Knowledge of Venous Thromboembolism Among Nigerian Pregnant Women: a Preliminary Survey for the 'move for Flow' Program

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Research Article

Abstract

Background: Pregnancy is a significant risk factor for Venous Thromboembolism (VTE) which results in high maternal and perinatal morbidity and mortality rates. Awareness creation is one of the preventable strategies of VTE. To this effect, we designed the 'Move for Flow' program aimed at maternal health education on VTE, its symptoms and preventive strategies. For the best implementation of this program, the current knowledge level of the relevant population is of great interest in guiding the program design and implementation.

Aim: To assess the knowledge levels of VTE among Nigerian pregnant women.

Methodology: In this cross-sectional survey, 1000 pregnant women residing in Enugu, Nigeria, completed a structured questionnaire which assessed their knowledge of VTE, its risk factors and prevention strategies. Quantitatively, their knowledge levels were categorized as no, poor, average and good knowledge.

Results: The majority of the respondents did not know about pregnancy-related deep vein thrombosis (DVT) (80.8%) and pulmonary embolism (PE) (88.9). Predictors of DVT knowledge levels include husbands' level of education (at most secondary education) (AOR=4.2; 95%CI =2.554-6.816; p= <0.001) and maternal age (AOR=0.9; 95% CI=0.930-0.999; p=0.044) while predictors of PE knowledge level include husbands' level of education (at most secondary education) (AOR=2.1; 95%CI=1.005-4.436; p=0.048)and maternal occupation (professionals) (AOR=0.4; 95% CI=0.219-0.794; p=0.008)

Conclusion: Pregnant women are unaware of pregnancy-related VTE in Enugu, Nigeria. Immediate designing and implementation of the 'Move for Flow' program are recommended to improve maternal knowledge levels of VTE.

Introduction

Pregnancy and the postpartum period are well-established high-risk factors for venous thromboembolism (VTE), a disease that includes pulmonary embolism (PE) and deep venous thrombosis (DVT). Moreover, VTE is among the major causes of cardiovascular diseases worldwide [1]. The prothrombotic vulnerability of pregnancy is characterized by the three components of Virchow's triad: venous stasis, endothelial injury, and hypercoagulability [2]. While both venous stasis and hypercoagulability are hormonally induced haemostatic alterations that culminate in a reduction in venous tone and the blockage of venous flow by the expanding uterus [3], they are also physiological preparations to limit the bleeding associated with parturition [4,5]. Likewise, endothelial injury in the pelvic veins might develop during birth or because of venous hypertension [6]. Furthermore, venous stasis in pregnancy [7,8], poor lifestyle habits (lack of exercise, smoking, and alcohol use), a higher frequency of complicated pregnancies, and a high rate of caesarean sections contribute to the development of VTE in pregnancy and the postpartum period [9].

The incidence and prevalence of VTE, as reported in the literature, warrant clinical and research concerns, as VTE affects around one in every 100,000 women of reproductive age [10]. It is up to ten times more prevalent in pregnant women than non-pregnant women of comparable age [11]and affects around 1 in 1,000 pregnancies in women under 35 [9]. Also, the affectation of 2.4 out of every 1,000 pregnancies in women over 35 has been reported [12]. More so, PEs have been reported in the UK to account for 10-20% of VTEs and are the leading direct cause of maternal mortality, accounting for one-third of all maternal deaths [13]. Meanwhile, there is a shortage of evidence on the awareness and practice of VTE preventive measures in Africa. In the case of pregnant women, this is of key clinical consequence as VTE has been reported as among the leading direct causes of maternal mortality [13]. Studies in Nigeria have reported gestational-related haemostatic changes in women with normal [14-16] and complicated [17,18]

pregnancies, suggesting the likelihood of VTE among this population. However, evidence of the global *epidemiology and* public awareness of this condition is deficient in *Africa[19]*.

According to Goldhaber and Fanikos [21], awareness of VTE is the best strategy for its prevention, as it will inform vulnerable persons to take appropriate lifestyle modifications to prevent its occurrence. Prevention and early detection of VTE are also better than its management as they could help to halt the progression and avoid morbidity and mortality associated with acute VTE [21]. Pharmaco-prophylaxis is the primary and commonest measure to prevent VTEs in pregnant and postpartum women. However, other alternative measures have documented evidence of their roles in preventing VTE. Some of these include lifestyle modifications [22], physical exercises [23,24], inferior vena cava filters [25], pneumatic compression devices [26], and early mobilization following cesarean deliveries [27].

Knowledge of DVT and PEs among pregnant women is paramount to ensure safe and high-quality patient care[20,28]. Meanwhile, studies have reported poor awareness of VTE, its major risk factors [28-30] and the practice of thromboprophylaxis globally, particularly among healthcare workers [31]. However, studies assessing awareness of VTE and its prevention strategies are scarce among women in their childbearing age. Ahmed et al. [28] conducted a study evaluating the awareness of VTE among at-risk pregnant and postpartum women in Saudi Arabia. Their findings showed poor awareness and knowledge deficit about VTE among the women. The authors recommended more campaigns to increase awareness of VTE risk to ensure safe and high-quality patient care.

To the best of our knowledge, there is a lack of data on the awareness of VTE among pregnant and postpartum women in sub-Saharan Africa. With the growing incidence of pregnancy-related VTE, there is a need to educate women on the concept of VTE, its risk factors, signs and symptoms, preventive strategies and appropriate health-seeking attitudes. Such interventions will undoubtedly reduce maternal mortality rates relative to pregnancy-related VTEs. As a result of this need, we launched the 'Move for Flow' (MFF) health promotion program aimed at maternal education targeted at the prevention and management of pregnancy-related VTE. However, implementation of such a program requires baseline information on current knowledge levels to enable its most appropriate design and effective outcomes. Therefore, we designed this study to assess the level of knowledge of DVT and PE among pregnant women in Enugu State, Nigeria.

Methodology

Study Design, Area, and Population

This study is a cross-sectional descriptive survey. We collected from one thousand (1000) pregnant women attending antenatal care in Enugu state, southeastern Nigeria. There are four major tertiary hospitals in the State, with seven district hospitals in different areas and at least one health centre or cottage hospital in each of the 17 local government areas [32].

Only two tertiary hospitals (the University of Nigeria Teaching Hospital and Enugu state University Teaching hospital) offering women's health services within the State were included in this study. Others included mission and private hospitals randomly selected from the Enugu metropolis using cluster sampling. These hospitals cut across all levels of healthcare delivery systems in rural and urban areas of the State. Pregnant women across various trimesters receiving antenatal care in the selected hospitals were conveniently recruited for this study. A comprehensive survey of all the pregnant women available at the selected hospitals and willing to participate in this study within three months (June-August 2022) was conducted with a sample size of 1000 respondents. Pregnant women who are health professionals with known memory impairments and previous diagnoses of VTE were excluded from this study.

Ethical Considerations

Before commencing this study, ethical approval was sought and obtained from the University of Nigeria Health Research and Ethics Committee NHREC/05/01/2008BB-FWA00002458-1RB00002323. Respondents will give signed informed consent before enrollment in this study.

Study instrument

Data was collected using a structured questionnaire, with some contents partly adapted from a previously validated one used in other studies [28,29]. This questionnaire comprises 37 close-ended questions divided into three sections, A, B and C. Section A, contains six questions investigating the socio-demographic characteristics of the respondents, while B assesses their past and present obstetric history with 11 questions. Section C, comprising 20 questions, assesses respondents' knowledge of DVT and PE, their symptoms, risk factors, preventive measures, and their sources of information. This questionnaire was initially drafted in English and translated into the Igbo language. Both versions underwent a face and content validation by experts in women's health and haematology. Subsequently, a pilot test was carried out at Enugu state university teaching hospital, Parklane, Enugu State, using the test-retest reliability method at an interval of one week. Twenty copies of each questionnaire were administered to 20 pregnant women in both situations. The scores were subjected to Cronbach's reliability test to determine their reliability coefficient, with alpha values of 0.86 and 0.79 for the English and Igbo versions, respectively.

Procedure for Data Collection

On approval to conduct this study in the respective hospitals, all identified pregnant women meeting the study criteria in each hospital were addressed collectively at the antenatal clinics. On indication of interest, prospective respondents were enrolled on the study. We administered the questionnaires to them face-to-face while guiding them accordingly. Filled copies of the questionnaires were collected immediately. A total of 1250 questionnaires were distributed, but only 1000 copies were filled out and returned, giving a response rate of 80%.

Data Analysis

Data were analyzed using Statistical Package for Social Sciences Software (version 23, SPSS, Inc. Chicago, Illinois). Data were summarized and analyzed using descriptive statistics of percentage, frequency counts, mean, and standard deviation, as well as inferential statistics of Chi-square to test for relationships between selected variables. In addition, stepwise multivariable logistic regression analysis was used to identify independent predictors. The p-value will be set at 0.05 for all analyses.

Results

Socio-demographic and obstetrics Characteristics of the Respondents

The majority of the respondents were within the age range of 21-40 years (95.2%), attained the tertiary level of education (46.3%) and had spouses who had reached the tertiary level of education (39.9%) (Table 1). The majority of the respondents have had 2-4 pregnancies (52.8%) with 2-4 childbirths (34.4%) and 1-4 children (52%), respectively. In their past obstetrics history, most commenced antenatal care within 13-24 weeks (51.1%), gave birth through safe vaginal delivery (41.6%) and received maternal health education in their respective antenatal classes (96.1%). Furthermore, table 2 shows that a greater percentage of the respondents (93.9%) have no known previous or current diagnosis of venous thromboembolism.

Knowledge and awareness of Venous thromboembolism among the respondents

More than the average of the respondents (53.8%) were aware of pregnancy as a risk factor for blood flow complications. However, only 19.2% and 11.1% of the respondents have heard of the terms deep vein thrombosis and pulmonary embolism, respectively. For DVT and PE only 17.7% and 6.4% have good knowledge of DVT and PE, respectively. Out of the 192 women reportedly aware of DVT, most identified venous blood clots as a causal factor (53.7%) and leg swelling as its primary symptom (44.8%). Of the women knowledgeable of PE, 58.6% reported that they know what PE feels like, while a majority (55.9%) of them know that it is caused by blood clots in the lungs' blood vessels with characteristic shortness of breath as its primary symptom. Cumulatively only 17.7% and 6.4% of the respondents have a good knowledge of DVT and PE, respectively.

Table 3: Awareness and knowledge of DVT and PE among the respondents (n=1000)

Variables	DVT	PE
Heard of DVT/PE (n=1000%)		
Yes	192 (19.2)	**111(11.1)**
No	808 (80.8)	**889 (88.9)**
Knowledge of what a DVT/PE experience feels like	DVT(n=192),	PE(n=111)
Yes	105 (54.7)	**65 (58.6)**
No	87 (45.3)	**46 (41.4)**
Causes of Deep venous thrombosis (n=192)		
Blood clot in the vein	103 (53.7)	-
Lack of oxygen in the vein	25 (13.0)	-
A tumour in the vein	17 8.9 ()	-
None of the above	4 (2.1)	-
Not sure	40 (20.8)	-
Causes of pulmonary embolism (n=111)		
A blood clot blocking a blood vessel in the lungs	-	65 (58.6)
A blood clot blocking a blood vessel in the heart	-	39 (35.1)
When the lung stops working	-	9 (8.1)
None	-	5 (4.5)
Not sure	-	29 (26.1)
Symptoms of pulmonary embolism (n=111)		
Shortness of breath	-	62 (55.9)
Slow, shallow breath	-	46 (41.4)
Chest pain	-	56 (50.5)
Rapid heart rate	-	35 (31.5)
Lightheadedness of passing out	-	38 (34.2)
Symptoms of a blood clot in the leg (n=192)		
Swelling of the leg	86 (44.8)	-

Itching of the leg	26 (13.5)	-
Pain or tenderness in the leg	51 (26.6)	-
Noticeable skin colour change	36 (18.8)	-
Leg feels warm to touch	33 (17.2)	-
Leg paralysis	16 (8.3)	-
Others	2 (1.0)	-
None of the above	3 (1.6)	-
Not sure	19 (9.9)	-
Cumulative knowledge level (n = 1000)		
No knowledge	808 (80.8)	889 (88.9)
Poor	0	17 (1.7)
Average	15 (1.5)	30 (3.0)
Good	177 (17.7)	64 (6.4)

Key: DVT – Deep venous thrombosis; PE – Pulmonary embolism

Awareness of risk factors of venous thromboembolism among the respondents.

Most respondents identified not moving for an extended period (sedentary lifestyle) as the major risk factor for VTE (54.3%). Other risk factors of VTE identified by them include high blood cholesterol (40.1%), surgery (33.1%), hospital stay (30.1%), pregnancy and postpartum (26.4%), cancer (26.4%) and age >60years (26.4%).

Health education profile of the respondents relative to VTE knowledge and its preventive strategies

Most respondents have never received any health education on the mechanism of blood flow in the blood vessels (81.1%), strategies for improving blood flow in the vessels and enhancement of blood flow as a means of blood clot prevention(83.3%). The commonest preventive strategies of venous thromboembolism, as identified by the respondents, include general body exercise (80.6%), some specific exercise of the leg and foot (67.7%), frequent health check-ups (66.4%), not sitting down or lying down at a place for a long time (61.2%) and not wearing tight clothing (53.9%).

Associations between Respondents' Socio-Demographic Characteristics and Knowledge of Venous Thromboembolism

The only factors associated with respondents' knowledge of DVT include their level of education (p=**0.003**), major occupation (p=**0.001**), and spouses' level of education (p=**< 0.001**). On the other hand, there was a significant association between the respondents' knowledge of PE and all the socio-demographic factors, including age (p =0.003), maternal level of education (p =0.003), current employment status (p =0.001), occupation (p <0.001) and spouses' level of education (p = 0.028) (table 3).

Table 4: Associations between respondents' socio-demographic characteristics and knowledge of venous thromboembolism

Variable	PE			DVT		
	Yes	No	X^2 (P value)	Yes	No	X^2 (P value)
Age						
<21	1 (0.9)	39 (4.4)	15.896 **(0.003)**	4 (2.1)	37 (4.6)	**2.823 (0.244)**
21-40	108 (97.3)	843 (94.8)		186 (96.9)	766 (94.8)	
>40	2 (1.8)	5 (0.5)		2 (1.0)	5 (0.6)	
Level of education						
None	1 (0.9)	14 (1.6)		2 (1.0)	13 (1.6)	**16.411(0.003)**
Primary	0 (0.0)	34 (3.8)	**22.075 (0.003)**	2 (1.0)	32 (4.0)	
Secondary	25 (22.5)	297 (33.4)		45 (23.4)	277 (34.3)	
Tertiary	63 (56.8)	400 (45.0)		100 (52.1)	363 (44.9)	
Postgraduate	22(19.8)	142 (16.0)		43 (22.4)	123 (15.2)	
Current employment status						
Yes	69 (62.2)	382 (43.0)	**14.542 (0.001)**	95 (49.5)	357 (44.2)	**1.757 (0.185)**
No	42 (37.8)	505 (56.8)		97 (50.5)	451 (55.8)	
Occupation						
None	24 (21.6)	330 (37.1)		50 (26.0)	301 (37.3)	**22.960 (0.001)**
Professional/technical/managerial	53 (47.7)	183 (20.6)		70 (36.5)	166 (20.6)	
Clerical	2 (1.8)	32 (3.6)	**47.561 (<0.001)**	4 (2.1)	30 (3.7)	
Sales and services	16 (14.4)	174 (19.6)		32 (16.7)	158 (19.6)	
Skilled manual	15 (13.5)	127 (14.3)		25 (13.0)	177 (21.9)	
Unskilled manual	0 (0.0)	24		4 (2.1)	20	

		(2,7)			(2.5)	
Agriculture	1 (0.9)	19 (2.1)		4 (2.1)	16 (2.0)	
Spouses' level of education						
None	3 (2.7)	46 (5.2)	**17.225 (0.028)**	5 (2.6)	44 (5.5)	**44.895 (< 0.001)**
Primary	1 (0.9)	35 (3.9)		4 (2.1)	32 (4.0)	
Secondary	15 (13.5)	235 (26.4)		23 (12)	227 (28.1)	
Tertiary	55 (49.6)	344 (38.7)		77 (40.1)	322 (39.9)	
Postgraduate	37 (33.3)	229 (25.8)		83 (43.2)	183 (22.7)	

Key: DVT – Deep venous thrombosis; PE – Pulmonary embolism

Associations between Respondents' Obstetrics Characteristics and Knowledge of Venous Thromboembolism

The only factors associated with respondents' knowledge of deep vein thrombosis are the stage of pregnancy when respondents usually commence antenatal care (p=**0.030**), while those associated with respondents' knowledge of pulmonary embolism include: the previous mode of delivery (p=**0.042**) and the antenatal care in previous pregnancies (p=**0.018**).

Predictors of the knowledge level of DVT and PE

In the multivariate regression model, assessing associations between respondents' socio-demographic characteristics and their knowledge levels of DVT and PE, respectively, maternal age (AOR = 0.09; 95% CI = 2.55-6.82; p-value = 0.004) and spouses' level of education (at most secondary school) (AOR = 4.2; 95% CI = 2.554 – 6.816; p <0. 001) were found to be independent predictors of DVT knowledge level. Relative to PE, only spouses' education level (AOR = 2.1; 95% CI = 1.01- 4.44; p = 0.048) and maternal occupation (AOR = 0.4; 95% CI = 0.22 - 0.79; p = 0.008) were associated with respondents' knowledge level of PE.

Table 5: Predictors of Knowledge Level of DVT

Variable	Crude Odd Ratio		Adjusted Odd Ratio	
	OR (95% CI)	p-value	AOR (95%CI)	p-value
Education level				
At most Secondary	0.4 (0.275 − 0.689)	<0.001	1.0 (0.620 − 1.775)	0.859
Graduate	0.9 (0.522 − 1.190)	0.257	0.9 (0.620 − 1.368)	0.548
Postgraduate (ref)	-	-	-	
When ANC Commenced				
1	2.2 (0.501 − 9.917)	0.292	0.6 (0.131 − 2.809)	0.522
2	1.5 (0.334 − 6.599)	0.604	0.8 (0.182 − 3.904)	0.828
3 (ref)	-	-	-	-
Husbands Education				
At Most Secondary	0.2 (0.149 − 0.364)	<0.001	4.2 (2.554 − 6.816)	<0.001
Graduate	0.5 (0.368 − 0.755)	<0.001	2.0 (1.352 − 2.955)	0.001
Postgraduate (ref)	-	-	-	-
Occupation				
Professional	1.9 (1.224 − 3.124)	0.005	0.7 (0.406 − 1.123)	0.131
Sales & Services	0.9 (0.529 − 1.491)	0.653	1.2 (0.718 − 2.093)	0.456
Other occupations (ref)	-	-	-	-
Age (years)			0.9 (0.930 − 0.999)	0.044

Adjusted with Age and Number of children. Reference Category = Good knowledge of DVT

Table 6: Predictors of Knowledge Level of Pulmonary Embolism

Variable	Crude Odd Ratio		Adjusted Odd Ratio	
	OR (95% CI)	p-value	AOR (95%CI)	p-value
Education level				
At most Secondary	0.5 (0.271 − 0.899)	0.021	1.0 (0.470 − 2.245)	0.946
Graduate	1.0 (0.612 − 1.736)	0.909	1.0 (0.531 − 1.908)	0.985
Postgraduate (ref)	-	-	-	-
Currently employed				
Yes	2.2 (1.446 − 3.257)	<0.001	0.6 (0.341 − 1.067)	0.083
No (ref)	-	-		
When ANC Commenced				
1	2.6 (0.343 − 20.199)	0.352	0.6 (0.069 − 4.863)	0.615
2	1.6 (0.203 − 12.028)	0.669	0.7 (0.088 − 6.125)	0.774
3 (ref)	-	-	-	-
Husbands Education				
At Most Secondary	0.4 (0.209 − 0.664)	0.001	2.1 (1.005 − 4.437)	0.048
Graduate	0.9 (0.632 − 1.550)	0.963	0.9 (0.529 − 1.613)	0.781
Postgraduate (ref)	-	-		
Occupation				
Professional	3.1 (1.694 − 5.589)	<0.001	0.4 (0.219 − 0.794)	0.008
Sales and services	0.9 (0.459 − 1.876)	0.836	1.1 (0.558 − 2.321)	0.722
Other occupations (ref)	-	-		
Age (years)	1.0 (0.996 − 1.080)	0.079	1.0 (0.950 − 1.059)	0.921

Adjusted with Age and Number of Children The reference category = Good knowledge of PE

Discussion

Pregnancy is one of the significant risk factors for developing venous thromboembolism (VTE). The prothrombotic nature of pregnancy, a normal physiological change during pregnancy, control the increased risk of bleeding from endothelial injuries in the pelvic veins during labour or due to venous hypertension[1] and increases the risk of developing VTE during pregnancy. This study was designed to ascertain the awareness level of venous thromboembolism (VTE) among pregnant women and to outline some predictors associated with this knowledge. Maternal education is vital for effectively preventing and managing this health condition.

The findings from this study showed low awareness and knowledge of DVT, with less than one-fifth (17.7%) of the respondents that have good knowledge of DVT. The most commonly identified cause of DVT was a blood clot in the vein (53.7%). In addition, the widely recognized signs and symptoms are leg swelling (44.8%), pain and tenderness

(26.6) and noticeable skin colour changes (18.8 %), which is in agreement with some previous studies among pregnant women. A Malaysian study (Fen et al.) [33] revealed that only about 4.2% of the pregnant population knew about VTE. Another Polish study (Dybowska et al.) [34] also showed low awareness of VTE (40%) among their participants. Similar studies in Nigeria [35] and a global survey [36] were in a heterogeneous population. Equally, they showed low levels of DVT knowledge at 33.8% and 44% rates, respectively, although the number of pregnant women was not representative in these studies.

Interestingly, out of the few women who claimed to know about DVT, the majority are unaware of the causes, signs, and symptoms of DVT, while others mentioned 'lack of oxygen in the vein' (13.0%) as one of its causes. Le Sage et al. [37] observed a similar trend in hospitalized patients who reported having heard of either DVT/PE or both but could not provide any information on either condition. Our findings contrast with studies on knowledge of malaria among pregnant women like Goshu et al. [38], which showed a high knowledge of malaria. This disparity may stem from the priority of malaria in public health education and campaigns for pregnant women compared to venous thromboembolism.

In the same vein, our findings equally showed low awareness and knowledge of PE among pregnant women, with only 6.4% having good knowledge. The most commonly identified cause of PE is a blood clot occluding the blood vessels in the lungs. They also identified shortness of breath, chest pain, slow, shallow breath, and lightheadedness of passing out as the significant signs and symptoms of PE. These findings corroborated previous studies [33,34,36] in other climes, specifically revealing low VTE and PE knowledge levels. In our study, most of those who claimed to know about PE could not adequately identify its causes, signs, and symptoms, with about 35.1% reporting 'blood clot blocking blood vessels in the heart' as one of the major causes of PE.

To further ascertain the depth of VTE knowledge among our respondents, we considered their knowledge of VTE risks. Our findings showed that more than half (53.8%) are unaware of pregnancy as a risk factor for blood flow complications. However, those that have reportedly heard of DVT/PE or both were able to correctly identify some of the VTE risk factors, including 'not moving for a long period', high blood cholesterol levels, surgery and hospital stay. In a previous similar study, Okoye et al.[35], respondents also identified extended periods of immobility, increased serum cholesterol levels, and surgery as significant risk factors for VTE.

These deficiencies in the knowledge levels of VTE, its symptoms and risks are possible as there is a lack of health education and public health campaigns focused on VTE in our environment compared to other disorders of public health importance like malaria, hypertension and diabetes for the general population and pregnant women. For example, although most pregnant women in our study correctly identified some prevention strategies for VTE, most had never received any health education or seen any public health campaign on VTE, which may be an essential indicator of the level of priority given to VTE as a disease of public health importance in our environment compared to other conditions in that category.

This study further showed the association between the respondents' socio-demographic and some obstetrics characteristics with their knowledge level of VTE. One of the factors associated with a high VTE knowledge level is the stage of gestation at which the woman usually commences an antenatal visit. Our findings showed that women who started antenatal classes earlier in pregnancy were found to have more knowledge levels of VTE. These categories of women are more exposed to a variety of maternal care and education compared to those who commenced antenatal visits later in pregnancy. The former may have benefitted from pregnancy-related DVT mentions in health education talks by their health care providers than the latter.

The study showed maternal age as a predictor of DVT knowledge level, with older women having better knowledge than their younger counterparts. This positive relationship may result from increased knowledge gain and experiences as one age. We also observed that women with previous caesarean deliveries had more knowledge of PE than their counterparts with vaginal deliveries. During pre and post-caesarean surgeries, a lot of emphases is usually on preventing thrombotic events. These may have directly or indirectly educated women with caesarean deliveries on VTE. A more in-depth regression analysis showed that women whose spouses had, at most secondary education were more likely to have higher knowledge levels than other spouses' education groups. This result agrees with Laksono et al. [39], who reported that spouses with higher levels of education were more likely to get involved in their wives' antenatal visits and education. Our findings suggest the need for maternal education on VTE and creating pointers to predictors of VTE knowledge levels. There is a need to develop the appropriate focus of such education programs on vulnerable women with risks of poorer knowledge.

This study draws its strength from the large sample size, involvement of multiple health centres, and timely duration of data collection and utilization of multiple variable statistical analysis. On the other hand, the cross-sectional design of this study is a limitation as it cannot determine the causes and effects between these low levels of knowledge of pregnancy-related VTE recorded in the study and socio-demographic and obstetric factors. Therefore, the recommendation is that future studies adopt research designs that determine this.

Conclusion

Generally, there is insufficient knowledge and awareness of VTE among pregnant women in the Enugu metropolis, Nigeria. Common predictors of VTE knowledge include the timing of the commencement of antennal visits, maternal and spouses' educational level, maternal age and maternal occupation.

There is an urgent need to improve maternal education on pregnancy-related VTE. Thus the inauguration of the Move for Flow program we proposed for maternal education should be considered an urgent priority, with more attention paid to the vulnerable population of women.

Declarations

Authors Contribution

OCP and TUN, contributed to the conceptualization of the study. The study was designed by OCP and TUN with input from LCA and ARE . OCP TUN, and LCA contributed to the data screening.. The initial draft was written by OCP TUN LCA All authors revised the manuscript for intellectual content and approved the final version.

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Conflict of interest

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Tables

Tables 1 and 2 are available in the Supplementary Files section.

Supplementary Files

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