ORIGINAL ARTICLE

Annals of Agricultural and Environmental Medicine
www.aaem.pl

Place of residence and time of day as factors affecting the course of vaginal delivery

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Bączek G, Szyszka M, Rzońca P, Gałązkowski R, Tataj-Puzyna U, Rzońca E. Place of residence and time of day as factors affecting the course of vaginal delivery. Ann Agric Environ Med. doi: 10.26444/aaem/153018

Abstract

Introduction and Objective. Childbirth is one of the most important events in a woman's life and is influenced by many factors. The aim of the research was to analyze the impact of the place of residence of women giving birth and the time of day on the course of natural birth.

Materials and method. The study was conducted using the method of analysis of retrospective electronic documentation of patients who gave natural vaginal birth in the St. Zofia hospital in Warsaw, Poland. The analysis covered the period from 1 January 2015–31 December 2020; from 40,007 cases, 20,980 were qualified for final analysis. Analysis of the documentation allowed to obtain the following data: socio-demographic, lifestyle, obstetrics, course of delivery and the condition of the newborn. Analysis of the relationship between qualitative variables was performed using the Chi-square test, while the Mann-Whitney U test was used to compare two quantitative variables.

Results. Women giving vaginal delivery from rural areas were younger (30.9 vs. 31.3), had primary education (2.4% vs. 1.7%) and secondary education (16.2% vs. 10.1%), were in a relationship (86.1% vs. 81.6%) and more often had a higher BMI at birth (27.8 vs. 27.0), compared to the patients living in cities ($p<0.05$). In addition, between 07:00–18:59., induction of labour (20.7% vs. 19.1%), epidural anesthesia (35.4% vs. 34.0%) and episiotomy were performed more often (29.1% vs. 27.8%) ($p<0.05$).

Conclusions. Differences were shown in the course of vaginal delivery in relation to the place of residence of the women, and the time of day of the delivery. These factors should be considered in the planning of perinatal care. At the same time, it is necessary to conduct further research on the analyzed aspect in order to ensure the highest quality care.

Key words

rural, vaginal delivery, urban, time of birth

INTRODUCTION

Childbirth is one of the most important events in a woman's life that affects not only her life and well-being, but also the lives of her loved ones. Moreover, the experience of childbirth affects the sense of self-confidence of women, which will accompany them through further life [1, 2, 3]. Childbirth experience is based on the interaction of physical, psychological, emotional and social determinants, accompanied by various obstetric factors. Childbirth is analyzed, among others, in relation to its type, care provided, obstetric factors and the experience of women [1, 2, 3, 4, 5, 6]. In addition, studies on childbirth outcomes, both for the mother and the newborn, are of particular interest to researchers [7, 8, 9, 10, 11], and include the importance of the place of residence, where unfavourable outcomes are more often associated with living in rural areas [12, 13, 14, 15, 16]. Moreover, the issue of the influence of the time of the day of childbirth on birth outcomes is being increasingly discussed [2, 17, 18, 19].

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Received: 02.07.2022; accepted: 25.08.2022; first published: 07.09.2022

The presented research is necessary to explore the subject of childbirth and ensure appropriate care during such an important event, which was the basis for undertaking research on the factors affecting the course of childbirth.

OBJECTIVE

The aim of the research was to analyze the impact of the place of residence (urban vs. rural) on the women giving birth and the time of day (between 07:00 a.m. – 18:59 vs. between 19:00–06:59) on the course of natural vaginal birth.

MATERIALS AND METHOD

The study was conducted using the method of retrospective analysis of electronic documentation of patients who gave natural vaginal birth in the St. Zofia hospital in Warsaw, Poland, which is a third level reference centre with the highest number of births in both Warsaw and Province of Mazowia. It is a public hospital containing a perinatology ward, a delivery room, maternity ward, neonatology ward, gynaecology ward, an operating theatre, and a birth house with a physiological puerperium ward. The hospital has 100

beds, employs 250 midwives and nurses, and 70 doctors. In 2020, there were 6,600 births.

The analysis covered the period from 1 January 2015–31 December 2020, in which a total of 40,007 cases of parturient women were recorded. In the process of analyzing the documentation, the following data were obtained: socio-demographic (age, education, partnership status, place of residence), lifestyle (smoking, BMI at birth), obstetric (pregnancy, childbirth, pregnancy diseases: gestational diabetes, pregnancy hypertension, pregnancy cholestasis, past cesarean section), related to the course of childbirth (place of delivery, date of delivery: season of the year, time of the day of delivery – 07:00–18:59 vs. 19:00–06:59, preinduction, induction, stimulation, epidural anaesthesia, perineal laceration, episiotomy, duration of labour, including I, II and III stage of childbirth, blood loss during childbirth, hospitalization) and neonatal data (birth weight, Apgar scores). The inclusion criteria were: singleton pregnancy, natural vaginal birth and over 38 weeks of pregnancy. The exclusion criteria were cases of childbirth before 38 weeks of gestation (n=4,800), multiple pregnancies (n=595), birth of neonate with severe birth defects (n=876) or abnormal karyotype (n=40), and cases of intrauterine death (n=18). The analysis additionally excluded cases of cesarean section (n=9,028), operative deliveries (n=726), and cases where data inconsistencies or lack of data were found in the documentation (n=2,944). Based on the adopted inclusion and exclusion criteria, 20,980 cases were qualified for the final analysis.

The study design was submitted to the Bioethics Committee at the Medical University of Warsaw, which issued a statement that the design, due to its retrospective nature, does not require consent (AKBE/204/2021). The data report was anonymous and it was not possible to identify any individual patient. The study was conducted in accordance with the principles of the Helsinki Declaration.

Statistical analysis was based on STATISTICA software version 13.2 (Tibco Software Inc., Palo Alto, CA, USA). Qualitative data are presented using the number (n) and percentage (%), while quantitative variables using the mean (M) and standard deviation (SD). The Kolmogorov-Smirnov test and the Lilliefors test were used to check the normality of the distribution of quantitative variables. Analysis of the relationship between qualitative variables was carried out using the Chi-square test, while the Mann-Whitney U test was used to compare two quantitative variables. The level of significance $p<0.05$ was adopted for the conducted analyses.

RESULTS

Analysis showed that parturient women from rural areas were younger (30.9 vs. 31.3), had education below university level (primary education – 2.4% vs. 1.7%; secondary education – 16.2% vs. 10.1%), were in a relationship (86.1% vs. 81.6%) and had a higher BMI at birth more often (27.8 vs. 27.0) than women from urban areas. Moreover, women living in rural areas were more often in the second and subsequent pregnancy (II pregnancy – 36.5% vs. 36.3%; III and the next pregnancy – 31.4% vs. 23.9%), and gave birth to a second and subsequent child (II childbirth – 40.8% vs. 39.4%; III and the next pregnancy – 21.2% vs. 14.2%) than those from the urban areas. The found relationships were statistically significant ($p<0.05$) (Tab. 1).

Table 1. Analysis of the relationship between place of residence and socio-demographic, lifestyle and obstetric variables.

Variables	Total n=20,980	Urban n=18,185	Rural n=2,795	p-value
Socio-demographic variables				
Age – M (SD)	31.3 (2.2)	31.3 (4.2)	30.9 (4.6)	0.000
Education – n (%)				
Primary education	370 (1.8)	302 (1.7)	68 (2.4)	0.000
Secondary education	2,281 (10.9)	1,829 (10.1)	452 (16.2)	
Higher Education:	18,329 (87.4)	16,054 (88.2)	2,275 (81.4)	
Partnership status – n (%)				
In a relationship	17,241 (82.2)	14,833 (81.6)	2,408 (86.1)	0.000
Single	3,739 (17.8)	3,352 (18.4)	387 (13.9)	
Lifestyle variables				
BMI at birth – M (SD)	27.1 (3.6)	27.0 (3.9)	27.8 (3.6)	0.000
Cigarette smoking - n (%)				
Yes	92 (0.4)	84 (0.5)	8 (0.3)	0.191
No	20,888 (99.6)	18,101 (99.5)	2,787 (99.7)	
Obstetric variables				
Gravidity – n (%)				
1	8,136 (38.8)	7,238 (39.8)	898 (32.1)	0.000
2	7,620 (36.3)	6,600 (36.3)	1,020 (36.5)	
3 and more	5,224 (24.9)	4,347 (23.9)	877 (31.4)	
Parity – n (%)				
1	9,500 (45.3)	8,438 (46.4)	1,062 (38.0)	0.000
2	8,314 (39.6)	7,173 (39.4)	1,141 (40.8)	
3 and more	3,166 (15.1)	2,574 (14.2)	592 (21.2)	
Gestational diabetes – n (%)				
Yes	1,763 (91.6)	1,513 (8.3)	250 (8.9)	0.268
No	1,9217 (8.4)	16,672 (91.7)	2,545 (91.1)	
Pregnancy hypertension– n (%)				
Yes	463 (2.2)	396 (2.2)	67 (2.4)	0.462
No	20,517 (97.8)	17,789 (97.8)	2,728 (97.6)	
Pregnancy cholestasis – n (%)				
Yes	99 (0.5)	83 (0.5)	16 (0.6)	0.405
No	20,881 (99.5)	18,102 (99.5)	2,779 (99.4)	

M – mean; SD – standard deviation; BMI – body mass index

Statistical analysis showed that in the respondents from rural areas, the duration of I (287.4 vs. 297.1 min) and II (24.7 vs. 27.8 min) stages of childbirth was shorter than in those born in urban areas ($p<0.05$). In addition, rural residents more often gave birth to children with a higher birth weight (3521.0 vs. 3500.9 grams) than women living in urban ($p<0.05$). (Tab. 2).

Statistical analysis showed that between 07:00–18:59, primigravidas (39.9% vs 37.8%) and primiparas (46.2% vs 44.4%) gave birth more often. The found dependencies were statistically significant ($p<0.05$) (Tab. 3).

Statistical analysis showed that between 19:00–06:59, children are more often born in winter (24.1% vs. 23.3%) than in spring (26.0% vs. 24.5%). In addition, between 07:00–18:59, induction of labour (20.7% vs. 19.1%), epidural anaesthesia (35.4% vs. 34.0%) and episiotomy were performed more often (29.1% vs. 27.8%). Whereas between 19:00–06:59 the duration of the second period of childbirth (27.1 vs. 27.8

Table 2. Analysis of the relationship between place of residence and selected variables related to delivery and newborn

Variables	Total n=20,980	Urban n=18,185	Rural n=2,795	p-value
Place of delivery – n (%)				
Hospital	17,590 (83.8)	15,225 (83.7)	2,365 (84.6)	0.233
Birth House	3,390 (16.2)	2,960 (16.3)	430 (15.4)	
Time of day – n (%)				
7:00 a.m. – 6:59 p.m	9,762 (46.5)	8,435 (86.4)	1,327 (13.6)	0.282
7:00 p.m. – 6:59 a.m.	11,218 (53.5)	9,750 (86.9)	1,468 (13.1)	
Duration of the first stage of childbirth [min] – M (SD)	295.8 (156.9)	297.1 (157.6)	287.4 (152.3)	0.003
Duration of the second stage of childbirth [min] – M (SD)	27.4 (21.7)	27.8 (21.8)	24.7 (20.2)	0.000
Duration of the third stage of childbirth [min] – M (SD)	11.8 (6.3)	11.8 (6.3)	11.9 (6.5)	0.255
Duration of delivery [min] – M (SD)	302.5 (213.0)	303.4 (213.9)	296.5 (207.6)	0.234
Blood loss [ml] – M (SD)	386.5 (125.5)	386.0 (123.7)	386.0 (136.5)	0.993
Birth weight [gram] – M (SD)	3,503.6 (398.0)	3,500.9 (396.6)	3,521.0 (406.9)	0.014

M – mean; SD – standard deviation; min – minutes; ml - millilitre

Table 3. Analysis of the relationship between time of delivery and selected obstetric variables

Variables	Total n=20,980	07:00-18:59 n=9762	19:00-06:59 n=11,218	p-value
Gravidity – n (%)				
1	8,136 (38.8)	3,895 (39.9)	4,241 (37.8)	0.003
2	7,620 (36.3)	3,522 (36.1)	4,098 (36.5)	
3 and more	5,224 (24.9)	2,345 (24.0)	2,879 (25.7)	
Parity – n (%)				
1	9,500 (45.3)	4,515 (46.2)	4,985 (44.4)	0.017
2	8,314 (39.6)	3,826 (39.2)	4,488 (40.0)	
3 and more	3,166 (15.1)	1,421 (14.6)	1,745 (15.6)	
State after cesarean section – n (%)				
Yes	1,120 (5.3)	512 (5.2)	608 (5.4)	0.573
No	19,860 (94.7)	9,250 (94.8)	10,610 (94.6)	

M – mean; SD – standard deviation

min), as well as the entire delivery (299.1 vs. 306.3 min) was shorter. The found dependencies were statistically significant ($p<0.05$) (Tab. 4).

DISCUSSION

The study indicates differences during vaginal delivery in relation to the place of residence (urban vs. rural) and time of day (between 07:00–18:59 vs. between 19:00–06:59). Women from rural areas giving birth were younger, more often had an education below university level, were in a relationship, had a higher BMI at the moment of vaginal delivery and were multiparous. The duration of the first and

Table 4. Analysis of the relationship between the time of delivery and selected variables related to delivery and newborn

Variables	Total n=20,980	07:00-18:59 n=9,762	19:00-06:59 n=11,218	p-value
Place of delivery – n (%)				
Hospital	17,590 (83.8)	8,213 (84.1)	9,377 (83.6)	0.285
Birth House	3,390 (16.2)	1,549 (15.9)	1,841 (16.4)	
Season of the year – n (%)				
Spring	5,314 (25.3)	2,395 (24.5)	2,919 (26.0)	0.010
Summer	5,545 (26.4)	2,640 (27.0)	2,905 (25.9)	
Autumn	5,152 (24.6)	2,457 (25.2)	2,695 (24.0)	
Winter	4,969 (23.7)	2,270 (23.3)	2,699 (24.1)	
Preinduction – n (%)				
Yes	329 (1.6)	169 (1.7)	160 (1.4)	0.076
No	20,651 (98.4)	9,593 (98.3)	11,058 (98.6)	
Induction – n (%)				
Yes	4,170 (19.9)	2,026 (20.7)	2,144 (19.1)	0.003
No	16,810 (80.1)	7,736 (79.3)	9,074 (80.1)	
Stimulation - n (%)				
Yes	3,431 (16.4)	1,612 (16.5)	1,819 (16.2)	0.551
No	17,549 (83.6)	8,150 (83.5)	9,399 (83.8)	
Epidural anaesthesia – n (%)				
Yes	7,272 (34.7)	3,459 (35.4)	3,813 (34.0)	0.028
No	13,708 (65.3)	6,303 (64.6)	7,405 (64.0)	
Perineal laceration – n (%)				
Yes	7,301 (34.8)	3,429 (35.1)	3,872 (34.5)	0.357
No	13,679 (65.2)	6,333 (64.9)	7,346 (65.5)	
Episiotomy -n (%)				
Yes	7,272 (34.7)	2,842 (29.1)	3,116 (27.8)	0.033
No	13,708 (65.3)	6,920 (70.9)	8,101 (72.2)	
Duration of first stage of childbirth [min] – M (SD)	295.7 (156.9)	295.7 (155.0)	295.8 (158.5)	0.592
Duration of second stage of childbirth [min] – M (SD)	27.4 (21.7)	27.8 (21.7)	27.1 (21.6)	0.010
Duration of third stage of childbirth [min] – M (SD)	11.8 (6.3)	11.8 (6.3)	11.8 (6.3)	0.651
Duration of delivery [min] – M (SD)	302.5 (213.0)	306.3 (215.3)	299.1 (210.9)	0.031
Hospitalization time [days] – M (SD)	3.8 (2.2)	3.8 (2.1)	3.7 (2.3)	0.120
Blood loss [ml] – M (SD)	386.4 (125.5)	387.7 (124.1)	385.3 (126.6)	0.127
Apgar 1 ' – n (%)				
7 and less	288 (1.4)	127 (1.3)	161 (1.4)	0.404
8 and more	20,692 (98.6)	9,635 (98.7)	11,057 (98.6)	
Apgar 5' – n (%)				
7 and less	48 (0.2)	18 (0.2)	30 (0.3)	0.209
8 and more	20,932 (99.8)	9,744 (99.8)	11,188 (99.7)	
Birth weight [gram] – M (SD)	3,503.6 (398.0)	3,504.9 (395.5)	3,502.9 (400.3)	0.551

M – mean; SD – standard deviation; min – minutes; ml - millilitre

second stages of vaginal delivery were shorter in the case of women from rural areas and gave birth to newborns with a higher birth weight. From 07:00–18:59., primigravidas and primiparas gave birth more often and induction of vaginal delivery, epidural anaesthesia, and perineal incision were performed more often. Between 07:00–18:59 p.m., children were more often born in winter and spring, and the duration of the second stage of vaginal delivery and the entire vaginal delivery was shorter.

The subject of the place of residence as a factor affecting the health of its inhabitants is a matter of interest to researchers [20, 21, 22, 23]. In own research, significant differences were found between parturient women from rural and urban areas. According to data from the Central Statistical Office on the demographic situation in Poland, by 2020, the median age of women giving birth to a child was 31 years, and 49% of women giving birth had a higher education. In addition, in extramarital relationships, more children were born in urban than in rural areas [24]. Richter et al. (2019) also noted an increase in 2011–2013 in the number of women giving birth after the age of 30, compared to those giving birth in 2004–2006 in Washington State, USA [25]. The results of research showed that respondents from rural areas were younger, more often had an education below university level and were in a relationship; these results are reflected in the above data. The results of own research also showed that women from rural areas had a higher BMI than urban residents. Studies by Trivendi et al. (2015) showed that the incidence of obesity was higher among both women and men from rural areas than among those from urban areas [26]. Gallagher et al. (2013) also found that women from rural areas more often had abnormal body weight before pregnancy than those from urban areas. In addition, they noted the relationship between gestational weight gain (GWG) and the type of residence depending on the BMI. They found that women from rural areas with normal body weight were more likely to develop inadequate GWG. They also found that living in rural areas is a protective factor against unhealthy GWG in the case of women who are overweight and obese [27].

On the other hand, research by Oladapo et al. (2018) among women living in urban areas from African countries showed that nulliparas were younger and had a lower BMI than multiparas [28]. In turn, Xinhua et al. (2020) stated that women from Inner Mongolia (China) with lower education, where both partners work and have middle incomes, more often decided to have more children [29]. Parturient women from the rural areas in own study were more often in the second and subsequent pregnancy and gave birth to the second and subsequent child in comparison to the respondents living in urban areas. According to data from the Central Statistical Office, more children are born in rural areas in Poland, and the fertility rate is higher than in urban areas [24], which is also reflected in the results of own research. The lower fertility rate in cities is due to the fact that women more often have a higher education, and thus take up employment. The worldview of motherhood differs between rural and urban areas. Among women from rural areas, being a mother was of paramount importance.

Socio-demographic changes also contributed to the difference in fertility rates in both groups [30]. According to research by Szukalski, women rural areas more often decided to have a large family than women in the urban areas. This is confirmed by the results of own research [31].

An important aspect regarding the course of labour is the activity of the uterus, which varies depending on the number of births. This in turn affects the duration of childbirth [32, 33]. Factors affecting the duration of childbirth include, among others, the number of births, spontaneous or induced beginning of childbirth, and body weight of the woman giving birth [34]. Bohren et al. (2017) showed that women living in urban areas and having support during childbirth, compared to women without such support, had a shorter duration of childbirth [35]. On the other hand, the results of own research showed that in the respondents from rural areas, the duration of both the first and second stage of childbirth was shorter than in parturient women in urban areas. In addition, the results of own research showed that the respondents living in the rural areas gave birth to children with a higher birth weight than women living in urban areas. Zhang et al. (2018) also found that prenatal nutrient supplementation affects the birth weight of newborns, which differs between urban and rural areas in north-western China [36]. In turn, Zhao et al. (2019) showed that the total estimated birth weight centiles of newborns from rural areas were higher than of those from urban areas born before 37 weeks of pregnancy. However, this trend was reversed in the case of newborns from full-term pregnancy [37]. On the other hand, Kaur et al. (2019) found that women from rural areas were more likely to give birth to newborns with a lower birth weight, compared to mothers living in urban areas [14]. The differences between the presented results in relation to the birth weight of the newborn may result from various socio-economic conditions, which affect, among others, nutritional status, physical activity and birth outcomes, including neonatal ones [14, 36, 37].

In the current study the authors analyzed the factors determining the course of vaginal delivery in relation to the time of day. The literature on the subject is dominated by research on the time of the day of childbirth in relation to the effects of provided care in the form of unfavourable perinatal outcomes [2, 3, 19, 38]. Studies by Joensuu et al. (2021) on maternal birth experiences and time of delivery showed that multiparas dominated among the respondents. In addition, they found that the birth experience depended on the time of delivery, and an evening birth led to the impairment of the birth experience in both primiparas and multiparas, compared to birth in other periods [2]. In turn, the results of own research showed that between 07:00–18:59, primigravidas and primiparas gave birth more often, and between 19:00–06:59 multiparas gave birth more often. Research by Mgaya et al. (2017) showed that nighttime births were significantly associated with a higher percentage of unfavourable perinatal outcomes, including a low Apgar score in the newborn, early neonatal death and fresh stillbirth, compared to the morning and evening times [38]. In addition, Adler et al. (2020) showed that a low level of birth experience was influenced by the induction of labour, primiparity, operative / surgical labour, and birth complications [3]. The results of own research showed that between 07:00–18:59, during childbirth, induction of labour, epidural anaesthesia and perineal incision were performed more often. In addition, it has been shown that children are born more often between 19:00–06:59 in winter and spring. In turn, research by Çobanoğlu and Şendir (2020) showed that in the analyzed period childbirths more often took place at night in a day-night cycle, and in the summer months [39]. In relation to the aspect analyzed

above regarding the duration of childbirth, it was found in own research that between 19:00–06:59 the duration of the second stage of childbirth, as well as the entire childbirth, is shorter. In this context, numerous factors are important which determine the duration of childbirth, such as the method of its initiation and the number of births or obstetric procedures used during the childbirth [34].

The strength of the current study is the very large number of respondents, long period of research, and the exclusion of incomplete data from the analysis. At the same time, the study had its limitations – the analysis of data from electronic medical records from only one centre, and that the study group came from only one hospital located in the capital of Poland. The hospital is popular and consciously chosen by women to give birth. That they often come from remote areas to give birth may be related to the higher social status of these women. This hospital has a birth house where only normal births take place. This may indicate a different group of women giving birth compared to other hospitals in Poland and constitute a limitation in the current study.

CONCLUSION

The study shows differences in the time of delivery depending on the place of residence (urban vs. rural) and the time of day (07:00–18:59 vs. 19:00–06:59) of vaginal delivery. The place of residence of mothers and the time of the day of vaginal delivery are factors that should be taken into account in planning perinatal care, especially in order to limit medicalization and reduce the risk of perinatal complications for both the mother and her child. Therefore, it is necessary to conduct further research in order to better understand the analyzed aspects and to improve the care during childbirth to ensure that it is of the highest quality.

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