



## ORIGINAL ARTICLE

### Diabetic foot units in Spain: Knowing the facts using a questionnaire<sup>☆</sup>



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#### KEYWORDS

Diabetic foot;  
Diabetic foot unit;  
Diabetic foot clinic;  
Multidisciplinary foot  
team

#### Abstract

**Objective:** To ascertain the number of diabetic foot units (DFUs) in Spain, the specialists working in them, and the population covered by them.

**Material and methods:** The Spanish Group on the Diabetic Foot (SGDF) prepared and agreed a questionnaire based on the recommendations of the 2011 International Consensus on the Diabetic Foot (ICDF). From October to December 2012, the questionnaire was sent to members of three scientific societies formed by professionals involved in the care of patients with diabetes mellitus. Population coverage of the responding centers and DFUs was estimated using the 2012 population census.

**Results:** Seventy five questionnaires were received, 64 of them from general hospitals, which accounted for 13% of the general hospitals of the National Health System. It was calculated that

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<sup>◇</sup> The Spanish Group Diabetic Foot (Gepid) is a multidisciplinary group composed of members of the Spanish Society of Diabetes, whose current composition is given in Annex at end of article.

**PALABRAS CLAVE**

Pie diabético;  
Unidad de pie  
diabético;  
Clínica del pie  
diabético;  
Equipo  
multidisciplinario  
de pie

they provided coverage to 43% of the population. Thirty four centers answered that they had a DFU. Specialized diabetic foot care was only provided to 25% of the population. The number of different professionals working at diabetic foot units was  $6.3 \pm 2.7$ . Classification of DFUs based on their complexity was as follows: 5 basic units (14.7%), 20 intermediate units (58.8%), and 9 excellence units (26.5%).

**Conclusions:** The number of DFUs reported in this study in Spain is low, and allow for foot care of only one out of every four patients with diabetes. Spanish health system needs to improve diabetic foot care by creating new DFUs and improving the existing ones.

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**Unidades de pie diabético en España: conociendo la realidad mediante el uso de un cuestionario**
**Resumen**

**Objetivo:** Conocer el número de unidades de pie diabético (UPD) que existen en España, especialidades que las integran y funcionamiento, así como la cobertura poblacional de las mismas.

**Material y métodos:** El Grupo Español del Pie Diabético (GEPID) elaboró y consensuó un cuestionario basándose en las recomendaciones organizativas para una clínica del pie diabético propuestas por el Consenso Internacional del Pie Diabético (CIPD) 2011. El cuestionario fue enviado desde octubre a diciembre de 2012, a los miembros de 3 sociedades científicas integradas por profesionales implicados en la atención de personas con diabetes mellitus. Se estimó la cobertura poblacional de los centros respondedores y de las UPD usando el censo poblacional 2012.

**Resultados:** Se recibieron 75 cuestionarios, 64 de ellos procedentes de hospitales generales, que supusieron el 13% de los hospitales generales del Sistema Nacional de Salud y se estimó que daban cobertura al 43% de la población censada en España. Respondieron que existía UPD 34 centros, estimándose que daban cobertura a un 25% de la población censada. El número de diferentes profesionales que integran las UPD es de  $6,3 \pm 2,7$  miembros. El análisis del tipo de UPD permitió identificar 3 modelos: mínimo 5 (14,7%), intermedio 20 (58,8%) y de excelencia 9 (26,5%).

**Conclusiones:** El número de UPD comunicadas en este estudio en España es escaso, permitiendo la atención como mucho de uno de cada 4 pacientes con diabetes mellitus. Se precisa mejorar la organización del cuidado del pie diabético en España, mediante la creación de UPD y mejorando las ya existentes.

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**Introduction**

Diabetic foot and its consequences, such as lower limb amputation (LLA), is a feared and well known complication of diabetes mellitus (DM). Diabetic foot care by multidisciplinary teams, ranging from those working in primary care to the most complex teams integrated in diabetic foot units (DFUs) where different healthcare professionals, including endocrinologists, podiatrists, surgeons (vascular, general and/or orthopedic), and diabetes educators, amongst others, are represented has been shown to decrease the LLA rate by 45–85% in the population with DM.<sup>1</sup>

Data recently published show that the LLA rate in people with diabetes is almost double the rate in Spain as compared to countries at a similar level of development,<sup>2</sup> and that this trend is actually increasing.<sup>3</sup> An improvement in the results of diabetic foot management is therefore a priority. On the other hand, there is no registry of Spanish DFUs or of the professionals working in them, and knowledge of these data is a key starting point for laying down the foundations for the improved management of this condition.

The Spanish Group on Diabetic Foot (SGDF) of the Spanish Diabetes Society (SED), consisting of different healthcare professionals, had in performing this study the following objectives: to examine the current situation of DFUs in Spain by ascertaining their number, the different specialists who work in them, and their operation, and in addition to estimate the population covered by these units.

**Material and methods**

The study was conducted by means of a questionnaire prepared and agreed by all the founding members of SGDF. The questionnaires consisted of a first part containing center data, and a second part including 12 items. The questionnaire, including open-ended answers, was intended to ascertain whether the surveyed centers had DFUs and to know their members, equipment, and functions. All items were formulated based on the recommendations for the organization of diabetic foot units proposed by the 2011 International Consensus on the Diabetic Foot (ICDF).<sup>4</sup>

## Dissemination of the questionnaire

The final format of the questionnaire was sent by electronic mail in an Excel file to all SED members in October 2012, and two months later, it was sent as an online survey as a reminder. The questionnaire was also available at the SED website ([www.sediabetes.org/](http://www.sediabetes.org/)). The online questionnaire was also sent in December 2012 by electronic mail to the members of the Spanish Society of Endocrinology and Nutrition (SEEN) and the Society of Endocrinology, Nutrition, and Diabetes of Madrid (SENDIMAD). The closing date of the questionnaire was March 31, 2013.

## Data analysis

The existence of DFUs at the surveyed centers was ascertained by asking whether they had a specific outpatient clinic to care for most patients with diabetic foot.

To know the overall response rate of the surveyed centers, the number of questionnaires from general hospitals as compared to the total number of hospitals of the National Health System (NHS) was calculated.<sup>5</sup> Population coverage of the surveyed centers and those with BFUs was also estimated based on the reference population of their catchment areas in 2012. The percentage contribution of centers answering the questionnaire was calculated by dividing the whole reference population cared for by the centers in each community by the population census in each community and in Spain as a whole.<sup>6</sup>

The extent of the coverage provided by each DFU and its operational organization were evaluated in terms of the number of patients assessed as new and reviewed in the past year, with the ratios between new and reviewed patients per 100,000 inhabitants, as well as the ratio between reviewed and new patients by DFU being calculated.

DFUs were categorized into three levels based on the recommendations of the ICDF<sup>4</sup> regarding the organization and models of diabetic foot clinics: (a) a minimum model (MM)  $\leq 3$  members (physician, nurse, and podiatrist), the care of patients belonging to the catchment area only, functions being the prevention and treatment of simple lesions, basic equipment; (b) an intermediate model (IM)  $>3$  and  $<6$  members, the care of patients with simple and more complex lesions from the catchment area, intermediate medical equipment, functions of cooperation with hospital departments and with catchment areas; and (c) an excellence model (EM)  $\geq 6$  members, the care of patients with simple and more complex lesions from inside and outside the catchment area, sophisticated equipment, collaboration with reference centers, the organization of courses and meetings, involvement in training, the presence of a leader, the involvement of professionals, and a decisive role in clinical guideline decisions.

Variable were expressed as absolute values and percentages (%) and mean  $\pm$  standard deviation (SD). Microsoft<sup>®</sup> Office Excel 2007 and statistical software Analyse-it for Microsoft Excel (version 2.20) were used.

## Results

### Questionnaires answered by and population coverage of diabetic foot units

Seventy five questionnaires were received from 64 general hospitals, one university, and 10 non-hospital centers (eight healthcare centers and two specialist centers). The 64 general hospitals represented 13% of all the general hospitals in the NHS. Most centers, 64 (85.3%), were publicly funded, while nine (12%) were state-assisted private hospitals, and two (2.7%) were fully private hospitals.

All the autonomous communities except for Ceuta and Meilla completed questionnaires, and the proportion of responding centers was proportional to the extent and number of centers of each community. The percentage of the population covered varied, being greater in communities where most of the population is seen at a few centers, as occurs in the Balearic Islands, Cantabria, and La Rioja.

For centers with an assigned reference population ( $n=62$ ), the population covered was estimated at 20,323,041 inhabitants, i.e. 43% of the Spanish population census. Table 1 shows the number of centers responding by autonomous community and their population coverage.

Thirty-four centers answered that they had DFUs. Of these, 31 were located in general hospitals, two in specialist centers, and one in a university. Table 1 shows the distribution of DFUs by autonomous community, as well as the percentage of the population covered. Two centers reported the planned start of operation of a DFU during 2013. Of the 34 centers with DFUs, 30 had an assigned reference population with a total coverage of 25% of the population census during 2012.

### Analysis of members of diabetic foot units

The number and mode of different professionals ascribed to DFUs were  $6.3 \pm 2.7$  and six members respectively. The specialties most represented included endocrinology/diabetology (85.6%), vascular surgery (73%), and nursing (70.6%) (Table 2). Three DFUs: 3 (8.8%) had no members from the areas of surgery or podiatry, and only 20 DFUs (58%) had vascular surgeons and podiatrists.

Thirty centers (88%) reported that a healthcare professional coordinated or managed the DFU; such professionals were, by decreasing frequency: an endocrinologist/diabetologist (40%), a podiatrist/endocrinologist (20%), a podiatrist (10%), a general surgeon (10%), a vascular surgeon (6.7%), and others (3%).

### Analysis of operation and equipment of diabetic foot units

Most DFUs, 27 (79.4%), used some clinical guideline for the management of patients with diabetic foot and 17 (50%) used more than one guideline, while seven DFUs used no guideline. The ICDF guideline from the *International Working Group on the Diabetic Foot* (IWGDF) was the one most commonly used (76.5%).<sup>4</sup>

**Table 1** Coverage by autonomous community of questionnaires answered and centers with diabetic foot units.

	Spanish population census 1/1/12	Responding centers	Population covered by responding centers	Percent census covered	Centers with DFU	Population covered by DFUs	Percent census covered
Andalusia	8,449,985	7	3,782,824	44.8	5	2,637,824	31.2
Aragón	1,349,467	1	220,000	16.3	0	0	0.0
Asturias	1,077,360	2	390,000	36.2	0	0	0.0
Balearic Islands	1,119,439	4	1,475,000	100.0	1	1,100,000	98.3
Canary Islands	2,118,344	1	0	0.0	1	0	0.0
Cantabria	593,861	1	580,000	97.7	1	580,000	97.7
Castile and León	2,546,078	2	520,000	20.4	0	0	0.0
Castile-La Mancha	2,121,888	6	1,455,000	68.6	1	435,000	20.5
Catalonia	7,570,908	10	2,760,000	36.5	5	2,040,000	26.9
Valencian Community	5,129,266	10	2,001,617	39.0	5	1,110,271	21.6
Extremadura	1,108,130	1	0	0.0	0	0	0.0
Galicia	2,781,498	2	850,000	30.6	0	0	0.0
Madrid, Community of	6,498,560	16	3,423,288	52.7	9	1,876,000	28.9
Murcia, Region of	1,474,449	6	1,034,312	70.1	3	740,000	50.2
Navarre, Foral Community of	644,566	2	450,000	69.8	1	450,000	69.8
Basque Country	2,193,093	3	1,080,000	49.2	2	980,000	44.7
Rioja, La	323,609	1	300000	92.7	0	0	0.0
Autonomous city of Ceuta	84,018	0	0	0.0	0	0	0.0
Autonomous city of Melilla	80,802	0	0	0.0	0	0	0.0
Total	47,265,321	75	20,322,041	43.0	34	11,949,095	25.3

Census data by community were obtained from the National Statistics Institute.<sup>6</sup>

Most DFUs (22, 64.7%) provided care only to the population from the catchment area, while some (9, 26.5%) also provided care to patients from outside their communities or catchment areas.

The main roles of DFUs included the prevention and treatment of all patients, including the most complex cases (29 DFUs, 85.3%), or the prevention and treatment of patients

with simple lesions only (5 DFUs, 14.7%). Other functions included the education and training of other centers (17 DFUs, 50%) and the development of innovative strategies and treatments, as well as participation in clinical trials (12, 35.3%). Table 3 lists the other activities performed at DFUs.

**Table 2** Different specialties incorporated into diabetic foot units.

	Number	Percentage
Family medicine	13	38
Podiatry	20	58
Nursing	24	70.6
Endocrinology/diabetology	29	85.6
General surgery	11	32.4
Orthopedic surgery	12	35.3
Vascular surgery	25	73
Interventional radiology	10	29.4
Diabetes educators	24	70.6
Plastic surgery	3	8.8
Dermatology	3	8.8
Internal medicine/specialist in infections	20	58
Microbiology	12	35.3
Physical therapy/rehabilitation	9	26.5
Psychiatry	6	6.1
Administrative and reception staff	3	8.8

**Table 3** Actions performed at diabetic foot units (n = 33).

	Number	Percentage
Close collaboration with a reference center	9	27.3
The presence of a coordinator leading the group	30	90.9
Exchange of experiences with other centers	18	54.5
Active collaboration with other hospital departments	28	84.8
Active collaboration with other non-hospital services (physicians, nursing, home care)	24	72.7
Organization of regional, national, or international meetings	17	51.5
Allowing visits of professionals to the centers to improve understanding and skills	12	36.4
Active collaboration with reference centers	8	24.2

**Table 4** Equipment/procedures available at the diabetic foot unit (n = 33).

	Number	Percentage
Treatment room with basic materials, including autoclave	26	78.8
10 g monofilament	33	100.0
128 Hz tuning fork	32	97.0
Operating room	24	72.7
Biothesiometry	17	51.5
Doppler for ABI	32	97.0
Complete set of podiatry instruments	20	60.6
X-rays	28	84.8
Laboratory for blood tests and culture processing	28	84.8
Transcutaneous oximetry	12	36.4
Echo-Doppler imaging	27	81.8
Arteriography	23	69.7
Arterial bypass	21	63.6
Fully equipped operating rooms	25	75.8
Intensive care unit	25	75.8
Laser Doppler	11	33.3
Baropodometry	9	27.3
Computerized records	24	72.7
Facilities fully equipped for training	16	48.5
Bathroom fully equipped with orthopedic aids	8	24.2
Burrs for removing calluses	8	24.2

As regards equipment (Table 4), a vast majority of DFUs had basic equipment for the detection of sensory loss (monofilament and tuning fork) and noninvasive arterial examination (ABI and echo-Doppler image). Seventy percent of DFUs had access to imaging procedures for intravascular treatment (arteriography) or to revascularization procedures such as artery bypass.

### Analysis of types of diabetic foot units and numbers of patients assessed in them

An analysis of the types of DFUs led to our identifying five DFUs (14.7%) as being MMs, 20 (58.8%) as IMs, and 9 (26.5%) as EMs. The distribution of these types of DFUs in the autonomous communities was proportional to the number of units in each community ((Table 5).

Patients assessed at DFUs could only be analyzed at 25 centers. Table 6 shows patients seen for the first time and subsequently per 100,000 inhabitants.

### Discussion

This study represents the first attempt to ascertain the number of DFUs in Spain, as well as analysing the professionals working in them and some aspects of how these units operate. It suggests that, apparently, no more than one out of every four Spanish patients with diabetic foot is

seen by a multidisciplinary team as recommended by the ICDF.

The study design included a questionnaire which was based on the ICDF recommendations and guidelines for the organization of diabetic foot units and accepted by the members of the SGDF with experience in this complication.

The questionnaire was sent to professionals involved in the care of diabetes, some of them in the specific care of patients with diabetic foot. These were mainly specialists in endocrinology, and internal medicine, nurses and diabetes educators, as well as a smaller proportion of primary care physicians and podiatrists. The dissemination of the questionnaire among more than 1800 members of SED, more than 1500 members of SEEN, and more than 170 members of SENDIMAD ensured the coverage of virtually all the professionals concerned working in the NHS hospital system.

The response was poor, as only 75 questionnaires were received, accounting for only 13% of all NHS general hospitals. If the center had no DFU, only two questions had to be answered. Low participation was considered to reflect the little attention usually paid to diabetic foot by Spanish endocrinologists, who were the healthcare professionals surveyed in most cases.

However, the centers were considered to be highly representative, as they covered 43% of the population. The lack of agreement between the low proportion of responding centers (13%) and the wide population represented may be explained by the fact that most of the hospitals which responded were those of a larger size and with more human and material resources. On the other hand, the reference populations of hospitals of different levels in large regions sometimes overlap, and are grouped in hospitals of the highest level.

Six different specialists usually staff the DFUs, of which endocrinologists or diabetologists, as well as vascular surgeons, are the most common. Surprisingly, three so-called DFUs had no member from the surgical field or podiatrist, which does rather question their right to be considered true DFUs.<sup>4,7,8</sup> It is perhaps even more striking that only 20 DFUs (58%) had a vascular specialist and a podiatrist on their staff. These professionals are indispensable for the adequate operation of a DFU because they are able to resolve many of the problems occurring in patients with diabetic foot, regardless of their complexity.<sup>9</sup>

Recently, a study by Jurado-Campos et al.<sup>10</sup> analyzed the resources and model of care for diabetic foot in Catalonia in 2008 using a structured survey to a sample of 36 basic health-care areas and 118 surgical centers. The study found that no more than 10–20% of primary care and surgical centers, respectively, had podiatrists on their staff.

Both this study<sup>10</sup> and ours demonstrate the limited access to podiatrists in the NHS. These are not among the health-care professionals hired by the public health system, and only a few of them are now being hired in some autonomous communities.

It should also be noted that family doctors were only reported in 38% of DFUs, despite the fact that they are essential for the adequate prevention and referral of these patients.<sup>4</sup> In Spain, the multidisciplinary unit protocol of Hospital de Cruces could serve as a model document representing what a DFU should be.<sup>11</sup> This DFU includes primary

**Table 5** Distribution of types of diabetic foot unit (minimum, intermediate, and excellence models) by autonomous communities.

	Minimum	Intermediate	Excellence	Total
Andalusia	0	4	1	5
Balearic Islands	0	1	0	1
Canary Islands	0	0	1	1
Cantabria	0	0	1	1
Castile-La Mancha	0	1	0	1
Catalonia	0	3	2	5
Valencian Community	2	2	1	5
Madrid, Community of	2	6	1	9
Murcia, Region of	0	2	1	3
Navarre, Foral Community of	1	0	0	1
Basque Country	0	1	1	2
Total	5	20	9	34

**Table 6** Analysis of patients (new and reviewed) assessed at diabetic foot units and ratio per 100,000 inhabitants.

	New patients	New/100,000 inhabitants	Reviewed patients	Reviews/100,000 inhabitants	New/reviewed ratio
n	26	22	25	21	25
M ± SD	188 ± 213	54 ± 56	1042 ± 1872	211 ± 185	6.4 ± 9.6
P0	20	3.5	50	16	1
P25	50	14.8	200	55	2
P50	120	27	500	175	3.3
P75	208	73.1	1127	344	5.4
P100	998	200	9523	577	48.1

Mean ± SD, P0–P100: percentile distribution.

care teams, hospital outpatient clinics, acute hospitalization, and home hospitalization. These are grouped in a multidisciplinary team with a common podiatrist–vascular axis.

Thirty of the 34 DFUs reported a leader, most commonly the endocrinologist and/or podiatrist. This agrees with the usual model in Europe, while in the United States the podiatrist is usually the coordinator of large DFUs.<sup>9</sup>

When DFUs were classified by model, the IM model was most common, followed by the EM, while the MM model was uncommon. This was to be expected: hospitals gave a majority response, and the poor development of clinics and DFUs in Spain explains their low response. The Jurado-Campos et al. study<sup>10</sup> found that, among the 85 surgical centers caring for patients with diabetic foot. 11 (13%) were of the EM type and 29 (34%) of the IM type. However, the primary study objective was to ascertain whether the centers surveyed had the resources to care for this condition. It should also be considered that, in standard clinical practice, healthcare for diabetic foot is rarely provided by units consisting of multidisciplinary teams caring for most patients living in the catchment area and following the recommendations of the ICDF.<sup>12</sup>

Analysis of the number of patients attending DFUs for new and subsequent visits showed a great difference in population coverage between them, reflecting the fact that many of them do not see the majority of patients with diabetic foot in their reference population. If we consider

the infrastructure for diabetic foot care in primary care, which does not correspond to what is considered a multidisciplinary team, it is very likely that many patients seen at such DFUs do not benefit from the ICDF recommendations and guidelines.<sup>4</sup> However, their role in prevention, the so-called minimum model, is essential. The reviewed/new patient ratio was also highly variable, demonstrating differences in working procedures between the DFUs. It should be borne in mind that many patients with ulcers require multiple visits, and that mean healing time is not less than 15 weeks,<sup>13</sup> despite which our study found that new patients were not seen more than twice in one out of every four DFUs.

One of the main study objectives of this questionnaire was to estimate the size of the population benefiting from the existence of a DFU in the NHS. Table 1 shows that only 25% of the population in the 2012 census, and thus of patients with DM, were receiving care at DFUs. However, because of the functional limitations of the various specialist skills represented in DFUs and the number of new patients seen by assigned populations, the actual figures may be lower. The low percentage of response of the professionals surveyed also suggests a low interest on the part of the healthcare professionals involved in the care for patients with DM in this complication. Both results may partly explain the high amputation rate in Spanish patients with DM despite the generally high quality of care for diabetic patients.<sup>14</sup>

The limitations of this study included:

- Its low dissemination among those professionals concerned who are not attached to hospitals, such as family doctors and podiatrists, most of whom are not members of the scientific societies to which the questionnaire was sent. It should be noted, however, that the specialized care for diabetic foot by both these groups of professionals outside multidisciplinary teams is probably exceptional.
- The existence of units not dependent on the endocrinology department at some hospitals which had therefore no access to the channels where the survey was disseminated.
- The risk of a low response rate and the difficulty of verifying the information collected and, thus, the accuracy of the data received. Because of the characteristics of the method, the actual number of professionals who received the survey could not be determined.
- The majority participation of centers better prepared and with more resources probably caused a participation bias, which may have led to our underestimating the number of units with an MM.

The study strengths included:

- The wide dissemination of the study questionnaire among the professionals concerned.
- The similar accuracy and percentage response of the questionnaire as compared to other methods of collecting information (telephone interview or regular post).<sup>15</sup>

The conclusion of this study is that the number of DFUs in Spain is low, and that probably as many as one out of every four patients with DM have no access to a DFU. The organization of diabetic foot care in Spain should be increased and improved by creating DFUs following the organizational models of the IWGDF and enhancing and/or improving the available DFUs.

## Funding and means for study conduct

This study was conducted using the means provided by the SED according to the rules for working groups. Specifically, this allowed for a meeting of the group members for that purpose, and covered the cost of computer support for the questionnaire in its online version.

## Conflicts of interest

The authors state that they have no conflicts of interest.

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## Appendix. Members of the Spanish Group on Diabetic Foot

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