

Demographic conditioning of awareness of prophylaxis against *Streptococcus agalactiae* (GBS) infections among parturients

*Demograficzne uwarunkowania świadomości w zakresie profilaktyki przeciw zakażeniom *Streptococcus agalactiae* (GBS) u rodzących kobiet*

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Medical Studies/Studia Medyczne 2016; 32 (3): 170–178

DOI: 10.5114/ms.2016.62307

Key words: pregnancy, awareness, *Streptococcus agalactiae*, prophylaxis.

Słowa kluczowe: ciąża, świadomość, *Streptococcus agalactiae*, profilaktyka.

Abstract

Introduction: Infection with *Streptococcus agalactiae* (group B *Streptococcus* – GBS) is a frequent cause of serious complications in the neonatal period. Circa 10–30% of pregnant women are carriers of this streptococcus. Current prophylaxis of GBS infections is an elementary way of defining whether there is a risk of the child's infection. The achieved research result determines further perinatal proceedings.

Aim of the research: To determine how such factors as age, residence, education, and current women's parity influence their awareness concerning prophylaxis of infections with *Streptococcus agalactiae*. The research also analysed women's knowledge of threats to their health related to the presence of GBS infections.

Material and methods: Analysis of 164 author's questionnaires completed by women giving birth at the labour ward in the early delivery stage. The results were analysed in view of statistical accordance of measurable qualities by means of χ^2 test. For statistical conclusions, the significance level of $p < 0.05$ was adopted.

Results and conclusions: Older pregnant women in comparison with the younger ones more frequently realise the importance of the GBS prophylaxis. Women from the urban environment have greater awareness of the GBS prophylaxis than women from the rural environment. An increase in the level of education is related to an increase in the GBS prophylaxis awareness. Women in their first pregnancy have a greater knowledge of the standards of pregnancy proceedings connected with GBS than women who have already given birth to a child.

Streszczenie

Wprowadzenie: Zakażenie *Streptococcus agalactiae* (group B *Streptococcus* – GBS) jest częstą przyczyną poważnych powikłań okresu noworodkowego. Około 10–30% kobiet ciężarnych jest nosicielkami tego paciorkowca. Obecnie obowiązująca profilaktyka zakażeń GBS stanowi podstawowy sposób określenia, czy istnieje ryzyko zakażenia dziecka. Wynik badania determinuje dalsze postępowanie okołoporodowe.

Cel pracy: Określenie, w jaki sposób takie czynniki, jak wiek, miejsce zamieszkania, wykształcenie oraz dotychczasowa rodność kobiet, wpływają na ich świadomość w zakresie profilaktyki zakażeń *S. agalactiae*. Przeanalizowanie wiedzy kobiet na temat zagrożeń dla ich stanu zdrowia związanych z obecnością infekcji GBS.

Materiał i metody: Analiza 164 autorskich ankiet wypełnianych przez rodzące w sali porodowej we wczesnym okresie porodu. Wyniki poddano analizie statystycznej zgodności cech mierzalnych za pomocą testu χ^2 . Dla wnioskowania statystycznego przyjęto poziom istotności $p < 0,05$.

Wyniki i wnioski: Większość kobiet w ciąży nie zdaje sobie sprawy z konsekwencji infekcji GBS zarówno dla nich samych, jak i noworodków. Starsze ciężarne w porównaniu z młodszymi częściej uświadamiają sobie znaczenie profilaktyki przeciwko GBS. Kobiety ze środowiska miejskiego mają większą świadomość profilaktyki przeciw GBS niż kobiety ze środowiska wiejskiego. Wzrost poziomu wykształcenia wiąże się ze wzrostem świadomości w zakresie profilaktyki zakażeń GBS. Większą wiedzę na temat standardów postępowania w ciąży związanych z GBS mają kobiety będące w ciąży po raz pierwszy w stosunku do kobiet, które rodzą kolejny raz.

Introduction

Infections with Gram-positive *Streptococcus agalactiae*, group B *Streptococcus* (GBS) play a key role in delivery-related complications, which were reported as early as in the 1930s and further defined in the 1970s century [1, 2]. According to the epidemiological data from the United States and Great Britain, GBS is responsible for 40–50% of neonatal period complications [3, 4]. Depending on the structure of a polysaccharide capsule, nine GBS serotypes can be distinguished, of which the most dangerous for the newborn are: Ia, Ib, III, and V [5].

Streptococcus agalactiae mainly have their source in humans and cattle. They are mostly asymptomatic colonisation of a temporary, periodic, or chronic in nature, mainly affecting the digestive tract and genitourinary system, and are found in 10–30% of pregnant women. Endogenic factors such as age, hormone concentration, systemic disorders, pregnancy, and lowered content of glycogen in the vaginal secretion have an impact on the GBS colonisation. Pregnant women are especially susceptible to infections caused by *S. agalactiae* because during pregnancy, due to inter alia a high concentration of estradiol, accumulation of glycogen in epithelium cells of the final section of the reproductive organ and an increase in the vaginal pH reaction favour the multiplication of these microorganisms [6]. If the phenomenon of GBS colonisation occurs in the first pregnancy, then its return in any subsequent pregnancy is highly probable [7]. In spite of a mostly asymptomatic course of infection in a pregnant woman, some of them may experience pregnancy and puerperium complications in the form of a premature rupture of the amniotic sac, premature birth, urinary system infection, birth-related fever, and puerperal inflammation of the endometrium [8, 9].

According to current reports, the risk of transfer of GBS between the mother and the foetus is up to 70% [10]. The foetus is infected during delivery or even earlier, when bacteria penetrate the foetal membranes. Caesarean section does not exclude the risk of infecting the newborn [11]. The literature specifies that complications occur in 85% of GBS-infected newborns in the first week after birth. These are mainly pneumonia, cerebrospinal meningitis, osteitis, otitis media, and umbilical cord inflammation. Early-onset sepsis poses the greatest threat to life because its mortality is up to 50% [12, 13].

In 1996 the Center for Disease Control and Prevention (CDC) in the United States published a report on the standards and recommendations concerning prevention of perinatal infections caused by *S. agalactiae*. The guidelines were modified in 2002. The latest modification from 2010 standardises laboratory methods aimed at detecting GBS specifies a dose of prophylactic antibiotic therapy and formulates recommendations concerning the procedure for dealing

with infection-endangered newborns born at term and prematurely [14–16]. Since 2008 the Polish Gynaecological Association has been recommending collection of a microbiological vaginal and rectal swab from every pregnant woman in the 35th–37th gestation weeks. A positive test result constitutes a recommendation for applying an intravenous antibiotic intrapartum therapy (at least four hours before the delivery), which must also be implemented in case of finding one of the following risk factors in a woman: delivery before 37th week (when no GBS screening test has been made), body temperature during delivery equal to or over 38°C, time over 18 h from the rupture of the amniotic sac, when a perinatal *S. agalactiae* disease occurred in children from the patient's previous pregnancies, and also in the case of GBS antibiotic eradication from the woman's genitourinary system in the course of the pregnancy, due to the frequent appearance of a phenomenon of re-colonisation after the completion of antibiotic therapy [10].

Aim of the research

The aim of the research was to determine how factors such as age, place of residence, education, and current women's parity influence their awareness concerning prophylaxis of infections with *S. agalactiae*. The research also analysed women's knowledge of threats to their health related to the presence of GBS infections.

Material and methods

The research material was based on the analysis of 164 author's questionnaires completed by women giving birth at the labour ward in the early delivery stage. Parturients were surveyed in the Świętokrzyskie Centre for Mothers and Newborns in Kielce after having been informed of the aims of the research, the method of giving answers, and upon receiving consent of the surveyed women. Participation in the research was anonymous. The criteria of inclusion in the research were pregnancy with no complications and delivery in accordance with the schedule. The surveyed patients were selected at random. For quantitative traits the arithmetic mean was calculated, and for qualitative traits – their percentage and quantitative distribution. The results were analysed in view of statistical accordance of measurable qualities by means of χ^2 test. For statistical conclusions, the significance level of $p < 0.05$ was adopted.

Results

The average age of the surveyed was 27.9 years, the most women i.e. 43.3% were aged from 26 to 30 years. A slightly smaller group (32.9%) was aged over 30 years. The range from 21 to 25 years covered 20.1% of the surveyed, whereas only 3.7% of women were

Table 1. Description of parturients

Description of parturients		Surveyed group n = 164
Age	< 20	3.7% (6)
	21–25	20.1% (33)
	26–30	43.3% (71)
	> 30	32.9% (54)
Average age of parturients		27.96
Place of residence	City	54.3% (89)
	Country	45.7% (75)
Education of parturients	Elementary	3.7% (6)
	Vocational	9.1% (15)
	Secondary	31.1% (51)
	Higher	56.1% (92)
Parity	Primiparas	40.2% (66)
	Multiparas	59.8% (98)
Have you done a GBS test in this pregnancy?	Yes	81.7% (134)
	35 th –37 th gestation week	69.6% (94)
	Admissions room	29.6% (40)
	No	18.3% (30)
Are you aware of the nature of a GBS test?	Yes	67.1% (110)
	No	32.9% (54)
Have you obtained any information from your doctor about the necessity of doing a GBS test?	Yes	74.4% (122)
	No	25.6% (42)
Are you aware that GBS disease prophylaxis is recommended?	Yes	12.2% (20)
	No	87.8% (144)
Do you know that GBS disease may cause serious complications in a newborn baby?	Yes	25.0% (41)
	No	75.0% (123)
Do you know that GBS disease may cause serious complications in a pregnant woman?	Yes	29.3% (48)
	No	70.7% (116)

under 20 years old. Over half of the surveyed (54.3%) live in the city while the remaining part (45.7%) lived in rural areas. Parturients in over half – (56.1%) had higher education, 31.1% had a secondary education, 9.1% vocational, and only 3.7% elementary. 59.8% of the surveyed women were multiparas, and for the remaining part (40.2%) it was their first childbirth. Among all parturients 81.7% were certain that they had undergone a GBS test during pregnancy, and in this group in case of 69.6% the test took place between 35 and 37th gestation weeks, and in the case of 29.6% in the admissions room while being admitted to hospital. Only 18.3% were not aware of the conducted *Streptococcus agalactiae* presence test. A clear majority of the respondents – 67.1% vs. 32.9% – had general knowledge of this test. In the course of pregnancy 74.4% women received information from their doctor on the necessity of making a GBS screening test. Every fourth parturient (25.6%) stated that they had not received such information from the obstetrician. Only 12.2% vs. 87.8% of the women were aware that GBS disease prophylaxis in Poland is recommended. Every fourth parturient (25%) knew that the GBS infection in the mother could result in complications during the neonatal period in a newborn child. As many as 75% of the respondents did not have that awareness whereas every third woman (29.3%) was aware that GBS could also be dangerous to herself (Table 1).

The data in Table 2 show in detail the interrelation between the age of the surveyed women and their awareness of GBS disease prophylaxis. The percentage of women who were aware that they had undergone a GBS test was the highest, though insignificant statistically ($p > 0.05$), in the 26–30 age group (87.3%). The results of parturients' self-evaluation of their knowledge of the nature of the GBS test proved to be statistically significant. This knowledge was mostly shared by women aged between 26 and 30 years (78.9%). The next group included respondents aged between 21 and 25 years old (63.6%), aged over 31 years (55.6%), and finally the group of the youngest women giving birth (50%). Information from the doctor supervising the pregnancy on the necessity of taking a GBS test was received by the majority of parturients in the 26–30 age bracket (83.1%). An equal percentage in this respect (72.7%) was achieved by the groups of patients in the 21–25 age bracket and aged over 31 years. No such information was given by the doctor to women aged under 20 years. The χ^2 test showed the statistical significance of the achieved results ($p < 0.05$). The oldest surveyed parturients (16.7%) made up the largest group aware of the recommended GBS disease prophylaxis. The respondents aged 26–30 years (11.3%) formed a slightly smaller group, and those aged 21–25 years (9.1%) even smaller. The youngest women, as mentioned previously, did not know of such actions at all. Not many women were aware that infection with

Table 2. Parturients' awareness of the GBS prophylaxis versus their age

Age		< 20		21–25		26–30		> 30		P-value
		n	%	n	%	n	%	n	%	
Have you done a GBS test in this pregnancy?	Yes	3	50.0	27	81.8	62	87.3	42	77.8	> 0.05
	No	3	50.0	6	18.2	9	12.7	12	22.2	
Are you aware of the nature of a GBS test?	Yes	3	50.0	21	63.6	56	78.9	30	55.6	< 0.05
	No	3	50.0	12	36.4	15	21.1	24	44.4	
Have you obtained any information from your doctor about the necessity of doing a GBS test?	Yes	0	0.0	24	72.7	59	83.1	39	72.2	< 0.05
	No	6	100.0	9	27.3	12	16.9	15	27.8	
Are you aware that a GBS disease prophylaxis is recommended?	Yes	0	0.0	3	9.1	8	11.3	9	16.7	> 0.05
	No	6	100.0	30	90.9	63	88.7	45	83.3	
Do you know that GBS disease may cause serious complications in a newborn baby?	Yes	0	0.0	7	21.2	15	21.1	19	35.2	> 0.05
	No	6	100.0	26	78.8	56	78.9	35	64.8	
Do you know that GBS disease may cause serious complications in a pregnant woman?	Yes	1	16.7	5	15.2	21	29.6	21	38.9	> 0.05
	No	5	83.3	28	84.8	50	70.4	33	61.1	

Streptococcus agalactiae in pregnant women may cause complications in the neonatal period. Women aged over 31 years made up the largest group (35.2%). Every fifth respondent aged 21–25 years (21.2) and aged 26–30 years (21.1%) was aware of such complications. As in the previous case, the youngest women had no knowledge of possible occurrence of disorders in a newborn baby that could be related to the GBS presence in the mother. Knowledge of the risk of complications in a pregnant woman with a positive GBS test was shared by 38.9% of the oldest parturients, 29.6% of parturients aged 26–30 years, 16.7% aged under 20 years, and 15.2% of women in the 21–25 age bracket. However, the above results were not statistically significant ($p > 0.05$).

The predominant majority of the surveyed women, both city-dwellers and villagers, were aware that during the pregnancy material for the *S. agalactiae* presence test was collected from them. Furthermore, parturients from the city – although with statistically insignificant results ($p > 0.05$) – were more aware of this than parturients from the country (86.5% vs. 76.0%, respectively). The identical group of city-dwellers was aware of the nature of this test in comparison with the half-size smaller group of villagers (44.0%). This interrelation turned out to be statistically significant ($p < 0.05$), similarly to the information from the pregnancy-supervising doctor on the necessity of doing a GBS test, which was obtained by 83.1% of the surveyed city-dwellers and 64% of the villagers. A similar, very small group, both from the city and the country (12.4% vs. 12.0%, respectively) was

aware of the recommended GBS prophylaxis during pregnancy. Nearly every fourth woman, regardless of the place of living (city – 25.8%, country – 24%), was aware that the infection with *S. agalactiae* may cause complications in a newborn's state of health, and 31.5% of parturients from the city and 26.7% from the country associated a GBS disease with the possibility of pathology occurring in herself. However, the above results were not statistically significant ($p > 0.05$). Table 3 illustrates in detail the results of the dependence of parturients' awareness of GBS prophylaxis on the place of living.

In the case of comparison of respondents' education with the surveyed points, each of them presents differences that are statistically significant ($p < 0.05$). During pregnancy a GBS test was conducted in the majority of women with a secondary level (88.2%), followed by women with higher education (83.7%), vocational education (60%), and elementary education (50%). Higher education was linked to knowledge of the nature of a GBS test in the case of 80.4% of respondents. Women with secondary education had such knowledge in 64% of cases whereas those with an elementary education made up only 50%. Respondents with vocational education were not aware of the nature of a GBS test. Information from the pregnancy-supervising doctor on the necessity of doing a GBS test was received by the majority of women with higher education (83.7%), followed by women with secondary education (70.6%), then elementary (50%), and vocational (40%). A small number of all the surveyed were aware of the recommended GBS prophylaxis

Table 3. Parturients' awareness of the GBS prophylaxis versus their place of residence

Place of residence		City		Country		P-value
		n	%	n	%	
Have you done a GBS test in this pregnancy?	Yes	77	86.5	57	76.0	> 0.05
	No	12	13.5	18	24.0	
Are you aware of the nature of a GBS test?	Yes	77	86.5	33	44.0	< 0.05
	No	12	13.5	42	56.0	
Have you obtained any information from your doctor about the necessity of doing a GBS test?	Yes	74	83.1	48	64.0	< 0.05
	No	15	16.9	27	36.0	
Are you aware that a GBS disease prophylaxis is recommended?	Yes	11	12.4	9	12.0	> 0.05
	No	78	87.6	66	88.0	
Do you know that GBS disease may cause serious complications in a newborn baby?	Yes	23	25.8	18	24.0	> 0.05
	No	66	74.2	57	76.0	
Do you know that GBS disease may cause serious complications in a pregnant woman?	Yes	28	31.5	20	26.7	> 0.05
	No	61	68.5	55	73.3	

during pregnancy. This group included only 18.5% of parturients with higher education and 5.9% with secondary education. Similarly, only a small group of the surveyed were aware of the risk of complications in a newborn baby related to a streptococcus infection. In this group, women with higher and secondary education also dominated (31.5% and 23.5%, respectively). Awareness of the risk of complications caused by GBS in a pregnant woman was greatest, the same as earlier, among the highest educated (40.2%), then in every fifth woman who finished secondary school (19.6%) and only in 6.7% of women with vocational education. Detailed relationships of the researched phenomenon are presented in Table 4.

No statistical relationship ($p > 0.05$) was shown between the parturients' awareness concerning the GBS prophylaxis and the parity (Table 5). 86.4% of primiparas and 78.6% of multiparas had detailed knowledge of the GBS test conducted during their pregnancy. More primiparas (72.7%) in relation to multiparas (63.3%) were aware of the nature of a prophylactic test. Similarly, more primiparas than multiparas (77.3% and 72.4%, respectively) obtained information from their doctor on the necessity of doing a *S. agalactiae* presence test. Conversely, a small number of the surveyed, with the primiparas prevailing over the multiparas (13.6% and 11.2%, respectively) were aware of the recommended prophylactic anti-GBS procedure during pregnancy. Only a small number of the surveyed parturients were aware of the risk of complications occurring in a newborn baby caused by a GBS infection in the mother. In this case, multiparas (29.6%) predominated over primiparas (18.2%).

A similar percentage of primiparas (30.3%) and multiparas (28.6%) knew about the risk of complications in a mother related to a GBS disease.

Discussion

There are many publications on *S. agalactiae* and its importance in the aetiology of serious complications of the neonatal period as well as pregnancy complications. However, not much is known about the recognition of this problem by women themselves. The tests presented in this paper analyse their knowledge and experience relative to their demographic factors.

In accordance with the presented results, 18.3% of all patients of the Świętokrzyskie Centre for Mothers and Newborns in Kielce claimed that they had not undergone a GBS screening test. Although the women surveyed by us came out much better than the patients of the Gynaecology and Obstetrics Ward at the Clinical Hospital in Poznan where this percentage was considerably higher and amounted to 51%, this result is doubtful because, according to the procedure at the Kielce hospital, midwives are always obliged to collect a swab for a GBS test when a pregnant woman does not have a valid result [17]. Since a high percentage of respondents in our survey did not know the nature of this test, it is likely that women declaring no participation in it may not have known that a microbiological swab had been collected from them in view of the fact that every fourth parturient had not obtained from their doctor any information on the GBS prophylaxis. The survey proved a generally low awareness among women of the consequences of a GBS disease for them and their baby.

Table 4. Parturients' awareness of the GBS prophylaxis versus their education

Education		Elementary		Vocational		Secondary		Higher		P-value
		n	%	n	%	n	%	n	%	
Have you done a GBS test in this pregnancy?	Yes	3	50.0	9	60.0	45	88.2	77	83.7	< 0.05
	No	3	50.0	6	40.0	6	11.8	15	16.3	
Are you aware of the nature of a GBS test?	Yes	3	50.0	0	0.0	33	64.7	74	80.4	< 0.05
	No	3	50.0	15	100.0	18	35.3	18	19.6	
Have you obtained any information from your doctor about the necessity of doing a GBS test?	Yes	3	50.0	6	40.0	36	70.6	77	83.7	< 0.05
	No	3	50.0	9	60.0	15	29.4	15	16.3	
Are you aware that a GBS disease prophylaxis is recommended?	Yes	0	0.0	0	0.0	3	5.9	17	18.5	< 0.05
	No	6	100.0	15	100.0	48	94.1	75	81.5	
Do you know that GBS disease may cause serious complications in a newborn baby?	Yes	0	0.0	0	0.0	12	23.5	29	31.5	< 0.05
	No	6	100.0	15	100.0	39	76.5	63	68.5	
Do you know that GBS disease may cause serious complications in a pregnant woman?	Yes	0	0.0	1	6.7	10	19.6	37	40.2	< 0.05
	No	6	100.0	14	93.3	41	80.4	55	59.8	

Table 5. Parturients' awareness of the GBS prophylaxis versus the parity

Parity		Primiparas		Multiparas		P-value
		n	%	n	%	
Have you done a GBS test in this pregnancy?	Yes	57	86.4	77	78.6	> 0.05
	No	9	13.6	21	21.4	
Are you aware of the nature of a GBS test?	Yes	48	72.7	62	63.3	> 0.05
	No	18	27.3	36	36.7	
Have you obtained any information from your doctor about the necessity of doing a GBS test?	Yes	51	77.3	71	72.4	> 0.05
	No	15	22.7	27	27.6	
Are you aware that a GBS disease prophylaxis is recommended?	Yes	9	13.6	11	11.2	> 0.05
	No	57	86.4	87	88.8	
Do you know that GBS disease may cause serious complications in a newborn baby?	Yes	12	18.2	29	29.6	> 0.05
	No	54	81.8	69	70.4	
Do you know that GBS disease may cause serious complications in a pregnant woman?	Yes	20	30.3	28	28.6	> 0.05
	No	46	69.7	70	71.4	

Mc Quaid *et al.* compared knowledge acquired by women of child-bearing age on the importance for the pregnancy of bacteria causing pertussis, flu virus, and B group streptococcus (GBS). It turned out that as much as 63% of the surveyed – the biggest number in

relation to other answering options – had never heard about GBS, whereas only 28% had never heard about pertussis bacteria, and 40% about flu virus [18].

The consequences of infections were known to the greatest number of parturients aged over 31 years. It

looks optimistic because, as Kovavisarach *et al.* prove, the risk of colonisation with GBS bacteria increases with the age of a pregnant woman [19]. The youngest parturients, aged under 20 years, had the smallest store of knowledge. Thus it is necessary to focus closer attention on the youngest, inexperienced pregnant women in the matter of honest information on the consequences of GBS disease and an adequate prophylactic procedure.

Women from the urban environment were aware that they had undergone a prophylactic test far more frequently than women from the rural environment. They also knew what risk was carried by a GBS disease. Moreover, they received information from their doctor on streptococcus disease more frequently than those from the country. Therefore, the tests proved that the situation of pregnant woman in the country in the scope of education about the GBS prophylaxis is worse than the situation of their peers in the city. Women in the country are frequently limited by a small number of local surgeries and the necessity of going to bigger centres. This considerably reduces possibilities of choosing medical services. The country also suffers from the lack of childbirth schools where information on infections and prophylaxis should be given. These observations prove that standards of medical care in the urban and rural areas have not been levelled yet.

Women's awareness of methods of *S. agalactiae* disease prophylaxis and infection-related risk as well as possibilities of obtaining and using medical information in this matter is strongly dependent on the level of education. The higher the level of education the better results are received. Generally, over 80% of parturients with higher education were aware that they had undergone a GBS test. However, a small number of respondents with higher education, although still the largest of all groups, were aware of recommended standards of procedures against GBS. They also had low awareness of consequences of infections. The surveyed women turned out a little better than the women assessed by Cowgil *et al.* in a report for CDC from 2003. These results can be regarded as historical because they come from the period during which the standards of prophylaxis against *S. agalactiae* were introduced. However, they show that women's awareness of GBS has increased since that time. In 2003, 47% of the surveyed women at child-bearing age knew about GBS. According to the authors, respondents with a low level of education (the same as in our case) knew the least about group B streptococcus. In the same publication it was shown that the awareness of GBS in the group of pregnant women, i.e. the most interested group, amounted to 66% [20].

Analysing the interrelation between the parturients' awareness of GBS prophylaxis and the number of pregnancies, it is worth noting, surprisingly enough, that women in their first pregnancy turn out better

than those in their subsequent pregnancy. It may seem that women could have known the procedure against GBS in their previous pregnancy. However, the surveyed women were asked about the number of previous pregnancies, not the number of previous deliveries. A GBS test is done between the 35th and 37th gestation weeks, and part of these women may have miscarried. Furthermore, in view of the fact that in the surveyed group there were a considerable number of women aged over 30 years (about 33%), some of them could have given birth to children in the times when *Streptococcus agalactiae* disease prophylaxis was not commonly used. Cheng *et al.* and Turrentine *et al.* are of opinion that, if the phenomenon of GBS colonisation occurs in the first pregnancy, then its return in any subsequent pregnancy is highly probable [7, 21]. Nonetheless, as the tests show, it is the primiparas that more frequently did a GBS test (86.4%) and were more aware that it was obligatory (13.6%).

We should strive to increase awareness, among pregnant women and also among women planning a child, of the risk related to carrying non-diagnosed GBS. An aware woman cooperates better with doctors and midwives, and can also demand more from them. If a pregnant woman knows that she is GBS positive, she should know that she has to go to hospital earlier for delivery because the effectiveness of antibiotic therapy is dependent on the time of drug administration [22]. Moreover, the obstetricians' attention should be drawn to the importance of giving information about prophylactic tests. The problem of not informing pregnant women does not concern only our country. Funacao and Archi, analysing pregnant women's infections with group B streptococcus in Sao Paulo, Brazil, in 2013, found that 23.3% of women had not done a GBS screening test – as they claimed – due to not being informed, whereas 26.1% of those who had such a test done were of the opinion that they had not been informed of the procedure and the importance of GBS prophylaxis [23]. According to Darbyshire *et al.*, pregnant women when asked about the source of information on group B streptococcus most frequently mentioned friends and family members [24].

Parents should be informed on *Streptococcus agalactiae* prophylaxis in the early stage of the pregnancy. Such information should be available in preconception clinics run by doctors and midwives and designated for couples who plan to have babies. Childbirth schools should also include GBS in their programs. Midwives, as Plumb *et al.* claim, due to their knowledge, skills, interpersonal skills, and frequent contacts with pregnant women, have excellent possibilities of conducting educational activities related to prevention of GBS infection consequences [25, 26].

In 2014 Maclaughlin *et al.* conducted a research project that aimed to improve the effectiveness of prophylaxis against GBS infections. A message about

GBS testing was placed on the website for making medical appointments. Primary care doctors were also trained, and presentations for pregnant women were organised. As a result of the program, pregnant women's participation in screening tests increased from 69% to 84%, and the number of repeated tests decreased from 20% to 8% [27].

Some authors suggest GBS streptococcus testing by pregnant women themselves by means of a commonly-available test. They underline that the sensitivity of such a test, carried out independently, but after having been trained by a midwife or a doctor, can be compared to the sensitivity of a test conducted by medical staff. However, as the authors claim, only 29% of pregnant women are willing to carry out that test themselves [28].

There are more and more publications on GBS vaccination. Vaccinations are to cover future mothers as well as other people exposed to infections because they are rising among old people, diabetics, carcinoma patients, and among post-surgery patients. Infected patients suffer from ulcerations, osteitis, urinary tract infections, peritonitis, and inflammation of soft tissues. Such a procedure would reduce antibiotic therapy, thereby it would contribute to reducing possible allergic reactions and decrease the risk of occurrence of bacteria resistant to antibiotics [29].

However, there are doubts as to the legitimacy of vaccinations, or rather the time of their administration as the vaccination of girls aged 12–15 years is proposed, which will make it possible to cover all potential pregnant women with prophylaxis. However, the effectiveness of the vaccine is 84% in the first year after the vaccination, up to 55% after the first year, and 35% 10 years after the vaccination [30]. At present women give birth to their first baby most frequently in the third decade of their life, so vaccination of teenage girls may not turn out to be fully effective. On the other hand, as a consequence of vaccinations in older age, teenage girls will not be covered by the program of vaccinations. Therefore, some authors propose a combination of GBS vaccination with the already-used prophylactic procedures recommended by CDC as the most effective in terms of health and costs [31].

Further research should be done in the field of combining different methods of prophylactic procedures, which will be the most effective from the point of view of elimination or reduction of effects of infection with *S. agalactiae*, bearing in mind that without an active cooperation on the part of pregnant women, no method will be effective enough. A positive relationship and good communication between the doctor and the patient is important [32]. Lack of proper education of pregnant women can have a negative effect on the prophylaxis against GBS, which is important for the foetus. Moreover, it can also cause abnormalities in pregnancy such as overweight or diabetes, which are so common nowadays [33].

Conclusions

Some of the women – patients of the Świętokrzyskie Centre for Mothers and Newborns in Kielce – are unaware of the importance of participation in prophylactic tests for *S. agalactiae*. A small number of pregnant women receive information from their doctor on the necessity of a GBS test. Most pregnant women are not aware of the consequences of a GBS infection, both for the mother and for the newborn. Older pregnant women in comparison with younger ones more often realise the importance of GBS prophylaxis. Women from an urban environment are more aware of GBS prophylaxis than women from a rural environment. An increase in the level of education is linked to an increase in awareness of the GBS prophylaxis. Primiparas have better knowledge of the standards of proceedings related to GBS during pregnancy than multiparas. Medical staff in the region of Kielce, who look after pregnant women, should put more stress on informing patients, especially those coming from a lower educational background and from the countryside, about the risk of infection with GBS during pregnancy.

Conflict of interest

The authors declare no conflict of interest.

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