International public awareness of peripheral artery disease

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Summary: *Background:* Peripheral artery disease (PAD) of the lower limbs is a common condition with considerable global burden. Some country-specific studies suggest low levels of public awareness. To our knowledge public awareness of PAD has never been assessed simultaneously in several countries worldwide. *Patients and Methods:* This was an international, general public, internet-based quantitative survey assessing vascular health and disease understanding**.** Questionnaires included 23 closed-ended multiple-choice, Likert scale and binary choice questions. Data were collected from 9,098 survey respondents from nine countries in Europe, North and Latin America during May-June 2018. *Results:* Overall, familiarity with PAD was low (57% of respondents were 'not at all familiar', and 9% were 'moderately' or 'very familiar'). Knowledge about PAD health consequences was limited, with 55% of all respondents not being aware of limb consequences of PAD. There were disparities in PAD familiarity levels between countries; highest levels of self-reported awareness were in Germany and Poland where 13% reported to be 'very' or 'moderately' familiar with PAD, and lowest in Scandinavian countries (5%, 3% and 2% of respondents in Norway, Sweden and Denmark, respectively). There were disparities in awareness according to age. Respondents aged 25–34 were most familiar with PAD, with 12% stating that they were 'moderately' or 'very' familiar with the condition, whereas those aged 18–24 were the least familiar with PAD (7% 'moderately' or 'very' familiar with PAD). In the 45–54, 55–64 and 65+ age groups, 9% said they were 'moderately' or 'very' familiar with the term. There was no important gender-based difference in PAD familiarity. *Conclusions:* On an international level, public self-reported PAD awareness is low, even though PAD is a common condition with considerable burden. Campaigns to increase PAD awareness are needed to reduce delays in diagnosis and to motivate people to control PAD risk factors.

Keywords: peripheral artery disease, population, surveys and questionnaires, awareness, risk.

Word count: 2,829 words

Summary: 300 words

Introduction

Peripheral artery disease (PAD), also termed lower extremity arterial disease (LEAD) (1) is a cardiovascular condition attributable to atherosclerotic disease (2). The condition is on the rise globally (2, 3) and exerts a significant burden on patients and healthcare systems (3). Its presentation ranges from the asymptomatic stage to pain at exertion, at rest, or to the occurrence of tissue loss. If not treated adequately, especially in cases of severe presentation, it may cause gangrene and necrosis resulting in limb amputation with substantial quality of life and socioeconomic burden. Patients with PAD, even though asymptomatic, are at increased risk of cardiovascular events and mortality (2).

Importantly, patients with PAD are still undertreated and treatment varies between countries. According to the 2016-17 Quality and Outcomes Framework in England, 89% of people with PAD are prescribed an antiplatelet agent (4, 5). In the national SWEDVASC registry authors showed that best medical therapy, defined as any antiplatelet or anticoagulant therapy along with statins, was offered to 65% of patients with claudication, and only to 45% of patients with critical limb ischaemia (6).

The prevalence of PAD has increased by 17% since 2010 when 202 million individuals were affected, illustrating the extent of PAD burden as a global public health problem (3). In 2015 nearly 237 million people were living with PAD worldwide with just under 64 million (27%) affected in high-income countries (HIC) (3). PAD prevalence was highest in Europe (7.99%, 95% confidence intervals (CI) 5.10–13.41) and lowest across Africa (4.06%, 95% CI 2.90–5.91) (3). In both HIC and low-income or middle-income countries (LMIC), the prevalence of PAD increased across all age groups from 25 to 69 years in 2015 (3). A slightly higher prevalence of PAD was identified in women than in men up to 75 years of age in HIC, however, in LMIC there were minimum gender differences (3). Smoking, diabetes, hypertension, and hypercholesterolaemia were also identified as major risk factors for PAD (3). The age-standardized disability-adjusted life year (DALY) rate (per 100,000) for PAD was 19.3 (14.4 to 26.3) in 2016 (7).

Despite these figures, PAD is currently underdiagnosed, and clinical awareness and interest in the condition appears to be lower (8),(9) compared to coronary artery disease (CAD) (10). Furthermore, awareness of symptoms associated with PAD, including intermittent claudication, critical limb ischaemia, and cardiovascular and limb-related outcomes, are inadequate (8). There is an urgent need to increase understanding and public awareness about PAD (11).

In this report, we present outcomes from an international survey designed to assess current levels of understanding of vascular health and disease among the public worldwide. In particular, this survey assessed awareness of PAD compared to CAD, the extent of recognition of PAD symptoms, PAD-related risk factors, complications and consequences.

Materials and Methods

An internet-based quantitative survey was developed to assess current levels of understanding of vascular health and disease among the public. Twenty-three closed-ended multiple choice, Likert scale and binary choice questions were asked throughout the questionnaire, to assess general awareness of PAD, CAD and the connection between vascular health and PAD/CAD.

Respondents were asked if they had a family history of vascular disease and if they were aware of the risk factors involved and preventative measures that could be taken. Moreover, participants were asked about their knowledge of symptoms and outcomes for each of both conditions. For descriptions of symptoms/outcomes, both true and false response options were offered to test the respondents' knowledge. Respondents were not permitted to return to completed questions or correct their answers in order to prevent any bias. The survey questionnaire is presented in Table SI, and additional results in Table SI through Table SX.

The survey data collection and fieldwork were carried out by the research agency Vitreous World according to British Healthcare Business Intelligence Association (BHBIA) Legal and Ethical Guidelines as well as guidelines established by the UK's Market Research Society (MRS). The survey was fielded among participants from the public aged over 18 years who were recruited from online panels that met required BHBIA and MRS standards for data collection. The survey was translated into individual languages for countries participating in the survey.

The data collection and fieldwork were completed between May 18, 2018, and June 13, 2018, across nine countries: UK, Germany, Sweden, Norway, Denmark, Poland, Canada, Mexico and Brazil. A nationally representative sample of data was collected in each country, utilizing quotas across age and gender. Demographic information of respondents including country of residence, age and gender was collected. The social classification of respondents was not included during data collection. Respondents were included to provide a 50/50 gender split and were evenly split among the six age groups. Once these quotas were reached in each country, the survey was closed. In order to have unbiased results,

healthcare professionals (e.g. physicians, nurses, pharmacists, researchers in biology) were systematically excluded from the survey.

Following this initial phase, eligible respondents were then asked to complete the full standardized questionnaire (see supplements, Table SI). Completion of the questionnaire took approximately 10 minutes. The questionnaire included 23 closed-ended multiple choice, Likert scale and binary choice questions.

Results

A total of 9,089 participants responded to the survey with 1,010 responses from each of the nine participating countries. Summary demographics of survey respondents are shown in Table I.

Familiarity With PAD

Among all respondents, 57% (n=5,222) declared they were ‘not at all familiar’ with PAD (Fig.1). Nine percent (n=853) stated they were ‘moderately’ or ‘very familiar’ with PAD. In Europe, the countries with the highest levels of familiarity with PAD were Germany and Poland, where 13% (n=133/1,010) of people in both countries claimed to be ‘very’ or ‘moderately’ familiar with the condition. The lowest levels of disease familiarity were reported from the Scandinavian countries, with 5% (n=47), 3% (n=34) and 2% (n=19) of respondents in Norway, Sweden and Denmark, respectively, reporting to be ‘moderately’ or ‘very’ familiar with PAD.

Disparities in awareness were observed according to age. Twelve percent of respondents aged 25–34 years stated that they were ‘moderately’ or ‘very’ familiar with PAD, compared with 7% of those aged 18–24 years. In the 45–54, 55–64 and 65+ age groups, 9% of respondents said they were ‘moderately’ or ‘very’ familiar with PAD. Among respondents aged 18–24 years, 79% stated that they were ‘slightly’ or ‘not at all’ familiar with PAD, followed by 78% in those aged 65+ years.

Knowledge of Body Parts Affected by PAD

Thirty-four percent (n=3,085) of all respondents definitely associated PAD with the arms and legs. Respondents from Scandinavian countries and the UK showed the lowest recognition, with more than two thirds of respondents either not associating arms and legs with PAD or being unsure about the association (Norway 80%, n=813; Denmark 78%, n=792; Sweden 74%, n=749; UK 71%, n=719), as shown in Table SII. Respondents from Germany showed the highest recognition with 47% (n=473) definitely considering the arms and legs to be

associated with PAD. In general, the heart was reported to be more frequently (48%; n=4,379) associated with PAD than arms and legs.

Among respondents who self reported to be ‘very’ or ‘moderately‘ familiar with PAD, most identified heart (25%) and arms and legs (22%) as body parts associated with PAD (Fig. 2). Individual country responses, where there is some variability in knowledge of body parts affected, are shown in the Electronic Supplementary Material, 2.

Knowledge of PAD Signs and Symptoms

Overall, 26% (n=2,338) of respondents definitely considered lower extremity ulcers as a symptom of PAD. The percentage was higher in respondents that self-reported as being ‘very familiar’ (55%) or ‘moderately familiar’ (50%) with PAD.

Less than half of the respondents in Poland (42%, n=428) considered leg weakness and numbness a symptom of PAD. Awareness of these symptoms was even lower in Denmark, Sweden, Norway and the UK. In Norway, only 10% (n=98) definitely considered cramping (claudication) a symptom of PAD.

The survey also included symptoms that are not associated with PAD to test whether respondents could identify those that are linked to the condition. Fever was identified as a direct PAD symptom by 11% (n=978) of all respondents. Respondents’ knowledge of PAD symptoms is shown in Fig. 3.

Awareness of the Risks Associated With PAD

Among all respondents, 55% (n=4,959) did not consider ‘death of the tissue in the leg caused by a lack of blood flow’ as a consequence of PAD. The lack of awareness of this PAD associated risk was highest in respondents from Norway (81%; n=821).

Almost half of all respondents (48%, n=4,324) considered ‘a complete loss of feeling in the leg due to a lack of blood flow’ as an outcome associated with PAD. Additionally, 47% (n=4,278) of all respondents stated that ‘reduced movement of the leg due to a lack of blood flow’ is an outcome of PAD. Awareness levels of the risks associated with PAD are shown in Fig. 4.

Awareness that PAD Commonly Occurs in Those Who Have CAD

Overall, 72% (n=6,507) of all respondents were unaware that PAD occurs more commonly in those who have CAD (Fig.5). The lowest proportion of people acknowledging this comorbidity occurrence was in Denmark (16%, n=162), the highest in Poland (47%, n=478).

Discussion

To our knowledge, this is the first international survey on public awareness of PAD. The findings from this international survey highlight a general lack of public awareness and knowledge about PAD. Awareness of its symptoms, future risks and how it affects the body were poor. Despite being the third leading cause of atherosclerotic cardiovascular morbidity (12), over half of all respondents admitted that they were 'not at all familiar' with PAD. Furthermore, 55% of all survey respondents were not aware that a key consequence of PAD is tissue death in the legs caused by a lack of blood flow. Overall, there was limited knowledge of which parts of the body are affected by PAD, and of the vascular system in general.

The lack of PAD awareness among the general public identified in this international survey is consistent with the results of a study conducted in Sri Lanka on awareness of PAD among the 40- to 74-year-old population (n=2912). The survey showed that 4.1% of participants were aware of PAD, significantly lower than awareness of other cardiovascular diseases such as cerebral vascular accidents (67.3%) and myocardial infarction (57.6%) which was statistically significant ($p<0.001$). The authors concluded that a comprehensive PAD awareness program to cover risk factors, consequences, and prevention strategies is needed to enhance public awareness of PAD. (13)

PAD is common in patients with CAD with a prevalence of 22–42% (14). Awareness of this association is important because among patients with CAD, those with comorbid PAD have worse cardiovascular outcomes than patients with CAD alone (14). However, the survey results showed that almost three quarters of all respondents were unaware that PAD commonly occurs in those who have CAD. In contrast to CAD, of which 37% of the respondents were "not at all familiar", this answer was given in 57% for PAD, and 87% considered CAD a more serious health condition than PAD, illustrating a lack of awareness with regards to PAD compared to CAD.

Of note, the 9% of familiarity with PAD among responders ("moderately" or "very familiar") is approximately on the level of overall prevalence of PAD (3). While we cannot infer it from the data, it may be that familiarity with PAD is stronger among people with direct experience with

PAD themselves as patients, and among their closest relatives. Accordingly, the space for public awareness among an international population seems to be very broad here.

Over the next decade, the burden of PAD worldwide is expected to grow rapidly, driven mainly by population growth, ageing, increasing trend in conventional PAD cardiovascular risk factors, and changing demographics and lifestyles (12, 15). Given the key knowledge gap existing among the public, especially related to the impact of PAD, raising awareness is an essential step to address social and economic consequences of PAD, as well as to enable effective preventive and secondary preventive measures (12).

The main goals of treatment in patients with PAD are to reduce cardiovascular risk and improve functional capacity. However, given the lack of awareness of PAD, undertreatment is an issue and needs to be addressed as a global health priority. This imperative was recognized by the European Society of Cardiology in association with the European Society for Vascular Surgery in their 2017 Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, as well as by the European Society of Vascular Medicine in their 2019 guidelines (1) (16).

Strategies to increase awareness need to be implemented in the community and in primary, secondary and tertiary care settings. PAD education among the public and healthcare practitioners should be developed in each country. This need was highlighted by a recent survey conducted in the North-East of England, United Kingdom, where factors were identified that impact on PAD diagnosis. These include the attitude of primary care health professionals to PAD, problems accessing diagnostic tests, and delays in patients seeking medical advice from their general practitioner due to a lack of understanding about PAD and its associated symptoms (17). A recent large French survey identified substantial differences in GP knowledge with broad knowledge about transient ischemic attacks, some knowledge on stable angina and very little knowledge about diagnosis and management of intermittent claudication (18). Public campaigns raising awareness about PAD and its risk factors are useful in informing and motivating people to act to prevent the disease and control its risk factors (17).

Limitations

Among limitations of this survey questionnaire, its online nature should be noted since people without internet access were unable to participate. Broadband access has been described as a “super-determinant” of health, and internet use associated with health literacy in older age (19, 20). Therefore, our findings may, if anything, overestimate true levels of understanding

among the general population, since PAD knowledge may be even lower than reported here in people with no internet access, and in older age groups. Respondents with internet access were able to answer the questionnaire via a personal computer or mobile device, and all respondent quotas by country and demographic were met without any survey adaptations. However, since the participants were recruited from online panels and respondents were provided with an incentive for their participation, the study group cannot be considered as representative for each participating country.

Also, it has been reported that the awareness about risk factors of PAD may be influenced by the individual's own risk factors (21). In our survey, we have not asked for personal health conditions and habits, so we cannot assess the influence of personal health background on the awareness of PAD and its risk factors.

Countries where a lower prevalence of PAD and CAD is observed, such as Italy, Spain, and Greece, were not included in this survey. While this is a multi-country survey, a limitation lies in the number of countries selected to participate and the geographical spread. For example, Africa and Australasia are not represented in this survey.

A further limitation was the language used around PAD, CAD and vascular health, with varying terminology used per country. We cannot exclude that an imperfect choice of the words used to translate PAD into common languages may have negatively influenced the understanding of the questions. Specifically, in the Nordic Countries, the more common lay man wording for PAD was not used in the questionnaire. This may partially explain the low level of awareness recorded in those countries. However, we do not think these would substantially alter our general conclusions.

Overall, a consistent survey methodology was used across all countries. Any differences in gender or age sampling per country is purely random and may be due to recruitment challenges, resulting in some countries having younger female respondents in samples than other countries. Similarly, the responses for older age groups above 65 years, were too few to analyse by country, perhaps reflecting lower internet use in these age groups (20). Despite the inherent cross-country limitations due to culture, language, and internet access, the dataset has enabled an international description of the general awareness of PAD.

Conclusions

The results of this international, public, self-reporting survey indicate that key knowledge gaps exist in relation to PAD, varying across countries. This demonstrates the need to

increase public and patient awareness of the importance of reducing lifestyle-associated risk factors as well as promptly recognizing PAD symptoms, thus allowing for appropriate diagnostic workup and therapeutic management. Death rates from PAD are expected to rise due to the aging of the population over the next decade, and it is important to inform people of the dangers associated with this.

These findings can assist in formulating educational programs aimed at the public, including patients with a diagnosis of PAD or CAD, to assist in driving preventative health awareness campaigns. As such, this paper can be used in communicating with patient advocacy groups, medical organizations, and governmental health departments, to provide evidence on the need for improved awareness about PAD and the potential lifelong implications of PAD to the health of nations around the world and to society and economies at large.

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Conflicts of Interest

All authors received fees from Bayer while acting as consultants on Euro PAD, during the development of this manuscript. RB has served as Principal Investigator on studies conducted by Bayer, Bristol Myers-Squibb, Boehringer Ingelheim, Daiichi-Sankyo and Leo, and has acted as a consultant and served on speaker bureaus for Bayer, BMS, Boehringer Ingelheim, Daiichi-Sankyo and Pfizer. CEC has received fees for consultancy work from Medtronic. SD has received fees while acting as a consultant for Bayer and Novo Nordisk and serves as an executive committee member for the Voyager PAD, XATOA and XATIVA studies. VA has acted as a consultant for Amgen, Bayer, Novartis, NovoNordisk and Pfizer/BMS alliance. MDC has received fees while acting as a consultant for Bayer during the conduct of the study, and received fees for consultancy work from Sanofi, Regeneron, Boehringer-Ingelheim, and Daiichi-Sankyo, outside the submitted work. HS has received fees or grants while acting as a consultant for Bayer, Novo Nordisk, Cook Medical and Philips Ultrasound. LM and their institution received fees related to work on the Euro PAD program. All other authors do not have any other conflicts of interests to declare, aside from receiving consultancy fees for participating in the EuroPAD collaboration group.

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Table I. Demographics of survey respondents by gender, age and country*

	Total	Age (years)					
		18-24	25-34	35-44	45-54	55-64	65+
No. Respondents	9089	1197	1696	1673	1656	1396	1471
Male	49%	34%	42%	47%	55%	57%	59%
Female	51%	66%	58%	53%	45%	43%	41%

	Total	Country								
		Mexico	Poland	Germany	Brazil	Canada	UK	Norway	Sweden	Denmark
No. Respondents	9089	1010	1010	1010	1010	1009	1010	1010	1010	1010
Male	49%	50%	48%	51%	48%	47%	49%	51%	50%	49%
Female	51%	50%	52%	49%	52%	53%	51%	49%	50%	51%
Age (years) 18-24	13%	19%	12%	11%	18%	12%	11%	13%	12%	10%
25-34	19%	23%	20%	16%	26%	15%	17%	18%	16%	16%
35-44	18%	19%	16%	19%	20%	16%	20%	19%	17%	19%
45-54	18%	20%	17%	22%	16%	20%	16%	20%	16%	18%
55-64	15%	13%	17%	15%	11%	18%	15%	16%	15%	18%
65+	16%	6%	17%	17%	10%	19%	21%	14%	24%	19%

***** A total 9,090 respondents were included, but one respondent from Canada did not meet quality control requirements and was removed from the database, and therefore the total number included was 9,089.

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Figure 1. Self-reported awareness of PAD among survey respondents in response to the question,

'How familiar are you with peripheral artery disease (PAD)?'

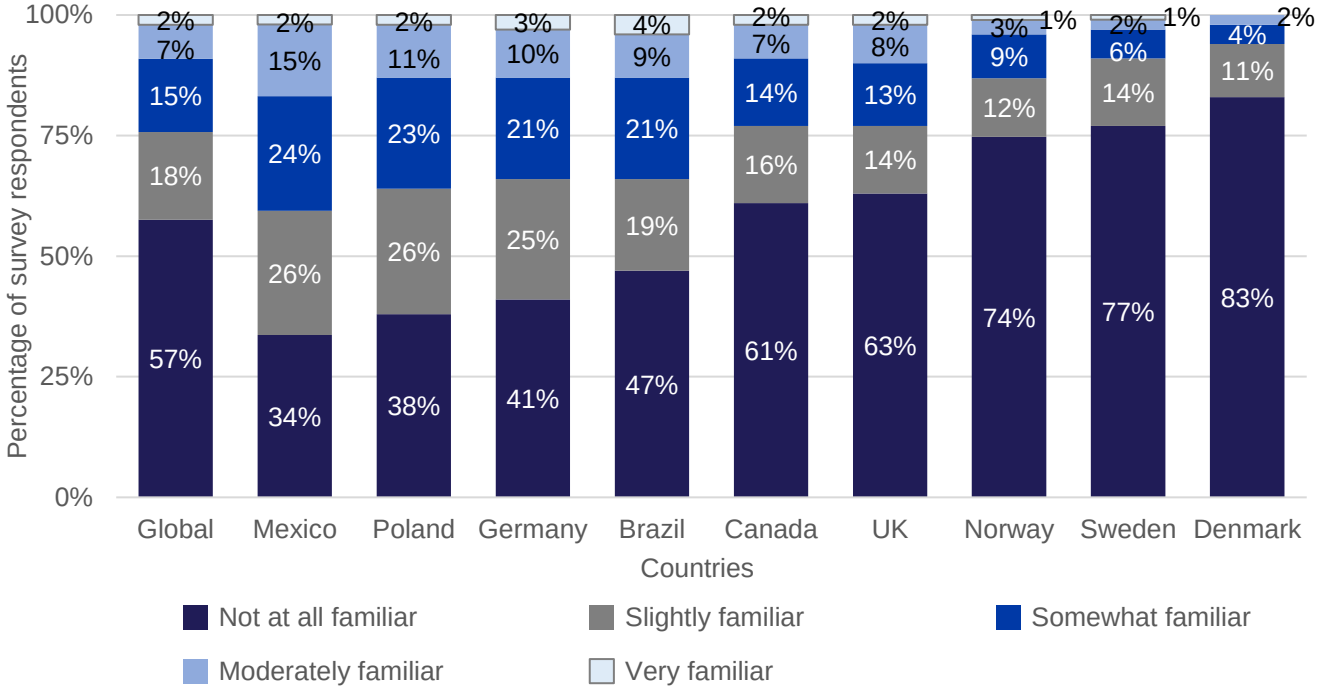

Figure 2. Knowledge of body parts affected by PAD in response to the question 'Which of the following parts of the body would you definitely associate with PAD: arms and legs, heart, kidneys, lungs, brain, stomach' among respondents whose self-reported awareness to PAD was'very familiar' or 'moderately familiar'

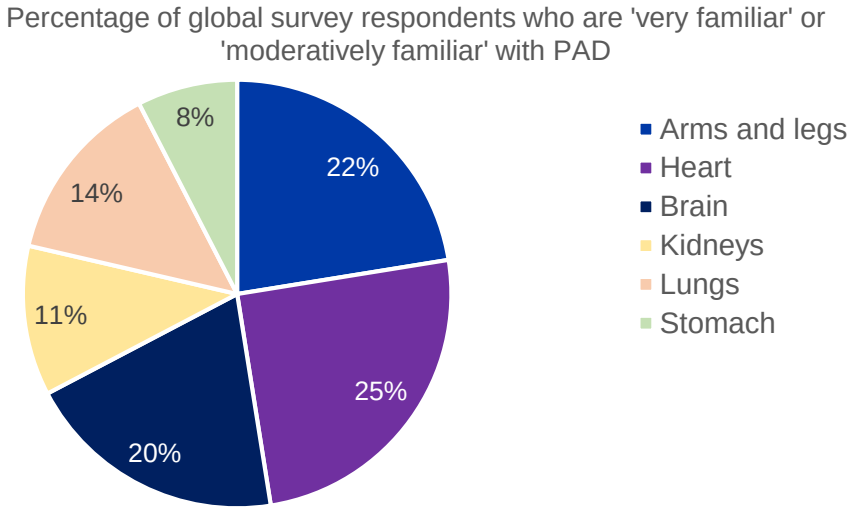

Figure 3. Knowledge of PAD symptoms among respondents in response to the question, 'Which of the following conditions would you definitely consider to be symptoms of PAD'?

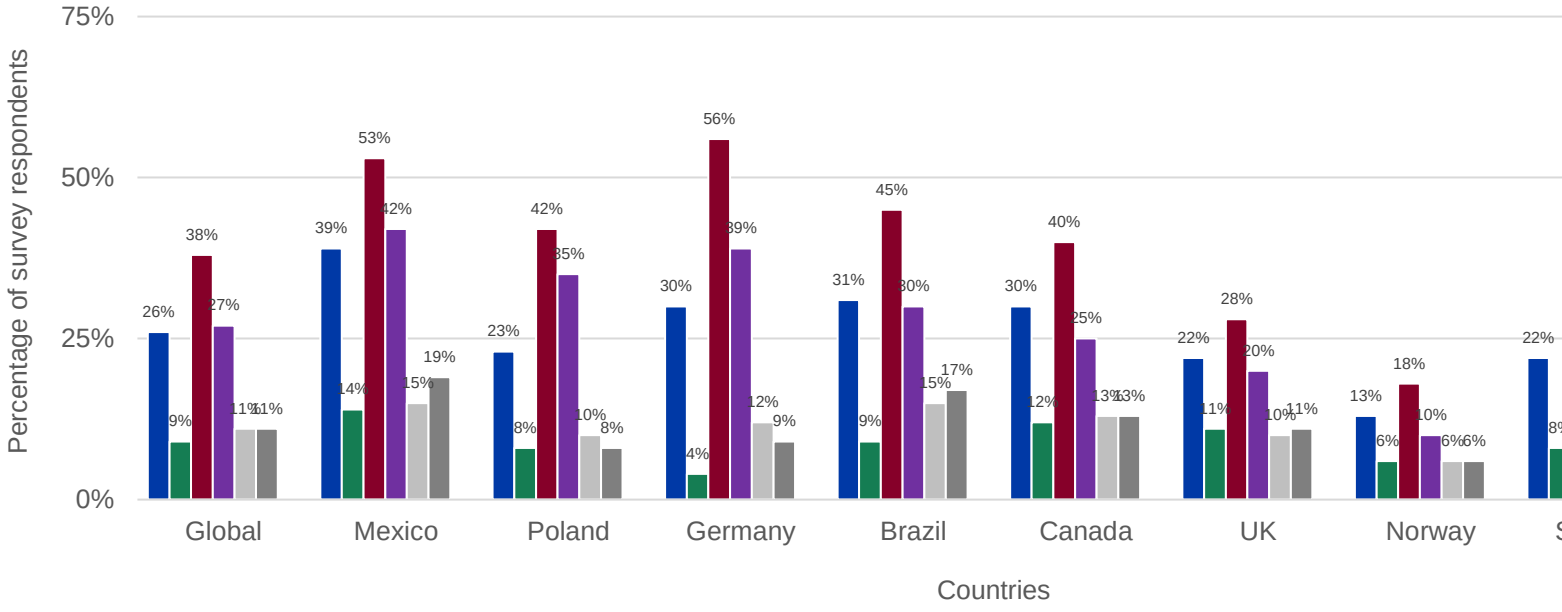

Figure 4. Awareness of the risks associated with PAD among respondents when asked the question, 'Which of the following conditions would you definitely consider to be symptoms of

PAD if left untreated: a complete loss of feeling in the leg due to a lack of blood flow, death of the tissue in the leg due to a lack of blood flow, infection caused by toxins in the blood, reduced movement in the leg due to a lack of blood flow?'

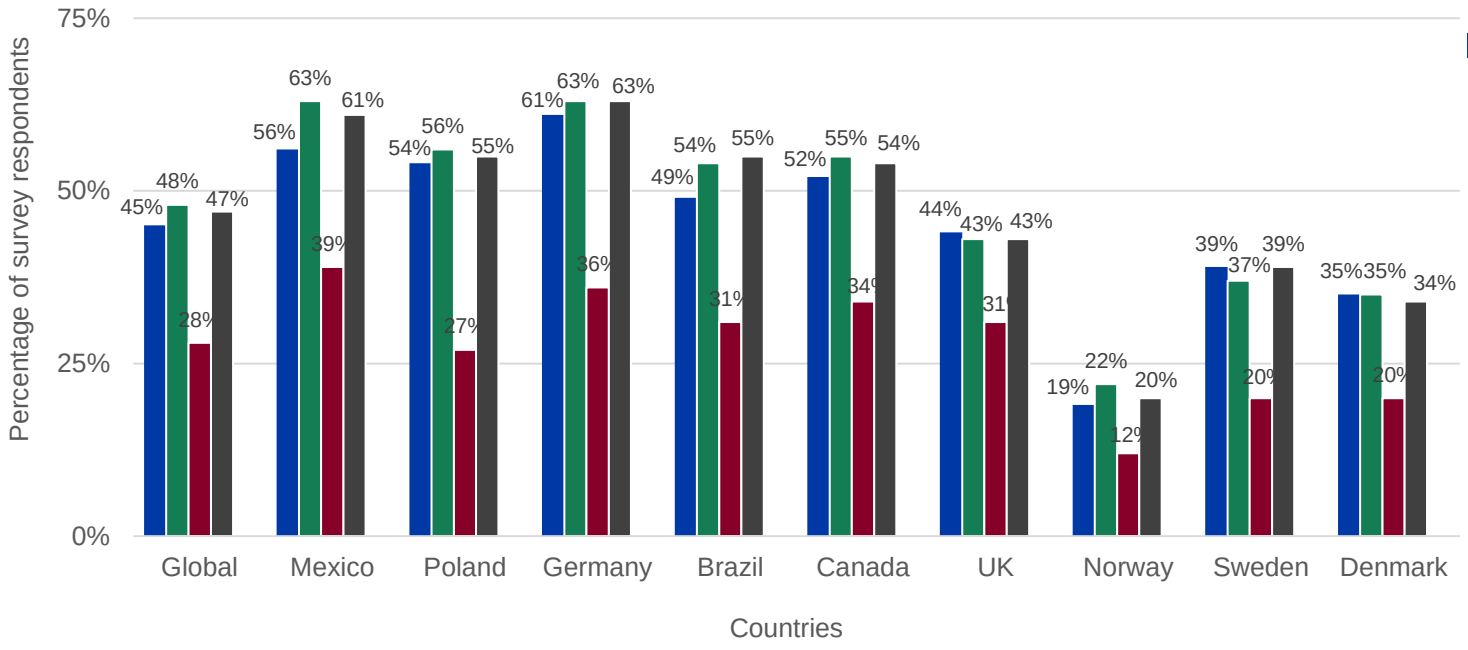

Figure 5. Rates of responses to the question: 'Peripheral artery disease (PAD) commonly occurs in those who have coronary artery disease (CAD), true or false?'