

ORIGINAL ARTICLE

Knowledge gaps in patients with venous thromboembolism: usefulness of a new questionnaire

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knowledge, non-vitamin K antagonist oral anticoagulants, questionnaire, venous thromboembolism, vitamin K antagonists

ABSTRACT

INTRODUCTION The current awareness of venous thromboembolism (VTE) and knowledge of thromboprophylaxis among patients receiving oral anticoagulation therapy (OAC) are insufficient.

OBJECTIVES We sought to develop and evaluate the usefulness of the Jessa AF Knowledge Questionnaire (JAKQ), modified for VTE patients.

PATIENTS AND METHODS Consecutive patients at least 1 month since the VTE event ($n = 273$, mean [SD] age, 51 [17] years; 52.7%, women; 55.9%, unprovoked event) were enrolled to the study.

RESULTS The median percentage of correct responses was 64.2% (interquartile range, 53%–73%; minimum, 12%; maximum, 100%). Younger patients had better knowledge about VTE in general, including a higher proportion of correct responses to the question about the definition of PE (71.4% vs 57.7%, $P = 0.03$), about the possible consequence of DVT, including PE (81.1% vs 62%, $P = 0.001$) and VTE risk related to long travels (78.1% vs 59.2%, $P = 0.002$). There was no difference in overall scoring between patients taking new oral anticoagulants and those taking vitamin K antagonists (mean [SD], 64.1% [16.3%] vs 63.9% [13.8%], respectively, $P = 0.7$). Regardless of the type of anticoagulants, 39.3% of patients knew that VTE is not always symptomatic, 33.6% knew what to do when they missed an OAC dose, and 50% did not know which painkillers are the safest in combination with anticoagulants. Education applied in 27 patients resulted in an increase in the median percentage of correct responses from 60% to 80% ($P = 0.0001$).

CONCLUSIONS Knowledge on VTE and anticoagulation is suboptimal among patients on VKA and NOACs. Education of VTE patients should be improved especially in older individuals on NOACs.

INTRODUCTION Venous thromboembolism (VTE), defined as deep vein thrombosis (DVT) or pulmonary embolism (PE), occurs in about 1 in 1000 persons each year.^{1,2} There is evidence that VTE is often asymptomatic, underdiagnosed, and undertreated.³ For more than 60 years, vitamin K antagonists (VKAs) were the mainstay of VTE treatment. Non-vitamin K antagonist oral anticoagulants (NOACs) have altered the landscape of treatment options. A meta-analysis of the 5 phase III trials comparing 4 NOACs (rivaroxaban, dabigatran, apixaban, and edoxaban) with warfarin

in 24 455 patients showed that the rates of recurrent VTE, fatal PE, and all-cause mortality were similar to the NOACs; however, the rate of major bleeding was significantly lower with the NOACs than with warfarin.^{2,4} Due to convenience in use and no need for routine monitoring, the number of patients with VTE and atrial fibrillation (AF) who take NOACs increase worldwide. Recent data from the RIETE registry⁵ showed that a nonnegligible proportion of VTE patients received nonrecommended doses and regimens of NOACs, which was associated with a higher rate

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of VTE recurrences, with no benefit in terms of bleeding or mortality.⁵

Although several risk factors and predictors of VTE recurrence have been identified, and effective VTE prophylaxis and treatment are available, knowledge about the disease among medical staff and patients seems to be insufficient. Few articles have compared current understanding of VTE,⁶⁻¹⁰ but all these studies addressed mainly patients free of VTE.

Almodaimegh et al,⁶ who evaluated patients' awareness of VTE and their perceptions of thromboprophylaxis, using 18 closed-ended questions developed by combining 2 previously validated surveys,^{8,10} reported poor awareness of DVT and PE among hospitalized patients. Le Sage et al⁸ demonstrated that one fifth of participants of their study had never heard of either DVT or PE. The findings from a global survey published by Wendelboe et al¹⁰ highlighted a relative lack of public awareness about thrombosis overall.

To our knowledge, there have been no studies designed to assess the awareness of the disease and anticoagulant therapy among VTE patients in relation to the medications used. We decided to modify the JAKQ containing 16 questions regarding issues relevant in patients with AF.¹¹ This questionnaire was introduced, validated, and tested by Desteghe and Heidbuchel.¹¹ Its usefulness was also confirmed in a recent study on Polish patients with AF,¹² which showed that the knowledge of this arrhythmia and anticoagulation is better regarding the safety issues among subjects on NOACs compared with VKAs.

The aim of this study was to test patient's knowledge about the VTE itself and its treatment with the use of the JAKQ-VTE and to determine the questionnaire's usefulness in personalized education among patients with VTE.

PATIENTS AND METHODS **Patients** We recruited consecutive patients with documented VTE who were referred for further diagnostic work-up to the John Paul II Hospital in Kraków (Poland), from July 2017 to January 2018. Eligible patients were older than 18 years of age, treated for at least a month with anticoagulants and able to provide consent. In the presence of the managing physicians, 275 patients with VTE were asked to complete the questionnaire.

Questionnaire The JAKQ, which was developed and validated to test the knowledge of patients with AF,¹¹ was modified (JAKQ-VTE) by introducing 8 new questions regarding VTE in the first and second sections (Supplementary material, *Table S1*). The modified questionnaire (JAKQ-VTE) also contained 16 questions. The choice of questions was discussed by investigators to reach consensus.

The study was approved by the Local Ethics Committee (by the Polish Chamber of Physicians and Dentist in Krakow). Questionnaires

were anonymous and oral informed consent was obtained from each patient; the methods were performed in accordance with the relevant guidelines and regulations. Briefly, the JAKQ-VTE consisted of multiple-choice questions (4 answers) with only 1 correct answer. In each question, there was an "I do not know" option to avoid guessing. A correct answer was scored as 1 point, and an incorrect or "I do not know" answer, as 0 points. The questionnaires were collected by doctors who completed general information about patients and medical data on the charts, which were then passed to an administrative official in our hospital, who collected and inputted data into a computer, without being aware of the aims of the survey. Data verification for their completeness was subsequently performed by another person. The final number of patients who properly completed charts was 273. Two charts were excluded due to incomplete clinical data. A total score was calculated from completed questions and displayed as a percentage.

The final version of the JAKQ-VTE was tested for sensitivity. A total of 27 VTE patients, who completed the JAKQ-VTE in July or August 2017, received education (20-minute personal training with each patient) concerning the questions incorrectly answered. All responses were discussed with them by investigators. After 3 to 4 months, these patients were asked to complete the same questionnaire during the next ambulatory visit at our center.

Clinical data We documented clinical variables including concomitant diseases (ie, heart failure, diabetes mellitus, inflammatory disease, vascular disease), risk factors for VTE and anticoagulant therapy with the dosing regimen. DVT and PE were diagnosed as described.¹³ The diagnosis of DVT was established by a positive finding in color duplex ultrasound (visualization of an intraluminal thrombus in calf, popliteal, femoral, or iliac veins). The diagnosis of PE was based on the presence of characteristic symptoms and positive results of high-resolution spiral computed tomography. Patients who reported hormonal contraception, pregnancy, childbirth, recent surgery or trauma, recent hospitalization, or long travel (>4 h), prior to the episode were classified as having provoked VTE. Active cancer was defined as newly diagnosed cancer, metastatic cancer, or cancer that was being treated and those individuals were analyzed separately. All the remaining patients were categorized as having unprovoked VTE. Prior major bleeding was defined as nonsurgical bleeding resulting in blood transfusion (at least 2 units of packed red blood cell units) or a significant fall in hemoglobin levels (at least 2 g/dl) or bleeding to critical organs, for example, intracranial bleeds.¹⁴ Minor bleedings on the current therapy as a potential factor enhancing

FIGURE 1 Frequency distribution of number of correct responses (in percentages) to 16 questions

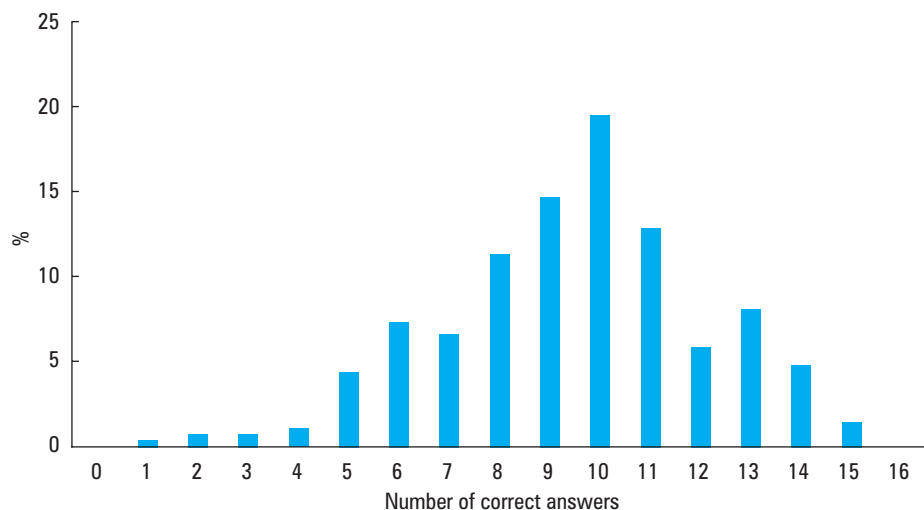


TABLE 1 Characteristics of the study population

Parameter	All patients (n = 273)
Age, y	51.0 (17.0)
Male sex, n (%)	129 (47.3)
Obesity, n (%)	105 (38.5)
Current smoking, n (%)	41 (15)
Thrombophilia, n (%)	70 (41.7)
Postthrombotic syndrome, n (%)	53 (19.4)
Active cancer, n (%)	21 (7.7)
Time interval since VTE diagnosis, mo	23 (9–51)
Time interval since initiating the OAC, mo	10 (5–22)
VTE characteristics, n (%)	
Provoked VTE	118 (43.4)
Unprovoked VTE	152 (55.9)
Isolated DVT	122 (44.9)
Isolated PE	51 (18.8)
Recurrent VTE	102 (37.9)
OAC complications, n (%)	
History of major bleeding	21 (7.7)
Easy bruising	42 (15.4)
Gingival bleeding	24 (8.8)
Heavy menstrual bleeding	33 (23.2)

Data are given as number (percentage), mean (SD), or median (interquartile range).

Abbreviations: DVT, deep vein thrombosis; OAC, oral anticoagulation; PE, pulmonary embolism; VTE, venous thromboembolism

an interest in the disease and anticoagulation were also recorded.

Statistical analysis Continuous variables were presented as means (standard deviation) or median (interquartile range) as appropriate. The Kolmogorov–Smirnov test was used to determine the normal distribution of variables. Categorical variables were reported as a number and percentage. The χ^2 test was used to compare categorical variables. The analysis of variance or Kruskal–Wallis tests for continuous variables were used to assess differences between the groups.

A multivariate logistic regression analysis was conducted to determine predictors of correct responses to selected questions. The Wilcoxon test was applied to evaluate the effect of targeted education. Backward logistic regression was applied. Statistical analyses were performed using SPSS 23.0 (SPSS Inc., Chicago, Illinois, United States). A *P* value of less than 0.05 was considered significant.

RESULTS A total of 273 patients with VTE, mostly outpatients 265 (97.1%), were included in the final analysis (TABLE 1). The mean time interval since VTE diagnosis was 23 months. The mean time interval since initiation of therapy was 10 months. There were 43 patients (15.7%) treated with VKAs (30 [69.8%] on warfarin and 13 [30.2%] on acenocoumarol) and 209 (76.5%) receiving NOACs. Among patients treated with NOACs, 119 (56.9%) received rivaroxaban. The less commonly used NOACs were dabigatran (n = 42 [20.0%]) and apixaban (n = 48 [22.9%]). Fifty-one individuals (24.4%) receiving NOACs were previously treated with VKAs. As many as 19 patients (6.9%) received a low-molecular-weight heparin (LMWH) at therapeutic or intermediate doses for a mean of 9 months (range, 2–36 months).

Two patients did not receive any antithrombotic treatment on the day of completing the questionnaire. One was treated in the past with VKA and the other received LMWH.

Overall results and knowledge gaps revealed in the questionnaire The median percentage of correct responses was 64.2% (IQR, 53%–73%; minimum, 12%; maximum, 100% in 3 patients [1.09%]) (FIGURE 1). Time for participants to complete the questionnaire ranged between 3 to 15 minutes (mean, 7 minutes) and showed a positive correlation with age ($r = 0.43$, $P < 0.0001$), but not with sex.

As shown in TABLE 2, most of the patients responded correctly to the question about the definition of PE (67.8%), possible thrombotic consequences of DVT (76.1%), and about the VTE

TABLE 2 Specific topics addressed in the JAKQ-VTE with the percentage of correct responses among patients with venous thromboembolism in 2 age groups

Parameter	All (n = 273)	Patients <65 years (n = 202)	Patients ≥65 years (n = 71)	P value
8 questions about VTE in general				
PE occurs when pulmonary arteries are partially occluded, most often by clots.	183 (67.8)	142 (71.4)	41 (57.7)	0.03
VTE is not always accompanied by pain or edema of the limb.	107 (39.3)	78 (38.8)	29 (40.8)	0.76
Venous ultrasound should be performed to detect DVT.	144 (52.9)	107 (53.2)	37 (52.1)	0.87
DVT can lead to PE.	207 (76.1)	163 (81.1)	44 (62.0)	0.001
Blood thinners prevent the recurrence of the disease.	137 (50.4)	100 (49.3)	38 (53.5)	0.54
Travel by air or car for more than 6–8 hours increases the risk of VTE.	199 (73.2)	157 (78.1)	42 (59.2)	0.002
Being overweight increases the risk of VTE.	201 (74.2)	154 (76.6)	47 (67.1)	0.11
Blood thinners should be used always, for at least 3 months after diagnosis of VTE.	66 (24.4)	51 (25.5)	15 (21.4)	0.49
5 questions about OAC therapy				
Patients with VTE should always take their blood thinners, especially if VTE is unprovoked.	214 (83.3)	159 (84.1)	55 (80.9)	0.53
Possible side effects of blood thinners are the occurrence of bleedings and longer bleeding times in case of injuries.	238 (91.9)	177 (93.2)	61 (88.4)	0.21
VTE patients may only take painkillers based on paracetamol.	130 (50.6)	98 (51.9)	32 (47.1)	0.49
When VTE patients regularly have minor nose bleeds (that spontaneously cease), they should contact the general practitioner or specialist, while continuing to take their blood thinner.	168 (64.9)	130 (68.4)	38 (55.1)	0.04
If a VTE patient needs an operation, he/she should consult a doctor to discuss possible options.	167 (66.8)	120 (65.6)	47 (70.1)	0.49
3 questions about VKA				
VTE patients taking VKA should have their blood thinning checked at least once a month.	95 (86.4)	68 (85.0)	27 (90.0)	0.75
When VTE patients taking VKA have forgotten to take their blood thinner, they should still take their forgotten pill (immediately or at the next dose).	37 (33.6)	26 (32.5)	11 (36.7)	0.68
INR is a measure to check how thick or how thin the blood is.	91 (82.7)	64 (80.0)	27 (90.0)	0.21
3 questions about NOAC				
For patients taking NOAC, it is important to take their blood thinner at the same time every day.	–	145 (91.2)	48 (85.7)	0.24
When VTE patients taking NOAC have forgotten to take their blood thinner, they can still take that dose, unless the time till the next dose is less than the time after the missed dose.	–	90 (57.0)	29 (51.8)	0.50
The NOAC card should be shown to their general practitioner and specialist by VTE patients.	–	–	–	–

Data are presented as number (percentage) of patients.

Abbreviations: INR, international normalized ratio; others, see [TABLE 1](#)

risk related to long travels (73.2%). There was also a fairly satisfactory knowledge about the importance of a regular anticoagulant intake (83.3%), but uniformly poor about the duration of anticoagulant therapy (24.4%). A major adverse event of blood thinners, that is, an increased risk of bleeding, was obvious to 91.9% of the respondents. However, only 39.3% of patients knew that VTE is not always symptomatic. Half of all patients (50.4%) were aware that blood thinners prevent the recurrence of VTE and only one third (33.6%) knew what to do when they missed a dose. Of note, half of the patients did not know which painkillers are the safest in combination with anticoagulants. Patients were informed to take

into consideration only painkillers unprescribed by a physician. There was no difference in the percentage of correct answers to this question between patients with unprovoked and provoked VTE (52.7% vs 47.7%, $P = 0.42$).

There was no difference in the distribution of correct answers between men and women (mean, [SD] 66.6% [15.5%] vs 62.5% [16.3%], $P = 0.81$). There was no correlation between the treatment duration and the percentage of correct responses ($r = 0.01$, $P = 0.81$). A weak inverse correlation between age and the percentage of correct responses was observed ($r = -0.22$, $P = 0.003$). Younger patients had better knowledge about VTE in general, including a higher proportion of correct

TABLE 3 Comparison of the percentage of correct responses among 27 patients with venous thromboembolism before and at 3 to 4 months after educational intervention

Parameter	T1	T2	P value
8 questions about VTE in general			
PE occurs when pulmonary arteries are partially occluded, most often by clots.	16 (59.2)	26 (96.3)	0.004
VTE is not always accompanied by pain or edema of the limb.	10 (37.0)	18 (66.6)	0.06
Venous ultrasound should be performed to detect DVT.	14 (51.8)	17 (62.9)	0.54
DVT can lead to PE.	21 (77.7)	23 (85.1)	0.61
Blood thinners prevent the recurrence of the disease.	13 (48.1)	21 (77.8)	0.009
Travel by air or car for more than 6–8 hours increase the risk of VTE.	20 (74.0)	22 (81.4)	0.72
Being overweight increases the risk of VTE.	25 (92.5)	24 (88.8)	1.00
Blood thinners should be used always, for at least 3 months after diagnosis of VTE.	4 (14.8)	3 (11.1)	1.00
5 questions about OAC therapy			
Patients with VTE should always take their blood thinners, especially if VTE is unprovoked.	17 (68.0)	23 (92.0)	0.07
Possible side effects of blood thinners are the occurrence of bleedings and longer bleeding times in case of injuries.	25 (96.1)	24 (92.3)	1.00
VTE patients may only take painkillers based on paracetamol.	10 (38.4)	23 (88.4)	0.003
When VTE patients regularly have minor nose bleeds (that spontaneously cease), they should contact the general practitioner or specialist, while continuing to take their blood thinner.	17 (65.3)	22 (84.6)	0.22
If a VTE patient needs an operation, he/she should consult a doctor to discuss possible options.	13 (56.5)	17 (73.9)	0.42
3 questions about VKA^a			
VTE patients taking VKA should have their blood thinning checked at least once a month.	7 (87.5)	8 (100)	–
When VTE patients taking VKA have forgotten to take their blood thinner, they should still take their forgotten pill (immediately or at the next dose).	1 (12.5)	1 (12.5)	–
INR is a measure to check how thick or how thin the blood is.	8 (100)	8 (100)	–
3 questions about NOAC^b			
For patients taking NOAC, it is important to take their blood thinner at the same time every day.	20 (86.9)	20 (86.9)	0.47
When VTE patients taking NOAC have forgotten to take their blood thinner, they can still take that dose, unless the time till the next dose is less than the time after the missed dose.	10 (43.4)	18 (78.2)	0.02
The NOAC card should be shown to their general practitioner and specialist by VTE patients.	1 (4.34)	7 (30.4)	–

Data are presented as number (percentage) of patients.

a Refers to 3 patients still on VKAs and 5 previously treated with these agents, who were on NOACs while completing the questionnaire.

b Refers to 23 patients.

Abbreviations: T1, test at baseline; T2, test after 3–4 months; others, see [TABLE 1](#)

responses to the question about the definition of PE (71.4% vs 57.7%, $P = 0.03$), about possible consequence of DVT, including PE (81.1% vs 62%, $P = 0.001$) and VTE risk related to long travels (78.1% vs 59.2%, $P = 0.002$, [TABLE 2](#)).

There was no difference in overall scoring on JAKQ-VTE between 76 (27.8%) patients treated up to 6 months and 197 (72.2%) treated for more than 6 months (mean, [SD] 63.3% [16.9%] vs 62.9% [14.7%], $P = 0.8$), although the latter subgroup had better knowledge about the necessity of long-term anticoagulation (86.2% vs 75%, $P = 0.03$; Supplementary material, [Table S2](#)).

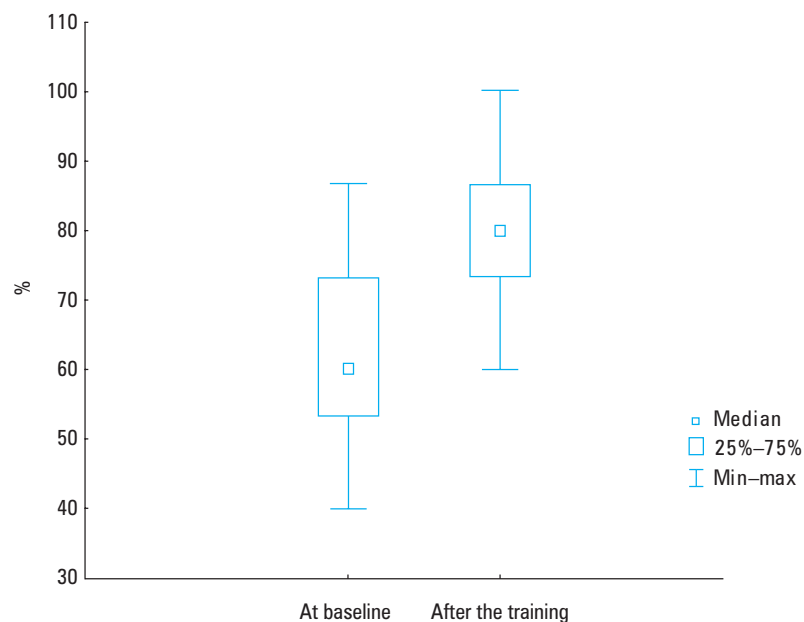
There was no difference in overall scoring on JAKQ-VTE between 102 individuals (37.9%) with recurrent VTE and 166 (60.8%) with the first episode of VTE (mean [SD], 63.6% [15.3%] vs 63.9% [16.1%], $P = 0.4$). The same was observed for 151 patients (55.5%) with PE and 121 (44.5%) with DVT

alone (mean [SD], 64.6% [15.6%] vs 63.0% [16.4%], $P = 0.24$) and for 118 patients (43.4%) with provoked VTE and 152 individuals (55.9%) with unprovoked VTE (mean [SD], 62.5% [16.8%] vs 66.6% [15.2%], $P = 0.27$).

VTE patients on NOACs versus those on VKAs had similar demographic characteristics, VTE type, and risk factors. There was no difference in overall scoring between NOAC and VKA patients (mean [SD], 64.1% [16.3%] vs 63.9% [13.8%], $P = 0.7$), and there was no difference in the distribution of correct answers (Supplementary material, [Table S3](#)).

Regarding the question what to do when they missed an OAC dose, as few as 28.6% of patients on VKA knew the correct response. A similar question regarding the missed OAC dose was answered correctly by 56.4% of the NOAC users. Patients receiving heparins did not differ in

FIGURE 2 Percentage of correct responses at baseline and at 3 to 4 months after the training ($P = 0.0001$)



their knowledge on the disease from the remainder (data not shown).

Effect of education Twenty-seven patients receiving OAC (mean [SD] age, 47.8 [15.3] years, including 23 [85.2%] using NOACs, 3 [11.1%] on VKAs, and 1 [3.7%] using LMWH) were asked to complete the questionnaire again after the educational intervention (TABLE 3). This subgroup did not differ from the remaining patients in terms of basic characteristics (data not shown).

The median percentage of correct responses was 60 (minimum, 40%; maximum, 86.7%) at baseline and 80 (minimum 60% and maximum 100%) at 3 to 4 months after the training (FIGURE 2). The analysis of individual questions after the educational intervention showed that patients had better knowledge about the definition of PE (59.2% vs 96.3%, $P = 0.004$), about the safest painkiller in combination with OAC therapy (38.4% vs 88.4%, $P = 0.003$), and what to do when they missed a NOAC dose (47.6% vs 85.7%, $P = 0.02$, TABLE 3).

DISCUSSION The present study evaluated the usefulness of a JAKQ-VTE in testing the knowledge of patients with VTE. This modification of the JAKQ, compared with the previous surveys that analyzed the understanding of the disease and VTE risk factors in various patient groups,⁶⁻¹⁰ enables an evaluation of the awareness of the safe therapy principles in subjects who experienced VTE and received anticoagulant agents including NOACs.

The JAKQ-VTE can be completed within a few minutes and can be widely used in the outpatient setting. This study demonstrates a satisfactory awareness about the definition of PE, possible thrombotic consequences of DVT, and about selected risk factors among patients who experienced VTE a few months earlier. The proportion

of correct responses about the essence of the disease in other studies that evaluated the knowledge about VTE was lower,^{6,8,10} but all these studies addressed mainly patients free of VTE. Almodaimegh et al⁶ and Le Sage et al⁸ conducted their study among hospitalized patients, with 14.4% and 14.6% of patients with personal history of VTE, respectively, while Wendelboe et al¹⁰ evaluated the global awareness of thrombosis in various countries, independent of personal history of VTE.

This study is the first to assess the knowledge and the effects of the education in the group of patients following VTE receiving the current types of anticoagulant medications. With the NOACs market growing, it is necessary to consider the specificity of this class of oral anticoagulants in the education of VTE patients, including, among others, the dosing regimen (once or twice daily) or the principles of discontinuation in various clinical situations. We found that therapy with rivaroxaban, dabigatran, or apixaban among VTE patients, though it appears easier in everyday use, was not associated with better knowledge of the disease and treatment compared with current VKA users despite a significantly longer treatment time.

In the present study, there was no association between treatment duration and the knowledge of the disease or anticoagulation. Overall, the results revealed that awareness of VTE is suboptimal in subjects who experienced such events. A comparison of our recent study on AF patients¹² and the current VTE study indicates that in the former, most patients responded correctly to the question about the definition of the disease as well as possible thrombotic complications of arrhythmia and VTE. There was also a good knowledge about the time interval for international normalized ratio (INR) control and the definition of INR.

In both studies, we found the same knowledge gaps. As few as about 1 in 4 of VKA patients knew what to do when they missed an OAC dose. A similar question regarding a missed OAC dose was answered correctly by half of the NOAC users. Thus, we conclude that the knowledge of the therapy safety does not depend on the disease type, but on the therapy type. Because of the higher price of NOACs, doctors devote more time to present the advantages and disadvantages of this therapy.

Looking for factors affecting the percentage of correct responses, we found that the group following unprovoked VTE, which has recommendations to use anticoagulation on a long-term basis,¹⁵ scored similarly to those with provoked episodes, which might have practical implications in terms of an increased risk of treatment failure and bleedings. However, we observed that patients treated for 6 months or longer had better knowledge about the necessity of long-term drug intake, which suggests that patients largely accepted this therapy although it had a potentially strong impact on their everyday lives.

The use of various anticoagulants in our study is similar to real-life data showing a large proportion of VTE patients receiving NOACs^{2,16-19}; however, in Poland we found a relatively higher proportion of VTE patients receiving dabigatran (20%). Among the participants of the RIETE registry⁵ including the clinical characteristics, treatment patterns, and outcomes in patients diagnosed with VTE, only 2% obtained dabigatran for a long-term therapy. In the Danish Nationwide Study,²⁰ which investigated temporal trends in initiation of rivaroxaban or apixaban or dabigatran vs VKA in patients with VTE, only 0.5% received dabigatran vs 38.7% treated with rivaroxaban and 5.4% using apixaban. Similar to this study, Badreldin et al²¹ reported in a cohort of VTE patients that only 2% of patients initiated dabigatran compared with 53%, 40%, and 5% initiated on rivaroxaban, apixaban, and edoxaban, respectively. The use of rivaroxaban versus apixaban or dabigatran did not affect the proportion of patients who responded well to the questions. Regardless of the type of a NOAC, we observed good knowledge about the importance of a regular anticoagulant but poor about the duration of anticoagulant therapy. Poor knowledge in both treatment groups was observed in one particular question concerning what to do with a missed OAC dose, which is of key importance for the efficacy of anticoagulants, in particular NOACs. Our findings suggest that a wide use of NOACs in VTE patients has not improved the VTE awareness yet.

Importantly, we observed an inverse correlation between age and the percentage of correct responses. Since several investigators reported a higher risk for total DVT and PE (up to 6 times higher) in elderly patients compared with younger subjects^{22,23} and age increases the risk of bleeding related to anticoagulant treatment,^{22,24,25} educational efforts should be focused on this group, especially if a long-term anticoagulation

is recommended. Our study indicates that older VTE patients on NOACs have statistically lower scores using the JAKQ-VTE compared with younger, including safety-related questions, which highlights the need for elderly dedicated educational programs. The optimal approach to improve knowledge in this growing group in aging society remains to be established.

Various methods are sought to determine and improve the knowledge level about AF but there are insufficient data for VTE patients. We demonstrated that JAKQ-VTE seems to be a good tool to efficiently guide and target personalized education in VTE patients. Discussing the results of the questionnaire with the patient and indicating the correct answers is a form of targeted education. In the group of the retested patients, we observed that education substantially improved their knowledge about the definition of PE, about the safest painkiller in combination with OAC therapy and what to do when they missed a NOAC dose, which are important questions regarding the efficacy and safety of anticoagulation in VTE like in AF.

It should be highlighted that like among AF patients,^{11,12} there is a low use of cards containing information for patients on anticoagulation. It is of importance that specialists dealing with patients on anticoagulation require access to tools, potentially including specific software, to guide systematic patient assessment and workflow.²⁶

The study has several limitations. First, its small sample size requires validation in a larger group in other countries. The study was conducted at a hospital dealing with cardiovascular diseases with well-organized clinics for outpatients with thrombotic diseases and OAC complications; therefore, our results could not be easily translated to primary care or local smaller hospitals. The score on the JAKQ-VTE may depend on the level of educational efforts at the time of diagnosis and initiation of therapy, which has not been addressed in this study. For 2 years our hospital has been distributing information booklets pertaining to OAC along with discharge cards.

We did not analyze the effect of the patients' level of education or cognitive function on VTE-related knowledge. VTE patients still receiving VKAs were underrepresented (15.7% of the whole group), so the data for them should be interpreted with caution; however, this low proportion reflects current trends in most European countries with regard to preferred anticoagulants.

Conclusions There are still important knowledge gaps concerning VTE in general and the associated oral anticoagulation therapy. The current study indicates that the JAKQ-VTE could be a useful tool in everyday practice to efficiently guide and target personalized education in VTE patients. The modified questionnaire presented in this study could help identify the VTE patients on which education should focus. Irrespective of the type of OAC therapy, education of VTE

patients should be improved with a particular emphasis on elderly population treated with NOACs.

SUPPLEMENTARY MATERIAL Supplementary material is available with the main article at www.pamw.pl.

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CONTRIBUTION STATEMENT MK and AU collected the data. MK drafted the manuscript. MK and PB analyzed the data. PB prepared tables and figure. AU was responsible for conception and design of the study. LD, HH, and AU critically revised the manuscript. All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

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