

## Article

# Application of telehealth in prenatal care during the COVID-19 pandemic - a cross-sectional survey of Polish women.

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**Abstract:** To reduce the risk of infection of SARS-CoV-2 during the commute to the clinic or due to the contact with medical staff, The American College of Obstetricians and Gynecologists recommended arranging part of the appointments in the form of “telehealth”. The aim of the study was to assess the access to medical care in pregnancy during the Sars-Cov-2 pandemic and the role of telehealth in implementation of prenatal care standards. This is a cross-sectional study. The study group included 618 women that were pregnant and or gave birth during the COVID-19 pandemic in Poland. The majority of participants experienced difficulties in access to medical care because of the pandemic. Correlation between this experience and the use of hybrid healthcare model was established. However, affiliation to public or private healthcare group was irrelevant. There was no relationship between healthcare (private/public or in-person/hybrid) and implementation of the prenatal care standards. To ensure safe access to prenatal care for pregnant women, recommendations for a hybrid pregnancy management model should be created with detailed information for which appointments patients must be present and which can be done remotely. To reduce movement risk and interpersonal contact, all visits during which tests and screenings take place should be done in-person. Other appointments can be arranged in the form of telehealth.

**Keywords:** SARS-CoV-2; COVID-19; Prenatal Care; Standard of Care; Telemedicine; Cross-Sectional Studies; Poland

## 1. Introduction

The Severe Acute Respiratory Syndrome–Novel Coronavirus-2 (SARS-CoV-2) was first identified in December 2019 in the city of Wuhan in China. The virus quickly started to spread all over the world. [1] On January 24<sup>th</sup>, 2020, the first case in Europe was diagnosed, and on March 4<sup>th</sup>, 2020, in Poland. On January 30<sup>th</sup>, 2020, World Health Organization (WHO) classified COVID-19 as a threat to public health. On March 11<sup>th</sup>, 2020, a world pandemic was declared. [2] The most commonly reported symptoms are cough, dyspnoea, and fever. It was not proven that infection increases the risk of antenatal complications. [3] The risk of vertical infection, fetal growth restriction, miscarriage, and preterm birth is still widely debated. The latest systematic review of pregnancy outcomes provides more insight into the risk of transmitting the infection from mother to child. [4]

Countries worldwide initiated procedures to prevent the spread of the virus and the development of severe disease. Due to the lack of treatment regimen and data re-

garding long-term complications of the disease, planned hospital admissions and doctor appointments were curtailed. In a challenging position were pregnant women, who had to follow a strict management plan of scheduled visits with their obstetrician or midwife during the pregnancy. To reduce the risk of infection during the commute to the clinic or due to the contact with medical staff, The American College of Obstetricians and Gynecologists (ACOG) recommended arranging part of the appointments in the form of "telehealth".[5] This term is defined as delivering remote medical services by healthcare providers using technology to communicate with patients to diagnose, treat and educate them on topics regarding their health. [6] Appointments are most often conducted by video chat, but they can also be conducted by phone when there is no access to a camera. Additionally, portable devices such as sphygmomanometers, glucometers, pulse oximeters, and mobile CTG devices are implemented to monitor patient wellbeing. [7]

In Poland, during pregnancy, patients have medical appointments scheduled every four weeks and after 34 weeks of gestation every two weeks. [8] An essential part of antenatal care is ultrasound screening in the first, second, and third trimesters. First-trimester screening is done between 11 and 13+6 weeks of gestation and consists of gestational sac evaluation and the risk assessment of chromosomal abnormalities. Second-trimester screening is done between 18 and 22 weeks of gestation and is a detailed anatomy scan to screen for congenital anomalies. The aim of the third-trimester ultrasound between 28 and 32 weeks of gestation is to assess fetal growth and rescan for congenital anomalies. According to The Polish Society of Gynecologists and Obstetricians' recommendations, the critical aspect of antenatal care is to perform ultrasound screenings within the recommended timeframe. [9] The authors emphasize the importance of these ultrasound screenings. WHO ANC Model from 2016 recommends eight medical visits during pregnancy [9,10]. The number of prenatal appointments can vary depending on the condition of both mother and her child.

The aim of the study was to assess the access to medical care in pregnancy during the Sars-Cov-2 pandemic and the role of telehealth in implementation of prenatal care standards.

## 2. Materials and methods

### *Study design*

This is a cross-sectional study. The study group included women that were pregnant and or gave birth during the COVID-19 pandemic in Poland. It is a convenience sample, meaning that every woman who got information about this study and consented to participate could participate in it. At the beginning of the questionnaire, participants were informed about the aim of the study, the time needed to complete the survey, ways in which gathered data would be used, and the fact that completing the survey is equivalent to giving consent for participation. The questionnaire was anonymous, and no information that could identify the respondents was collected. Because of the anonymity of the questionnaire, it was impossible to withdraw submitted answers.

The survey was prepared by specialists in the field of obstetrics, gynecology, and perinatology. It was divided into five parts:

- questions about demography, chronic diseases, access to medical care during the pandemic, exposure to COVID-19 infection
- questions about the course of pregnancy, screening tests, ultrasounds, and antenatal medical appointments with their obstetrician
- questions about laboratory tests performed during pregnancy
- questions about parturition and child's condition
- questions about mental state and potential miscarriage

After conducting a pilot study on a group of women, experts assessed the relevance of this questionnaire, notes from participants, and proposed their questions. The final survey consisted of 98 questions in Polish.

Study data were collected and managed using REDCap electronic data capture tools hosted at The Foundation of St. Sophia's Specialist Hospital. REDCap (Research Elec-

tronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies, including questionnaire surveys. [11,12] It was an open survey, available to every internet user with no need for registration and logging in. Link to the survey was shared on social media, particularly on groups dedicated to pregnancy and on prenatalproject.org and szpitalzelazna.pl websites. The survey was voluntary, and participants did not receive any reward or "presents" for completing the questionnaire. Data were collected from August 5, 2020 to October 29, 2020.

The questionnaire was divided into five viewscreens by topics of the questions. Every question was mandatory (where it was justified the answer "not applicable" or "rather not say" was available). The completeness and correctness of the responses were checked each time before proceeding to the next viewscreen. In case of incompleteness or incorrectness of the questionnaire, the website displayed the message asking to correct the responses. Participants were able to go back to previous viewscreens to check and change their answers.

The website was displayed 9119 times by internet users. 1351 people participated in the study and completed screening questions. The recruitment rate was 15%. 1312 participants entirely completed the questionnaire, and the completeness rate was 97%.

#### *Reporting, ethics, and dissemination*

The STROBE and Cherries guidelines were used to ensure proper reporting of this cross-sectional web-based survey. [13,14] The study was conducted according to the criteria set by the declaration of Helsinki. Surveys as noninterventional studies do not require assessment by a bioethics committee according to Polish research law. The respondents were informed that the survey is anonymous. The survey consisted of an information letter and a statement that, by filling out and returning the survey, the participant gives their informed consent.

#### *Risk of bias*

Questionnaire survey shared online is at risk of bias, including selection bias, non-response bias, response bias, recall bias, and attentional bias. Conducted statistical analysis can be impaired by omitted-variable bias.

#### *Study Group*

The web-based survey yielded 1312 individual responses. Respondents that were not pregnant during the pandemic of COVID-19 (n=425) were excluded from the study. After accessing the histograms looking for outliers, only participants between 18 and 40 were included in the study. Additionally, the following inclusion criteria were defined: declaration of being pregnant or giving birth during COVID-19 pandemic, filling the questionnaire in Polish, and answering all mandatory questions. Excluding criteria were the age below 18 or above 40 and lack of pregnancy and/or birth during the COVID-19 pandemic. In the end, the quantity of the study group was 618 patients. Characteristic of the study group was presented in Table 1. The respondents declared their state of residence depending on number of inhabitants (32% > 500,000, 40% 100,00-500,000, 28% < 10,000). Patients were divided into groups by the type of visits they had during their pregnancy. The first group (n=293) had in-person visits and at least one telehealth visit during pregnancy, while the second group (n=325) had only in-person appointments. Patients were also divided by declared access to private (n=477) or public (n=141) healthcare.

Tab.1 Characteristic of the study group.

Variable	Yes	% yes	No	% no
Birth during COVID-19 pandemic.	246	39,8%	372	60,2%
Experiencing difficulties in access to medical care because of pandemic.	452	73,14%	166	26,87%
Changing obstetrician because of pandemic.	74	11,97%	544	88,03%
Having a telehealth prenatal appointment during pandemic.	293	47,41%	325	52,59%

Being tested for COVID-19 during pregnancy.	63	10,19%	555	89,81%
Being quarantined during COVID-19 pandemic.	17	2,75%	601	97,25%
Primiparity	351	56,8%	267	43,21%
Ultrasound before 10 weeks of gestation.	578	93,53%	40	6,48%
Ultrasound screening between 11 and 13+6 weeks of gestation.	603	97,57%	15	2,43%
Combined screening test	364	58,9%	254	41,11%
Ultrasound screening between 18 and 22 weeks of gestation.	555	89,8%	63	10,2%
Fasting glucose test.	574	92,88%	44	7,12%
Oral glucose tolerance test	470	76,05%	148	23,95%
Ultrasound screening between 28 and 32 weeks of gestation.	420	67,96%	198	32,04%
Diagnosed Gestational diabetes mellitus (GDM).	99	16,02%	519	83,99%
Diagnosed anemia during pregnancy.	105	16,99%	513	83,01%
Access to private healthcare.	477	77,18%	141	22,82%

In the next stage of the study, it was determined which patients have had the prenatal care standard implemented, e.g., had all tests and screenings recommended in Poland for their gestational age. In this step, all patients who did not finish the first trimester were excluded from the study, for it was not possible to assess whether the standard was implemented completely in such early pregnancies. Eventually, the implementation of prenatal care standard was evaluated in 550 women (n=550). Realization of the prenatal care standard was compared between the hybrid and in-person healthcare groups and then between private and public healthcare groups using the chi-squared test.

Statistical Package for Social Sciences (SPSS) for Mac, version 27.0.0.0 program was used to analyse statistical data. The Kolmogorov–Smirnov test was used to evaluate the distribution of variables. Quantitative variables were treated as medians. To compare quantitative variables Mann–Whitney test was used. To compare logical variables Chi-squared test was used. The statistical significance level was defined at  $\alpha < 0.05$ .

### 3. Results

The majority of participants experienced difficulties in access to medical care because of the pandemic. Correlation between this experience and the use of hybrid healthcare model was established. However, affiliation to public or private healthcare group was irrelevant. There was no relationship between healthcare (private/public or in-person/hybrid) and implementation of the prenatal care standards.

A Mann–Whitney test showed that women who had access to private medical care were older (Mdn=30) in comparison to women in public healthcare (Mdn=29),  $U=28.14$ ,  $p=.003$ . Quantitative variables comparison showed no statistically significant differences between in-person healthcare group and hybrid healthcare group.

The Chi-squared test was conducted to check the hypothesis that healthcare (in-person or hybrid) is linked with sufficient access to tests and screening procedures during pregnancy. In the access to the combined screening test, there was a statistically significant difference between study groups  $\chi^2(1, N=618) = 4.83$ ,  $p=.017$  Cramer's  $V=.09$ . Patients who only had in-person visits less often had OGTT than those who had at least one remote appointment  $\chi^2(1, N=618) = 3.68$ ,  $p=.034$ , Cramer's  $V=.07$ . A significant difference between study groups was also found regarding ultrasound screening between 28 and 32 weeks of gestation  $\chi^2(1, N=618) = 7.51$ ,  $p=.004$ , Cramer's  $V=.11$  as well as regarding experiencing difficulties in access to prenatal care because of pandemic of COVID-19  $\chi^2(1, N=618) = 29.14$ ,  $p<.001$ , Cramer's  $V=.22$ . Detailed information can be found in Table 2.

Table 2. Comparison of logical variables between in-person and hybrid healthcare groups.

	Group of hybrid healthcare	Group of in-person healthcare	
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Variable	Yes	%yes	No	%no	Yes	%yes	No	%no	df	Chi-squared	p-value
Experiencing difficulties in access to medical care because of pandemic.	244	83.28%	49	16.72%	208	64%	117	36%	1	29.14	<.001
Primogeniture	126	43%	167	57%	225	69.23%	100	30.77%	1	43.19	<.001
Diagnosed Gestational diabetes mellitus (GDM).	55	18.77%	238	81.23%	44	13.54%	281	86.46%	1	3.14	.077
Diagnosed hypothyroidism during pregnancy.	86	29.35%	207	70.64%	71	21.85%	254	78.15%	1	4.58	.032
Diagnosed anemia during pregnancy.	52	17.75%	241	82.25%	53	16.31%	272	83.69%	1	0.23	.634
Ultrasound before 10 weeks of gestation.	276	94.2%	17	5.8%	302	92.92%	34	10.46%	1	0.414	.520
Ultrasound screening between 11 and 13+6 weeks of gestation.	285	97.27%	8	2.73%	318	97.85%	7	2.15%	1	0.22	.642
Double marker test.	186	64.48%	107	36.52%	178	54.77%	147	45.23%	1	4.83	.028
Ultrasound screening between 18 and 22 weeks of gestation.	269	91.81%	24	8.19%	286	88%	39	12%	1	2.44	.118
Fasting glucose test.	273	93.17%	20	6.82%	301	92.61%	24	7.38%	1	0.07	.787
OGTT	233	79.52%	60	20.48%	237	72.92%	88	27.08%	1	3.68	.055
Ultrasound screening between 28 and 32 weeks of gestation.	215	73.38%	78	26.62%	205	63.08%	120	36.92%	1	7.51	.006

A chi-squared test was conducted to assess the relationship between being in a private or public healthcare group and access to tests and screenings during pregnancy. Significant statistical difference was found between the groups regarding access to fasting glucose test  $\chi^2(1, N=618) = 8.807$ ,  $p=.003$ , Cramer's  $V=.12$ , oral glucose tolerance test (OGTT)  $\chi^2(1, N=618) = 5.28$ ,  $p=.022$  Cramer's  $V=.09$ , and ultrasound screening between 28 and 32 weeks of gestation  $\chi^2(1, N=618)=9.28$ ,  $p=.002$ , Cramer's  $V=.12$ . Detailed information can be found in Table 3.

Table 3. Comparison of logical variables between private and public healthcare groups.

Variable	Private health group				Public health group				df	Chi-squared	p-value
	Yes	%yes	No	%no	Yes	%yes	No	%no			
Experiencing difficulties in access to medical care because of pandemic.	344	72.12%	133	27.28%	108	76.6%	33	23.4%	1	1.11	.172
Diagnosed gestational diabetes mellitus (GDM).	79	16.56%	398	83.44%	20	14.18%	121	85.82%	1	0.46	.297
Diagnosed anemia during pregnancy.	79	16.56%	398	83.44%	26	18.44%	115	81.56%	1	0.27	.342
Ultrasound before 10 weeks of gestation.	450	94.34%	27	5.66%	128	90.78%	13	9.22%	1	2.28	.097
Ultrasound screening	467	97.9%	10	2.1%	136	96.45%	5	3.54%	1	0.97	.242

between 11 and 13+6 weeks of gestation.											
Double marker test.	289	60.59%	188	33.41%	75	53.19%	66	46.81%	1	2.46	.117
Ultrasound screening between 18 and 22 weeks of gestation.	432	90.57%	45	9.43%	123	87.23%	18	12.77%	1	1.32	.251
Fasting glucose test.	451	94.55%	26	5.45%	123	87.23%	18	12.77%	1	8.81	.003
OGTT	373	78.2%	104	21.8%	97	68.79%	44	31.21%	1	5.28	.022
Ultrasound screening between 28 and 32 weeks of gestation.	339	71.07%	138	28.93%	81	57.45%	60	42.55%	1	9.28	.002

A chi-squared test was conducted to assess the relationship between the type of healthcare and implementation of the prenatal care standards, i.e., all tests and screenings recommended for gestational age. No statistically significant difference was found between in-person and hybrid healthcare groups,  $\chi^2(1, N=550) = 0.103$ ,  $p=.748$ , Cramer's  $V=.01$ . Detailed information can be found in Table 4 [Tab.4]. In private and public healthcare groups, there was no statistically significant difference,  $\chi^2(1, N=550) = 0.272$ ,  $p=.342$ , Cramer's  $V=.064$ . Detailed information regarding these groups can be found in Table 5.

Table 4. Characteristics of prenatal care standard implementation in hybrid and in-person healthcare groups.

		Hybrid healthcare		In-person healthcare		In total	
		N	%	N	%	N	%
Completely implemented standard	no	127	50.2%	145	48.8%	272	49.5%
	yes	126	49.8%	152	51.2%	278	50.5%
In total		253	100%	297	100%	550	100%

Table 5. Characteristics of prenatal care standard implementation in public and private healthcare groups.

		Public healthcare		Private healthcare		In total	
		N	%	N	%	N	%
Completely implemented standard	no	62	55.9%	210	47.8%	272	49.5%
	yes	49	44.1%	229	52.2%	278	50.5%
In total		111	100%	439	100%	550	100%

A chi-squared test was conducted to assess the relationship between the use of public or private healthcare and hybrid or in-person pregnancy management type. There was no statistically significant difference found,  $\chi^2(1, N=618) = 0.126$ ,  $p=.398$ .

#### 4. Discussion

Before the pandemic, telehealth was not routinely used in pregnancy management. Only one paper can be found in literature about the use of telehealthcare in obstetrics before 2020. Karwowski et al. showed that in Poland most patients sought telehealth medical help in case of threatened abortion or premature birth. [15] Our research demonstrated that 47.41% of women had at least one telehealth appointment during pregnancy. This number is higher compared to research done by Madden et al., where the percentage of telehealth appointments in New York during the COVID-19 pandemic was 31.8%. [16] In ASPE (The Assistant Secretary for Planning and Evaluation) report, an increase in the use of telehealth in the biggest cities in the United States was from 0.1% in February 2020 to 43.5% in April 2020. [15,17]

Telehealth was used to a similar extent in public (46.01%) and private healthcare (48%) in this study. In comparison, in Australia in 2014, 68% of healthcare providers that

offered telehealth services were a part of the public healthcare system. [18] In a meta-analysis by Xie et al., it was proven that patients using telehealth controlled their blood glucose levels better and had a lower risk of maternal and fetal complications than the in-person group. [19]

According to the Royal College of Obstetricians & Gynaecologists' recommendations, it is better to do a HbA1c test instead of OGTT during the pandemic restrictions. [20] A meta-analysis showed that women who had telehealth medical appointments had lower glycosylated hemoglobin levels than those who had only in-person visits. [21,22] According to The Polish Diabetes Society's guidelines, gestational diabetes mellitus (GDM) is diagnosed with fasting glucose test and OGTT. [23] Our research showed a statistically significant difference in access to those tests in private and public healthcare groups. Siru et al. proved that doing only fasting glucose test without following OGTT can result in more undiagnosed cases of gestational diabetes (GDM). [23]

Our research showed that primigravidae more often attended in-person than hybrid prenatal appointments. These results contradict those obtained by Du et al., according to whom primigravidae prefer telehealth visits. It is possible that our participants chose the in-person model because of the fear of prenatal complications. [24]

Only 49.45% of participants had prenatal healthcare standards implemented completely regardless of their affiliation to in-person or hybrid healthcare model groups or use of private or public medical care. Interestingly, a relationship has been found between being in a hybrid healthcare model group and experiencing difficulties in access to medical care because of the pandemic, even though prenatal healthcare standard implementation in both groups was similar. It was shown that 73.14% of women experienced difficulties in access to medical care during the COVID-19 pandemic. In comparison, in survey research by Ceulemans et al., 61.8% of women received less medical help from their obstetrician than before the COVID-19 pandemic. [25]

Another interesting finding is that patients using private healthcare more often had fasting glucose test, OGTT, and ultrasound screening between 28 and 32 weeks of gestation than those using public healthcare. It is probably related to the fact that patients cancelled their appointments in medical facilities because they feared SARS-CoV-2 infection. Justmana et al. reported a lower number of admissions to obstetrics wards and ultrasound screenings in March-April 2020, comparing to the same period in the preceding year. [26] Another analysis showed that almost half of participants considered cancellation of their prenatal appointments in the hospital due to the pandemic. At the same time, 20% of patients experienced anxiety associated with any visit in a medical facility. [27] Because of movement restrictions due to the pandemic, it seems beneficial to create a recommendation for a hybrid healthcare model. Appointments during which patients have tests and screenings should be done in-person, while follow-up visits can be done via telehealth. This model allows us to lower the risk of COVID-19 infection while maintaining a high prenatal care standard. In this context hybrid prenatal care model seems more beneficial than the traditional in-person care model.

### Conclusions:

We are currently experiencing a third wave of the pandemic. To ensure safe access to prenatal care for pregnant women, recommendations for a hybrid pregnancy management model should be created with detailed information for which appointments patients must be present and which can be done remotely. To reduce movement risk and interpersonal contact, all visits during which tests and screenings take place should be done in-person. Other appointments can be arranged in the form of telehealth.

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**Informed Consent Statement:** The respondents were informed that the survey is anonymous. The survey consisted of an information letter and a statement that, by filling out and returning the survey, the participant gives their informed consent.

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