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ORIGINAL RESEARCH

Pregnant and puerperal women's knowledge and awareness of venous thromboembolism: a medical of things survey technique

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Abstract

Pregnant women are at a higher risk of venous thromboembolism (VTE) during pregnancy and postpartum. Coronavirus disease 2019 (COVID-19) infection increases the risk of VTE. This study aimed to assess pregnant and puerperal women's knowledge and awareness of VTE. The study included 403 females at the maternity hospital in the Al-Ahsa region, Saudi Arabia. All participants were chosen by convenience sampling technique and interviewed about their bio-demographic, clinical, and gynecological data, personal and/or family history of VTE, history of thromboprophylaxis, and knowledge about deep vein thrombosis (DVT) and pulmonary embolism (PE). The results of the study revealed that 284 (70.5%) of the participants had poor knowledge about DVT, and only 119 (29.5%) had a good level of knowledge, with a mean score of 8.7 out of 20. Although VTE prevalence has increased due to COVID-19 and its complications, the study results showed a lack of knowledge and poor awareness of VTE among 70.5% of the study participants. The education of women regarding VTE should be improved, especially among pregnant females. More patient education and public education campaigns are needed to increase public awareness of VTE, especially during the COVID-19 pandemic.

Keywords

Venous thromboembolism; COVID-19; Postpartum; Obstetric hemorrhage

1. Introduction

Venous thromboembolism (VTE) is a blood clot in the vein that usually occurs in the lower extremities [1–3]. There are two types of VTE: deep vein thrombosis (DVT) and pulmonary embolism (PE) [1–3]. Deep vein thrombosis is the formulation of blood clots in a deep vein in the body, usually the lower leg, thigh, or pelvis, whereas pulmonary embolism is a complication of DVT whereby a clot travels from the leg to the lungs through the bloodstream, causing a blockage in the lung artery [4]. Venous thromboembolism (VTE) is a serious medical condition that may lead to death [4]. However, VTE can be prevented if the risk factors are well managed. Pregnant women are at a higher risk of developing blood clots during pregnancy and postpartum; the cumulative incidence of VTE worldwide has been reported to occur in 0.5–2.0 per 1000 pregnancies and accounts for 1.1 deaths per 100,000 pregnancies [5]. During pregnancy, as the foetus's size increases, pressure increases on the blood vessels around the pelvis, reducing the blood flow in the vein from the leg to the heart [6, 7]. In addition, blood clots can constrict blood flow during labour and delivery [6, 7]. Therefore, the risk of VTE is five times higher in pregnant women than in non-pregnant women [8]. Risk factors of VTE in pregnancy include a previous history of VTE, obesity, multiple deliveries, caesarean section (CS), immobility, being 35 years old or older, major surgical procedures or trauma, recent hospitalisation within the previous 90 days, and infections, especially coronavirus disease 2019 (COVID-19) [9–11]. Pregnancy may also cause immunosuppression, which makes pregnant females more susceptible to complications after viral infections [12, 13]. Several studies have found that thromboembolic complications increase after COVID-19 infections in pregnant women, which may lead to increased hospitalisation and increased maternal mortality [14–18]. A study conducted in Arabian Gulf countries showed that 32% of pregnant women have at least one risk factor that may lead to the development of VTE [19], a fact that highlights the need for increased awareness among pregnant women about this condition. Furthermore, the risk extends after delivery up to six weeks, and the incidence increases with caesarean delivery compared to incidence after normal vaginal delivery [20, 21]. Optimal prophylaxis or treatment is started after assessing the

pregnant woman's condition and risk factors [8, 21, 22]. Low-molecular-weight heparin (LMWH) and unfractionated heparin (UH) are the anticoagulant drugs of choice [8, 21, 22]. The prophylactic dose is usually calculated based on the patient's weight, thrombosis, and bleeding risk. Thus, depending on the risk assessment and hospital protocols, pregnant women may have to take blood thinner medication during pregnancy and continue with prophylactic treatment for a short period after giving birth [8, 21, 22]. On the other hand, some pregnant women may only need the medication during the postpartum period [8, 21, 22]. This study contributes to the prevention of VTE by emphasising the importance of educating women and raising their awareness of the risk factors of VTE. The study also highlights the role of medical prophylaxis in preventing such a serious condition and notes that the general health of pregnant and postpartum women could be improved [23, 24]. However, unfortunately, global awareness of VTE is poor [25, 26]. In 2020, The American Heart Association and the International Society on Thrombosis and Haemostasis stated that the management of VTE in paediatric and pregnant patients is still understudied and more studies targeting this population are warranted to assess and increase the patients' awareness about the risk factors and prevention of VTE [27, 28]. In a previous study conducted in the Alahsaa region, Saudi Arabia, the authors found that 44% of postpartum females lacked knowledge about the importance of DVT prophylaxis after caesarean section [3]. Effective educational techniques regarding VTE during pregnancy would improve adherence to VTE prophylaxis and thereby decrease the frequency of VTE in this high-risk population [27, 28]. Therefore, in this study, we aimed to assess pregnant and puerperal women's knowledge and awareness of VTE.

2. Materials and methods

2.1 Study design, sampling, and data collection

For this cross-sectional study, the research team conducted a patient interview-based survey among 403 pregnant or puerperal women waiting for a consultation at the Maternity and Children Hospital (MCH) in the eastern province of Saudi Arabia. MCH is the main public maternity hospital in Al-Ahsa. A convenience sampling technique was used to select the participants. The data collection period was four months (from November 2020 to February 2021). To meet the inclusion criteria, the participants had to be women aged 18 years or older who were currently pregnant or postpartum. Women who were under 18, not married, or had never been pregnant were excluded.

2.2 Study questionnaire

The study questionnaire consisted of 14 questions. Some questions were adopted and modified from a prior study [25]. The questionnaire was validated by specialists in the field of pharmacy at King Faisal University for clarity and suitability and modified after a pilot study conducted on 15 participants [28, 29]. The questionnaire comprised two main parts: (1) the women's demographics: age, education, individual history or family history of VTE, and frequency of pregnancies/abortions, and (2) the definition of DVT and PE, features and causes of DVT and PE, and factors leading to VTE

2.3 Sample size

The sample size was calculated based on the average daily number of patients who follow the public MCH in Al-Ahssa and the number of deliveries per month, by using an online sample size calculator (Raosoft®, Inc); at a 5% margin of accepted error, and 95% confidence interval with a daily average of 150 based on patients' attending the public maternity hospital in Al-Ahssa. The desired sample size was 341 participants; however, the actual sample size was 403.

The sample size n and margin of error E are given by:

$x = Z(c/100)2r(100 - r)$

$n = N\,x/((N - 1)E2 + x)$

$E = Sqrt[(N - n)x/n(N - 1)]$

where N is the population size, r is the fraction of responses., and Z(c/100) is the critical value for the confidence level c.

2.4 Statistical analyses

After data were extracted, it was revised, coded, and fed to statistical software IBM SPSS version 22 (SPSS, Chicago, IL, USA).

A descriptive analysis, frequency, and percent distribution were done for all variables, including demographic data, pregnancy status, gravidity, abortion, hospital site and the participants' awareness of DVT and its clinical presentations.

The three knowledge domains of the survey were DVT, PE, and general awareness. Each correct answer within a domain was given one point. The overall score of the total summation of the discrete scores was calculated as 20 points. A participant with poor knowledge scored less than 60% of the total score for each domain and the overall score. On the other hand, a participant was considered as having good knowledge if her score was equal to or more than 60%.

Cross-tabulation was used to assess the distribution of knowledge as it related to participants' characteristics. A Pearson Chi-square test and exact probability test were used to test the relationships because of small frequency distributions. One way Analysis of variance (ANOVA) was applied to compare the differences in knowledge scores for three or more groups.The entire statistical analysis was done using two-tailed tests. Statistically significant results were those with a *p*-value of less than 0.05.

3. Results

Four hundred and three women completed the study questionnaire and fulfilled the inclusion criteria. The participants' mean ages 28.2 ± 10.9 years. Two hundred forty-one (59.8%) participants had degrees or post-graduate degrees. Out of the 403 participants, 170 (42.2%) had been pregnant three or more times while 78 (19.4%) were pregnant for the first time. Concerning abortion frequencies, 91 (22.6%) participants had had one abortion, 34 (8.4%) participants had had two abortions, and the remaining 234 (58.1%) had no history of abortion. Two hundred and forty-nine (61.8%) of the study participants

were pregnant at the time of the study. Regarding medical and family history, 68 (16.9%) participants had a family history of DVT, 12 (3%) had a personal history of DVT, and 116 (28.8%) received prophylactic treatment for DVT (Table 1).

TABLE 1. Bio-demographic aspects of the 403 study participants.

Bio-demographic Aspects	No	%
Age (years)		
18–25	94	23.3%
26–35	190	47.1%
36–45	96	23.8%
>45	23	5.7%
Educational level		
high school or less	162	40.2%
graduates	241	59.8%
Gravidity		
Once	78	19.4%
2	83	20.6%
3	72	17.9%
>3	170	42.2%
Abortions		
None	234	58.1%
1 time	91	22.6%
2 times	34	8.4%
3 times	23	5.7%
>3 times	21	5.2%
Pregnancy status		
Puerperal	154	38.2%
Pregnant	249	61.8%
Hospital site		
Maternity and Children's Hospital	345	85.6%
Other hospitals	58	14.4%
Personal/family history of DVT		
Had a family history of DVT	68	16.9%
Had a personal history of DVT	12	3.0%
Received prophylactic treatment for DVT	116	28.8%
None of the above	249	61.8%

DVT: deep vein thrombosis.

One hundred sixty-two (40.2%) participants correctly defined DVT as blood clots in thigh veins. When asked about the risk factors of DVT, the number of participants who chose the correct answers were as follows: 264 (65.5%) identified limited mobility, 231 (57.3%) identified increased weight, 146 (36.2%) identified cesarean section, 111 (27.5%) identified contraceptive pills, and 102 (25.3%) identified pregnancy. As for signs and symptoms of DVT, the most commonly identified correct answers were unilateral limb oedema (54.3%), limb numbness (46.2%), limb pain (39.5%), and black toenails (21.8%) (Table 2).

TABLE 2. Study participants' awareness of the definition of DVT, risk factors, and correct and incorrect signs and symptoms.

DVT Awareness	No.	%
1-What is DVT?		
Correct statement		
Blood clots in thigh veins	162	40.2%
Incorrect statement		
Leg paralysis	3	0.7%
Blood clots in coronary arteries	64	15.9%
Vascular bleeding	6	1.5%
Do not know	168	41.7%
2-Risk factors of DVT		
Do not know	71	17.6%
Correct risk factors		
Increased weight	231	57.3%
Limited mobility	264	65.5%
Pregnancy	102	25.3%
Ceserean section	146	36.2%
Using contraceptives	111	27.5%
Incorrect statements		
Long time standing	103	25.6%
Wearing high-heeled shoes	38	9.4%
Lack of sun exposure	85	21.1%
Calcium deficiency	53	13.2%
3-Signs of DVT		
Do not know	81	20.1%
Correct signs and symptoms		
Unilateral limb oedema	219	54.3%
Limb pain	159	39.5%
Black toenails	88	21.8%
Limb numbness	186	46.2%
Incorrect statements:		
Tachycardia	162	40.2%
Dyspnoea	139	34.5%
Skin inflammations	55	13.6%
Fever	88	21.8%
Loss of leg hair	33	8.2%

DVT: deep vein thrombosis.

One hundred and twelve (27.8%) study participants correctly defined PE as the transfer of DVT to the lung vascularity. Regarding signs and symptoms, the most frequently identified correct signs and symptoms were dyspnoea (66%), followed by chest pain and tightness (58.6%), tachycardia (37%), dizziness (30%), and cough (29.3%) (Table 3).

When assessing the study participants' general awareness

TABLE 3. Study participants' awareness of the definition of PE, risk factors, and correct and incorrect signs and symptoms.

Pulmonary Embolism	No	%
1-What is a pulmonary embolism?		
Do not know	139	34.5%
Correct statement		
DVT transferred to the lung vascularity	112	27.8%
Incorrect statement		
Pulmonary inflation	26	6.5%
Pulmonary oedema	122	30.3%
Lung cancer	4	1.0%
2-Signs and symptoms of PE		
Do not know	105	26.1%
Correct signs and symptoms		
Cough	118	29.3%
Dyspnoea	266	66.0%
Chest pain and tightness	236	58.6%
Tachycardia	149	37.0%
Dizziness	121	30.0%
Incorrect signs and symptoms		
Fever	81	20.1%
Vomiting	66	16.4%

DVT: deep vein thrombosis; PE: pulmonary embolism.

of VTE, 56% reported that pregnant women aged 35 years and above should be concerned about DVT; 68.5% knew that DVT can cause PE; 43.9% knew that heparin can be used to prevent DVT, and 43.2% knew that heparin can be used for the treatment of DVT (Fig. 1).

The calculation of the participants' overall knowledge level (and score) regarding VTE revealed that 284 (70.5%) participants had poor knowledge about VTE and only 119 (29.5%) had a good level of knowledge, with a mean score of 8.7 out of 20 (Table 4).

TABLE 4. Participants' knowledge level (and score) regarding VTE.

Overall Knowledge Level	No	%	Range	Mean ± SD
Poor	284	70.5%	0–20	8.7 ± 4.7
Good	119	29.5%		

SD: Standard deviation.

When distributing participants' knowledge regarding VTE, we found that 40.4% of young females (18–25 years) had good knowledge compared to 26.1% of participants aged more than 45 years, with a reported statistical significance (p = 0.044). Furthermore, 32.4% of highly educated participants had a good knowledge level about VTE compared to 25.3% of those with educational levels below university, with a significant statistical difference (p = 0.048). Other factors, including gravidity, abortion, and pregnancy status had no significant relation to the participants' level of knowledge (Tables 5,6).

4. Discussion

Based on our results, the majority of participants (70.5%) have poor knowledge about VTE. This is consistent with previously published studies [26, 30, 31]. A slightly higher level of awareness was reported by Wendelboe *et al.* [25], who found, nevertheless, that the global knowledge and awareness of VTE are poor. Sixty-eight percent, 44 percent, and 54 percent of the more than 7000 respondents from different countries knew the terms thrombosis, deep vein thrombosis, and pulmonary embolism, respectively [25]. The results of the study conducted by Wendelboe *et al.* [25] revealed that global awareness of VTE is lower than that of heart attacks and strokes (88% and 85%, respectively). Also, similar results were found in a study conducted in King Abdulaziz Medical City, Riyadh, KSA, which revealed a poor level of awareness of VTE among hospitalised patients (48.3% were females) receiving LMWH [31, 32]. It is worth noting that only a small number of our study participants (25.3%) identified pregnancy as a risk factor for VTE. A committee from the American College of Obstetricians and Gynecologists' (ACOG) reported that pregnant and postpartum females are at an increased risk of thromboembolism [33]. Furthermore, other risk factors that have been highlighted in the American Academy of Family Physicians' (AAFP) guidelines like immobility and obesity were better known by 65.5%, 57.3%, and 36.2% of participants, respectively [34].

Only 36.2% of our study participants identified caesarean section (CS) as a risk factor for DVT. Results from several studies showed that CS poses a significantly higher risk of postpartum mortality due to VTE than vaginal delivery [20, 35]. The American Heart Association has classified major surgeries like CS as a strong risk factor for VTE [36]. Women who have had an emergency CS birth or an elective CS birth with additional risk factors should receive LMWH for ten days as postnatal thromboprophylaxis, according to the Royal College of Obstetricians and Gynaecologists (RCOG). Moreover, the American College of Chest Physicians recommends that patients who undergo CS delivery and who have additional risk factors for VTE be prescribed LMWH prophylactically. In addition, at King Edward Memorial Hospital in Australia, LMWH thromboprophylaxis is recommended following a CS birth for elective CSs with one or more risk factors or where an emergency or non-elective CS birth has been performed during labour [8, 21, 22].

In addition, our study participants' answers demonstrate insufficient information regarding the clinical signs and symptoms of DVT. This may be explained by the results of a study done in Riyad that showed that 46% of the study participants were not satisfied with the information given to them about DVT and PE [31]. Patient education is crucial in the management of VTE. All pregnant women should be informed about the signs and symptoms of VTE and advised to seek medical assistance as soon as possible [24].

Pregnant women should be able to recognise VTE signs and

TABLE 5. An analysis of the participants' levels of knowledge of VTE based on their bio-demographic characteristics.

Bio-demographic Information	Level of Knowledge				*p*-value
	Poor		Good		
	No.	%	No.	%	
Age (years)					
18–25	56	59.6%	38	40.4%	0.044*
26–35	143	75.3%	47	24.7%	
36–45	68	70.8%	28	29.2%	
>45	17	73.9%	6	26.1%	
Educational level					
Below university	121	74.7%	41	25.3%	0.048*
University or above	163	67.6%	78	32.4%	
Gravidity					
1	53	67.9%	25	32.1%	0.265
2	53	63.9%	30	36.1%	
3	56	77.8%	16	22.2%	
>3	122	71.8%	48	28.2%	
Abortions					
None	153	65.4%	81	34.6%	0.063#
1	68	74.7%	23	25.3%	
2	29	85.3%	5	14.7%	
3	19	82.6%	4	17.4%	
>3	15	71.4%	6	28.6%	
Pregnancy status					
Puerperal	104	67.5%	50	32.5%	0.309
Pregnant	180	72.3%	69	27.7%	
Hospital site					
MCH	240	69.6%	105	30.4%	0.331
Another	44	75.9%	14	24.1%	

p: Pearson χ^2 test.
#: Exact probability test.
** $p < 0.05$ (significant).*
MCH: Maternity and Children Hospital.

symptoms correctly because they resemble other conditions such as varicose veins; although both have similar features such as skin discoloration, discomfort, or leg oedema, they are managed differently. Thus, healthcare providers should explain the differences to their patients as the risk of varicose veins is also increased during pregnancy [37].

In our study, the participants with a higher level of education had a significantly better understanding of VTE ($p = 0.048$), which is consistent with the results in Jordan [26]. This finding emphasises the fact that "education is a fundamental social determinant of health" [38].

Of the young participants (18–25 years), 40.4% were found

TABLE 6. An analysis of participants' knowledge scores regarding VTE based on their bio-demographic data.

Bio-demographic Data	Overall Knowledge Score (0–20)		*p*-value
	Mean	SD	
Age in years			
18–25	9.3	4.9	0.058$
26–35	8.3	4.5	
36–45	9.3	4.6	
>45	8.3	4.9	
Educational level			
Below university	8.3	4.9	0.106^
University or above	9.0	4.5	
Gravidity			
1 time	8.7	4.6	0.982$
2 times	8.7	4.9	
3 times	8.6	4.3	
>3 times	8.8	4.7	
Abortions			
None	9.0	4.7	0.232$
1 time	8.6	4.5	
2 times	7.6	4.9	
3 times	7.4	4.6	
>3 times	9.5	4.0	
Pregnancy status			
Puerperal	8.8	5.0	0.882^
Pregnant	8.7	4.4	
Hospital site			
MCH	9.0	4.6	0.012*^
Another	7.3	4.9	

$: One Way ANOVA.
^: independent t-test.
** $p < 0.05$ (significant).*
MCH: Maternity and Children Hospital; SD: Standard deviation.

to have a good level of knowledge, compared to 26.1% of women over 45 years old. Unlike our results, the study conducted in Jordan showed younger patients were less aware of DVT, which could be due to their limited exposure/experience compared to older patients [26].

We believe that pregnant and puerperal women should be aware of VTE, especially during pandemics like COVID-19. In coronavirus-infected pregnant women, D-dimer increased, as did prothrombin time and activated thromboplastin time, amplifying the coagulopathy state during pregnancy [39]. These serious laboratory changes are usually linked to a poor prognosis, as shown in many recently published articles [40–42]. Pregnant women are believed to be more vulnerable to severe infections that may require intensive care unit (ICU) admission and mechanical ventilation [43–45]. COVID-infected pregnant women had a 22-fold greater mortality rate than non-pregnant women, according to international cohort research [45–47]. In addition, some of the foetal complications that have been reported are mainly attributed to premature rupture of membranes and intrauterine growth restriction [46]. Multiple professional societies encourage the use of VTE prophylaxis, especially for cases that require hospital admission.

Even though the current study is based on a single-center experience, it was carried out at the region's primary public maternity hospital. In addition, the study participants are from different age groups and different educational levels, which makes the generalisability of our findings feasible. Also, at the end of every interview, the participants were encouraged to ask questions and were pleased with the amount of information they received. In-person interviews with the target population helped to enhance the participants' knowledge of VTE risks and symptoms.

Our study has several limitations. Firstly, it is a single-center study. Secondly, we did not assess the knowledge of the participants who took prophylactic treatments of DVT.

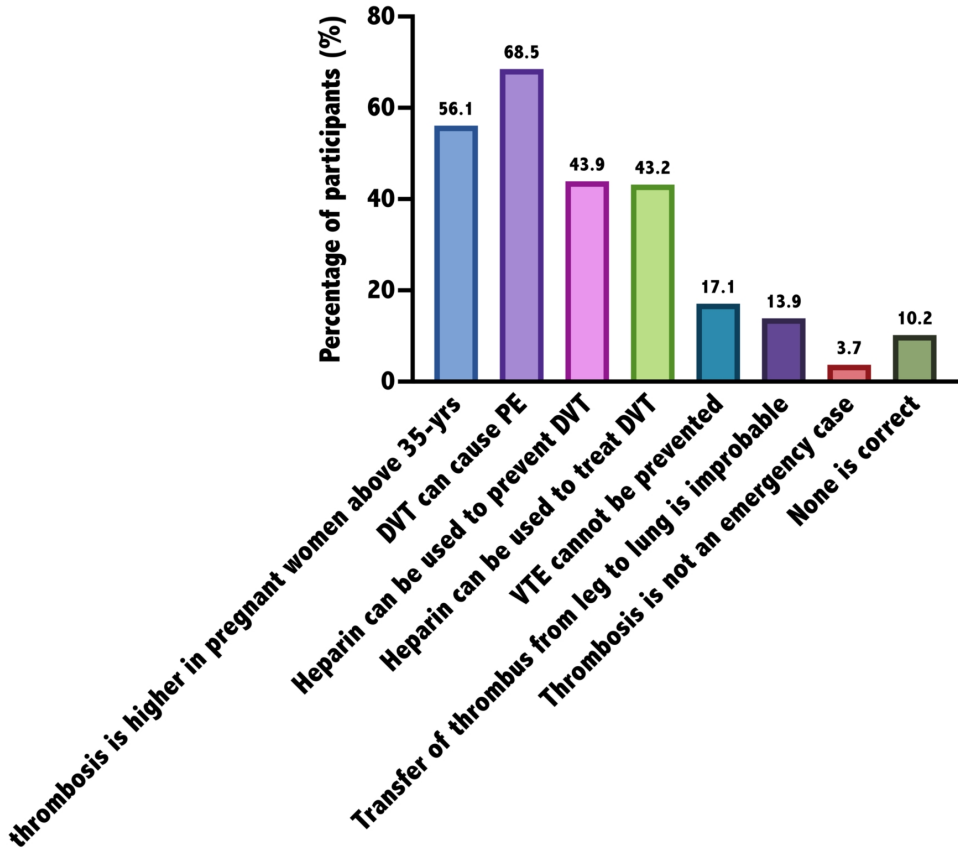

FIGURE 1. Study participants' general awareness of VTE. DVT: deep vein thrombosis; PE: pulmonary embolism; VTE: venous thromboembolism.

5. Conclusions

The study results showed a lack of knowledge and poor awareness about VTE among 70.5% of the study participants, who were pregnant and puerperal women. Health education of women regarding VTE should be improved, especially among pregnant females. More patient education and public education campaigns are needed to increase public awareness of VTE.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

DAE and ASA—Conceptualization, supervision, and project administration; DAE, AZA, JTA, TAA, ZMA, NSA, NAA, SIA, ZHA and MA—Methodology, investigation, and resources; DAE and NSA—Software; DAE, NAA and ASA—Validation; DAE and NSA—Formal analysis; AZA, JTA, TAA and ZMA—Data curation; DAE, AZA, JTA, TAA, ZMA, NSA, MA and ZHA—Writing original draft; DAE and ASA—Writing, review, and editing; DAE and ASA—Visualization. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Institutional Review Board (IRB) at King Fahad Hospital Hofuf (KFHH RCAN0. 57-35-2020). All participants provided informed verbal consent before data collection.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.signavitae.com/mre-signavitae/article/1655842848302350336/

attachment/Supplementary%20material.docx.

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