**1.89**	**0.70**	**1.62**	**0.81**	**9.74**	**0.0209***	**1-4***
Search for instrumental support	**2.15**	**0.59**	**1.86**	**0.58**	**1.93**	**0.63**	**1.64**	**0.68**	**12.37**	**0.0062***	**1-4***
Doing something else	1.90	0.62	1.59	0.51	1.48	0.80	1.80	0.63	8.41	0.0383*	
Negation	0.84	0.78	0.73	0.64	0.88	0.73	0.89	0.80	0.76	0.8589	
Discharge	**1.74**	**0.61**	**1.52**	**0.58**	**1.27**	**0.61**	**1.47**	**0.61**	**11.97**	**0.0075***	**1-3****
Take psychoactive substances	0.74	0.88	0.50	0.61	0.27	0.50	0.27	0.55	11.40	0.0097*	
Cessation of activities	0.65	0.65	0.70	0.50	0.61	0.58	0.59	0.54	1.21	0.7494	
Blaming yourself	**1.64**	**0.82**	**1.33**	**0.67**	**1.21**	**0.64**	**1.14**	**0.70**	**10.30**	**0.0155***	**1-4****

$\bar{x}$ – arithmetic mean, SD – standard deviation, H – value of Kruskal-Wallis test; * significant at $p<0.05$; ** variables between which there is a statistically significant difference in the Kruskal-Wallis post-hoc test.

Table 5. Relationship between individual coping strategies (Mini-COPE) and nurses' workplace

Variables	Hospital department				Mann-Whitney Test	
	Conservative ward		Surgery department			
	$\bar{x}$	SD	$\bar{x}$	SD	Z	p
Active coping	2.49	0.54	2.39	0.51	1.41	0.1591
Planning	2.33	0.57	2,29	0.58	0.42	0.6780
Positive reevaluation	1.91	0.62	1.96	0.59	–0.25	0.8034
Acceptance	1.97	0.59	1.92	0.59	0.66	0.5063
Sense of humor	0.79	0.53	0.88	0.66	–0.41	0.6812
Turning to religion	1.49	1.01	1.28	0.96	1.34	0.1809
Search for emotional support	1.77	0.75	1.96	0.74	–1.65	0.0981
Search for instrumental support	1.85	0.67	1.97	0.61	–0.97	0.3337
Doing something else	1.66	0.68	1.74	0.66	–0.30	0.7639
Negation	0.85	0.74	0.83	0.75	0.24	0.8076
Discharge	1.46	0.56	1.56	0.69	–1.08	0.2792
Take psychoactive substances	0.37	0.59	0.55	0.79	–1.25	0.2120
Cessation of activities	0.59	0.56	0.70	0.58	–1.21	0.2261
Blaming yourself	1.26	0.68	1.43	0.80	–1.43	0.1535

$\bar{x}$ – arithmetic mean, SD – standard deviation, Z – Mann-Whitney U-test.

Discussion

This study attempted to explore the coping strategies used to deal with stress by nurses working during the COVID-19 pandemic in healthcare units in the Opolskie and Lubelskie provinces. First, it should be noted that during the pandemic, the nurses studied combated stress mainly through active coping, planning, acceptance, positive reevaluation, and seeking instrumental support. Respondents with the shortest length of service coped with stress through humor, seeking emotional support, seeking instrumental support, and blaming themselves.

The COVID-19 pandemic has been a source of great stress for individuals and social groups. Different people have experienced different levels of psychological crisis, but it has been particularly dif-

ficult for those at the center of the crisis [16]. A study conducted during the pandemic in China found that, among healthcare workers, nurses were particularly likely to experience psychological strain [17]. The rapid spread of the SARS-CoV-2 coronavirus, its high infectiousness and mortality rate, and the lack of specific treatment poses a great risk to nurses' life and health. In addition, due to a lack of medical personnel, nurses are faced with additional physical, mental, and environmental stressors, which lead to increased psychological burden and impact on their emotional reactions [16,18].

Inherent in stressful situations are ways of coping with stress. Adequately applied strategies can help to cope with stress and its consequences, including negative emotions [19]. The effectiveness of particular coping strategies depends on many factors, including the stressful situation and the possibility of controlling it. Problem-focused strategies are often considered to be the most effective. Coping with stress by focusing on emotions is usually considered less effective. On the other hand, avoidance-focused strategies are considered the least effective [8, 20]. In the available literature, there are no studies on strategies applied by nurses during the COVID-19 pandemic. Therefore, the discussion of the obtained research results will be based on the approximation of the reports of Polish authors from earlier years.

In our analysis, empirical data showed that, during the pandemic, nurses in the process of coping with stress used both task-focused strategies (active coping and planning) and strategies that serve to reduce tension and negative emotions (acceptance and positive reevaluation). As can be seen, nurses participating in the study tended to prefer active coping strategies which, in turn, indicates that their efforts are focused on the problem and coping with various difficult situations originating from the work environment. The strategies used least frequently by respondents include denial and stopping action (avoidance behavior) and substance use (helplessness). In the available Polish publications, there are no studies on the identification of stress coping styles of nurses during the COVID-19 pandemic. The authors, who before the pandemic used the Mini-COPE Questionnaire in a study on coping strategies, obtained similar results. The nurses' most frequently used strategies during stressful situations were active coping strategies, planning, and taking care of something else. The least popular strategies were substance abuse, stopping activities, and denial [21-24].

In our analysis, we found a relationship between age, length of service, and education and coping strategies in Polish nurses. The problem-focused strategy (seeking instrumental support) tended to be used during the pandemic by younger people, people with a master's degree, and people with the shortest length of service (up to 10 years). Seeking instrumental support is considered a problem-focused strategy and its aim is to remove the stressor or reduce the negative effects caused by it [8].

Research has shown that using humor to cope with stress increases individual adaptive capacity in the face of workplace stress by changing perspectives and distancing oneself from problems at work [25]. Analysis of our own research showed that a sense of humor, which is considered less effective in coping with stress but is very useful in some situations [8], was used by younger respondents and those with the lowest work experience (up to 10 years).

In the present study, younger respondents often coped with stress by choosing to use psychoactive substances and blaming themselves. In addition, those with the lowest seniority (up to 10 years) were more likely to cope by blaming themselves and discharging. Use of the strategy "turning to religion" was associated with age (as respondents grew older, they were more likely to seek solace in prayer and meditation) and a master's degree education. The use of the strategy aimed at turning to religion may be due to the need for emotional support [22]. In contrast, seeking reassurance, understanding, and support from others was reported by people with the lowest length of service (up to 10 years) and respondents with a master's degree.

Limitations of the study

Limitations of the study include the small sample size and the limited number of provinces that the respondents came from. In the future, it would be advisable to conduct similar studies with a larger number of nurses and to extend the study to a larger number of provinces, as well as to compare the results obtained in Poland with those obtained in other countries.

The advantage of the study is that the results can be used in the future to allow monitoring of changes in nurses' applied strategies for coping with stress during a pandemic (both nationally and internationally).

Conclusions

During the Sars-CoV-2 pandemic, the surveyed nurses combated stress mainly through active coping, planning, acceptance, positive reevaluation, and seeking instrumental support. Likely due to age and life experience, respondents with the lowest work experience (up to 10 years) tended to cope with stress through humor, seeking emotional support, seeking instrumental support, and blaming themselves. In

view of the growing problem of stress, it is necessary to share information on effective ways of coping with stress. Increasing nurses' awareness of their own resources and limitations, as well as providing training in social skills, is an important activity for addressing workplace stress.

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OBESITY AND LOW LEVELS OF PHYSICAL ACTIVITY ARE ASSOCIATED WITH A DECREASED HEALTH-RELATED QUALITY OF LIFE IN POSTMENOPAUSAL WOMEN: A WROCLAW PILOT STUDY

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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: Menopause is associated with numerous somatic dysfunctions, an increased risk of chronic diseases, and complications in the mental and social components of health that lower the quality of life (QoL). Obesity and related comorbidities affect over 60% of postmenopausal women in Poland. A significant role for systematic physical activity (PA) in the prevention of dysfunctions and chronic diseases, including obesity and mental disorders, has been observed previously. A low level of PA is observed across the Polish population, especially in postmenopausal women.

Aim of the study: To examine QoL in postmenopausal women participating in a community health promotion program as it relates to obesity and levels of PA.

Material and methods: The study sample consisted of 76 postmenopausal women (aged 65.75±5.14 years) participating in the *Active Wrocław 55+* program. Before starting the program, anthropometric measurements were taken, and QoL and PA were assessed using the 36-Item Short Form Health Survey (SF-36) and the International Physical Activity Questionnaire-Short Form (IPAQ-SF), respectively.

Results: Most women had a PA level above 600 MET-min/week (78.95%), and were overweight or obese (86.84%). A waist circumference over 80 cm, indicating an increased risk for metabolic syndrome, was observed in 85.89% of the participants. BMI and waist circumference negatively correlated with the level of PA (p=0.001 and p=0.017, respectively). Women exhibiting low levels of PA and higher BMIs showed a significantly lower QoL compared to those with higher PA and lower BMIs, particularly with regard to the physical domains of QoL.

Conclusions: Obesity and a low level of PA are associated with a significant decline in the health-related QoL (especially in the PF and PCS domains) of postmenopausal women an urban setting.

KEYWORDS: menopause, quality of life, obesity, physical activity

Background

Demographic change in the general population is an important public health and economic issue, as it can be associated with increased healthcare costs [1]. Postmenopausal women currently outweigh the number of older men in the post-working age population [2], and it is estimated that there will be 1.2 billion postmenopausal women by 2030 [3]. At present, approximately 30% of life expectancy occurs after menopause [4]. Quality of life (QoL) has a multifactorial basis, including health, demographic, economic, and cultural issues [5-6]. The process of aging is associated with numerous disorders and an increased risk of poor health, leading to a lower QoL [7-8]. Menopause entails many vasomotor and emotional changes, such as hot flashes, dizziness, excessive sweating, and sleep disorders, as well as emotional lability, irritability, low mood and self-esteem, difficulty concentrating, and an increased risk of depression [9-12]. Adverse lifestyle changes are also often observed in postmenopausal women, especially in terms of diet and regular physical activity (PA). Poor diet and exercise are modifiable risk factors for chronic diseases [13], including obesity and its associated complications [14-16]. Being overweight, obesity, and an increased risk of metabolic diseases affect up to 78% of postmenopausal women in Poland [17]. Insufficient levels of PA and poor diet contribute to the increased prevalence of excessive body weight in the general Polish population, including in postmenopausal women [18]. Numerous studies have confirmed the positive effects of PA for the prevention of diseases in postmenopausal women [9,16,19-22]. At the same time, many studies have also demonstrated a low level of PA in older women [23-24], including those in Poland [25-26].

Aim of the study

The current study aimed to assess the QoL in relation to obesity and low levels of PA in postmenopausal female residents of Wrocław participating in the community health promotion program *Active Wrocław 55+* (*Aktywny Wrocław 55+*).

Material and methods

Study design, setting, and selection criteria

Approval for the study was issued by the Wrocław Health Center, an independent public healthcare institution, in 2014 (WCZ/PZ/11/04.2014 of 10/04/2014).

The voluntary study involved surveying postmenopausal women selected from a group participating in the community health promotion program *Active Wrocław 55+ (Aktywny Wrocław 55+*), which was implemented from April 1 to November 30, 2015. The *Active Wrocław 55+* program was financed by the Wrocław Health Center and was part of a project entitled "Health promotion of people over 55 years of age." The women who qualified for this study participated in classes at the Aquapark on Borowska Street in Wrocław.

Participants

A total of 89 postmenopausal women initially volunteered for the study, based on the inclusion and exclusion criteria. In total, 76 naturally postmenopausal women aged 65.75±5.14 years were included. The prerequisites for joining the *Active Wrocław 55+* program were the consent of a primary care physician and a statement that there were no contraindications to participate in various forms of PA. The exclusion criteria were the use of hormone replacement therapy for the last six months (due to its potential effects on the redistribution of adipose tissue), and the presence of cancer or other chronic conditions, including liver and kidney disease, hyper- or hypothyroidism, and surgical menopause.

Data sources/Measurement

Anthropometric measurements (body weight, height, waist circumference [WC], hip circumference, body mass index [BMI], and waist-to-hip ratio [WHR]) were taken and questionnaires – the International Physical Activity Questionnaire Short Form (IPAQ-SF) and the 36-Item Short Form Health Survey (SF-36) – were completed on the first day before starting the activities included in the *Active Wrocław 55+* program. The sociodemographic characteristics of the study group are shown in Table 1.

The level of PA was assessed using the validated IPAQ-SF [27]. The results were expressed in MET-min/week, where MET stands for Metabolic Equivalent of Task (MET), defined as a multiple of resting metabolic rate. The levels of PA – high (>3000 MET-min/week), moderate (600–3000 MET-min/week), and low (<600 MET-min/week) – were established on the basis of the American Heart Association recommendations on minimum weekly PA for adults (*Physical Activity Guidelines*) [28].

QoL was assessed using the SF-36 (QualityMetric Incorporated, license number QM030530). The SF-36 measures QoL in eight domains: physical functioning (PF), role physical (RP), bodily pain (BP),

Table 1. Sociodemographic characteristics of the study sample (n=76)

Characteristics	Answers	n=76
Education [%]	primary	1
	secondary	57
	incomplete higher	3
	higher	39
Employment status [%]	employed	11
	unemployed	1
	drawing a disability pension	3
	retired	85
Smoking [%]	non-smoking	83
	smoking	17
Cigarettes smoked per day [%]	up to 5 cigarettes	15.5
	up to 10 cigarettes	69
	over 10 cigarettes	15.5
Children [%]	no children	29
	1 child	16
	2 children	41
	3 children	13
	4 children	1
Time since the last menstruation [years]	mean (standard deviation)	13.8 (±6.9)
	minimum	2
	maximum	34
Weight gain after the last menstruation [kg]	mean (standard deviation)	10.6 (±6.6)
	minimum	0
	maximum	32
Family history of at least one of the following diseases* [%]	applies	75
	does not apply	25

* Diseases: obesity, type 2 diabetes, hypertriglyceridemia, coronary artery disease, arterial hypertension before the age of 60, myocardial infarction, stroke, neoplastic diseases.

general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). These domains are grouped into two health components, the physical component summary (PCS: PF, RP, BP, GH) and the mental component summary (MCS: VT, SF, RE, MH). The results for each of the questionnaire domains range from 0 to 100. To facilitate comparison of the results with those obtained from other populations, the scores for the summary domains (PCS, MCS) were standardized according to Norm-Based Scoring (1998) using an algorithm included in the SF-36 manual (T-score transformation with mean, 50±10 [SD]). The higher the score for a given domain, the higher the QoL in that domain, and the norm for standardized values is between 45 and 55 points [29].

Statistical analyses

Statistical analyses were performed using IBM SPSS (v.25 and v.26) software. Values are expressed as means and standard deviations, or as medians with a confidence interval between the 5th and 95th percentile. The normality of the data distributions was assessed with the Shapiro-Wilk test. The non-parametric Mann-Whitney U test was used to compare the differences between independent groups formed on the basis of BMI and the level of PA according to the IPAQ-SF. The relationships between the studied parameters were determined using the Spearman's rank correlation test. The level of statistical significance was $p \leq 0.05$.

Results

Descriptive data

The anthropometric data (BMI, WC, WHR) and the levels of PA are shown in Table 2. 13.16% of the women had a normal body weight, 43.42% were overweight, and 43.43% were obese. The means ±SD for the BMI categories were 23.10±1.78 kg/m^2,

27.77±1.47 kg/m^2 and 34.16±3.45 kg/m^2, respectively. A WHR above 0.8 (82.89%) prevailed in the study sample, as did a WC ≥80 cm (85.5%). The women showed a tendency towards android fat distribution and an increased risk of metabolic disorders.

Table 2. Anthropometric and physical activity data (n=76)

Variable	Mean ±SD	Percentage of women with values above the norm
Age [years]	65.75±5.14	—
BMI [kg/m^2]	29.93±4.75	86.84 [25]
WC [cm]	92.28±12.47	85.53 [80]
WHR	0.85±0.06	82.89 [0.8]
PA [MET-min/week]	2868±2293	—
Low PA levels (<600 MET-min/week)	21.05%	
MVPA (>600 MET-min/week)	78.95%	

SD – standard deviation; BMI – body mass index; WC – waist circumference; WHR – waist-to-hip ratio; PA – physical activity; MET – standard metabolic equivalent unit; MVPA: moderate-to-vigorous physical activity. PA levels are shown for the number of individuals and the percentage of the whole sample.

The PA level of the group ranged from 450 to 10358 MET-min/week. The majority of the women (78.95%) showed a moderate (600–3000 MET-min/week) or a high (>3000 MET-min/week) level of PA (15.79% vs. 63.16%). In 21.05% of cases, PA was insufficient (<600 MET-min/week).

It was found that the level of PA was significantly related to BMI and WC (p=0.001 and p=0.017, respectively; Table 3).

Table 3. Spearman's rank correlation between categorized BMI, WC, and WHR values and categorized PA (n=76)

Parameter	rho	p
BMI (healthy, overweight, or obese)	–0.582*	0.001*
WC	–0.273*	0.017*
WHR	0.119	0.306

BMI – body mass index; WC – waist circumference; WHR – waist-to-hip ratio; * statistical significance.

The highest SF-36 QoL scores (Table 4) were recorded for the domain of limitations in usual role activities because of emotional problems (RE; 82.68±28.28), PF (77.89±15.06), and for the domain of limitations in usual role activities because of physical health problems (RP; 76.48±28.15), while the lowest QoL levels were seen for the domains of GH (47.20±11.15), BP (64.42±25.29), and VT (62.01±17.01). The norm for standardized values is between 45 and 55 points [29].

Table 4. SF-36 QoL scores on the specific subscales (n=76)

SF-36	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Mean	77.89	76.48	64.42	47.20	62.01	75.82	82.68	72.24	46.68	49.91
SD	15.06	28.15	25.29	11.15	17.01	21.73	28.28	15.02	8.06	9.25
Minimum	45.00	25.00	0.00	20.00	25.00	25.00	25.00	30.00	27.34	21.71
Maximum	100.00	100.00	100.00	77.00	100.00	100.00	100.00	95.00	62.96	67.03

SD – standard deviation; PF – Physical Functioning; RP – Role Physical; BP – Bodily Pain; GH – General Health; VT – Vitality; SF – Social Functioning; RE – Role Emotional; MH – Mental Health; PCS – Physical Component Summary; MCS – Mental Component Summary.

Table 5. Comparisons of the mean scores for the SF-36 domains across BMI categories (n=76)

SF-36 domains	Normal body weight	Overweight and obesity	Mann-Whitney U	p
PF	87.50	76.46	219.0	0.040*
RP	86.88	74.71	275.5	0.197
BP	76.00	62.49	246.0	0.095
GH	50.10	46.75	294.0	0.340
VT	66.88	61.25	286.0	0.288
SF	82.50	74.42	242.0	0.081
RE	77.50	83.46	335.5	0.696
MH	66.00	73.31	249.0	0.107
PCS	52.56	45.73	166.0	0.005*
MCS	46.87	50.38	296.0	0.364

PF – Physical Functioning; RP – Role Physical; BP – Bodily Pain; GH – General Health; VT – Vitality; SF – Social Functioning; RE – Role Emotional; MH – Mental Health; PCS – Physical Component Summary; MCS – Mental Component Summary; * statistical significance.

Comparisons of the scores obtained for the specific SF-36 domains, as well as for overall physical (PCS) and mental (MCS) health, in women with a normal BMI and those who were overweight or obese are shown in Table 5. Statistically significant differences in QoL were observed for the PCS (p=0.005) and the PF (p=0.04) domains, with higher values observed in women with a normal body weight. In the case of other domains, no statistically significant differences across the BMI groups were observed.

Table 6 shows the comparisons between the two categories of PA with regard to the SF-36 scores. In this case, significantly higher QoL levels on the PF (p=0.008) and PCS (p=0.045) domains were also observed in women having at least a moderate level of PA.

Taking into account the multifactorial basis of QoL, two groups of women were compared: those with low levels of PA and at least an overweight BMI, and those with a normal BMI and the recommended level of PA sufficient to maintain health, according to the IPAQ-SF (Table 7). Women with sufficient levels of PA and a normal BMI had significantly higher QoL scores for the PF and the PCS domains (p=0.01 and p=0.034, respectively).

Table 6. The mean scores for the SF-36 domains depending on the level of physical activity (n=76).

SF-36 domains	Low physical activity	Moderate and high physical activity	Mann-Whitney U	p
PF	68.61	80.77	307.5	0.008*
RP	68.06	79.09	424.0	0.202
BP	61.67	65.28	482.0	0.620
GH	45.50	47.72	434.0	0.274
VT	65.28	60.99	451.0	0.383
SF	78.47	75.00	498.5	0.769
RE	81.02	83.19	492.0	0.660
MH	77.50	70.60	384.0	0.090
PCS	43.12	47.79	358.0	0.045*
MCS	52.91	48.98	405.5	0.155

PF – Physical Functioning; RP – Role Physical; BP – Bodily Pain; GH – General Health; VT – Vitality; SF – Social Functioning; RE – Role Emotional; MH – Mental Health; PCS – Physical Component Summary; MCS – Mental Component Summary; * statistical significance.

Table 7. The mean scores for the SF-36 domains depending on BMI and the level of physical activity (n=76)

SF-36 domains	Low physical activity + above normal BMI	Sufficient physical activity + normal BMI	Mann-Whitney U	p
PF	68.24	80.67	296.0	0.010*
RP	66.91	79.24	403.0	0.190
BP	60.94	65.42	457.0	0.574
GH	45.41	47.71	417.0	0.287
VT	65.44	61.02	431.5	0.380
SF	77.21	75.42	498.5	0.969
RE	80.88	83.19	485.0	0.805
MH	78.24	70.51	350.5	0.058
PCS	42.74	47.81	331.0	0.034*
MCS	53.07	49.00	379.5	0.128

PF – Physical Functioning; RP – Role Physical; BP – Bodily Pain; GH – General Health; VT – Vitality; SF – Social Functioning; RE – Role Emotional; MH – Mental Health; PCS – Physical Component Summary; MCS – Mental Component Summary; * statistical significance.

Discussion

Key results

Postmenopausal women with an above normal BMI and a low level of PA were characterized by a decreased QoL, especially in terms of physical health.

Interpretation

Postmenopausal women are at increased risk for obesity and its associated complications, particularly metabolic disorders [30]. The majority of the women in the current study were characterized by excessive body weight (86.84%), which corresponds

with findings reported by other authors [9,16-17-,31-32]. The participants declared an average weight gain of 10 kg in the perimenopausal period, which, according to other authors, may be partly due to hormonal changes [7,9,14-15,33]. Additionally it may be associated with unfavorable lifestyle changes in this period [13,16,19,29]. In the study sample, increased abdominal fat deposition was demonstrated, indicating an android type of obesity. A WC>80 cm and a WHR > 0.8 were also observed in 85.53% and 82.9% of women, respectively, which confirms an increased risk for metabolic disorders, as reported by other researchers [17,34-35]. The participants of the present study also scored higher on the MCS domain than the PCS domain (49.91±9.25 vs. 46.68±8.06, respectively). However, both values were within the normal range for adults (Norm Based Scoring, 1998).

Many studies have shown a relationship between excessive body weight and reduced QoL [6,31,36-37]. This association was confirmed by Slagter et al. [6], who demonstrated a significant QoL decline in the PF domain related to the performance of everyday activities. This observation is consistent with the current findings showing that women with a higher BMI had a lower QoL in terms of physical health (PCS), especially in the PF domain, than their counterparts with a normal body weight.

The PCS reflects overall physical health and includes several domains (PF, RP, BP and GH). The participants in the current study showed different levels of BP (64.42±25.29), and rated GH lower compared to other domains (GH: 47.20±11.15, where the maximum score was 100 points). QoL may have been affected by climacteric disorders and age-related comorbidities, other than obesity, as shown in other studies [8-9]. No significant differences were found in the SF-36 domains related to mental health between women with a normal BMI and those who were overweight. Similarly, other authors have observed a significant and greater effect of obesity on QoL changes in the physical health domains than in those associated with mental health [6,31,37].

Behavioral factors such as low levels of PA and poor eating habits are also important in the context of reduced QoL and obesity in the perimenopausal period [14]. The positive impact of PA on women's physical, mental and social health in the postmenopausal period has been confirmed in many studies, and it is these elements that make up the perception of QoL [11,15,21,37]. Taking up PA has a positive effect on the self-esteem and emotional state of the elderly, and higher physical fitness is associated with a higher QoL [11,22]. Among the women participating in the program, the majority had sufficient PA (78.95% > 600 MET-min/week), which may suggest that people enrolling in such programs usually prefer a healthy lifestyle.

The level of PA was shown to influence the QoL assessment. Women with a sufficient level of PA (moderate or high level, > 600 MET-min/week) rated their QoL higher, especially in terms of physical health (PCS). Similar findings were reported by Moilanen et al. who examined 45–64-year old women. After an eight-year follow-up, a higher QoL was observed in those women who had higher levels of PA that did not decrease after menopause [38]. In a study by Villalobos et al., a group of women who underwent controlled moderate PA for nine months (2139.1±2059.3 MET-min/week) showed a significant improvement in QoL, as measured by the HRQoL questionnaire, compared to a control group [39].

The present study confirmed a significant relationship between higher levels of PA and lower BMI among women. Other authors have published similar results [13,22,33,39]. A significant weak correlation was found between WC and PA levels, but no such relationship was observed for WHR. In studies conducted by other authors on larger groups, such relationships were confirmed [22,39]. PA in postmenopausal women is important not only to prevent a decline in QoL associated with the occurrence of obesity complications. The literature indicates a positive effect of moderate PA on reducing the risk of metabolic complications [7,15] and cardiovascular disease [32,40]. In sum, a low level of PA in postmenopausal women is associated with a decrease in their QoL, especially in the domains of overall physical health (PCS) and PF. Excessive body weight reduces QoL in the PCS and PF domains, compared to women with a normal body weight. This confirms the important role of PA as a stimulator of high QoL, and an indispensable element for the prevention of disorders typical of peri- and postmenopausal women.

Limitations

The current study has some limitations resulting from the fact that the study group consisted of only 76 women. However, on the other hand, the study group was homogeneous in terms of demographic, social and cultural aspects. At the same time, the proportion of women having insufficient PA, as well as a normal BMI, was small. Moreover, the study was conducted among women who volunteered for a program in which PA was the main component. Thus, it could be expected that participants were those who prefer an active way of spending their free time. In addition, the level of PA was assessed with a questionnaire, but one that is widely used and validated. Therefore, the

study needs to be continued, and the current results should be verified in a larger group.

Conclusions

Obesity and low PA levels are associated with reduced health-related QoL (especially in the PF and PCS domains) in postmenopausal women living in an urban area. In sum, systematic moderate PA is an important factor not only for the prevention of metabolic diseases, but for improvements in the mental and social health of postmenopausal women.

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ASSESSMENT OF NUTRITION KNOWLEDGE DURING LACTATION AMONG POSTPARTUM WOMEN

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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: Breastfeeding is the most appropriate form of nutrition for newborns and infants. During lactation, milk production is an important function of a new mother's body. The lack of a healthy, balanced diet carries a high risk of macro- and micronutrient deficiencies in postpartum women.

Aim of the study: The aim of the study was to explore the nutrition knowledge of postpartum mothers during lactation, based on current guidelines.

Material and methods: The study involved 103 postpartum mothers who stayed in the maternity and neonatal ward in a secondary care hospital from April 2019 to January 2020. The diagnostic survey method was used as the research tool, which included an original questionnaire. Participation in the study was voluntary and anonymous. Results were analyzed using Microsoft Excel descriptive statistics. The analysis of Spearman's R correlation between the variables was performed in the Statistica 13.1 program. Statistical significance was taken at $p < 0.05$.

Results: The average score among respondents was 4.82/10 points. Most study participants (77%, n=79) considered breastfeeding women to have greater energy and nutritional requirements. More than half of the study participants (59%, n = 61) declared that some food products should be eliminated from the diet, namely strawberries, citrus fruit and chocolate.

Conclusions: Women's knowledge about nutrition during lactation is insufficient. There is a need to intensify education in this area by medical professionals including midwives.

KEYWORDS: breastfeeding, lactation, nutrition, human milk, knowledge

Background

Breastfeeding is the most appropriate form of nutrition for newborns and infants. According to the World Health Organization, exclusive breastfeeding is recommended for the first 6 months of life, and after introducing other types of food into the child's diet, breastfeeding should be continued at least until 24 months of age. A similar view has been adopted by the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), which additionally emphasizes that breastfeeding should last as long as both the mother and the child need it [1–4].

The nutritional function is not the only role that breast milk plays. Due to the presence of many ac-

Table 1. The recommendations for women's nutrition during lactation [11–16]

Recommendations about nutrition during lactation	
An increase in energy demand	about 450–500 kcal per day
Fluid intake	about 3 liters per day
Recommended products rich in specific nutrients	
Carbohydrates	groats, pasta, rice, vegetables
Fat (polyunsaturated fatty acid)	corn oil, nuts, olive oil, sea fish*, sunflower oil
Proteins	dairy products, eggs, fish*, meat
Vitamins and minerals	cereal and dairy products, eggs, fish*, fruit, vegetables
Stimulants during lactation	
Caffeine	≤ 200 mg per day (2 cups of coffee or 4 cups of tea)
Nicotine and smoking	limit smoking to a minimum or completely refrain

* Due to the possible adversity of heavy metals, it is necessary to overlap fish from very polluted waters.

tive ingredients, such as lactoferrin, lactalbumin, cytokines and lysozyme, breast milk effectively supports the child's developing immune system, which helps to prevent infections. In 2011, McGuire et al. described the human milk microbiome in which they detected the presence of bacteria, including *Streptococcus*, *Staphylococcus*, *Serratia* and *Corynebacteria*. Yet another study demonstrated that colostrum, as well as subsequent breast milk, contain lactic acid bacteria *(Lactobacillus)* and some *Bifidobacteria* that model the immature immune system of the newborn. According to research, the composition of the breast milk microbiome may depend on the environment and the needs of the breastfeeding woman and the newborn. The factors that may affect it include, among others: the diet and nutritional habits of the mother during pregnancy and lactation [4–7].

During lactation, milk production is an important function of a new mother's body. The lack of a balanced diet carries a high risk of macro- and micronutrient deficiencies in a woman and is not conductive to maintaining a healthy body weight. The National Institute of Public Health – National Institute of Hygiene recommends that breastfeeding mothers follow the principles of nutrition based on the current food pyramid [8–10]. During lactation, energy demand increases by up to 670 kcal/day, of which approximately 500 kcal should be obtained from food. The rest should come from fat accumulated during pregnancy. Moreover, the means of obtaining additional energy depends to a large extent on a woman's body type. Slim mothers should have a greater caloric intake from food than women with more body fat [5,8,11,12] . It should also be noted that mothers who breastfeed more than one child at the same time should have a correspondingly greater caloric intake. For now, it is assumed that this should be an additional 500–600 kcal for each child. In addition to increased energy demand, adequate fluid intake is also crucial. A breastfeeding woman should drink at least 3 liters of fluid a day, which means that the fluid demand increases by about 800–1000 mL as compared to before pregnancy. The detailed recommendations are described in the table below (Table 1) [8,11].

Aim of the study

The aim of the study was to explore whether postpartum mothers have knowledge about nutrition during lactation, in relation to The Expert's Group recommendations of the Dietary Guidelines for lactating women, dated 2013 (in Polish: Stanowisko Grupy Ekspertów w sprawie zaleceń żywieniowych dla kobiet w okresie laktacji) as well as the guidelines of the National Institute of Public Health – National Institute of Hygiene, the European Office for Food Safety and the World Health Organization [11–14].

Material and methods

Study design and setting

The study was conducted among postpartum mothers who stayed in the maternity and neonatal ward in a secondary care hospital in Warsaw from April 2019 to January 2020. The study did not bear the features of a medical intervention and did not require the opinion of the Bioethics Committee. The researchers obtained the consent of the head of the hospital to conduct the study. The study was performed in compliance with the principles outlined in the Declaration of Helsinki. Participation of respondents was voluntary, and before completing the questionnaire, each woman was informed about the purpose of the study and the principle of data anonymity.

Participants

The study group was selected based on the following criteria:

– inclusion: women over 18 years of age who expressed their willingness to complete the questionnaire with writing and reading skills in Polish;

– exclusion: women under 18 years of age, no language skills in Polish

Variables

The study was conducted using the diagnostic survey method, which included a questionnaire devised by the study author. The questionnaire included questions about demographics and assessed knowledge about nutrition during breastfeeding, as well as sources of information in this regard. In the case of questions that evaluated participant knowledge, respondents were awarded points for giving correct answers (correct answer=1 point) for 10 of the questions.

Statistical methods

Results were analyzed using Microsoft Excel descriptive statistics. The analysis of Spearman's R correlation between the variables was performed in the Statistica 13.1 program. Statistical significance was taken at $p < 0.05$.

Results

Participants

We distributed 106 questionnaires among the postpartum mothers. All of them were returned to us. Due to incomplete data, three questionnaires were rejected from the analysis, leading to 103 participants in total.

Descriptive data

The postpartum mothers included in the study were 1–4 days post-delivery. Ages ranged from 18 to 49 years (average age - 29.95 years, median - 30 years). Most of the surveyed women were primiparous (61%, n=63), had higher education (73%, n=75), were married (70%, n=72), lived in a city with over 500,000 inhabitants (78%, n=81) and assessed their economic status as "good" (60%, n=62). The vast majority (96%, n=99) had plans to breastfeed their newborn baby. Detailed characteristics of the study group are presented in Table 2.

Table 2. Study group characteristics (n = 103)

Tested Feature		N	%
Delivery	first	63	61
	second	33	32
	third	6	6
	fourth	1	1
Level of education	lower secondary school	1	1
	vocational school	1	1
	secondary school	26	25
	tertiary education	75	73
Place of residence	village	7	7
	city up to 100,000 inhabitants	10	10
	city up to 250,000 inhabitants	3	3
	city up to 500,000 inhabitants	2	2
	city over 500,000 inhabitants	81	78
Marital status	married	72	70
	in an informal relationship	25	24
	single	5	5
	divorced	1	1
Economic status	very good	22	21
	good	62	60
	average	19	19
	poor	0	0
Breastfeeding of the previous child	yes	36	35
	no	4	4
	it is my first baby	63	61
Planning to breastfeed newborn baby	yes	99	96
	no	4	4
Influence of those closest to respondents on their nutrition during lactation	yes	32	31
	no	71	69

Knowledge about nutrition during lactation

The respondents were evaluated for their nutritional knowledge based on 10 specific questions on the topic. The average score was 4.82/10 points (Table 3).

Table 3. Level of knowledge about nutrition during lactation (n=103)

Level of knowledge about nutrition during lactation					
N	M	Me	Min.	Max.	SD
103	4.82	5.00	0.00	10.00	1.84

Almost half of the postpartum mothers (48.5%, n=50) claimed that "there is no such thing as a breastfeeding mother's diet" and 35.9% (n=37) of the respondents were convinced of its existence. The remaining respondents (15.4%, n=16) had no opinion on the subject.

Table 4. Opinions of postpartum mothers on nutrition during lactation (n=103)

Opinions on nutrition during lactation		N	%
Maternal nutrition during lactation and the composition of breast milk	Yes, it has a great influence on the composition of breast milk	47	45
	Yes, but it has little effect on the composition of breast milk *	38	37
	No, it has no effect on the composition of breast milk	10	10
	I do not know	8	8
The decision to follow an elimination diet when breastfeeding	Yes, you can always opt for an elimination diet	22	21
	Yes, but only if it is medically justified (e.g. allergy) *	58	56
	No, you should never switch to an elimination diet once you start breastfeeding	3	3
	I do not know	20	20
The influence of a woman's nutrition during lactation on the subsequent eating habits of the child	Yes *	48	47
	No	24	23
	I do not know	31	30

* Correct answer.

When assessing the energy and nutritional requirements of breastfeeding women, the vast majority of the study participants (77%, n=79) claimed there were special requirements when breastfeeding, whereas 23% (n=24) did not.

Slightly more than half of the surveyed women (59%, n=61) declared that some food products should be eliminated from the diet during lactation. Next, these respondents could choose products from a list prepared by the authors. The list of products was based on prevailing common myths concerning nutrition at breastfeeding [17]. Participants chose strawberries (64%, n=39), citrus fruit (52%, n=32) and chocolate (52%, n=32) most often as foods that should be avoided or eliminated during lactation. Almost half (44%, n=27) of respondents pointed cabbage, nuts and legumes as products that should be eliminated from the breastfeeding mother's diet. Cow's milk (28%, n=17), eggs (11%, n=7) and wheat (3%, n=5) were the least frequently selected items. Twenty six percent (n=16) of respondents offered a different answer than those proposed by the researchers, which included foods such as raw meat, fish, honey and blue cheese.

When assessing the amount of fluid intake by breastfeeding women, the majority of the study participants (69%, n=71) had knowledge of the recommended daily amount of fluid intake (approximately 3 liters of fluid per day). Guidelines for caffeinated coffee (maximum of 2 cups of coffee per day) and tea (maximum of 4 cups of lightly brewed tea per day) intake when breastfeeding were known to 47% (n=48) and 57% (n=59) of the study participants, respectively.

In the opinion of most of the women (91%, n=94), smoking is absolutely contraindicated during lactation. Only 4% (n=4) of the respondents claimed that smoking was not contraindicated, but that it inhibited lactation, and 5% (n=5) of the study participants had no knowledge in this regard.

Nearly half of the study participants (45%, n=47) were convinced that the mother's diet has a tremendous impact on the composition of breast milk. Only 37% (n=38) of women knew that nutrition had little influence on the composition of breast milk. In the opinion of 56% (n=58) of breastfeeding women, the elimination diet in a breastfeeding mother can be used only when it is medically justified. Moreover, 47% (n=48) of the study participants claimed that the nutrition of a breastfeeding mother had an impact on the later eating habits of the child (Table 4).

Factors influencing the level of knowledge of women

A weak statistically significant correlation between level of education and level of nutrition knowledge was found among postpartum women. The more educated the respondents, the better they knew about nutrition in the lactation period. The influence of those closest to the participants harmed their level of knowledge in this regard (Table 5).

Table 5. Correlations between the level of knowledge (0–10 points) and selected feature

Tested Feature	Spearman's Rho	p-value
Age	–0.003	0.971
Delivery	–0.105	0.288
Level of education	0.207	0.036
Breastfeeding the previous child	0.096	0.335
Planning of breastfeeding a newborn baby	0.046	0.641
Influence of those closest to respondents on their nutrition during lactation	–0.257	0.009

Women learned about nutrition during lactation from various sources. Most often they obtained information from the midwife. The surveyed women also preferred to use websites run by medical personnel (63%, n=65) and with advice for parents, the so-called "parenting websites" (52%, n=54) (Table 6).

There was a weak statistically significant correlation between the use of websites run by medical professionals and level of knowledge. Obtaining information from such websites contributes to increased awareness concerning nutrition in the lactation period (Table 6).

Table 6. Correlations between level of knowledge (0–10 points) and sources of information on nutrition during lactation (n=103)

Source of information	N	%	Spearman's Rho	p-value
Midwife	76	74	0.028	0.782
Websites run by medical personnel	65	63	0.309	0.001
Parenting advice websites	54	52	0.121	0.225
Books and magazines for a mother-to-be	48	47	0.118	0.234
Doctor	39	38	–0.109	0.273
Family / friend	36	35	0.037	0.714
Lactation consultant	27	26	0.156	0.116
Nurse	20	19	–0.103	0.299
Medical textbooks	19	18	–0.075	0.454
Dietician	5	5	0.115	0.246
Pharmacist	4	4	0.108	0.276
Other	3	3	0.031	0.759
Birth doula	1	1	0.024	0.812

Discussion

Key results

During lactation, women often limit their consumption of various products, even though they did not give them up before and during pregnancy. Such behavior is the result of misconceptions about the possibility of causing digestive system problems or allergies in the child [18]. This phenomenon is widespread not only in Poland. In a study by Jeong et al. an unjustified abandonment of selected food groups among young mothers was observed in South Korea. This is related to many myths regarding breastfeeding that are popular in Asia. In Korea, breastfeeding women are most often warned not to eat cold dishes or spicy food, including kimchi which contains large amounts of chilli [19].

Generalizability

According to current knowledge, a woman's diet does not cause the child to develop food allergies. Therefore, a diet that excludes potentially allergenic products (e.g. milk, nuts, strawberries, eggs) is unjustified in healthy women, with the exception of women who need to give up certain products due to their own allergy or disease. Moreover, an elimination diet without therapeutic indications may contribute to the occurrence of nutrient deficiencies in postpartum women [7,10,12,13].

In our study, 35.9% of women claimed that there exists a special diet for breastfeeding mothers. However, most postpartum mothers stated that certain foods should be avoided during lactation, mostly strawberries (64%), citrus fruit (52%) and chocolate (52%). Every fifth respondent stated that an elimination diet can always be adopted when breastfeeding. In a study by Bakalarz et al., 9% of women of childbearing age claimed that there exists a diet for breastfeeding women. In a study assessing the diet and nutritional status of breastfeeding mothers by Gajewska et al., women gave up products causing flatulence (65%) and fast food (64%). More than half of them excluded citrus fruit from their diet. They avoided chocolate (36%) or fine-stone fruit such as strawberries (33%) to a lesser extent. In a study by Jeong et al., respondents most often reported giving up caffeinated beverages (90.3%) and spicy dishes (85.5%). Less frequently, they indicated the elimination of nuts (13.1%) or selected fruit (10.3%) from the daily diet. According to Catherin et al., Indian women gave up eating eggs and fish while breastfeeding due to a belief that they had a negative effect on the baby's skin and hair [19–22].

In our study, some respondents declared that it is necessary to avoid raw meat, fish and blue cheese during breastfeeding. The consumption of these products are not contraindicated in this period but should meet specific conditions. Meat should be fresh, examined and come from a verified supplier. Fish must not come from very polluted waters and blue cheese should be pasteurized [23].

Balanced nutrition during breastfeeding is very important to maintain metabolic homeostasis. Due to the energy cost of breast milk production by a woman's body, her energy and nutrient requirements increase. Various groups of experts recommend increasing caloric intake postpartum. Following the WHO recommendation, the caloric content of the diet should increase by 10–20% depending on the physical activity undertaken by the woman. According to the recommendations of the US Centers for Disease Control and Prevention (CDC), breastfeeding women should consume about 450–500 kcal more than before pregnancy. The results of our study indicate that 23% of the respondents incorrectly stated that energy demand during lactation does not change in relation to non-breastfeeding women. Similar results were presented in a study by Niewiadomska et al., where 7.1% of women claimed that there is no increase in caloric demand during lactation [15,17,24,25] .

It is crucial to keep the body properly hydrated when breastfeeding. The opinion of the Expert Group recommendations of the Dietary Guidelines for lactating women (dated 2013) indicates that during lactation, daily fluid intake should amount to 3 liters. Our study demonstrated that as many as 69% of the respondents knew this recommendation. In the study by Niewiadomska et al., 63.5% of postpartum

mothers indicated that the daily fluid intake should be greater than 2 liters [11,24].

According to the guidelines of the European Office for Food Safety, the maximum daily amount of caffeine when breastfeeding is 200 mg, which is approximately 2 cups of coffee or 4 cups of tea. In our study, only 47% of postpartum mothers knew the acceptable daily intake level of coffee. The results of our study are different from those in a study by Bakalarz et al., where 80.4% of the respondents gave the correct answer for the acceptable amount of caffeine in the daily diet [13,15,20].

As emphasized by Nehring-Gugulska, smoking has a negative effect on lactation because nicotine reduces the concentration of prolactin, which results in lowered production of breast milk. Moreover, nicotine from the blood of a smoking mother can pass into breast milk, which adversely affects the development of the newborn, and later into infancy. Smoking cigarettes immediately prior to feeding the baby significantly increases the amount of nicotine in the breast milk and lowers the production of docosahexaenoic acid in the mammary gland that supports the proper development of the eyes and brain in infants up to 12 months of age. During lactation, women should completely refrain from smoking, and if this is impossible, limit smoking to a minimum. Most of the study participants considered smoking to be absolutely contraindicated when breastfeeding. In the study by Bakalarz et al., 65.4% of the respondents stated that a breastfeeding woman should not smoke [20,26,27].

According to nutritional recommendations, breastfeeding women should care for a varied and balanced diet during lactation. Despite this, their nutrition has little effect on the composition of breast milk. The only substances that influence it are minerals, vitamins B and C and select fatty acids. A total of 37% of postpartum mothers in our study knew about the little influence of nutrition on the composition of breast milk [16].

Limitations of the study

The collected data was from the maternity and neonatal ward in one hospital in Warsaw. It is possible that results could be different from another medical facility.

Conclusions

1. The majority of the study participants (59%), contrary to expert guidelines, claim that certain food products should be eliminated from the diet when breastfeeding.

2. Lack of knowledge about proper nutrition during lactation and the lack of essential nutrients in the diet may contribute to nutritional deficiencies, and consequently have a negative impact on the health of breastfeeding women.

3. Parenting advice websites, which may contain content that is inconsistent with current medical knowledge, are one of the main sources of information on nutrition for women during lactation. It is necessary for women to approach Internet advice with more caution and encourage them to verify the information from such sources. Medical professionals, especially midwives who care for women at every stage of the perinatal period, may play an educational role in this regard.

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LEVEL OF KNOWLEDGE AMONG PHYSIOTHERAPY STUDENTS CONCERNING THE MANAGEMENT OF STRESS URINARY INCONTINENCE IN WOMEN: A COMPARISON BETWEEN TWO UNIVERSITIES

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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 health and financial burden imposed by chronic non-communicable diseases is expected to increase in parallel with the rapid rate of global population aging. Stress urinary incontinence (SUI) is an important health problem. Medical professionals should thus provide their patients with knowledge about the appropriate prevention and treatment of chronic diseases, including SUI.

Aim of the study: This study compared the level of knowledge concerning the risk factors, prevention, and treatment of SUI in women between physiotherapy graduates at two different Universities with a focus on medicine (Med) and physical education (PE).

Material and methods: This study included final-year physiotherapy students (n=401). Respondents provided answers to open-ended questions used to measure their knowledge about SUI in women.

Results: The complete and correct definition of SUI was provided by 64.4% of the students at University Med, and 56.3% of the students at University PE. Students at University Med, in comparison with the students at University PE, had a significantly higher awareness of the risk factors (86.4% vs. 69.4%), prevention methods (85.6% vs. 68.7%), and conservative (92.4% vs. 77.8%) as well as surgical treatment (28.0% vs 6.7%) of SUI in women ($p<0.001$).

Conclusions: There is a need for greater emphasis on education about SUI in order to better prepare physiotherapy graduate students to provide optimal care to their female patients. The disciplinary focus of Universities that provide graduate programs in physiotherapy plays a significant role in gaining knowledge about SUI.

KEYWORDS: primary healthcare, physiotherapy, stress urinary incontinence

Background

The expected increase in healthcare expenditure imposed by chronic non-communicable diseases (NCDs) over the coming decades is linked in part to a rapid increase in global population aging. This development significantly influences the requirements of medical professionals needed in order to prevent and treat age-related chronic illnesses [1-4]. Health is an important and precious value, since only a healthy person can fully benefit from all aspects of professional and private life, including entertain-

ment and sport. Health has a significant influence on quality of life, social connectedness, and earning potential [5-7].

Stress urinary incontinence (SUI) is often regarded as a taboo topic, which necessitates a frank and open discussion about this often overlooked chronic illness. SUI occurs when coughing, sneezing, laughing, or during heavy physical activity, all of which increase intra-abdominal pressure leading to involuntary urine leakage [8]. SUI is the most common form of urinary incontinence, and can occur at any age. Representatives of the International Health Organization estimate that more than 200 million people in both developing and developed countries suffer from SUI. It affects individuals irrespective of biological sex, although the majority (67%) of affected patients are women [9,10]. SUI worsens the occupational, social, mental, physical, and sexual wellbeing of women. The cost involved in treating and rehabilitating SUI in women, including household expenditure on purchasing female hygiene and absorbent products, is enormous [11,12]. Indeed, SUI imposes a significant medical, personal, social, and financial burden. The financial impact of SUI is expected to increase in parallel with the increasing age of the global population.

In 1999, the World Confederation for Physical Therapy [13] adopted a general definition of what the physiotherapy profession entails. Their policies define the physiotherapist as a person who provides services aimed at developing, maintaining, and restoring a maximum range of movement and level of functioning throughout the patient's lifespan. The physiotherapist is thus a medical professional who seeks to maximise the patient's quality of life by restoring their functional abilities to the maximum possible extent [14,15]. However, despite this common social perception, their skills extend beyond specialist treatment of musculoskeletal disorders. Physiotherapists working in general healthcare treat patients across all disciplines, irrespective of their specific medical diagnosis or level of functioning [16-19]. Physiotherapists work to improve the individual's health, thus contributing to better health for society at large. They provide various therapies aimed at preventing the development or exacerbation of age-related NCDs associated with environmental risk factors. In addition, physiotherapists cooperate with family members in order to and teach them how to adapt conditions at home to meet the health-related needs of the patient. Physiotherapists are expected to demonstrate emotional resistance and empathy when dealing with people who suffer from pain. Therefore, they should know how to motivate patients to undertake movement rehabilitation, frequently overcoming patient's unwillingness to incorporate therapy into their daily life [20-24].

SUI is an important problem which should receive more attention, and student physiotherapists should strive to gain the knowledge and skills needed to improve the quality of life of women suffering from this condition. They should inform patients about the risk factors for SUI, as well as educate them about the role physiotherapy can play in its prevention and treatment. These conversations should be considered as routine, and not limited to the occurrence of SUI during physical therapy. Physiotherapy students should be aware that shame and embarrassment concerning SUI are important reasons driving the reluctance of women to talk about this condition. In this situation, providing appropriate education and raising awareness with great tact and sensitivity are essential to bridge this communication divide and promote a sincere dialogue about SUI [16-20].

Aim of the study

It is possible that limited training of medical students in communicating with and managing patients with SUI contributes to its perceived stigma compared to other NCDs. To the best of our knowledge, no studies to date have assessed to what extent medical and physiotherapy students are educated about the risk factors, prevention, diagnosis, as well as conservative and surgical treatment of SUI. In response to this knowledge gap, the aim of our study was to examine and compare the level of knowledge about these aspects of SUI among physiotherapy graduate students enrolled at two different Universities with a focus on medicine and physical education, respectively.

It was anticipated that our research would emphasize the importance of including education concerning SUI as part of the disciplinary focus of Universities that offer medical training. Our research is also intended to call attention to the serious and crucial issues surrounding SUI that physiotherapists should be aware of. It is thus our hope that this research would inspire physiotherapists to widen their breadth of knowledge concerning SUI, promote health education, and take greater action in order to benefit women suffering from this condition.

Material and Methods

Study design

This cross-sectional questionnaire-based study included 5th-year physiotherapy students in their 10th semester (n=401, 288 females, 113 males; mean age=25.4±3.8 years) who were in attendance during

mandatory classes on the day the surveys were administered.

Selection of research participants

The participants were selected from students enrolled across two Polish universities located in Katowice, known for their long history of providing quality education and training in physiotherapy. First, we selected 117 students (87 females, 30 males) enrolled at the Medical University of Silesia (University Med). We also included 284 students (201 females, 83 males) enrolled at the Jerzy Kukuczka Academy of Physical Education (University PE). The curricula at both faculties include mandatory classes aimed at educating students about SUI. These students were selected for inclusion in our research based on the observation that their future patients would include women with or at risk for SUI. In particular, physiotherapy students are required to have specialized knowledge about prophylaxis and preventive treatment, as such activities are included in their professional competences.

Assessment measures and data collection

The authors compiled a study questionnaire which was administered to all participants. This included open-ended questions used to assess their knowledge concerning the risk factors, prevention, diagnosis, as well as conservative and surgical treatment of SUI in women. The participants selected an appropriate definition of SUI from three columns of four available statements. The definition provided by the participant was considered as correct and complete when a correct statement was selected across all columns. This corresponded to a definition of SUI occurring when an increase in intra-abdominal pressure, associated with coughing, sneezing, laughing, or heavy physical work, is accompanied by the accidental release of urine [8-12].

Ethics statement

The Committee for Bioethics of the Medical University of Silesia in Katowice, Poland waived the need for ethics approval (KNW/0022/KB/40/18). Verbal informed consent was obtained from all potentially eligible participants. Written, involuntary consent from research participants is not however needed when data are acquired using survey-based questionnaires. Detailed documentation of participant consent was therefore not obtained, since this might have inferred refusal to participate in the research, despite all students having expressed their willingness to do so.

Statistical analysis

Statistical testing was performed using Excel (version 2016) and Statistica (version 9.0) software packages. Between-group differences were examined using the Chi-squared (X^2) test. A p-value threshold of 0.05 was used to indicate statistical significance.

Results

Descriptive data

The complete and correct definition of SUI in women was given by 64.4% (76) (students enrolled at University Med, and 56.3% (160) students at University PE (Figure 1).

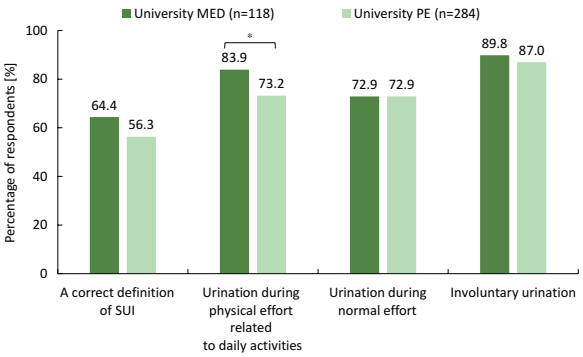

Figure 1. The percentage of physiotherapy students at Universities Med and PE who correctly defined SUI (*p=0.02)

A significantly higher number of students at University Med 83.9% (99) correctly identified the types of effort which contribute to the onset of SUI symptoms compared to the students at University PE 73.2% (208) (p=0.02).

The distribution of students at University Med 72.9% (86) compared to students at University PE 72.9% (207) who identified the effort associated with SUI as "normal" instead of and "significant" or "professional" was the same. There was no statistically significant difference between the number of students at University Med 89.8% (106) and the number of students at University PE 87.0% (247) who reported that SUI is accompanied by "involuntary urination", as illustrated in Figure 1.

Summary of participant responses

The two student groups differed significantly ($p<0.001$) in terms of their knowledge concerning the risk factors, prevention, as well as conservative and surgical treatment of SUI in women ($p<0.001$), as shown in Figure 2.

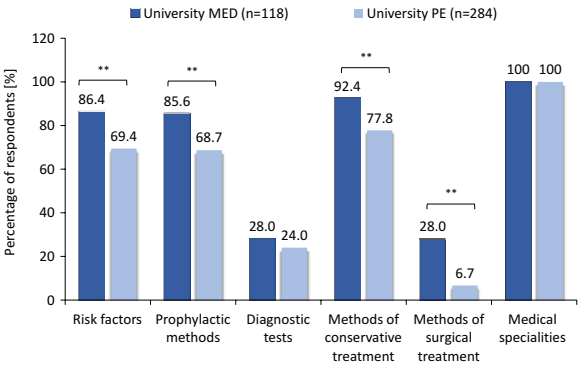

Figure 2. The percentage of physiotherapy students at Universities Med and PE who expressed knowledge of risk factors, prophylactic methods, diagnostic tests and methods of conservative and surgical treatment (**p<0.001)

The number of correct answers provided concerning the risk factors and prevention methods for SUI was significantly higher in students at University Med 87% (103) compared to students at University PE 70% (199). The correct methods used in the conservative treatment of SUI were provided by 92.4% (109) of the students at University Med compared to 77.8% (221) of the students at University PE. In comparison, the correct methods used in the surgical treatment of SUI were provided by 28.0% (33) students at University Med compared to 6.7% (23) at University PE. The correct information concerning the test used to diagnose SUI was provided by 28% (33) students at University Med and 24% (68) students at University PE. The correct response concerning the medical specialties which are involved in treating SUI was provided by all respondents (Figure 2).

Participant responses compared between student groups

Second, we compared the knowledge of SUI risk factors, prevention methods, diagnostic tests, treatment strategies, and specialties best positioned to treat affected women between students at University Med and students at University PE. This was expressed as indication indices calculated as proportion frequencies between the two groups (Figure 3). All indices except surgical treatment tended to favour a higher level of knowledge among students at University Med, although this was not statistically significant (Figure 3).

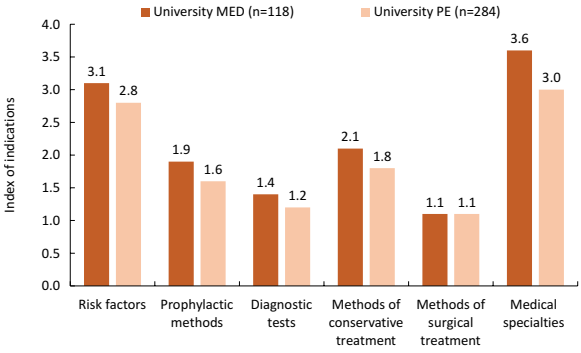

Figure 3. The index of indications of risk factors, prophylactic methods, diagnostic tests and methods of conservative and surgical treatment, and medical specialties helpful to treat stress urinary incontinence in the groups of physiotherapy students at Universities Med and PE

Risk factors, prevention and diagnosis of SUI

Third, we compared responses relevant to the risk factors, prevention measures, and diagnostic tests for SUI in women between the two student groups (Table 1).

The majority of students at both University Med 76.3% (90) and University PE 56% (159) identified pregnancy, childbirth, and its consequences as risk factors for SUI (Table 1). The following risk factors were correctly identified more often by students at University Med compared to students at University PE: pregnancy, childbirth and the its consequences ($p<0.001$); neurological and other diseases ($p<0.001$); urological diseases ($p<0.001$); age and menopause ($p=0.01$); and surgeries to the pelvic area ($p=0.01$). Students at University Med compared to students at University PE less often reported the incorrect response of "other" ($p<0.001$) (Table 1).

The most commonly reported preventive measures for SUI in women were Kegel exercises in both the University Med 45.8% (54) and University PE 28.5% (81) groups, and pelvic floor exercises in both the University Med 41.5% (49) and University PE 30.6% (87) groups. Students at University Med more often indicated the correct responses in terms of how to prevent SUI compared to students at PE. This was evident across the following prevention measures: Kegel exercises ($p<0.001$), pelvic floor exercises ($p=0.04$), physiotherapeutic procedures ($p<0.001$), healthy lifestyle ($p=0.01$), and physical activity ($p=0.03$).

The students at University Med demonstrated greater knowledge of the following tests for SUI in women compared to the students at University PE. In

Table 1. The percentage of physiotherapy students from Universities MED and PE who mentioned specific risk factors, types of prophylaxis and diagnostic tests in urinary incontinence

Risk factors	Med	PE	Prophylaxis	Med	PE	Diagnostic tests	Med	PE
Pregnancy, childbirth and the consequences thereof	p<0.001		Kegel exercise	p<0.001		cough stress test, pad test, effort test	p<0.001	
	76.3 (90)	56.0 (159)		45.8 (54)	28.5 (81)		13.6 (16)	3.2 (9)
Age and menopause	p=0.01		pelvic floor muscle exercises	p=0.04		urodynamic examination	p<0.001	
	42.4 (50)	28.5 (81)		41.5 (49)	30.6 (87)		8.5 (10)	0.4 (1)
Neurological and other diseases	p<0.001		healthy lifestyle	p=0.01		gynaecological and urological examination	p=0.01	
	28.0 (33)	13.4 (38)		27.1 (32)	16.2 (46)		7.6 (9)	1.8 (5)
Urological diseases	p<0.001		physical activity	p=0.03		USG, EMG	p=0.01	
	27.1 (32)	13.4 (38)		15.3 (18)	8.1 (23)		7.6 (9)	1.4 (4)
Weakness of pelvic floor muscle	22.0 (26)	15.1 (43)	frequent health check-ups	12.7 (15)	8.8 (23)	pelvic floor muscle exercises	p<0.001	
							0.0 (0)	20.4 (58)
Obesity	19.5 (23)	16.9 (48)	physiotherapeutic procedures	p<0.001		others	0.8 (1)	1.4 (4)
				12.7 (15)	2.8 (8)			
Surgeries	p=0.01		educating women about the problem	5.1 (6)	5.3 (15)			
	16.1 (19)	6.0 (17)						
Lack of physical exercise	13.6 (16)	11.3 (32)	exercises of abdominal and urethral sphincter muscles	2.5 (3)	7.4 (21)			
Significant physical exercise	p=0.05		perinatal prophylaxis,	1.7 (2)	0.7 (2)			
	6.8 (8)	13.7 (39)						
Genetic and development defects	4.2 (5)	4.2 (12)	medication	1.7 (2)	1.1 (3)			
Psychological factors and stress	4.2 (5)	4.2 (12)	avoiding excessive effort	0.0 (0)	1.4 (4)			
Gynaecological diseases	1.7 (2)	2.8 (8)	others	0.0 (0)	0.7 (2)			
Others	p<0.001							
	5.1 (6)	10.2 (29)						

particular, correct responses were more frequently reported for the following diagnostic tests: the cough stress test (p<0.001), pad test (p<0.001), effort test (p<0.001), urodynamic examination (p<0.001), gynaecological and urological examination (p=0.01), diagnostic ultrasound imaging, and electromyography (p=0.01) (Table 1). In contrast, an incorrect response indicating the belief that pelvic floor muscle exercises can be used to diagnose SUI in women was reported by as many as 58 (20.4%) students at University PE.

Treatment strategies for SUI

Fourth, we compared responses relevant to the treatment of SUI in women between the two student groups (Table 2).

The students at University Med also demonstrated significantly greater knowledge concerning the conservative treatment of SUI compared to students at University PE for the following modalities: Kegel exercises (62.7% vs. 50%, p=0.02), pelvic floor exercises (51.7% vs. 25.7%, p<0.001), and general physical exercise (16.1% vs. 3.9%, p<0.001).

The surgical treatment modalities mentioned by the participants were imprecise, and included tapes, urethral surgery, artificial sphincter, and pelvic floor surgery, indicating that respondents were less familiar with these methods. In total 19.5% (23) students at University Med described surgical treatment with tapes, compared to only 3% (8) students at University PE (p<0.001) (Table 2).

Respondents were asked which specialists should be visited by a woman suffering from SUI.

Table 2. The percentage of physiotherapy students from Universities Med and PE who indicated certain methods of conservative and surgical treatment in urinary incontinence and certain types of specialists who treat urinary incontinence

Methodsof conservative treatment	Med	PE	Methods of surgical treatment	Med	PE	Speciality	Med	PE
Kegel exercise	p=0.02		tapes	p<0.001		urology	p<0.001	
	62.7 (74)	50.0 (142)		19.5 (23)	3.0 (8)		94.1 (111)	75.4 (214)
Pelvic floor muscle exercises	p<0.001		urethra surgery, artificial sphincter	6.8 (8)	3.2 (9)	gynaecology	91.5 (108)	90.5 (257)
	51.7 (61)	25.7 (73)						
Physiotherapeutic procedures	34.7 (41)	31.3 (89)	surgeries regarding pelvic floor muscles	4.2 (5)	1.4 (4)	general medicine	p=0.03	
							57.6 (68)	45.8 (130)
General physical exercises	p<0.001					neurology	p=0.01	
	16.1 (19)	3.9 (11)					39.8 (47)	25.0 (71)
Exercises of urethral sphincter muscles	6.8 (8)	8.8 (25)				nephrology	34.7 (41)	41.5 (118)
Ball and vaginal cones	5.9 (7)	7.7 (22)				geriatrics	31.4 (37)	22.9 (65)
Medication	5.9 (7)	3.5 (10)				others	p=0.01	
							8.5 (10)	2.1 (6)
Visit to a specialist	0.0	1.1 (3)						
Others	7.6 (9)	6.0 (17)						

Their most frequent responses included: gynaecologists (University Med: 91.5% n=108; University PE: 90.5% n=257) and urologists (University Med: 94.1% n=111; University PE: 75.4% n=214) (Table 2). The students from University Med more frequently mentioned that SUI is also treated by general practitioners (p=0.03), neurologists (p=0.01) and other specialists (p=0.01) compared to students from University PE (Table 2).

Discussion

This study touches upon the issue of educating future medical personnel who will have direct professional contact with women with or at risk of developing SUI. The presence of physiotherapists in the multidisciplinary healthcare team is a crucial component of service delivery, and these professionals are indispensable in addressing the adverse health and economic impact of NCDs. The study might provide inspiration for other researchers to consider the importance of physiotherapy training at University, as well as providing inspiration for medical professionals to address the burden imposed by SUI in women. The introduction of appropriate education on NCDs could provide a foundation for limiting health care expenditure on NCDs such as SUI.

Generalisability of our findings

Medical professions provide their patients with knowledge about the appropriate prevention and treatment of diseases. Indeed, illness prevention and early detection form the basis of public health. However, preventive measures cannot be taken if there is health no awareness, especially in those with risk factors for increased illness severity and mortality. This transfer of knowledge promises to support physiotherapists in addressing the negative impact of NCDs on health and wellbeing [14,20,24].

Health education is one of the most important methods of preventing the development NCDs and their adverse social consequences. It should be targeted at protecting, maintaining, strengthening, and restoring health, as well as providing new, up-to-date information on how to combat NCDs such as SUI. Substantive preparation of healthcare professionals commenced during their undergraduate studies, and continued throughout their postgraduate education, has significant downstream effects on patient care. Education and knowledge about health-promoting behaviour should be expanded, particularly in terms of risk factors for NCDs, including SUI [2,3,6,20,24].

Physiotherapy students are focused on health and physical activity. Since they work in clinics and hospitals, they are obliged to provide healthcare education to their patients. This necessitates an ap-

propriate level of undergraduate knowledge concerning chronic NCDs including SUI. It is the duty of the physiotherapists to educate their patients about the causes of SUI, facilitate their understanding of the problem, inform them about the consequences of neglecting or abandoning treatment, and to educate their patients about behaviours which predispose to or aggravate illness. It is up to physiotherapists to encourage a healthy lifestyle in order to avoid the development of NCDs. However, in order to fulfil these criteria and provide health education in clinics and hospitals, physiotherapists must be adequately prepared [13,15-19].

SUI is an embarrassing problem that forces a woman to change her way of life. Therefore, an attempt has been made in order to determine how future physiotherapists can be prepared to provide health education to and support their patients. The absolute priority is to detect illness among patients as early as possible, recognize these disorders, and refer patients for specialized treatment. However, without proper knowledge, the abovementioned tasks are not feasible, since a lack of knowledge limits the ability to provide health promotion.

This study examined the level of knowledge concerning SUI in women among a sample of physiotherapy graduate at two Universities. Millions of women do not seek treatment for SUI because they feel ashamed to talk about it, and medical personnel do not routinely inquire about it. This study appraised the need to educate future physiotherapists who will have direct professional contact with women with or at risk for developing SUI [25-28].

Interpretation

It is unsatisfactory that only 64.4% of students at University Med and 56.3% of students at University PE were able to provide a full and correct definition of SUI in women. A significant proportion of respondents thus did not know what the disease is. This fact is alarming, since the students were provided with multiple options in the questionnaire, and their task was only to select the correct definition. This raises the question of how these students will be able to recognize SUI in their future patients and refer them for specialist treatment.

Risk factors for SUI were identified by 86.4% of the students at University Med and 69.4% of the students at University PE. The index of indication per person was 3.1 and 2.8, respectively. Knowledge about SUI constitutes the basis for effective support for future patients. Not being familiar with risk factors for SUI [9, 10] means that the physiotherapist will not be able to convey appropriate knowledge about this condition to their patients, who will remain unaware of how to prevent its development or exacerbation.

Risk factors for SUI reported by the respondents in both groups are consistent with those reported in the literature [29-37] including pregnancy and childbirth, advancing age and menopause [38], obesity, and a weak pelvic floor [39]. However, the students at University PE placed greater emphasis on significant physical effort as a risk factor for SUI (13.7%) compared to students at University Med (6.8%). This discrepancy could be related to the specialized knowledge of University PE students about SUI in professional sportswomen who practice sport such as running or jumping.

It is important to prevent the development NCDs in at-risk population. In total, 85.6% of the students at University Med, and 68.7% of the students at University PE, had sufficient knowledge about the prevention of SUI, with the index of indications per person being 1.9 and 1.6, respectively. This observation suggests that students at University Med are well-prepared to educate their female patients about the prevention of SUI, including modalities such as pelvic floor exercises [40-42]. This was exactly the answer expected from physiotherapy students, since their professional training includes movement and physical measures. Their responsibilities include motivating patients to engage in moderate physical activity in order to prevent SUI by strengthening the pelvic floor muscles. However, only 27.1% of the students at University Med and 16.2% of the students at University PE regarded a healthy lifestyle as a preventive measure. The concept of a "healthy lifestyle" is very general, and each person can interpret it in a different way. Physiotherapists should provide professional and very precise terms regarding the specific preventive measures for a particular illness [37]. In this context 15.3% of the students at University Med and 8.1% of the students at University PE noted "physical activity" as a preventive measures for SUI. This answer is unfortunately laconic and imprecise, because it does not explicitly state what kind of physical activity is effective in preventing and even alleviating the symptoms of SUI in women.

The students at University PE emphasized the need to educate women about the problem more strongly than the students at University Med. Education should constitute the basis of all preventive methods for SUI. Unfortunately, only a very small percentage of students stressed the need for perinatal prophylaxis, which is also a key element of prevention. The greater the extent of soft tissue injuries during childbirth, the higher risk of developing SUI over time. In terms of their education, physiotherapy students should thus be made aware that certain high-risk women are more predisposed towards SUI, and intervention should be prioritized for these groups.

In addition to prevention, pelvic floor exercises and physiotherapeutic interventions play a role in the conservative treatment of SUI in women, a fact that was highlighted by most of the respondents in this study. These exercises, also known as Kegel exercises, can take various forms, and may involve the use of additional equipment, or be combined with a physical factor such as electrical current in order to strengthen muscle contractions [34-37,41,42]. It is unfortunate that some students provided less precise answers such as "general physical exercise". Physical activity other than pelvic floor exercise is not considered an effective conservative treatment for SUI.

A significant difference in the percentage of responses regarding the surgical treatment applied of SUI was observed. A higher proportion of students at University Med (28.0%) mentioned surgical treatment methods compared to the students at University PE (6.7%), even though the index of indications per person was 1.1 in both groups. The highest percentage of replies regarded the use of tapes, consistent with the real-world application of tension free vaginal tapes (TVT) as a surgical treatment option for SUI in women [43,44].

The diagnosis of SUI is the responsibility of physicians. However, a small percentage of physiotherapists also demonstrate adequate knowledge on this subject. We found large discrepancies regarding knowledge of students from the two Universities. The correct methods of diagnosis, including a cough stress test, test pad, effort test, and urodynamic examinations [45,46], were provided by of 22.1% of the students at University Med, but only 3.6% of the students at University PE. In addition, 20.4% of the students at University PE said that pelvic floor muscle exercises play a role in the diagnosis of SUI in women, which is incorrect. Physiotherapy students correctly selected specialists and physicians, including urologists, gynaecologists and family doctors, whom female patients with SUI should ideally consult.

The rapid rate of human population ageing is expected to be accompanied by an increased demand for healthcare services aimed at treating chronic NCDs, at a significant cost. This is said to have a preferential impact in the developing world. Comprehensive professional cooperation between specialists working in a healthcare team is important for improving effective healthcare service delivery. The presence of physiotherapists in the multidisciplinary team is a crucially important factor and indispensable component of healthcare service delivery. Technological progress is providing clinicians with more options for contacting and reaching out to their patients and providing important knowledge concerning NCD prevention. This provides greater flexibility and generates new solutions for expanding healthcare knowledge. The introduction of appropriate education on chronic NCDs including SUI provides a foundation for limiting health care expenditures and achieving promising health outcomes in at-risk populations [14-19].

Limitations and research strengths

The main limitation of this study was that it only included students from two Universities in Poland. However, these Universities are two of the largest institutions in the Silesian region that provide healthcare education. The Medical University of Silesia is indeed one of the largest universities in Poland. Our study also has several strengths, including a large sample size and diverse research population.

Conclusions

In summary, physiotherapy students often lack satisfactory knowledge about SUI in women. However, we contend that most of the respondents showed promise in at least conducting a basic conversation about this topic with their future patients. It is however concerning that many students provided imprecise answers, and showed misconceptions about the measures needed to prevent, diagnose, and treat SUI. Research has shown that the disciplinary focus of Universities educating students of physiotherapy plays a significant role in gaining knowledge about SUI.

In conclusion, the students at University Med demonstrated greater knowledge concerning the risk factors, prevention methods, as well as conservative and surgical treatment of SUI in women compared to the students at University PE. The emphasis put on individual risk factors, diagnostic tests, conservative treatment methods, and medical specialties useful in treating SUI differed between the students of at the two Universities.

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ASSESSMENT OF NURSING AND MIDWIFERY STUDENTS' KNOWLEDGE OF TREATMENT OF DIABETIC FOOT SYNDROME USING LUCILIA SERVICATA LARVAE

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ABSTRACT

Background: Diabetes mellitus is one of the most common chronic diseases, and in recent years its prevalence has been systematically increasing. Untreated or ineffectively treated diabetes leads to the development of many complications. Among these that can significantly affect the quality of life is diabetic foot syndrome (DFS). Larvotherapy is a therapeutic method of treating wounds arising during the course of DFS.

Aim of the study: The main objective of this study was to assess the level of knowledge of nursing and midwifery students on the treatment of DFS using Lucilia sericata larvae.

Material and methods: This study is a cross-sectional, observational study in which 202 nursing and midwifery students of Opole University were surveyed. The study was conducted online between June and November 2020, using a questionnaire developed by the authors.

Results: The analysis showed considerable variation in the level of students' knowledge of treatment techniques for DFS. Those with the highest level of knowledge represented 39.15% (n=79), the average level of knowledge was represented by 28.2% (n=57), and the lowest level of knowledge was represented by 32.7% (n=66) of students. Regarding biosurgery in general, the highest level of knowledge about biosurgery was represented by 48.0% (n=97) of students. Nursing students had a higher level of knowledge than midwifery students regarding DFS treatment methods (p=0.001). There was no difference in the level of knowledge about biosurgery between nursing and midwifery students (p=0.503).

Conclusions: The research presented in this study indicates that nursing and midwifery students have insufficient knowledge of DFS treatment methods and biosurgery. Nursing students are more likely than midwifery students to derive knowledge of DFS treatment methods from their studies and the literature. Education on treatment methods and techniques for DFS should be increased among students. Students' knowledge can be increased by classes in the course of their education and meetings with professionals.

KEYWORDS: diabetic foot syndrome, chronic wounds, biosurgery, Lucilia sericata larvae

Background

Diabetes is one of the most common chronic diseases, and its prevalence has been systematically increasing in recent years [1]. According to the International Diabetes Federation, 463 million people were diagnosed with diabetes in 2019. By 2045, it is estimated that this number will increase up to 700 million [2]. Untreated or ineffectively treated diabetes leads to the development of many complications, which are a growing medical challenge. Diabetic foot syndrome (DFS) is one of the common distant com-

plications of diabetes, and warrants special attention due to its high rate of associated amputations and mortality [3]. DFS is defined as infection, ulceration or tissue destruction of the foot associated with neuropathy and/or peripheral arterial disease of the lower extremities in people with diabetes [4,5]. Furthermore, DFS has a long disease course, with the average healing time of ulcers ranging from 2 months to several years [6]. Based on epidemiological studies, it is estimated that 25% of people with diabetes will develop a diabetic foot issue during their lifetime, and between 5% and 15% will be treated for amputation of the foot or leg. Treatment is lengthy and expensive and the outcomes are uncertain [7]. Studies have shown that DFS has been associated with adverse effects that may further impair the quality of life of patients with diabetes and increase the social and economic burden and morbidity [8].

The most important steps in the treatment of DFS include metabolic control of diabetes, which directly translates into improved healing of the damaged skin, antibacterial treatment and foot-pain relief (adjustment of orthotic insoles to the patient's shoes or the use of orthotic shoes). However, in some cases local treatment and surgery are introduced as a therapeutic option. Unconventional methods to treat DFS include vacuum methods, platelet-rich plasma dressings, hyperbaric therapy and larval therapy using the Lucilia sericata fly larvae. These methods are effective in promoting healing and reducing infection. When used together with conventional methods of ulcer treatment in DFS, they reduce the risk of amputation [9,10].

Biosurgery, or Lucilia sericata larvae therapy, is a natural alternative method used to treat acute and chronic wounds. It involves the pinpoint introduction of sterile flytrap larvae into the patient's wound in a fully controlled process. The larvae, which feed only on necrotic tissue, are carefully selected and come from controlled laboratory environments. They are thawed according to strict rules, under aseptic conditions, on sterile media and their eggs are chemically sterilized [11]. In addition to DFS, larvae are used in the treatment of tissue damage in the course of DFS, bedsores with deep necrosis, congestive venous ulcers, wounds of neoplastic origin, burns, MRSA-infected wounds, post-traumatic wounds not requiring urgent surgical interventions and non-healing wounds following surgery [12]. This method is an effective and safe technique for wound debridement and accelerates the wound healing process, thus resulting in a reduction of treatment costs [13]. Due to the development of multidrug-resistant bacteria, larvae therapy is currently gaining adoption and appreciation [11].

Therapy with Lucilia sericata larvae is one form of therapy that can potentially save patients from amputation. Nursing and midwifery graduates play a key role in the therapeutic team and have a significant part in shaping other people's attitudes towards the value of health. Therefore, it is important to gain an understanding of the state of knowledge of students on the treatment of DFS using biological material, including Lucilia sericata larvae.

Aim of the study

The aim of the study was to analyze the level of knowledge of nursing and midwifery students on the treatment of DFS with the use of Lucilia sericata larvae.

Material and methods

Study design and participants

The study was conducted between June and November 2020 using a group of 202 nursing and midwifery students of the Faculty of Health Sciences, University of Opole, Poland. Due to the ongoing SARS-CoV-2 pandemic, the survey was conducted online. The original survey questionnaire was placed on the Google Forms platform, although it was made available to students of selected faculties via the Microsoft Teams web application. Written consent was obtained from the Bioethics Committee at the PMWSZ in Opole (KB: 22/PI/2020). The inclusion criteria for the study were as follows: a student of nursing or midwifery at the University of Opole, and consent to participate in the study (sending the questionnaire). The exclusion criteria were students of cosmetology, physiotherapy, and dietetics at the University of Opole and lack of participant consent. The questionnaire introduction contained information about the aim, method and anonymity of the study, as well as the possibility of withdrawal from the study at any stage.

Data collection

A self-administered questionnaire consisting of 26 questions was used to assess nursing and midwifery students' knowledge of treatment of DFS using biological material, specifically Lucilia sericata larvae. Questions 1 to 5 dealt with sociodemographic data. Question 6 was to find out whether the participants had a family member with diabetes. Question 7 aimed to discover whether the participants thought they had enough knowledge about the treatment of DFS, while the next question examined whether the study participants would like to increase their knowledge about treatment methods for DFS. Question 9 aimed to identify the main source of knowledge about treatment methods for DFS and question 10 surveyed which sources respondents trusted the most. Ques-

tion 11 determined whether sufficient information about techniques and treatments for DFS had been provided during their study. The next question asked whether more material on treatment methods for DFS were needed in the course of their study. Question 13 was multiple choice and was designed to determine the level of familiarity of the study participants with the techniques for treating DFS generally, and question 14 examined their knowledge on modern methods of treating DFS. Questions 15 to 24 addressed knowledge of larvotherapy, and the final two questions, sought to determine whether the study participants would opt for larvotherapy and, if not, why not.

Statistical analyses

For qualitative variables, the frequency (i.e. percentage) was determined and variables expressed at the ordinal or nominal level were analyzed using tests based on the chi-square distribution. For 2×2 tables, a continuity correction was applied, and a Fisher's exact test with expansions for tables larger than 2×2 was used for data that did not meet conditions for Chi-square tests whereas when the conditions for using the chi-square test were not met.

In order to assess the level of knowledge in the techniques and methods of treatment of DFS, as well as in the field of biosurgery, points awarded for correct answers to questions 13 and 14, and 19-23 were summed. In single-choice questions, one point was awarded for indicating the correct answer, while for multiple-choice questions, one point was awarded for indicating each correct answer and also for not indicating an incorrect answer. The more points obtained in total, the higher was the level of knowledge of the respondents. The number of points possible to obtain was between 0-13 points for treatment methods and techniques and 0-12 points for biosurgery. After standardizing the point scores to 100, the percentage of correct answers was obtained. These results were divided into ranges, namely the lowest level (up to 40% correct answers), average level (41-60% correct answers), and highest level (more than 60% correct answers).

Values where $p \leq 0.05$ were considered statistically significant. Analyses were performed using R v.3.6.0, PSPP and MS Office 2019.

Results

Sociodemographic data and clinical characteristics of respondents

Women dominated the study, accounting for 96.5% (n=195) of the participants. The largest group were young people aged 18-25 years, at 67.8% (n=137). People living in rural areas made up 24.8% (n=50) of the students. Among the respondents, there was an even segregation between nursing students, constituting 50.5% (n=102), and midwifery students, making up 49.5% (n=100). Taking into account the year of study, the largest group were students in the second and third year of their first degree studies at 24.3% (n=49). Among the respondents, 49% (n=99) had a family member with diabetes (Table 1).

Table 1. Sociodemographic data of the participants (n=202)

Variable			n	%
Gender		women	195	96.5
		men	7	3.5
Age		18–25 years	137	67.8
		26–35 years	45	22,3
		36–45 years	16	7.9
		over 45 years	4	2.0
Place of residence		urban	152	75,2
		rural	50	24.8
Direction of study		nursing	102	50.5
		obstetrics	100	49.5
Year of study	**BA**	I year	20	9.9
		II year	49	24.3
		III year	49	24.3
	MA	I year	40	19.8
		II year	44	21.8
A family history of diabetes		yes	99	49.0
		no	103	51.0

Legend: BA – bachelor's degree; MA – master's degree; n – group quantity; % – percentage.

Students' knowledge of treatment methods and techniques for DFS

Our analysis demonstrated that students' knowledge of the methods and techniques for treating DFS was varied. The most numerous group of students were the respondents with the highest level of knowledge regarding treatment for DFS at 39.2% (n=79). The lowest level of knowledge was found in 32.7% (n=66) of students and the average level of understanding was 28.2% (n=57). Those representing the highest level of knowledge of biosurgery constituted 48% (n=97) of the group. Students with an average level of knowledge constituted 45% (n=91), while those with the lowest level of knowledge made up 6.9% (n=14) (Table 2).

A detailed analysis of students' knowledge of DFS treatment techniques and biosurgery demonstrated that the most familiar treatment technique for DFS

Table 2. Level of knowledge of DFS treatment techniques and biosurgery (n=202)

Variable		n	%
Level of knowledge of treatment techniques for DFS	lowest	66	32.7
	average	57	28.2
	highest	79	39.2
Level of knowledge about biosurgery	lowest	14	6.9
	average	91	45.0
	highest	97	48.0

Legend: n – group quantity; % – percentage.

was surgical wound debridement, recognized by 52% of participants (n=105). Respondents also frequently selected silver dressings (49%; n=99) and hydrocoid dressings (45.5%; n=92) as their familiar DFS treatment techniques. Interestingly, some respondents (10%; n=21) were not aware of any treatment techniques for DFS. Respondents indicated negative pressure therapy as the most familiar modern treatment for DFS (44.6%; n=90). Larvotherapy was indicated by 38.6% (n=78), although no modern treatments for DFS were known to 20.3% (n=41). Among the respondents, 49.5% (n=100) correctly marked dressings used in biosurgery. Very good wound cleansing as an advantage of biosurgery was indicated by the majority (64.4%; n=130) of the respondents. Students in 72.3% (n=96) correctly indicated the facility where maggots are inserted into the wound, and 47.5% (n=96) stated that after insertion of maggots into the wound, it is

Table 3. Detailed results regarding knowledge of DFS treatment and biosurgery techniques and methods (n=202)

Variable		n	%
Treatment techniques	strategia TIME	71	35.2
	hydrofiber dressings	88	43.6
	hydrocolloid dressings	92	45.5
	surgical debridement	105	52.0
	silver dressings	99	49.0
	vascular treatments	69	34.2
	amputation of a limb	75	37.0
	I don't know of any	21	10.0
Modern treatment methods	negative pressure dressings	90	44.6
	larvotherapy	78	38.6
	hyperbaric oxygen	83	41.1
	skin graft	53	26.2
	I don't know of any	41	20.3
Dressings used in biosurgery	closed	26	12.9
	open	74	36.6
	closed and open	100	49.5
	I don't know	2	1.0
Benefits of biosurgery	very good wound cleansing	130	64.4
	decontamination of the wound environment	86	42.6
	reduction of antibiotic-resistant bacteria	85	42.1
	stimulation of wound healing	125	61.9
	removal of complex bacterial structures	119	58.9
Institution inserting maggots into the wound	hospital – in the operating theatre	53	26.2
	patient's home	40	19.8
	biosurgery clinics	146	72.3
	hospital – in the surgical ward	94	46.5
Need to be in a hospital setting	in each case	41	20.3
	there is no need	96	47.5
	I don't know	65	32.2
Source of larvae used for biosurgery	collected from free-flying fly eggs	1	0.5
	bred under sterile conditions in Poland	162	80.2
	bred in high-income countries	38	18.8
	I don't know	1	0.5

Legend: n – group quantity; % – percentage.

necessary for the patient to remain in the hospital setting. The vast majority of respondents (80.2%; n=162) correctly indicated the site of production of larvae used in biosurgery (Table 3).

Relationship between year and field of study and opinion on having sufficient knowledge of techniques and treatments for DFS

The analysis showed that first-year BA students were most likely to believe that they did not have sufficient knowledge (75%; n=15) of DFS treatment techniques and methods. Furthermore, there was no significant difference between the year of study and the self-generated opinion of having sufficient knowledge in the techniques and methods of treating DFS (p=0.136). Nursing students were significantly more likely than midwifery students to believe that their knowledge of DFS treatment techniques and methods was insufficient (p=0.016) (Table 4).

Nursing and midwifery students' source of knowledge on techniques and treatments for DFS

Nursing students most often (60.8%; n=62) drew their knowledge of treatment methods from studies

Table 4. Relationship between year and field of study, and the opinion of having sufficient knowledge of DFS treatment techniques and methods

Variable			Year of study					Chi² test
			BA (year)			MA (year)		
			I	II	III	I	II	
Having sufficient knowledge	Yes	n	5	26	18	19	15	χ^2=6.993 df=4 p=0.136
		%	25.0	53.1	36.7	47.5	34.1	
	No	n	15	23	31	21	29	
		%	75.0	46.9	63.3	52.5	65.9	
Total		n	20	49	49	40	44	
		%	100.0	100.0	100.0	100.0	100.0	

Variable			Direction of study		Chi² test
			Nursing n=102	Obstetrics n=100	
Having sufficient knowledge	Yes	n	33	50	χ^2=5.788 df=1 p=0.016
		%	32.4	50.0	
	No	n	69	50	
		%	67.6	50.0	

Legend: BA – bachelor's degree; MA – master's degree; n – group quantity; % – percentage; χ^2.

Table 5. Relationship between field of study and knowledge of techniques and treatment methods of DFS, and biosurgery

Variable			Direction of study		Chi² test
			Nursing n=102	Obstetrics n=100	
Level of knowledge of treatment techniques for DFS	lowest	n	25	41	χ^2=27.524 df=2 p=0.001
		%	24.5	41.0	
	average	n	19	38	
		%	18.6	38.0	
	highest	n	58	21	
		%	56.9	21.0	
Level of knowledge about biosurgery	lowest	n	6	8	χ^2=1.376 df=2 p=0.503
		%	5.9	8.0	
	average	n	43	48	
		%	42.2	48.0	
	highest	n	53	44	
		%	52.0	44.0	

Legend: n – group quantity; % – percentage; χ^2 – test statistic Chi²; df – degrees of freedom; p – statistical significance.

and medical literature, and were more likely to do so when compared to midwifery students (p=0.001). Midwifery students most often drew their knowledge from other sources, such as doctors/nurses/midwifes, internet, television and family (75%; n=75).

Relationship between field of study and knowledge of techniques and treatment methods DFS and biosurgery

Our analysis demonstrated that nursing students had significantly greater knowledge of DFS treatment techniques and methods than midwifery students (p=0.001). We found no significant difference in knowledge of biosurgery between nursing and midwifery students (p=0.503) (Table 5).

Disscusion

The present study analyzed the level of knowledge of nursing and midwifery students on methods and techniques of treating DFS using Lucilia sericata larvae. First of all, it should be noted that only slightly more than 1/3 of the students had the highest level of knowledge in this area. Conversely, when examining biosurgery in general, students representing the highest level of knowledge accounted for 48%. It should be emphasized that these future nurses and midwives will play an important role in prevention and/or education activities, regardless of the place of work.

There are no studies in the available literature on assessing the level of knowledge of students about larvotherapy, and few relating to knowledge of treatment techniques for DFS. Therefore, we will discuss our results in the more general context of knowledge about type 2 diabetes and DFS management. In a study by Abdulwassi et al. (2020) on knowledge of diabetic foot management among medical students in Saudi Arabia, the level of knowledge displayed was very high. Fifth-year students had the highest level of knowledge in this study, while fourth-year students had the lowest. According to the authors, the level of students' knowledge should be higher, and this can be achieved by increasing physical examination classes and encouraging them to take an active part in practical classes [14]. In the authors' study, the second-year students believed that they had the highest level of knowledge, while the first-year students were of the opinion that they had the lowest level of knowledge. It seems that the knowledge of students majoring in nursing and midwifery in our investigation could be improved by increasing the hours of practical classes in specialist wards involved in the treatment of DFS. Changes in the curriculum could also include expanding the scope of classes to include modern treatment techniques for DFS.

A study conducted by Kłys and Gerstenkorn (2005) assessed the level of knowledge of female nursing students about type II diabetes. In this study, most students felt that the problem of diabetes was not sufficiently discussed during their university classes, and the graduating students felt that their knowledge was insufficient for future work as patient educators. Almost all participants indicated a willingness to improve their knowledge in this area [15]. Similar results were obtained in our study, with 55.4% (n=112) of the students indicating that their studies on the methods of treatment of DFS was insufficient. A large proportion of the respondents (88.1%; n=178) expressed a desire to expand their knowledge, and 58.9% (n=119) of the students felt that they did not have sufficient knowledge about modern methods of DFS treatment. In a study by Karłowicz et al. (2010) on the assessment of the level of knowledge about DFS in type II diabetic patients, it was noted that a well-educated nursing team is critical to improve patient education regarding disease complications [16]. Similar results were obtained in a study by Graffigna et al.(2016), in which the authors evaluated the role and ability of healthcare professionals in motivating patients to self-care and self-management in type II diabetes. This study indicated that an involved healthcare team resulted in them being viewed as good educators [17]. The attitudes of the students in our study indicate a desire to increase their own knowledge about the treatment of DFS. Greater knowledge among future nurses and midwives may result in a reduction in the incidence of diabetic complications, improved patient function and a reduction in hospital visits.

The level of knowledge regarding diabetes and related factors of Chinese students was assessed by Zang et al. (2016) , who found that students who had a family member with diabetes showed higher levels of knowledge [18]. Similar results were obtained by Amankwah-Poku (2019) who analyzed knowledge and awareness of type II diabetes among a student population in Ghana [19]. Interestingly, our study demonstrated that students with the highest level of knowledge were both with (47.6%; n=49), and without (48.5%; n=48) a family member with diabetes. Similar results were obtained in a study by Dąbska and Żołnierczuk-Kieliszek (2016) [20], suggesting that having a diabetic person in the family of the student is not important for the student's knowledge.

In a study on diabetes knowledge among university students in Ajman in UAE, Khan et al. (2012) reported that students used a variety of sources to gain knowledge about diabetes. The most frequently chosen source was information obtained from friends and relatives with 79%, and television and the Inter-

net with 7% [21]. In this study, the main sources of knowledge of nursing students about the treatment of DFS were university classes and medical literature (60.8%; n=62), while midwifery students by far the most frequently drew this knowledge from other sources (75%; n=75). This indicates that students in our study are obtaining knowledge on DFS from reliable sources such as college classes. The Internet, to which students now have easy access, actively increases students' awareness of biosurgery, with many medical articles available on the web. However, noting the level of students' knowledge of biosurgery could definitely be higher, more effort should be made to ensure that knowledge is taught more during college classes. The Internet would be an additional source of knowledge in this field, based solely on medical articles.

The results of the study indicate the need for further research on the knowledge of methods and techniques of treatment of DFS and biosurgery in the group of nursing and midwifery students. It is also reasonable to consider the need to carry out educational activities for students and to increase the number of hours of practical classes in specialist departments. It is important that the knowledge of future nurses and midwives is at the highest possible level, because education and medical care plays a very important role in preventing the occurrence of complications of diabetes in patients.

Limitations and future directions

The limitations of this study include the relatively small sample size, and that it was conducted among students at one institution, which may limit the generalization of results. In the future, we plan to conduct a multi-center study that will include nursing and midwifery students from other universities in Poland.

Conclusions

The research presented in this study indicates that nursing and midwifery students have insufficient knowledge of DFS treatment methods and biosurgery. Nursing students are more likely than midwifery students to derive knowledge of DFS treatment methods from their studies and the literature. Education among students on treatment methods and techniques for DFS should be increased. Students' knowledge can be increased by classes in the course of their education and meetings with professionals.

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THE EFFECTS OF COMBINED DIAMOND MICRODERMABRASION AND A MIXTURE OF COSMETIC ACIDS ON THE CONDITION OF ACNE PRONE SKIN: A CASE REPORT

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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: Exfoliating treatments are widely used in cosmetology and dermatology for the treatment of skin lesions and, above all, to reduce the number of skin eruptions that occur with acne vulgaris. An effective treatment that can be offered to people suffering from this disease is diamond microdermabrasion. The addition of acid peeling to this treatment may lead to even better results than in the case of monotherapy.

Aim of the study: To assess the effectiveness of a combination of microdermabrasion and acid peeling on a 21-year-old woman suffering from acne vulgaris.

Case report: The patient suffered from acne vulgaris, too high a level of sebum on the entire surface of the face, and, over the course of the disease, developed open and closed blackheads and inflammatory pustules. The sebum level was measured with a DermaUnitSCC3 device and the number of skin eruptions was determined using the global acne severity scale (GAGS).

Conclusions: The series of cosmetological treatments led to a reduction in the sebum on the surface of the epidermis and the number of skin eruptions.

KEYWORDS: microdermabrasion, cosmetics acids, acnevulgaris, GAGS, sebumeter

Background

Acne vulgaris is characterized by changes on the skin caused by overactive sebaceous glands, which leads to seborrhea. Acne eruptions may show a multiform nature and can be characterized as papular, pustular, or nodular, often leading to scarring [1,2]. Acne lesions are accompanied by inflammation, which is induced by an excessive colonization of *Cutibacterium acnes* in the sebaceous glands. The over-reactivity of the sebaceous glands is caused by hyperkeratinization of the hair follicles as a result of increased testosterone levels and an immune response to the presence of *Cutibacterium acnes* in the sebaceous glands

[1,3]. Acne vulgaris as an inflammatory skin disease that occurs in 95% of boys and 83% of girls aged 16 years. It has been observed that women experience acne vulgaris at an earlier age than men. However, men usually struggle with a more severe course of the disease. In men, acne lesions most often occur on the back and chest, while in women, the lesions are most often located on the face [4].

Acne vulgaris is a disease that can affect individuals of all ages. The group of acne diseases includes adult acne (acne tarda), which occurs most often in women aged 20 to 25 years. Acne is divided into two groups according to the age at which the first lesions appear. Permanent acne, which appears in adolescence and continues into adulthood, concerns 80% of acne cases. The second subtype of adult acne is late-onset acne, which appears for the first time in adulthood. Adult acne differs histopathologically from juvenile acne [2,5,7]. Thus subtype of acne is characterized by maculopapular and nodular changes, and the lesions are most often located around the neck, chin and jaw. The blackhead form in adult acne consists of macrocomedones. The course and characteristics of changes in adult acne are mild-to-moderate and are generally resistant to treatment. In addition to taking medications under the constant observation of a dermatologist, the patient should change his or her eating habits and lifestyle. Cosmetological treatments are complementary and support the treatment of acne, including the prevention or removal of its negative effects, such as discoloration or scars [5].

Cosmetology offers a number of cosmetic treatments that are able to improve the condition of the patient's skin. One of these treatments is chemical peeling, which consists of the exfoliation of the layers of the epidermis. Its purpose is to deliberately damage the superficial layers of the skin by exfoliating them, which consequently causes tissue regeneration. The effects of chemical exfoliators are broadly understood and include regulation of sebum secretion and pore narrowing, exfoliation of the epidermis, prevention of imperfections, blackheads and sebaceous fibers, stimulation of collagen production, a reduction of acne scars, lightening of discoloration, antibacterial and anti-inflammatory properties, and moisturizing. The specific effects of these treatments depend on the substance used, its concentration, the pH of the product and, most importantly, the time allowed for the preparation to work directly on the skin. Extremely effectiveisa combination of several acids [6,8].

Lactobionic acid works more gently than other acids and is recommended for sensitive and vascular skin, as well as for people struggling with rosacea, Psoriatic Arthritis (PsA) or Atopic Dermatitis (AD). This acid supports the reduction of telangiectasia, and has anti-inflammatory and soothing effects. Lactobionic acid exfoliates the outer layers of the epidermis, allows it to retain water, and, therefore, improves its hydration. In addition, this acid reduces shallow wrinkles and improves skin regeneration processes. It does not have a phototoxic effect and can be used all year round. Lactobionic acid also has an anti-aging effect. It inhibits metalloproteinases – enzymes responsible for the breakdown of collagen, which keeps the skin looking young.

Pyruvic acid is stronger than glycol and effectively exfoliates the top layer of the epidermis by loosening the connections between cells. This acid penetrates the skin quickly and acts in the hair follicles to work against blackheads. It also has antibacterial and sebostaticqualities. Pyruvic acid is used for acne-prone skin, but also for skin with visible signs of aging and sun discoloration.

Lactic acid is an acid of moderate strength with excellent moisturizing feature sat a concentration of up to 10%. This acid affects the synthesis of ceramides, supports the balance of the hydrolipid coat in higher concentrations (30–50%), and exfoliates the epidermis well. Lactic acid also helps to firm the skin by stimulating collagen synthesis and prevents discoloration by inhibiting melanin synthesis. Low concentrations of this acid are also used in cosmetic products to regulate their pH.

Azelaic acid is used to treat all types of acne, including inflammatory forms and rosacea. It is a lithophilic acid, thus it penetrates the epidermis well and reduces seborrhea to a large extent. Azelaic acid also prevents the formation of blackheads, has antibacterial properties, and lightens all forms of discoloration. This acid can be used safely on couperose skin prone to erythema. It is considerably well tolerated, can be used all year round, and is rarely followed by side effects [9].

Diamond microdermabrasion is a mechanical peeling consisting of the controlled removal (mainly by friction) of the epidermal layers. While there are different types of microdermabrasion devices, the most popular are diamond microdermabrasion and corundum microdermabrasion. Diamond microdermabrasion is based on the use of special abrasive rings with different gradations containing microcrystals that can be adjusted to the treatment area, skin thickness, and the therapeutic problem. Regular microdermabrasion regenerates the skin and makes it elastic. A noticeable improvement is observed in the smoothness of the surface of the epidermis and in the radiance of the appearance (i.e., it loses its dull, earthy color). In the dermis, mechanical exfoliation stimulates cell division, which is the result of increasing the production of collagen and elastin. Due to the force of friction and the effect of negative pressure, a local hyperemia occurs in the treatment area, and, therefore, results in better nutrition and oxygenation of the tissues.

Microdermabrasion also causes irritation reactions by increasing post-inflammatory cytokines and transcription factors (as in the healing process), increasing the regenerative capacity of the skin [8].

Aim of the study

The aim of this study is to assess the effectiveness of combined microdermabrasion and acid peeling on a 21-year-old individual suffering from acne vulgaris.

Material and methods

Study design, setting and duration

The diamond microdermabrasion and cosmetic acids treatment was performed every 2 weeks for a total of 5 treatments. Before each treatment, the face was cleansed with micellar water. Mechanical exfoliation was performed for 10 minutes using a vacuum of 20 cmHg. After microdermabrasion, the mixture of cosmetic acids was applied for 3.5 minutes. After the time had elapsed, a neutralizer was used, which was then washed off with cool water. After removing the acid from the treated area, the skin was toned and a cream with an SPF 50 filter was applied. The study was conducted between February 2021 and May 2021 at Opole University in Poland.

Participant

The participant was a 21-year-old female with acne vulgaris and increased sebum secretion. The patient had been suffering from acne vulgaris for 7 years.

Inclusion criteria

The patient met the inclusion criteria for the study including an age of 19–21 years, no comorbidities, no competitive sports, no dermatological treatments within last 12 months, no current hormonal contraception, and mild-to-moderate acne as measured by the global acne severity scale (GAGS).

Exclusion criteria

Exclusion criteria for this study were active inflammation of the skin,disturbed skin condition, bacterial, viral, allergic and fungal infections, activerosacea, numerous telangiectasia, skin diseases, psoriasis, eczema, skin cancers, numerous melanocyticnevi, oral antibiotic pills taken within the previous three months, oral is otretinoin within the previous year, oral contraceptive pill use, pregnancy and breastfeeding.

Ethical considerations

This study was approved by the Human Research Ethics Committee of the Opole Medical School (KB/54/NOZ/2019), according to the principles of the Declaration of Helsinki. The participant was informed about the principles and purpose of the study, signed a voluntary written consent form, and was informed that she could withdraw from study at anytime without providing a reason.

Data sources/measurements

The participant was diagnosed with mild acne vulgaris (GAGS=18). The GAGS divides the body into areas (forehead, cheeks, nose) and assigns a factor to each area on the basis of size. The location and factors are: forehead – 2, right cheek – 2, left cheek – 2, nose – 1; chin – 1; chest and upper back – 3. Each type of lesion is also given a value depending on severity: no lesions=0, comedones=1, papules=2, pustules=3, and nodules=4. The score for each area (local score) is calculated using the following formula: Local score=Factor × Grade (0–4). The global score is the sum of local scores, and acne severity is graded using this metric: 1–18 is considered mild, 19–30 moderate, 31–38 severe, and >39 very severe [14].

Before the treatment and 30 days (Table 1) after the end of the treatment series, measurements were taken in the morning. The patient was asked to remove her face makeup and not to apply any skin care products the day before the measurements were taken. On the day of the measurement, any use of micellar water and cosmetic productswere forbidden. The patient acclimated for 20 minutes in a room that was 22 °C and had a humidity between 40–50%. Measurements were made 1 cm above the left and right eyebrows, on both cheeks 5 cm from the nostril, on both nose petals, and on the chin 1 cm from the lower lip. The patient was informed that during the course of the research she was not allowed to use any other cosmetic procedures, the solarium, swimming pool or sauna. Oral supplementation with preparations that could reduce the amount of sebum produced were also forbidden. She was informed that a delicate micellar water along side cream with a SPF 50 filter should be used for home skin care. Matting and sebum regulating cosmetics were also forbidden during home skin care.

Results

After applying a series of five cosmetic treatments using microdermabrasion and a mixture of cosmetic acids, there was a noticeable improvement in the skin parameters (Table 2) and a reduction in skin eruptions (Table 1). The GAGS score was reduced from 18 to 14. There was also a reduction of the amount of sebum on the surface of the epidermis between the eyebrows from 206 to 98 (μg cm^2), on the chin from 178 to 112 μg/cm^2, on the right nose petal from 244 to 128 μg/cm^2, on the left nose petal from 225 to 158 μg/cm^2, on the right cheek from 183 to 114 μg/cm^2, and on the leftcheek from 213 to 146 μg/cm^2.

Table 1. GAGS score before and after treatment.

GAGS score before the treatment	GAGS score 30 days after the end of last treatment
18	14

Table 2. Sebum levels before and after treatment.

Area of measurement	Sebum level before the treatment [μg/cm^2]	Sebum level 30 days after the end of the treatment [μg/cm^2]
Between the eyebrows	206	98
On the chin	178	112
Right nosepetal	244	128
Leftnosepetal	225	158
Right cheek	183	114
Leftcheek	213	146

Discussion

Keyresults

The combined microdermabrasion and acid treatment is effective for individuals who struggle with acne vulgaris and oily skin.

Interpretation

The diamond microdermabrasion treatment has a positive effect on the condition of the patient's skin, regulating the level of secreted sebum, reducing the number of blackheads, and minimizing the risk of bacterial infection, a potential consequence of acne vulgaris. In addition, microdermabrasion stimulates fibroblasts to produce collagen and elastin, inducing repair processes in the skin, and preventing the negative effects of acne scars.

Chilicka et al. examined the influence of microdermabrasion on the general condition of the skin and concluded that diamond microdermabrasion results in improvements in skin elasticity and smoothness, a change in the extent of skin peeling, and, above all, a sharp decrease in the level of skin oiliness [10]. Dybaś et al. also reported a positive effect of diamond microdermabrasion on the general condition of the skin. In particular, a change in the level of skin oiliness was noted. Before the series of treatments, the skin was oily with clear zones of excessive sebum production and, after the treatments, the level of sebum decreased and the skin became dry. However, the study did not show a significant change in the level of epidermis hydration [12]. In contrast, Kmieć et al. reported that diamond microdermabrasion can affect the level of skin hydration. In this study, an examination was performed after a series of 6 treatments, and an increase in hydration was maintained up to two weeks after completion of the treatments [13].

Chemical exfoliation involves the application of chemical substances that are intended to accelerate cell renewal. The effects of these treatments are visible almost immediately and, depending on the concentration, the exfoliation may be more shallow or deeper. The long-term effects of chemical peels cause the skin to regenerate and produce new collagen. As a result, the skin becomes moisturized, and fine wrinkles and discoloration disappear [6,7].

Based on research conducted by Wasylewski, it can be concluded that lactobionic acid is perfect for supporting acne treatment, as it has antioxidant properties that combat free radicals. In addition, this acid has a moisturizing effect and creates a protective barrier on the skin surface. Another important aspect of the treatment of acne with lactobionic acid is the fact that it is used to regulate sebum secretion. The study by Wasylewski showed that this acid can be used throughout the year for vascular skin and with symptoms of acne, as it does not increaserisk of discoloration. However, it was indicated that high UVA/UVB protection is recommended after each exfoliation treatment [6].

Kapuścinska et al. reported that pyruvic acid is well soluble in water, is neutralized under its influence, and causes superficial exfoliation of the skin. Thus, thanks to these properties, this acid aidsin the penetration of active substances into the skin. This compound also induces a metabolic effect, acting both as a keratolytic and a comedolytic. Due to its antibacterial and sebostatic qualities, it is a very effective agent that reduces increased sebum production, hyperkeratosis, bacterial colonization, and hormonal disorders that can cause acne. Kapuścinska et al. recommend that the time between pyruvic acid treatments should be 10 to 14 days [7].

Surgiel-Gemza et al. have demonstrated that azelaic acid has multiple effects, including anti-inflammatory and antibacterial properties, reducing excessive keratinization and inhibiting the activity of the tyrosinase enzyme, which is of key importance in the process of melanogenesis,and prevents or reduces the occurrence of discoloration. This study also showed that azelaic acid has a 70–80% efficacy in anti-inflammatory action compared to placebo, and is more effective than metronidazole [8].

Many studies have assessed the impact of microdermabrasion on the condition of skin affected by common acne or on the elimination of acne-related scars. Chemabrasion improves acne skin quality, and is an effective treatment for scars and discoloration [6,7,10,12,17,18,19]. However, few studies have described the influence of combination therapies on the course of acne vulgaris.

While combined therapies are an effective treatment for acne vulgaris, other therapies are also available on the cosmetic market, and many studies have identified equally effective methods of fighting acne. One of these cosmetic methods is hydrogen purification, which was shown to be effective by Chilicka et al. Hydrogen purification significantly reduced the level of sebum, increased the level of skin hydration, and strengthened the skin's protective barrier. Despite the fact that the procedure is performed with water at pH 8–10, the pH of the skin does not change much [14]. Another effective therapy is the use of pulsed Intensive Pulsing Light (IPL). Studies have revealed that this method helps to reduce acne lesions, including pustules, blackheads and papules, and improves the quality of acne-affected skin [15]. A perfect supplemental therapy is the use of alkaline water. This treatment is safe and effective in the event of acne eruptions and excessive sebum secretion. Chilicka et al. have shown a significant reduction in acne eruptions and the level of sebum with this treatment [16].

All of the above-mentioned treatments have a positive effect on the condition of acne-prone skin. However, it is worth noting that acne therapy should begin with a dermatological consultation, and all cosmetic procedures should be considered complementary and carried out in close cooperation with a dermatologist.

Study limitations

The results of the current research are promising. However, in the future, we plan to expand the study group to include a larger number of patients, including men. A placebo treatment can also be used, where a microdermabrasion treatment is performed and mineral water is used instead of acid.

Recommendations

We recommend this treatment for people suffering from acne vulgaris and an oily skin type. It is safe and cause no side effects.

Conclusions

Microdermabrasion and acid treatments are safe procedures to treat acne. The current treatment regimen reduced the amount of skin eruptions and sebum on the patient's face. It should be noted that this procedure cannot replace dermatological treatments and should be considered an adjunct therapy.

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