



# Bleeding during pregnancy as a reason for interventions by emergency medical services teams in Poland

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## Abstract

**Introduction and objective.** Vaginal bleeding during pregnancy is associated with risks to the health and life of the woman and/or the foetus. Moreover, it is usually unanticipated, which requires on-site care to be provided to the woman. Such care is handled by emergency medical services (EMS) teams until specialist obstetric care can be provided. The purpose of study was to analyze the characteristics of EMS team responses to calls regarding pregnant women with vaginal bleeding, considering the location of call: urban vs. rural area.

**Materials and method.** The study was based on a retrospective analysis of 5,487 EMS team interventions due to vaginal bleeding in pregnant women in Poland. The data analyzed included the period January 2018–December 2019, obtained from the National Monitoring Centre of Emergency Medical Services.

**Results.** The teams were more commonly dispatched to pregnant women in rural areas, who were more likely to be older and in the course of a second (27.52% vs. 26.88%) or subsequent pregnancy (34.00% vs. 27.49%), to have had one (28.22% vs. 26.75%) or more previous births (28.87% vs. 22.87%), and to have antepartum bleeding (23.91% vs. 20.36%) than those from urban areas. The mean time between receipt of the call and patient hand-over at the hospital by the EMS team was longer in rural areas (50.00 vs. 37.23 minutes).

**Conclusions.** EMS teams responding to calls from rural areas regarding pregnant women with vaginal bleeding were most commonly dispatched in the summer, and the mean time between the receipt of the call and patient hand-over at the hospital was longer than in the calls from urban areas. Compared to patients calling from urban areas, those from rural areas were also more likely to be pregnant for the second or subsequent time, to have antepartum bleeding, and to have given birth before.

## Key words

pregnant women, emergency medical service, vaginal bleeding

## INTRODUCTION

Pregnancy is a natural condition associated with a number of anatomical and physiological changes resulting from the adaptation of a woman's body to the needs of a developing foetus and preparation for delivery. Even in the normal course of pregnancy, signs and symptoms of obstetric complications may occur [1, 2]. Alarming symptoms during the pregnancy include vaginal bleeding, abdominal pain, swelling, headaches, fever, or marked changes in foetal movement. These symptoms may be associated with a risk to the health and life of the woman and/or foetus, and are usually unexpected [2–5].

Vaginal bleeding is an alarming symptom that may occur at any time during pregnancy [2–5]. In early pregnancy, bleeding occurs in approx. 25% of women [6] and is most commonly associated with miscarriage or ectopic pregnancy [3–10]. Later in the pregnancy, bleeding may mark the beginning of a preterm labour, and may result in a haemorrhage threatening the health of the woman and

the foetus. In the second and third trimester, severe or life-threatening conditions associated with vaginal bleeding include placental abruption and placenta previa [3, 11–16].

Risks to the health or life of the pregnant woman may occur at any time during pregnancy [3, 12]. The Polish Emergency Medical Services (EMS) have been established to provide care to patients with severe or life-threatening emergencies. The Polish EMS system consists of hospital emergency departments and emergency medical services teams, including air medical services teams. Emergency medical services teams and air medical services teams are units of the EMS system responsible for responding to emergencies and performing medical emergency procedures on site and during transport to hospital. EMS teams may include physicians, emergency medical technicians, and nurses, and are classified as non-physician-staffed and physician-staffed [17].

The present study was motivated by the potential risks to pregnant women's health or life associated with vaginal bleeding, necessitating the provision of care on site by an EMS team [2, 3, 5, 8, 11, 12, 16].

## OBJECTIVE

The aim of the study was to analyze the characteristics of emergency medical services (EMS) team responses to calls regarding pregnant women with vaginal bleeding, considering the location of call: urban vs. rural area.

## MATERIALS AND METHOD

The study was based on a retrospective analysis of EMS team interventions due to vaginal bleeding in pregnant women in Poland, based on data from the Emergency Medical Services' command support system for the period January 2018–December 2019, prepared by the National Monitoring Centre of Emergency Medical Services. The centre's Information and Technology Communication (ICT) system is used to register calls and information from emergency numbers, dispatch EMS teams, register medical events, and locate each event [18]. Data obtained from its database included emergency medical procedure records and EMS team dispatch records. The documentation was analyzed to obtain the following information: date and location of call, details of the pregnant patient, main diagnoses based on the International Statistical Classification of Diseases and Related Health Problems (ICD-10), patient clinical parameters, emergency medical procedures performed, and other characteristics of the intervention. The study was approved by the Polish Ministry of Health, which also provided the data for analysis. The study protocol was submitted to the Bioethics Committee at the Medical University of Warsaw, which confirmed that this study did not require consent due to its retrospective nature (AKBE/17/2021).

The study included all cases of vaginal bleeding in pregnant women classified by the EMS team under ICD-10 codes O20 – haemorrhage in early pregnancy, O44 – placenta previa, O45 – premature separation of placenta (abruptio placentae), or O46 – antepartum haemorrhage, not classified elsewhere. Exclusion criteria were: refusal of medical assistance, cancellation of call, absence of the patient on site. Of the 6,396,387 EMS team interventions in Poland in the period analyzed, 5,487 EMS team interventions regarding pregnant women with vaginal bleeding were selected for further analysis, based on the established criteria and after accounting for missing data in the medical records.

The data obtained from the documentation analysis were analyzed statistically using the STATISTICA software, version 13.2 (Tibco Software Inc., Palo Alto, CA, USA). Qualitative data were described using numbers (n) and percentages (%), while quantitative data were reported using means (M) and standard deviations (SD). Distribution normality for quantitative variables was tested using the Kolmogorov-Smirnov test and the Lilliefors test. Statistically significant differences between qualitative variables were tested using the Chi<sup>2</sup> test, and differences between two independent groups were tested using the non-parametric Mann-Whitney U-test. Correlations and differences at  $p < 0.05$  were considered statistically significant.

## RESULTS

Table 1 shows the characteristics of the pregnant patients, and an analysis of relationships between selected variables regarding the patients and their obstetric history, and location of call (urban/rural area). The mean age of the women studied was 29.61 years, and the most numerous age range was 30–34 years (28.45%). Most patients were pregnant for the first time (43.21%), in their first trimester (66.16%) – at 15.12 weeks, on average, and had not previously given birth (47.85%) or miscarried (88.24%). Early pregnancy bleeding was identified in most cases (78.44%).

Pregnant women from rural areas who received assistance from EMS teams were older, on average (mean age 29.92 years), than patients from urban areas. Compared to patients with vaginal bleeding during pregnancy calling from urban areas, those from rural areas were also more likely to be pregnant for the second or subsequent time, in the second or third trimester, and at a later gestational week, to have antepartum bleeding, and to have given birth before. All these associations were statistically significant ( $p < 0.05$ ) (Tab. 1).

Overall, EMS teams were more often dispatched to pregnant women with vaginal bleeding in the summer (26.88%), between 07:00–18:59 (53.98%), with urgency code

**Table 1.** Characteristics of patients and their obstetric history, and analysis of relationships between selected variables and location of call

Variables	Total	Location of call		p-value
		Urban area	Rural area	
<b>Age – n (%)</b>				
15–19 years	358 (6.52)	140 (6.60)	118 (6.37)	
20–24 years	915 (16.68)	613 (16.87)	302 (16.30)	
25–29 years	1,343 (24.48)	910 (25.04)	433 (23.37)	0.1575
30–34 years	1,561 (28.45)	1,044 (28.93)	517 (27.90)	
35–39 years	966 (17.61)	614 (16.90)	352 (19.00)	
40 and older	344 (6.27)	213 (5.86)	131 (7.07)	
Mean age – M (SD)	29.61 (6.42)	29.45 (6.35)	29.92 (6.55)	0.0104
<b>Pregnancy – n (%)</b>				
1	2371 (43.21)	1658 (45.62)	713 (38.48)	
2	1,487 (27.10)	977 (26.88)	510 (27.52)	0.0000
3 or more	1,629 (29.69)	999 (27.49)	630 (34.00)	
<b>Trimester – n (%)</b>				
first trimester	3,630 (66.16)	2,454 (67.53)	1,176 (63.46)	
second trimester	832 (15.16)	539 (14.83)	293 (15.81)	0.0064
third trimester	1,025 (18.68)	641 (17.64)	384 (20.72)	
Gestational week – M (SD)	15.12 (10.11)	14.84 (9.97)	15.69 (10.34)	0.0036
<b>Previous labour – n (%)</b>				
0/no	2,626 (47.85)	1831 (50.39)	795 (42.90)	
1	1,495 (27.25)	972 (26.75)	523 (28.22)	0.0000
2 or more	1,366 (24.90)	831 (22.87)	535 (28.87)	
<b>History of miscarriage – n (%)</b>				
Yes	645 (11.76)	424 (11.67)	221 (11.93)	0.7782
No	4,842 (88.24)	3,210 (88.33)	1,632 (88.07)	
<b>Bleeding – n (%)</b>				
in early pregnancy	4,304 (78.44)	2,894 (79.64)	1,410 (76.09)	0.0025
antepartum	1,183 (21.56)	740 (20.36)	443 (23.91)	

2 (58.06%). Most were two-person (60.31%), non-physician-staffed teams (60.31%). The mean duration of intervention, i.e. time between receipt of the call and hand-over of the pregnant patient at the hospital, was 41.56 minutes. An emergency call regarding vaginal bleeding during pregnancy was most often made by the pregnant patient herself (26.43%), but in more than half of the cases studied, the caller was unidentified (53.91%) (Tab. 2).

As for calls from rural areas, EMS teams were more often dispatched in the summer, between 19.00–06.59, with urgency code 1; most teams were composed of two people; and most calls were made by a family member of the patient. The mean time between receipt of the call and patient hand-over at the hospital by the EMS team was longer in rural areas than in urban areas (50.00 vs. 37.23 min.). The above associations were statistically significant ( $p < 0.05$ ), although no statistically significant correlation was found between EMS team type and location of call ( $p > 0.05$ ) (Tab. 2).

Emergency medical procedures most commonly performed by EMS team members for pregnant patients with vaginal bleeding were blood pressure measurement (92.98%) and pulse oximetry (91.53%). In the studied cases of calls to pregnant patients with vaginal bleeding, EMS call location was significantly correlated with the procedures performed, including blood pressure measurement, physical examination, vital parameter monitoring, intravenous cannulation, and

blood glucose measurement, as well as with systolic blood pressure values ( $p < 0.05$ ). No significant relationship was found between selected physical examination findings or use of pulse oximetry and location of call ( $p > 0.05$ ) (Tab. 3).

## DISCUSSION

Vaginal bleeding during pregnancy is associated with risks to the health and life of the woman and/or the foetus. Moreover, it is usually unanticipated, and care must be provided on site by the EMS team until the patient is safely transferred to specialist obstetric care [2, 3, 5, 8, 11, 12, 13, 16]. This aspect motivated the present study, the aim of which was to analyze the characteristics of emergency medical services (EMS) team responses to calls regarding pregnant women with vaginal bleeding, considering the location of call: urban vs. rural area. Importantly, vaginal bleeding in the first trimester is among the most common complications of pregnancy, occurring in 15–25% of cases, and results in miscarriage in approximately half of them. In turn, patients who are still pregnant after an episode of bleeding are at a higher risk of complications at later stages of pregnancy, including preterm birth or premature separation of placenta [16, 19–22].

**Table 3.** Characteristics of selected emergency medical procedures performed by EMS teams and selected physical examination findings, and analysis of relationships between these variables and location of call

Variables	Total	Location of call		p-value
		Urban area	Rural area	
Most common emergency procedures — n (%)				
Blood pressure measurement	5,102 (92.98)	3,332 (91.69)	1,770 (95.52)	0.0000
Pulse oximetry	5,022 (91.53)	3,307 (91.00)	1,715 (92.55)	0.0488
Physical examination	3,988 (72.68)	2,694 (74.13)	1,294 (69.83)	0.0007
Monitoring	3,072 (55.99)	1,976 (54.38)	1,096 (59.15)	0.0008
Intravenous cannulation	2,071 (37.74)	1,241 (34.15)	830 (44.79)	0.0000
Blood glucose measurement	1,441 (26.26)	8,72 (24.00)	569 (30.71)	0.0000
Selected physical examination findings — n (%)				
Abdominal tenderness	1,282 (23.36)	836 (23.00)	4,46 (24.07)	0.3783
Abnormal respiratory sounds	1,006 (18.33)	683 (18.79)	3,23 (17.43)	0.2170
Pallor	501 (9.13)	314 (8.64)	187 (10.09)	0.0776
Fainting	121 (2.21)	79 (2.17)	42 (2.27)	0.8250
Vomiting	117 (2.13)	84 (2.31)	33 (1.78)	0.1982
GCS – M (SD)	14.99 (0.15)	14.99 (0.15)	14.99 (0.15)	0.8618
RTS – M (SD)	11.97 (0.23)	11.97 (0.24)	11.97 (0.23)	0.9151
Respiration rate – breath/min M (SD)	15.86 (2.69)	15.87 (2.70)	15.82 (2.66)	0.5371
Saturation – % M (SD)	98.00 (1.27)	97.99 (1.32)	98.02 (1.18)	0.7070
Systolic blood pressure – mmHg M (SD)	125.23 (17.58)	124.74 (17.32)	126.15 (18.02)	0.0101
Diastolic blood pressure – mmHg M (SD)	77.35 (11.66)	77.26 (11.69)	77.53 (11.62)	0.2704
Heart rate – beat/min M (SD)	93.25 (16.47)	93.41 (16.73)	92.94 (15.96)	0.4458
Blood glucose – mg/dL M (SD)	106.97 (24.96)	105.91 (23.40)	108.59 (27.12)	0.0521

GCS – Glasgow Coma Scale; RTS – Revised Trauma Score

**Table 2.** Characteristics of interventions and analysis of relationships between selected variables and location of call

Variables	Total	Location of call		p-value
		Urban area	Rural area	
Time of year – n (%)				
Spring	1,340 (24.42)	881 (24.24)	459 (24.77)	0.0023
Summer	1,475 (26.88)	928 (25.54)	547 (29.52)	
Autumn	1,324 (24.13)	887 (24.41)	437 (23.58)	
Winter	1,348 (24.57)	938 (25.81)	410 (22.13)	
Time of call – n (%)				
07:00–18:59	2,962 (53.98)	2,008 (55.26)	954 (51.48)	0.0080
19:00–06:59	2,525 (46.02)	1,626 (44.74)	899 (48.52)	
Urgency code — n (%)				
code 1	2,301 (41.94)	1,400 (38.63)	901 (48.62)	0.0000
code 2	3,186 (58.06)	2,234 (61.47)	952 (51.38)	
EMS team type — n (%)				
non-physician-staffed	4,215 (76.82)	2,785 (76.64)	1,430 (77.17)	0.6571
physician-staffed	1,272 (23.18)	849 (23.36)	423 (22.83)	
EMS team composition — n (%)				
two-person	3,309 (60.31)	2,153 (59.25)	1,156 (62.39)	0.0246
three-person	2,178 (39.69)	1,481 (40.75)	697 (37.61)	
Time between the receipt of call and patient hand-off at the hospital – M (SD)	41.56 (17.73)	37.23 (16.24)	50.00 (17.47)	0.0000
Caller – n (%)				
pregnant patient	1,450 (26.43)	1,017 (27.99)	433 (23.37)	0.0000
family member	664 (12.10)	427 (11.75)	237 (12.79)	
other	415 (7.56)	307 (8.45)	108 (5.83)	
unidentified	2,958 (53.91)	1,883 (51.82)	1,075 (58.01)	

Vaginal bleeding in early pregnancy is most commonly associated with miscarriage [3–10]. There are numerous risk factors for miscarriage, including advanced age, history of miscarriage, substance use, patient's abnormally low or high body weight, history of preterm birth, history of stillbirth, history of Caesarean section, and gestational diabetes in a previous pregnancy [23–27]. The findings of the current study show that early pregnancy bleeding was identified in most of the cases studied.

Singh et al. (2018) studied the use of emergency medical services by pregnant women in two states in India. They found that approximately one in three of the women studied had a high-risk pregnancy or pregnancy complications [28]. Bills et al. (2018) published a study on decreases in the early neonatal mortality rate in India in the context of EMS use by pregnant women. Most newborns included in the analysis had been born to mothers living in rural areas. At the time of the first EMS call, most pregnant patients were at term. The most common reasons for the call were abdominal pain and spasm, followed by rupture of membranes, contractions, and vaginal bleeding [29]. Findings similar to those by Bills et al. (2018) [29] were reported by Singh et al. (2017) in their study on pregnant women transferred to healthcare centres by emergency medical services in five states in India [30]. Another study on the characteristics of women using EMS in India due to pregnancy-related problems in the third trimester was performed by Strehlow et al. (2016). The authors found that women from rural areas were more likely to use EMS [31]. The current findings are consistent with those cited above, as in Poland EMS teams were also more commonly dispatched to pregnant women from rural areas who were pregnant for the second or subsequent time, in the second or third trimester, with antepartum bleeding, and who had previously given birth.

In the literature, multiple authors have focused on the specific characteristics of EMS interventions for different health problems and hazards, as emphasize, e.g. by Cantwell et al. (2016), Faramand et al. (2019), Ramgopal et al. (2019) and Javaudin et al. (2019) [32–35]. A similar analysis was performed in the current study. Rzońca et al. (2019) compared HEMS missions carried out in Poland and demonstrated that HEMS teams were dispatched most often in the period May–August [37]. Another study by Rzońca et al. (2019) included an analysis of HEMS missions in rural areas over an 8-year period, and found that most such HEMS missions in rural areas occurred in the summer [38]. The current study demonstrated that in cases of vaginal bleeding in pregnant patients from rural areas, EMS teams were more often dispatched in the summer, between 19:00–06:59, with urgency code 1. Strehlow et al. (2016) demonstrated that the time between the call and transfer to hospital was longer in cases of pregnant patients from rural areas, compared to those from urban areas [31], which is also corroborated by the presented findings.

An interesting study on emergency response in cases of non-hospitalized patients at the University of Pennsylvania hospital in the USA was performed by Dechert et al. (2013). The authors found that the subjects, including outpatients, visitors, and hospital staff, were most commonly given oxygen and intravenous fluids [39]. Strehlow et al. (2016) also reported that EMS team members almost always measured the pregnant patients' heart rate and blood pressure, and placed them in the left lateral position [31]. Rzońca et al.

(2019) found that HEMS missions in rural areas more often involved mechanical ventilation, patient immobilization, intravenous cannulation, chest compressions, and endotracheal intubation [37]. In the current study, EMS interventions in rural areas for pregnant patients with vaginal bleeding most commonly included the following procedures: blood pressure measurement, monitoring of vital parameters, intravenous cannulation, and blood glucose measurement.

The presented study is the first Polish analysis of all calls registered by the National Monitoring Centre of Emergency Medical Services in 2018–2019, which constitutes its strength, as it has allowed for developing a credible characterization of EMS interventions in cases of women with bleeding during pregnancy. However, the presented study also has certain limitations. The analysis only included information contained in the EMS documentation, with no data on subsequent patient management, patient health, or obstetric outcome. These limitations do not, however, impair the quality of the study. Notably, the study addresses the important issue of differences between rural and urban areas in terms of the health problems experienced and care received (in this case, from EMS teams in Poland) by women during pregnancy. The findings indicate the need for more health promotion efforts focused on pregnant women. Further studies on the health problems of pregnant patients are warranted to provide a better understanding of the subject, and ensure that the best possible care is provided to these patients by EMS teams.

## CONCLUSIONS

EMS teams are a key component in the pre-hospital care system, providing on-scene assistance to patients, including pregnant women, with various health emergencies. EMS teams were most commonly dispatched to pregnant patients with vaginal bleeding who were aged 30–34, pregnant for the first time, in the first trimester, with early pregnancy bleeding.

Location (urban vs. rural) differentiated EMS team calls to pregnant women with vaginal bleeding in terms of the woman's age, number of past pregnancies and births, trimester, gestational week, type of bleeding, time of the year, time of call, urgency code, EMS team composition, time between receipt of the call, and patient hand-over at the hospital, caller, and selected emergency medical procedures performed.

EMS teams in Poland responding to calls from rural areas regarding pregnant women with vaginal bleeding were most commonly dispatched in the summer, with urgency code 1, and the mean time between receipt of the call and patient hand-over at the hospital was longer than in the case of calls from urban areas. Compared to patients with vaginal bleeding during pregnancy calling from urban areas, those from rural areas were also more likely to be pregnant for the second or subsequent time, in the second or third trimester, to have antepartum bleeding, and to have previously given birth.

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