

Prevalence of pregnancy complications in the Świętokrzyskie province: a follow-up of a cohort of patients participating in first-trimester prenatal screening tests

Prewalencja powikłań ciąży w województwie świętokrzyskim: follow-up kohorty pacjentek w pierwszym trymestrze ciąży uczestniczących w badaniach prenatalnych

Grzegorz Świercz^{1,2}, Anna Zmelonek-Znamirowska^{1,2}, Justyna Armańska², Marta Stanisławska², Marta Młodawska¹, Jakub Młodawski^{1,2} 

¹Collegium Medicum, Jan Kochanowski University, Kielce, Poland

²Department of Obstetrics and Gynecology, Voivodeship Hospital Complex, Kielce, Poland

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Key words: epidemiology, prevalence, pregnancy complication.

Słowa kluczowe: epidemiologia, prewalencja, powikłania ciąży.

Abstract

Introduction: This study addresses the scarcity of detailed epidemiological data in Poland and presents an rate of pregnancy complications in the Świętokrzyskie province. A follow-up on patients who underwent first-trimester prenatal screening at the Prenatal Testing Clinic of the Voivodeship Hospital Complex in Kielce was conducted, providing valuable regional data. **Aim of the research:** The aim of the study was to record the prevalence of selected pregnancy complications in the Świętokrzyskie province, utilizing a retrospective study of medical records.

Material and methods: The study encompassed 1212 patients who underwent first-trimester prenatal screening tests in 2018–2019. These patients subsequently gave birth at the Department of Obstetrics and Gynecology of the Voivodeship Hospital Complex in Kielce. The study involved compiling data on various pregnancy complications such as fetal growth restriction, gestational diabetes, arterial hypertension, and more.

Results: Among pregnancy complications, fetal growth restriction (FGR) occurred in 2.20% of cases, with 34.60% diagnosed before 32 weeks and 65.40% after. Gestational diabetes was noted in 14.80% of pregnancies, with 51.40% managed with diet and 46.90% with insulin. Arterial hypertension affected 7.60%, including pregnancy-induced hypertension (61.80%) and chronic hypertension (14.50%). Preeclampsia was observed in 1.40% of cases. Preterm prelabor rupture of membranes (PPROM) occurred in 3.60%, while cervical insufficiency requiring cerclage was seen in 1.65%. Placenta-related complications included placenta previa (0.41%) and placenta accreta spectrum (0.21%).

Conclusions: The study provided essential insights into the prevalence of pregnancy complications in the Świętokrzyskie province, revealing that rates are generally in line with global trends. It underscores the need for continued research and monitoring of these trends to optimize health outcomes.

Streszczenie

Wprowadzenie: Niniejsze badanie odnosi się do braku szczegółowych danych epidemiologicznych dotyczących powikłań ciąży w Polsce i prezentuje odsetek komplikacji ciążowych w województwie świętokrzyskim. Przeprowadzono *follow-up* wśród pacjentek, które przeszły badanie prenatalne w pierwszym trymestrze ciąży w Poradni Badań Prenatalnych Wojewódzkiego Szpitala Zespołowego w Kielcach, dostarczając cennych danych regionalnych.

Cel pracy: Zarejestrowanie częstości występowania wybranych powikłań ciążowych w województwie świętokrzyskim przy wykorzystaniu retrospektywnego badania opartego na dokumentacji medycznej.

Materiał i metody: Badaniem objęto 1212 pacjentek, które przeszły badania prenatalne w pierwszym trymestrze ciąży w latach 2018–2019. Pacjentki te następnie rodziły w Klinice Położnictwa i Ginekologii Wojewódzkiego Szpitala Zespołowego w Kielcach. Ocena polegała na kompilacji danych na temat różnych powikłań ciążowych, takich jak ograniczenie wzrostu płodu, cukrzyca ciążowa, nadciśnienie tętnicze.

Wyniki: Wśród powikłań ciąży ograniczenie wzrastania płodu (FGR) wystąpiło w 2,20% przypadków, z czego 34,60% rozpoznano przed 32. tygodniem, a 65,40% po 32. tygodniu. Cukrzyca ciążowa dotyczyła 14,80% ciąż, z czego 51,40% leczono dietą, a 46,90% insuliną. Nadciśnienie tętnicze wystąpiło u 7,60% pacjentek, w tym nadciśnienie indukowane ciążą (61,80%) oraz nadciśnienie przewlekłe (14,50%). Stan przedrzucawkowy zaobserwowano w 1,40% przypadków. Przedwczesne pęknięcie błon płodowych (PPROM) stwierdzono w 3,60% przypadków, a niewydolność szyjki macicy wymagająca założenia szwu w 1,65%. Powikłania związane z łożyskiem obejmowały przodujące łożysko (0,41%) i spektrum przyrośnięcia łożyska (0,21%).

Wnioski: Badanie dostarczyło istotnych informacji na temat częstości występowania powikłań ciążowych w województwie świętokrzyskim, pokazując, że wskaźniki generalnie są zgodne z trendami globalnymi. Podkreśla to potrzebę kontynuowania badań i monitorowania tych trendów w celu optymalizacji wyników zdrowotnych.

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Introduction

Epidemiological studies on disease prevalence are a fundamental measurement in medicine. Prevalence, as defined by the “Oxford Dictionary of Epidemiology”, is “the total number of individuals who have a condition (e.g., disease, exposure, characteristic) at a specific time (or within a specified period) divided by the population at risk of having the condition” [1]. In Poland, in most disease instances, prevalence is not known because, epidemiological statistics are not kept, with a few exceptions. For literature concerning disease occurrence frequency, we often refer to foreign literature, extrapolating to Polish conditions. This issue arises from the lack of reliable registries from which we can gain knowledge. The problem of the absence of reliable data is beginning to become noticeable in certain branches of medicine, and initiatives like the Integrated Platform of Oncology Registries/e-KRN+ integrated information platform and the Polish National Cancer Registry [2], which collects data on oncological patients, are emerging. More detailed epidemiological data can also be found when studies are conducted as part of the preventive programs of the National Health Fund and publications of the Central Statistical Office (GUS). However, this is only an excerpt of the statistics that are needed to systematically respond to diseases in society.

Material and methods

Sample selection

In our study, we have decided to conduct a follow-up on the course of pregnancy in patients who underwent first-trimester prenatal screening (ultrasound examination along with determination of pregnancy associated plasma protein A (PAPP-A) and free betaHCG subunit (fbHCG)) at the Prenatal Testing Clinic of the Voivodeship Hospital Complex in Kielce (a center that manages about a third of all births in the Świętokrzyskie province).

The minimum sample size (n') was calculated using the following formula: n' (with finite population correction) = $[z^2 \times p \times (1 - p)/e^2] / [1 + (z^2 \times p \times (1 - p)/(e^2 \times N))]$ [3].

In the above formula, we adopted the following values:

- N – representing the finite population size, was set at 10,000, corresponding to the annual number of births in the Świętokrzyskie province in 2019 according to the GUS statistical yearbook [4].
- e (margin of error) was set at 3%.
- Z – the z -score for a given confidence level was set at 1.96, corresponding to a 95% confidence level.
- p represents the proportion of the population that has the characteristic of interest. Given that we were determining a range of different complications, we used $p = 0$, because this value maximizes the product of the equation. This value leads to the largest sample size estimate and provides the most conservative result.

Given that we were determining a range of different complications, we used $p = 0.5$ because this value maximizes n .

The minimum sample size obtained from the equation was 965 women. By rounding the time window to 2 years, we included all patients who underwent prenatal screening in 2018–2019. We believe the group under study represents a representative sample of women from our region. All patients included in the study also gave birth at our center, which allowed for follow-up throughout the entire pregnancy. This was a retrospective study of medical records. We recorded the incidence of selected complications during pregnancy in the included cohort.

Results

The study included 1212 patients who underwent first-trimester prenatal screening and subsequently gave birth at the Department of Obstetrics and Gynecology of the Voivodeship Hospital Complex in Kielce in 2018–2019. The characteristics of the group are presented in Table 1.

The percentage of individual complications, the number of cases, and the percentage in specific subgroups are presented in Table 2.

Discussion

Epidemiological data in medicine are essential for many reasons. From an individual doctor's perspective, they assist in initial diagnostics. By knowing the prevalence of a particular disease entity, in cases of differential diagnosis, we can estimate the probability of a particular diagnosis and guide the diagnostics. From a payer's perspective in healthcare, knowing the prevalence allows for directing resources and personnel where they are most needed, setting costs of reimbursement of pharmaceuticals for a particular disease entity, and assessing the population effects of interventions. In infectious disease cases, epidemiological data inform us about hygiene levels in the population and the degradation of the natural environment. In Poland, data

Table 1. Demographic characteristics of the group

Parameter	Value
Age (mean)	30.2 years (SD = 4.3)
Height (mean)	165 cm (SD = 13.33)
Weight (mean)	66 kg (SD = 7.88)
BMI (mean)	24.82 kg/m ² (SD = 17.13)
IVF pregnancy	4.1% ($n = 50$)
1 st pregnancy	36.1% ($n = 438$)
White race	100% ($n = 1212$)

Table 2. Prevalence of specific complications in the studied cohort

Complication of pregnancy	Percentage	N
Fetal growth restriction	2.20	27
< 32 weeks of pregnancy	0.74 (34.60% of FGR cases)	9
≥ 32 weeks of pregnancy	1.49 (65.40)	18
Cervical insufficiency (as an indication for cervical cerclage)	1.65	20
Pregestational diabetes	1.15	14
Gestational diabetes	14.80	179
Managed with diet	7.5 (51.40 among patients with gestational diabetes)	92
Managed with insulin	6.93 (46.90 among patients with gestational diabetes)	84
Arterial hypertension	7.60	76
Pregnancy-induced hypertension (PIH)	3.8 (61.80 among patients with arterial hypertension)	47
Chronic hypertension	0.9 (14.50)	11
Preeclampsia <i>de novo</i>	0.6 (10.50)	8
Preeclampsia superimposed on chronic hypertension	0.8 (13.15)	10
Preterm prelabor rupture of membranes (PPROM)	3.60	44
T. gondii infection during pregnancy	0.82	10
Exposure to chickenpox (administration of anti-VZV immunoglobulin)	0.03	4
Placenta previa	0.41	6
Placenta accreta spectrum	0.21	3

regarding the prevalence of diseases during pregnancy are significantly limited. Diseases occurring during pregnancy are not subject to mandatory reporting, nor are there registries collecting data on the frequency of these diseases. Therefore, epidemiological data are often limited to segments of the population.

In obstetrics, prevalence studies are particularly important in the context of a modern approach to pregnancy and its complications, which largely relies on risk assessment and modeling to stratify patients into groups with varying baseline risk levels of a given complication. Such a procedure can currently be used in predictive models estimating the risk of non-hereditary chromosomal aberrations, preeclampsia, intrauterine growth restriction, preterm birth, intrauterine fetal demise, and others [5–8]. In such models, predictive value largely depends on the frequency of the disease occurrence. Prevalence data are used in modeling as training data.

Knowledge of prevalence is also essential for assessing the population effectiveness of interventions aimed at treating or preventing a disease or its complications (e.g., the use of acetylsalicylic acid in preeclampsia prevention). Extrapolation between geo-

graphical regions is often unreliable, even within the same race. This is particularly evident in situations where the disease has an environmental basis. In such situations, prevalence reflects environmental factors involved in the pathogenesis of diseases and their representation in a given population (such as age, BMI, etc.). In our study, we wanted to compare the occurrence of specific complications in our province's population with global data on the prevalence of certain disease entities in pregnancy. In Polish literature, when discussing a particular issue, there is often a lack of local epidemiological data, and the data regarding epidemiology are frequently taken from the global literature, where the studied populations may have different racial and ethnic compositions, which undoubtedly affects the obtained results. We hope that this study will help fill this gap by providing obstetricians and physicians of other specialties with reliable data on the prevalence of specific diseases. Knowing the baseline frequency of a given complication allows for increasing diagnostic accuracy by modifying pretest probability [9].

Global data indicate that the overall percentage of patients who develop preeclampsia in pregnancy

is 4.6% (95% uncertainty range: 2.7–8.2), while preeclampsia (PE) affects about 1.4% (95% uncertainty range: 1.0–2.0) [10]. The cited study concerns the analysis of databases from 2002–2010. Currently, the global trend in PE occurrence may be changing, all thanks to the results of the ASPRE study published in 2017 [11], which indicated a 62% reduction in the chance of PE occurring in a group of patients taking 150 mg of acetylsalicylic acid (ASA). In our cohort of patients, the total number of PE was 1.49%, so as in the cited study covering data from before the era of acetylsalicylic acid use. Preeclampsia has a multifactorial etiology, its occurrence largely depends on the presence of risk factors in the population. Some of them, such as antiphospholipid syndrome or type I diabetes, are non-modifiable. However, factors such as chronic hypertension, pre-pregnancy body mass index (BMI) > 30 kg/m² are largely dependent on habits and lifestyle in the population [12]. Meanwhile, the problem of obesity is growing in many European countries. According to WHO, the percentage of obese people has tripled since the early 1980s in Western European countries [13]. In Poland, in 2017–2018, the percentage of overweight people reached 33.2%, and of obese people 13.9%, and there are significant differences in the prevalence of overweight and obesity between European countries. Obesity is almost twice as rare in the Mediterranean region, with an obesity rate in Italy of 7.5% among adults [14]. On the one hand, therefore, we have effective prevention of preeclampsia, but on the other, the problem of obesity and later pregnancy is growing. We do not currently know how the impact of these two factors affects the overall calculation of PE occurrence in Poland. In the case of ASA use in PE prevention, it is also important to stratify patients from the high-risk group, who should use ASA. Currently, in our region, mainly for economic reasons, the model of including ASA based on risk factors predominates. The current prenatal screening program does not include biochemical and Doppler screening for PE.

Preeclampsia (PE) is invariably associated with the occurrence of intrauterine growth restriction (FGR), which can be one of the diagnostic criteria for PE [15]. In our cohort, the occurrence of this complication is rarer than WHO estimates covering global data from 2020. According to these data, 16.3% (50% credible interval (CrI) 14.9–18.9%) of term pregnancies are too small for gestational age (SGA), while 1.1% (50% CrI: 0.9–3.1%) of newborns worldwide are born prematurely with SGA simultaneously [16]. According to WHO, half of neonatal deaths worldwide are associated with low birth weight. Therefore, screening for this fetal complication is extremely important. The significant difference between our results and WHO statistics is due to the methodology of the studies. In the WHO analysis, only birth weight and gestational week (evaluation on the percentile grid) were taken into account,

while in our case we used the commonly accepted, perinatal definition of FGR as the co-occurrence of estimated fetal weight (EFW) or abdominal circumference (AC) below the 10th percentile for a given age and abnormal vascular flows. Constitutional growth deficiency (SGA) is a more common perinatal complication than FGR. Additionally, when assessing complications in our cohort, we took into account the prenatal diagnosis, not the final weight of the newborn. According to diagnostic criteria, a fetus with FGR can have a normal EFW, for example, in the case of a decrease in AC/EFW by two centile channels in a sequential ultrasound examination. This can result in a diagnosis of FGR in cases of pregnancy with EFW > 10th percentile after a “drop on the centile grid” with simultaneous occurrence of abnormal vascular flows (e.g., CPR < 5th percentile or UA-PI > 95th percentile for late FGR) [17].

The interesting data in our study relate to diabetes. The prevalence of this complication in our patient cohort is very high. However, it does not significantly differ from global data. The estimated percentage of pregnant women with this complication worldwide is about 17% (14.8% in our patient cohort), with the highest percentage observed in South-East Asia, reaching even 25% [18]. The percentage of pregnancies complicated by diabetes also depends on obesity in the population [19] and the trend in its occurrence in our geographic region has been discussed above. A significant role is also played by the screening method and stratification of patients who are included in screening for carbohydrate metabolism disorders in pregnancy. In Poland, we use “universal screening” (fasting glucose determination in the first trimester and OGTT in the second trimester for each patient). After the change of recommendations on the diagnosis of gestational diabetes by the International Association of Diabetes and Pregnancy Study Groups (IADPSG) [20], which have been implemented in Poland (after WHO recommendations from 2013) [21], the percentage of women diagnosed with gestational diabetes mellitus (GDM) has increased. Data from some countries indicate a three-fold increase in the frequency of diagnoses, without improved obstetric outcomes in women without GDM risk factors [22]. Some authors point to the imperfection of screening methods in the face of contemporary diagnostic and therapeutic methods for diabetes [23].

Newly diagnosed toxoplasmosis in pregnancy affected 0.82% of pregnant women. In these data, we do not take into account the initial serological status of women. Data from the late 1990s suggest that in Poland, the percentage of seropositive women of reproductive age is 59% [24]. Applying our prevalence result to these historical data, we can conclude that 2% of seronegative women (susceptible to toxoplasma infection) will be treated during pregnancy. These data are of good quality as toxoplasma screening in Poland is universal and regulated by the Minister of Health.

A similar rate was shown in Turkey where, in the entire population of women (the percentage of seropositive women was 46.2%), the percentage of new cases was 4%, which, when calculated for seronegative women, gives a result of 2.1% [25]. In cases of treating this complication, the percentage of children with congenital toxoplasmosis is low and estimated at 1% of treated women [25]. The actual prevalence of this disease also depends on the laboratory methods used in screening diagnostics, which can have a high percentage of false-positive results [26].

The frequency of other complications does not differ significantly from those observed in the literature. The percentage of placenta accreta spectrum cases does not differ from those currently observed in developed countries with a high percentage of cesarean sections, which is estimated at 0.17% (95% CI: 0.14–0.19) [27]. The percentage of women diagnosed with placenta previa during pregnancy also does not differ from that observed in the literature – 0.4 % (0.42% in our cohort) [28]. Similarly, global data suggest that the percentage of pregnancies complicated by preterm prelabor rupture of membranes (PPROM) is about 3% (3.6% in our cohort) [29].

In our study, we did not assess the socioeconomic status of the patients. However, it is interesting to compare our cohort with a study from the United States that examined the percentage of pregnancy complications between the first quartile of the most affluent women in a cohort of over 5 million Americans and the remaining group [30]. In our group, we observed a lower percentage of pregnancy complications related to hypertensive disorders: pregnancy induced hypertension (PIH) (3.8% vs. 6.7%) and preeclampsia (PE) (1.5% vs. 3.2%). This may be related to the racial composition of the American population compared to our homogeneous population. Studies indicate that the highest risk of gestational hypertensive diseases occurs in non-Hispanic black women [31], who constituted 7.3% in the cited study, whereas our cohort was racially homogeneous. In our study, we also observed an overall higher percentage of women with GDM (14.8% vs. 6.6%). This difference is likely related to classification issues discussed earlier.

Additionally, we observed a higher percentage of PPRM (vs. 1.1%) with a similar percentage of preterm labour (PTL) (6.95% vs. 6.1%). This difference may arise from different management recommendations for PPRM between countries. In Poland, the indication to continue pregnancy in cases of PPRM and absence of maternal and fetal health risk is to reach 37 weeks of pregnancy [32], in line with the American College of Obstetrics and Gynecology guidelines where expectant management is not recommended after 34 weeks of pregnancy [33]. Due to this difference, some patients with PPRM in the study from the United States were likely classified into the PTL group.

We observed the same percentage of fetal growth restriction (2.2%) in our study.

Conclusions

The prevalence of pregnancy complications in our region is similar to that in developed countries. While some individual complications may vary slightly, overall, our data align with established global trends. Continued research and ongoing monitoring of these trends are crucial to further our understanding and improve the health outcomes of both mothers and babies.

Importantly, we must also focus on preventative strategies and early detection methods for these complications. As demonstrated in our study, factors such as universal screening and stratification of patients can significantly influence the prevalence and management of complications such as gestational diabetes and toxoplasmosis.

Our results emphasize the critical role of comprehensive prenatal care in detecting and managing these pregnancy complications, ultimately working towards healthier pregnancies and improved neonatal outcomes.

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Ethical approval

Not applicable.

Conflict of interest

The authors declare no conflict of interest.

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Address for correspondence:

Jakub Młodawski
Collegium Medicum
 Jan Kochanowski University
 Kielce, Poland
 E-mail: jakub.mlodawski@ujk.edu.pl

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