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High prevalence of foot diseases in Europe: results of the Achilles Project

Hohe Prävalenz von Fußkrankheiten in Europa: Ergebnisse des Achilles-Projekts

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ABSTRACT

Objective. To provide an insight into the prevalence of foot disease in Europe, and to include an assessment of the prevalence of predisposing factors and their correlation with foot disease.

Design. Large population-based survey conducted in 16 European countries.

Setting. The project consisted of two parts (study I and study II), in which all patients presenting to general practitioners and dermatologists over a defined time period were invited to participate.

Patients. In study I, 70,497 patients presenting to dermatologists or general practitioners were recruited, and in study II 19, 588 patients presenting to dermatologists were recruited.

Main Outcome Measure. The feet of all participants were examined for signs of foot disease. The assessors also recorded relevant details such as the age and sex of patients, and the presence of predisposing factors for foot disease. In addition, patients in study II were offered a free mycological examination of the toenails and skin on the feet.

Results. In study I, 57.0% of patients had at least one foot disease. In study II, 61.3% had at least one foot disease. The proportions of patients with fungal foot disease and non-fungal foot disease in study I were 34.9% and 38.4%, respectively, and in study II were 40.6% and 41.7%, respectively. Orthopedic conditions and metatarsal corns were the most frequently reported non-fungal foot diseases, and onychomycosis and tinea pedis were the most frequently observed fungal infections.

Conclusions. This large-scale survey suggests that the prevalence of fungal and non-fungal foot disease is higher than previously estimated.

ABSTRACT

Zielsetzung: In Europa Einblicke in die Prävalenz von Erkrankungen des Fußes zu gewinnen sowie eine Bewertung der Prävalenz prädisponierender Faktoren und ihrer Korrelation mit Fußkrankheiten bereitzustellen.

Design. In 16 Ländern Europas durchgeführte, groß angelegte Populations-basierende Erhebung.

Durchführungsorte. Das Projekt umfasste zwei Teile (Studie I und Studie II), wobei über einen festgelegten Zeitraum alle eine Allgemeinpraxis und eine dermatologische Praxis aufsuchenden Patienten/innen um ihre Mitwirkung gebeten wurden.

Patienten. Für die Studie I wurden 70 497 Patienten/innen rekrutiert, die eine dermatologische oder eine Allgemeinpraxis aufsuchten, während für die Studie II 19 588 Patienten/innen gewonnen wurden, die sich in eine Fachpraxis für Dermatologie begaben.

Primäre Studienvariable. Die Füße aller Studienteilnehmer/innen wurden auf Anzeichen von Fußkrankheiten untersucht. Die Prüfer/innen zeichneten außerdem relevante Angaben wie Alter und Geschlecht der Teilnehmer/innen sowie das Vorliegen von für Fußkrankheiten prädisponierenden Faktoren auf. Den für die Studie II rekrutierten Patienten/innen wurde zudem eine mykologische Untersuchung der Zehennägel und der Haut der Füße angeboten.

Ergebnisse. In Studie I wurde bei 57,0 % der Patienten/innen mindestens eine Fußkrankheit festgestellt. Mindestens eine Fußkrankheit lag in Studie I bei 61,3 % der Patienten/innen vor. Der Anteil an Patienten/innen mit mykotischer und nicht-mykotischer Erkrankung der Füße belief sich bei Studie I auf 34,9 % beziehungsweise 38,4 %, wobei diese Werte in der Studie II bei 40,6 % beziehungsweise 41,7 % lagen. Als häufigste nicht-mykotische Krankheitsbilder wurden orthopädische

Beeinträchtigungen und metatarsale Clavi mitgeteilt, während unter den Pilzinfektionen Nagelmykose und Tinea pedis überwogen.

Schlussfolgerungen. Diese groß angelegte Studie legt nahe, dass die Prävalenz mykotischer wie auch nicht-mykotischer Fußkrankheiten höher als bislang angenommen ist.

INTRODUCTION

Foot diseases cause pain and discomfort, which can limit the activities of daily living in many patients [1, 2]. In addition, conditions such as diabetes, arthritis, and nerve and circulatory disorders often present with foot disease [3-5]. Despite this, and the availability of effective treatments for many foot conditions, knowledge of the prevalence of foot diseases and the associated risk factors in the general population is limited.

In the USA, the epidemiology of foot problems has been assessed in a few large-scale surveys [1, 6]. These studies relied on questionnaires or interviews that asked respondents to assess their own foot conditions; with surveys of this type, foot disease may be under-recorded because the respondents are neither skilled clinical observers nor especially knowledgeable about health.

Smaller-scale surveys have assessed the prevalence of foot diseases but these have concentrated on the elderly [2, 7], on particular groups of patients with conditions such as diabetes[8, 9], or on specific foot diseases [10, 11].

Here we describe the results of the Achilles Project, a large-scale survey, which was devised to provide an insight into the prevalence of foot disease in Europe, including an assessment of the prevalence of predisposing factors and their correlation with foot disease. General practitioners (GPs) and dermatologists from 16 European countries took part in the project, which involved detailed clinical and mycological examinations of the feet of more than 90,000 patients, and provides the most comprehensive survey of foot disease conducted in any population to date.

METHODS

The Achilles Project was conducted in 16 European countries: Austria, Belgium, the Czech Republic, Germany, Greece, Hungary, Italy, Luxembourg, the Netherlands, Poland, Russia, Slovenia, Spain, Sweden, Switzerland and the UK. Patients were recruited in the late Spring of 1997 and 1998. All patients were informed and the level of consent and ethics committee approval gained depended on local regulations.

Patients

The project consisted of two parts: study I and study II. In study I, all patients, irrespective of their initial diagnosis, presenting to GPs or dermatologists were asked if they would consent to a clinical examination of the feet. In study II, patients, irrespective of their initial diagnosis, presenting to dermatologists were offered both clinical and mycological examinations of the feet. In study I, patients were recruited in all participating countries except Spain, whereas those in study II were recruited in all countries except Austria, Italy, Slovenia, Sweden and Switzerland.

Assessments

Information on gender, age, race and predefined predisposing factors (see table 1) was gathered for all patients in both parts of the project by questionnaire. The presence of predisposing factors was determined from medical records and from questioning the patients.

Clinical examination

If the initial clinical impression was that the patient had a foot disease, specific details were recorded. In study I the presence of the following foot diseases was recorded: fungal infection (of the plantar and/or interdigital skin [tinea pedis], dorsal skin [tinea

dorsum pedis] or nails); orthopedic malformations (pes planus, pes cavus, pes varus, pes valgus, pes equinus, pes talus or hammer toes); metatarsal corns; skin diseases (psoriasis or eczema); virus infections (warts); and vascular diseases (gangrene, necrosis or ulcer). These were recorded by clinical impression only.

The clinical examination in study II was more comprehensive and, in addition to the details recorded in study I, the presence of bacterial infection, viral infection (papilloma), pigmented spots and Raynaud's disease or scleroderma was recorded. Furthermore, signs and symptoms of foot disease including desquamation, erythema and pruritus or itching were recorded. Similarly, for nail disease the presence of swelling or recession of the nail fold, redness, exudation, loss of cuticle and tenderness, discoloration, thickening, brittleness and dystrophy of the nail plate was recorded.

Mycological examination

In study II, if the patient had signs of a fungal foot disease, a mycological examination of the skin and toenails was offered. Samples of skin and nail were tested for fungi by culture and/or potassium hydroxide (KOH) preparation for microscopy. The results of the examination (negative, positive or unknown) and the identified pathogen (if applicable) were recorded.

Skin was sampled by first cleaning with ethanol and then taking a scraping from the active border of the lesion. Target nails were cleaned with ethanol and samples taken from the affected area of the nail and subungual keratin by clipping, curette or scraping.

Skin and nail samples were prepared for microscopy by softening and clearing the specimen in 20–30% KOH.

To identify the species of fungi, samples were inoculated into suitable microbiological media to allow detection of all types of fungi and incubated at 25–28°C. Samples were analyzed by the mycological laboratory normally used by each investigator.

A positive result from the mycological examination was defined as a positive result from either KOH preparation or culture. A negative mycological result was defined as either a negative result from KOH preparation with a negative result or missing data from culture, or a negative result from culture with a negative result or missing data from KOH preparation.

Statistical Analysis

The prevalence of foot disease was analyzed using logistic regression [12], and association between binary variables was quantified using odds ratios [12, 13].

The analysis of the data faced issues common to this type of research [14, 15]. A modeling approach was used to address selection bias; recorded prevalences may not correspond to those in the population as a whole but were regarded as the maximum of the true prevalences. A complete case approach to missing data was used [16]; modeling was based on those patients who contributed information on all variables included in a particular statistical model. Two analyses of data were performed: one based on clinical examination results and one based on mycological examination results. Inconsistencies between the definitions based on the clinical and mycological examinations were ignored. The two analyses can therefore be seen as two extreme approaches, with respect to adjustment for inconsistent data.

In all models, the following covariates were considered: age (as a continuous covariate); gender; country; and presence of any of the predisposing factors.

In all analyses, an $\alpha = 0.05$ nominal two-sided significance level was used. As the purpose of the analysis was exploratory and hypothesis–generating rather than confirmatory, no adjustment for multiple testing was applied. The analysis was performed using *Stata v.6.0* statistical software.

RESULTS

Patients

A total of 70,497 patients were recruited into study I, and 19,588 patients were recruited into study II.

The distribution of patients included in the Achilles Project is summarized in table 1. Data on gender were missing for 1433 (2%) patients in study I and 574 (2.9%) patients in study II, and data on race were missing for 1498 (2.1%) and 1041 (5.3%) patients in study I and study II, respectively. Both parts of the project had a similar balance of genders and races, but enrollment of patients was not distributed evenly among the 16 countries participating. For example, German patients accounted for 10,339 (52.8%) in study II, but only 8468 (12.0%) in study I. In general, there were more females than males recruited in each country; the one exception was in the Netherlands where more males than females were recruited into study II (recruitment to study II in the Netherlands was peculiar, in that it took place in sports clubs). The mean age of females was similar to the mean age of males overall (study I: females 47.5 ± 19.9, males 46.2 ± 19.8; and study II: females 44.1 ± 19.9, males 44.0 ± 19.9). However, the mean age of patients recruited in different countries varied considerably, and the mean age of females was higher than the mean age of males in all countries, except in study I in the UK and the Netherlands.

The four most frequently recorded predisposing factors in both parts of this project were vascular disease, obesity, osteoarticular pathology and participation in sports (table 1). No information on predisposing factors was obtained for 3506 (5.0%) patients in study I and for 561 (2.9%) patients in study II. In general, the frequencies of predisposing factors were similar in studies I and II, but some differences were observed (e.g., participation in sports was recorded in 11.2% of patients in study I and 17.3% of patients in study II).

There were some differences in the frequency of predisposing factors between the genders. In both studies, obesity and osteoarticular pathology were more frequently observed in women than in men (for example, in study I 19.5% of females and 14.2% of males were obese and in study II the values were 15.2% and 11.3%, respectively). Trauma and participation in sports were more frequently observed in men than in women (for example, the proportion of men and women participating in sports was 16.4% and 7.5%, respectively, in study I, and 23.4% and 14.0%, respectively, in study II).

In addition, the frequency of predisposing factors varied between countries; for example, in Russia a high proportion of patients had vascular disease (more than 40% of patients in both parts of the project). Other major differences in the frequency of predisposing factors included: a high number of patients in Hungary (19.0%) and Slovenia (16.1%) with diabetes in study I; a high number of obese patients in Slovenia (39.8%) in study I; a low number of obese patients (0.7%), a low number of patients with vascular disease (2.0%) and a high number of patients participating in sports (78.3%) in study II in the Netherlands; and a high number of patients in Hungary with osteoarticular pathology (> 20% in both studies).

Clinical examination

A total of 40,160 (57.0%) patients in study I and 12,003 (61.3%) patients in study II had at least one foot disease. Data on the type of foot disease were missing for 2069 (2.9%) and 701 (3.6%) patients in studies I and II, respectively, and therefore data on the type of foot disease were available for 38,091 patients in study I and for 11,302 patients in study II (figure 1). In each part of the project, non-fungal foot disease and fungal foot disease were present in a similar proportion of patients (figure 1). A total of 26,262 (38.4%) and 7883 (41.7%) patients had non-fungal disease in study I and study II, respectively; 23,903 (34.9%) and 7666 (40.6%) patients had fungal foot disease in study I and study II, respectively. In study II, the odds of observing a fungal foot infection in a patient who had a non-fungal foot disease were 2.59 fold (95% C.I.: [2.44 – 2.75]) higher than the odds in a patient with no non-fungal foot disease. In study I the odds ratio was significantly lower at 2.18 (95% C.I.: [2.11 – 2.25]).

Fungal foot disease and foot disease overall was more prevalent in males than in females; in study I, 58.1% of males and 56.2% of females, and in study II, 64.0% of males and 60.1% of females had foot disease. However, in both parts of the project, non-fungal foot disease was more prevalent in females than males (data not shown).

The most frequently observed non-fungal foot diseases were orthopedic conditions (pes planus, pes cavus, pes varus, pes valgus, pes equinus, pes talus, hammer toes) and metatarsal corns (table 2); these conditions were reported more often in females than in males. The most frequently observed fungal foot infection was onychomycosis in both parts of the project (figure 2).

In both parts of the project the prevalence of foot disease increased with increasing age (figure 3), but there was also a minor peak in prevalence between the ages of 10 and 15 years. In study I, raw estimates suggest that this minor peak was at age 11 and

12 in females and males, respectively; in study II the minor peak was at age 12 and 11, respectively. This minor peak in prevalence of foot disease was the result of a minor peak in the prevalence of non-fungal foot disease (figure 4), which appeared one year earlier in females than in males: in study I, age 11 and 12, respectively; in study II, age 10 and 11, respectively.

Although the prevalence of fungal foot infection also increased with increasing age (figure 5A), there was no minor peak in prevalence between the ages of 10 and 15 years, and the increase in prevalence with increasing age was not apparent in patients over the age of 75 years. The peak in prevalence of fungal foot infections was between the ages of 70 and 75 years (figure 5A). In study I, estimates based on models suggest a peak in prevalence at age 73.9 for both males and females; in study II, the estimates for the peak in prevalence were 79.1 and 72.4 for females and males, respectively.

Most predisposing factors significantly increased the odds of foot disease (table 3). The only predisposing factors that did not have a significant effect on the prevalence of foot disease were the use of systemic antibiotics in study I, the use of systemic corticosteroids in study II, and immunosuppression in study II. When the influence of predisposing factors on the prevalence of fungal and non-fungal foot disease was assessed, similar odds ratios were calculated (data not shown). The only predisposing factors that did not have an effect on the prevalence of non-fungal foot disease were, in study I, the use of systemic antibiotics and participation in sports, and in study II, the use of systemic antibiotics and immunosuppression. The prevalence of fungal foot disease was influenced by all predisposing factors except the use of systemic antibiotics, the use of systemic corticosteroids and immunosuppression in study II.

Mycological examination

Of the 12,003 patients in study II with foot disease, data on the type of foot disease (fungal or non-fungal) were missing for 701 patients. Of the 7666 patients with fungal foot infection, data on the site of infection (skin or toenails) were missing for a further 16 patients. The results of the skin and toenail mycological examination for all 12,003 patients are presented in table 4. Excluding the missing data, the sensitivity of the clinical diagnosis of fungal foot-skin infection was 96.1% and the specificity was 71.0%. Similarly, for the clinical diagnosis of toenail infections, if missing data are excluded, the sensitivity was 98.1% and the specificity was 76.5%. However, there was a lot of missing data and therefore it was worth estimating what influence these missing data have on the sensitivity and specificity. One extreme assumption is that missing data for patients with clinically diagnosed skin infection (n = 1747) are negative for the mycological examination of foot skin and the missing data for patients with no clinically diagnosed skin infection (n = 1116) are positive for the mycological examination of foot skin (worst case). The alternative extreme assumption is to assume that the missing data in this situation are positive and negative, respectively (best case). The worst case sensitivity and specificity of the clinical diagnosis of fungal foot-skin infection were 63.0% and 37.4%, respectively; the best case sensitivity and specificity were 96.9% and 81.6%, respectively. Likewise, for the clinical diagnosis of toenail infections, the worst case sensitivity and specificity were 76.2% and 52.1%, respectively, and the best case sensitivity and specificity were 98.6% and 77.9%, respectively.

Of the 5413 patients who had a positive result for one of the two mycological examinations, 4110 patients had a positive culture. Of these, toenail infections were the most frequently observed fungal foot infections; 3220 (78.3%) patients had toenail infections, 1766 (43.0%) patients had skin infections and 876 (21.3%) patients had both

toenail and skin infections. Most fungal foot infections were caused by *Trichophyton* species (3085; 75.1%) but *Candida* species (484; 11.8%) and *Aspergillus* species (241; 5.9%) were also frequently isolated. In general, only one pathogen was isolated from most patients (3118; 75.9%).

The results from the mycological examination show that age has an influence on the prevalence of fungal foot infections (figure 5B). There was an increase in the prevalence of foot disease with increasing age, but as was shown in the results from the clinical examination the increase in prevalence with increasing age was not apparent in patients over the age of approximately 75 years; the peak in prevalence was estimated at 76.7 years for both males and females.

Most of the predisposing factors significantly increased the odds of fungal foot infection recorded in the mycological examination. These were qualitatively and quantitatively similar to the increased odds of foot disease when predisposing factors were present calculated from the clinical examination (table 5).

DISCUSSION

The Achilles Project is the first investigation of the prevalence of foot diseases to be conducted on such a large scale. The results from study I show that most patients visiting their GP have a clinically definable foot disease. In study II, a similar proportion of patients visiting dermatology offices was shown to have a foot disease. Furthermore, the prevalence of foot disease increased with increasing age and in the presence of several predisposing factors.

The prevalence of non-fungal and fungal foot disease was apparently influenced by gender, with more females than males having non-fungal foot disease and more males than females having fungal foot disease. Wearing high-heel shoes with pointed toes is often blamed for structural abnormalities of the feet, such as hallux valgus [17]. A higher prevalence of non-fungal foot disease in women may therefore reflect this association. Similarly, previous studies have also shown a greater prevalence of fungal foot infections in men than in women; in a previous survey in the USA, men reported foot infection twice as often as women [1]. In our survey, fungal foot disease was more prevalent in men than women but the difference between genders was not as pronounced. The greater prevalence of fungal foot infections in men is thought to result from a higher use of common showers by men after participation in sports or working in heavy industries [10, 18-20]. In the Achilles Project considerably more men than women participated in sports (data not shown).

The predisposing factors recorded in this survey have been shown to influence the prevalence of certain foot diseases [11, 21-24]. It is therefore no surprise that in both parts of the project nearly all the predisposing factors increased the odds of non-fungal and fungal disease. The only predisposing factors that did not have a significant effect

on the prevalence of foot disease were the use of systemic antibiotics in study I, the use of systemic corticosteroids in study II and immunosuppression in study II.

Similarly, the increasing prevalence of foot disease with increasing age has been demonstrated in other studies [1, 6, 7], and may be caused by a higher prevalence of predisposing factors in the elderly. However, the lack of an increase in the prevalence of fungal foot disease in patients over the age of 75 is more difficult to explain; a similar trend was observed for the prevalence of foot infections in a previous study [1]. One possible explanation is that reduced sweating or drier skin in the elderly produces an environment less favorable to the development of fungal infection. The minor peak in the prevalence of non-fungal foot disease between the ages of 10 and 15 years may be explained by the high frequency of warts in this age group [25-27]. In addition, because the management of warts in children often involves weekly visits to a GP or dermatologist, the one-week recruitment period of the Achilles Project would have resulted in the inclusion of a large proportion of these children.

The prevalence of foot disease measured by this study is considerably higher than previous estimates [1, 6]. Previous surveys were based on patient self-assessment, which may explain the lower prevalences measured in these surveys (see Greenberg & Davis, 1993 [1], for a discussion of sources of underestimation). However, surveys of people over 65 years old have demonstrated a similarly high prevalence of foot problems [7].

Recruitment of patients was conducted by dermatologists in study II, and mainly by GPs in study I, resulting in samples from two different populations. Consequently, there were important differences between the samples; for example, patients in study I were, on average, older than those in study II. In addition, more cases of diabetes and obesity were reported in study I, and more patients in study II participated in sports. This results

from different sampling procedures in the different parts of the study and in different countries. However, the effects of age and gender on the prevalence of foot diseases were similar in both parts of the project. We can also draw similar conclusions regarding the association between the prevalence of foot diseases and the presence of predisposing factors. Furthermore, the clinical examination had a high sensitivity and specificity for the diagnosis of fungal foot infections. This is an interesting and unexpected observation, as it implies that clinical diagnosis by the participating doctors of both tinea pedis and onychomycosis is accurate.

An important consideration in discussing the results of the Achilles Project is their validity to the general population in Europe. Both the study I and study II populations may well differ from the general population (i.e., an unselected group of individuals as opposed to the patients in the Achilles Project who were all consulting a doctor). We cannot, therefore, simply apply the results of the Achilles Project to the general population. There is consistency between the results of studies I and II but the prevalence of predisposing factors is likely to be higher than in the general population; therefore the prevalence of foot disease in this project may be higher than in the general population. However, it seems reasonable to assume that the effects of age, gender and predisposing factors on the prevalence of foot diseases, seen in both parts of the Achilles Project, will apply to the general population.

The Achilles Project indicates a higher than expected prevalence of foot disease. Even though effective treatments are available, a large proportion of people suffering from foot disease do not consult a medical professional [7]. This suggests a role for the routine clinical examination of patients' feet by GPs and dermatologists if early recognition can be shown to prevent long-term structural or infective sequelae and the associated morbidity and cost.

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Table 1. The distribution of patients by sex, age, race and predisposing factors

Characteristic	**Study I [*n* (%)]**	**Study II [*n* (%)]**
Sex		
Female	40,150 (57.0)	10,973 (56.0)
Male	28,914 (41.0)	8041 (41.1)
Age (mean ± SD)	47.0 ± 19.9	44.0 ± 19.9
Race		
White	66,980 (95.0)	18,020 (92.0)
Black	571 (0.8)	174 (0.9)
Oriental	917 (1.3)	282 (1.4)
Other	531 (0.8)	71 (0.4)
Predisposing factors		
Diabetes	6715 (9.5)	1180 (6.0)
Obesity	12,163 (17.3)	2600 (13.3)
Use of antibiotics	1635 (2.3)	575 (2.9)
Use of corticosteroids	1307 (1.9)	397 (2.0)
Immunosuppression	896 (1.3)	301 (1.5)
Vascular disease	11,115 (15.8)	3414 (17.4)
Trauma	3014 (4.3)	876 (4.5)
Osteoarticular pathology	9396 (13.3)	2110 (10.8)
Participation in sports	7926 (11.2)	3395 (17.3)
None	28,541 (40.5)	8633 (44.1)

Table 2. The prevalence of different types of non-fungal foot disease in patients with available data

Type of foot disease	**Study I [*n* (%)]**	**Study II [*n* (%)]**
All non-fungal	26,262 (38.4)	7883 (41.7)
Orthopedic conditions	13,935 (20.4)	4681 (24.8)
Metatarsal corns	7913 (11.6)	1821 (9.6)
Psoriasis	1394 (2.0)	562 (3.0)
Eczema	3968 (5.8)	1175 (6.2)
Warts	3589 (5.2)	1553 (8.2)
Ulcer	1547 (2.3)	316 (1.7)
Gangrene, necrosis	299 (0.4)	76 (0.4)
Other	3684 (5.4)	951 (5.0)
Bacterial infection	–	135 (0.7)
Viral infection	–	150 (0.8)
Pigmented spots	–	274 (1.5)
Scleroderma	–	69 (0.4)

Table 3. The effect of predisposing factors on the odds of foot disease (from the clinical examination)

Predisposing factor	**Study I [odds ratios (95% C.I.)]**	**Study II [odds ratios (95% C.I.)]**
Diabetes	1.68 (1.57 – 1.79)***	1.55 (1.31 – 1.84)***
Obesity	1.47 (1.40 – 1.54)***	1.35 (1.21 – 1.50)***
Use of antibiotics	0.95 (0.84 – 1.07)	0.77 (0.63 – 0.95)*
Use of corticosteroids	1.40 (1.23 – 1.59)***	1.19 (0.92 – 1.54)
Immunosuppression	1.19 (1.01 – 1.40)*	0.89 (0.65 – 1.22)
Vascular disease	1.78 (1.68 – 1.88)***	1.79 (1.60 – 1.99)***
Trauma	2.04 (1.86 – 2.23)***	1.87 (1.53 – 2.29)***
Osteoarticular pathology	3.05 (2.87 – 3.24)***	3.36 (2.90 – 3.89)***
Participation in sports	1.24 (1.18 – 1.31)***	1.34 (1.23 – 1.46)***
Others	1.93 (1.79 – 2.09)***	1.27 (1.09 – 1.49)**

* statistical significance $p \leq 0.05$

** statistical significance $p \leq 0.01$

*** statistical significance $p \leq 0.001$

Table 4. The identification of fungal foot disease in study II by mycological examination

		Foot skin			Toenails		
Foot disease[1]	***N***	**Positive [*n* (%)]**	**Negative [*n* (%)]**	**Unknown [*n* (%)]**	**Positive [*n* (%)]**	**Negative [*n* (%)]**	**Unknown [*n* (%)]**
Fungal							
Skin (± toenails)	5042	**2732 (54.2)**	563 (11.2)	1747 (34.6)	**–**	–	–
Toenails only	2608	**112 (4.3)**	1380 (52.9)	1116 (42.8)	**–**	–	–
Toenails (± skin)	5594	**–**	–	–	**3912 (69.9)**	562 (10.0)	1120 (20.0)
Skin only	2056	**–**	–	–	**73 (3.6)**	1832 (89.1)	151 (7.3)
Non-fungal	3636	**31 (0.8)**	1282 (35.3)	2323 (63.9)	**43 (1.2)**	2999 (82.5)	594 (16.3)
Missing data	717	**38 (5.3)**	484 (67.5)	195 (27.2)	**189 (26.4)**	415 (57.9)	113 (15.8)

[1] Based on clinical examination

Table 5. The effect of predisposing factors on the odds of foot disease (from the mycological examination)

Predisposing factor	**Study II [odds ratios (95% C.I.)]**
Diabetes	1.53 (1.28 – 1.82)***
Obesity	1.38 (1.22 – 1.56)***
Use of antibiotics	0.94 (0.73 – 1.21)
Use of corticosteroids	1.15 (0.84 – 1.57)
Immunosuppression	0.93 (0.63 – 1.38)
Vascular disease	1.59 (1.41 – 1.79)***
Trauma	1.67 (1.35 – 2.06)***
Osteoarticular pathology	1.72 (1.49 – 1.99)***
Participation in sports	1.35 (1.20 – 1.52)***
Others	1.30 (1.09 – 1.54)**

** statistical significance $p \leq 0.01$

*** statistical significance $p \leq 0.001$

Figure 1. Distribution of non-fungal and fungal foot diseases in patients with available data

Figure 2. The prevalence of different types of fungal foot disease in patients with available data

Figure 3. The observed (circles) and predicted (continuous line) prevalence of foot diseases, from the clinical examination, based on study-specific logistic regression models with gender, and linear and quadratic age effects as covariates

Figure 4. The observed (circles) and predicted (continuous line) prevalence of non-fungal foot diseases, from the clinical examination, based on study-specific logistic regression models with gender, and linear and quadratic age effects as covariates

Figure 5. The observed (circles) and predicted (continuous line) prevalence of fungal foot infections, based on study-specific logistic regression models with gender, and linear and quadratic age effects as covariates: A, from the clinical examination in study I and study II; B, from the mycological examination in study II