

## Original Article

# The factors that influence compliance of prenatal examination and pregnancy outcome

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**Abstract:** Objective: This study aims to determine the influencing factors regarding compliance of pregnant women who receive prenatal examination and the influence on the outcome of the examination. Methods: A total of 218 pregnant women from the Obstetrics Department of the Second Affiliated Hospital of Guilin Medical College from August 2016 to August 2017 were enrolled, and were divided into control group ( $n=107$ , times of prenatal examination  $< 5$ ) and research group ( $n=111$ , times of prenatal examination  $\geq 5$ ) according to the times of prenatal examination. Clinical data, compliance on prenatal examination, related influencing factors and pregnancy outcome of all pregnant women were analyzed. Results: There was significant difference of the understanding of items and time of prenatal examination among pregnant women with different education backgrounds, registered residence and economic income levels ( $P < 0.05$ ). The compliance was significantly different due to diverse education period and family income ( $P < 0.05$ ). The frequency of prenatal examination in local pregnant women was significantly higher than that in migrant pregnant women ( $P < 0.05$ ). The incidence rates of cesarean section, placental abruption, premature birth, prolonged pregnancy, pregnancy-induced hypertension, placenta previa and postpartum hemorrhage in research group were significantly lower than those in control group ( $P < 0.05$ ). Conclusion: The compliance of pregnant women on prenatal examination is related to personal factors, family factors and social factors. These factors should be considered before clinical targeted interventions, so as to improve the pregnancy outcome and ensure the life health of both mother and infant.

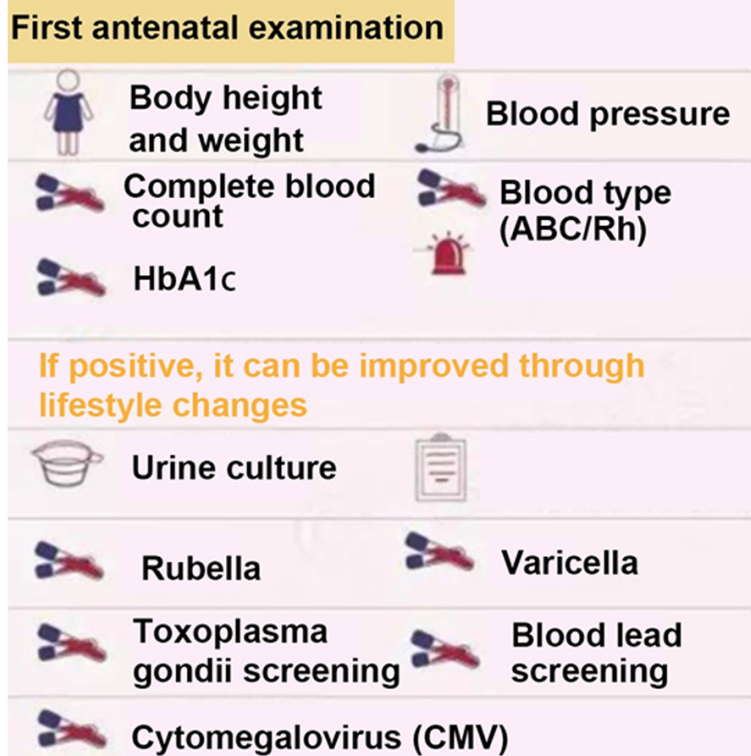
**Keywords:** Prenatal examination, compliance, pregnant women, influencing factors, pregnancy outcome

## Introduction

Prenatal examination represents an important means of monitoring of pregnant women and fetuses, and early detection and prevention of complications in clinical medicine, in order to provide a series of advice and measures about medical treatment and nursing for women during pregnancy as well as to reduce related adverse effects. The appropriate examination mode and medical advice for pregnant women during pregnancy can effectively lower the risk of maternal death and perinatal death [1, 2]. Previous study showed that the accurate prenatal examination facilitated identification of the specific conditions of pregnant women and fetuses in time, and determination of the pathological changes in pregnancy, which is conducive to the timely and effective treatment. Moreover, prenatal examination is an important

means of ensuring the health of pregnant women and fetuses, as well as one of the main measures to implement safe delivery [3]. Evidence revealed that the effective prenatal examination can significantly reduce the occurrence of pregnancy-related complications and adverse pregnancy outcomes, such as low-birth-weight infant and premature infant [4]. In recent years, with the development of social economy, constant social progress and changes in people's ideology, the coverage of prenatal examination has shown an increasing trend. However, the overall level is still low, and there are few women receiving prenatal examination for more than 5 times [5]. In this scenario, we analyzed the factors influencing compliance of pregnant women in prenatal examination and evaluated the impact of prenatal examination on pregnancy.

## First antenatal examination should take place at 6<sup>th</sup>/8<sup>th</sup> weeks or immediately after discovery of pregnancy



**Figure 1.** Initial prenatal examination (6-8 weeks). It includes physical and gynecological exams to identify and monitor the potential risk during pregnancy to prevent or lessen complications for mother and baby. High risk conditions contain high blood pressure, obesity, severe varicose veins, uterine size, pelvic size and diabetes.

## Materials and methods

### General materials

A total of 218 pregnant women from the Obstetrics Department of the Second Affiliated Hospital of Guilin Medical College from August 2016 to August 2017 were enrolled. The gestational periods were more than 37 weeks. They were 21-39 years old with an average age of  $28.6 \pm 3.1$ , including 118 cases aged  $\leq 30$  and 100 cases aged  $> 30$ . In terms of educational level, 117 cases attended primary and middle school or below (i.e., education year  $\leq 9$ ), and 101 cases attended high school and above (i.e., education year  $> 9$ ). In terms of registered residence, 123 were local citizens, and 95 were migrant workers. In 126 cases, the family income was less than 4500 yuan/month, while the income in 92 cases was more than 4500

yuan/month. Pregnant women were divided into control group ( $n=107$ , times of prenatal examination  $< 5$ ) and research group ( $n=111$ , times of prenatal examination  $\geq 5$ ) according to the times of prenatal examination.

### Survey of influencing factors

The questionnaire about the compliance on prenatal examination and its related influencing factors was adopted [6]. Under the condition that objects of study voluntarily accepted the survey, data including general data, understanding of prenatal examination, compliance on prenatal examination, and influencing factors were collected.

### Prenatal examination

All pregnant women received the prenatal examination according to relevant criteria for prenatal examination in the "Chinese Obstetrics and Gynecology" [7]. In particular, pregnant women received examination once before 12 gestational weeks, systematic

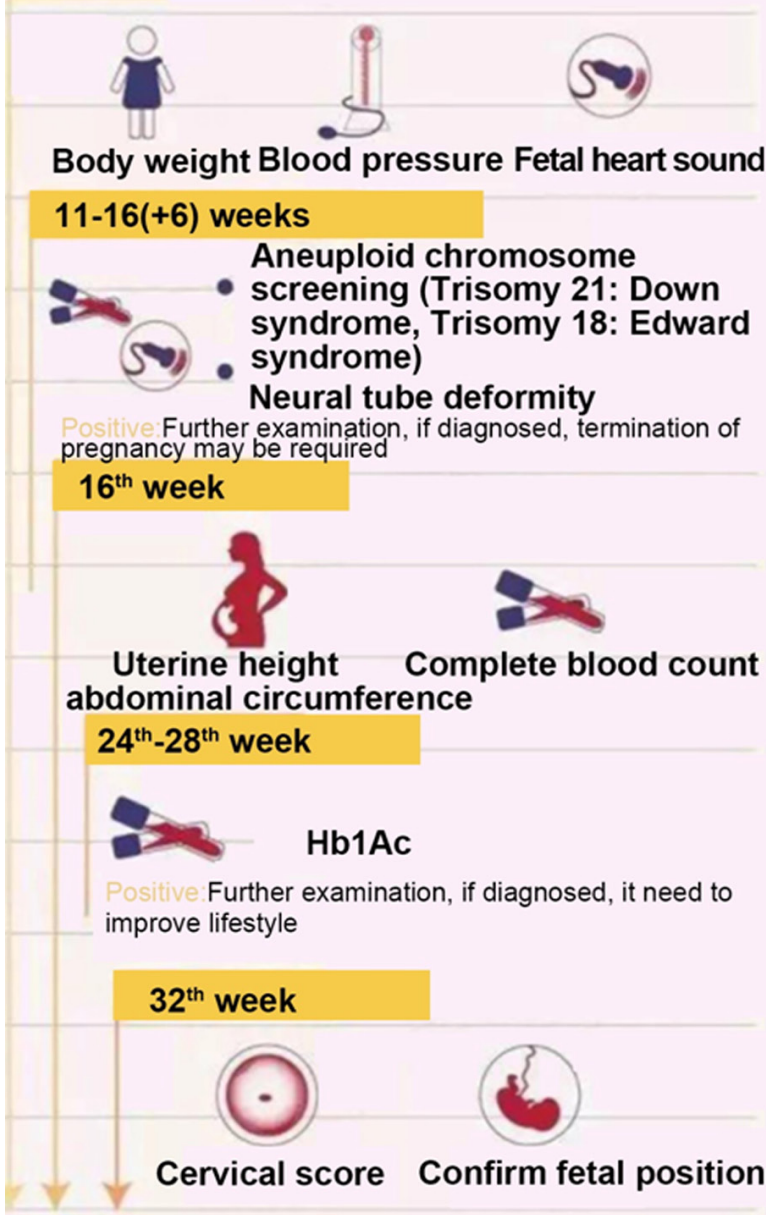
examination once every 4 weeks from 20 gestational weeks, examination once every 2 weeks after 32 gestational weeks, and examination once every week after 36 gestational weeks. The prenatal examination mainly included blood and urine routine tests, height, weight, abdominal circumference, fundal height, fetal heart rate monitoring and B-ultrasonic examination (Figures 1-4). The pregnancy outcomes, including cesarean section, placental abruption, premature delivery, prolonged pregnancy, pregnancy-induced hypertension, placenta previa and postpartum hemorrhage, were comparatively analyzed between the two groups.

### Statistical analysis

Statistical Product and Service Solutions (SPSS) 22.0 software was used for statistical analysis. Measurement data were presented as ( $\bar{x}$

## Subsequent prenatal examination, content varies according to gestational week

Since 10<sup>th</sup> week



**Figure 2.** Subsequent prenatal examination (more than 10 weeks). After first prenatal examination, subsequent prenatal examinations are performed, including to determine the body weight, blood pressure, fetal heart rate, examine aneuploid chromosome, screen Trisomy 21: Down syndrome, Trisomy 18: Edward syndrome, neural tube deformity, and identify uterine height, complete blood count, abdominal circumference, Hb1Ac, cervical score, fetal position, etc.

±s), and *t* test was performed. Enumeration data were presented as case (n) and proportion

(%), and chi-square test was performed.  $P < 0.05$  suggested that the difference was statistically significant.

### Results

*The understanding of prenatal examination in pregnant women*

There were no significant differences in the understanding of items, time and importance of prenatal examination among pregnant women between research and control groups ( $P > 0.05$ ). In addition, the importance of prenatal examination was valued among pregnant women with different age, education backgrounds, registered residence and economic income levels ( $P > 0.05$ ). However, the understanding of items and time of prenatal examination significantly varied among pregnant women with different education backgrounds, registered residence and economic income levels ( $P < 0.05$ ) (Table 1).

*Compliance of pregnant women with prenatal examination*

No statistical difference was found regarding the compliance of prenatal examination among pregnant women in different age groups ( $P > 0.05$ ). Nonetheless, the compliance in pregnant women with education year  $> 9$  years was significantly higher than that in pregnant women with education year  $\leq 9$  years ( $P < 0.05$ ). In terms of registered residence, the frequency of prenatal examination in local pregnant women was significantly

higher than that in migrant pregnant women ( $P < 0.05$ ). Besides, the compliance on prenatal





**Figure 3.** Fetal heart rate monitoring. The ultrasound device was used to monitor fetal heart rate and rhythm. Any heart-related changes may indicate signs that either the baby or the mom is at physical risk, which can prompt the doctor to take immediate action to restore the safety of the fetus and mother.



**Figure 4.** B-ultrasonic examination. B-examination is conducted to directly observe the baby's growth and development. Generally, 3 times of B-ultrasonic during pregnancy is permitted (18-20, 28-30, 37-40 weeks).

examination in pregnant women with monthly family income > 4500 yuan was significantly higher than that in pregnant women with monthly family income ≤ 4500 yuan (Tables 2, 3).

### *Influencing factors*

The compliance of pregnant women was associated with personal factors, family factors and social factors. Of note, there were apparent differences in elements of pregnancy risk factors, understanding of prenatal examination, working condition of husband, husband's support, service attitude of medical staff, advice of friends and relatives, and local medical conditions (Table 4).

### *Pregnancy outcome*

We compared the pregnancy outcome between research and control groups. The result showed that the incidence rates of cesarean section,

placental abruption, premature birth, prolonged pregnancy, pregnancy-induced hypertension, placenta previa and postpartum hemorrhage in research group were significantly lower than those in control group ( $P < 0.05$ ) (Table 5).

### **Discussion**

During pregnancy, women are often accompanied by physiological and pathological changes. If pregnant women do not receive formal prenatal examination in time, some of the gestational diseases may not be diagnosed in the hospital until parturition, resulting in missing the best opportunities of prevention and treatment, inducing adverse pregnancy outcomes, and damages to the health and safety of pregnant women and fetuses [8, 9]. The growth and development processes of fetuses in pregnant women are easily vulnerable to external factors, such as fetal anatomical and morphological deformities. The loss and abnormality of physiological function increase the risk of labor induction, and affect the life quality of pregnant women and their families. According to the analysis, the pathogenesis of fetal malformation is possibly related to genetic factors, external environmental factors, and maternal conditions, etc. [10]. In recent years, with the continuous development and improvement of ultrasonic diagnostic technique, the ultrasound has been gradually developed into an important diagnostic means for clinical monitoring of fetal growth, and screening of fetal malformation, which is mainly used to detect abnormalities of nervous system, cardiac structure, facial region, abdominal development and limb development, and other serious structural abnormalities. Therefore, the standardized ultrasonic examination plays a special important role in screening fetal malformation. Studies have manifested from the perspective of health economics that ultrasonic examination is generally not suitable for determining early pregnancy in the first trimester, but it should be performed immediately to confirm the pregnancy once threatened abortion and early pregnancy symptoms, such as ectopic pregnancy, trophoblastic diseases and abnormalities, occur [11]. The measurement of head-hip length of fetus is highly accurate before 12 gestational weeks, so ultrasonic examination can be avoided. After 12 gestational weeks, however, the fetus is prone to leaning and bending, and the measurement of head-hip length cannot meet the requirement of clinical examination, so ultra-

## Influencing factors of compliance on prenatal examination

**Table 1.** Understanding of prenatal examination in 218 pregnant women [n (%)]

General data		n	Lack of understanding the items of prenatal examination			Lack of understanding the time of prenatal examination			Prenatal examination is not important		
			n	$\chi^2$	P	n	$\chi^2$	P	n	$\chi^2$	P
Age (years old)	≤ 30	118	13 (11.0)	0.000	1.000	33 (28.0)	0.699	0.403	3 (2.5)	1.045	0.108
	> 30	100	11 (11.0)			23 (23.0)			0 (0.0)		
Education year (years)	≤ 9	117	24 (20.5)	23.281	0.000	41 (35.0)	12.892	0.000	3 (2.6)	1.076	0.105
	> 9	101	0 (0.0)			14 (13.9)			0 (0.0)		
Registered residence	Local	123	0 (0.0)	36.561	0.000	17 (13.8)	20.822	0.000	1 (0.8)	1.453	0.097
	Migrant	95	25 (26.3)			39 (41.1)			4 (4.2)		
Economic income (yuan/month)	≤ 3000	126	24 (19.0)	19.692	0.000	46 (36.5)	20.133	0.000	5 (4.0)	2.176	0.053
	> 3000	92	0 (0.0)			9 (9.8)			0 (0.0)		

## Influencing factors of compliance on prenatal examination

**Table 2.** Comparison of frequency in prenatal examination among pregnant women [n (%)]

General data		n	Not enough times of prenatal examination			Initial prenatal examination after 12 weeks		
			n	$\chi^2$	P	n	$\chi^2$	P
Age (years old)	≤ 30	118	65 (55.1)	2.202	0.138	52 (44.1)	0.572	0.450
	> 30	100	45 (45.0)			39 (39.0)		
Education year ( years )	≤ 9	117	93 (79.5)	58.812	0.000	65 (55.6)	21.218	0.000
	> 9	101	28 (27.7)			25 (24.8)		
Registered residence	Local	123	71 (57.7)	16.156	0.000	50 (40.7)	0.004	0.952
	Migrant	95	79 (83.2)			39 (41.1)		
Economic income (yuan/month)	≤ 3000	126	96 (76.2)	16.062	0.000	70 (55.6)	36.531	0.000
	> 3000	92	46 (50.0)			14 (15.2)		

**Table 3.** Comparison of compliance in prenatal examination among pregnant women [n (%)]

General data		n	Fail to finish prenatal examination			Fail to receive prenatal examination regularly		
			n	$\chi^2$	P	n	$\chi^2$	P
Age (years old)	≤ 30	118	63 (53.4)	0.691	0.406	52 (44.1)	0.337	0.562
	> 30	100	59 (59.0)			48 (48.0)		
Education year (years )	≤ 9	117	67 (57.3)	2.983	0.084	63 (53.8)	12.917	0.000
	> 9	101	46 (45.5)			30 (29.7)		
Registered residence	Local	123	65 (52.8)	1.468	0.0226	58 (47.2)	0.187	0.665
	Migrant	95	58 (61.1)			42 (44.2)		
Economic income (yuan/month)	≤ 3000	126	46 (36.5)	3.255	0.071	78 (61.9)	32.758	0.000
	> 3000	92	23 (25.0)			21 (22.8)		

**Table 4.** Factors that influence compliance of pregnant women in prenatal examination [n (%)]

Influencing factor		Yes	No
Personal factors	Working condition	118 (54.1)	100 (45.9)
	Have risk factors of pregnancy or not	191 (87.6)	27 (12.4)
	Parity	116 (53.2)	102 (46.8)
	Understanding of prenatal examination	133 (61.0)	85 (39.0)
	Receive prenatal education or not	111 (50.9)	107 (49.1)
Family factors	Working condition of husband	140 (64.2)	78 (35.8)
	Distance from home to hospital	98 (45.0)	120 (55.0)
	Supported by husband or not	156 (71.6)	62 (28.4)
	Emphasis of family on fetus	105 (48.2)	113 (51.8)
	Mode of medical payment	107 (49.1)	111 (50.9)
Social factors	Examination expenses	129 (59.2)	89 (40.8)
	Service attitude of medical staff	165 (75.6)	53 (24.3)
	Advice of friends and relatives	58 (26.6)	160 (73.4)
	Local medical conditions	156 (71.6)	62 (28.4)

sonic examination is required for induced labor [12]. The fetus in the first trimester basically possesses a more complete structure, and ultrasonic examination of fetal craniofacial and intracranial structures, neck, stomach, abdomi-

nal wall, umbilical cord, bladder and limbs can clearly display whether there are malformations, such as anencephaly, exencephaly, holoprosencephaly, spinal abnormality, encephalocele and limb deficiencies. Moreover, the char-

**Table 5.** Comparisons of pregnancy outcomes between the two groups of pregnant women [n (%)]

Group	Cesarean section	Placental abruption	Premature birth	Prolonged pregnancy	Pregnancy-induced hypertension	Placenta previa	Postpartum hemorrhage
Control group (n=107)	50 (46.7)	8 (7.5)	10 (9.3)	9 (8.4)	9 (8.4)	8 (7.5)	11 (10.3)
Research group (n=111)	26 (23.4)	1 (0.9)	3 (2.7)	2 (1.8)	1 (0.9)	1 (0.9)	3 (2.7)
$\chi^2$	13.031	4.407	4.288	4.967	4.750	4.407	5.206
<i>p</i>	0.000	0.015	0.038	0.026	0.012	0.015	0.023

acteristic “cocoon-like” changes in fetal edema can be diagnosed earlier by ultrasonic examination, thus determining whether there is fetal deformity, and avoiding increased damage to the body of pregnant women due to induced labor during the second trimester and third trimester [13]. Studies have demonstrated that strengthening the prenatal examination can directly have a positive impact on pregnancy outcomes at all stages of gestation period, and reduce the incidence of adverse pregnancy, which, therefore, is conducive to timely detection of risk factors and early implementation of intensive monitoring, so as to improve the health care quality of pregnant women in perinatal period, and ensure the maternal and fetal health.

According to results of this study, most pregnant women understood the prenatal examination well, which may be related to the active development of health education in schools and communities, thus improving pregnant women’s understanding of health care knowledge. However, some pregnant women had little understanding of prenatal examination, and there were significant differences in the understanding of knowledge related to prenatal examination among pregnant women with different educational levels, registered residence and family incomes. Highly-educated pregnant women had better understanding of prenatal examination than poorly-educated pregnant women, which is possibly due to the relevant limitation of intellectual level of poorly-educated pregnant women [14]. Moreover, the level of understanding of prenatal examination in local pregnant women with high family income was higher than that in migrant pregnant women with low family income, and the reason behind this is probably that migrant pregnant women with low family income are mostly workers with hard living conditions. It is difficult for them to obtain the knowledge of prenatal examination from multiple channels consequently, and they

cannot learn maternal health knowledge in formal pregnancy schools due to busy work [15]. At the same time, the compliance of pregnant women in prenatal examination was related to the educational level, registered residence and economic income of pregnant women, but had no significant correlation with the age of pregnant women. The compliance of pregnant women with high educational level on prenatal examination was higher than that of pregnant women with low educational level. The reason may be that pregnant women with high educational level have more understanding of knowledge related to prenatal examination and a stronger sense of prenatal examination. Pregnant women with high family income can afford relevant prenatal examination expenses, so they have higher compliance in prenatal examination [16]. In addition, migrant pregnant women are mostly workers with poor family conditions, and they have lower compliance in prenatal examination. The analysis of influencing factors of pregnant women’s compliance in prenatal examination demonstrated that personal factors had the most significant influences on pregnant women receiving prenatal examination. In terms of family factors, the compliance was correlated with the support from husband and working conditions, and most pregnant women believed that these factors had a certain influence on prenatal examination [17]. As for social factors, the majority of pregnant women thought that the service attitude of medical staff during prenatal examination, local medical conditions and relevant examination expenses had some impacts on prenatal examination [18], indicating that the influence on pregnant women’s prenatal examination is mostly related to personal factors, but family factors and social factors also have varying degrees of influence. It is required to perform targeted interventions based on relevant influencing factors and improve the prenatal examination rate, such as strengthening the publicity and education regarding prenatal

examination, improving the medical insurance system, changing the mode of prenatal examination, and raising the high-quality service awareness of medical staff, which is of great significance in ensuring the maternal and fetal health, and conducive to safe delivery [19]. According to results of this study, the pregnancy outcome of women in research group was superior to that in control group, suggesting that increasing the times of prenatal examination can significantly reduce the incidence of adverse pregnancy outcomes. The main reason is that prenatal examination at each stage during pregnancy can detect adverse pregnancy in time, and benefit the effective treatment as soon as possible, so that physicians can fully grasp the specific conditions of pregnant women and actively make emergency preparations to eliminate some dystocia factors, ensure the smooth fetal delivery and improve the pregnancy outcome [20].

## Conclusion

In conclusion, the compliance of pregnant women in prenatal examination is mostly related to personal factors, family factors and social factors. Therefore, targeted interventions should be actively performed after the influencing factors are determined. Especially, prenatal examination ought to be strengthened for pregnant women and the times of prenatal examination should be increased appropriately, so as to improve the pregnancy outcome and reduce the incidence of adverse pregnancy outcomes.

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## Disclosure of conflict of interest

None.

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