Review paper

Public Knowledge of Deep Vein Thrombosis (DVT): A Street Survey in the Suburbs of Birmingham, UK

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ABSTRACT

Background: Venous thromboembolism (VTE) consists of deep vein thrombosis (DVT) and pulmonary embolism (PE), causing considerable morbidity and mortality. The economic burden on the NHS of this common preventable condition is significant. Whilst studies into public knowledge of other conditions are published, there is no current literature regarding DVT public knowledge.

Aims: Primary aim: to assess the extent of public knowledge of DVT. Secondary aim: to assess the influence of socio-demographic factors upon DVT knowledge.

Methods: A street survey of 385 participants was performed in two suburbs of Birmingham, UK using an interviewer-assisted open questionnaire.

Results: Participants named a mean of 1.41, 1.18, 0.856 and 1.22 correct symptoms, risk factors, complications and preventative methods, respectively. 41.5% named flying as a risk factor. 31.3% named death as a complication of DVT and 8.88% of participants identified that a blood clot could travel to the lungs. A higher proportion incorrectly stated it could travel to the heart (24.0%) or brain (17.4%). 38.5% were unable to name any DVT complications. Males, those in lower socio-economic classes, those of Non-White ethnicity and the over-70s were found to have significantly poorer knowledge. Knowledge decreased with socio-economic status in a trend-like manner.

Conclusions: Overall, knowledge of DVT was limited. This study supports the concept of a VTE public awareness campaign, with particular focus on the complications of DVT and raising awareness amongst people in the above socio-demographic groups.

Keywords: Deep Vein Thrombosis, Public Health, Primary Care, Health Knowledge, Attitudes, Practice

How this fits in with quality in primary care

What do we know?

The public knowledge of several serious health conditions has been evaluated, including myocardial infarction and stroke. It is known that socio-demographic factors influence this knowledge. However, there is no previous literature reporting the public knowledge of deep vein thrombosis.

What does this add?

This study provides an initial evaluation of the public knowledge of deep vein thrombosis, based on a street survey of 385 people. The effect of socio-demographic variables on this knowledge is also reported.

Introduction

Venous thromboembolism (VTE) is characterised by inappropriate blood clotting within the circulatory system resulting in considerable morbidity and mortality. VTE comprises deep vein thrombosis (DVT) and pulmonary embolism (PE).[1,2] PEs commonly arise secondary to a DVT, usually in the legs, although DVT can also occur in veins in the upper limbs.[3] The clot may dislodge, propagate to the lungs and cause death in severe cases.[1] A VTE can lead to chronic thromboembolic pulmonary hypertension or post-thrombotic syndrome. Post-

thrombotic syndrome is characterised by poor venous outflow resulting in leg pain, chronic leg oedema, haemosiderin skin pigmentation, lipodermatosclerosis and venous ulceration of the skin.[4,5]

Community incidence rates, studied in France and Sweden, are estimated at over 1.5 per 1000 per year, although these are likely to be underestimates.[6,7] In the UK, 64,000 cases of VTE were reported in 2004-5 amongst NHS in-patients, with the House of Commons Health Committee estimating 25,000 deaths per year are due to hospital-acquired VTE.[8,9] These relatively high incidence rates combined with the fact that VTE deaths often occur following hospital discharge, indicates that lay awareness of the symptoms and complications of VTE is important. The economic burden of VTE is also very high, costing the NHS an estimated £640 million in 2005.[10]

VTE has been recognised as a "growing public health problem", prompting research into this understudied field.[1] A large study (ExPeKT) is currently investigating the VTE knowledge amongst UK primary healthcare professionals and hospitalised patients deemed to have a high VTE risk, alongside the current practice and perceived role of thromboprophylaxis.[10] There is no current published literature measuring general public knowledge of DVT. In 2009, the National Blood Clot Alliance conducted an unpublished online research questionnaire of 500 American adults to assess DVT and PE lay awareness.[11] Only 21% and 16% of the sample had heard of the terms DVT and PE, respectively. Conversely, 80% of respondents knew what a blood clot was and 98% knew that these could be fatal. Over 68% of respondents were aware of family history, major trauma, major surgery and immobility as risk factors for blood clots. This suggests medical terminology is a barrier to public awareness of DVT and its sequelae.

It is commonly understood that demographic factors influence knowledge and awareness of common medical conditions, along with their severity and complications.[12-15] For example, lay knowledge of stroke and myocardial infarction (MI) varies between population sub-groups. Despite being at increased risk, males, those of ethnic minorities and the elderly have demonstrated lower knowledge levels of the symptoms of these conditions.[14,15] However, the effect of demographic factors on public knowledge of DVT has not been investigated.

Flying, specifically long-haul flights and their association with DVT, is classically one of the most well-known risk factors for DVT and has been the focus of much media attention resulting in considerable public concern.[2] In 1988, Cruickshank *et al.* coined the term "economy class syndrome".[16] Subsequently, news articles have highlighted the risk of developing DVT from air travel (BBC News 2001; Telegraph Travel 2010). In 2007, the World Health Organisation concluded that for a cohort of healthy individuals, the absolute risk of VTE for a flight longer than four hours was 1 in 6000. This increased risk also applied to other methods of transport where travellers were exposed to prolonged, immobile seated positions.[17] A 2009 meta-analysis performed by Chandra *et al.* reported a dose-response relationship between travel and VTE risk. For air travel the risk of developing VTE increased by 26% for every 2 hours of flight, compared to 18% for other methods of transport.[18]

In reality, despite long-haul flights being well-publicised, there are many more common and important risk factors for VTE. Key disease and surgical factors include multiple trauma, major surgery, malignancies, chronic heart failure and rare hereditary coagulopathies.[2] Major general surgery has been documented as a strong risk factor, such that VTE prophylaxis is recommended in this group.[8] Both mechanical (anti-embolism stockings) and pharmacological (low-molecular weight heparin or fondaparinux) methods are used, with a combination offered to those at highest risk.[2,8]

Patient factors convincingly demonstrated to increase DVT risk include increased age, prolonged immobility, pregnancy and a previous history of DVT.[19] Evidence suggests that VTE incidence dramatically increases over the age of 60.[2] Carter *et al.* reported a 20-fold increase in DVT incidence during the postpartum period compared with an age-matched cohort of non-pregnant women.[20]

In summary, although DVT has been recognised as a "growing public health problem" and the importance of raising public awareness of the condition to reduce death and morbidity highlighted, there is no current literature directly measuring public knowledge of DVT, demonstrating the need for a study to assess this.[1,21] This study into a previously uninvestigated field describes a street survey using an interviewer-assisted questionnaire which aimed to assess the extent of public knowledge of DVT and the influence of socio-demographic factors. This study, alongside the results of the ExPeKT study will provide an improved overall understanding of awareness of DVT/VTE in the UK.

Methods

A street survey was carried out during 2013 in two Birmingham, UK suburbs using an interviewer-assisted questionnaire. Moseley and Kings Heath were selected for our study as they are representative of Birmingham's population.[22] Based on current guidelines, Birmingham City Council required no permissions or ethical approval for this survey.[23]

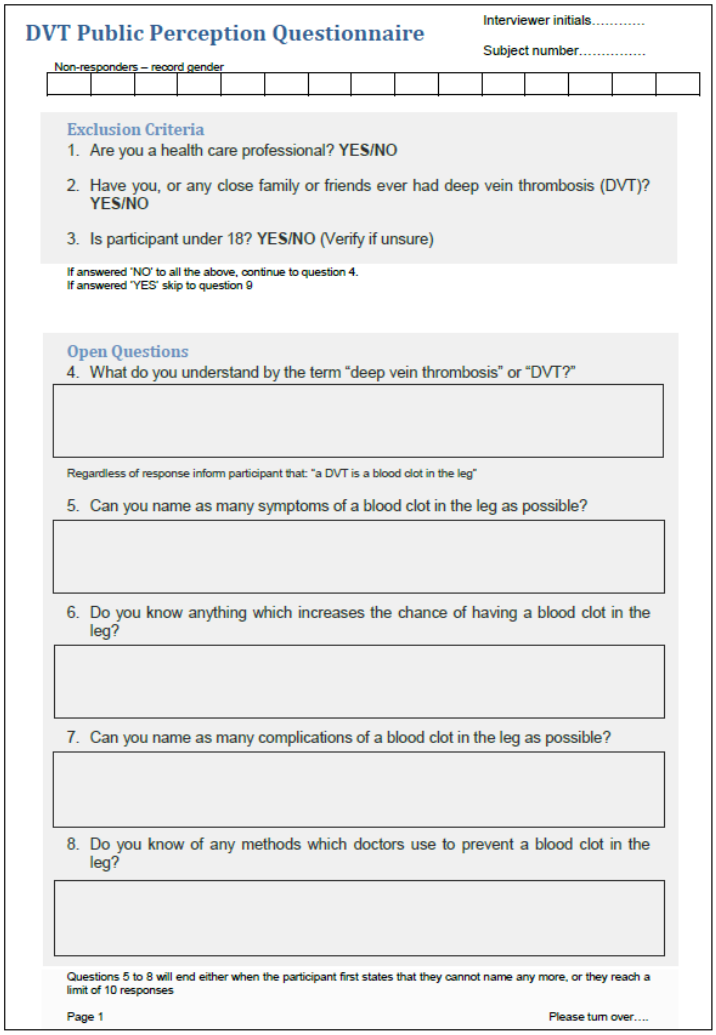
Surveying was performed on weekdays and weekends. A systematic method of sampling was used; every 4th person passing the interviewer from the right was approached. Anyone aged under 18, worked as a healthcare professional or who had a past history of DVT or knew a close relative or friend with a history of DVT was excluded from the study using three initial screening questions.

The questionnaire assessed the participant's knowledge of DVT with four open questions (Table 1). These questions tested knowledge of DVT symptoms, risk factors, complications and preventative methods for DVT. Initially, participants were asked "What do you understand by the term deep vein thrombosis?" and subsequently (irrespective of answer) were told DVT was "a blood clot in the leg". No leading or assistance was given and responses were recorded verbatim until the participant stated they knew no more. Finally, the participant's socio-demographics (gender, age category, ethnicity and occupation) were collected.

Analysis

Ethnicity was recorded using the Office of National Statistics ethnicity codes and were grouped into two categories

Table 1: Questionnaire.



DVT Public Perception Questionnaire

Interviewer initials.....

Subject number.....

Non-responders – record gender

Exclusion Criteria

1. Are you a health care professional? **YES/NO**
2. Have you, or any close family or friends ever had deep vein thrombosis (DVT)? **YES/NO**
3. Is participant under 18? **YES/NO** (Verify if unsure)

If answered 'NO' to all the above, continue to question 4.
If answered 'YES' skip to question 9

Open Questions

4. What do you understand by the term "deep vein thrombosis" or "DVT?"

Regardless of response inform participant that: "a DVT is a blood clot in the leg"

5. Can you name as many symptoms of a blood clot in the leg as possible?
6. Do you know anything which increases the chance of having a blood clot in the leg?
7. Can you name as many complications of a blood clot in the leg as possible?
8. Do you know of any methods which doctors use to prevent a blood clot in the leg?

Questions 5 to 8 will end either when the participant first states that they cannot name any more, or they reach a limit of 10 responses

Page 1 Please turn over....

for analysis; White and Non-White. [24]

Occupation was used as a surrogate measure for socio-economic class in accordance with the National Statistics Socio-Economic Classification (NS-SEC).[25] Occupation was recorded via an open question and assigned a code from the Standard Occupational Classification 2010.[25] For analysis, occupation was categorised into four groups using a modified NS-SEC three-class method to incorporate the unemployed and retired. These were: "Higher managerial, administrative and professional"; "Intermediate"; "Routine and Manual" and "Unemployed and Retired". Students reading non-vocational courses and also those not providing an occupation were classified as "Unemployed and Retired".

Responses were grouped into major categories and their sub-categories, and subsequently assigned numerical codes. Analysis was performed using SPSS™. Correct and incorrect responses were defined according to the literature.[2,19,26,27]

Analysis focused on the number of correct responses given by the participant for each question. Mean values of correct responses per question and for the whole questionnaire were calculated. When analysing the effect of socio-demographic factors, an independent t-test was used for gender and ethnicity, and an ANOVA with post-hoc Tukey for age and NS-SEC analytic class. All significant results are to the $p<0.05$ level.

Results

Demographics

385 people completed the questionnaire. 304/385 people were included in the analysis after exclusion criteria had been applied (healthcare professional – 28; previous DVT – 52; participant under 18 – 1). 7.3% of participants approached were health care professionals, reflecting the proportion of the UK workforce that are health care professionals based on census data.[28]

Subject demographics of included participants are shown in Table 2. 56.9% respondents were female, 50.7% aged ≥50 and 76.3% were of White ethnicity. The most common occupational class was "Higher managerial, administrative and professional" (36.2%) and "Routine and Manual" was the least common (15.1%). 71.7% of participants were either currently employed or retired having stated a previous occupation. The sample was representative of the suburb population according to the 2011 Census Data.[22]

Knowledge of DVT symptoms, risk factors, complications

and preventative methods

73.0% of respondents knew at least one correct symptom and in total participants named a mean of 1.41 symptoms. Table 3 shows the most commonly reported were pain and swelling (178, 129).

A similar proportion knew of at least one risk factor (71.1%), with a mean number of 1.18 correct responses. The most commonly mentioned risk factors were lifestyle factors (including obesity, lack of exercise, smoking and alcohol) (134), flying (126) and immobility (108). 41.5% of participants stated that flying was a risk factor for DVT, however only 9.21% of participants specifically mentioned long-haul flights as a risk factor.

A lower proportion of respondents stated at least one complication (61.5%). Clot movement (124), death (96) and specific medical conditions (including stroke, heart attack, hypertension and PE) (92) were the most frequently identified complications. The mean number of correct responses for this question was lowest of all (0.856). 8.88% of people mentioned travel to the lungs or PE as a complication of DVT with just two people specifically stating the term PE. This is much lower than the proportion of people who incorrectly said that a clot could travel to the heart or cause a heart attack (24.0%) and travel to the brain or cause a stroke (17.4%).

73.4% of respondents knew of at least one preventative method with a mean number of 1.22 correct preventative methods named. Medication was reported most commonly (196) followed by stockings (107). Of medications mentioned 38 stated aspirin, 32 warfarin, but only 3 enoxaparin.

The influence of socio-demographic factors on knowledge of DVT symptoms, risk factors, complications and preventative methods

Total number of correct responses: Figure 1 summarises differences in mean total number of correct responses for each socio-demographic factor. Females had a significantly higher mean total than males (5.09 vs. 4.07) (t=3.140, p=0.002). 30-39s had a significantly higher mean total than 18-29 and 70+ age groups (5.48 vs. 3.76, p=0.036; 5.48 vs. 3.69, p=0.024). When comparing the 70+ group to all other ages combined,

Table 2: Socio-demographic factors of included participants. (N=304).

Socio-demographic factor		N (%)
Sex	Male	131 (43.1)
	Female	173 (56.9)
Age	18-29	41 (13.5)
	30-39	54 (17.8)
	40-49	55 (18.1)
	50-59	48 (15.8)
	60-69	64 (21.1)
	70+	42 (13.8)
Ethnicity	White	232 (76.3)
	Asian	40 (13.2)
	Black	23 (7.57)
	Other	8 (2.63)
	Unclassified	1 (0.33)
Occupation	Professional	110 (36.2)
	Intermediate	62 (20.4)
	Routine and Manual	46 (15.1)
	Unemployed and Retired	75 (24.7)
	Unclassified	11 (3.6)

Table 3: Top four response categories for each question. Lifestyle factors include obesity, lack of exercise, smoking and alcohol. Specific conditions include stroke, heart attack, hypertension and PE. (N=number of times mentioned, some participants may have given two or more responses from the same category)

Symptoms		Risk Factors		Complications		Preventative Methods	
Description	**N**	**Description**	**N**	**Description**	**N**	**Description**	**N**
Pain	178	Lifestyle	134	Clot movement	124	Medication	196
Swelling	129	Flying	126	Death	96	Stockings	107
No knowledge	69	Immobility	108	Specific conditions	92	No knowledge	77
Skin changes	47	Past medical history	86	No knowledge	73	Activity	75

they had a significantly lower mean score (3.69 vs. 4.80) (t=-2.372, p=0.018). Mean number of total correct responses decreased in a trend-like manner for occupational class, with both "Professionals" and "Intermediate" scoring significantly higher than "Unemployed and Retired", and "Professionals" also scoring significantly higher than "Routine and Manual". The largest difference was seen between "Professionals" and "Unemployed and Retired" (5.59 vs. 3.60, p<0.005). Finally, those of White ethnicity scored a significantly higher total than those of Non-White ethnicity (4.94 vs. 3.63) (t=3.466, p=0.001). Table 4 lists all significant findings when comparing socio-demographic factors.

Symptoms: Females stated a significantly higher mean correct answers than males (1.61 vs. 1.14) (t=3.705, p<0.0005). There was also a significant difference in mean number of correct symptoms between "Professionals" and "Routine and Manual" groups (1.59 vs. 1.04, p=0.029). Those of White ethnicity gave a significantly higher correct mean number of symptoms compared to those of Non-White ethnicity (1.49 vs. 1.11) (t=2.495, p=0.013).

Risk factors: Again, females averaged more correct risk factors than males (1.29 vs. 1.04) (t=2.218, p=0.027). The 70+ age group scored significantly lower than three other age groups; the 30-39s, 40-49s and 60-69s. The largest difference was between the 30-39s and 70+ group (1.41 vs. 0.714, p=0.007). The 18-29s also answered this question poorly (0.878) though this was not significantly worse than other age groups. The mean number of correct responses again decreased in a trend-like manner for occupational classes. "Professionals" provided the highest number of mean correct responses (1.55), significantly higher than all other occupational classes. The largest difference was compared to the "Unemployed and Retired" group (1.55 vs. 0.853, p<0.005). Those of White ethnicity gave a significantly higher mean number of correct risk factors compared to those of Non-White ethnicity (1.25 vs. 0.929) (t=2.417, p=0.016). The percentage of participants in each occupational class stating flying as a risk factor decreased in a trend-like manner: 54.5% of "Professionals" stated flying as a risk factor compared to 22.7% of "Unemployed and Retired".

Complications: Between females and males there was a significant difference between mean correct responses (0.966 vs. 0.710) (t=2.649, p=0.008). Those of White ethnicity gave a significantly higher correct mean number of complications compared to those of Non-White ethnicity (0.922 vs. 0.620) (t=2.676, p=0.008). No significant differences were seen between age groups or occupational classes. Notably, no sub-group of any demographic factor had a mean number of correct

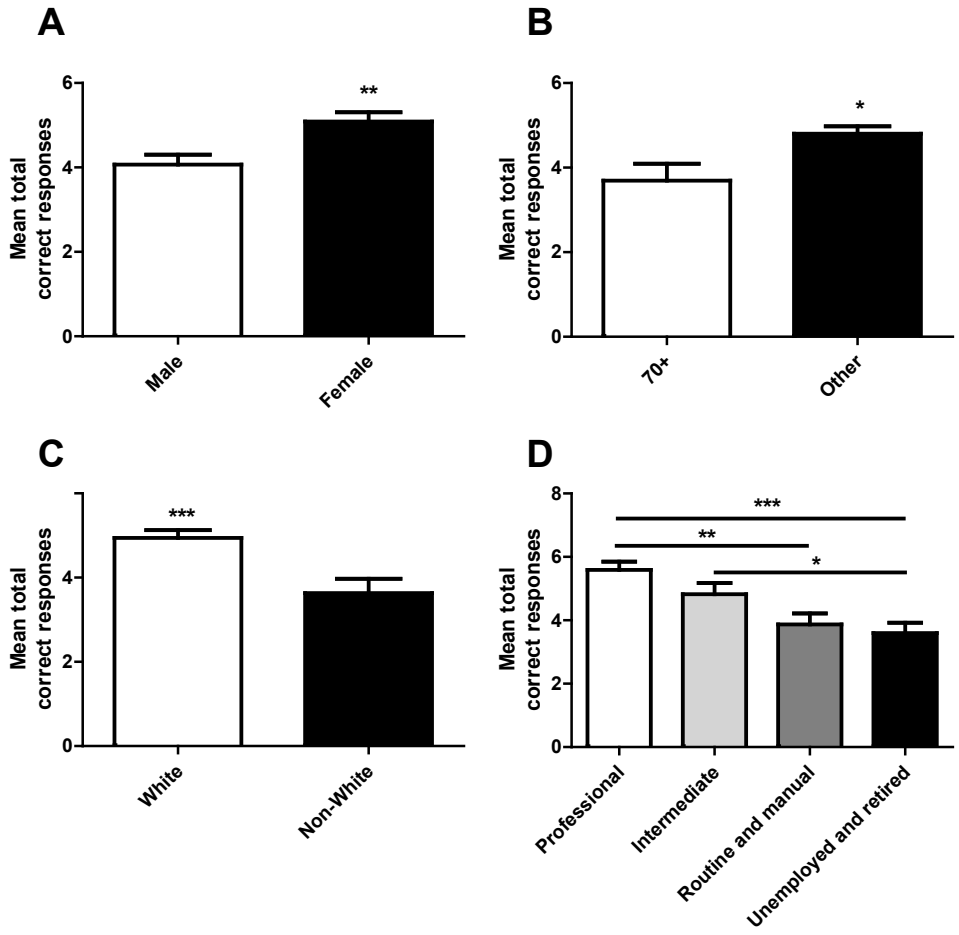


Figure 1: Mean total correct responses by socio-demographic factor. A Females gave significantly more correct responses than males. **B** 70+ age group gave significantly fewer correct responses than other age groups combined. **C** Participants of White ethnicity gave significantly more correct responses than those of Non-White ethnicity. **D** Mean correct responses varied significantly by occupational class with "Professionals" having the greatest mean and "Unemployed and retired" the least. Results are presented as mean with SEM; *p<0.05, **p<0.01, ***p<0.001.

responses above 1.00 for this question. Moreover, 38.5% of participants were unable to give any correct answers.

Preventative methods: Again, females gave a higher mean number of correct responses (1.25 vs. 1.18), however unlike previous questions this was non-significant. 18-29 year olds scored the lowest number of correct preventative methods with a mean of 0.829; significantly lower than the 30-39 year old group (0.829 vs. 1.44, p=0.039). Similar to risk factor knowledge, the mean number of correct responses decreased in a trend-like manner with occupational class. "Professionals" and "Intermediate" both gave a significantly higher mean number of correct responses than "Unemployed and Retired" (1.47 vs. 0.840, p<0.005; 1.32 vs. 0.840, p=0.024). Those of White ethnicity scored a significantly higher correct mean number of preventative methods compared to those of Non-White ethnicity (1.28 vs. 0.986) (t=2.190, p=0.029).

Discussion

Main Findings

This street survey assessed public knowledge of DVT in Birmingham, UK using open questions; the first study of its kind. In general, knowledge of DVT was poor, particularly of complications where the mean number of correct responses was less than one (0.856) with 38.5% of participants not able to give a correct answer.

Only 8.88% of people stated that a DVT can travel to the lungs, with only two participants mentioning the term PE. This finding is particularly noteworthy considering the high mortality and morbidity associated with PE secondary to DVT.[1] A much larger proportion of the participants incorrectly believed a clot could travel to the heart (24.0%) or brain (17.4%) causing a heart attack or stroke respectively. Only just under a third of people reported death as a complication (31.3%). Together, this indicates poor knowledge of the severity of DVT, a concerning finding.

When evaluating our study alongside other public awareness studies, overall public knowledge of DVT appears to be poorer than that of other common conditions including stroke and asthma.[29,30] While this may be explained by the higher

Table 4: Summary of significant differences in mean number of correct responses for socio-demographic factors. (Pro. = Professionals; Int. = Intermediate; R&M = Routine and Manual; U&R = Unemployed and Retired).

Question	Socio-demographic factor	Higher mean	Lower mean	Mean Difference	*p*-value
Total	Gender	Female	Male	1.02	0.002
	Age	30-39	18-29	1.73	0.036
		30-39	70+	1.79	0.024
	Occupation	Pro.	R&M	1.72	0.002
		Pro.	U&R	1.99	<0.0005
		Int.	U&R	1.22	0.045
	Ethnicity	White	Non-White	1.31	0.001
Symptoms	Gender	Female	Male	0.475	<0.0005
	Occupation	Pro.	R&M	0.547	0.029
	Ethnicity	White	Non-White	0.379	0.013
Risk factors	Gender	Female	Male	0.253	0.027
	Age	30-39	70+	0.693	0.007
		40-49	70+	0.631	0.019
		60-69	70+	0.614	0.019
	Occupation	Pro.	Int.	0.438	0.020
		Pro.	R&M	0.595	0.003
		Pro.	U&R	0.697	<0.0005
	Ethnicity	White	Non-White	0.323	0.016
Complications	Gender	Female	Male	0.256	0.008
	Ethnicity	White	Non-White	0.303	0.008
Preventative methods	Age	30-39	18-29	0.615	0.039
	Occupation	Pro.	U&R	0.633	<0.0005
		Int.	U&R	0.483	0.024
	Ethnicity	White	Non-White	0.299	0.029

prevalence of stroke and asthma, increased knowledge of stroke is likely also be a result of the FAST campaign, launched in the UK prior to the study.[15]

Our study identifies a poorer knowledge of DVT symptoms compared to that of MI. We demonstrated a mean of 1.41 correct DVT symptoms identified per respondent, whereas a similar study reported a mean of 2.20 MI symptoms.[14] This is likely due to community MI awareness programmes and its more common prevalence.[31] However, Yardley *et al.* reported only 31% of respondents knew at least one colorectal cancer symptom.[13] This is lower than for DVT although may not be comparable as a commercial telephone survey was used.

Ideally our results would also be considered alongside other similar DVT awareness studies, however comparison with the National Blood Clot Alliance online DVT survey is not possible as the methodology is unclear.

We found that socio-demographic factors appeared to have a significant influence on DVT knowledge. Females consistently showed greater knowledge than males and thus appear to be more informed about DVT. This correlates with results of public knowledge studies for other conditions.[13] Overall, knowledge of DVT decreased in a trend-like manner for occupational class, with "Unemployed and Retired" participants scoring lowest. Those of White ethnicity named significantly more correct responses than those of Non-White ethnicity, for all questions and in total. This is also consistent with similar studies of other conditions.[15] This could be because ethnic minorities may have poorer access to health promotion services, potentially due to language barriers. Differences in knowledge according to age were not consistent between questions. Overall, those in the oldest age category (70+) had the poorest knowledge. This is concerning considering older people are more prone to developing DVT.[2,19] In summary, our findings regarding the effect of socio-demographic factors on DVT public knowledge correlate well with that of other public awareness studies.[12-15]

Limitations

As this was a primary study, a street survey was most appropriate to obtain the public's knowledge of DVT.[32] This method provides a more representative sample population compared to telephone surveys.[33] However, street surveys can be subject to biases.[33] Selection bias was present but minimised by systematic sampling. Inevitably some population sub-groups are likely to be under-represented; principally the very old, disabled and Non-English language speakers. Surveying was performed at Friday lunchtimes and also weekends to minimise exclusion of the working population.

Health care professionals and participants with a previous history of DVT were excluded in our study, accounting for 20.8% of the 385 participants approached. This noteworthy group are likely to have improved background knowledge of DVT compared to the general population. This is in part a reflection of the high prevalence of DVT.

There was a skew towards older responders (-0.091); this was expected as previous census data had shown that the area has a slightly older population compared with the rest of Birmingham.[22]

Conclusions

Our study revealed poor knowledge of DVT, principally regarding complications. Very few respondents recognised that a DVT can travel to the lungs and cause a fatal PE. As this is such a serious complication, more investigation into public knowledge of the complications of DVT would be logical. Males, those in lower socio-economic classes and those of Non-White ethnicity were found to have poorest knowledge. Based on the extensive poor knowledge demonstrated in this study, any future public health campaigns should address the whole population, with particular focus on the complications of DVT and raising awareness in groups with least knowledge. As DVT is common post-operatively it follows that surgical healthcare professionals, particularly nursing staff, should be made aware of public knowledge and encouraged to pass on appropriate advice and recommendations to patients.

Previous street surveys have indicated that public knowledge of the symptoms of stroke and MI improved following educational campaigns (FAST campaign and REACT study, respectively).[15,34] In light of the successes of previous public awareness initiatives, the findings from this study support the recent recommendation from the All-Party Parliamentary Thrombosis Group for a nationwide VTE public awareness campaign.[21]

Finally, this study demonstrates that a street survey is an inexpensive yet effective method for analysing public awareness of common clinical conditions. A strength of our study is the ability to distinguish different aspects of knowledge of a health condition, which other studies' methodologies do not allow. This methodology could be replicated for other conditions in primary health care and may serve to inform future health promotion programmes.

Ethical approval

Birmingham City Council required no explicit permissions for the survey. The study was carried out as a medical student Public Health project and was carried out following the guidelines for Public Health projects at the University of Birmingham College of Medical and Dental Sciences.

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