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Attendance of prenatal education course reduces caesarean section rate on maternal request: A questionnaire study in a tertiary women hospital in Shanghai, China

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Attendance of prenatal education course reduces caesarean section rate on maternal request: A questionnaire study in a tertiary women hospital in Shanghai, China

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Abstract

Objective: Caesarean section rate has significantly increased worldwide with China having a higher rate, including caesarean section on maternal request. In this study, we investigated the association between maternal characterises and caesarean section on maternal request.

Design: Questionnaire study

Setting: tertiary hospital in China

Sample: 564 questionnaires

Methods: On day 42 of post-partum, questionnaire data were collected. Data including age, parity, gravida, delivery mode, educational level, residence status, living condition and attendance of prenatal education course were analysed.

Primary and secondary outcome measures: Factors associated with caesarean section on maternal request.

Results: 46% of women were delivered by caesarean section on maternal request. Maternal age, residence status and attendance of prenatal education course were significantly associated with caesarean section on maternal request. The odds ratio of an increase in caesarean section on maternal request in women over 30 years was 2.42 (95%CL: 1.597, 3.666), compared to women under 30 years. 75% more women who reside in Shanghai had caesarean section on maternal request, compared to women who live outside of Shanghai. However, there was a significant reduction (35%) in the number of caesarean section on maternal request in women who attended a prenatal education course (p=0.029). There was no factor associated with attendance of prenatal education course.

Conclusion: Although maternal age increased the risk of caesarean section on maternal request, attendance of a prenatal education course significantly reduced this increased rate. Our data suggest that promotion of prenatal education course is very important in China to reduce the rate of caesarean section.

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Strengths and limitations of this study

1. Prenatal education course has not been performed in most of women's hospital in China.
2. This survey study was done in the largest women's hospital in China with more than 12,000 deliveries a year.
3. We found that attendance of a prenatal education course could affect the rate of caesarean section on maternal request.
4. Regional difference in China may also result in a bias.

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Key Words: caesarean section rate; prenatal education course; maternal request

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Introduction

The rate of caesarean section has significantly increased worldwide over the last decades (1). Caesarean section can result in a small overall increase in poor outcomes in women with low risk and typically takes longer to recover than vaginal birth. Caesarean section also increases the risk of infection and associated morbidity up to 20 folds in comparison to vaginal delivery (1). Therefore, World Health Organization (WHO) recommends that caesarean section should be performed only when there is a medical indication (WHO Statement on Caesarean Section Rate, 2015). Today globally, approximate 2.5% to 18% caesarean sections are carried out without any medical indication, dependent on the regions (1-3).

According to WHO report, China has a higher caesarean section rate in comparison to other countries. Previous studies reported that the caesarean section rate has significantly increased to 35% - 50% (regionally dependent) in China (4, 5) and the most recent caesarean section rate was approximately 46% in China (1). The predominant reason for this trend may be because the number of caesarean section on maternal request is increased since last decade in China (4, 5). Worldwide estimated caesarean section rate on maternal request was 10-20% among Northern Europe, the United States, Sweden and Australia (6-9). We previously reported in 2012 that the caesarean section rate on maternal request was about 10% in China (10), however a recent study reported the caesarean section rate on maternal request has significantly increased to 38% in China (11).

Fear and anxiety of childbirth as well as psychological stress during labour and birth appear to be the most important reasons for caesarean section on maternal request. About 5–40% of pregnant women fear childbirth in western countries (12, 13), and a recent study reported that Chinese pregnant women have moderate levels of childbirth fear and anxiety (14). In addition, failure of hospitals to support normal delivery including a birthing environment can result in maternal stress and anxiety during labour and birth (15). A satisfying birth environment can

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minimize maternal stress and anxiety during labour and birth and support physiologic birth (15). Furthermore, safety of the baby has become another main reason for caesarean section on maternal request in a large proportion of pregnant women (16). However, factors associated with caesarean section on maternal request may vary by the ethnicities. This is because the educational levels of pregnant women, prenatal care system, economic condition and performance of prenatal education course are different among countries and ethnicities. In addition, the ethical principles of medical practice are influenced by the patient-doctor relationship. To date, study about the association of maternal characterises or social environment and caesarean section on maternal request is limited. In this retrospective study we analysed the factors that are associated with caesarean section on maternal request in one of the largest tertiary hospital in Shanghai, China.

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Methods

This questionnaire study was performed in The Hospital of Obstetrics & Gynaecology of Fudan University, Shanghai, China from January 2017 to June 2017. This study was approved by the ethics board of The Hospital of Obstetrics & Gynaecology of Fudan University (Reference No. 2017-04).

Patient and Public Involvement

There was no patient and public involvement in this study.

Study design and participants

A total of 600 pregnant women with a live fetus at term at our hospital who came back for post-partum clinic at day 42 at our hospital were asked to complete a questionnaire. All these pregnant women had no maternal and fetal complications during pregnancy. All these women voluntarily completed the questionnaire. The questionnaire included basic maternal characteristics and postpartum care including breastfeeding as well as neonatal care information. Of them, 580 questionnaires were returned and after excluding 16 invalid questionnaires, 564 questionnaires were analysed in this study (Figure 1). In this study we analysed the first part of questionnaire: factors associated with caesarean section on maternal request. Basic maternal characteristics included maternal age, parity, gravida, delivery mode, maternal weight before pregnancy, educational level of mother, residence status (permanently reside in Shanghai or permanently live outside of Shanghai), living condition and attendance of prenatal education course. Living condition was referred as economic level.

The prenatal education course is designed as a free half-day intensive one by one course for pregnant women between 36 and 37 weeks of gestation in our hospital. The course is led and run by experienced or specialised midwives in our hospital. Course information focuses on

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supporting pregnant women to prepare for labour and normal births including the role of the father during labour and birth, labour coping skills and management of pain in order to avoid medical intervention during labour and birth.

The Hospital of Obstetrics & Gynaecology of Fudan University is one of the largest tertiary maternity hospitals with advanced prenatal care system and is located in Shanghai, a wealthy city in China. This consequently results in many women who live outside of Shanghai to come to give birth in our hospital. Our hospital has more than 12,000 deliveries a year.

Power of sample size

A sample size calculation was based on the estimated incidence of caesarean section (40%) in China (1) and at least 130 respondents were needed for a statistical power of 90% for each group to detect a significant difference between two groups at a level of 0.05 (two-tailed). We overenrolled to allow for attrition, section our final recruitment target at 600 women.

Statistical Analysis

The statistical difference in maternal age and maternal body weight before pregnancy between women with vaginal delivery and women with caesarean section was assessed with a Mann-Whitney U-test using the Prism software package. The statistical difference in parity, gravida, educational level, residence status, attendance of a prenatal education course between women with vaginal delivery and women with caesarean section was assessed with Chi-square test (or Fisher's exact test) using the Prism software package. The analysis in the rate of caesarean section on maternal request was assessed by odds ratio was analysed and 95% confidence limits (CL) using OpenEpi software. P-values of <0.05 were considered significant.

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Results:

The median maternal age was 32 years (ranging from 23 to 48 years). Of 564 women, 469 (83%) women were nulliparous and 304 (54%) women had a vaginal delivery and 260 (46%) women had a caesarean section on maternal request. The majority of women (97%) received a tertiary or above education and 448 (80%) women lived in Shanghai. Only 116 (20.6%) women attended the prenatal education course before delivery.

The demographic information of women with vaginal delivery and with caesarean section are summarised in Table 1. There was no statistical difference in parity, gravida, educational level and maternal weight before pregnancy between women with vaginal delivery and women with caesarean section (Table 1). However, the maternal age in women with caesarean section was statistically more significant than women with vaginal delivery (p=0.008, Table 1). In addition, women who reside in Shanghai had a significantly higher caesarean section rate, in comparison to women who live outside of Shanghai (p=0.005, Table 1). The odds ratio of an increase in caesarean section on maternal request in women who reside in Shanghai was 1.749 (95%CL: 1.14, 2.67, Table 3), compared to women who live outside of Shanghai. In addition, women who attended the prenatal education course had a significantly lower rate of caesarean section on maternal request, compared to women who did not attend to prenatal education course (p=0.045, Table 1). The odds ratio of a reduction in caesarean section on maternal request in women who attended to prenatal education course was 0.656 (95%CL: 0.432, 0.997, Table 3), compared to women who did not attend to prenatal education course.

To analyse the association of caesarean section on maternal request and age distribution, we then divided the maternal age into three groups (Table 2). We found that women between 30 to 39 years had the highest caesarean section rate (78%), compared to women between 20 to 29 years (15%) or women over 40 years (6.5%).

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We then analysed whether there is a difference in educational levels between women who reside in Shanghai and women who live outside of Shanghai. There was no statistical difference in tertiary or above level education between two groups (98% vs 93%).

We further analysed factors which affected pregnant women attending the prenatal education course (Table 4). There was no statistical difference in maternal age, educational level, residence status, parity and gravida between women who attended to prenatal education course and women who did not.

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Discussion

Main Findings

In this questionnaire study with a medium sample size, we found that maternal age, residence status and attendance of a prenatal education course could affect the rate of caesarean section on maternal request. In contrast, parity, gravida and maternal education level were not associated with rate of caesarean section on maternal request. In addition, there were no factors associated with attendance of the prenatal education course.

Strengths and Limitations

China has a highest caesarean section rate worldwide and approximate 40% of these cases did not have any medical indications for caesarean section. To reduce the caesarean section rate is a challenge to midwives and obstetricians. Prenatal education course have been shown many benefits to pregnant women in order to reduce fear and anxiety of childbirth as well as psychological stress during labour and birth. But whether it can reduce the rate of caesarean section on maternal request has not been fully investigated. In addition, prenatal education course has not been fully set up in most maternity hospitals in China. The Hospital of Obstetrics & Gynaecology of Fudan University is one of the largest tertiary and leading maternity hospitals with advanced prenatal care system in China.

There were some limitations in this study. First, this questionnaire study was done in a single tertiary women hospital in Shanghai. Second, our prenatal education course was not designed to reduce rates of obstetric intervention. This limitation must be taken into account about the association between prenatal education course and perinatal outcomes. In addition, regional difference in China may also result in a bias.

Interpretation

It has been reported that the caesarean section has doubled from 2003 to 2018 to reach 21%, and is increasing annually by 4% worldwide. The predominant reasons for this increased

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trend are unclear, but the increased caesarean section on maternal request could be one of the main reasons. China has highest caesarean section rate and the rate of caesarean section on maternal request has also significantly increased to 38% in China in 2017 (11). In our current study, the rate of caesarean section on maternal request was 46%. Due to limited resources of health care facilities, the birthing environment in China such as individual delivery room and family member support during labour and birth are not routine practice in China. These conditions could result in a fear of childbirth and increased psychological stress to pregnant women. In addition, the long term One Child Policy (around 40 years) which ended in October 2015 may contribute to this increase. This policy may change the philosophy of childbirth to pregnant women. As women can only give birth once, pregnant women including their family members did not consider the risks of a caesarean section on future pregnancies instead of only considering the safety of the baby (16).

It has been reported that caesarean section rate is associated with maternal age and women with advanced maternal age have the highest caesarean section rate (17). This could be because advanced maternal age is associated with a number of complications of pregnancy such as preeclampsia and gestational diabetes mellitus (GDM) (18). However, advanced maternal age is also associated with an increased risk of obstetric intervention including caesarean section (19-21) and obstetrics blood loss during labour and birth in low-risk pregnant women (22). These adverse outcomes during labour and birth could result in a fear to pregnant women with advanced maternal age. In our current study, we found that the rate of caesarean section on maternal request was significantly increased with maternal age and 85% pregnant women with age over 30 years had caesarean section on maternal request in all cases with caesarean section on maternal request. The odds ratio of an increase in caesarean section on maternal request in pregnant women over 30 years was 2.42 (95%CL: 1.597,

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3.666), compared to pregnant women under 30 years. In addition, pregnant women between 30-39 years had the highest rate of caesarean section on maternal request.

Prenatal education course is well performed in western countries for a long time but not in most maternity hospitals in China. The main purpose of a prenatal education course is to support pregnant women to prepare for labour and birth including pain management as well as care of newborn (23). The prevalence of attendance of prenatal education course was 33% in Canada (24) and 84% in nulliparous women in Australia (25). Because the prenatal education course is a new program in China and in our hospital (under 5 years), the prevalence of attendance of prenatal education course was only 20% in this study, which was significantly lower than western countries. However, in our current study we showed a significant reduction (35%) in the number of caesarean section on maternal request in pregnant women (n=116) who attended the prenatal education course. Other study reported that the prenatal education course increased the vaginal delivery rate (24). We further analysed the factors that are associated with attendance of a prenatal education course and found that maternal age, educational level, parity, gravida and residence status did not influence pregnant women attending a prenatal education course. Other studies have showed nulliparous or older pregnant women had higher attendance than multiparous or younger one (25). This higher attendance was also observed in pregnant women with higher income and higher education level (23, 25). The difference in these factors between our current study and other studies could be explained by the short duration of the prenatal education course in our hospital and it has not been strongly recommended yet, by midwife or obstetrician.

Interestingly in this study we found that women who reside in Shanghai had a higher rate of caesarean section on maternal request, compared to women who did not reside in Shanghai. We do not know the exact reason for this difference. We analysed the educational level between these two groups of women and found there was no difference in the educational

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level between two groups. However, we found the maternal age in women who reside in Shanghai was significantly older than women who did not reside in Shanghai by 1.2 years (p=0.006). As we discussed before, advanced maternal age is associated with an increased risk of obstetric intervention. This may be one of the causes for women who reside in Shanghai considering caesarean section. Another possible reason for this difference may be because Shanghai is a wealthy city in China and culturally women who reside in Shanghai traditionally trended to be more apprehensive, regarding most aspects of life, compared to women who live outside of Shanghai.

Conclusion

In this study, in low risk pregnant women we found that maternal age, residence status and attendance of prenatal education course were associated with caesarean section on maternal request. Attendance of a prenatal education course can significantly reduce caesarean section on maternal request. Our findings suggest that promotion of the prenatal education course is very important in China to reduce the caesarean section rate.

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Declaration of Interest

All authors have no conflict of interest to report.

Contribution to authorship:

All authors were involved in the drafting, editing and approval of the manuscript for publication. In addition to this, each author contributed to follow work:

YG, YT: collected the data reported in this work

MT, YD: contributed to conception and design of this study

YD, QC: designed study and wrote the manuscript draft

Ethics approval

This study was approved by the ethics board of The Hospital of Obstetrics & Gynaecology of Fudan University.

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Figure legend

Figure 1: Flow chart of data collection

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Table 1: General clinical parameters in study cohort according to the mode of delivery

	Vaginal delivery (n=304)	**caesarean section (n=260)**	**P-value**
Maternal age (years, median/range)	32 (24-48)	33 (23-45)	**P=0.008**
Parity (number, %)			
1 (n=469)	258 (55%)	211 (45%)	0.24
2 (n=95)	46 (48%)	49 (52%)	
Gravida (number, %)			
1 (n=415)	232 (56%)	183 (44%)	0.281
2 (n=122)	59 (48%)	63 (52%)	
≥3 (n=27)	13 (48%)	14 (52%)	
Education Level (number, row%)			
Under tertiary (n=18)	8 (44%)	10 (56%)	0.728
Under graduate (n=450)	244 (54%)	206 (46%)	
Post graduate (n=96)	52 (54%)	44 (46%)	
Residence (number, row%)			
Shanghai (n=448)	229 (51%)	219 (49%)	**P=0.009**
Non-Shanghai (n=116)	75 (64%)	41 (36%)	
maternal weight before pregnancy (kg, mean/SD)	55.28±7.76	55.36±8.98	P=0.902
Living conditions			
Own house (n=489)	255 (52%)	234 (48%)	0.0802
Rental house (n=25)	15 (60%)	10 (40%)	
Parent's house (n=45)	31 (68%)	14 (32%)	
Attendance of a prenatal education course (number, row%)			
Yes (n=116)	72 (62%)	44 (38%)	**P=0.045**
No (n=448)	232 (52%)	216 (48%)	

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Table 2: The association of age distribution and rate of caesarean section on maternal request

Age distribution	Women with caesarean section (n=260)	P value
20-29 years (number, %) (Lower CL, Upper CL)	39 (15%) (10.89%, 19.93%)	p<0.001
30-39 years (number, %) (Lower CL, Upper CL)	204 (78.5%) (72.96%, 83.3%)	
≥40 years (number, %) (Lower CL, Upper CL)	17 (6.5%) (3.85%, 10.26%)	

CL: confidence Limits

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Table 3: Odds ratio (OR) and 95% confidence limits (CL) for the effect of maternal age, residence and attendance of a prenatal education course on caesarean section rate

	Caesarean section	Vaginal delivery	OR	95%CL	P value
Maternal age (number, %)					
20-29 years (n=130)	39 (30%)	91 (70%)	2.392	1.57, 3.65	<0.0001
30-39 years (n=403)	204 (51%)	199 (49%)			
Maternal age (number, %)					
30-39 years (n=403)	204 (51%)	199 (49%)	0.844	0.41, 1.75	0.395
≥40 years (n=31)	17 (55%)	14 (45%)			
Maternal age (number, %)					
20-29 years (n=130)	39 (30%)	91 (70%)	2.833	1.27, 6.31	0.009
≥40 years (n=31)	17 (55%)	14 (45%)			
Residence status (number, %)					
Shanghai (n=448)	219 (84%)	229 (75%)	1.749	1.14, 2.67	0.005
Non-Shanghai (n=116)	41 (16%)	75 (25%)			
Attendance of a prenatal education course (number, %)					
Yes (n=116)	44 (38%)	72 (62%)	0.656	0.43, 0.99	0.029
No (n=448)	216 (48%)	232 (52%)			

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366 **Table 4: Factors associated with attendance of a prenatal education course**

	Attendance of prenatal education course		P value (Chi-square)
	Yes (n=116)	No (n=448)	
Maternal age distribution			
20-29 years (n=130)	24 (18.5%)	106 (81.5%)	0.708
30-39 years (n=403)	85 (21.2%)	318 (78.9%)	
≥40 years (n=31)	7 (22.6%)	24 (77.4%)	
Residence (number, %)			
Shanghai (n=448)	91 (20%)	357 (80%)	0.796
Non-Shanghai (n=116)	25 (22%)	91 (78%)	
Education level (number, %)			
Under tertiary (n=18)	2 (11%)	16 (89%)	0.328
Under graduate (n=450)	90 (20%)	360 (80%)	
Post graduate (n=96)	24 (25%)	72 (75%)	
Parity (number, %)			
1 (n=469)	103 (22%)	366 (78%)	0.071
2 (n=95)	13 (14%)	82 (86%)	
Gravida (number, %)			
1 (n=415)	91 (22%)	324 (78%)	0.297
2 (n=122)	22 (18%)	100 (82%)	
≥3 (n=27)	3 (11%)	24 (89%)	

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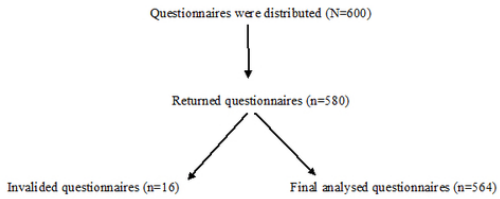
Figure 1



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Does attendance of a prenatal education course reduce rates of caesarean section on maternal request? A questionnaire study in a tertiary women hospital in Shanghai, China

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Does attendance of a prenatal education course reduce rates of caesarean section on maternal request? A questionnaire study in a tertiary women hospital in Shanghai, China

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Running title: Factors associated with caesarean section

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Abstract

Objective: Caesarean section rates have significantly increased worldwide. China has a caesarean rate of 46%, with a moderate contribution of caesarean section on maternal request. In this study, we investigated the association between maternal characteristics, attendance at a prenatal education course and caesarean section on maternal request.

Design: Questionnaire study

Setting: Tertiary hospital in China

Sample: 564 questionnaires

Methods: On post-partum day 42, questionnaire data were collected. Data including age, parity, gravida, delivery mode, educational level, residence status, living condition and attendance of prenatal education course were analysed.

Primary and secondary outcome measures: Factors associated with caesarean section on maternal request.

Results: 46% of women were delivered by caesarean section on maternal request. Maternal age and residence status were all significantly associated with having a caesarean section on maternal request. The odds ratio of an increase in caesarean section on maternal request in women over 30 years was 2.42 (95%CL: 1.597, 3.666), compared to women under 30 years. 75% more women who resided in Shanghai had caesarean section on maternal request, compared to women who resided outside of Shanghai. However, there was a significant reduction (35%) in the number of caesarean sections on maternal request in women who attended a prenatal education course (p=0.029). There was no significant association between attendance of a prenatal education course and the other maternal characteristics studied.

Conclusion: Maternal age is associated with an increased risk of caesarean section on maternal request. For women of all age, attendance of a prenatal education course significantly reduced the rate of caesarean section on maternal request. Our data suggest that

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promotion of a prenatal education course is an important tool in China to reduce the rate of caesarean section.

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Strengths and limitations of this study

1. Prenatal education courses are not performed in most women's hospital in China.
2. This survey study was done in the largest women's hospital in China with more than 12,000 deliveries a year.
3. We found that attendance of a prenatal education course could affect the rate of caesarean section on maternal request.
4. Regional difference in China may also result in a bias.

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Key Words: caesarean section rate; prenatal education course; maternal request

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Introduction

The rate of caesarean section has significantly increased worldwide over the last three decades (1). Caesarean section in low risk women can result in a small overall increase in poor outcomes and typically takes longer to recover from than vaginal birth. Caesarean section also increases the risk of infection and associated morbidity up to 20 folds in comparison to vaginal delivery (1). Therefore, the World Health Organization (WHO) recommends that caesarean section should be performed only when there is a medical indication (WHO Statement on Caesarean Section Rate, 2015). Today globally, approximate 2.5% to 18% of caesarean sections are carried out without any medical indication, dependent on the regions (1-3).

According to the WHO report, China has a higher caesarean section rate in comparison to other countries. Previous studies reported that the caesarean section rate has significantly increased to 35% - 50% (regionally dependent) in China (4, 5) and the most recent caesarean section rate was approximately 46% in China (1). The predominant reason for this trend may be an increase in the number of caesarean section on maternal request in the last decade (4, 5). Worldwide, the estimated rate of caesarean section on maternal request was 10-20% in Northern Europe, the United States, Sweden and Australia (6-9). We previously reported in 2012 that the rate of caesarean section on maternal request was about 10% (10). However a recent study reported the rate of caesarean section on maternal request has significantly increased to 38% in China (11).

Fear and anxiety of childbirth as well as psychological stress during labour and birth appear to be the most important reasons for caesarean section on maternal request. About 5–40% of pregnant women fear childbirth in western countries (12, 13), and a recent study reported that Chinese pregnant women have moderate levels of childbirth fear and anxiety (14). In addition, failure of hospitals to support normal delivery including a supportive birthing environment

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can result in maternal stress and anxiety during labour and birth (15). A satisfying birth environment can minimize maternal stress and anxiety during labour and birth and support physiologic birth (15). Finally, concerns about the safety of the baby have become another main reason for caesarean section on maternal request in a large proportion of pregnant women (16).

Globally, factors associated with caesarean section on maternal request may vary. Educational levels of pregnant women, prenatal care system, economic condition, the patient-doctor relationship and performance of prenatal education course are different among countries and ethnicities. To date, studies investigating the association of maternal characteristics or social environment and caesarean section on maternal request are limited. In this retrospective study, we analysed the factors that are associated with caesarean section on maternal request in one of the largest tertiary women hospitals in China.

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Methods

This questionnaire study was performed in The Hospital of Obstetrics & Gynaecology of Fudan University, Shanghai, China from January 2017 to June 2017. This study was approved by the ethics board of The Hospital of Obstetrics & Gynaecology of Fudan University (Reference No. 2017-04).

Patient and Public Involvement

There was no patient and public involvement in this study.

Study design and participants

A total of 600 pregnant women who delivered a live fetus at term in our hospital and returned for post-partum clinic on day 42 were asked at random to complete a voluntary questionnaire. All women surveyed had no maternal and fetal complications during pregnancy and delivery. The questionnaire included questions on basic maternal characteristics, postpartum care including diet, breastfeeding and neonatal care. To reduce the recall bias, this study was carried out in six months. 580 questionnaires were returned, 16 invalid questionnaires were excluded as they were incompletion and overall 564 questionnaires were analysed in this study (Figure 1). In this study, factors associated with caesarean section on maternal request were analysed. Basic maternal characteristics included maternal age, parity, gravida, delivery mode, maternal weight before pregnancy, educational level of mother, residence status (permanently reside in Shanghai or permanently reside outside of Shanghai), living conditions and attendance of a prenatal education course. Living condition was referred as economic level. Caesarean section on maternal request was defined as a planned elective caesarean section with no medical indication. No women who had an emergency Caesarean section were included in our study.

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The prenatal education course described in our study is a free half-day intensive one by one course for pregnant women between 36 and 37 weeks of gestation in our hospital. It is common that either husbands or parents (in particular pregnant women's mothers) come along with the pregnant women. The course is led and run by experienced and specialised midwives in our hospital. Course information focuses on supporting pregnant women to prepare for labour and normal births including the role of the father during labour and birth, labour coping skills and management of pain during labour and birth.

The Hospital of Obstetrics & Gynaecology of Fudan University is located in Shanghai, the wealthiest city in China, and is a leading provider of tertiary maternity care. Many women who reside outside of Shanghai come to give birth in our hospital because of the services provided and the hospital has more than 12,000 deliveries in a year.

Power of sample size

The sample size calculation was based on the estimated incidence of caesarean section (40%) in China (1). At least 130 respondents were needed for a statistical power of 90% for each group to detect a significant difference between two groups at a level of 0.05 (two-tailed). We overenrolled to allow for attrition, setting our final recruitment target at 600 women.

Statistical Analysis

The statistical difference in maternal age and maternal body weight before pregnancy between women with vaginal delivery and women with caesarean section was assessed with a Mann-Whitney U-test using the Prism software package. The statistical difference in parity, gravida, educational level, residence status, attendance of a prenatal education course between women with vaginal delivery and women with caesarean section was assessed with Chi-square test (or Fisher's exact test) using the Prism software package. The analysis in the

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rate of caesarean section on maternal request was assessed by odds ratio and 95% confidence limits (CL) using OpenEpi software. P-values of <0.05 were considered significant.

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Results:

The median maternal age was 32 years (ranging from 23 to 48 years). Of 564 women, 469 (83%) women were nulliparous and 304 (54%) women had a vaginal delivery and 260 (46%) women had a planned caesarean section on maternal request. The majority of women (97%) had a tertiary or above education (a bachelor's degree or Masters or PhD) and 448 (80%) women resided in Shanghai. Only 116 (20.6%) women attended the prenatal education course before delivery.

The demographic information of women with vaginal delivery and with caesarean section are summarised in Table 1. There was no statistical difference in parity, gravida, educational level and maternal weight before pregnancy between women with vaginal delivery and women with caesarean section (Table 1). However, the maternal age in women with caesarean section was significantly higher compared to women with vaginal delivery ($p=0.008$, Table 1). In addition, women who resided in Shanghai had a significantly higher caesarean section rate than women who resided outside of Shanghai ($p=0.005$, Table 1). The odds ratio of an increase in caesarean section on maternal request in women who resided in Shanghai was 1.749 (95%CL: 1.14, 2.67, Table 2), compared to women who resided outside of Shanghai. Women who attended the prenatal education course had a significantly lower rate of caesarean section on maternal request compared to women who did not attend to the prenatal education course ($p=0.045$, Table 1). The odds ratio of a reduction in caesarean section on maternal request in women who attended to the prenatal education course was 0.656 (95%CL: 0.432, 0.997, Table 2), compared to women who did not attend to the prenatal education course.

To analyse the association of caesarean section on maternal request and age distribution, we then divided women into three groups by age (Table 3). We found that women between 30 to

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39 years had the highest caesarean section rate (78%) compared to women between 20 to 29 years (15%) or women over 40 years (6.5%).

We then analysed whether there was a difference in educational levels between women who resided in Shanghai and women who resided outside of Shanghai. There was no statistical difference in tertiary or above level education between the two groups (98% vs 93%).

We further analysed factors which affected pregnant women attending of a prenatal education course (Table 4). There was no statistical difference in maternal age, educational level, residence status, parity and gravida between women who attended to the prenatal education course and women who did not.

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Discussion

Main Findings

In this questionnaire study with a medium sample size, we found that maternal age, residence status, and attendance of a prenatal education course could affect the rate of caesarean section on maternal request. In contrast, parity, gravida and maternal education level were not associated with an increased rate of caesarean section on maternal request. In addition, there were significant association between attendance of a prenatal education course and the other maternal characteristics studied.

Strengths and Limitations

The effect of attendance of a prenatal education course on the rate of caesarean section on maternal request has not been fully investigated. In addition, prenatal education courses have not been fully set up in most maternity hospitals in China. The Hospital of Obstetrics & Gynaecology of Fudan University is one of the largest and top ranked tertiary maternity hospitals with more than 12,000 deliveries a year in China. Our hospital does provide a one on one prenatal education course.

There were some limitations in this study. First, our questionnaire study was done in a single tertiary women hospital with a relative medium sample size (n=564), but this was relatively small compared to the 12,000 deliveries in the hospital every year. Our hospital's maternity care package may be different to other hospitals in China and these regional differences may result in a bias. Therefore our findings need to be further investigated with a large multicenter trial. Second, our prenatal education course was not designed to reduce the rates of obstetric intervention. This limitation must be taken into account when considering the association between prenatal education courses and perinatal outcomes. Third, due to the nature of the

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questionnaire study, all the data used in our study were self-reported. A possible recall bias should also be taken into account.

Interpretation

Compared to 2003, worldwide caesarean section rates have doubled by 2018. There are varied reasons for this increasing trend, but we believe that the increased rate of caesarean section on maternal request is an important factor, particular in the high rates of caesarean section, including the rate of caesarean section on maternal request in China (11). In our current study of uncomplicated pregnancies and deliveries, the rate of planned caesarean section on maternal request was 46%. Previous study suggested that a supportive birth environment can minimize maternal stress and anxiety during labour and birth and support physiologic birth (15). Unfortunately, due to limited resources of many health care facilities, the birthing environment in China may not always be conducive to supporting natural births. Individual delivery room and family member support in labour are not routine practice in most maternity hospitals in China. Conditions like these could result in a fear of childbirth and increased psychological stress to pregnant women. In addition, the long term One Child Policy, which extended from 1979 to 2015, may contribute to changing women and their families' philosophy around childbirth. If a woman can only have one child, she may not consider the risks of a caesarean section on future pregnancies to be relevant (16). Increasing maternal age is associated with an increased caesarean section rates and women with advanced maternal age have the highest caesarean section rate (17). Advanced maternal age is associated with a number of complications of pregnancy such as preeclampsia and gestational diabetes mellitus (GDM) (18), obstetric assisted delivery (including emergency caesarean section) (19-21), and obstetrics blood loss during labour and birth (22). These adverse outcomes during labour and birth could result in a fear to pregnant women with

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advanced maternal age. In our current study, we found that the rate of caesarean section on maternal request was significantly associated with maternal age. We found that in women who requested the planned caesarean section, 85% of them were over 30 years. The odds ratio of an increase in caesarean section on maternal request in pregnant women over 30 years was 2.42 (95%CL: 1.597, 3.666), compared to pregnant women under 30 years. We also found that pregnant women between 30-39 years had the highest rate of caesarean section on maternal request.

Prenatal education courses are a common component of western antenatal care for a long time, but are not offered in most maternity hospitals in China. The main purpose of a prenatal education course is to support pregnant women to prepare for labour and birth and included information on the labour and birth process, pain management , breastfeeding, and care of the newborn (23). The prevalence of attendance of prenatal education course was 33% in Canada (24) and 84% in nulliparous women in Australia (25). However, prenatal education courses for pregnant women are a relatively new to our hospital (under 5 years). The current percentage of attendance at our prenatal education course was 25% in our hospital and 20% in our study, which is significantly lower than rates in western countries.

Our study has found a significant reduction (35%) in the number of caesarean section on maternal request in pregnant women who attended a prenatal education course. Our finding is supported by other study that suggested that prenatal education courses were associated with higher rates of vaginal delivery (24). In our study, maternal age, educational level, parity, gravida and residence status did not influence pregnant women attending a prenatal education course. Other studies have showed that prenatal education courses are more likely to be attended by nulliparous women and older pregnant women (25). This higher attendance was also observed in pregnant women with higher income and higher education level (23, 25). The difference in factors associating with the attendance of a prenatal education course

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between our current study and other studies could be because that our prenatal education courses have only been running for 5 years in our hospital and it has not been strongly recommended yet, by midwife or obstetrician. As the courses are relatively new, we hope that our results will encourage obstetricians and midwives to recommend prenatal education courses to pregnant women.

Interestingly, we found that women who resided in Shanghai had a higher rate of caesarean section on maternal request compared to women who did not reside in Shanghai. We do not know the exact reason for this difference. Women who resided in Shanghai were significantly older than women who did not reside in Shanghai by 1.2 years (p=0.006), but there was no other significant difference between two groups. As we have mentioned, further research in a multicentre trial is needed to further understand the similarities and differences in pregnant women characteristics and preferences in different parts of China

Conclusion

In this study of low risk pregnant women at a tertiary hospital in Shanghai, China, we found that maternal age, residence status, and attendance of a prenatal education course affect the rate of caesarean section on maternal request. Attendance of a prenatal education course significantly reduced the rate of caesarean section on maternal request. Our findings suggest that part of China's strategy to reduce the overall caesarean rate should include prenatal education courses.

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Declaration of Interest

All authors have no conflict of interest to report.

Data Availability

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Contribution to authorship:

All authors were involved in the drafting, editing and approval of the manuscript for publication. In addition to this, each author contributed to follow work:

YG, YT: collected the data reported in this work

MT, YD: contributed to conception and design of this study

YD, QC: designed study and wrote the manuscript draft

QC: completed the revised manuscript

Ethics approval

This study was approved by the ethics board of The Hospital of Obstetrics & Gynaecology of Fudan University (Reference No. 2017-04).

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Figure legend

Figure 1: Flow chart of data collection

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Table 1: General clinical parameters in study cohort according to the mode of delivery

	Vaginal delivery (n=304)	**caesarean section (n=260)**	**P-value**
Maternal age (years, median/range)	32 (24-48)	33 (23-45)	**P=0.008**
Parity (number, %)			
1 (n=469)	258 (55%)	211 (45%)	0.24
2 (n=95)	46 (48%)	49 (52%)	
Gravida (number, %)			
1 (n=415)	232 (56%)	183 (44%)	0.281
2 (n=122)	59 (48%)	63 (52%)	
≥3 (n=27)	13 (48%)	14 (52%)	
Education Level (number, row%)			
Under tertiary (n=18)	8 (44%)	10 (56%)	0.728
Under graduate (n=450)	244 (54%)	206 (46%)	
Post graduate (n=96)	52 (54%)	44 (46%)	
Residence (number, row%)			
Shanghai (n=448)	229 (51%)	219 (49%)	**P=0.009**
Non-Shanghai (n=116)	75 (64%)	41 (36%)	
maternal weight before pregnancy (kg, mean/SD)	55.28±7.76	55.36±8.98	P=0.902
Living conditions			
Own house (n=489)	255 (52%)	234 (48%)	0.0802
Rental house (n=25)	15 (60%)	10 (40%)	
Parent's house (n=45)	31 (68%)	14 (32%)	
Attendance of a prenatal education course (number, row%)			
Yes (n=116)	72 (62%)	44 (38%)	**P=0.045**
No (n=448)	232 (52%)	216 (48%)	

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Table 2: Odds ratio (OR) and 95% confidence limits (CL) for the effect of maternal age, residence and attendance of a prenatal education course on caesarean section rate

	Caesarean section	Vaginal delivery	OR	95%CL	P value
Maternal age (number, %)					
20-29 years (n=130)	39 (30%)	91 (70%)	2.392	1.57, 3.65	<0.0001
30-39 years (n=403)	204 (51%)	199 (49%)			
Maternal age (number, %)					
30-39 years (n=403)	204 (51%)	199 (49%)	0.844	0.41, 1.75	0.395
≥40 years (n=31)	17 (55%)	14 (45%)			
Maternal age (number, %)					
20-29 years (n=130)	39 (30%)	91 (70%)	2.833	1.27, 6.31	0.009
≥40 years (n=31)	17 (55%)	14 (45%)			
Residence status (number, %)					
Shanghai (n=448)	219 (84%)	229 (75%)	1.749	1.14, 2.67	0.005
Non-Shanghai (n=116)	41 (16%)	75 (25%)			
Attendance of a prenatal education course (number, %)					
Yes (n=116)	44 (38%)	72 (62%)	0.656	0.43, 0.99	0.029
No (n=448)	216 (48%)	232 (52%)			

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Table 3: The association of age distribution and rate of caesarean section on maternal request

Age distribution	Women with caesarean section (n=260)	P value
20-29 years (number, %) (Lower CL, Upper CL)	39 (15%) (10.89%, 19.93%)	p<0.001
30-39 years (number, %) (Lower CL, Upper CL)	204 (78.5%) (72.96%, 83.3%)	
≥40 years (number, %) (Lower CL, Upper CL)	17 (6.5%) (3.85%, 10.26%)	

CL: confidence Limits

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Table 4: Factors associated with attendance of a prenatal education course

	Attendance of prenatal education course		P value (Chi-square)
	Yes (n=116)	No (n=448)	
Maternal age distribution			
20-29 years (n=130)	24 (18.5%)	106 (81.5%)	0.708
30-39 years (n=403)	85 (21.2%)	318 (78.9%)	
≥40 years (n=31)	7 (22.6%)	24 (77.4%)	
Residence (number, %)			
Shanghai (n=448)	91 (20%)	357 (80%)	0.796
Non-Shanghai (n=116)	25 (22%)	91 (78%)	
Education level (number, %)			
Under tertiary (n=18)	2 (11%)	16 (89%)	0.328
Under graduate (n=450)	90 (20%)	360 (80%)	
Post graduate (n=96)	24 (25%)	72 (75%)	
Parity (number, %)			
1 (n=469)	103 (22%)	366 (78%)	0.071
2 (n=95)	13 (14%)	82 (86%)	
Gravida (number, %)			
1 (n=415)	91 (22%)	324 (78%)	0.297
2 (n=122)	22 (18%)	100 (82%)	
≥3 (n=27)	3 (11%)	24 (89%)	

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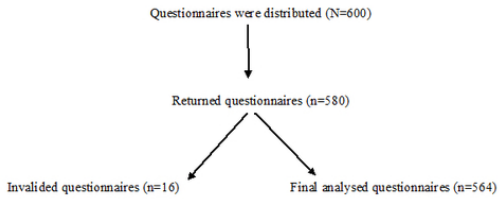
Figure 1



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STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Reported on Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	8
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8
Bias	9	Describe any efforts to address potential sources of bias	13
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9-10
		(*b*) Describe any methods used to examine subgroups and interactions	9-10
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	Figure 1

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Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	Report numbers of outcome events or summary measures over time	11-12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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