

# Perception of diabetic foot ulcers among general practitioners in four European countries: knowledge, skills and urgency

**Objective:** Diabetic foot ulcers (DFU) have the potential to deteriorate rapidly, in the absence of prompt assessment and treatment. The aim of this study was to analyse the awareness and perception of DFU among general practitioners (GPs) from four European countries, and to find possible differences between these countries in terms of management.

**Method:** A two-part, quantitative, online questionnaire was distributed to GPs across four countries in Europe— the UK, France, Germany and Spain. The first part entailed a survey on the perception and knowledge of the pathogenesis and management of DFU, among GPs. The second part of the questionnaire was used for the collection of data on recently-managed DFU cases.

**Results:** For the first part of the study, 600 questionnaires were collected (150 per country) and 1188 patient cases of DFU management were included in the second part. In France, only 49% of GPs mentioned neuropathy as the main causative process in DFU development.

However, in Germany and the UK, 82% and 83% of GPs, respectively, considered neuropathy as an important causative factor. DFU care in

Spain and the UK is thought to be organised by multidisciplinary teams (MDT) (83% and 84% of GPs, respectively, completely agreed with this statement). In France and Germany, GPs are responsible for follow-up and management. Only UK physicians have clearly identified specialised podiatrists to refer patients to, if needed. Approximately 29–40% of GPs in all countries did not feel they were sufficiently trained in the DFU treatment protocol. Almost 30% of GPs in France and Germany thought that DFU treatment was not well-established due to the absence of clinical guidelines and protocols.

**Conclusion:** The intra-country and inter-country management of the complex aspects of DFU is quite heterogeneous. The cause of this finding is multifactorial. Although there are international guidelines, it would be beneficial to establish clear and specific competencies for the different health professionals involved in DFU management. As a minimum, intra-country heterogeneity should improve with their development.

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diabetes mellitus • diabetic foot ulcers • general practitioners

**D** iabetic foot ulcer (DFU), one of the most important complications in patients with diabetes, can lead to major limb amputation, increase the risk of death, significantly decrease quality of life (QoL) and incur high societal costs.<sup>1,2</sup> The global DFU prevalence in Europe is 5.5%<sup>3</sup> and the annual incidence is around 2–4%, in developed countries.<sup>2,4</sup> During treatment, lower limb amputation, in any form, is performed in nearly 30% of cases.<sup>5</sup>

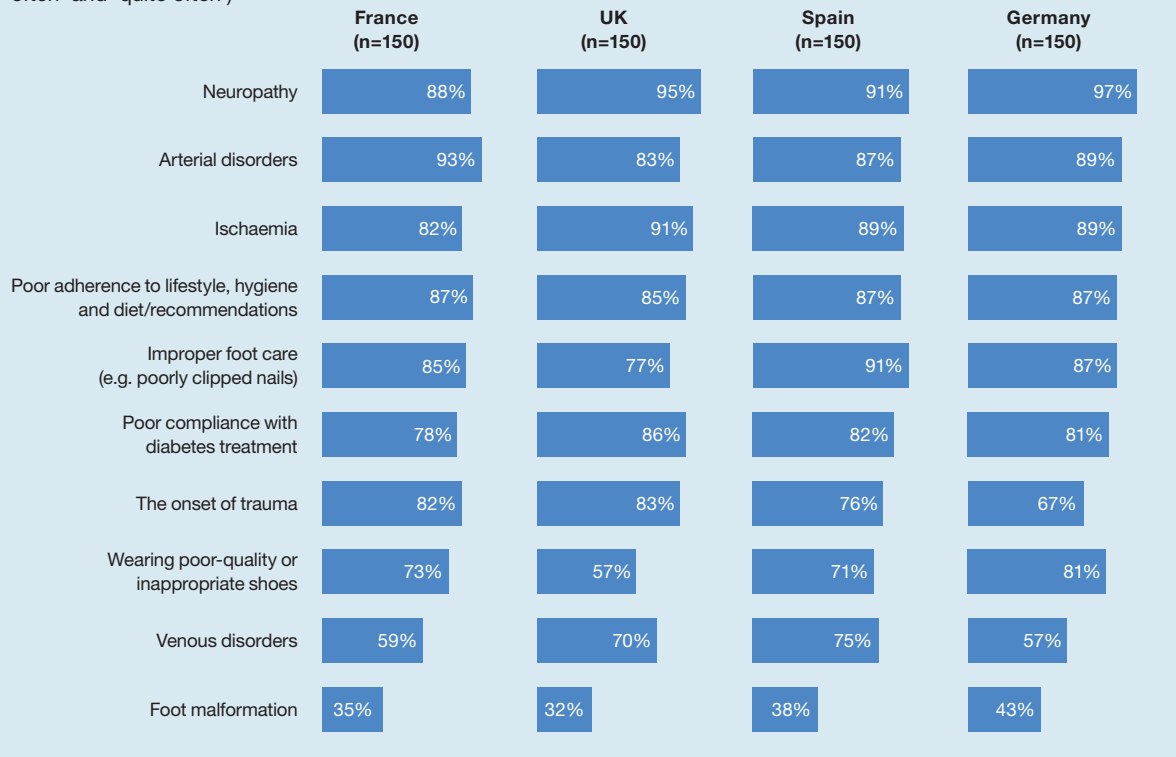
The most important factors that lead to the development of DFU are peripheral neuropathy (sensory loss, motor disease with foot deformities and autonomic dysregulation), peripheral artery disease and trauma.<sup>6</sup> Ulceration and impaired healing are direct consequences these pathophysiological factors. However, they are not the only concerns for DFU patients. Once a wound is present, the risk of infection will increase, this is the most common precipitating event leading to lower extremity amputation.<sup>6–9</sup> If infection develops, the healing process gets more complicated and limb and/or life could be threatened, especially if deep structures like bones are involved. In some of these cases, although the tissue is infected, common inflammatory signs are absent. The presence of a non-healing ulcer is sometimes the only feature that leads to the suspicion of diabetic foot osteomyelitis. In addition, infected DFU treatment is not always easy and treatment with broad spectrum antibiotics is usually not sufficient. Therefore, accurate ulcer depth assessment, sharp debridement, sampling tissue for culture and offloading are vital for DFU management.<sup>10,11</sup> Vascular and neurological evaluations are also necessary and helpful in the identification of the main mechanism of ulceration. Accurate global DFU evaluation is useful to implement effective treatments and secondary

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**Fig 1.** Implication of different mechanisms in DFU development as perceived by GPs (% of GPs who responded 'very often' and 'quite often')



prevention strategies in order to avoid re-ulceration.<sup>12,13</sup>

Since DFU is not an uncommon disease, the first evaluation is frequently performed by general practitioners (GPs). According to the severity of the ulcer, patients with limb-threatening or life-threatening DFU problems should be immediately referred to specialised units with acute care services.<sup>14</sup> Accurate initial evaluation can detect these high-risk patients, so that they can receive early and adequate intensive treatment. Taking this into account, GPs are one of the most important figures in DFU management, because they frequently have to decide whether or not the patient needs quick referral to a specialised clinic or hospital.

**Aim**

The aim of this study is to analyse the awareness and perception that GPs from four European countries have of DFUs and to find possible differences between these countries, in terms of management.

**Methods**

This study is an analysis of a quantitative survey conducted among GPs in the UK, France, Germany and Spain. It forms part of a project conducted in these four countries which, using a qualitative approach, aimed to explore the global DFU perception of different primary health professionals including GPs, nurses and podiatrists.

Data were collected online, through a 45-minute questionnaire, divided into two main parts. The first part aimed to collect data about awareness as well as

knowledge of DFU. Respondents were asked to answer questions on the following aspects:

- How would they define the pathophysiological mechanisms that impact the feet of patients with diabetes? This was not a multiple-choice question and respondents had to specify three factors
- Did they feel that wounds/ulcers on diabetic feet are linked to neuropathy, arterial disorders, ischaemia, poor adherence to lifestyle, improper foot care, poor adherence with diabetes treatment protocols, trauma, wearing inappropriate shoes, venous disorders and foot malformation? GPs were asked to consider each item to be either: 'never', 'sometimes', 'quite' or 'very often' implicated in DFU development
- GPs were also asked for their opinions on the best treatment strategies for DFU management, by agreeing or disagreeing with the following statements: 'DFU management requires patient education and training for practitioners, as well as the presence of a multidisciplinary team (MDT)'; 'DFU treatment is primarily a GP's responsibility'; 'There are guidelines that establish DFU treatment'
- Participants were asked to describe their self-perception of whether or not they felt sufficiently trained in the different aspects of DFU treatment/management. For example some of the items evaluated; comfort level/performance of offloading devices; identifying specialised facilities should the need arise; using DFU treatment protocols
- What additional tests did they run when DFU was

initially diagnosed? Open text answers were requested

- What clinical situations led to hospitalisation, and how frequently did they happen? For each situation, GPs were asked to choose one of the following options: 'never', 'sometimes', 'quite often' or 'very often'.

The second part of the questionnaire consisted of collecting data based on patient cases. Here, GPs were asked to describe the management of two of patients with DFUs whose wounds had recently healed (whether or not amputation was involved, and whether or not revascularisation was needed). Simple cracks, blisters, hyperkeratosis without any wounds, and venous leg ulcers (VLU) were excluded.

For each patient case, the data collected were: profile of patient (sex, age, education level), type of diabetes, date of diagnosis of diabetes, date and context of DFU diagnosis, time between the onset of the wound and DFU diagnosis, characterisation of DFU (location, depth, size and pathophysiological origin of the wound), additional tests that were prescribed, which health professional had primary responsibility in terms of patient follow-up and prescribing offloading devices and dressings, rates and causes of hospitalisation, length of time between DFU diagnosis and referral to hospital, service where patient was admitted to hospital, medical procedures/treatments that were prescribed during hospitalisation and the duration of hospitalisation, as well as the amputation rates among hospitalised patients.

Post-hospitalisation characteristics were also assessed by evaluating whether or not wounds healed after hospital discharge, and which health professional was in charge of patient follow-up after hospitalisation.

The fieldwork was conducted from August to September 2015. Fieldwork and data analysis were managed by the Consumer Science and Analytics research team. Results were provided with cross-tabs of all open- and closed-ended questions, and cross-tabs among various questions. Results were delivered at the

country level. Significant differences between countries were analysed with a confidence interval (CI) of 95%.

### Results

A sample of 600 GPs (150 GPs per country) and representative, in terms of sex, age and region, were sent a questionnaire. All GPs responded. A total of 1188 patient cases (295 in France, 298 each in the UK and Spain, and 297 in Germany) were also collected.

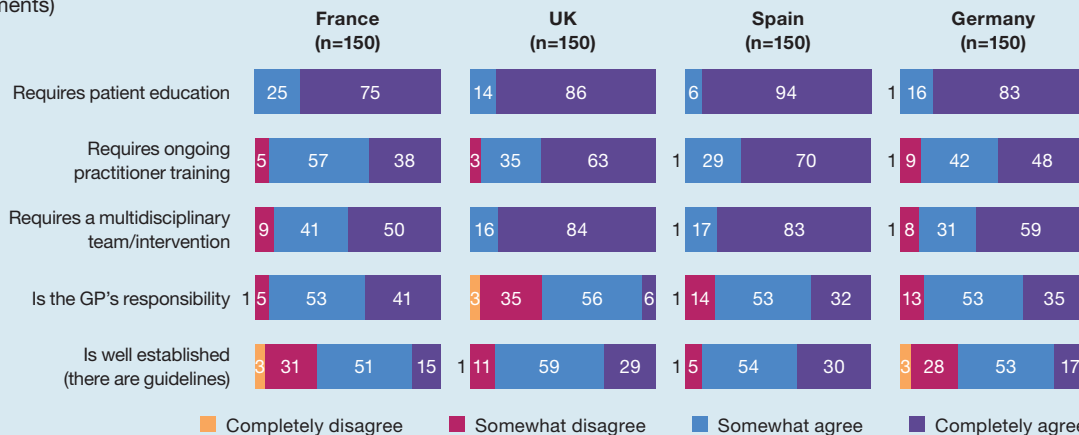
#### Awareness and knowledge: main factors implicated in DFU development

From a pathophysiological point of view, vasculopathy and neuropathy were the mechanisms most often considered as being responsible for DFU development. The importance given to each pathophysiological mechanism was not the same in the four participating countries. In France, 49% of GPs mentioned that neuropathy was among the main causative processes in the development of DFU, while in Germany and the UK, neuropathy was considered an important factor by 82% and 83% of GPs, respectively. When answering direct multiple-choice questions about ischaemia and neuropathy as pathogenic agents in wound development, more than 80% of the GPs in all countries thought they were implicated 'quite often' or 'very often' (Fig 1). Other factors usually associated with DFU, such as lifestyle, trauma, improper foot care, wearing inappropriate shoes or foot deformity, were assessed similarly in the four countries. In Germany, the perception of the implication of trauma was lower. GPs in Spain gave increased importance to venous disorders.

#### Awareness and knowledge: best treatment strategies for DFU global management according to the GPs

In general, patient education and training for practitioners play an essential role in DFU management; almost all the GPs 'completely agreed' or 'somewhat agreed' with this idea. DFU care in Spain and the UK is thought to be organised by a multidisciplinary team

**Fig 2.** Best treatment strategies referred by GPs for DFU global management (% of GPs who agree/disagree with statements)



**Fig 3.** Self-perception about feeling sufficiently trained in different aspects of diabetic foot ulcer (DFU) management (% of GPs who agree with statements)

	France (n=150)	UK (n=150)	Spain (n=150)	Germany (n=150)
Should the need arise, you have clearly identified podiatrists	NA	88%	NA	NA
Should the need arise, you have clearly identified DFU clinical practitioners working in a hospital facility	85%	85%	80%	73%
You have sufficient training concerning the pathophysiology of DFUs	64%	75%	79%	82%
Should the need arise, you have clearly identified chiropodists	80%	NA	68%	83%
You have sufficient training concerning the DFU treatment protocol	60%	61%	73%	71%
You have sufficient training concerning the additional tests a DFU patient should be prescribed	55%	61%	75%	68%
You have sufficient training concerning the offloading of a diabetic patient's foot wound	51%	50%	63%	79%
Should the need arise, you have clearly identified DFU specialists working in a private practice	70%	39%	47%	77%

(MDT), 83% and 84% of GPs completely agreed with this idea. In France and Germany, GPs are responsible for follow-up and management. In France, 94% of GPs and 87% of GPs in Germany considered GPs to be the health professionals who had responsibility in the treatment of DFU patients. Even so, the presence of a MDT was considered a good management option, in all participating countries (Fig 2).

Clinical guidelines and protocols were not generally used, and nearly 30% of GPs in France and Germany thought that DFU treatment was not well-established due to the lack of guidelines on the daily management. In addition, only 40% of GPs in Spain completely agreed that DFU treatment was well-established in the presence of relevant guidelines.

**DFU management: treatment protocol and complementary tests**

Between 29% and 40% of GPs in all countries felt they were not sufficiently trained in DFU treatment protocols. Similar findings were observed with respect to whether or not GPs felt capable of prescribing offloading devices. Only 50% of GPs in France and UK thought they could perform offloading safely. In Germany almost 80% of GPs stated that they were comfortable performing offloading treatments (Fig 3).

With respect to the additional tests that were run by GPs when a DFU was diagnosed, GPs in Germany focused on neurological tests (filament testing, vibration evaluation with diapason and temperature sensitivity), while GPs in France used the Doppler ultrasound more frequently than those from the other countries.

Arterial disorders were considered to be one of the

main aetiological factors for DFU development by GPs in Spain. Nevertheless, 35% of GPs from Spain did not perform any vascular evaluation. There was a major focus on vascular evaluation among GPs from France, although they also had the lowest number of ankle-brachial pressure index (ABPI) tests performed. This complementary exploration technique was used 'quite often' or 'very often' in the UK and Spain, where 73% and 62% of GPs, respectively, run them.

Nearly 80% of participating GPs in all countries clearly identified specialised DFU facilities to where they could refer patients should the need arise. More specifically, in the UK, 88% of GPs clearly identified specialised podiatrists. In the other three countries, this question was not answered (Fig 3 and 4).

**DFU management: hospitalisation**

Clinical situations leading to hospitalisation were similar in all the participating countries—the most frequently cited ones being gangrenous toe, suspected osteomyelitis and suspected ischaemia. The need for sharp debridement was also cause for referral to specialised care. Of those responding from the UK, GPs did this 'frequently' or 'systematically' in 91% of the cases. In the other countries, this percentage was lower, but still relatively high (52% in France, 75% in Spain and 76% in Germany).

**Study of patient cases: DFU diagnosis**

A total of 22% of GPs from the UK did not personally diagnose DFU. In such cases, diagnosis was usually performed by a district nurse (27% of the cases).

In all the countries, the most common warning sign that led to the diagnosis of DFU was a complaint from

a patient or his/her family when they noticed a problem in their feet and asked for a medical assessment of it. Between 19% and 28% of cases, depending on the country, were diagnosed as a result of an incidental discovery during a routine examination. In these cases, patients did not cite any symptoms.

**Study of patient cases: ulcer characterisation and additional tests**

Following the GPs' criteria, most ulcers (between 79% and 87%, depending on the country) were superficial and small at the time of diagnosis. The highest percentage of deep ulcers, affecting the capsules, joints and/or bone, was observed in Germany, where 20% of the wounds involved one or more of these structures. With regards to the pathophysiological origin, approximately 45% of the patients (between 34% in the UK and 54% in Spain) were reported to have a vascular component to their wound (Fig 5).

Additional tests for DFU characterisation were not always performed. Therefore, 50% of the total responding GPs did not carry out any test during the first visit. When performed, the most common tests were those for vascular assessment. Neurological tests were also frequently performed, at an average of 20–30% of the cases, depending on the country. GPs in Germany

prescribed neurological tests more frequently than those in the other countries; 34% of them prescribed any neurological test, while 16% prescribed specific vibration tests.

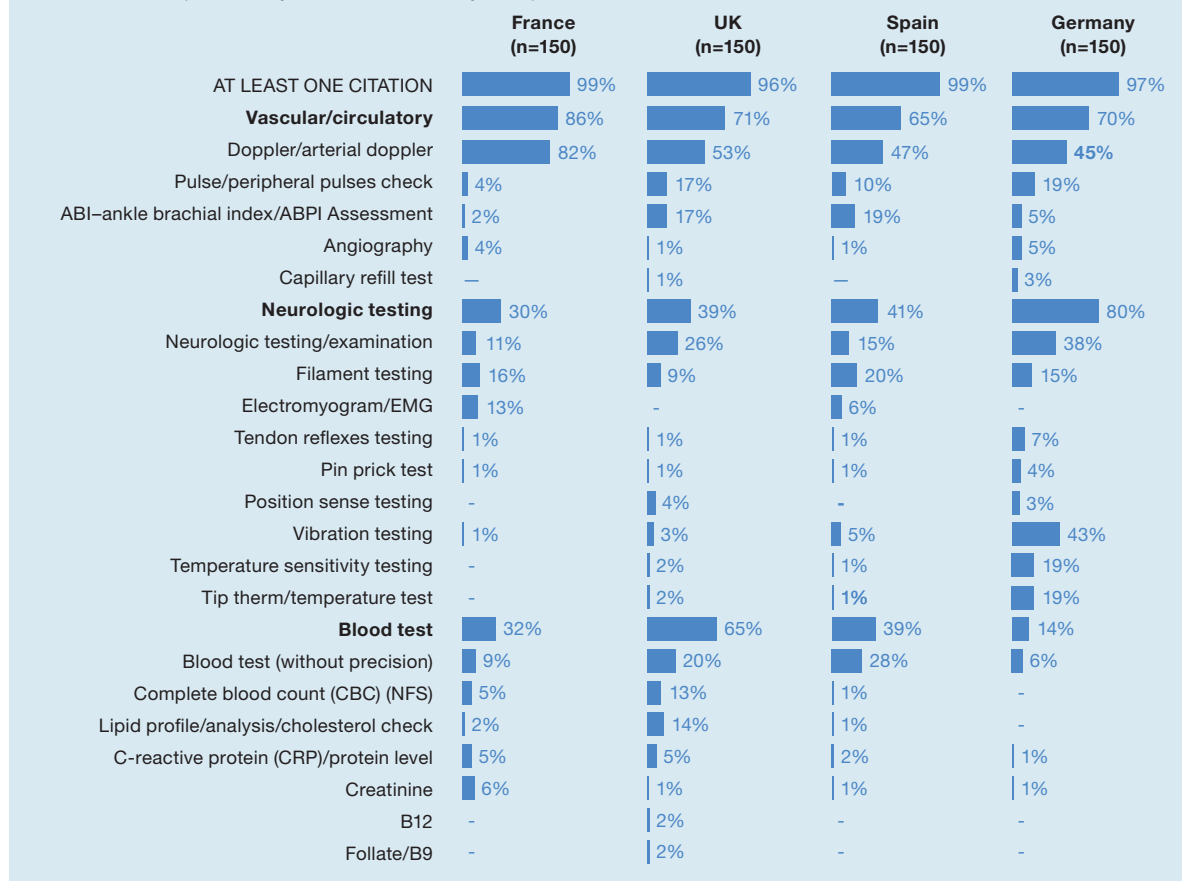
Infection research was conducted in 7% to 26% of patients, depending on the country. However, infection was reported to be present in 56% to 72% of DFU patients, depending on the country, according to the wound appearance (Fig 5 and 6).

**Discussion**

Regarding the perception that GPs have of DFUs, one of the most important findings of our study is the great heterogeneity between the participating countries, in the assessment of some aspects of DFU diagnosis and management.

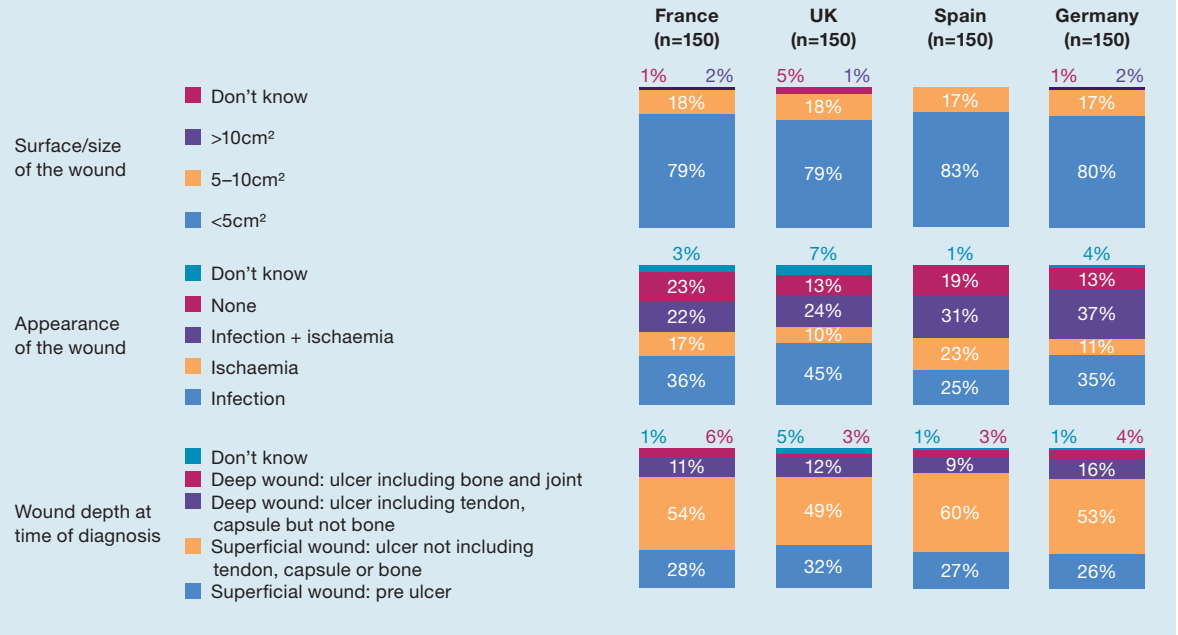
Many of the differences can be attributed to the differences in the methods of working/clinical practice and health-care organisation procedures, education level on DFU, reimbursement, established referral patterns, between the individual health-care systems of each of the four countries. This article does not analyse the quality or efficiency of the participating GPs or compare their knowledge levels, by country. We have merely described the situation concerning DFU awareness and management among GPs in four European countries.

**Fig 4.** Main complementary tests carried out by European GPs





**Fig 5.** Appearance of wounds at diagnosis in patient-cases



**Awareness and knowledge: main factors implicated in DFU development**

The first aspect in which heterogeneity was observed was the main causative mechanism that leads to DFU development, with different levels of importance given to neuropathy. It is important to mention that this part of the questionnaire had to be answered through open text, and not chosen from pre-formulated options; therefore, more than 100 different possible causes were registered as answers. It is not possible to conclude, from the responses provided, that neuropathy is not taken into account to explain DFU physiopathology. In fact, answers to direct multiple-choice questions showed that more than 80% of responding GPs in all the countries thought that neuropathy was implicated 'quite often' or 'very often' as pathogenic agents in wound development. However, these data show that mechanisms involved in DFU development are not sufficiently clear among participating GPs.

**Best treatment strategies for DFU global management, according to the GPs**

With regards to the optimal treatment for DFU patients, the most interesting result of this study is the vast disparity between the four participating countries.

Regarding the optimal treatment strategy for DFU, a point of disagreement seems to be whether or not GPs should be the health professionals who have the highest level of responsibility. In the case of Germany and France, the answer to this question was 'yes'. However, in Spain and the UK, the obtained opinions focused on shared responsibility between different professionals in the care of patients with diabetes who have a DFU. For example, specialised podiatrists are

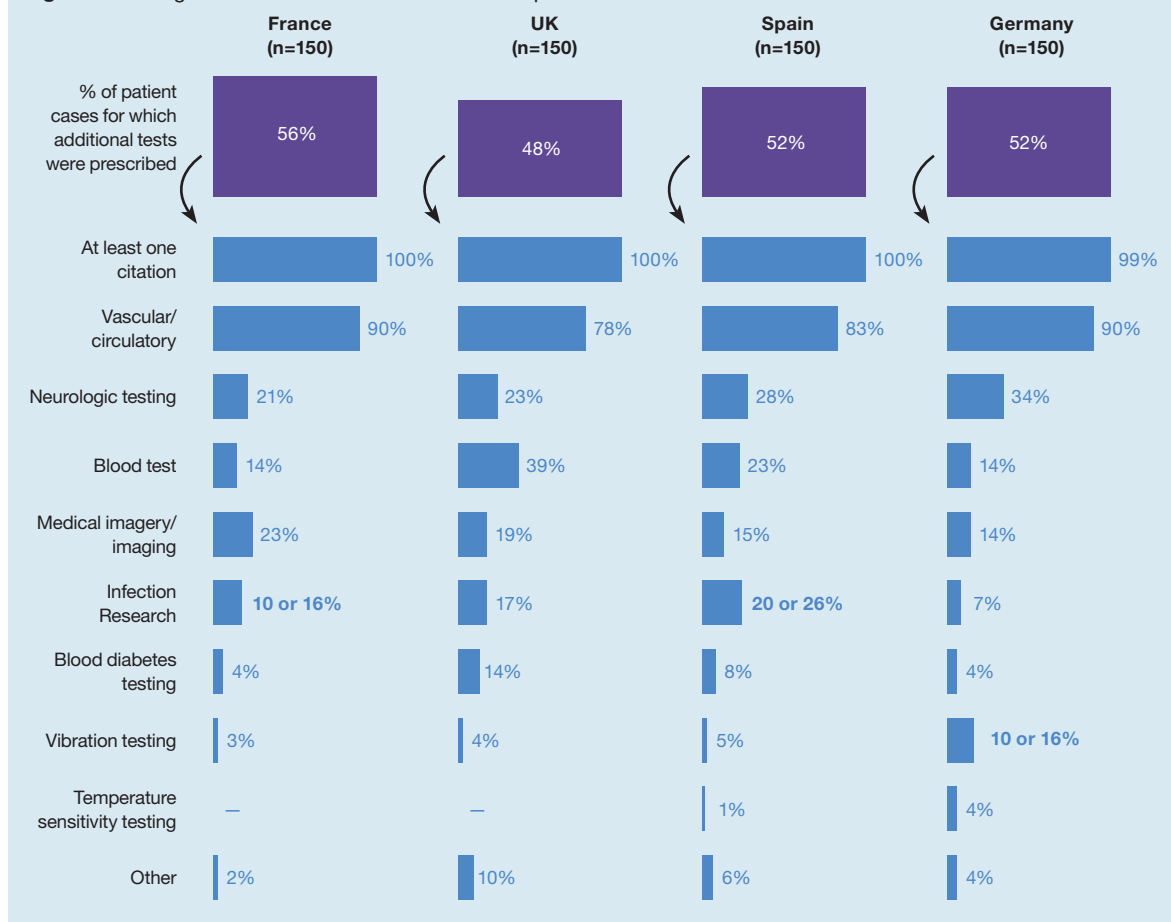
only clearly identified in the UK, which is consistent with their multidisciplinary approach. The higher degree of autonomy among GPs in Germany could be partially attributed to the fact that a majority of them felt they were sufficiently trained in and comfortable with performing offloading treatment. Another fact that is consistent with the higher autonomy of GPs in France and Germany is the more frequent use of Doppler ultrasound and neurological tests, respectively.

The presence of heterogeneity, in terms of the management strategies, could also be explained by the different health-care systems in the four countries. In 2016, in Germany, 68 inpatient-facilities and 206 outpatients-facilities, were found to be accredited as specialised DFU centres. However, it is problematic that the availability of such certified foot services, across Germany, is not all-encompassing, as the geographical distribution of certified specialised departments per million inhabitants is not uniform.<sup>15</sup> The consequence of this distribution is that GPs in some regions of Germany are obliged to hold the highest responsibility for DFU management, without the possibility of being able to choose a multidisciplinary approach.

Regional differences were not evaluated in this article; however, it seems reasonable to assume that they may be present. The intra-country answers to our question about GP responsibility in DFU management were also not homogeneous. Within the same country, there seemed to be considerable differences in the levels of knowledge and perceptions on the issue, which could be a cause of concern.

Another important point to discuss is the fact that clinical guidelines and protocols do not seem to be generally used. The problem is not just the presence or

**Fig 6.** Percentage and distribution of additional tests prescribed



absence of guidelines or protocols,<sup>11,12,14,16-18</sup> but possibly that some health professionals find it too difficult to access or to understand the information at hand because they find that the text is not clear enough. The presence of guidelines and protocols is compulsory; additionally, these need to be easily accessible and clear enough to be understood by those using them. Translation of international guidelines into local languages could prove effective.

**DFU management: treatment protocol and complementary tests**

Many of those GPs taking part in our study do not feel sufficiently trained in DFU treatment, although they perform it. Furthermore, they are sometimes the professionals with the highest level of responsibility in this context. Only 50% of the participating GPs in France and the UK thought they could perform offloading safely. However, for those GPs in the UK, it may be because they have the option of referring patients to clearly identified, specialised podiatrists. This is consistent with the multidisciplinary approach that is preferred in this country.

With regards to the additional tests that are carried out by GPs, some of the findings seem self-contradictory;

in Spain, one of the countries in which the vascular mechanism was considered the main mechanism behind DFU development, as many as 35% of the GPs do not perform any vascular evaluation. In addition, France, another country focused on the vascular mechanism, had the lowest number of ankle-brachial pressure index (ABPI) tests performed. This points to the heterogeneity observed in the management of DFU, even within the same country. It is important to understand the importance of the different mechanisms that lead to DFU development; however, it is also necessary to understand and unify how they should be assessed correctly.<sup>17</sup> The creation and, most importantly, the distribution of clear guidelines and protocols, with precise information about what tests should be performed, would help in resolving this problem.<sup>17,19</sup> Checklists, with easy and clear information about what additional tests are needed at the time of DFU diagnosis and management, could also help to improve this aspect of treatment and management. Screening programmes for vasculopathy and/or neuropathy could also be helpful.<sup>20</sup>

In the same sense, one of the factors that could improve DFU patient diagnosis and treatment is the availability of local structures dedicated to DFU management.<sup>15</sup> However, between 15% and 27% of the

GPs, depending on the country, did not know if these structures existed. It is important for GPs to know if such clinics exist and are available, so referral can be performed easily and quickly. The country with the best organisation with regards to specialised treatment of DFUs is the UK, where up to 90% of responding GPs know of the existence of these structures, and in 85% of the cases, these clinics are located at a distance of less than 12 miles from the GP.

#### **DFU management: hospitalisation**

On analysing the causes of hospitalisation, we found that they were similar in all the four countries. In order to evaluate referral pathways, it would have been interesting to know when the complication that led to the hospitalisation of the patient began to be suspected. These data were not directly asked in the questionnaire, since evaluating this was not the main objective of this study.

It is also interesting that the need for sharp debridement is a frequent cause of referral to hospital. Again, referral to a specialised DFU clinic or service could reduce the number of hospital admissions by allowing for these procedures to be carried out in outpatient clinics.

#### **Study of patient cases: DFU diagnosis**

With regards to the study of patient cases, on analysing the warning signs that led to DFU diagnosis, we observed that the results were quite similar in the four countries. It is interesting to note that there was a high number of patients who did not pay enough attention to their foot care. Between 19% and 28% of cases, depending on the country, were diagnosed thanks to an incidental discovery. In these cases, patients did not describe any symptoms. In addition, sensitive neuropathy leads to the loss of protective sensation, so that patients do not notice initial lesions.<sup>10,15</sup> Any effective strategy to avoid ulcer development and perform early diagnosis when wounds appear should include the necessity to improve patient education and awareness, thus lowering the rate of incidental diagnosis. One possible tool to improve patient awareness is the use of development surveys intended to help patients<sup>21</sup> increase their awareness on preventing wounds, and signs and symptoms of DFUs.

#### **DFU management: ulcer characterisation and additional tests**

Regarding ulcer characterisation, there were no big differences between the four countries. In all the countries, most ulcers were superficial at the time of diagnosis. This issue needs to be further discussed, since, in our study, eventual differences in the measurement and evaluation of ulcer depth were not taken into account. It is therefore possible that some of the ulcers were not as superficial as initially recorded.<sup>5</sup> However, size and depth are not the only important

aspects in the assessment of DFU severity. The presence of infection also needs to be ruled out.<sup>11,12,16</sup> In this study, two-thirds of all ulcers of patients appeared to have an infection in their DFU. However, infection research was only performed in 7% to 26% of patients, which seems to be a small percentage. The assessment of presence of infection is quite complex. Severity degrees, risk factors for multi-resistant microorganisms, bone involvement, antibiotic spectrum and tissue penetration must be taken into account.<sup>22,23</sup> Accurate assessment of an infected DFU is critical for effective treatment.<sup>11,16</sup>

Interestingly, we noted that additional assessment and diagnostic tests were not always performed. This could lead to incomplete evaluation. For example, vasculopathy assessment is an important step in DFU management. Approximately 45% of the patients in this study had a vascular component, which increases the risk of ulcer development and impaired healing. The absence of vascular evaluation, predominantly in long evolution cases, is known as a major cause of therapeutic failure.<sup>19</sup> In addition, if vascular evaluation is not performed, it is possible that this causative mechanism may be underestimated (additional tests for DFU characterisation were not always performed by the GPs in this study). Again, it would not be prudent to conclude that GPs should perform a higher number of complementary tests and investigations than they currently do. The daily work of GPs depends on the health-care system within each country; this aspect was not evaluated in the present study.

#### **Limitations**

The different health-care systems in each of the four participating countries makes it difficult to compare inter-country management. However, some of our findings have shown heterogeneity in terms of DFU perception and knowledge, which are not related with health-care organisation. Another possible point of discussion is that formulated questions could be misunderstood because of the different languages in the four countries. However, this should not be considered a true limitation since the whole questionnaire was translated to local languages by an accredited team. Finally, intra-country heterogeneity in DFU management seems to be present because of some contradictory findings, in particular regarding the additional diagnostic tests that are performed by physicians. Again, the health-care organisation, which is not evaluated in this study, could have some influence in our results.

#### **Conclusion**

The main conclusion of this study is that both the intra-country and inter-country management of the complex aspects of DFU is heterogeneous. The cause of this finding is multifactorial. Although there are international guidelines on DFU management, GPs do not find them clear enough or easily accessible. The



use of clearer tools, such as screening programmes, surveys, short checklists or translated guidelines could improve this.

It would be beneficial to establish clear and specific competences for the different health professionals in DFU management. At the least, intra-country heterogeneity should improve with their development. **JWC**

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## Reflective questions

- What are the main factors that contribute to the heterogeneity in diabetic foot ulcer (DFU) management across different European countries?
- Which aspects should be improved to make DFU management more homogeneous?
- What additional tests should be carried out by GPs during the first evaluation of a patient with a DFU?

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