

ORIGINAL RESEARCH ARTICLE

Motivation towards first trimester screening for preeclampsia among pregnant women in Denmark: A cross-sectional questionnaire study

Sandra Maria Behnke Gerdes¹  | Charlotte Kvist Ekelund^{1,2} | Line Rode^{2,3} |
Caroline Borregaard Miltoft^{1,2} | Julie Midtgaard^{1,4} | Finn Stener Jørgensen^{1,5} |
Kasper Pihl⁵ | Ann Tabor^{1,2} | Iben Riishede^{1,2} 

¹Department of Clinical Medicine, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark

²Center of Fetal Medicine, Department of Obstetrics, Copenhagen University Hospital Rigshospitalet, Copenhagen, Denmark

³Department of Clinical Biochemistry, Copenhagen University Hospital Rigshospitalet, Glostrup, Denmark

⁴Center for Applied Research in Mental Health Care (CARMEN), Mental Health Center Glostrup, Glostrup, Denmark

⁵Fetal Medicine Unit, Department of Obstetrics and Gynecology, Copenhagen University Hospital Hvidovre, Hvidovre, Denmark

Correspondence

Iben Riishede, Copenhagen University Hospital, Rigshospitalet, Blegdamsvej 9, 4002, 2100 Copenhagen, Denmark.
Email: ibenriishede@gmail.com

Funding information

The Research Fund of Copenhagen University Hospital Rigshospitalet

Abstract

Introduction: The aim of this cross-sectional questionnaire study was to investigate motivation to participate in a possible new screening for preeclampsia in the first trimester of pregnancy among Danish pregnant women through a questionnaire based on Theory of Planned Behavior developed for this specific purpose. The new screening combines maternal characteristics with mean arterial pressure, uterine artery pulsatility index and biochemical markers to predict the risk of preeclampsia, whereas the current Danish screening uses maternal characteristics alone.

Material and methods: Participation was offered to a proportion of women attending a first or a second trimester screening scan at two University Hospitals in Copenhagen. The questionnaire was set up in REDCap® and answers were entered directly into the database, which was accessed via a QR-code.

Results: We invited 772 pregnant women to participate in the questionnaire survey between November 2021 and April 2022 at Copenhagen University Hospital Rigshospitalet (study site one) ($n = 238$) and Copenhagen University Hospital Hvidovre (study site two) ($n = 534$). The response rate was 71.8% (171/238) at study site one and 33.9% (181/534) at study site two. A total of 352 women were included in the study (total participation rate 45.6%). Most women had a positive attitude towards preeclampsia screening in pregnancy, and 99.4% said they would participate in a risk assessment for preeclampsia if given the opportunity. A total of 97.4% answered “yes” to whether a first trimester preeclampsia screening should be offered to all pregnant women in Denmark. Positive motivation to participate in preeclampsia screening was correlated with having a network with a positive attitude towards preeclampsia screening.

Abbreviations: cFTS, combined first trimester screening; PE, preeclampsia; SA, acetylsalicylic acid; TPB, theory of planned behavior.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2023 The Authors. *Acta Obstetrica et Gynecologica Scandinavica* published by John Wiley & Sons Ltd on behalf of Nordic Federation of Societies of Obstetrics and Gynecology (NFOG).

Conclusions: The results of this study indicate that Danish pregnant women have a positive attitude towards participation in a first trimester screening for preeclampsia. This observation might be useful in relation to possible future implementation in Denmark.

KEYWORDS

first trimester screening, motivation, preeclampsiaquestionnaire, Theory of Planned Behavior

1 | INTRODUCTION

Preeclampsia (PE) and its complications are major contributors to maternal and perinatal morbidity and mortality.^{1,2} Development of effective prediction and prevention strategies have been important objectives of prenatal care and of research over the last decades. A screening model used in the first trimester of pregnancy based on maternal characteristics, mean arterial pressure, uterine artery pulsatility index and two serum biomarkers has been developed by the Fetal Medicine Foundation.³⁻⁵ This model detects around 75% of preterm (delivery before 37 weeks of gestation) PE cases and has been validated in several populations.⁶⁻⁸ Low-dose acetylsalicylic acid (ASA) reduces the risk of preterm PE by 62%⁹ and prophylactic treatment with ASA could substantially reduce the incidence of preterm PE if applied in combination with first trimester screening for PE. First trimester screening for PE could be implemented in Denmark as an add-on to the current first trimester screening for aneuploidies. Prior to implementation, ethical aspects of PE screening must be considered, as they are important not only for pregnant women but also for healthcare professionals specialized in maternity care. The possible concern introduced by a positive screening result should not be underestimated, and it is considered a requirement to evaluate pregnant women's motivation to participate in screening for PE before introducing it as part of the national prenatal screening program.

For this purpose, we conducted a questionnaire survey based on the Theory of Planned Behavior (TPB).¹⁰ The TPB is widely accepted as a theoretical structure for studies that investigate predicted and explained health behavior and health intentions.¹¹⁻¹³ Behavior is driven by motivation and TPB contributes to understanding the motivation behind a certain behavior. TPB suggests that the likelihood of an individual to engage in a health behavior correlates with the strength of the individual's intention to engage in the behavior. Specifically, TPB contains three components that link beliefs to behavior: attitude, subjective norm and perceived behavioral control. *Attitude* refers to an individual's belief that the behavior is favorable or unfavorable. A person who perceives a behavior as favorable is more likely to consider performing the behavior. *Subjective norm* is an individual's estimate of the social acceptance of performing a behavior. If a person feels that a specific behavior is looked upon favorably by colleagues, friends or family, the person is more likely to perform the behavior. *Perceived behavioral control* refers to whether an individual believes that he or she can perform the behavior.¹⁰ The aim of this cross-sectional study was to investigate screening behavior as

Key message

This study is a questionnaire survey investigating Danish pregnant women's attitude towards a new screening for preeclampsia in the first trimester of pregnancy. The attitude towards preeclampsia-screening in Denmark is positive, and this information is valuable in relation to future implementation.

well as motivation among Danish pregnant women concerning the new screening model for PE in the first trimester of pregnancy. A questionnaire was developed for this specific purpose based on TPB to establish the connection between pregnant women's beliefs and their behavioral intentions.

2 | MATERIAL AND METHODS

We conducted a cross-sectional questionnaire study at two University Hospitals in Copenhagen, Denmark, during two periods from November 2021 to January 2022 and from February 2022 to April 2022.

The study was carried out among pregnant women who came for their first trimester screening scan or their second trimester anomaly scan at Copenhagen University Hospital Rigshospitalet (study site one) or Copenhagen University Hospital Hvidovre (study site two). We intended to obtain answers from a wide sample of the pregnant population including both nulliparous and multiparous women at different gestational ages to avoid potential bias that could emerge from asking a highly selected group. At study site one, inclusion took place in the evening clinic, where women were invited to participate while awaiting the results of their scan. Women at study site two were included during daytime in immediate continuation of being given their scan results. Oral and written study information were given by sonographers. The questionnaire was set up in REDCap®,¹⁴ and answers were entered directly into the database accessed via a QR-code. Women who were able to read and write in Danish were included. We did not send follow-up inquiries.

The questionnaire was developed following a comprehensive search of the literature and formal discussions with health

professionals (obstetricians and sonographers) with specialist knowledge about this specific group of women (Appendix S1). We did not find any validated questionnaires covering attitude towards screening for PE but we were inspired by cross-sectional and qualitative studies conducted among pregnant women.¹⁵⁻¹⁷ TPB was used as framework for the behavior-related questions inspired by similar studies.^{18,19}

The questionnaire consisted of 45 items, which took approximately 10 minutes to complete, including general information about PE and a new first trimester screening test for PE. In all, 29 items were presented to all participants and branching logic was used in 16 items, causing only relevant items based on prior answers to be displayed.

The first section of the questionnaire covered sociodemographic characteristics (eight items), screening behavior and the impact of ultrasound examinations on mental well-being (seven items). Maternal characteristics included age, level of education, religious beliefs, ethnicity, civil status and current use of ASA. The second section was designed to determine whether there was a correlation between motivation to participate in screening for PE and the three components of TPB: attitude, subjective norm and perceived behavioral control (15 items). For example, women's intention to participate in a risk assessment for PE was linked to their prior knowledge about PE (attitude), whether their network would approve screening for PE (subjective norm) and whether they believe it is possible to do something about PE (perceived behavioral control).

For sociodemographic characteristics, dichotomous scales were used for relationship status (single/in a relationship) and ethnicity (European/other ethnic group), whereas the remaining questions had more than two options: age, education, religious faith, gestational age. Attitude towards screening in general and the level of agreement with each of the TPB constructs were examined by a four-point Likert scale (*strongly agree, agree, disagree, strongly disagree*). A dichotomous index was yielded for questions on agreement by grouping the categories "strongly agree" with "agree" and "strongly disagree" with "disagree". Women's attitude towards PE screening was examined using a binary response (yes or no).

The questionnaire was pilot-tested by an expert panel consisting of obstetricians and researchers with expertise in qualitative studies, and the survey was presented to five pregnant women to ensure comprehensibility.

2.1 | Statistical analyses

Differences in maternal characteristics as well as differences in answers between the two hospitals were assessed using the Chi-square test. A two-sided *P*-value of <0.05 was considered statistically significant.

Hypothesizing that the attitude among pregnant women in Denmark is largely positive, we expected that at least 80% of the participants would say yes to future implementation of PE screening and to participate in the screening. A confidence interval of 75%–85% was found acceptable.

For a sample size of 350, 80% (280) equals a confidence interval of 75.8%–84.2%, meaning that the true number of women with a positive attitude is between 75.8% (265) and 84.2% (295), which was acceptable for this study.

If only 70% (245 answers) or 60% (210 answers) of the participants said yes to future implementation of PE screening, the confidence interval for a sample size of 350 would be 65.2%–74.8% and 54.9%–65.1%, respectively, which is also within acceptable limits for this study.

2.2 | Ethics statement

According to Danish law (Legislative Decree concerning ethics in relation to health science, Section 1[4]), ethics approval is not required for questionnaire studies unless the project involves human biological material. This was confirmed by the Danish Ethical Committee at the request of the authors before starting the survey (Journal: H-20034471 Ref.: 20034471).

The study was approved by the Danish Data Protection Agency (P-2020-598) on May 26, 2020. Informed consent to participate in the study was obtained when participants submitted the electronic questionnaire.

3 | RESULTS

A total of 772 pregnant women were invited to participate in the questionnaire survey between November 2021 and April 2022 at study site one (*n*=238) and study site two (*n*=534). The response rate was 71.8% (171/238) at study site one and 33.9% (181/534) at study site two. A total of 352 women were included in the study (total participation rate 45.6%). Sociodemographic characteristics are presented in Table 1. Most of the women were between 26 and 35 years old (80.8%), of European ethnic origin (93.1%) and had a higher education of at least 3 years (86.1%). There was no significant difference in maternal characteristics between responders from study site one and two (Table 1).

3.1 | Ultrasound examinations and screening behavior

Most women (92.2%) felt reassured by ultrasound examinations, as 78.3% strongly agreed and 14.0% agreed with the statement "Ultrasound examinations make me feel safe and reassured that the pregnancy is healthy". For some women, ultrasound examinations were not only reassuring, as 51.2% agreed or strongly agreed with the statement "Ultrasound examinations reassure but also concern me because they remind me that something might be wrong" (Table 2). All women who answered the survey were either planning to participate in the combined first trimester screening (cFTS) or had already completed the cFTS.

TABLE 1 Sociodemographic characteristics of questionnaire participants

	All (n = 352)	Study site one (n = 171)	Study site two (n = 181)	P
Age, n (%) (years)				
<18	0 (0.0)	0 (0.0)	0 (0.0)	0.31
18–25	20 (5.7)	7 (4.1)	13 (7.2)	
26–35	282 (80.8)	144 (84.2)	138 (76.2)	
36–45	46 (13.2)	20 (11.7)	26 (14.4)	
>45	1 (0.3)	0 (0.0)	1 (0.6)	
Missing	3 (0.9)	0 (0.0)	3 (1.7)	
Education, n (%)				
Primary school	4 (1.1)	1 (0.6)	3 (1.7)	0.33
Skilled worker	3 (0.9)	0 (0.0)	3 (1.7)	
Upper secondary education	15 (4.3)	5 (2.9)	10 (5.5)	
Higher education				
<3 years	27 (7.7)	12 (7.0)	15 (8.3)	
3–4 years	113 (32.1)	57 (33.3)	56 (30.9)	
≥5 years	190 (54.0)	96 (56.1)	94 (51.9)	
Civil status, n (%)				
In a relationship	347 (98.6)	167 (97.7)	180 (99.4)	0.33
Single	5 (1.4)	4 (2.3)	1 (0.6)	
Ethnicity, n (%)				
European	326 (93.1)	159 (93.5)	167 (92.3)	0.95
Other	24 (6.8)	11 (6.5)	13 (7.2)	
Missing	2 (0.6)	1 (0.6)	1 (0.6)	
Religious belief, n (%)				
Christian	172 (49.3)	81 (47.6)	91 (50.3)	0.92
Muslim	8 (2.3)	4 (2.4)	4 (2.2)	
Buddhist	0 (0.0)	0 (0.0)	0 (0.0)	
Other religious belief	7 (2.0)	4 (2.4)	3 (1.7)	
No religious belief	162 (46.4)	81 (47.6)	81 (44.8)	
Missing	3 (0.9)	1 (0.6)	2 (1.1)	
Gestational age, n (%)				
<14 weeks	221 (63.1)	103 (60.9)	118 (65.2)	0.02
14–22 weeks	115 (32.9)	54 (32.0)	61 (33.7)	
>22 weeks	14 (4.0)	12 (7.1)	2 (1.1)	
Missing	2 (0.6)	2 (1.2)	0 (0.0)	
cFTS (planned or completed), n (%)				
Yes	352 (100.0)	171 (100.0)	181 (100.0)	0.59
No	0 (0.0)	0 (0.0)	0 (0.0)	
ASA, n (%)				
No	341 (96.9)	164 (95.9)	178 (98.3)	0.44
Yes	9 (2.6)	6 (3.5)	3 (1.7)	
Missing	1 (0.3)	1 (0.6)	0 (0.0)	

Abbreviations: ASA, acetylsalicylic acid; cFTS, combined first trimester screening.

3.2 | Motivation and screening for PE

All but three women (99.4%, 95% confidence interval [CI] 99–100) answered “yes” to the question “Would you participate in a risk assessment

for PE if you had the opportunity?” Among women who would participate in a risk assessment for PE, 98.5% agreed or strongly agreed that they liked to have as much knowledge as possible about their pregnancy and to be prepared for possible complications (Table 2). A total

TABLE 2 Attitude towards ultrasound examinations and screening for preeclampsia

Item, n (%)	All (n = 352)	Study site one (n = 171)	Study site two (n = 181)	P
Ultrasound examinations make me feel safe and reassured that the pregnancy is healthy				
Strongly agree	274 (77.8)	134 (78.4)	140 (77.3)	0.43
Agree	49 (13.9)	20 (11.7)	29 (16.0)	
Disagree	0 (0.0)	0 (0.0)	0 (0.0)	
Strongly disagree	27 (7.7)	15 (8.8)	12 (6.6)	
Missing	2 (0.6)	2 (1.2)	0 (0.0)	
Ultrasound examinations reassure me but also concern me because they remind me that something might be wrong				
Strongly agree	24 (6.8)	14 (8.2)	10 (5.5)	0.42
Agree	156 (44.3)	79 (46.2)	77 (42.5)	
Disagree	130 (36.9)	61 (35.7)	69 (38.1)	
Strongly disagree	41 (11.6)	16 (9.4)	25 (13.8)	
Missing	1 (0.3)	1 (0.6)	0 (0.0)	
I do not like ultrasound examinations because they make my pregnancy feel like a disease				
Strongly agree	5 (1.4)	2 (1.2)	3 (1.7)	0.54
Agree	0 (0.0)	0 (0.0)	0 (0.0)	
Disagree	33 (9.4)	19 (11.1)	14 (7.7)	
Strongly disagree	312 (88.6)	150 (87.7)	162 (89.5)	
Missing	2 (0.6)	0 (0.0)	2 (1.1)	
Would you participate in a risk assessment for preeclampsia if you had the opportunity?				
Yes	349 (99.1)	171 (100.0)	178 (98.3)	0.50
No	2 (0.6)	0 (0.0)	2 (1.1)	
Missing	1 (0.3)	0 (0.0)	1 (0.6)	
Said yes to the question: Would you participate in a risk assessment for preeclampsia if you had the opportunity? (n = 349)				
I like to have as much knowledge as possible about my pregnancy and to be prepared for possible complications				
Strongly agree	220 (63.0)	106 (62.0)	114 (64.0)	0.47
Agree	124 (35.5)	61 (35.7)	63 (35.4)	
Disagree	2 (0.6)	2 (1.2)	0 (0.0)	
Strongly disagree	3 (0.9)	2 (1.2)	1 (0.6)	
Do you think that all pregnant women in Denmark should be offered a first trimester screening for preeclampsia?				
Yes	341 (96.9)	163 (95.3)	178 (98.3)	0.15
No	10 (2.8)	8 (4.7)	2 (1.1)	
Missing	1 (0.3)	0 (0.0)	1 (0.6)	
Said yes to the question: Do you think that all pregnant women in Denmark should be offered a first trimester screening for preeclampsia? (n = 341)				
It would make me feel calm if screening shows that I have a low risk of preeclampsia				
Strongly agree	203 (59.5)	99 (60.7)	104 (58.8)	0.59
Agree	137 (40.2)	64 (39.2)	73 (41.2)	
Disagree	0 (0.0)	0 (0.0)	0 (0.0)	
Strongly disagree	1 (0.3)	0 (0.0)	1 (0.6)	
Said no to the question: Do you think that all pregnant women in Denmark should be offered a first trimester screening for preeclampsia? (n = 10)				
Screening would make me unnecessarily worried				
Strongly agree	1 (10.0)	1 (12.5)	0 (0.0)	0.10
Agree	2 (20.0)	2 (25.0)	0 (0.0)	
Disagree	5 (50.0)	5 (62.5)	0 (0.0)	
Strongly disagree	2 (20.0)	0 (0.0)	2 (100.0)	
Screening would make my pregnancy feel like a disease				
Strongly agree	0 (0.0)	0 (0.0)	0 (0.0)	0.32
Agree	0 (0.0)	0 (0.0)	0 (0.0)	
Disagree	4 (40.0)	4 (50.0)	0 (0.0)	
Strongly disagree	6 (60.0)	4 (50.0)	2 (100.0)	

(Continues)

TABLE 2 (Continued)

Item, n (%)	All (n=352)	Study site one (n=171)	Study site two (n=181)	P
I do not like to take medicine during pregnancy if I'm not sick				
Strongly agree	3 (30.0)	4 (50.0)	0 (0.0)	0.56
Agree	3 (30.0)	2 (25.0)	1 (50.0)	
Disagree	2 (20.0)	1 (12.5)	1 (50.0)	
Strongly disagree	2 (20.0)	1 (12.5)	0 (0.0)	

of 97.4% (95% CI 96–99) answered “yes” to whether first trimester screening for PE should be offered to all pregnant women in Denmark; within this group, 99.7% agreed or strongly agreed that it would make them feel calm if screening showed that they had a low risk of PE.

Among women who did not think that all pregnant women in Denmark should be offered screening for PE ($n=10$), 60% agreed or strongly agreed that they do not like to take medicine during pregnancy if they are not sick. None agreed that screening for PE would make their pregnancy feel like a disease and 70% disagreed or strongly disagreed that screening would make them unnecessarily worried (Table 2).

3.3 | Beliefs and behavior, TPB

3.3.1 | Attitude

The attitude towards participation in first trimester screening for PE was positive both among women who had prior knowledge of PE (99.4% [$n=330$]) and among women who did not (100% [$n=19$]). Similarly, there was a positive attitude towards participation in first trimester screening for PE both in the group who said they would be concerned if they were categorized as being at high risk and in the group who would not (99.4% [$n=313$] and 100% [$n=35$], respectively).

Among women who had prior knowledge of PE, 97.3% answered “yes” to the question “Do you think that all pregnant women in Denmark should be offered first trimester screening for PE?”. All women who did not have prior knowledge of PE answered “yes” to this question.

Most women answered “yes” to the question “Do you think that all pregnant women in Denmark should be offered first trimester screening for PE?” regardless of whether they would be concerned if they were at high risk or not (96.8% among women who would be concerned if categorized as being at high risk vs 97.2% among women who would not).

3.3.2 | Subjective norms

In the group of women who had a social network with a negative attitude towards first trimester screening for PE, 87.5% would participate in a risk assessment for PE. Significantly more women said they would participate in a risk assessment for PE when having a social network with a positive attitude towards this screening (99.7%, $P<0.001$).

Further, a significantly higher proportion of women agreed that all pregnant women in Denmark should be offered screening for PE

when having a social network with a positive attitude towards the screening, compared with the proportion who said “yes” and had a social network with a negative attitude towards screening for PE (97.9% vs 77.8%, $P<0.001$; Table 3). The questionnaire did not elaborate on the type of social network but allowed the women to make their own interpretation.

3.3.3 | Perceived behavioral control

Whether or not the women were willing to take medicine to reduce the risk of PE did not influence their motivation to participate in screening for PE. In all, 99.4% of women who were willing to take medicine to prevent PE said that they would participate in first trimester screening for PE and 100% of women who were not willing to take medicine would participate in screening for PE if they had the opportunity (screening for information only).

All women would participate in a risk assessment for PE regardless of their answer to the statement “If I'm at high risk of PE, I believe that it's possible to do something about it and the extra checks will make me feel reassured”. A higher proportion of the women who believed they could do something about PE were positive towards offering screening for PE to all pregnant women in Denmark (97.9%) compared with 80% in the group who answered “no” to the statement “If I'm at high risk of preeclampsia, I believe that it's possible to do something about it and the extra checks will make me feel reassured” ($P<0.01$; Table 3).

Nine women received treatment with ASA when they completed the questionnaire. We found no significant difference between the ASA group and the rest of the cohort as to whether they would participate in a risk assessment for PE if they had the opportunity (100% would participate in a risk assessment for PE in the ASA group vs. 99.4% in the non-ASA group [$P=1.00$]).

Two women answered “no” to whether they would participate in a risk assessment for PE if they had the opportunity. The maternal characteristics of these women did not differ from the rest of the cohort.

4 | DISCUSSION

To our knowledge, this is the first questionnaire-based investigation of the attitude and motivation regarding PE screening among pregnant women. Our study explores the influence of experienced

TABLE 3 Connection between beliefs and behavior according to the Theory of Planned Behavior

	Attitude		Subjective norms		Perceived behavioral control	
	Did you know that there is a risk of developing preeclampsia in pregnancy? n = 352 (100%)	Would it make you concerned or affect you negatively if you were categorized as being at high risk? n = 351 (99.7%) [1]	Do you think that your friends and family have a positive attitude towards screening for preeclampsia? n = 347 (98.6%) [5]	Are you willing to take medicine to reduce the risk of preeclampsia? n = 351 (99.7%) [1]	If I'm at high risk of preeclampsia, I believe that it's possible to do something about it and the extra checks will reassure me = 348 (98.9%) [4]	
Said yes to the question: Would you participate in a risk assessment for preeclampsia if you had the opportunity? % (n)	Yes (333) 99.4 (330) P = 1.00	No (19) 100 (19) P = 1.00	Yes (338) 99.7 (337) P < 0.001	No (9) 87.5 (7) [1] P = 0.94	Yes (343) 100 (343) P = 1.00	No (5) 100 (5)
Said yes to the question: Do you think that all pregnant women in Denmark should be offered a first trimester screening for preeclampsia? % (n)	97.3 (322) [2] P = 1.00	100 (19) 97.4 (305) [2] P = 0.98	97.9 (329) [2] P < 0.001	77.8 (7) P < 0.001	98.2 (323) [2] P < 0.001	90 (18) 97.9 (334) [2] P < 0.001

Note: Square brackets = [missing].

social norms on women's attitudes towards screening for PE, which is important in relation to dissemination of information about the screening and adherence to screening.

We found an overall positive attitude towards first trimester screening for PE consistent with the general positive attitude towards screening in pregnancy among Danish women.^{20,21} A previous qualitative study among Danish women showed that their motivation for participation in the cFTS is the anticipation of assurance that the fetus is healthy.²² This tendency was confirmed in the current study. Although ultrasound and screening in pregnancy introduce mixed feelings including concern, our results indicate that ultrasound examinations are reassuring for most women, which is an important finding in relation to future implementation of first trimester screening for PE.

The positive attitude towards PE screening found in this study is in line with two other studies regarding PE screening. In a Dutch study conducted by Crombag et al.¹⁷ pregnant women's preferences regarding prediction models for PE were examined. Among most women in the ten focus groups (n=45) a positive attitude was found towards first trimester screening for PE. The Dutch women did not like the idea of using medication in case they were screened positive, which differs from our study, where 94.3% would take medicine if they were at high risk of developing PE. In a recent Canadian study²³ of satisfaction with PE screening was evaluated postpartum, 93% of participants reported high levels of satisfaction (70-100%) and 98% stated that they would recommend the screening to all pregnant women. Almost all participants in our questionnaire survey said that they would participate in a risk assessment of PE if they had the opportunity and most thought that screening for PE should be offered to all women in Denmark. Among women who did not support national PE screening (n = 10), negative feelings in relation to screening in general could not explain their attitude. The motive for not supporting PE screening was rather derived from their subjective norms, as a significantly lower proportion of the women who had a social network with a negative attitude towards screening for PE agreed to national PE screening compared with the group with a social network with a positive attitude. Subjective norms were also significant predictors of intention to be vaccinated against COVID-19 in an Israeli cross-sectional questionnaire study by Shmueli,²⁴ ie agreement with the statement "most of my friends will support the COVID-19 vaccine".

Women in our study who thought that they could do something to prevent PE, ie experienced perceived behavioral control, were significantly more motivated to receive PE screening. These findings are in accordance with the concept of TPB and in line with findings by Zhang et al. on primiparas' breastfeeding in China.²⁵ In the Chinese intervention group receiving lectures on breastfeeding, telephone follow-ups and encouragement to share their experiences, perceived behavioral control scores of the intervention group were higher than those of the control group (P < 0.05).

Anxiety is a common experience during pregnancy, and screening positive for PE can increase anxiety levels due to the uncertainty

of what lies ahead, as well as the potential for complications. Additionally, interventions following a positive screening, including more frequent prenatal visits, can add to a woman's stress level. In all, 89.7% of women in our study said that it would make them concerned or affect them negatively if they were categorized as being at high risk. The impact of anxiety on pregnant women can be significant, even in pregnancies that never develop PE. Therefore, it is essential for healthcare professionals to be aware of the experience of anxiety in women who screen positive for PE and provide appropriate support and counseling.

If PE screening is implemented in Denmark, it would be very relevant to conduct a survey among screen-positive women to evaluate the impact of the screening result on their mental well-being and their attitude towards PE screening.

Previous studies found an association between the component "attitude" and intention to engage in screening.^{26,27} Wollancho et al. investigated predictors for behavioral intention towards participation in cervical cancer screening and found that positive attitude towards cervical cancer screening significantly affected women's intention to participate in screening.²⁷ Our study did not confirm a correlation between the component "attitude" and motivation to participate in PE screening, which may be explained by the general positive attitude towards prenatal screening in Denmark reflected in the high uptake rate (90% participate in the cFTS).²⁸ Given the large proportion of pregnant women with a positive attitude towards PE screening, a larger sample size is needed to show a potential correlation between attitude and motivation to participate in PE screening.

This is the first questionnaire to investigate the construct of attitude and motivation in relation to screening for PE. Questionnaires are relatively cheap, appropriate for participants' anonymous self-report, and enable acquisition of answers from many participants as well as inclusion of many items even though the time available is limited. To obtain validity, the questionnaire was based on the TPB, and items were developed in collaboration with an expert panel. Expert evaluations combined with inputs from the literature ensured the content and face validity of the questionnaire. The ability of participants to rate their anxiety reliably based on hypothetical scenarios has not been thoroughly investigated and bias in the results due to complex questions and scenarios is possible. The participation rate at study site one was high (71.8%) compared with study site two (33.5%), which might be explained by differences in inclusion strategies. We found no significant difference between the responders from the two hospitals in terms of background characteristics and answers to the behavior-related questions.

This study was not able to report on characteristics of the non-responders. The responders were representative in age and ethnicity for the general population of Danish women giving birth (background mean age 31.4 years; 90.9% of European origin). However, more study participants had a higher education of at least 3 years compared with the background population (86.1% vs 30.2%, respectively).²⁹ The difference in educational level might represent selection bias if women with higher educational levels are more likely to

respond to questionnaires. This might also have caused bias in the answers, which can limit generalizability of the results. To establish external validity, women from a wider range of Danish hospitals should be recruited, including women from non-urban areas.

The study was performed at two Danish hospitals which both have a well-established tradition of offering cFTS. Most probably, the positive attitude towards cFTS in Denmark translates to a positive attitude towards PE screening found in the study. Whether the same results would be found in a setting using non-invasive prenatal testing as the preferred screening for trisomies, is uncertain. Selection bias in relation to no inclusion of women who did not participate in cFTS must also be considered. This group of women may have a more negative attitude towards PE screening than do women who participate in cFTS. A previous study evaluated the characteristics of cFTS non-responders among 851 women in Denmark and showed that not having a cFTS performed was associated with country of origin other than Denmark, less education, unemployment and that these women more often had a religious belief.³⁰ Other studies have found a lower uptake of screening for trisomy 21 in women from ethnic minority groups.^{30,31} Women who were not able to read Danish were not included in our survey, 93.1% of the participants were of European origin and 46.4% said they had no religious belief. Ethnic differences in knowledge about prenatal screening may cause bias in our study, as women from groups that are more likely not to respond to future PE screening, ie ethnic minority women, women with a language barrier, and women with a low educational level are scarcely represented in our study.

5 | CONCLUSION

The results of this study indicate that Danish pregnant women have a positive attitude towards first trimester screening for PE. The findings support anticipated future national implementation of first trimester PE screening in Denmark and may help healthcare providers tailor their communication and education strategies to address concerns about screening for PE and increase participation in screening.

AUTHOR CONTRIBUTIONS

SG, CE and IR planned the study in collaboration with LR, CBM, JM and AT. SG wrote the questionnaire. IR was responsible for recruitment and practical implementation of the survey with help from CE, FSJ and KP. SG analyzed and interpreted questionnaire data. SG wrote the paper supervised by IR, CBM and CE. All authors read and approved the final article.

ACKNOWLEDGMENTS

The authors would like to thank all sonographers and the staff at the Center of Fetal Medicine at Rigshospitalet and the Fetal Medicine Unit at Hvidovre Hospital who helped with day-to-day running of the project and made an extraordinary effort to recruit women for the questionnaire survey. Special thanks to Hanne Hegaard for valuable review and feedback.

FUNDING INFORMATION

IR's salary was paid by a grant from The Research Fund of Copenhagen University Hospital Rigshospitalet.

CONFLICT OF INTEREST STATEMENT

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

DATA AVAILABILITY STATEMENT

The datasets generated and analyzed during the current study are not publicly available since individual privacy could be compromised, but they are available from the corresponding author on reasonable request.

ORCID

Sandra Maria Behnke Gerdes  <https://orcid.org/0000-0002-3826-1359>

[org/0000-0002-3826-1359](https://orcid.org/0000-0002-3826-1359)

Iben Riishede  <https://orcid.org/0000-0001-9353-8958>

REFERENCES

- Mol BWJ, Roberts CT, Thangaratinam S, Magee LA, de Groot CJM, Hofmeyr GJ. Pre-eclampsia. *Pre-Eclampsia Lancet*. 2016;387:999-1011.
- Chaemsaihong P, Sahota DS, Poon LC. First trimester pre-eclampsia screening and prediction. *Am J of Obstet Gynecol*. 2022;226:S1071-S1097.e2.
- Wright D, Akolekar R, Syngelaki A, Poon LCY, Nicolaides KH. A competing risks model in early screening for preeclampsia. *Fetal Diagn Ther*. 2012;32:171-178.
- Akolekar R, Syngelaki A, Poon L, Wright D, Nicolaides KH. Competing risks model in early screening for preeclampsia by biophysical and biochemical markers. *Fetal Diagn Ther*. 2013;33:8-15.
- Wright D, Syngelaki A, Akolekar R, Poon LC, Nicolaides KH. Competing risks model in screening for preeclampsia by maternal characteristics and medical history. *Am J Obstet Gynecol*. 2015;213(62):e1-62.e10.
- Chaemsaihong P, Pooh RK, Zheng M, et al. Prospective evaluation of screening performance of first-trimester prediction models for preterm preeclampsia in an Asian population. *Am J Obstet Gynecol*. 2019;221(650):e1-650.e16.
- Tan MY, Wright D, Syngelaki A, et al. Comparison of diagnostic accuracy of early screening for pre-eclampsia by NICE guidelines and a method combining maternal factors and biomarkers: results of SPREE. *Ultrasound Obstet Gynecol*. 2018;51:743-750.
- O'Gorman N, Wright D, Poon LC, et al. Multicenter screening for pre-eclampsia by maternal factors and biomarkers at 11–13 weeks' gestation: comparison with NICE guidelines and ACOG recommendations. *Ultrasound Obstet Gynecol*. 2017;49:756-760.
- Rolnik DL, Wright D, Poon LC, et al. Aspirin versus placebo in pregnancies at high risk for preterm preeclampsia. *N Engl J Med*. 2017;377:613-622.
- Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50:179-211.
- Catalano HP, Knowlden AP, Birch DA, Leeper JD, Paschal AM, Usdan SL. Using the theory of planned behavior to predict HPV vaccination intentions of college men. *J Am Coll Health*. 2017;65:197-207.
- Pourmand G, Doshmangir L, Ahmadi A, et al. An application of the theory of planned behavior to self-care in patients with hypertension. *BMC Public Health*. 2020;20:1290.
- Ajzen I, Driver BL. Prediction of leisure participation from behavioral, normative, and control beliefs: an application of the theory of planned behavior. *Leisure Sciences*. 1991;13:185-204.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42:377-381.
- Miltoft CB, Rode L, Tabor A. Positive view and increased likely uptake of follow-up testing with analysis of cell-free fetal DNA as alternative to invasive testing among Danish pregnant women. *Acta Obstet Gynecol Scand*. 2018;97:577-586.
- Winkelhorst D, Loeff RM, van den Akker-Van Marle ME, de Haas M, Oepkes D. Women's attitude towards routine human platelet antigen-screening in pregnancy. *Acta Obstet Gynecol Scand*. 2017;96:991-997.
- Crombag NMTH, Lamain-de Ruiters M, Kwee A, et al. Perspectives, preferences and needs regarding early prediction of preeclampsia in Dutch pregnant women: a qualitative study. *BMC Pregnancy Childbirth*. 2017;17:12.
- Karimian Z, Sadat Z, Afshar B, Hasani M, Araban M, Kafaei-Atrian M. Predictors of self-medication with herbal remedies during pregnancy based on the theory of planned behavior in Kashan. *Iran BMC Complement Med Ther*. 2021;21:211.
- Addis A, Alemnew W, Kassie A, Handebo S. Physical exercise and its associated factors among Ethiopian pregnant women: a cross-sectional study based on the theory of planned behavior. *BMC Psychol*. 2022;10:146.
- Lou S, Dahl K, Ulbjerg N. Screening kan give både tryk og ængstelse—eksempel ved screening for Downs syndrom. [Screening causes both reassurance and concern—for example when screening for Down Syndrome]. *Dan Med J*. 2014;176:1122-1125.
- Bangsgaard L, Tabor A. Do pregnant women and their partners make an informed choice about first trimester risk assessment for down syndrome, and are they satisfied with the choice? *Prenat Diagn*. 2013;33:146-152.
- Lou S, Dahl K, Risør MB, et al. A qualitative study of pregnant women's choice of nuchal translucency measurement. *Dan Med J*. 2007;169:914-918.
- Silang K, Tomfohr-Madsen L, Maxey C, Pastuck M, Johnson J-A. First-trimester preeclampsia screening and prevention: impact on patient satisfaction and anxiety. *AJOG Global Reports*. 2023;3:100205.
- Shmueli L. Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model. *BMC Public Health*. 2021;21:804.
- Zhang Y, Yuan R, Ma H. Effect of the theory of planned behavior on primipara breastfeeding. *Ann Palliat Med*. 2021;10:4547-4554.
- Huang J, Wang J, Pang TW-Y, et al. Does theory of planned behaviour play a role in predicting uptake of colorectal cancer screening? A cross-sectional study in Hong Kong. *BMJ Open*. 2020;10:e037619.
- Wollancho W, Amdissa D, Bambaro S, Wasihun Y, Tareke KG, Gizaw AT. Determining behavioral intention and its predictors towards cervical cancer screening among women in Gomma district, Jimma, Ethiopia: application of the theory of planned behavior. *PLoS ONE*. 2020;15:e0238472.
- FØTO. Danish National Fetal Medicine Database, Annual Report 2018. https://www.dfms.dk/s/2020-03-18-Arsrapport_FTO_2018_officiel.pdf
- Statistics Denmark. Danish Statistical Publications. Accessed October 25, 2022. <https://www.dst.dk/en>
- Wolf HT, Wulff CB, Ekelund C, Sundberg K, Tabor A. Characteristics of first-trimester screening of non-responders in a high-uptake population. *Dan Med J*. 2016;63:A5219.

31. Dormandy E, Michie S, Hooper R, Marteau TM. Low uptake of pre-natal screening for down syndrome in minority ethnic groups and socially deprived groups: a reflection of women's attitudes or a failure to facilitate informed choices? *Int J Epidemiol*. 2005;34:346-352.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Gerdes SMB, Ekelund CK, Rode L, et al. Motivation towards first trimester screening for preeclampsia among pregnant women in Denmark: A cross-sectional questionnaire study. *Acta Obstet Gynecol Scand*. 2023;102:1531-1540. doi:[10.1111/aogs.14632](https://doi.org/10.1111/aogs.14632)