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Experiences and opinion of medical professionals regarding the use of telemedicine tools in management of patients with chronic diseases: a cross-sectional survey

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Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Bioethics Committee of the Lower Silesian Chamber of Physicians (approval no. KB 01/BNR/2024, approval date 14.02.2024). Informed consent was obtained from individual participants included in the study.

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Conflict of Interest

No conflict of interest.

Author Contributions Statement

B.J.-P. was responsible for study conceptualization, literature review, data analysis, manuscript drafting, project management, and funding acquisition. W.T. was responsible for study conceptualization, literature review, data analysis, manuscript drafting, supervision, and funding acquisition. W.S.Z. was responsible for data interpretation and critical revision of the manuscript. M.W. was responsible for preparing figures

and tables and contributed to the manuscript review. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Abstract

Telemedicine has rapidly become a vital tool in managing chronic diseases, yet its effective integration relies on the acceptance and preparedness of healthcare professionals. This study aimed to assess the experiences, opinions, and expectations of medical professionals regarding telemedicine tools in patient care. This cross-sectional study was conducted from October to November 2024 among 237 employees of the 4th Military Clinical Hospital in Wroclaw, Poland. Respondents completed an online questionnaire assessing telemedicine experiences, expectations, and barriers. This study used the "Expectations of Telemedicine" (ET-14) and "Benefits and Requirements of Telemedicine" (BRT-10). Over half of the respondents (54%) reported experience with telemedicine, especially paramedics (91.7%) and general practitioners (71.4%). Healthcare professionals identified improved patient access and optimized resource utilization as primary expectations, while significant barriers included difficulty performing physical examinations (73.8%) and technological limitations (50.6%). Although paramedics exhibited greater skepticism about telemedicine's usefulness compared to other professions, most participants acknowledged its potential benefits for chronic disease management. The instruments used demonstrated high reliability (Cronbach’s alpha > 0.95). In conclusion,

telemedicine offers significant benefits for chronic disease management but requires addressing barriers such as training gaps, technological infrastructure, and regulatory adjustments. Tailored interventions and enhanced integration with existing healthcare systems are essential for broader adoption.

Keywords: telemedicine, chronic disease, health personnel, perception, attitude of health personnel, technology acceptance, health services accessibility, remote consultation.

Introduction

The rapid advancement of digital technologies has transformed healthcare delivery, with telemedicine emerging as a vital tool in managing chronic diseases [1,2]. By enabling remote consultations, continuous patient monitoring, and improved access to medical expertise, telemedicine bridges geographical and logistical gaps, making it a cornerstone of modern healthcare systems [3]. Its significance has grown exponentially during the COVID-19 pandemic, which accelerated its adoption across diverse medical specialties [4].

Chronic diseases, such as diabetes, cardiovascular conditions, and respiratory disorders, require frequent monitoring and timely interventions [5]. Telemedicine offers a practical solution, enhancing care continuity and optimizing resource allocation. However, the successful integration of telemedicine into clinical practice depends on healthcare

professionals' experiences, perceptions, and readiness to adopt these technologies [6,7].

Globally, countries such as the United States, Germany, and Sweden have reported increased telemedicine adoption due to favorable regulatory frameworks and investments in digital infrastructure [8]. In Poland, telemedicine adoption has increased significantly, particularly in response to the pandemic [9,10]. However, challenges such as limited digital literacy, infrastructural gaps, and regulatory uncertainties persist, underscoring the need for tailored interventions to maximize its potential in the Polish healthcare system [11,12].

While medical professionals recognize telemedicine's benefits, including improved access for remote patients and resource optimization, previous studies have often presented generalized findings without sufficient attention to profession-specific perspectives or clearly defined barriers that impact effective implementation [13,14]. The inability to conduct physical examinations, technical issues like poor internet connectivity, insufficient training in digital tools, and challenges integrating telemedicine with existing systems are among the most commonly cited barriers [15]. Additionally, the acceptance of telemedicine varies by profession and frequency of use, with paramedics and general practitioners reporting the highest levels of experience [16].

It should be mentioned that prior research has also often omitted rigorous psychometric validation of instruments measuring practitioner attitudes. This limits the interpretability and reproducibility of findings. Therefore, while our study assesses attitudes toward telemedicine, it also ensures robust validation of the applied scales (ET-14 and BRT-10), although reliability testing per se is not the primary aim unless psychometric properties are a research focus.

Notably, there remains limited research specifically examining how acceptance and perceived barriers differ among multidisciplinary teams involved in chronic disease management. Understanding these differences is essential for creating tailored implementation strategies. Therefore, our study aims to address this research gap by systematically

exploring healthcare professionals' experiences, expectations, perceived effectiveness, and specific barriers related to telemedicine use across various medical professions and specializations. This study seeks to answer two research questions: (1) What are the experiences and attitudes of Polish healthcare professionals from different clinical backgrounds toward telemedicine in the context of chronic disease care? and (2) How valid and reliable are the standardized tools ET-14 and BRT-10 when applied in the Polish healthcare context?

This study evaluates healthcare professionals' experiences, opinions, and expectations regarding telemedicine in chronic disease management. It assesses the reliability of the "Expectations of Telemedicine" (ET-14) and "Benefits and Requirements of Telemedicine" (BRT-10) scales, providing insights into barriers, opportunities, and strategies for improving telemedicine adoption in routine care. Also, this research fills an existing gap by offering one of the first comprehensive assessments of cross-professional telemedicine attitudes in Poland, utilizing validated instruments and reflecting developments from 2020–2025.

Results

Participants Characteristics

The respondents' ages ranged from 23 to 82 years (M = 35.6 years, SD = 12.0 years). The survey primarily targeted healthcare personnel with experience in using telemedicine (n = 128). Basic demographic and professional statistics of the study participants are presented in **Table 1**. The study participants represented a diverse range of medical and nursing specializations. Among medical professionals, the most common specialties included surgery (20.7%), internal medicine (17.2%), and anesthesiology and intensive care (6.9%). Other represented fields included cardiology (6.9%), orthopedics (6.9%), emergency medicine (3.4%), neurology (3.4%), ophthalmology (3.4%), otolaryngology (3.4%), psychiatry (3.4%), and radiology (3.4%). A small proportion of respondents (13.8%) did not disclose their specialization. In the nursing

group, anesthesiology and intensive care nursing was the most frequently reported specialization (27.6%), followed by surgical nursing (10.3%) and internal medicine nursing (10.3%). Additional specializations included geriatrics (3.4%), orthopedics (6.9%), emergency nursing (3.4%), and family medicine nursing (3.4%).

Telemedicine Experience

Respondents were divided into two groups based on their response to the question, "Do you have experience in providing care to patients using telemedicine solutions?" More than half of the respondents (54.0%) reported having experience with telemedicine. The results of comparisons regarding the frequency of declared telemedicine experience among different professional groups, analyzed using Fisher's exact test, are presented in contingency tables **(Tables 2 and 3)**.

Telemedicine experience was most frequently reported by paramedics (91.7%), primary care physicians (71.4%), specialist doctors (69.0%), and nurses specializing in anesthesiology and intensive care (62.5%). Medical professionals who used telemedicine frequently (100%) or occasionally (98.0%), as well as individuals aged 34 and older, were significantly more likely to report telemedicine experience ($p < 0.001$). Lack of telemedicine experience was more common among physiotherapists (63.6%) and other professions (64.1%), including medical interns, dentists, and medical caregivers, as well as those who rarely used telemedicine (35.6%) and individuals younger than 28 years. Additionally, the daily time spent on the Internet was significantly longer among respondents with telemedicine experience and those providing telemedicine services ($p < 0.05$) **(Fig. 1)**.

The likelihood of an individual providing telemedicine services having experience with its use is nearly thirty times higher compared to those who do not offer such services (OR = 27.0). In response to the question about the types of telemedicine services provided, 47.3% of respondents gave an answer. The most commonly reported services included medical consultations (advice) via video calls, which involved

assessing patient conditions, providing health-related guidance, and similar activities (31.6% of all study participants and 67.0% among those providing telemedicine services). Other frequently mentioned services were issuing prescriptions and managing or adjusting medications to the patient's changing health conditions, as well as maintaining medical documentation (12.2% each). Additionally, follow-up visits or online check-ins to evaluate treatment effectiveness, monitor potential health changes, and adjust treatment plans were reported by 11.4%.

Expectations of Telemedicine

The second part of the questionnaire included 14 questions regarding expectations toward telemedicine, scored on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The total possible score ranged from 14 (pessimistic) to 70 (optimistic). Among the 237 participants, scores ranged from 14 to 70, with a mean of 48.5 and a standard deviation of 12.5. The distribution of scores significantly deviated from normality (Shapiro-Wilk test: $W = 0.877$, $p < 0.001$); therefore, non-parametric tests were used for group comparisons.

To assess differences in the levels of telemedicine expectations on the ET-14 scale across professional groups, the Kruskal-Wallis test was applied. For multiple comparisons (post-hoc analysis), Dunn's test was used. A statistically significant difference was observed only between paramedics and other professions (28 vs. 53 points, $p = 0.004$) **(Fig. 2)**.

To evaluate differences in expectations from telemedicine (ET-14 scale) between groups of respondents with and without declared telemedicine experience (Question 2), the Mann-Whitney U test was applied. Among respondents with telemedicine experience, expectations were slightly higher than those without experience (52 vs. 51 points, $p = 0.590$). Expectations toward telemedicine did not significantly depend on the respondents' declared experience. In both groups, the most skepticism was directed toward Question 5 ("The use of telemedicine will have a positive impact on the quality of patient care") and Question 10

("*The use of telemedicine will reduce the number of hospitalizations due to exacerbations of disease states*") **(Fig. 3)**.

Differences in expectations were observed among groups of employees with varying frequencies of providing telemedicine services. Medical personnel who rarely provided such services (participation in 1–2 projects) were more optimistic compared to those who provided telemedicine services more frequently (more than 2 projects, but not on a daily basis) (53 vs. 46 points, $p = 0.005$) **(Fig. 4)**.

A statistically significant difference in expectations toward telemedicine was observed between surgeons and internists, as well as between nurses specializing in these fields **(Fig. 5)**.

Opinions on Telemedicine Usefulness

The third part of the questionnaire included 10 statements regarding the usefulness of telemedicine, scored on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The total possible score ranged from 10 (low usefulness) to 50 (high usefulness). Among the 237 participants, the mean score was 36.9, with a standard deviation of 9.0. The distribution of usefulness ratings on the BRT-10 scale significantly deviated from normality (Shapiro-Wilk test: $W = 0.830$, $p < 0.001$); therefore, non-parametric tests were used for comparisons between groups. To evaluate differences in responses to Part III questions between two groups of respondents, the Mann-Whitney U test was applied. Overall opinions between the groups did not differ significantly (40 vs. 40 points, $p = 0.590$). Paramedics expressed significantly lower opinions about the usefulness of telemedicine compared to specialist doctors (24 vs. 40 points, $p = 0.001$) and other professions (24 vs. 40 points, $p < 0.001$). Orthopedic specialists also had lower opinions compared to internists (40 vs. 36 points, $p = 0.031$; **Fig. 6**).

The opinion on the usefulness of telemedicine, assessed using the BRT-10 scale, was significantly lower among respondents who frequently used telemedicine (more than 2 projects, but not daily)

compared to those who either did not use it or used it rarely (participation in 1–2 projects, $p < 0.001$; **Fig. 7**).

Employees who provided telemedicine services were more skeptical in their opinion regarding the usefulness of telemedicine for patients who prefer home treatment ($p < 0.012$) and for patients with communication exclusion ($p < 0.003$) (**Fig. 8**).

A positive, moderately strong correlation was observed between the ratings of actual telemedicine experience in daily clinical practice (BRT-10) and expectations toward telemedicine (ET-14). An increase in experience by one point was associated with an average increase in expectations by 1.02 points. Outliers observed on the correlation diagram **(Fig. 9)** pertain to surgeons (#11, #69, #81), a paramedic (#202), and a dentist (#172).

Barriers to the Telemedicine Application

To assess differences in responses to Part IV questions between two groups of respondents, the Mann-Whitney U test was applied. Among the analyzed telemedicine-related barriers, only the inability to perform a physical examination significantly differentiated the respondent groups ($p = 0.031$). Individuals providing telemedicine services were less likely to perceive the lack of a physical examination as a significant obstacle compared to those without such experience. For other barriers, such as communication issues, connection quality, or equipment problems, no significant differences were found ($p > 0.05$) (**Table 4**).

Discussion

Telemedicine has revolutionized the management of chronic diseases by improving accessibility, patient engagement, and providing successful clinical management and clinical outcomes control. The present study demonstrated that healthcare professionals recognize significant potential in telemedicine for improving patient access and resource optimization, particularly for chronic disease management. However,

acceptance and perceived usefulness varied notably by profession, with paramedics exhibiting more skepticism compared to specialist physicians and nurses. Additionally, our findings emphasize specific barriers including difficulties performing physical examinations remotely, technological infrastructure issues, and training gaps. These results underscore the need for targeted strategies addressing profession-specific concerns and identified barriers to optimize telemedicine integration into routine clinical practice.

It should be noted that Corbett et al. [17] highlight its ability to provide consistent monitoring and timely interventions, particularly for conditions like hypertension, where remote consultations can overcome geographical barriers and optimize care delivery. Similarly, Kruse et al. [18] demonstrate telemedicine's effectiveness in managing chronic heart disease, noting significant reductions in hospital readmissions and enhanced treatment adherence. Wootton [19] reinforces these findings, showing that telemedicine has consistently improved patient satisfaction and cost-efficiency over two decades of evidence synthesis.

The COVID-19 pandemic further emphasized telemedicine's importance, with Wang et al. [20] illustrating its ability to maintain continuity of care when traditional access was disrupted. Beyond remote consultations, telemedicine supports self-management of chronic conditions, as shown by Hanlon et al. [21], who describe its role in empowering patients with diabetes, asthma, COPD, and other long-term conditions. While these benefits are promising, challenges such as digital literacy gaps, the need for robust technological infrastructure, and tailored solutions for diverse populations remain. Addressing these barriers is critical to realizing telemedicine's full potential in chronic disease management.

The results of this study provide a comprehensive overview of healthcare professionals' experiences, expectations, and challenges related to telemedicine in managing chronic diseases. The majority of respondents recognized telemedicine's potential to improve accessibility and

streamline healthcare delivery, particularly for patients in remote or underserved areas.

Notably, paramedics and orthopedic specialists in our study expressed relatively greater skepticism toward telemedicine tools. This may reflect the nature of their clinical duties, which often require direct physical examination, manual assessment, or urgent, hands-on interventions that are difficult to replicate in a virtual environment. Additionally, while telemedicine experience positively correlated with expectations, barriers such as the inability to conduct physical examinations, technical challenges, and regulatory constraints were identified as critical limitations.

Our study highlights a nuanced perspective on telemedicine adoption for chronic disease management, aligning with and expanding upon findings from other recent investigations. A majority of our respondents recognized telemedicine's potential to enhance accessibility and streamline care, particularly for patients in remote areas. This aligns with findings from Rabinowitz et al. [22], who observed similar benefits in U.S. primary care settings, where telemedicine was praised for its ability to reduce geographical barriers and optimize resource use. However, both studies noted significant variability in adoption rates, emphasizing the role of institutional infrastructure and training in shaping perceptions.

The issue of physical examination limitations was prominent in our study, where many respondents expressed skepticism about telemedicine's ability to replace in-person assessments. Sten-Gahmberg et al. [23] reported similar concerns, particularly among patients and providers managing chronic conditions such as diabetes and COPD. Both studies highlight the importance of hybrid care models combining in-person visits with telemedicine follow-ups, a recommendation echoed in Tan et al. [24], who identified this approach as critical for long-term care.

Barriers related to digital infrastructure were another common theme. In our study, the inability to integrate telemedicine tools with existing systems and concerns about connection quality were frequently

cited. Borges do Nascimento et al. [25] and Habib et al. [26] reported similar findings, stressing that insufficient IT support and technological disparities hinder broader adoption. Our participants also proposed solutions, such as enhanced EHR integration and the use of AI for automated monitoring—recommendations consistent with the advanced tools discussed by Lundereng et al. [27] in palliative care settings.

A noteworthy divergence from the literature was observed in attitudes toward telemedicine among professional groups. In our study, paramedics and orthopedists were less optimistic about telemedicine's utility compared to internists and general practitioners, with paramedics citing a lack of relevance to their hands-on work. This contrasts with findings by Khan et al. [28], who reported more uniform acceptance among professionals when telemedicine tools were tailored to specific workflows.

The role of training emerged as a critical factor influencing telemedicine perceptions. Our respondents emphasized the need for practical, hands-on training, particularly for older staff. Ali Garavand et al. [29] similarly highlighted the importance of education in overcoming resistance to telemedicine adoption. Additionally, Hajesmaeel-Gohari et al. [30] underscored the significance of usability assessments, a sentiment reflected in our respondents' call for user-friendly applications and patient assistants, particularly for elderly users.

Our findings regarding patient engagement align with Lundereng et al. [27] and Hanlon et al. [21], who demonstrated that telemedicine empowers patients to actively manage their conditions. However, as seen in our study, barriers such as low digital literacy among older patients remain significant. Addressing these challenges requires targeted interventions, such as simplified interfaces and personalized support. Our study is consistent with and extends insights from recent investigations into telemedicine's barriers and opportunities. For example, Abdelghany et al. [31] emphasized healthcare providers' concerns about the lack of physical interaction, echoing our respondents' reservations about the inability to perform comprehensive physical

examinations via telemedicine. Both studies highlight this as a critical limitation for specialties reliant on tactile diagnostics, such as orthopedics and paramedicine.

Moreover, Patel et al. [32] further elaborate on barriers experienced during the COVID-19 pandemic, identifying key issues such as disparities in access to telemedicine technology, lack of standardized training, and patient digital literacy. These findings are consistent with our study, where digital illiteracy among both patients and older healthcare professionals was a recurring challenge. Notably, Patel et al. observed that providers with prior telemedicine experience were more optimistic about its utility, a trend mirrored in our findings, where familiarity with telemedicine correlated with higher expectations and perceived benefits.

These findings underscore the need for profession-specific strategies in implementing telemedicine. A national framework should account for inter-professional differences and incorporate them into the development of clinical guidelines and targeted training curricula. For example, integrating specialized telemedicine modules into continuing education for clinical disciplines showing lower acceptance—such as orthopedics or emergency medicine—may support broader and more effective adoption. Tailoring implementation efforts to the specific expectations and concerns of various professional groups could enhance both the acceptability and sustainability of telemedicine solutions. In the context of ongoing digital transformation in healthcare, such differentiated strategies are essential to ensure equitable, efficient, and high-quality care delivery across the entire health system.

Study Limitations

This study has several limitations that may affect the interpretation of the findings. First, the sample was drawn from a single medical institution, which may limit the generalizability of the results to other healthcare settings or regions. Additionally, the reliance on self-reported data introduces the possibility of recall bias or subjective interpretation.

The response rate for detailed suggestions to improve telemedicine was low (6.3%), potentially underrepresenting broader opinions. Furthermore, the cross-sectional design does not allow for causal inferences regarding the relationships between telemedicine experience, expectations, and barriers. Additionally, the study focuses on healthcare providers, excluding patient viewpoints critical for assessing telemedicine's effectiveness and usability. Finally, challenges related to digital literacy among older healthcare professionals and patients warrant further investigation to improve telemedicine adoption.

Conclusions

This study highlights the varied experiences and expectations of medical professionals regarding telemedicine, with paramedics, primary care physicians, and specialists reporting the most experience. While telemedicine is recognized for improving accessibility and efficiency, concerns about physical examination limitations and technological barriers persist. A positive correlation between telemedicine experience and expectations underscores the need for targeted training and support.

Hybrid care models combining in-person and remote consultations, improved technological integration, and legal adjustments are essential for broader adoption. Policymakers and healthcare leaders are encouraged to address regulatory gaps, standardize telemedicine practices, and ensure equitable access to digital health services. Future research should focus on longitudinal assessments of attitude changes over time, cost-effectiveness analyses of hybrid care models, and the impact of training interventions on adoption rates in various clinical specialties. Also, it should focus on understanding patient perspectives, long-term clinical outcomes, and cost-effectiveness to guide the development of sustainable telemedicine solutions that meet the diverse needs of both patients and providers.

Methods

Participants and Settings

The study, conducted in October and November 2024, included 237 employees from the 4th Military Clinical Hospital in Wrocław (Poland) which employs about 1,500 medical staff (including about 1,300 with professional licenses. The study was conducted in accordance with the Declaration of Helsinki, and approved by the Bioethics Committee of the Lower Silesian Chamber of Physicians (approval no. KB 01/BNR/2024). This study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The sampling method employed was convenience sampling, inviting all medical staff fulfilling inclusion criteria and consenting to participate voluntarily. Participants were informed clearly about the study objectives and their right to withdraw at any stage without providing reasons.

Inclusion criteria were: 1. Employment at the 4th Military Clinical Hospital in Wrocław in a medical position (e.g., physician, nurse, paramedic, physiotherapist); 2. Possession of a valid professional license (if applicable); 3. A minimum of 6 months of professional experience in the healthcare system; 4. Voluntary consent to participate in the study; 5. Involvement in the care of patients with chronic diseases or prior experience in using telemedicine tools. The study sample was drawn in the context of two hospital-led projects focused on the implementation of telemedicine solutions for managing chronic diseases and supporting elderly patients.

Exclusion criteria were: 1. Non-medical staff (e.g., administrative or technical personnel), unless directly involved in delivering healthcare services via telemedicine; 2. Individuals currently on long-term sick leave, maternity leave, or otherwise not in active patient contact; 3. Lack of consent to participate in the study or incomplete questionnaire responses; 4. Lack of professional experience in clinical or remote patient care.

Questionnaire Structure and Consistency

The "Expectations of Telemedicine" (ET-14) questionnaire consisted of four parts, each containing a set of closed, open-ended, or mixed questions. Part I include 10 questions about respondents' professions, experience with telemedicine in patient care, frequency of telemedicine use, age, years of professional experience, frequency of internet usage, access to internet applications and devices, types of telemedicine services provided, and their nature. Part II comprise 14 questions about opinions and expectations related to telemedicine, based on respondents' previous experiences. A five-point Likert scale (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree) was used to assess attitudes, opinions, and levels of agreement or disagreement with specific statements. Overall expectations toward telemedicine were measured using the ET-14 scale, which summed the scores from Part II questions.

To evaluate the consistency of the questionnaire items, a reliability analysis was conducted, and Cronbach's alpha was calculated, serving as a measure of internal consistency within the test or psychometric scale. The results **(Table 5)** indicated a very high level of consistency (Cronbach’s alpha = 0.958). The statements that received the least agreement among respondents were those regarding telemedicine's positive impact on the quality of patient care (item 5) and its potential to reduce hospitalizations due to exacerbations of disease (item 10). The internal consistency reliability (Cronbach's alpha) for the total ET-14 score was estimated at 0.958, meaning approximately 96% of the variability in the total score reflects true variability among respondents in their expectations toward telemedicine.

Part III include 10 statements about practical experiences with using telemedicine in daily clinical practice, which collectively formed the "Benefits and Requirements of Telemedicine" (BRT-10) score. The internal consistency reliability (Cronbach’s alpha) for the total BRT-10 score was estimated at 0.955, indicating that approximately 95% of the

variability in the total score reflects true variability in respondents' experiences with telemedicine **(Table 6)**.

Part IV contains a multiple-choice question (12 response options) addressing barriers that hinder the use of telemedicine tools in clinical practice **(Table 7)**.

Sample Size

The minimum sample size required for the applied statistical tests (z-test for two proportions and Mann–Whitney U test for two independent quantitative variables) was determined using the GPower software, assuming a significance level of $\alpha = 0.05$, statistical power of $1 - \beta = 0.8$, and an expected effect size of $f = 0.5$. The minimum required sample sizes for the two-sided z-test for proportions were $n_1 = 69$ and $n_2 = 58$. For the two-sided Wilcoxon–Mann–Whitney test, the minimum required sample sizes were $n_1 = 74$ and $n_2 = 62$. The actual collected sample size was nearly double the required size.

Statistical Analysis

Statistical analysis of survey results was performed using STATISTICA v. 13.3 (TIBCO Software Inc., Palo Alto, CA, USA), the R environment (R Project for Statistical Computing), and Microsoft Excel. The conformity of empirical distributions of all continuous quantitative variables (e.g., age, work experience) and discrete variables (e.g., expectations and benefits of telemedicine measured by the ET-14 and BRT-10 scales) with theoretical normal distributions was assessed using the Shapiro-Wilk test. For quantitative variables, the following were calculated: mean (M), standard deviation (SD), median (Me), lower quartile (Q1), upper quartile (Q3), and extreme values (Min, Max). In tables and figures, variables with distributions approximating normality were described using the mean and standard deviation: M (SD), while variables significantly deviating from normality were described using medians and quartiles: Me [Q1; Q3]. For qualitative nominal variables (e.g., profession, medical specialization) and ordinal variables (e.g., frequency

of telemedicine use), counts (n) and percentages (%) were calculated and presented in contingency tables. The independence of qualitative variables was tested using Pearson's chi-squared test (χ^2) or Fisher's exact test. The significance of differences in mean values between two groups for variables with approximately normal distributions and unequal variances was assessed using Welch's t-test. Variance homogeneity was verified with Levene's test. For variables deviating significantly from normality or with unequal variances, the Mann-Whitney U test was used for comparisons between two independent groups. For multiple groups, the Kruskal-Wallis test was employed, with Dunn’s test as the post-hoc method. Differences in mean values for dependent groups were verified using Friedman’s test. To evaluate the strength and nature of relationships between two quantitative variables (e.g., ET-14 and BRT-10 scores), correlation and linear regression analyses were conducted. Spearman’s rank correlation coefficient (rho) and its 95% confidence interval were calculated. A significance level of $\alpha = 0.05$ was adopted for all statistical tests, with results considered significant when $p < 0.05$. Quantitative variables (age and length of employment) showed highly skewed distributions and contained outliers. The Box-Cox transformation applied to the raw variables did not yield the expected normalization of data; therefore, non-parametric tests were used for comparisons.

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Tables

Table 1. Characteristics of study participants ($N = 237$).

Variable		
Age (years)		
M (*SD*)	35.6 (12.0)	
Me [*Q*1; *Q*3]	31 [26; 43]	
Min - *Max*	23 - 82	
Work experience (years)		
M (*SD*)	12.3 (11.9)	
Me [*Q*1; *Q*3]	7 [3; 20]	
Min - *Max*	1 - 50	
Telemedicine usage	***N***	**%**
Rarely (participation in 1–2 projects)	88	37.1%
Sometimes (not daily)	49	20.7%

Frequently (daily in professional work)	17	7.2%
No response	83	35.0%
Profession		
1. Primary care physician	14	5.9%
2. Specialist doctor	29	12.2%
3. Nurse	29	12.2%
4. Physiotherapist	11	4.6%
5. Paramedic	37	15.6%
6. Medical coordinator	3	1.3%
7. Physician assistant/Secretary	4	1.7%
8. Other	110	46.4 %

M – Mean; SD – standard deviation; Me – Median; Q1 – lower quartile (25th percentile); Q3 – upper quartile (75th percentile); Min – minimum value; Max – maximum value.
Bolded values indicate statistically significant differences ($p < 0.05$).

Table 2. Number (percentage) of respondents in groups differing in experience with telemedicine and results of statistical tests (Z test for proportions).

Occupation performed	**QI-2. Experience with telemedicine**				***p*-value**
	Yes (*N* = 128)		**No (*N* = 108)**		
1. Primary care physician	10	71.4%	4	28.6%	**0.02**
2. Specialist doctor	20	69.0%	9	31.0%	**0.004**
3. Nurse	13	46.4%	16	53.6%	0.58
4. Physiotherapist	4	36.4%	7	63.6%	0.20
5. Paramedic	33	91.7%	3	8.3%	**<0.001**
6. Medical Coordinator	1	33.3%	2	66.7%	0.41

7. Assistant/secretary	1	25.0%	3	75.0%	0.16
Other	46	35.9%	82	64.1%	**<0.001**

Bolded values indicate statistically significant differences ($p < 0.05$).

Table 3. Characteristics of participants in terms of frequency of telemedicine use, age and work experience.

Questions	**QI-2. Experience with telemedicine**				**Test result**
	Yes		**No**		
3. How often did you use telemedicine?, *N* (%)					
Rarely (participation in 1-2 projects)	56	64.4%	31	35.6%	$\chi^2 = 26.4$ $df = 2$

Sometimes (more than 2 projects, but not every day)	48	98.0%	1	2.0%	**p < 0.001**
Often (every day at work)	17	100.0 %	0	0.0%	
4. Age (year of age)					
M (*SD*)	37.2 (12.1)		33.6 (11.6)		Z = 2.86
Me [*Q*1; *Q*3]	34 [26; 43]		28 [25; 39]		**p = 0.004**
Min - *Max*	24 - 82		23 - 77		
5. Length of service (years)					
M (*SD*)	12.4 (11.9)		12.2 (12.0)		Z = 0.34 p = 0.73
Me [*Q*1; *Q*3]	7 [3.5; 20]		8 [3; 20]		
Min - *Max*	1 - 47		1 - 50		

M – Mean; SD – standard deviation; Me – median (50th percentile); Q1 – lower quartile (25th percentile); Q3 – upper quartile (75th percentile); Min - minimum value; Max – maximum value. Statistically significant differences are highlighted at the level of p < 0.05.

Bolded values indicate statistically significant differences (p < 0.05).

Table 4. Number (percentage) of opinions in groups of employees differing in the provision of telemedicine services regarding its usefulness (Part III), along with the results of Fisher's Exact Test.

Opinions	Provision of telemedicine services				*p*
	Yes *N* = 91		No *N* = 141		
	N	%	*N*	%	
I see a problem with the lack of possibility to conduct a physical examination	60	65.9 %	112	79.4 %	**0.03**
I see a problem with communication due to the patient's hearing or visual deficits	45	49.5 %	79	56.0 %	0.35
I see a problem with the quality of the connection	42	46.2 %	75	53.2 %	0.35
I see a problem with the appropriate quality of equipment enabling teleconsultation	35	38.5 %	64	45.4 %	0.34
I see a problem in managing a patient in telemedicine without a first face-to-face meeting	38	41.8 %	77	54.6 %	0.06
I see a problem in the insufficient competences of medical personnel in the field of solutions for the use of telemedicine in everyday medical activities.	20	22.0 %	48	34.0 %	0.06
I see a problem in the insufficient competences of medical personnel in the use of digital solutions and modern technologies	23	25.3 %	40	28.4 %	0.65
I see a problem with verifying the patient's identity and securing his data	31	34.1 %	62	44.0 %	0.17
I see a problem in the lack of interest in the use of telemedicine by staff	22	24.2 %	27	19.1 %	0.41
I see a problem in the lack of interest in using telemedicine by patients	21	23.1 %	31	22.0 %	0.87
I see a problem in the high costs of using telemedicine	11	12.1 %	20	14.2 %	0.70
I see other problems	4	4.4%	6	4.3%	1.00

Bolded values indicate statistically significant differences ($p < 0.05$).

Table 5. Evaluation of the reliability of the "Expectations of telemedicine" scale items (ET-14).

Item	*M**	*SD**	*r**	α*
1. Permanent integration of telemedicine can have a positive impact on the use of limited healthcare staff resources.	45.0	11.5	0.734	0.956
2. The use of telemedicine will increase staff job satisfaction	45.1	11.5	0.799	0.954
3. The use of telemedicine will reduce staff working time	44.9	11.6	0.746	0.956
4. The use of telemedicine will enable flexible working hours	44.8	11.6	0.777	0.955
5. The use of telemedicine will have a positive impact on the quality of patient care	45.3	11.6	0.737	0.956
6. The use of telemedicine will facilitate access to specialist consultations	44.9	11.5	0.835	0.953
7. The use of telemedicine will increase access to care, especially for patients with chronic diseases	44.9	11.5	0.820	0.954
8. The use of telemedicine will enable quick access to specialists and health experts, which can speed up the diagnostic and treatment process, improving the overall effectiveness of treatment	45.0	11.5	0.823	0.954
9. The use of telemedicine will enable continuous monitoring of the patient's health using special devices and applications, allowing for a quick response to any changes	44.9	11.6	0.793	0.954
10. The use of telemedicine will reduce the number of hospitalizations due to exacerbations of disease states	45.4	11.7	0.692	0.957
11. The use of telemedicine will allow for the utilization of additional survey tools supplementing the patient assessment	44.9	11.6	0.788	0.955
12. The use of telemedicine will facilitate the establishment of a therapeutic relationship with the patient	45.2	11.6	0.727	0.956
13. The use of telemedicine will facilitate access to patients' medical and laboratory data	44.8	11.6	0.771	0.955

14. The use of telemedicine will increase patient engagement in health management and self-care	45.2	11.6	0.747	0.955
Mean = 48.5 score; *SD* = 12.5 score; *N* = 237; Cronbach's Alpha = 0.958 [0.945, 0.968]; *r* = 0.626				

M* – total score of the ET-14 scale after removing the specific item; SD* – standard deviation of the ET-14 score after removing the specific item; r* – Correlation between individual items on the scale and the total score (excluding the specific item); α* – Cronbach's alpha value if the specific item were removed from the scale.

Table 6. Evaluation of the reliability of the Benefits and Requirements of Telemedicine Scale items (BRT-10).

Items	***M****	***SD****	***r****	□*
1. It is especially useful for patients who prefer treatment at home, eliminating the need to visit an outpatient medical center.	33.4	8.1	0.726	0.953
2. For patients living in rural or remote areas, it helps to eliminate geographical barriers	33.3	8.2	0.724	0.953
3. Requires prior provision of technical support and access to educational materials for staff and patients	33.1	8.1	0.801	0.949
4. Requires the development of an educational campaign to assess and promote the potential benefits	33.2	8.1	0.844	0.948
5. Requires the launch of a pilot program monitoring selected patient groups	33.3	8.2	0.791	0.950
6. Requires analysis of monitoring data to assess effectiveness and potential program optimization	33.2	8.2	0.830	0.948
7. The need to implement a remote monitoring system, a consultation application and a platform for sharing research results	33.2	8.1	0.838	0.948
8. Requires integration of telemedicine systems with existing IT systems in a medical facility	33.2	8.0	0.873	0.946

9. The need for surveys to identify the needs and expectations of patients regarding this form of care	33.4	8.1	0.812	0.949
10. The need for surveys to identify the needs and expectations of staff regarding this form of care	33.3	8.1	0.784	0.950

Mean = 36.9 score; *SD* = 9.0 score; *N* = 237; Cronbach's Alpha = 0.955 [0.935, 0.967]; *r* = 0.686

M* – total score of the BRT-10 scale after removing the specific item; SD* – standard deviation of the BRT-10 score after removing the specific item; r* – Correlation between individual items on the scale and the total score (excluding the specific item); α* – Cronbach's alpha value if the specific item were removed from the scale.

Table 7. Number (percentage) of responses to survey questions about respondents' opinions on barriers to working with telemedicine tools.

In your opinion, what are the barriers that make it difficult to work with telemedicine tools? Please select all appropriate answers	***N***	**%**
I see a problem with the lack of possibility to conduct a physical examination	175	73.8%
I see a problem with communication due to the patient's hearing or visual deficits	125	52.7%
I see a problem with the quality of the connection	120	50.6%
I see a problem with the appropriate quality of equipment enabling teleconsultation	99	41.7%
I see a problem in managing a patient in telemedicine without a first face-to-face meeting	116	48.9%
I see a problem in the insufficient competences of medical personnel in the field of solutions for the use of telemedicine in everyday medical activities.	68	28.7%

I see a problem in the insufficient competences of medical personnel in the use of digital solutions and modern technologies	63	26.6%
I see a problem with verifying the patient's identity and securing his data	95	40.1%
I see a problem in the lack of interest in the use of telemedicine by staff	49	20.7%
I see a problem in the lack of interest in using telemedicine by patients	52	21.9%
I see a problem in the high costs of using telemedicine	31	13.1%
I see other problems	10	4.2%

Figure Legends

Figure 1. Comparison of time spent daily on the Internet in groups of respondents differing in their declared experience with telemedicine and provision of telemedicine services and the results of the significance test.

Figure 2. Positional statistics of the assessment of the level of expectations towards telemedicine on the ET-14 scale in subgroups of

respondents differing in their profession and the result of the significance test.

Figure 3. Positional statistics of the frequency of responses to 14 statements regarding expectations towards telemedicine among respondents with and without experience in using telemedicine and results of the Friedman significance test.

Figure 4. Position statistics of the assessment of the level of expectations towards telemedicine on the ET-14 scale in subgroups of respondents differing in the frequency of providing telemedicine services and the results of the significance test.

Figure 5. Expectations towards telemedicine in groups of medical workers with different specializations and the result of the Kruskal-Wallis significance test and post hoc tests (Dunn's test).

Figure 6. Position statistics of the assessment of the usefulness of telemedicine on the BRT-10 scale in subgroups of respondents differing in profession (left) and specialization (right) and the results of the significance test.

Figure 7. Positional statistics of telemedicine usefulness ratings on the BRT-10 scale in subgroups of respondents differing in the frequency of providing telemedicine services and the results of the significance test.

Figure 8. Opinions of employees differing in the provision of telemedicine services on statements regarding the usefulness of telemedicine for patients preferring treatment at home and patients excluded from communication and results of the significance test.

Figure 9. Scatter plot of expectations towards telemedicine (ET-14) with the assessments of benefits and requirements related to daily clinical practice (BRT-10), Spearman's rank correlation coefficient (rho) value and linear regression equation.