Infectious Skin Diseases in Children in General Practice

Epidemiology and management

Robbert S.A. Mohammedamin

Infectieuze Huidziekten bij Kinderen in de Huisartspraktijk

Epidemiologie en beleid

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Copromotor:	Dr. J.C. van der Wouden

Voor mijn ouders

Contents

Manuscripts based on studies described in this thesis

1. Mohammedamin RSA, van der Wouden JC, Koning S, van der Linden MW, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Increasing incidence of skin disorders in children? A comparison between 1987 and 2001. BMC Dermatology 2006; 6:4. *(Chapter 2)*

2. Koning S, Mohammedamin RSA, van der Wouden JC, van Suijlekom-Smit LWA, Schellevis FG, Thomas S. Impetigo: incidence and management in Dutch general practice in 1987 and 2001. Results from two national surveys. British Journal of Dermatology 2006; 154: 239 – 243. *(Chapter 3)*

3. Mohammedamin RSA, van der Wouden JC, Koning S, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Incidence and management of acne in Dutch general practice. A comparison between 1987 and 2001. [submitted] *(Chapter 4)*

4. Mohammedamin RSA, van der Wouden JC, Koning S, van der Linden MW, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Incidence and management of warts in children in Dutch general practice. A comparison between 1987 and 2001. [submitted] *(Chapter 5)*

5. Mohammedamin RSA, van der Wouden JC, Koning S, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Incidence and management of dermatophytosis in children in Dutch general practice. A comparison between 1987 and 2001. [submitted] *(Chapter 6)*

6. Mohammedamin RSA, van der Wouden JC, Koning S, Willemsen SP, Bernsen RMD, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Association between skin diseases and severe bacterial infections in children: case-control study. BMC Family Practice 2006; 7: 52. *(Chapter 7)*

1

Introduction

Introduction

Skin diseases form a substantial part (10-24%) of the total childhood morbidity encountered in general practice [1,2,3,4]. Initial analyses of the second Dutch national survey of general practice showed that skin diseases are the most common disease in children and form 23% of the total childhood morbidity presented to the general practitioner (GP) [5]. Scarce data is available about the epidemiology of skin diseases in children in general practice and many questions in this field are still unanswered.

Relevance of this study

Measurement of disease epidemiology in general practice can contribute to wider improvements in health and health care services, through better understanding of disease aetiology, use of health care services and the role of different health care interventions [6]. Measuring and monitoring the actual incidence, prevalence, and treatment of skin diseases in children in general practice is important for several reasons.

Firstly, the past decades have been characterized by changes in children's socio-demographic [7] and health characteristics and by health care changes in the Netherlands; the proportion of children from ethnic minorities increased considerably from 7 to 13% [7] and the proportion of persons younger than 20 years increased in urban areas whereas it decreased in rural and suburban areas [8]. The prevalence of overweight and obesity increased in children [9,10] and the incidence of asthma, atopic eczema and other allergic disorders increased also [11,12,13]. Furthermore, the number of single-handed practices decreased and nowadays more general practitioners cooperate with colleagues in daily practice.

Previous analyses by Otters et al showed that childhood morbidity presented in general practice changed parallel with changing childhood demographics. Accordingly, the proportion of skin diseases and general or unspecified diagnoses increased considerably whereas respiratory tract disorders decreased [5]. Consequently, the relative importance of skin diseases in children in general practice increased.

Secondly, by measuring the incidence of skin diseases over time, trends can be identified. Consequently, changing incidence of skin diseases may necessitate a shift of priorities in order to optimize management in general practice and/or direct the future research agenda. A previous study performed in Dutch general practice reported an increase of the incidence of common infectious skin diseases (warts, impetigo, dermatophytosis) [14]. Infectious skin diseases are thus becoming quantitatively more important in general practice and this should have consequences for general practitioners. Possibly more

dermatological expertise might be needed and implemented in the vocational training programmes and continuing medical education programmes for general practitioners. For instance only two days are devoted to dermatology in the Rotterdam vocational training scheme for general practitioners in training. Of these two days only one day is devoted to infectious skin diseases [15]. A previous review of the literature reported that general practitioners performed in about 60% of the cases the correct dermatological diagnosis compared to dermatologists (93%) [16].
Furthermore, determinants may be identified that are associated with the changing incidence of skin diseases. These determinants could be useful tools in order to facilitate diagnosis, to improve the management of skin diseases, and to prevent spread of contagious skin diseases by providing appropriate advice.

Thirdly, in the nineties the Dutch College of General Practitioners issued clinical guidelines for the diagnosis and treatment of a few skin diseases (bacterial skin infections, dermatophytosis, acne, atopic eczema), which may have had consequences for the management policy of the general practitioner [17,18,19,20]. These guidelines apply to patients of all ages. A previous analysis of data from the second Dutch National Survey of general practice showed that Dutch general practitioners treated skin diseases overall according to the guidelines; in case of acne vulgaris and dermatophytosis the management of the GP was consistent in 91% of the cases with the guideline [21]. For atopic eczema and bacterial skin infections this percentage was 24% and 65% respectively [21]. We do not have a clear insight to what extent these guidelines are being followed specifically in children in daily practice. Previous studies showed that only a part of dermatological patients in a tertiary clinic received evidence-based treatment [22,23]. Abeni et al reported that only 50% of the dermatological patients received treatment that is based on results of randomized controlled trials [22]. Comparable data about children in general practice is not available. This emphasizes the importance of research concerning the treatment of dermatological problems in children.

Fourthly, in the past decades patients' attitudes showed a shift away from consulting the general practitioner for minor ailments which are usually self-limiting and can be relieved with over-the-counter medications or other self-care strategies [24]. This finding is supported by Otters et al [5] showing a significant decrease of the overall consultation rate in general practice in the past decades. These changes may lead to an overall decreasing incidence of skin diseases in general practice or patients may consult their general practitioner in a later phase of the disease which is important for the general practitioner regarding the choice of the treatment.

Fifthly, skin diseases, especially skin infections, are usually curable, but some may lead to serious complications such as nephritis, carditis, arthritis and sepsis if the diagnosis is delayed and/or treatment is inadequate [25,26,27,28,29,30,31,32]. In general practice, skin infections (bacterial, viral, fungal) contribute 42 – 65% to the total skin morbidity in children [1,3,4]. It is important to know whether the general practitioner could play a role in preventing such complications by diagnosing and treating skin diseases timely and appropriately.

The role of general practice in childrens' health care

The Dutch health care system has been structured in four layers. Collective disease prevention forms the basic echelon. The first echelon consists of primary health care that includes general practitioners, district nurses, physiotherapists, midwives, pharmacists, home care and social workers. The second and third echelon consists of specialized health care and long term care (psychiatric hospitals, nursing homes and convalescent centers) respectively [33].

Although there is freedom of choice of a general practitioner, in the Netherlands general practices have a fixed list size, and all inhabitants are listed in a general practice. Usually, the first contact with health care is the contact with the general practitioner, meaning that general practitioners are gatekeepers for specialized medical care and virtually all health problems in the population, for which professional help is sought, are presented primarily in general practice.

In only a fraction of children with complaints and symptoms parents or children themselves decide to seek medical help; in general this phenomenon is called the iceberg of symptoms [34] indicating that the vast majority of health problems is not presented to the health care system at all. When a child with health problems consults the general practitioner he or she will decide to treat or to refer to secondary health care only if the child is critically ill and needs acute specialized care. For most diagnostic procedures general practitioners rely on external facilities. If the general practitioner is unsure about a certain diagnosis he may consult the specialist for an opinion. General practitioners deal with skin diseases in a similar way [35]. Nowadays teledermatology (high quality photographs of skin lesions sent by email to the dermatologist) is an emerging option to get an advice from the dermatologist.

This thesis

Summarizing, measurement of morbidity in Dutch general practice provides an overview of the health of the population as far as presented to health care and also provides

insight in health care use. As Dutch general practitioners control referrals to specialized care, insight is also gained in the demand for secondary care.

In this thesis, after a general overview of all skin related morbidity in children in general practice, we will focus on the changes in the incidence and management of infectious skin diseases during the past decades.
Moreover, we aim to identify determinants that are associated with the incidence of infectious skin diseases in children encountered in general practice in order to provide tools for improvement of general practice care and prevention of infectious skin diseases and their complications.

More precisely our study questions are:

- Have the incidence rates of skin diseases, especially the most frequent infectious skin diseases (impetigo, warts, dermatophytosis, acne) in children in Dutch general practice changed between 1987 and 2001 and if so, were these changes related to socio-demographic characteristics?
- How do general practitioners manage infectious skin diseases and are their management policies in accordance with the national guidelines and/or evidence-based knowledge on the effectiveness of different therapies?
- Are general practitioners able to prevent complications such as sepsis and/or bacteraemia requiring hospital admission by managing skin diseases, especially skin infections, timely and appropriately?

To address these questions we used data of two successive nation-wide surveys, the first and the second Dutch national survey of general practice carried out in 1987 and 2001 [36,37].
In **chapter 2** of this thesis, an overview of all skin diseases encountered in general practice is presented. Incidence rates stratified for several socio-demographic characteristics are presented and results of two points in time (1987 and 2001) are compared. Skin diseases were divided into two groups: infectious (bacterial, viral, fungal, parasitic) and non-infectious (eczema, neoplasms, injuries). **Chapter 3** describes the epidemiology and management of impetigo in children in general practice. Impetigo is the most common bacterial skin infection in children. Results from two points in time (1987 and 2001) are compared. In **chapter 4** a comparison over time of the incidence rate and management of acne in children and adolescents is presented. As reported in previous studies acne is a mulifactorial disease in which *Propionibacterium acnes* plays an important role and therefore acne is considered a bacterial skin infection. In **chapter 5**, warts, the most common (viral) skin disease in children in general practice, is examined in more detail. Incidence rate and management in general practice are compared as

before. **Chapter 6** describes the incidence rate and management of fungal skin diseases in children in general practice. The association between skin diseases, especially skin infections, and severe bacterial infections requiring hospitalization in children is explored in **chapter 7.** As reported in previous studies skin diseases are considered to be an important causal factor in children who are hospitalized due to a severe bacterial infection. Therefore we hypothesize that these critically ill children suffer more often from skin diseases, especially skin infections, and initially consult the general practitioner more often for that reason than other children. If our hypothesis is true the general practitioner may play an important role in reducing the risk of being hospitalized due to a severe infection by diagnosing and treating skin diseases appropriately. To test this hypothesis we performed a case-control study. In **chapter 8** we discuss the main findings of this thesis and offer suggestions for future directions of research.

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2

Increasing incidence of skin disorders in children? A comparison between 1987 and 2001

Mohammedamin RSA, van der Wouden JC, Koning S, van der Linden MW, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Increasing incidence of skin disorders in children? A comparison between 1987 and 2001. BMC Dermatology 2006; 6:4.

Abstract

Background

The increasing proportion of skin diseases encountered in general practice represents a substantial part of the morbidity in children. Only limited information is available about the frequency of specific skin diseases. We aimed to compare incidence rates of skin diseases in children in general practice between 1987 and 2001.

Methods

We used data of all children aged 0-17 years derived from two consecutive surveys performed in Dutch general practice in 1987 and 2001. Both surveys concerned a longitudinal registration of GP consultations over 12 months. Each disease episode was coded according to the International Classification of Primary Care. Incidence rates of separate skin diseases were calculated by dividing all new episodes for each distinct ICPC code by the average study population at risk. Data were stratified for socio-demographic characteristics.

Results

The incidence rate of all skin diseases combined in general practice decreased between 1987 and 2001. Among infants the incidence rate increased. Girls presented more skin diseases to the GP. In the southern part of the Netherlands children consulted their GP more often for skin diseases compared to the northern part. Children of non-western immigrants presented relatively more skin diseases to the GP. In general practice incidence rates of specific skin diseases such as impetigo, dermatophytosis and atopic dermatitis increased in 2001, whereas warts, contact dermatitis and skin injuries decreased.

Conclusions

The overall incidence rate of all skin diseases combined in general practice decreased whereas the incidence rates of bacterial, mycotic and atopic skin diseases increased.

Background

In general practice, skin disease accounts for a substantial part of the morbidity in children and adolescents [1,2,3,4]. Compared to 1987, in 2001 the childhood morbidity encountered in Dutch general practice has changed; proportionally more skin diseases were presented to the general practitioner (GP) whereas other most frequent diseases (e.g. respiratory tract and general diseases) were presented less often. By the same token the overall consultation rate in general practice decreased by 22% [5,6]. Did the incidence rate of skin diseases in general practice increase?

However, little information is currently available about the epidemiology of skin diseases encountered in general practice. The few studies which have been performed show a wide variety in the occurrence of skin diseases presented to GPs [3,4,7]. Against the background of the changing consultation behaviour in general practice [5] and the increasing population-based prevalence of some skin diseases (e.g. atopic eczema) [8,9] it is important to estimate current incidence rates of the different skin diseases affecting children and adolescents in general practice. Further, primary care epidemiology can contribute to wider improvements in health and health care services, through better understanding of disease aetiology, use of health care services and the role of different health care interventions [10].

The present study relies on two consecutive surveys which were performed in Dutch general practice in 1987 and 2001. As they included all patient-physician contacts during a one-year study period, selection bias and the influence of seasonal variation are avoided.
To estimate current incidence rates of skin diseases affecting children and adolescents and to generate reference material for future studies, we conducted a detailed analysis of the skin diseases encountered in Dutch general practice between 1987 and 2001.
Our research questions were:

- How often did the GP see children aged 0-17 with specific skin diseases; to what extent did that change between 1987 and 2001?
- Was the incidence rate of skin diseases encountered in general practice in 1987 and 2001 related to socio-demographic characteristics?

Methods

We used data from the first and second Dutch national surveys of general practice, which were performed by the Netherlands Institute for Health Services Research (NIVEL) in 1987 and 2001. In the Netherlands, general practices have a fixed list size, and

all non-institutionalised inhabitants are listed in a general practice, and GPs have a gate-keeping role. Usually, the first contact with health care, in a broad sense, is the contact with the general practitioner. Each survey included a representative sample of the Dutch population.

In 1987 practices were randomly sampled from a list of all Dutch practices, per stratum defined by region and degree of urbanization. Sampling fractions differed between strata. 161 GPs in 103 practices participated in the first national survey [11]. With respect to age and gender the participating GPs and practices were representative of Dutch GPs and practices in 1987. The GPs were divided into four groups, and each group used registration forms to register data (e.g. diagnosis, prescription and referrals) on all contacts between patient and practice during one of four consecutive 3-month periods. Baseline characteristics such as age and gender were derived from patient records. Other socio-demographic characteristics such as socio-economic status (SES) and ethnicity were obtained by a questionnaire and filled out by parents, or by the children themselves if they were older than 12 years (response rate 91.2%). SES was based on the father's occupation, which was categorized into five classes "non-manual work high (class I)", "non-manual work middle (class II)", "non-manual low and farmers (class III)", "manual work high / middle (class IV)" and "manual work low (class V)". Ethnicity was derived from the country of birth of either parent. If either parent was born in Turkey, Africa, Asia (except Japan and Indonesia) and Central or South America, their children were considered to be children of non-western origin (in accordance with the classification of Statistics Netherlands). All other children were defined as western. The degree of urbanization was derived from the general practice's postal code and categorized into four classes "under 30,000 inhabitants", "30,000-50,000 inhabitants", "over 50,000 inhabitants" and "the three large Dutch cities Amsterdam, Rotterdam and The Hague". The Netherlands were divided into a Northern, Central and Southern region. Season was divided into four categories: spring was defined as months April - June, summer as July - September, autumn as October - December and winter as January - March.
The diagnoses made by the GPs were coded afterwards by clerks using the International Classification of Primary Care (ICPC) [12].

In 2001, 195 GPs in 104 practices registered data about all physician-patient contacts over 12 months [13]. They registered all health problems presented within a consultation, and coded the diagnosis themselves using the ICPC. Patient demographic characteristics such as age and gender were derived from the GP's computerized patient files. As in 1987, SES and ethnicity were obtained by a questionnaire (response rate 76%). Degree of urbanization, region and season were derived as in 1987.

In both surveys each contact with the GP was defined as one consultation. All health problems presented within one consultation were recorded separately. Both surveys were episode orientated, meaning that a consultation on a new health problem marked the beginning of a new episode. If there were multiple consultations in a single episode, the diagnosis made during the last consultation was regarded as the episode-diagnosis. In order to decide whether two consultations with the same problem belonged to the same episode or were different episodes, the latter was arbitrarily decided upon if the interval between two consultations was at least four weeks (28 days).

There were 20 practices that participated in both surveys. In 2001 eight practices were excluded from analyses for the following reasons: two practices had software problems; one practice registered only over a three-month period; five practices showed insufficient quality of the morbidity registration.

Ethical approval

The study was carried out according to Dutch legislation on privacy. The privacy regulation of the study was approved by the Dutch Data Protection Authority. According to Dutch legislation, obtaining informed consent is not obligatory for observational studies.

Statistical analysis

This study analyzed data from both surveys for children aged 0-17 years presenting with skin diseases, classified by ICPC codes. Incidence rates in general practice were calculated for all combined skin diseases and for each skin disease separately with a distinct ICPC code. We calculated the incidence rate by dividing the total number of new episodes (numerator) by the study population at risk multiplied by the follow-up time (denominator). In 1987 the denominator was calculated by multiplying the number of all patients listed in the participating practices by the follow-up time (person years). In 2001, persons that moved into or out of the participating practices during the registration period were assumed to contribute for half a year to the follow-up time. The so-called mid-time population was calculated as the mean of all listed patients of all participating GPs, aged 0-17 years, at the beginning and at the end of the registration period, irrespective of health care use. Data were stratified for age categories, gender, urbanization level, region, season, SES and ethnicity.

Further we assessed the changes in incidence rates of all skin diseases between 1987 and 2001. Incidence rates were expressed per 1000 person-years; 95% confidence intervals (CI) were calculated assuming a Poisson distribution. Skin diseases which contributed

less than 0.5 percent to the total skin morbidity were not analyzed in detail and were combined into one residual group.

Results

Study populations in 1987 and 2001

The study population in 1987 consisted of 86,577 children yielding 21,644 person years. These children presented a total of 9,271 contacts with skin problems which contributed to 6,870 episodes; 75.4% of these episodes resulted in a single contact with the GP. In 2001 there were 88,307 children yielding 82,053 person-years. These children presented a total of 29,637 contacts with skin problems that contributed to 23,586 episodes; 76.6% of these episodes consisted of only one contact with the GP.

All episodes of skin disease

Table 1 shows the distribution and the change in incidence rates of skin diseases in general practice between 1987 and 2001, stratified for several background characteristics. Compared to 1987, in 2001 the overall incidence rate of skin diseases combined had decreased significantly from 317.4, CI: [309.9 – 325.0] to 287.5, CI: [283.8 – 291.2] per 1000 person years. The incidence rate of skin diseases presented to the GP increased among infants (children under one year); in all other age categories except age category "1-4 years" the incidence rates decreased.

In 2001, girls presented significantly more skin diseases to the GP than boys. There was a similar geographic gradient in both surveys: in the southern part of the Netherlands children presented more often skin diseases to the GP compared to the northern part. In 2001, the incidence rate of skin diseases presented to the GP increased in rural areas whereas it decreased in suburban areas. In the big cities the incidence rate remained stable. In both surveys the seasonal peak was in spring. In 2001 children with parents in SES class I, II, IV, V showed a decrease of the incidence rate of skin diseases presented to the GP whereas the incidence rate in class III (non-manual low and farmers) remained stable compared to 1987. In both surveys the incidence rates of skin diseases in general practice were higher in lower SES classes.

In 2001 children of non-western immigrants visited the GP more often with skin diseases than children of natives and western immigrants combined.

Table 2 shows the incidence rates of skin diseases in general practice for the distinct ICPC codes. In 2001 incidence rates are shown for separate age categories and compared with the crude incidence rate in 1987. In both surveys warts, impetigo, dermatophytosis, contact dermatitis, atopic dermatitis and injuries of the skin were the most frequent skin diseases, accounting for about 57% of the total skin-related morbidity presented to the GP. Although, in general practice the incidence rate of warts decreased by 23% in

Table 1: Incidence rates per 1000 person years of all new episodes of all skin diseases combined in general practice in 1987 and 2001

	1987		2001		
	Incidence Rates	**95% Confidence Intervals**	**Incidence Rates**	**95% Confidence Intervals**	**P-value**
Age Categories					
< 1 year	**352.1**	321.0 – 385.5	**460.8**	441.0 – 481.3	<0.001
1- 4 years	**328.9**	312.2 – 346.2	**320.0**	311.8 – 328.3	0.35
5 – 9 years	**340.3**	325.4 – 355.7	**273.7**	267.1 – 280.5	<0.001
10 – 14 years	**276.2**	262.8 – 290.1	**235.3**	229.1 – 241.6	<0.001
15 – 17 years	**319.0**	302.5 – 336.3	**266.9**	258.3 – 275.7	<0.001
Gender					
Male	**315.9**	305.5 – 326.5	**279.2**	274.2 – 284.3	<0.001
Female	**319.0**	308.3 – 330.0	**296.2**	290.8 – 301.5	<0.002
Urbanization					
< 30,000	**307.8**	295.3 – 320.6	**324.3**	318.4 – 330.4	0.02
30,000 – 50,000	**315.4**	303.1 – 328.1	**253.9**	246.0 – 261.9	<0.001
> 50,000	**349.9**	332.6 – 367.9	**258.1**	251.9 – 264.3	<0.001
Big Cities	**289.1**	265.5 – 314.2	**285.8**	271.7 – 300.5	0.82
Region					
Northern	**303.3**	281.8 – 326.0	**253.6**	244.6 – 262.8	<0.001
Central	**310.2**	301.0 – 319.6	**282.4**	277.6 – 287.3	<0.001
Southern	**342.7**	327.1 – 358.8	**314.6**	307.4 – 321.8	0.001
Season					
Winter	**305.8**	290.4 – 321.8	**279.4**	272.2 – 286.8	0.003
Spring	**336.6**	322.5 – 351.1	**294.5**	287.1 – 302.1	<0.001
Summer	**319.3**	302.9 – 336.4	**292.5**	285.1 – 300.0	0.004
Autumn	**304.9**	291.1 – 319.2	**272.7**	265.8 – 279.8	<0.001
SES					
Class I	**305.0**	289.3 – 321.2	**265.2**	258.6 – 271.9	<0.001
Class II	**325.2**	304.1 – 347.4	**278.8**	270.8 – 287.0	<0.001
Class III	**264.2**	232.2 – 299.4	**299.0**	284.4 – 314.0	0.06
Class IV	**340.9**	322.1 – 360.6	**299.5**	283.6 – 316.1	0.001
Class V	**336.4**	315.8 – 358.0	**283.2**	270.4 – 296.5	<0.001
Ethnicity					
Natives & Western Immigrants	**315.7**	308.1 – 323.5	**275.1**	270.7 – 279.6	<0.001
Non-Western Immigrants	**346.1**	313.6 – 380.9	**295.6**	281.6 – 310.0	0.01
Total	**317.4**	309.9 – 325.0	**287.5**	283.8 – 291.2	<0.001

Table 2: Incidence rates per 1000 person years of all new episodes of skin diseases according to ICPC codes in Dutch general practice in 1987 and 2001

			2001								1987
					< 1 year	1-4 years	5-9 years	10-14 years	15-17 years	0-17 years	0-17 years
	ICPC		N	%							
Bacterial infections	S84	Impetigo	1684	7.1	18.6	29.4	27.7	13.4	7.3	20.5	16.5
	S11	Localized skin infections	726	3.1	10.2	9.0	9.1	7.4	9.4	8.8	4.5
	S09	Infected finger/toe/paronychia	455	1.9	7.7	7.3	5.3	5.1	3.2	5.5	7.7
	S10	Carbuncle/cellulitis	196	0.8	0.9	2.0	2.8	2.0	3.1	2.4	6.1
	S76	Erysipelas/erythrasma	153	0.6	2.3	2.4	1.4	1.5	2.3	1.9	3.2
Viral infections	S03	Warts	2816	11.9	0.7	13.7	54.8	38.7	27.4	34.3	44.8
	S95	Mollusca contagiosa	777	3.3	2.3	18.1	17.0	1.4	0.3	9.5	10.8
	S71	Herpes Simplex skin/lip	148	0.6	1.8	2.6	1.2	1.8	1.8	1.8	2.9
	S70	Herpes zoster	134	0.6	0.0	1.6	1.4	2.1	1.5	1.6	2.0
Fungal infections	S74	Dermatophytosis	2085	8.8	41.0	24.7	20.3	24.6	29.6	25.4	20.8
	S75	Moniliasis/candidiasis	801	3.4	112.9	12.5	1.4	1.0	1.2	9.8	4.9
Parasitic infestations	S12	Insect bite	577	2.4	9.3	11.8	6.9	4.0	4.7	7.0	6.7
Dermatitis	S88	Contact dermatitis/other eczema	1882	8.0	31.1	24.6	18.9	19.8	28.5	22.9	33.2
	S87	Atopic dermatitis	1353	5.7	90.9	26.0	9.5	7.1	6.5	16.5	11.3
	S86	Seborrhoeic dermatitis	416	1.8	24.7	3.3	2.4	5.2	5.3	5.1	3.4
	S89	Diaper rash	406	1.7	48.5	10.3	0.2	0.0	0.0	4.9	10.5
	S90	Pityriasis rosea	124	0.5	0.2	0.5	1.1	2.1	2.8	1.5	1.2
Neoplasms	S82	Naevus/mole	479	2.0	1.4	1.3	4.5	7.9	11.9	5.8	3.5
	S04	Local swelling/mass	372	1.6	8.2	4.6	3.9	4.0	5.0	4.5	2.0
	S79	Other benign neoplasms	203	0.9	1.8	1.0	1.6	3.1	5.1	2.5	3.8
	S93	Sebaceous cyst	184	0.8	1.4	1.3	1.4	2.2	5.2	2.2	3.9

2001, it remained the most frequent skin disease in children in both surveys. In 2001, in general practice the incidence rate of impetigo, dermatophytosis and atopic dermatitis increased whereas the incidence rate of the most viral skin infections decreased. Also contact dermatitis and several types of skin injuries showed a decreased incidence rate in general practice. Most of the specific skin diseases (e.g. dermatophytosis, moniliasis/candidiasis, contact dermatitis, atopic dermatitis and diaper rash) showed the highest incidence rate among infants in general practice.

Discussion

These two large and representative surveys give a comprehensive assessment of the dermatological morbidity in children encountered in Dutch general practice, and enabled us to estimate current incidence rates for all skin diseases.

Table 2: Incidence rates per 1000 person years of all new episodes of skin diseases according to ICPC codes in Dutch general practice in 1987 and 2001 (continued)

			2001								1987
					< 1 year	1-4 years	5-9 years	10-14 years	15-17 years	0-17 years	0-17 years
Injuries	S18	Laceration/cuts	1668	7.1	7.9	30.8	21.8	15.0	15.1	20.3	23.4
	S16	Bruises/contusions	713	3.0	6.6	7.9	7.2	10.0	10.2	8.7	7.8
	S17	Abrasion/scratch/blister	440	1.9	2.3	5.8	5.3	4.4	7.1	5.4	6.0
	S14	Burns/scalds	255	1.1	5.0	4.9	1.4	2.2	4.4	3.1	3.4
	S13	Human / animal bite	169	0.7	1.6	2.2	2.0	2.0	2.1	2.1	2.5
	S15	Foreign body in skin	131	0.6	0.5	1.6	2.0	1.5	1.3	1.6	1.9
	S19	Other injuries to skin	165	0.7	1.6	2.5	2.4	1.6	1.4	2.0	11.8
Others	S98	Urticaria	673	2.9	6.3	12.0	9.2	5.4	6.2	8.2	7.4
	S96	Acne	506	2.1	0.2	0.1	0.3	9.9	19.7	6.2	9.9
	S06	Erythema/rash	437	1.9	22.4	7.9	3.7	2.5	3.7	5.3	4.2
	S94	Ingrown toenail/other diseases of nail	430	1.8	0.9	1.5	1.6	9.1	11.0	5.2	4.9
	S21	Symptoms/complaints of skin texture	349	1.5	15.6	5.5	3.3	2.3	3.5	4.3	2.3
	S02	Pruritis/skin itching	310	1.3	3.2	4.8	3.7	2.7	4.3	3.8	2.3
	S29	Other symptoms/complaints skin	207	0.9	8.4	2.0	1.4	2.2	3.5	2.5	1.5
	S99	Other diseases of skin/ subcutaneous tissue	184	0.8	4.1	1.6	1.5	2.3	3.6	2.2	5.8
	S22	Symptoms/complaints of nails	126	0.5	1.4	1.6	1.2	1.7	1.6	1.5	1.3
Residuals			852	3.6						10.4	16.3
Total			23586	100						287.5	317.4

ICPC = International Classification of Primary Care
N = number of incident episodes of skin diseases
% = percentage of new episodes of skin diseases with a distinct ICPC

The overall incidence rate of skin diseases presented to the GP decreased by 9.4%, which is surprising given the decreased overall GP consultation rate by children as reported elsewhere [5]. According to the decrease of the overall GP consultation rate by 22% we expected a lower incidence rate of skin diseases in 2001 in general practice.
In infants, the incidence rate of skin diseases presented to the GP has increased in 2001, especially of atopic dermatitis and moniliasis/candidiasis (**table 2**). This increase is in accordance with previous studies showing an increase of atopic dermatitis in the general population [8,9].
Girls visited the GP more often concerning skin problems which is in accordance with previous studies [1,2,14]. Probably this difference is based on aesthetic reasons.

Between 1987 and 2001, the incidence rate of skin diseases in general practice increased in rural areas and decreased in suburban areas. It seems plausible that this increase

could partly be explained by the increased incidence of bacterial skin infections in our data. It is suggested elsewhere that children in rural areas are more exposed to infectious pathogens due to the larger number of animals and farms [15]. Actually, with the decreasing consultation rate we would expect also a decrease of the incidence rate of skin diseases in general practice in urban areas but this did not change between 1987 and 2001. Probably children in urban areas are suffering more from skin diseases. This is in accordance with "the pollution hypothesis" meaning that children in urban areas have a higher chance in developing atopic diseases [15,16]. Crowding in urban areas could be a potential factor in spreading infectious skin diseases.

According to **table 1** there is a regional variation in the incidence rates of skin diseases in general practice. The highest incidence rates of skin diseases encountered in practices in the south is a striking observation, especially for a small country like the Netherlands. Of the six most frequent skin diseases impetigo (S84) had a geographical gradient with a two fold higher incidence rate in the south compared to the north. Also for non-dermatological conditions we found a significantly higher consultation rate in the south of the Netherlands in both surveys. Practice characteristics seem not to play an important role.

In 2001, children of non-western immigrants consulted their GP more often with skin diseases. The significantly higher consultation rate and the proportional increase of non-western children from 7.4% to 9.7% in the Dutch childhood population might explain these differences [5,6]. Probably, non-western children suffer more from skin diseases; a previous study reported that non-western immigrants in the Netherlands more often felt unhealthy [13].

We found the highest incidence rate of skin diseases in general practice in the lower SES classes, which is consistent with previous studies [17,18]. The most striking finding is that the incidence rate of skin diseases in general practice remained stable in SES class III (**table 1**). In all other SES classes the incidence rate have decreased between 1987 and 2001 which is in accordance with the decreased consultation rate in general practice [5].

Furthermore, from **table 2** it becomes clear that the incidence rates of some skin diseases presented to the GP have increased while others have decreased substantially. The increased incidence rate of infectious (bacterial and fungal) and allergic skin diseases in our data is compatible with reported trends [5,8,9,14]. The increasing use of day-care and after-school facilities in the Netherlands might explain the increase of infectious skin diseases in general practice [15]. There are suggestions that the increasing use of

topical antibiotics resulted in more resistant bacterial strains, which could have resulted in a rise of the incidence of bacterial skin infections in the population. The striking decrease in incidence rate of most viral skin infections in our data is in parallel with the decreased overall GP consultation rate. In 2001, infectious skin diseases represent a substantial part (45%) of the total skin morbidity presented to the GP which is in accordance with previous studies [3,4]. Skin injuries and allergic skin diseases contributed about 15% and 18% respectively.

This study had some limitations. There were small differences in the design of the two national surveys, which might disturb the comparability of data. Some of the differences in occurrence may be explained by the fact that ICPC coding was not performed equally in both surveys: in 1987 clerks coded diagnoses afterwards, whereas in 2001 the GPs coded the diagnoses themselves during the consultation. We assume that coding by clerks more often led to a diagnosis-specific ICPC code. In the present study the accuracy of diagnoses made by the GPs could be a subject of debate. In our analysis we assumed that the diagnoses made by the GPs were correct. In 2001 the participating GPs were trained in coding the diagnoses correctly using ICPC codes. Overall these trained GPs classified diagnoses correctly in about 81% of the test cases [19].

Conclusions

The overall incidence rate of all skin diseases combined in general practice decreased whereas the incidence rates of bacterial, mycotic and atopic skin diseases increased. On these topics more detailed epidemiological data and population-based prevalence studies are needed.

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3

Impetigo: incidence and management in general practice in 1987 and 2001. Results from two national surveys

Koning S, Mohammedamin RSA, van der Wouden JC, van Suijlekom-Smit LWA, Schellevis FG, Thomas S. Impetigo: incidence and management in general practice in 1987 and 2001. Results from two national surveys. British Journal of Dermatology 2006; 154: 239 – 243.

Abstract

Objectives

Impetigo is a common skin infection in children. The epidemiology is relatively unknown, and the choice of treatment is subject for debate. The objective of our study was to determine the incidence and treatment of impetigo in Dutch general practice, and assess trends between 1987 and 2001.

Methods

We used data of the first (1987) and second (2001) Dutch national survey of general practice. All diagnoses, prescriptions and referrals were registered by participating general practitioners (GPs), 161 and 195 respectively.

Results

Incidence The incidence rate of impetigo increased from 16.5 (1987) to 20.5 (2001) per 1000 person years under 18 years old ($p< 0.01$). In both years, the incidence was significantly higher in summer, in rural areas and in the southern region of the Netherlands, compared to winter, urban areas and northern region respectively. Socio-economic status was not associated with the incidence rate.

Treatment From 1987 to 2001, there was a trend towards topical antibiotic treatment (from 40% to 64%), especially fusidic acid cream and mupirocin cream. Oral antibiotic treatment (from 29% to 14%), and disinfecting agents (from 11% to 3%) were less often prescribed.

Conclusions

Incidence We have shown an increased incidence of impetigo in the past decades, which may be the result of increased tendency to seek help, or increased antibiotic resistance and virulence of *Staphylococcus aureus*. Further microbiological research of the marked regional difference in incidence may contribute to understanding the factors that determine the spread of impetigo.

Treatment Trends in prescribing for impetigo generally follow evidence-based knowledge on the effectiveness of different therapies, rather than the national practice guideline.

Background

Impetigo or impetigo contagiosa is a contagious superficial skin infection. *Staphylococcus aureus* is currently the most common causative agent. For parents, a child with impetigo brings about concern and inconvenience, since children with impetigo are usually barred from schools and kindergartens. Although the incidence and population prevalence of impetigo seem to have decreased over the past decades, it is still a common disease, particularly in young children [1,2,3].

Not much is known about the epidemiology. There is a general belief that good hygiene may prevent the occurrence of impetigo [4], and that social factors such as crowding may increase the risk of developing of this disease. Regarding the level of the causative agent, specific characteristics of *S. aureus* have been identified, which affect the development and course of impetigo [5,6,7].
There is debate about the treatment of impetigo. Are topical antibiotics effective? Should their use be promoted or discouraged because of rising resistance rates, especially against fusidic acid? [8,9]. Since 1999, there is a guideline for Dutch general practitioners (GPs) on bacterial skin infections, issued by the Dutch College of General Practitioners. [9]. In summary, the advice for impetigo is a basic treatment of disinfection, and additional zinc ointment in case of limited lesions or fusidic acid cream in case of more extensive lesions.

Against the background of changing social behaviour and changing resistance of the pathogen it is important to establish the occurrence and treatment of impetigo in daily practice. We investigated the incidence of impetigo and its management by GPs in the Netherlands, and tried to identify trends between 1987 and 2001. Our questions were:

- How often does the GP see children aged 0-17 with impetigo, and how is the incidence related to sex, age, season, region, urbanization level and social economic status, and how did that change between 1987 and 2001?
- What is the treatment policy of the GP, and how did that change between 1987 and 2001?

Methods

We analyzed data from the first and second Dutch national surveys of general practice, which were carried out by the Netherlands Institute for Health Services Research in 1987 and 2001, respectively. For this study, data from both surveys for children aged 0–17 years were analyzed. In the Netherlands, general practices have a fixed list size, and all non-institutionalised inhabitants are listed in a general practice, and GPs have a

gate-keeping role. Both surveys included a representative sample of the Dutch population.

First Dutch National Survey 1987

A non-proportionally stratified sample of 161 GPs was selected randomly to participate in the survey. The GPs were divided into four groups and each group registered data about all contacts between patient and practice on registration forms during one of four consecutive 3-month periods during 1987. The four registration periods covered one calendar year to correct for seasonal variability of morbidity. Data recorded from each consultation included patient characteristics (age, gender), diagnosis and prescription of drugs. Specially trained workers using the International Classification of Primary Care (ICPC) coded diagnoses made by the general practitioner afterwards. Other demographic patient characteristics were obtained by a questionnaire. Because of an underrepresentation of deprived areas, the population was weighted to the Dutch population of 1987. For further details about the first Dutch national survey, we refer to the book by Bruijnzeels [1].

Second Dutch National Survey 2001

The second national survey was carried out in 2001. In short, 195 general practitioners in 104 practices registered data about all physician-patient contacts during 12 months. GPs registered all health problems presented within a consultation and coded diagnoses using the ICPC. Also, all prescriptions made by the GP were registered. Characteristics of participating practices such as settlement in rural or urban area were obtained by a mailed questionnaire. Patient characteristics such as age and gender were derived from the GPs' computerized patient files. For further details about the second Dutch national survey, we refer to the article by Westert [11]. For this analysis, data from nine of the 104 practices were excluded for various reasons: five practices with inadequate registration of patient contacts or drug prescription were excluded after quality control. Four other practices were excluded because of software problems. When several contacts had taken place for impetigo, and there had been no cure between the contacts, we constructed an episode.

Statistical analyses

We defined incidence as number of first contacts for impetigo per 1000 person years. Differences between incidence rates were tested assuming a Poisson distribution with a significance level of 0.05 using STATA version 8.2.

Results

In the first National Survey (1987) and the second National Survey (2001), 86,577 and 81,716 children aged 0-17 participated respectively. In these groups, there were 380 (1987) and 1682 (2001) episodes of impetigo. These figures form the basis of the incidence rates.

Incidence

The incidence of impetigo in children under 18 was 16,5 per 1000 person years in 1987. In 2001, the incidence had risen to 20.5, an increase of 24% ($p < 0.01$). The incidence by age is represented in **figure 1**. It shows that especially children aged 6-11 years had impetigo more often in 2001 compared to 1987. Consequently, the peak age group for impetigo has widened and shifted to an older age. There was no sex difference in incidence in 1987 whereas in 2001 boys more often consulted the GP for impetigo.

Table 1 shows the incidence of impetigo, related to urbanization level, region, season and socio-economic status. Like in 1987, impetigo was more frequent in smaller towns and villages (< 30,000 inhabitants). This difference was statistically significant compared to all three other categories of urbanization level. There was a geographic gradient in both surveys, stronger in 2001 than in 1987. In the south of the Netherlands, the incidence of impetigo was twice as high as in the north. In multivariate analysis, this proved

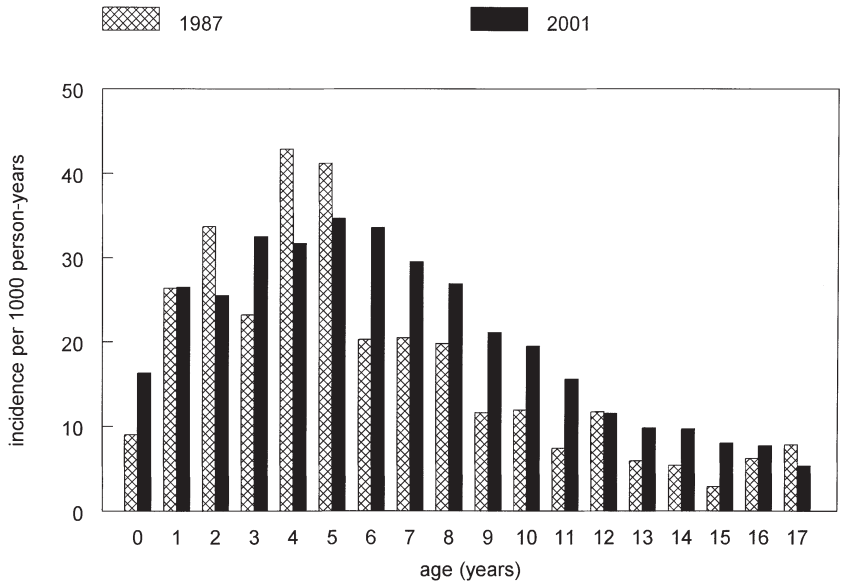

Figure 1: Incidence of impetigo by age in general practice per 1000 person years

Table 1: Incidence rates (1000 person years) of impetigo in 0-17 years olds by urbanization level, region, season, and socio-economic group

	1987		2001	
	Incidence rates	**95% CI interval**	**Incidence rates**	**95% CI interval**
Urbanization level				
<30,000 inhabitants	**22.0**	18.75 – 25.59	**25.8**	24.13 – 27.52
30-50,000 inhabitants	**13.7**	11.27 – 16.59	**12.0**	10.33 –13.84
>50,000 inhabitants	**14.0**	10.69 – 17.96	**14.1**	12.65 – 15.57
Big cities [1]	**11.5**	7.21 – 17.41	**12.9**	10.04 – 16.33
Region				
Northern	**15.6**	11.07 – 21.46	**13.0**	11.05 – 15.25
Central	**15.5**	13.53 – 17.74	**19.4**	18.19 – 20.74
Southern	**19.2**	15.68 – 23.34	**26.4**	24.35 – 28.55
Season				
Winter	**15.6**	12.27 – 19.56	**14.8**	13.20 – 16.61
Spring	**10.9**	8.53 – 13.83	**12.2**	10.72 – 13.81
Summer	**21.5**	17.38 – 26.26	**31.2**	28.78 – 33.66
Autumn	**18.6**	15.31 – 22.38	**23.0**	20.97 – 25.08
Socio-economic group[2]				
1 Non-manual high	**17.4**	13.79 – 21.58	**19.5**	17.72 – 21.37
2 Non-manual middle	**16.0**	11.62 – 21.47	**22.6**	20.37 – 25.01
3 Non manual low & farmers	**15.0**	8.22 – 25.23	**23.5**	19.58 – 28.02
4 Manual high/middle	**22.2**	17.63 – 27.67	**22.5**	18.34 – 27.41
5 Manual low	**21.0**	16.09 – 26.90	**20.8**	17.41 – 24.62
Total	**16.5**	14.83 – 18.30	**20.5**	19.55 – 21.53

1 Amsterdam, Rotterdam, The Hague
2 according to education of the father

to be independent of urbanization level. The seasonal peak in incidence in the summer was stronger in 2001 than in 1987. Socio-economic status appeared no significant factor in both surveys.

Prescriptions

The data are based on the prescriptions in the first contact of an episode, and are presented in **table 2**. Sixty nine percent of all prescriptions in 1987 were for an antibiotic; in 2001 this percentage was 78. In 2001, more topical antibiotics, especially fusidic acid cream and mupirocin cream, and less oral antibiotics were prescribed than in 1987. Other topical antibiotics were hardly used anymore. The number of prescriptions for disinfecting agents decreased from 11% to 3%. In a small minority of the consultations more than one prescription was issued.

Table 2: Prescriptions in the first contact of the impetigo episode

	1987		2001	
	Number	**percentage**	**Number**	**percentage**
Total number of episodes	**380**	**100**	**1682**	**100**
Oral antibiotic	**109**	**29**	**242**	**14**
Amoxicillin and other penicillinase susceptible penicillins	82	22	78	5
Penicillinase resistant penicillins (flucloxacillin, amoxicillin + clavulanic acid)	15	4	89	5
Macrolides	4	1	60	4
Cefalosporins	1	0	14	1
Other	7	2	1	0
Topical antibiotic	**153**	**40**	**1078**	**64**
Fusidic acid	64	17	855	51
Mupirocin	-	0	210	12
Tetracyclin	54	14	3	0
Other	35	9	10	1
Antiseptic	**40**	**11**	**48**	**3**
Chloorhexidin	12	3	19	1
Povidon-iodine	17	4	29	2
Other	11	3	-	0
Other topical medication	**80**	**21**	**68**	**4**
No prescription	**35**	**9**	**240**	**14**

Referrals

In 1987 three (0.8%) and in 2001 fourteen (0.8%) of the children with impetigo were referred to the dermatologist. In 2001, a similar proportion of boys and girls were referred to the dermatologist, whereas in 1987 all the referred children were girls.

Discussion

Incidence: increase

We observe an increased incidence of impetigo seen in general practice over the past 14 years, which seems to be an upheaval after decades of decreasing incidence [2]. This increase may reflect a rising tendency of medical attention seeking and should not necessarily imply an increase at the population level. The unsightly aspect of (facial) impetigo may now be less acceptable to parents than before. Also, there seems to be more pressure from schools to undergo antibiotic treatment before the child can be permitted at school again. This may also explain the fact that the increase has mainly affected the age group 6-11 years. Possible explanations for an increased incidence

at the population level are either a change in human behaviour, such as increased travelling or, on the other side, increasing virulence of the causative pathogen. Genetic characteristics of *S aureus* are changing, and a selection of more virulent strains may take place [5]. Also, a rise of antibiotic resistance in staphylococci has been reported [8,9,12,13]. Cure of impetigo may therefore last longer than before and patients may be contagious for a longer time. Reports of impetigo epidemics that are difficult to control, caused by multiple resistant staphylococci, are illustrative in this respect [14,15].

Incidence: regional variance

The twofold higher incidence in the south compared to the north is a striking observation, especially for a small country like the Netherlands. Climatic differences within the country are small and seem to offer no explanation. The level of urbanization and socio-economic scale turned out to be no factor either, shown by multivariate analysis. We propose that staphylococcal transfer from animal to man may explain the geographical gradient. Zoonoses in staphylococcal pyogenic skin infections have been proven before [16]. In the Netherlands, there is a concentration of pig farming in the southern provinces, where approximately ten times as many pigs are bred as in the northern provinces [17]. It has been shown recently that pig farmers in France more frequently were nasal carriers of *S aureus* than matched non-farmers, and that the *S aureus* were more frequently macrolide resistant [18]. The same explanation may account for the twofold higher incidence of impetigo in rural areas versus other urbanization levels. Research comparing genetic staphylococcal characteristics of specimens derived from different regions would be needed to test these hypotheses. The rise in incidence of impetigo does not seem to continue southwards, as data from Belgian GPs suggest that the incidence in Belgian general practice is lower than in the Netherlands. (Personal communication, Dr Stefaan Bartholomeeusen) The higher incidence of impetigo in the summer is not new and is consistent with many other reports [2,19,20].

Treatment

There is a trend towards prescribing of topical antibiotics for impetigo, at the expense of oral antibiotics. The trebled increase of fusidic acid cream prescriptions from 1987 to 2001 may be influenced by the publication of the guideline on bacterial skin infections by the Dutch College of General Practitioners in 1999 [10]. In this guideline, fusidic acid is the first choice antibiotic treatment. Contrarily, the number of prescriptions of mupirocin has also increased. Mupirocin cream, not available in 1987 yet, has proven efficacy in the treatment of impetigo [21], but was not recommended in the 1999 guideline, considering that mupirocin should be reserved for treatment of nasal carriage of *S aureus*. Many GPs did not follow the guideline in this respect. Furthermore, the guideline recommends disinfecting therapy with chlorhexidine or povidon-iodine as a basic

treatment. This advice was even less often complied with in 2001 than in 1987. Possibly, disinfectants have been advised in some cases and were not registered because they are over-the-counter-medicines. However, a great proportion of GPs apparently has no faith in the value of disinfecting treatments. The lack of evidence for the effectiveness of disinfectants may play a role [21]. In the group of oral antibiotics, a remarkable one third of all prescriptions are still penicillinase susceptible penicillins such as penicillin, amoxicillin and feneticillin, which are not indicated for the treatment of impetigo.

Referrals

In both surveys less than 1% of the children suffering from impetigo were referred to the dermatologist indicating that impetigo is a typical disease seen and treated by general practitioners. Although in 2001 boys more often consulted the GP for impetigo the referral rate between boys and girls are equal.

Limitations of this study

There are small differences in the design of the two national surveys, which might hinder the comparability of data. For example, in the first national survey, trained investigators coded diagnoses afterwards, whereas in the second national survey, the GPs coded the diagnoses themselves during the consultation. Furthermore, the participating GPs in the two national surveys may not be fully representative for the average GP in the Netherlands. This and the fact that their actions were recorded might distort our results.

Conclusions

We have shown an increased incidence of impetigo in the past decades, and marked regional differences in incidence. Further (microbiological) research of this observation may contribute to understanding the factors that determine the spread of impetigo. Secondly, we found a variety in the treatment of impetigo by GPs, which was incompatible with the national guideline.

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4

Incidence and management of acne in children and adolescents in Dutch general practice. A comparison between 1987 and 2001

Mohammedamin RSA, van der Wouden JC, Koning S, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Incidence and management of acne in children and adolescents in Dutch general practice. A comparison between 1987 and 2001 [submitted]

Abstract

Objective

Acne is a multifactorial disease and the most common skin disease among adolescents. The epidemiology is relatively unknown and there is debate about changes in the prevalence of acne in the population. We determined the incidence rate and management of acne in children and adolescents in general practice in 1987 and 2001.

Methods

We used data of all participants 10-24 years of age of the first (1987) and second (2001) Dutch national survey. All diagnoses, prescriptions and referrals were registered by participating general practitioners (GPs), 161 and 195 respectively. Both surveys concerned a longitudinal registration of GP consultations over 12 months.

Results

The incidence rate of acne in general practice decreased from 20.0 (1987) to 11.8 (2001) per 1000 person years. Girls, adolescents aged 15-19 years and non-western immigrants consulted the general practitioner more often with acne. Overall, general practitioners treated acne according to the clinical guideline.

Conclusions

In general practice the incidence rate of acne in children and adolescents decreased substantially which could be a consequence of changing consultation behaviour for acne or a decreasing prevalence in the population. More studies on the population prevalence of acne and help seeking behaviour in general practice are needed.

Background

Acne is the most common skin disease among adolescents, with estimates indicating that 80 to 95% of adolescents will suffer from acne [1,2,3,4]. The prevalence among school children is high ranging from 27.7% in 10-12 year olds to 93.3% in 16-18 year olds [4]. Acne is a multifactorial disease in which the *Propionibacterium acnes*, the rise in circulating androgen levels during puberty, and emotional stress and diet play an important role in the onset [1].

There is debate about changes in the prevalence of acne in the population. One study has reported a decrease of the prevalence of acne over the past decades [5] whereas some other studies reported that dermatologists are increasingly seeing adolescents with acne [6,7]. Available data can not indicate whether this is a true increase against the background of the increasing antibiotic resistence of *P. acnes* [8,9], or whether adolescents are simply more aware that dermatologists can do more to relieve acne and therefore present it more frequently [6]. It is unclear whether these changes can also be observed in general practice.

Although acne is not associated with severe morbidity, mortality or physical disability, it can have considerable psychological and social consequences [10,11,12]. Appropriate management of acne is therefore an important component of routine healthcare for general practitioners. Given the multifactorial etiology of acne, several potential targets for therapeutic intervention exist [1,2,3,13]. In 1991, the Dutch College of General Practitioners issued a clinical guideline for the diagnosis and treatment of acne [14]. In summary, therapy should be appropriately tailored to the severity of acne, with reliance on topical therapies (such as benzoylperoxide or salicylic acid, tretinoin or a topical antibiotic) for milder cases and judicious use of systemic antibiotics for inflammatory acne. Systemic retinoid should be used especially for severe acne. In females who prefer oral contraception, hormonal treatment is the first therapeutic option, provided there is no contraindication.

In the present study we compared the results of two consecutive surveys in general practice performed in 1987 and 2001 respectively and we aimed to know if the introduction of the clinical guideline for diagnosis and treatment of acne has influenced the management policy (prescriptions, referrals) of GPs. Against the background of the debate about the changing prevalence of acne in the population and its impact on those who were affected, it is important to establish the incidence of acne in daily practice. Knowledge about the contributing factors to the changing incidence might improve

the care for patients with acne in general practice and its prevention. Our research questions were:

- What was the incidence rate of acne in children and adolescents aged 10-24 in general practice and did this change between 1987 and 2001?
- Was the incidence rate of acne in general practice related to socio-demographic characteristics?
- How did the GP manage acne (prescription, referral) and did this change between 1987 and 2001?

Methods

We used data from the first and second Dutch national surveys of general practice, which were performed by the Netherlands Institute for Health Services Research (NIVEL) in 1987 and 2001. Each survey included a representative sample of the Dutch population. In the Netherlands, general practices have a fixed list size, and all inhabitants are listed in a general practice, and GPs have a gate-keeping role, meaning that, for example in the case of acne a dermatologist can only be consulted after referral by a GP. Usually, the first contact with health care, in a broad sense, is the contact with the general practitioner.

In 1987 a non-proportionally stratified sample of 161 GPs in 103 practices was selected randomly to participate in the first national survey [15]. With respect to age and gender the participating GPs and practices were representative of Dutch GPs and practices in 1987. The GPs were divided into four groups, and each group used registration forms to register data (e.g. diagnosis, prescription and referrals) on all contacts between patient and practice during one of four consecutive 3-month periods. Baseline characteristics such as age and gender were derived from patient records. Other socio-demographic characteristics such as socio-economic status (SES) and ethnic origin were obtained by a questionnaire and filled out by parents, or by the children themselves if they were older than 12 years (response rate 91.2%). SES was based on the father's occupation, which was categorized into five classes "non-manual work high (class I)", "non-manual work middle (class II)", "non-manual low and farmers (class III)", "manual work high / middle (class IV)" and "manual work low (class V)". Ethnic origin was derived from the country of birth of either parent. If either parent was born in Turkey, Africa, Asia (except Japan and Indonesia) and Central or South America, their children were considered to be children of non-western origin (in accordance with the classification of Statistics Netherlands). All other children were defined as western. The degree of urbanization was derived from the general practice's postal code and categorized into four classes "under 30,000 inhabitants", "30,000-50,000 inhabitants", "over 50,000 inhabitants" and

"the three large Dutch cities Amsterdam, Rotterdam and The Hague". The Netherlands were divided into a Northern, Central and Southern region. Season was divided into four categories: spring was defined as months April-June, summer as July-September, autumn as October-December and winter as January-March.
The diagnoses made by the GPs were coded afterwards by clerks using the International Classification of Primary Care (ICPC) [16].

In 2001, data about all physician-patient contacts over 12 months were derived from the electronic medical records of all listed patients in 104 practices (195 GPs) [17]. They registered all health problems presented within a consultation, and coded the diagnosis themselves using the ICPC. Patient demographic characteristics such as age and gender were derived from the GP's computerized patient files. As in 1987, SES and ethnicity were obtained by a questionnaire (response rate 76%). Degree of urbanization, region and season were derived as in 1987.

In both surveys each contact with the GP was defined as one consultation. All health problems presented within one consultation were recorded separately. Both surveys were episode orientated, meaning that a consultation on a new health problem marked the beginning of a new episode. If there were multiple consultations in a single episode, the diagnosis made during the last consultation was regarded as the episode-diagnosis. In 2001 we excluded nine practices from the analyses, mainly because of technical problems with registration.

Ethical approval

The study was carried out according to Dutch legislation on privacy. The privacy regulation of the study was approved by the Dutch Data Protection Authority. According to Dutch legislation, obtaining informed consent is not obligatory for observational studies.

Data-analysis

This study analyzed data from both surveys of children and adolescents aged 10-24 years presenting with acne which was coded as S96 (ICPC). Because of an underrepresentation of deprived areas, the 1987 survey population was weighted to the Dutch population of 1987. Incidence rate of acne were calculated by dividing the weighted number of new episodes (numerator) by the study population at risk (denominator).

In 2001 we calculated the incidence rate of acne by dividing the total number of new episodes (numerator) by the average study population at risk, the mid-time population (denominator). The mid-time population was calculated as the mean of all listed pa-

tients of all participating GPs, aged 10-24 years, at the beginning and at the end of the registration period. Data were stratified by age categories, gender, urbanization level, region, season, SES and ethnic origin. Incidence rates were expressed per 1000 person-years; 95% confidence intervals were calculated assuming a Poisson distribution. In this study we only included the first new episodes of acne.

Different groups of prescriptions at the first contact of each new episode were expressed as a proportion of the number of all new episodes. Referrals were expressed as a percentage of all new episodes.

Results

Study populations in 1987 and 2001

The study population in 1987 consisted of 78,470 children and adolescents 10-24 years of age yielding 19,618 person years. These children and adolescents had 392 episodes of acne during the one-year registration period. In 2001 the participating children and adolescents contributed 69,554 person-years (mid-time) to the follow-up. These children had 818 episodes of acne during the one-year registration period.

Incidence rate

Table 1 shows the distribution of incidence rates of acne in 1987 and 2001 in general practice stratified for several background characteristics. Compared to 1987, in 2001 the total incidence rate of acne decreased by 41%. Except SES class I and class III the incidence rate decreased in all subgroups (**table 1**).

In both surveys we found the highest incidence rate in the age category 15-19 years. In 2001, girls presented significantly more acne than boys to the GP. In 1987 we found the lowest incidence rate in the northern part of the Netherlands, whereas in 2001 the incidence rate was equal over all regions. In 1987, the incidence rate of acne was the lowest in rural areas (< 30,000 inhabitants) compared to suburban and urban areas, whereas in 2001 the incidence rate was equally distributed over all urbanization levels. In 1987 we observed the lowest incidence rate in autumn and spring and the highest in summer and winter, whereas in 2001 we observed the lowest incidence rate in spring and summer and the highest in autumn and winter. In 1987 we found the lowest incidence in SES class III and the highest in SES class V, whereas in 2001 the incidence rate was equally distributed over all classes. Compared to 1987, in 2001 the incidence rate of acne decreased significantly in class II, IV and V.
In both surveys non-western children and adolescents visited the GP more often with acne than western children and adolescents.

Table 1: Incidence rates per 1000 person years of all new episodes of acne in general practice in 1987 and 2001

	1987		2001		
	Incidence rates	**95% Confidence intervals**	**Incidence rates**	**95% Confidence intervals**	**P-value**
Age Categories					
10 – 14 years	**12.5**	11.0 – 14.1	**9.7**	8.4 – 11.0	0.007
15 – 19 years	**33.3**	31.1 – 35.5	**16.8**	15.1 – 18.6	< 0.001
20 - 24 years	**13.3**	12.0 – 14.7	**9.0**	7.8 – 10.3	< 0.001
Total	**20.0**	19.0 – 21.0	**11.8**	11.0 – 12.6	< 0.001
Gender					
Male	**19.9**	18.5 – 21.3	**9.1**	8.2 – 10.2	< 0.001
Female	**20.1**	18.7 – 21.5	**14.2**	13.0 – 15.5	< 0.001
Urbanization					
< 30,000	**14.7**	13.3 – 16.1	**10.9**	9.7 – 12.2	< 0.001
30,000 – 50,000	**23.2**	21.6 – 25.0	**11.3**	9.5 – 13.3	< 0.001
> 50,000	**20.4**	18.0 – 23.0	**12.3**	10.9 – 13.7	< 0.001
Big Cities[1]	**26.1**	20.7 – 32.4	**14.7**	11.2 – 18.8	0.001
Region					
Northern	**16.4**	14.7 – 18.2	**10.5**	8.7 – 12.6	< 0.001
Central	**20.5**	18.9 – 22.3	**11.8**	10.7 – 12.9	< 0.001
Southern	**20.2**	18.6 – 21.9	**12.1**	10.6 – 13.7	< 0.001
Season					
Winter	**21.1**	19.2 – 23.1	**13.8**	12.1 – 15.7	< 0.001
Spring	**17.5**	15.6 – 19.5	**10.4**	8.9 – 12.0	< 0.001
Summer	**24.4**	22.3 – 26.6	**9.2**	7.8 – 10.7	< 0.001
Autumn	**17.0**	15.1 – 19.0	**13.4**	11.7 – 15.2	0.007
SES[2]					
Class I	**16.5**	13.2 – 20.5	**10.8**	5.8 – 18.5	0.1
Class II	**18.4**	15.6 – 21.6	**6.1**	3.4 – 10.1	< 0.001
Class III	**15.4**	13.5 – 17.3	**10.5**	6.2 – 16.6	0.069
Class IV	**17.3**	15.1 – 19.8	**9.1**	5.0 – 15.3	0.002
Class V	**25.2**	22.4 – 28.3	**7.8**	5.0 – 11.5	< 0.001
Ethnic origin					
Natives & Western Immigrants	**18.2**	17.2 – 19.4	**10.8**	9.9 – 11.9	< 0.001
Non-Western Immigrants	**33.8**	26.3 – 42.7	**22.1**	17.3 – 27.9	0.02

1 = Amsterdam, Rotterdam, The Hague
2 = according to fathers' occupation

Prescriptions

In **table 2** we present the prescriptions in the first contact of an episode. Between 1987 and 2001 the percentage of prescriptions for systemic antibiotics decreased from 14.6 to 8.7; boys received considerably more frequently antibiotics. Compared to 1987, in

Table 2: Prescriptions in first contact of acne episode

	1987		2001	
	number(%)		number(%)	
Total number of episodes	**321(100)**[1]		**818(100)**[2]	
	boys	girls	boys	girls
	146(100)	175(100)	321(100)	497(100)
Oral antibiotic	**30(20.5)**	**17(9.7)**	**55(17.1)**	**16(3.2)**
Tetracyclines (tetracycline, minocycline, doxycycline)	28(19.2)	15(8.6)	48(15.0)	15(3.0)
Macrolides (erythromycin, clindamycin)	0(0.0)	1(0.6)	5(1.6)	1(0.2)
Other	2(1.4)	1(0.6)	2(0.6)	0(0)
Other oral drug	**1(0.7)**	**10(5.7)**	**9(2.8)**	**106(21.3)**
Cyproterone and estrogen	0(0)	7(4.0)	0(0)	102(20.5)
Other	1(0.7)	3(1.7)	9(2.8)	4(0.8)
Anti-acne dermatologicals	**102(69.9)**	**123(70.3)**	**141(43.9)**	**315(63.4)**
Benzoyl Peroxide	69(47.3)	88(50.3)	92(28.7)	127(25.6)
Clindamycin	13(8.9)	16(9.1)	47(14.6)	74(14.9)
Erythromycin	6(4.1)	5(2.9)	73(22.7)	101(20.3)
Tretinoin	6(4.1)	8(4.6)	23(7.2)	12(2.4)
Other	8(5.5)	6(3.4)	6(1.9)	2(0.4)
Topical antibiotic	**1(0.7)**	**2(1.1)**	**8(2.5)**	**13(2.6)**
Other dermatologicals	**4(2.7)**	**7(4.0)**	**10(3.1)**	**18(3.6)**
Unknown	**26(17.8)**	**27(15.4)**	**14(4.4)**	**21(4.2)**
No prescription in 1st contact	**16(11.0)**	**18(10.3)**	**48(15.0)**	**95(19.1)**

1 = unweighted number of new episodes
2 = number of new episodes in the mid-time population

2001 much more systemic hormonal treatments were prescribed in girls. In both surveys the majority of acne were treated by anti-acne dermatologicals; in 1987 the GPs mostly prescribed benzoyl peroxide whereas in 2001 benzoyl peroxide, topical erythromycin and clindamycin were the most prescribed drugs. In 1987, in 10.6% of the episodes the GPs did not prescribe any treatment at the first contact whereas in 2001 this percentage was 17.5%.

Referrals

Forty-eight (12.2%) and 104 (12.7%) of the patients with acne were referred to a dermatologist in 1987 and 2001 respectively. In 1987 the boys to girls ratio of referred children was 1:1, whereas in 2001 this was 3:2. In 1987 we found the highest referral rate in the age group 20 – 24 years whereas in 2001 this was in the age group 15 – 19 years.

Discussion

Incidence and sociodemographics

We observed a decrease of 41% of the incidence rate of acne encountered in general practice over the past 14 years which is consistent with a previous study performed in the Netherlands [18]. As reported elsewhere the overall consultation rate in Dutch general practice (second Dutch national survey) decreased by 22% in children (0-17 years) over the past 14 years [19] which could partly explain our finding. Probably our finding is a consequence of a decreased prevalence in the population as reported by Stathakis et al [5].

Currently, little information is available about children and adolescents that use self-care strategies and do not seek medical help for their acne. Cardol et al reported that in 2001 patients' attitudes showed a shift away from consulting their GP for minor ailments which are self-limiting and could be relieved with over-the-counter medication or other self-care strategies [20]. Nowadays more over-the-counter medication for acne is available and it is quite conceivable that adolescents apply more self-care strategies and consequently seek less medical help, which could fit in our finding assuming that acne is a minor ailment. This should have consequences for the treatment policy of the GPs, because the GPs will see the more severe cases in which self-care strategies have failed.

Girls and adolescents aged 15-19 years visited the GP more often concerning acne than boys and persons from other age groups respectively, which is in accordance with previous studies [18,21]. However, the prevalence of acne in the population in this age group was found to be higher in boys [4,22,23]. Probably girls are more sensitive for the esthetic aspects of the disease. A previous study reported that girls suffering from acne had higher levels of emotional and behavioural difficulties [12].

In 1987 we found a striking regional variation in the incidence rate of acne, which is especially noteworthy for a small country like the Netherlands. Compared to the northern part, we found higher incidence rates of acne in the central and southern part of the Netherlands. In 2001 this variation had decreased. We also observed the lowest incidence rate of acne in general practice in rural areas (< 30,000) compared to suburban and urban areas. Epidemiological data on acne in general practice are scarce. This regional variation and the differences in urbanization levels have never been reported earlier.

The seasonal variability as occurred in 2001 is in accordance with previous studies [5,18] showing an exacerbation in the colder months and an improvement in the warmer months. However, the seasonal variability as occurred in 1987 is different from 2001. In 1987 we strikingly observed the highest incidence rate of acne in summer.

In both surveys children non-western children and adolescents consulted their GP more often with acne. The significantly higher consultation rate in non-western children might explain this difference [19]. This finding is supported by another previous study that reported that elderly, less educated, and non-western inhabitants in the Netherlands are lagging behind the changing trend, and continuing to consult GPs for minor ailments [20]. Possibly, children of non-western immigrants suffer more from acne. A previous study reported that non-western immigrants in the Netherlands more often felt unhealthy [17].

In 1987 we found the higher incidence rates of acne in general practice in the lower SES classes, which is consistent with a previous study [18]. However, in 2001 the incidence rate was similar in all classes, but strikingly the incidence rate decreased considerably in the lower SES classes.

Prescriptions

Between 1987 and 2001 the prescription of oral hormonal treatments in girls increased from 4.0% to 20.5%. In 2001 the GPs prescribed less oral antibiotics. These changes in treatment strategies may have been influenced by the introduction of the clinical guideline for the diagnosis and treatment of acne by the Dutch College of General Practitioners in 1991 [14].
In both surveys the majority of acne cases were treated with topical anti-acne dermatologicals which is also consistent with the clinical guideline.

In both surveys boys received much more oral antibiotics than girls which is in agreement with a previous study performed in general practice in north-east England [21]. As reported elsewhere boys are more frequently affected and had more severe acne than girls especially in the puberty, which might contribute to this issue [4,6]. In adolescence girls start with oral hormonal contraceptives which might be another explanation that boys received more oral antibiotics.

Referrals

The boys to girls ratio of referred patients concerning acne strikingly changed from 1:1 (1987) to 3:2 (2001). As suggested earlier, girls may be more sensitive for the esthetic reasons of the disease and therefore consulted the GP more often than boys in 2001.

However, a higher proportion of boys were referred to the dermatologist indicating that boys, especially during puberty, more often suffer from moderate to severe acne as reported in previous studies [1,4,22]. This might be a consequence of the rise in circulating androgen levels during puberty in boys [1].

Strenghts and limitations of the study

These two large and representative surveys give a comprehensive assessment of the morbidity in children and adolescents in general practice, and enabled us to accurately estimate epidemiological data on acne and a comparison between two points in time.

There were small differences in the design of the two national surveys, which might disturb the comparability of data. ICPC coding was not performed identically in both surveys: in 1987 clerks coded diagnoses afterwards, whereas in 2001 the GPs coded the diagnoses themselves during the consultation. We assume that coding by clerks more often led to a specific diagnostic ICPC code. In our analysis we assumed that the diagnoses were coded correctly. In 2001, the participating GPs were trained in coding the diagnoses using ICPC codes. These trained GPs classified diagnoses correctly in about 81% of the test cases [24].

Conclusions

In general practice the incidence rate of acne in children and adolescents decreased substantially which could be a consequence of changing consultation behaviour for acne or a decreasing prevalence in the population. More studies on the population prevalence of acne and help seeking behaviour in general practice are needed.
The participating GPs treated acne according to the clinical guideline for general practice.

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Incidence and management of warts in children in Dutch general practice. A comparison between 1987 and 2001

Mohammedamin RSA, van der Wouden JC, Koning S, van der Linden MW, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Incidence and management of warts in children in Dutch general practice. A comparison between 1987 and 2001 [submitted]

Abstract

Background

Warts appear commonly in children. The epidemiology is relatively unknown, and no single treatment has been defined as most effective. We assessed the self-reported prevalence of warts in children (0-17 years) and which proportion of these children sought medical help. Further we determined the incidence rate and management of warts in children in general practice in 1987 and 2001.

Methods

We used data of all children 0-17 years of age of the first (1987) and second (2001) Dutch national survey. All diagnoses, prescriptions and referrals were registered by participating general practitioners (GPs), 161 and 195 respectively. To assess the prevalence of warts and medical helpseeking we used additional health interview data of the second Dutch national survey. Both surveys concerned a longitudinal registration of GP consultations over 12 months.

Results

The self-reported prevalence of warts in children is 6.2%, and 23.3% of these children consulted the general practitioner for warts. The incidence rate of warts in general practice decreased from 44.5 (1987) to 32.1 (2001) per 1000 person years. Girls, especially in puberty, and natives consulted the general practitioner more often with warts. General practitioners treated the majority of warts by applying cryotherapy with salicylic acid on the second place.

Conclusions

The incidence rate of warts in general practice has decreased, probably due to changing consultation behaviour. The self-reported prevalence has hardly changed over time. General practitioners do not follow evidence-based knowledge on the effectiveness of different treatments.

Background

Cutaneous warts are discrete benign epithelial proliferations caused by the human papillomavirus [1] that mostly affects hands and feet [2]. Warts can be painful depending on their location (plantar and near the nails), and may cause embarrassment and a negative appraisal by others [1,3,4,5]. In general practice warts are one of the four most frequent diseases and the most common skin disease in children [6].

Currently, limited information about the epidemiology of warts in children in the population is available. The prevalence among schoolchildren varies from 2-22% [7,8,9,10]. Region, social class, family size and ethnic origin are related to the incidence of warts [9]. Some studies have suggested that wart frequency in the population has been increasing during the past decades [7,11]. However, the incidence rate of warts in Dutch general practice decreased between 1987 and 2001 [6]. This change is poorly understood and it is unknown whether this change is related to socio-demographic characteristics.

Only a small proportion of children with sufficient complaints have parents that seek professional medical help. These patients represents the "tip of the iceberg" [12]. No data about the "shape" of the iceberg of patients infected with warts in the Netherlands has been previously available.
Warts continue to be a therapeutic challenge and no treatment has been defined as the gold standard. Conventional methods which are painful and poorly tolerated by children, attempt to destroy infected tissue in a non-specific way. Topical treatments containing salicylic acid have a therapeutic effect, but cryotherapy is less efficious [1,2,13].

The present study relies on two large consecutive surveys performed in general practice and aimed to gain more insight in the epidemiology and management of warts in children.
Our research questions were:

- What is the self-reported prevalence of warts in children aged 0-17 years and what proportion of these children consulted the GP for warts?
- What is the incidence of warts in general practice in children aged 0-17 and the GP's management; did it change between 1987 and 2001?

Methods

We used data from the first (1987) and second (2001) Dutch national survey of general practice, performed by the Netherlands Institute for Health Services Research (NIVEL).

Both surveys included a representative sample of the Dutch population. In the Netherlands, general practices have a fixed list size, all inhabitants are listed in a general practice, and GPs have a gate-keeping role.

Dutch national survey I (1987)

A non-proportionally stratified sample of 161 GPs in 103 practices was selected randomly [14]. The participating GPs and practices were representative for Dutch GPs and practices in 1987 with respect to age and gender. Because there was an underrepresentation of solo practices and practices in deprived areas, the population was weighted to the Dutch population of 1987. The GPs were divided into four groups and each group registered data (e.g. diagnosis, prescription and referrals) about all contacts between patient and practice during one of four consecutive 3-month periods. Patient demographic characteristics (age and gender) were derived from patient records. Socioeconomic status (SES) and ethnic origin were obtained by a questionnaire and filled out by parents, or by the children themselves if they were older than 12 years (response rate 91.2%). Ethnic origin was derived from country of birth from either parent. Degree of urbanization was derived from the practice's postal zip code and categorized into four classes. The Netherlands were divided into a Northern, Central and Southern region. The diagnoses made by the GPs were coded afterwards by clerks using the International Classification of Primary Care (ICPC) [15].

Dutch national survey II (2001)

195 GPs in 104 practices registered data about all physician-patient contacts during 12 months [16]. All health problems were coded (ICPC) by the GPs themselves during the consultation. Patient demographic characteristics (age and gender) were derived from the GPs computerized patient files. As in 1987, SES and ethnic origin were obtained by a questionnaire (response rate 76%). Degree of urbanization, region and season were derived in a similar way as in 1987. Contrary to 1987, in 2001 therapeutic interventions apart from prescriptions were registered by only a part of the practices (N=72) during a part of the registration period (6 weeks).

In both surveys each contact with the practice was defined as one consultation and recorded separately. Both surveys were episode orientated, meaning that a consultation on a new health problem marked the beginning of a new episode. If there were multiple consultations in a single episode, the diagnosis made during the last consultation was regarded as the episode-diagnosis. In 2001 we excluded nine practices from analysis, mainly because of technical problems with registration.

To assess the prevalence of warts in the population and to determine if childhood warts seen by physicians represent the "tip of the iceberg", we used additional health interview data of the second Dutch national survey in 2001 (similar data of 1987 were not available). Patients were invited to participate in a health interview (response rate 65%) after they were selected randomly (5% sample) from the list of the participating GPs. One of the questions in the interview was whether the participants had suffered from warts during fourteen days before the interview. The interview was conducted with one parent or caretaker as a proxy when the child was younger than 12 years. In children 12 through 17 years old the interview was done in the presence of a parent or caretaker.

Ethical approval

The study was carried out according to Dutch legislation on privacy. The privacy regulation of the study was approved by the Dutch Data Protection Authority. According to Dutch legislation, obtaining informed consent is not obligatory for observational studies.

Data-analysis

Self-reported prevalence of warts was expressed as the proportion of those who reported to suffer from warts, divided by the number of children interviewed, stratified for sociodemographic characteristics. Among these children we assessed the proportion of those who consulted the GP for their warts, the so called helpseekers, and those who did not consult the GP for their warts, the so called non-helpseekers. We defined helpseekers as those who reported to suffer from warts and consulted their GP within 14 days before and 3 months after the interview, and in whom the GP made the diagnosis of warts or a diagnosis of another skin disease that may be confused with warts by the lay public. The diagnosis made by the GP in these consultations are listed in the appendix. Differences between helpseekers and non-helpseekers were assessed at a significance level of 5% using the Pearson Chi-Square test for categorical variables and the Linear-by-Linear Association test for ordinal variables.

From both surveys data of children aged 0-17 years were analyzed. Incidence rates of warts in general practice were calculated by dividing the number of new episodes with ICPC code S03 (numerator) by the average study population at risk, the so called mid-time population (denominator). The mid-time population was calculated as the mean of all listed patients of all participating GPs, aged 0-17 years, at the beginning and at the end of the registration period. Incidence rates were expressed per 1000 person years. 95% confidence intervals of incidence rates were calculated assuming a Poisson distribution.

Results

Study populations in 1987 and 2001

The study population in 1987 consisted of 86,577 children aged 0–17 years yielding 21,644 person years. In 2001 the study population consisted of 87,952 children aged 0–17 years yielding 81,716 person years.

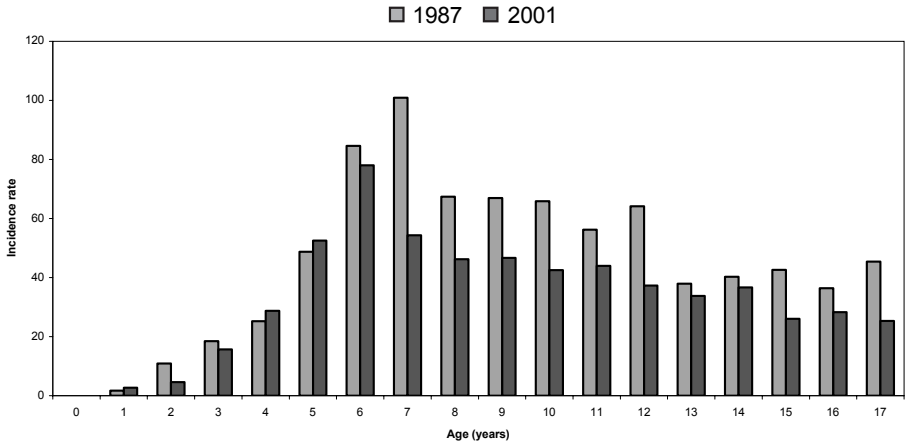
Self reported prevalence of warts and help seeking

In total 2847 children aged 0–17 years were interviewed in 2001 about their health status; of these 176 (6.2%) reported to suffer from warts**.** From these 176 children 41 (23.3%) sought medical help and the GP diagnosed warts or a warts-like diagnosis. In only 20 (11.4%) of the 176 children the GP made the diagnosis warts within a time window of 14 days before and 3 months after the health interview. We repeated this analysis for different time windows and found almost similar results.

Table 1 shows the distribution of the self-reported prevalence of warts during the previous 2 weeks stratified for sociodemographic characteristics. The highest prevalence were found in the age category 5-9 and 10-14 years. Infants (< 1 year) did not suffer from warts. **Table 1** also shows a comparison in socio-demographic characteristics of helpseekers versus non-helpseekers; there were no differences between these two groups.

Incidence rate of warts in general practice

In 1987, the GPs saw 963 episodes of warts. Of these episodes 76.2% consisted of a single contact with the GP. In 2001, the GPs saw 2625 episodes of warts. Of these episodes 71.8% consisted of a single contact with the GP.



Figuur 1: Incidence rates of warts in general practice per 1000 person years

Table 1: Prevalence of warts among 2847 children aged 0-17 years in the population during two weeks and socio-demographic characteristics of medical helpseekers versus non-helpseekers

	self-reported prevalence (%) N0 = 176	95% Confidence Intervals (%)	helpseekers (N1 = 41) (%)	non-helpseekers (N2 = 135) (%)	P-value
Age categories					
< 1 year	**0**	0	0	0	0.646
1 – 4	**3.7**	2.4 – 5.5	17.1	14.1	
5 – 9	**8.4**	6.6 – 10.6	46.3	40.0	
10 – 14	**7.2**	5.5 – 9.2	29.3	37.0	
15 – 17	**3.7**	2.1 – 6.1	7.3	8.9	
Total	**6.2**	5.3 – 7.2	100	100	
Gender					
Boys	**5.9**	4.7 – 7.3	46.3	48.9	0.941
Girls	**6.5**	5.2 – 8.0	53.7	51.1	
Urbanization					
< 30,000	**5.3**	4.1 – 6.7	31.7	39.3	0.257
30,000-50,000	**7.2**	5.1 – 9.9	19.5	22.2	
> 50,000	**7.2**	5.5 – 9.2	43.9	34.1	
Big Cities[1]	**4.6**	2.0 – 9.1	4.9	4.4	
Region					
Northern	**6.5**	4.4 – 9.4	15.0	16.3	0.677
Central	**6.6**	5.4 – 7.9	55.0	60.0	
Southern	**5.5**	4.0 – 7.4	30.0	23.7	
SES[2]					
Non-manuel high	**5.1**	3.7 – 6.7	30.3	35.8	0.544
Non-manuel middle	**7.5**	5.6 – 9.8	45.5	33.9	
Non-manuel low & farmers	**7.0**	4.0 – 11.3	6.1	12.8	
Manuel high/middle	**6.2**	3.2 – 10.9	12.1	7.3	
Manuel low	**5.7**	3.0 – 9.7	6.1	10.1	
Ethnicity					
Natives & Western Immigrants	**6.3**	5.3 – 7.5	97.1	93.0	0.276
Non – Western Immigrants	**4.3**	2.0 – 8.2	2.9	7.0	

N0 = children who reported to suffer from warts in the population
N1 = children who suffer from warts and consulted the GP within 14 days before and 3 months after the interview
N2 = children who suffer from warts and did not consulted the GP within this timeframe
1 = Amsterdam, Rotterdam, The Hague
2 = according to fathers' occupation

Figure 1 represents the distribution of incidence rates of warts presented to the GP by age in years. In 1987 the peak incidence rate was found at the age of seven whereas in 2001 this peak reached at the age of six. On almost each age between 0-17 the incidence rate of warts presented to the GP was higher in 1987.

Table 2: Incidence rates of warts per 1000 person years in Dutch general practice in 1987 and 2001

		1987		2001	
		Incidence rates	**95% Confidence intervals**	**Incidence rates**	**95% Confidence intervals**
Age categories					
< 1 year		**0**	0 – 2.8	**0**	0 – 0.8
1 – 4 years	boys	**12.7**	8.5 – 18.2	**12.2**	10.1 – 14.7
	girls	**15.0**	10.2 – 21.1	**12.5**	10.2 – 15.1
5 – 9 years	boys	**71.5**	62.2 – 81.7	**48.4**	44.6 – 52.5
	girls	**75.5**	65.6 – 86.4	**55.7**	51.4 – 60.2
10 – 14 years	boys	**41.4**	34.3 – 49.5	**34.4**	31.2 – 38.0
	girls	**63.4**	54.5 – 73.4	**37.3**	33.9 – 41.0
15 – 17 years	boys	**39.2**	31.5 – 48.1	**18.3**	15.3 – 21.8
	girls	**42.3**	33.8 – 52.1	**30.8**	26.7 – 35.3
Total		**44.5**	41.7 – 47.4	**32.1**	30.9 – 33.4
Gender					
Boys		**40.6**	36.9 – 44.5	**29.4**	27.8 – 31.1
Girls		**48.7**	44.6 – 53.1	**34.5**	32.7 – 36.3
Urbanization					
< 30,000		**40.1**	35.7 – 44.9	**32.5**	30.7 – 34.5
30,000-50,000		**43.1**	38.7 – 48.0	**33.0**	30.1 – 36.0
> 50,000		**61.2**	54.1 – 69.0	**28.7**	26.7 – 30.9
Big cities[1]		**29.8**	22.6 – 38.6	**24.1**	20.1 – 28.7
Region					
Northern		**49.4**	40.9 – 59.0	**35.2**	31.8 – 38.8
Central		**42.8**	39.4 – 46.4	**31.1**	29.5 – 32.7
Southern		**46.7**	41.1 – 52.9	**32.7**	30.4 – 35.1
Season					
Winter		**47.2**	41.3 – 53.8	**31.3**	28.9 – 33.9
Spring		**44.1**	39.1 – 49.6	**33.2**	30.7 – 35.8
Summer		**31.4**	26.4 – 37.1	**31.9**	29.5 – 34.4
Autumn		**52.5**	46.8 – 58.6	**30.9**	28.5 – 33.3
SES[2]					
Non-manuel high		**53.4**	46.9 – 60.4	**35.5**	33.1 – 38.1
Non-manuel middle		**50.9**	42.8 – 60.1	**37.1**	34.2 – 40.2
Non-manuel low & farmers		**39.7**	28.0 – 54.8	**36.8**	31.8 – 42.3
Manuel high/middle		**44.5**	37.8 – 51.9	**37.7**	32.2 – 43.9
Manuel low		**39.9**	33.1 – 47.8	**31.0**	26.9 – 35.7
Ethnicity					
Natives & Western Immigrants		**47.1**	43.7 – 50.7	**36.2**	34.6 – 37.9
Non-Western Immigrants		**27.4**	18.9 – 38.5	**30.0**	25.6 – 34.8

1 = Amsterdam, Rotterdam, The Hague
2 = according to fathers' occupation

Table 2 shows the distribution of the incidence rates of warts in general practice between 1987 and 2001, stratified for socio-demographic characteristics. The total incidence rate decreased by 28% from 44.5 (1987) to 32.1 (2001). In both surveys the highest incidence rate were found in age category 5-9 years. Girls showed a higher incidence rate of warts presented to the GP, but we found the most striking differences in gender among 10-14 year olds in 1987 and among 15-17 year olds in 2001.

In 1987 we found the highest incidence rate in cities (> 50,000 inhabitants) and the lowest in the three big cities whereas in 2001 the incidence rate was similar over all urbanization levels. Except for the three big cities in 2001 the incidence rate decreased over all urbanization levels. In both surveys the incidence rate is similar among all regions. In 1987 the lowest incidence rate was found in summer whereas in 2001 all seasons showed the same incidence rates. Except for summer, in 2001 the incidence rate decreased in all seasons. In 1987 the highest incidence rate was found in SES class I and class II whereas in 2001 these two classes showed a striking decrease. In both surveys natives and western immigrants presented more often with warts to the GP than non-western immigrants, but the difference became smaller in 2001. In 1987 the incidence rate of warts was higher in practices that treated warts with cryotherapy.

Management of warts in general practice.

Table 3 shows rates of prescriptions, therapeutic interventions and referrals concerning warts per 100 episodes in 1987 and 2001. In both surveys the prescription rate was similar and salicylic acid was the most frequently prescribed treatment. In both surveys the majority of warts were treated with cryotherapy. The rate of surgery and referrals decreased by about 50% in 2001. Practices that did not apply cryotherapy had a considerable higher referral rate in both surveys.

Table 3: Prescriptions, interventions and referrals of children with warts per 100 episodes

	1987	2001
All prescriptions	23.1	23.9
Salicylic acid	11.1	10.3
Antiseptic	0.5	0.6
Emollients	0.3	2.3
Others	11.1	10.8
Cryotherapy (liquid nitrogen)	58.0	48.0
Surgery	8.0	4.8
All referrals	6.1	3.1
Referrals in practices applying cryotherapy	2.1	2.6
Referrals in practices not applying cryotherapy	18.1	7.9

Discussion

Summary of main findings

The self-reported prevalence of warts among Dutch children (0-17 years) is 6.2%; of these children 23.3% consulted the GP for warts.
Between 1987 and 2001 the total incidence rate of warts presented to the GP decreased by 28%.
In both surveys GPs treated the majority of children with warts by applying cryotherapy (liquid nitrogen) with salycilic acid on the second place. In 2001 GPs referred fewer children to secondary care compared to 1987.

Strenghts and limitations of the study

These two large representative and comprehensive surveys enabled us to assess accurately epidemiological data on warts in children. For this study data of only two points in time were available. Actually to identify a sustained trend of the incidence of warts in general practice data of multiple points in time are needed. Although our health interview had a response rate of 65%, the responders were representative for the Dutch population [17].

There were small differences in the design of the two national surveys, which might disturb the comparability of data. For example ICPC coding of the diagnoses was not performed equally in both surveys: in 1987 clerks coded diagnoses afterwards, whereas in 2001 the GPs coded the diagnoses themselves during the consultation.

Comparison with existing literature

The self-reported prevalence in our study is consistent with one previous study performed among Romanian school children (6-12 years) showing a prevalence of 6.3% [10]. A Dutch study (1959) among schoolchildren reported a prevalence of 7.2%; the prevalence in our study among children of the same age (5-14 years) is 7.8% indicating that the prevalence has hardly changed over time [5].
No data about the so-called iceberg phenomenon of warts in the Netherlands is available. A Dutch study showed that 28% of the children (0-14 years) that reported to suffer from skin diseases consulted their GP for that reason [18].

The decrease in incidence rate of warts in general practice, which is in proportion to the decreasing overall GP consultation rate in the Netherlands [6], is not consistent with a previous study which has been performed in four practices in the eastern part of the Netherlands [19]. The decreasing overall GP consultation rate is a consequence of changing patients' attitudes showing a shift away from consulting their GP for minor

ailments [20]. Assuming that warts are a minor ailment the decreased incidence rate could be explained by a changing patients' attitude. Further it is unclear whether the proportion of children suffering from warts used over-the-counter medication or other self-care strategies and did not seek medical help, has changed over time.

In both surveys, girls especially between 10-17 years, visited the GP more often concerning warts, which is in accordance with a previous study [19]. However most large studies have found no evidence of a sex difference in wart prevalence [7]. Probably girls are more sensitive for the esthetic aspects of the disease.

Williams et al. reported in 1993 that being a resident in the south of Britain, having a father with non-manual occupation and belonging to an ethnic group other than white European were associated with a decreased risk of warts [9]. Beside ethnic origin our results are different. Natives and western immigrants more often consulted the GP concerning warts.

The majority of patients with warts were treated with cryotherapy (liquid nitrogen), although the evidence for this treatment is weak [1,2,13]. Probably the use of cryotherapy is simple and safe. In both surveys Dutch GPs chose for salicylic acid if it came to a prescription, which is in accordance with evidence about efficacy [1,2,13].
In 2001 more practices (85%) provided cryotherapy than in 1987 (70%). However, in 2001 the use of cryotherapy and surgery (**table 3**) is lower than in 1987. Probably patients used primarily self-care strategies and consulted their GP in a later phase of the disease which should have consequences for the GP's management and choice of treatment. In both surveys about 11% of the prescriptions (**table 3**) were magistral preparations. In both surveys practices that did not apply cryotherapy had a considerable higher referral rate.

Implications for future research or clinical practice

More insight should be gained in what proportion of children with warts primarily apply self-care and do not seek medical help or consult their GP in a later phase of the disease.
More high quality randomized controlled trials should be performed in order to confirm the efficacy of cryotherapy (liquid nitrogen) in the treatment of warts.

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Appendix

Skin diseases and the corresponding ICPC [15] codes diagnosed by the GP among helpseekers:

S03 Warts
S05 Lumps / swellings generalized
S06 Rash localized
S11 Skin infection post-traumatic
S20 Corn / callosity
S74 Dermatophytosis
S75 Moniliasis / candidiasis skin
S82 Naevus / mole
S87 Dermatitis / atopic eczema
S88 Dermatitis contact / allergic
S90 Pityriasis rosea
S93 Sebaceous cyst
S95 Molluscum contagiosum

6

Incidence and management of dermatophytosis in children in general practice. A comparison between 1987 and 2001

Mohammedamin RSA, van der Wouden JC, Koning S, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Incidence and management of dermatophytosis in children in general practice. A comparison between 1987 and 2001 [submitted].

Abstract

Background

Dermatophytosis is a common skin infection in children. Although the epidemiology is relatively unknown it is becoming a major health problem in some countries.

Objectives

To determine the incidence and management of dermatophytosis in Dutch general practice, and assess trends between 1987 and 2001.

Methods

We used data of all children aged 0-17 years derived from two national surveys performed in Dutch general practice in 1987 and 2001 respectively. Both surveys concerned a longitudinal registration of GP consultations over 12 months. All diagnoses, prescriptions and referrals were registered by the participating general practitioners (GPs), 161 and 195 respectively.

Each disease episode was coded according to the International Classification of Primary Care. Incidence rates were calculated by dividing all new episodes by the average study population at risk. Data were stratified for socio-demographic characteristics.

Results

Compared to 1987, in 2001 the total incidence rate of dermatophytosis in children in general practice increased. Infants (< one year), girls, children in rural areas and children of non-western immigrants more often consulted the GP for dermatophytosis in 2001

In both surveys GPs treated the majority of children with dermatophytosis with topical drugs, especially with azoles.

Conclusions

The incidence rate of dermatophytosis in children in general practice increased; however it is unclear whether this is a consequence of an increasing prevalence in the population or a changing help seeking behaviour. GPs generally follow the national guideline for the treatment of dermatophytosis in children which is in accordance with evidence-based knowledge on the effectiveness of different therapies.

Background

Superficial fungal skin infections (dermatophytosis) caused by dermatophytes are known as *tinea* and will have a specific name depending on body location, as in tinea *capitis*, tinea *corporis*, or tinea *pedis* [1]. Dermatophytoses are common in children [2,3,4].

Little data is available about the epidemiology of dermatophytosis in children in the population. Most studies in this field dealt with adults or with a specific form of dermatophytosis. The few surveys performed in children reported a prevalence that varies from 2.5 – 15.2% [5,6,7] and differ from country to country. Tinea *capitis* is predominantly a disease of children, especially under 12 years of age, and rare in adults [2,3,4,7,8,9,10,11,12]. The frequency of tinea *capitis* is declining in developed nations; however in the United Kingdom and the United States it is becoming a major public health problem, and Afro-Caribbean children are particularly affected [5,9,10,11,12,13]. Data about the other forms of dermatophytosis in children are relatively limited available.

Initial analysis by Otters et al showed that the incidence rate of dermatophytosis in children in Dutch general practice has increased between 1987 and 2001 [14]. It is unclear whether this increase reflected an increase of the incidence in the population and is related to socio-demographic characteristics. Knowledge about the factors contributing to the increasing incidence might improve the care for patients with dermatophytosis in general practice and its prevention.

Both topical and oral treatments are proven to be effective [15,16,17]. However, in a British study only 7% of children had received appropriate treatment for tinea *capitis* before referral to dermatology practice [11]. The evaluation of management of dermatophytosis in children in general practice is therefore important. In 1997, the Dutch College of General Practitioners issued a clinical guideline for the diagnosis and treatment of dermatophytosis for all ages [18]. We do not have a clear insight in the degree of application of this guideline in children.

In the present study we compared the results of two consecutive surveys in general practice performed in 1987 and 2001 respectively and aimed to answer the following research questions:

- What was the incidence rate of dermatophytosis in children aged 0-17 in general practice in 1987 and in 2001?
- Were these incidence rates related to socio-demographic characteristics?
- How did the GP manage dermatophytosis (prescription, referral) and did this change between 1987 and 2001?

Methods

We used data from the first and second Dutch national surveys of general practice, which were performed by the Netherlands Institute for Health Services Research (NIVEL) in 1987 and 2001. Each survey included a representative sample of the Dutch population. In the Netherlands, general practices have a fixed list size, all inhabitants are listed in a general practice, and GPs have a gate-keeping role. Usually, the first contact with health care, in a broad sense, is the contact with the general practitioner.

In 1987 a non-proportionally stratified sample of 161 GPs in 103 practices was selected randomly to participate in the first national survey [19]. With respect to age and gender the participating GPs and practices were representative of Dutch GPs and practices in 1987. The GPs were divided into four groups, and each group used registration forms to register data (e.g. diagnosis, prescription and referrals) on all contacts between patient and practice during one of four consecutive 3-month periods. Baseline characteristics such as age and gender were derived from patient records. Other socio-demographic characteristics such as socio-economic status (SES) and ethnic origin were obtained by a questionnaire and filled out by parents, or by the children themselves if they were older than 12 years (response rate 91.2%). SES was based on the father's occupation, which was categorized into five classes "non-manual work high (class I)", "non-manual work middle (class II)", "non-manual low and farmers (class III)", "manual work high / middle (class IV)" and "manual work low (class V)". Ethnic origin was derived from the country of birth of either parent. If either parent was born in Turkey, Africa, Asia (except Japan and Indonesia) and Central or South America, their children were considered to be children of non-western origin (in accordance with the classification of Statistics Netherlands). All other children were defined as western. The degree of urbanization was derived from the general practice's postal code and categorized into four classes "under 30,000 inhabitants", "30,000-50,000 inhabitants", "over 50,000 inhabitants" and "the three large Dutch cities Amsterdam, Rotterdam and The Hague". The Netherlands were divided into a Northern, Central and Southern region. Season was divided into four categories: spring was defined as months April-June, summer as July-September, autumn as October-December and winter as January-March. The diagnoses made by the GPs were coded afterwards by clerks using the International Classification of Primary Care (ICPC) [20].

In 2001, data about all physician-patient contacts over 12 months were derived from the electronic medical records of all listed patients in 104 practices (195 GPs) [21]. The GPs registered data on diagnosis, prescriptions and referrals, and coded the diagnosis themselves using the ICPC. Patient demographic characteristics such as age and gender

were derived from the GP's computerized patient files. As in 1987, SES and ethnicity were obtained by a questionnaire (response rate 76%). Degree of urbanization, region and season were defined as in 1987.

In both surveys each contact with the GP was defined as one consultation. All health problems presented within one consultation were recorded separately. Both surveys were episode orientated, meaning that a consultation on a new health problem marked the beginning of a new episode. If there were multiple consultations in a single episode, the diagnosis made during the last consultation was regarded as the episode-diagnosis. In both surveys all prescriptions were coded according to the ATC classification (Anatomical-Therapeutical-Chemical) [22]. Concerning referrals, the GPs registered the indication and specialism of referral. In 2001 we excluded data from nine practices from the analyses, mainly because of technical problems with registration.

Ethical approval

The study was carried out according to Dutch legislation on privacy. The privacy regulation of the study was approved by the Dutch Data Protection Authority. According to Dutch legislation, obtaining informed consent is not obligatory for observational studies.

Data-analysis

This study analyzed data from both surveys for children aged 0-17 years presenting with dermatophytosis which was coded as S74 (ICPC). Because of an underrepresentation of deprived areas, the 1987 survey population was weighted to the Dutch population of 1987. Incidence rates were calculated by dividing the weighted number of new episodes (numerator) by the study population at risk (denominator).

For 2001 we calculated the incidence rate of dermatophytosis by dividing the total number of new episodes (numerator) by the average study population at risk, the mid-time population (denominator). The mid-time population was calculated as the mean of all listed patients of all participating GPs, aged 0-17 years, at the beginning and at the end of the registration period. Data were stratified by age, gender, urbanization level, region, season, SES and ethnic origin. Incidence rates per 1000 person-years and 95% confidence intervals were calculated assuming a Poisson distribution. In both surveys, we only included the first new episode for every child. Thus we excluded two recurrent episodes in 1987 and 77 in 2001.
Prescriptions and referrals were expressed as proportions of all new episodes.

Results

Study populations in 1987 and 2001

The study population in 1987 consisted of 86,577 children aged 0-17 years yielding 21,644 person years. These children had 559 contacts concerning dermatophytosis which contributed to 450 episodes; 85.3% of these episodes included a single contact with the GP. In 2001 there were 87,952 children yielding 81,716 person-years. These children had 2318 contacts concerning dermatophytosis which contributed to 2007 episodes; 88.2% of these episodes consisted of only one contact with the GP.

Incidence rate

Table 1 shows the distribution of incidence rates of dermatophytosis in 1987 and 2001 in general practice stratified for several background characteristics. Compared to 1987, in 2001 the total incidence rate of dermatophytosis in general practice increased by 18%.

In 2001 versus 1987 the incidence rate of dermatophytosis in general practice increased in young children (0-4 years); infants (< one year) showed in 2001 a three fold higher incidence rate.

Compared to 1987 in 2001, the GP more often diagnosed dermatophytosis in girls than boys. In 1987 we found the highest incidence rate in the three big cities and the lowest in the rural areas (< 30,000) whereas in 2001 it was distributed equally over all urbanization levels. Compared to 1987, in 2001 the incidence rate increased in the rural areas (< 30,000) and decreased in small cities (30,000-50,000), whereas it remained stable in larger cities (> 50,000) and the three big cities. In 1987 we found the highest incidence rate in the central part of the Netherlands compared to the northern part whereas in 2001 the incidence rates were not different between regions. In 2001, the incidence rates increased in the northern and southern part of the Netherlands compared to 1987.

In both surveys the incidence rates were distributed equally over all seasons and SES classes. In 2001 versus 1987 the incidence rate of dermatophytosis in general practice increased in summer.

In 2001, the GP more often diagnosed dermatophytosis in children of non-western immigrants than in children of natives and western immigrants.

Prescriptions

In 1987 the GPs made 388 prescriptions in the first contact of the episode; in 92.5% of these episodes only one drug was prescribed. In 10% of the episodes the GPs did not prescribe any medication in the first contact. During all episodes the GPs made 464

Table 1: Incidence rates per 1000 person years of all new episodes of dermatophytosis in general practice in 1987 and 2001

	1987		2001		
	Incidence Rates	**95% Confidence Intervals**	**Incidence Rates**	**95% Confidence Intervals**	**P-value**
Age Categories					
< 1 year	**12.8**	7.5 - 20.5	**35.1**	29.8 – 41.1	< 0.01
1 – 4 years	**17.4**	13.7 – 21.7	**24.8**	22.6 – 27.2	< 0.01
5 – 9 years	**19.7**	16.3 – 23.7	**18.9**	17.2 – 20.8	0.69
10 – 14 years	**24.8**	20.9 – 29.2	**24.0**	22.1 – 26.1	0.73
15 – 17 years	**22.7**	18.5 – 27.7	**27.6**	24.9 – 30.6	0.07
Total	**20.8**	18.9 – 22.8	**24.6**	23.5 – 25.7	< 0.01
Gender					
Boys	**20.0**	17.4 – 22.8	**22.6**	21.2 – 24.1	0.08
Girls	**21.7**	18.9 – 24.7	**26.0**	24.4 – 27.6	< 0.01
Urbanization					
< 30,000	**16.6**	13.9 – 19.8	**23.0**	21.5 – 24.7	< 0.01
30,000 – 50,000	**23.3**	20.0 – 26.9	**18.2**	16.1 – 20.5	0.01
> 50,000	**20.4**	16.4 – 25.1	**19.8**	18.1 – 21.6	0.80
Big Cities [1]	**27.7**	20.8 – 36.2	**24.1**	20.1 – 28.7	0.41
Region					
Northern	**14.4**	10.0 – 20.0	**24.8**	22.0 – 27.9	< 0.01
Central	**22.3**	19.9 – 24.9	**23.9**	22.5 – 25.3	0.28
Southern	**19.8**	16.2 – 24.0	**25.7**	23.7 – 27.9	< 0.01
Season					
Winter	**19.3**	15.6 – 23.7	**22.7**	20.7 – 24.9	0.14
Spring	**23.1**	19.6 – 27.2	**26.4**	24.2 – 28.7	0.13
Summer	**19.9**	16.0 – 24.5	**25.4**	23.3 – 27.7	0.02
Autumn	**20.3**	16.8 – 24.2	**22.2**	20.3 – 24.3	0.36
SES [2]					
Non-manual high	**21.0**	17.1 – 25.6	**21.9**	20.0 – 23.9	0.70
Non-manual middle	**20.0**	15.1 – 26.0	**24.0**	21.7 – 26.5	0.18
Non-manual low & farmers	**23.6**	14.8 – 35.8	**25.6**	21.5 – 30.3	0.71
Manual high / middle	**21.7**	17.1 – 27.0	**23.4**	19.1 – 28.4	0.62
Manual low	**26.7**	21.2 – 33.3	**25.1**	21.4 – 29.3	0.66
Ethnic origin					
Natives & Western Immigrants	**21.7**	19.4 – 24.1	**22.3**	21.0 – 23.6	0.65
Non-Western Immigrants	**29.9**	20.9 – 41.4	**33.6**	29.0 – 38.7	0.50

1 = Amsterdam, Rotterdam, The Hague
2 = according to fathers occupation

prescriptions resulting in an average prescription rate of 1.16 per episode; in 7.5% of the episodes the GPs did not prescribe any medication.

Table 2: Prescriptions in the first contact of dermatophytosis episode

	1987	2001
	Number (%)	Number (%)
Total number of episodes	400 (100) [1]	2007 (100) [2]
Oral treatments		
Antifungals	13 (3.3)	113 (5.6)
Azoles	13 (3.3)	48 (2.4)
Allylamines	0 (0)	60 (3.0)
Others	0 (0)	5 (0.2)
Topical treatments		
Antifungals	231 (57.8)	1098 (54.7)
Azoles	209 (52.3)	1002 (49.9)
Allylamines	0 (0)	43 (2.1)
Undecenoic acid	20 (5.0)	41 (2.0)
Others	2 (0.5)	12 (0.6)
Combinations (antifungals & corticosteroids)	94 (23.5)	375 (18.7)
Corticosteroids	10 (2.5)	20 (1.0)
Emollients	3 (0.8)	31 (1.5)
Others	37 (9.3)	78 (3.9)
No prescription in 1st contact	40 (10)	451 (22.5)

1 = unweighted number of new episodes
2 = number of new episodes in the mid-time population

In 2001 the GPs made 1715 prescriptions in the first contact of the episode; in 90.4% of these episodes only one drug was prescribed. In 22.5% of the episodes the GPs did not prescribe any medication in the first contact. During all episodes the GPs made 2333 prescriptions resulting in an average prescription rate of 1.16 per episode; in 18.3% of the episodes the GPs did not prescribe any medication.

In **table 2** we present the drugs prescribed in the first contact of the episode. In both surveys about three quarters of the dermatophytosis cases were treated with topical drugs; GPs prescribed in about 50% of the children with dermatophytosis topical antifungals and in about 20% topical antifungals combined with topical steroids. Oral antifungals were applied in only a very small proportion of the cases. However, compared to 1987, in 2001 the proportion of oral antifungal prescriptions almost doubled from 3.3 to 5.6%. For oral treatment in 1987 only azoles were prescribed whereas in 2001 both azoles and allylamines were prescribed in almost equal proportions.

Referrals

In 1987 twelve (2.6%) and in 2001 thirty-two (1.6%) of the children with dermatophytosis were referred to the dermatologist. In 1987 the boys to girls ratio of referred children was 3:1, whereas in 2001 this was 1:2.

Discussion

Incidence and sociodemographics

The incidence rate of dermatophytosis in general practice increased over the past 14 years which is consistent with a previous study performed in the Netherlands [23]. Considering the decrease of the overall consultation rate of children in Dutch general practice (second Dutch national survey) [14] the increased incidence rate of dermatophytosis in general practice is substantial. Probably our finding is a consequence of an increased prevalence in the population as reported by Sladden et al [12] who showed that dermatophytosis is becoming a major health problem in the U.K. and the U.S.A. A previous study reported that the consultation rate for onychomycosis in Dutch general practice increased from 5.9 (1999) to 8.2 (2000-1) and fell to 4.9 (2002) following a nationwide information campaign performed by the manufacturer of terbinafine in the Netherlands, advising people with onychomycosis to visit their GP [24]. Alternatively the increased incidence rate does not reflect an increase in incidence of dermatophytosis in the population but a higher inclination to present this disease to the GP.

The GPs more often diagnosed dermatophytosis in girls which is different from a previous Dutch study [23]. However, the prevalence of dermatophytosis in the population was found to be higher in boys [3,4,6] in three studies in Mediterranean countries. Probably girls are more sensitive for the esthetic aspects of the disease and therefore present this problem more easily to their GP.

The incidence rate increased in rural areas (< 30,000) and remained stable in urban areas. A previous study performed in children in rural areas in Turkey [6] reported that the prevalence of dermatophytosis is higher under poor hygienical conditions. However, in the Netherlands, the difference in hygiene conditions between rural and urban areas is negligible. Considering the decrease of the overall consultation rate of children in Dutch general practice (second Dutch national survey) [14] it might reflect an increase in incidence rate of dermatophytosis in children in general practice in urban areas. However, our finding is consistent with two British studies that reported an increased prevalence of tinea *capitis* in south-east London, a highly urbanized area [10,11].

Children of non-western immigrants consulted their GP more often with dermatophytosis; in 2001 this difference became more apparent. The significantly higher overall consultation rate in non-western children might explain this difference [14]. The increasing racial and ethnic heterogeneity of the Dutch childhood population might contribute to an increased incidence of dermatophytosis in the population. This is supported by previous studies reporting that Afro-Caribbean children are particularly affected by tinea

capitis in the UK [12] and that the prevalence of tinea *capitis* in Stockholm increased corresponding with the increased immigration from Africa [25].

Prescriptions

Between 1987 and 2001 the prescription pattern of the GP changed. In 2001 more oral antifungals especially terbinafine (not available in 1987) were prescribed. Probably, this was influenced by the nationwide information campaign, as mentioned earlier [24]. In 2001 there were more episodes in which the GP did not prescribe any medication. Probably this has to do with the fact that nowadays more over-the-counter drugs are available for dermatophytosis; patients who initially use these medications may consult their GP in a later phase of the disease which should have consequences for the GPs' management.

The majority of the dermatophytosis patients were treated with topical azoles and a very small proportion with allylamines or other antifungals indicating that dermatophytoses were primarily treated with azoles. This is in accordance with the results of the Cochrane reviews [15,16] and the clinical guideline for the treatment of dermatophytosis issued by the Dutch College of General Practitioners in 1997 [18].

In 2001 there were more episodes that included only one contact with the GP and more oral medication especially allylamines were prescribed. In both surveys the prescription rate per episode is the same, but in 2001 there were more episodes in which the GP did not prescribe any medication. The referral rate per episode in 2001 is lower than in 1987. These changes in disease management could be the consequence of the introduction of the clinical guideline for diagnosis and treatment of dermatophytosis issued by the Dutch College of General Practitioners in 1997 [18] which may have improved the care for patients with dermatophytosis in general practice.

Referrals

The boys to girls ratio of referred children concerning dermatophytosis strikingly changed from 3:1 (1987) to 1:2 (2001). As suggested earlier, girls may be more sensitive for the esthetic reasons of the disease and therefore consulted the GP more often than boys in 2001. This is supported by our previous analysis [27] showing that girls more often consulted the GP than boys concerning all skin diseases combined. Possibly, for cosmetic reasons girls or their parents put more pressure on the GPs for being referred to a dermatologist.

Strengths and limitations of the study

These two large representative and comprehensive surveys enabled us to assess accurately epidemiological data on dermatophytosis in children. For this study data of only two points in time were available. To identify a sustained trend of the incidence of dermatophytosis in general practice data of multiple points in time are needed.

There were small differences in the design of the two national surveys, which might disturb the comparability of data. For example ICPC coding of the diagnoses was not performed equally in both surveys: in 1987 clerks coded diagnoses afterwards, whereas in 2001 the GPs coded the diagnoses themselves during the consultation. We assume that coding by clerks more often led to a specific diagnostic ICPC code.

In the present study the accuracy of diagnoses (S74) made by the GPs could be a subject of debate. In our analysis we assumed that the diagnoses made by the GPs were correct. In 2001 the participating GPs were trained in coding the diagnoses correctly using ICPC codes. Overall these trained GPs classified diagnoses correctly in about 81% of the test cases [26].
However, initial analysis showed that the incidence rate of diaper rash (S89) decreased by about 50% in 2001 [27]. Possibly GPs have coded diaper rash as dermatophytosis which may have lead to an overestimation of the incidence rate of dermatophytosis in 2001. Another possibility is that GPs have coded dermatophytosis as diaper rash in 1987, which may have led to an underestimation of the incidence rate of dermatophytosis in 1987.

Conclusions

In general practice the incidence rate of dermatophytosis in children increased, especially in girls, children of non-western immigrants, rural areas and in the northern and southern part of the Netherlands. This increase in incidence rate could be a consequence of an increasing prevalence in the population. More studies on the population prevalence of dermatophytosis and help seeking behaviour are needed, especially in children of non-western immigrants and rural areas to test this hypothesis.
GPs generally follow the clinical guideline for diagnosis and treatment of dermatophytosis in children which is in accordance with evidence-based knowledge on the effectiveness of different therapies.

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7

Association between skin diseases and severe bacterial infections in children: case-control study

Mohammedamin RSA, van der Wouden JC, Koning S, Willemsen SP, Bernsen RMD, Schellevis FG, van Suijlekom-Smit LWA, Koes BW. Association between skin diseases and severe bacterial infections in children: case-control study. BMC Family Practice 2006; 7: 52.

Abstract

Background

Sepsis or bacteraemia, however rare, is a significant cause of high mortality and serious complications in children. In previous studies skin disease or skin infections were reported as risk factor. We hypothesize that children with sepsis or bacteraemia more often presented with skin diseases to the general practitioner (GP) than other children. If our hypothesis is true the GP could reduce the risk of sepsis or bacteraemia by managing skin diseases appropriately.

Methods

We performed a case-control study using data of children aged 0 - 17 years of the second Dutch national survey of general practice (2001) and the National Medical Registration of all hospital admissions in the Netherlands. Cases were defined as children who were hospitalized for sepsis or bacteraemia. We selected two control groups by matching each case with six controls. The first control group was randomly selected from the GP patient lists irrespective of hospital admission and GP consultation. The second control group was randomly sampled from those children who were hospitalized for other reasons than sepsis or bacteraemia. We calculated odds ratios and 95% confidence intervals (CI). A two-sided p-value less than 0.05 was considered significant in all tests.

Results

We found odds ratios for skin related GP consultations of 3.4 (95% CI: [1.1 – 10.8], p = 0.03) in cases versus GP controls and 1.4 (95% CI: [0.5 – 3.9], p = 0.44) in cases versus hospital controls. Children younger than three months had an odds ratio (cases / GP controls) of 9.2 (95% CI: [0.81 - 106.1], p = 0.07) and 4.0 (95% CI: [0.67 – 23.9], p = 0.12) among cases versus hospital controls. Although cases consulted the GP more often with skin diseases than their controls, the probability of a GP consultation for skin disease was only 5% among cases.

Conclusions

There is evidence that children who were admitted due to sepsis or bacteraemia consulted the GP more often for skin diseases than other children, but the differences are not clinically significant indicating that there is little opportunity for GPs to reduce the risk of sepsis and/or bacteraemia considerably by managing skin diseases appropriately.

Background

Sepsis or bacteraemia requiring hospital admission is rare, however it is a significant cause of high mortality and serious complications such as septic shock and multi organ dysfunction syndrome [1,2,3]. Currently, little data is available about the causal factors of sepsis or bacteraemia in children in the population. The available studies in this field deal particularly with adults or with children belonging to high-risk groups such as neonates and those who are immunocompromized due to HIV infection and children with underlying malignancies [4,5,6,7]. The few studies which have been performed on sepsis or bacteraemia in children from the general population are case series [8,9,10] or deal with specific causative bacterial agents [1,11,12,13].

Three previous studies of which only one performed in children reported that from the identifiable primary focus in patients with sepsis or bacteraemia most often (22-37%) an infection of the skin was detected [1,2,12]. Children suffering from atopic dermatitis are chronic carriers of *Staphylococcus Aureus* and run therefore a higher risk to develop sepsis or bacteraemia [9,14]. Skin infections are almost always curable, but some may lead to serious complications such as nephritis, carditis, arthritis and sepsis if the diagnosis is delayed and/or treatment is inadequate [15].

A Dutch study performed in children aged 0-14 years reported that 28% of those with skin diseases consulted the general practitioner (GP) [16]. Hence, for this reason, we hypothesize that children who were admitted to hospital due to sepsis or bacteraemia suffered more often from skin diseases, especially skin infections, and therefore visited their GP for this reason more often prior to their admission compared to their controls. If our hypothesis is true and given the fact that skin diseases account for 23% of the total morbidity in children in general practice [17], the GP may be able to reduce the risk of sepsis or bacteraemia by recognizing the skin diseases in time and treating them adequately.

To test this hypothesis we performed a case-control study, aiming to answer the following research question:
- Did children who were admitted to a hospital for sepsis or bacteraemia visit their GP more often for skin diseases before their admission, compared to matched controls?

Methods

We used data of the second Dutch National Survey of general practice performed by NIVEL (Netherlands Institute for Health Services Research) in 2001 and data of the LMR (National Medical Registration in the Netherlands).

Second Dutch National Survey

In the Netherlands, general practices have a fixed list size and all inhabitants are listed with a general practice, and GPs have a gate-keeping role. Usually, the first contact with health care, in a broad sense, is the contact with the general practitioner. This survey included a representative sample of the Dutch population. Data about all physician-patient contacts, prescriptions and referrals during 12 months in 2001 were extracted from electronic medical records of all listed patients of 104 practices (195 GPs) [18]. All diagnoses were coded using the International Classification of Primary Care (ICPC) [19]. Different health problems within one consultation were recorded separately. Socio-demographic characteristics such as age, gender, region and urbanization level of all patients listed to the participating GPs were derived from the GP's computerized patient file. The degree of urbanization was derived from the general practice's postal code and categorized into four classes "under 30,000 inhabitants", "30,000-50,000 inhabitants", "over 50,000 inhabitants" and "the three large Dutch cities Amsterdam, Rotterdam and The Hague". The Netherlands were divided into a Northern, Central and Southern region. Childrens' socioeconomic status (SES) and ethnic origin were obtained by a questionnaire filled out by parents or by the children themselves if they were older than 12 years (response rate 76%). SES was based on the father's occupation, which was categorized into five classes "non-manual work high (class I)", "non-manual work middle (class II)", "non-manual low and farmers (class III)", "manual work high / middle (class IV)" and "manual work low (class V)". Ethnicity was derived from the country of birth of either parent. If either parent was born in Turkey, Africa, Asia (except Japan and Indonesia) and Central or South America, their children were considered to be children of non-western origin (in accordance with the classification of Statistics Netherlands). All other children were defined as western. Eight practices were excluded from analysis because of insufficient quality of data registration.

National Medical Registration (LMR)

This continuous registration contains information about hospital admissions, diagnostic and therapeutic interventions of all hospitals in the Netherlands. All diagnoses were coded using the International Classification of Diseases 9th revision (ICD-9) [20]. Previous research revealed that about 87% of the patients referred by the GP to a specialist can be linked to a record of the hospital register [21].

Definition of cases

Cases were defined as being diagnosed with sepsis or bacteraemia at discharge. The corresponding ICD-9 codes for sepsis and bacteraemia are listed in Appendix 1. Cases were only selected when their admission date was at least 14 days after the start and before the end of the one-year registration period of the survey in general practice. If cases had more than one admission within a week concerning the same health problem only the first admission was selected. We excluded all children who were primarily admitted to a hospital for skin diseases (N = 29), but assessed GP consultations of these children 14 days prior to their hospital admission.

Selection of controls

We selected two control groups by matching each case with six controls. Cases and controls were matched on age group (**table 1**), gender and region. The first control group was randomly selected from the GP patient lists irrespective of hospital admission and GP consultation, the so called GP controls. The second control group was composed by drawing a random sample from those children who were admitted to a hospital for other reasons than sepsis or bacteraemia, the so called hospital controls. This second control group was added because we can not rule out that some of our severely ill cases bypassed the general practitioner prior to their hospital admission which might lead to an under-estimation of contacts with the GP in this group.

Data-analysis

We analyzed data of all children aged 0-17 years and assessed whether a higher proportion of cases visited the GP with any disease, especially skin disease as listed in the S-chapter of the ICPC (Appendix 2), within 14 days prior to their admission than controls (GP controls and hospital controls). We calculated odds ratios for presence of GP consultations for all diseases, skin diseases and other diseases than skin diseases (cases / controls) and 95% confidence intervals (CI) using a conditional logistic regression model. We performed the same analysis for skin diseases within 30 days prior to the hospital admission of the cases. We repeated the latter analysis in a more strictly defined group (N = 44) of cases suffering from sepsis or severe bacteraemia and their matched controls. These cases were explicitly defined as being admitted to hospital due to sepsis, meningitis, acute osteomyelitis, acute pyelonefritis, acute mastoiditis, infectious arthritis or pneumonia. A two-sided p-value less than 0.05 was considered significant in all tests.

Table 1: Baseline characteristics in percentages of cases and controls

	Cases (N = 101)	GP Controls[1] (N = 597)	Hospital Controls[2] (N = 583)
Age group			
0 – 3 months	8.9	7.7	9.3
3 – 6 months	6.9	6.9	5.8
6 – 24 months	27.7	30.2	28.3
24 – 72 months	27.7	26.8	26.8
6 – 17 years	28.7	28.5	29.8
Gender			
Boys	63.4	63.7	64.3
Girls	36.6	36.3	35.7
Urbanization			
< 30,000	36.6	38.0	36.4
30,000 – 50,000	18.8	15.9	17.5
> 50,000	37.6	39.2	36.9
Big cities[3]	6.9	6.9	9.3
Region			
Northern	19.8	20.1	18.0
Central	61.4	60.8	62.4
Southern	18.8	19.1	19.6
SES[4]			
Non–manual high	34.1	37.4	38.8
Non–manual middle	31.8	31.3	35.6
Non–manual low & farmers	15.9	13.5	5.0
Manual high / middle	2.3	7.5	9.6
Manual low	15.9	10.3	11.0
Ethnicity			
Natives & Western Immigrants	85.7	89.8	87.2
Non – Western Immigrants	14.3	10.2	12.8

1 = control group randomly sampled from the general practitioners' (GP) patient lists irrespective of hospital admission and GP consultation
2 = control group randomly sampled from those children who were being hospitalized for other reasons than sepsis or bacteraemia
3 = Amsterdam, Rotterdam, The Hague
4 = according to fathers occupation

Results

Study population

The total general practice population included 88,307 children aged 0-17 years. We found 101 cases that could be matched with 597 GP controls and 583 hospital controls. **Table 1** shows the baseline characteristics of cases and both control groups. Cases were comparable to their controls regarding socio-demographic characteristics.

GP consultations

Sixty eight cases (67%) consulted the GP 161 times within 14 days prior to their hospital admission; five cases (5%) consulted the GP for a skin disease. Among the GP controls 67 consultations were made by 53 (9%) children within 14 days prior to the admission of the case they were linked to; nine controls (1.5%) consulted the GP for a skin disease. In the same period 255 (43.7%) children among the hospital controls consulted their GP 477 times; of these children 20 (3.4%) presented a skin disease. **Table 2** shows which skin diseases were presented to the GP by cases and controls.

Children who were primarily admitted to hospital for a skin disease (N = 29) and excluded from analysis had the following diagnosis at discharge: skin abscesses, cellulitis, erysipelas, impetigo, infected finger/toe, paronychia and local skin infections. Of these children 14 (48%) consulted the GP 28 times within 14 days prior to their hospital admission. Eight children (28%) consulted the GP for a skin disease.

Table 2: GP consultation for skin diseases within 14 days prior to hospital admission of cases

Diagnoses	ICPC[1]	Cases (N = 101)	GP Controls[2] (N = 597)	Hospital Controls[3] (N = 583)
Pruritis	**S02**	0	1	0
Rash localized	**S06**	0	0	1
Skin infection post-traumatic	**S11**	0	0	1
Insect bite / sting	**S12**	0	1	0
Burn / scald	**S14**	0	3	1
Bruise / contusion	**S16**	0	0	1
Laceration / cut	**S18**	0	0	1
Dermatophytosis	**S74**	1	0	1
Moniliasis / candidiasis skin	**S75**	1	2	4
Naevus / mole	**S82**	0	0	1
Impetigo	**S84**	0	1	2
Dermatitis seborrhoeic	**S86**	0	0	2
Dermatitis / atopic eczema	**S87**	2	2	4
Dermatitis contact / allergic	**S88**	0	0	2
Diaper rash	**S89**	0	0	2
Sebaceous cyst	**S93**	1	0	0
Molluscum contagiosum	**S95**	0	1	0
Urticaria	**S98**	0	0	1

1 = International Classification of Primary Care
2 = control group randomly selected from the general practitioners' (GP) patient lists irrespective of hospital admission and GP consultation
3 = control group randomly sampled from those children who were being hospitalized for other reasons than sepsis or bacteraemia

Strengths of relationships

Table 3 shows the odds ratios (cases / controls) for whether or not a GP was consulted stratified for skin diseases and other diseases than skin diseases within 14 days prior to the hospital admission of the cases for children aged 0-17 years. Compared to their controls, more cases consulted the GP. The odds ratio for skin diseases (cases / GP controls) was 3.4 (95% CI: [1.1-10.8], p = 0.03) and 1.4 (95% CI: [0.5 – 3.9], p = 0.44) for cases versus hospital controls.

Table 3a and 3b show the odds ratios of skin diseases and other diseases for children younger than three months and for children aged three months – 17 years respectively. Cases younger than three months showed an odds ratio (cases / GP controls) of 9.2 (95% CI: [08.1 – 106.1], p = 0.07). In this age group the odds ratio (cases / hospital controls) was 4.0 (95% CI: [0.67 – 23.9], p = 0.12). In all age groups significantly more cases consulted the GP for other diseases than skin diseases 14 days prior to their hospital admission compared to matched controls.

Table 3: GP consultations of children aged 0-17 years admitted for severe bacterial infections and matched controls: odds ratios, 95% confidence intervals and p-values

Diagnoses according to ICPC[1]	Cases (N = 101) vs GP controls (N = 597)	Cases (N = 101) vs Hospital controls (N = 583)
Skin diseases (S01 – S99)	OR[2] 3.4 [1.1 – 10.8], p = 0.03	OR 1.4 [0.5 – 3.9], p = 0.44
Other diseases	OR 33.0 [16.4 – 66.7], p < 0.0001	OR 2.8 [1.8 – 4.5], p < 0.0001
All diseases	OR 25.9 [13.6 – 49.4], p < 0.0001	OR 2.7 [1.7 – 4.2], p < 0.0001

1 = International Classification of Primary Care
2 = Odds ratio

Table 3a: GP consultations of children < 3 months admitted for severe bacterial infections and matched controls: odds ratios, 95% confidence intervals and p-values

Diagnoses according to ICPC[1]	Cases (N = 9) vs GP controls (N = 46)	Cases (N = 9) vs Hospital controls (N = 54)
Skin diseases (S01 – S99)	OR[2] 9.2 [0.81 – 106.1], p = 0.07	OR 4.0 [0.67 – 23.9], p = 0.12
Other diseases	OR 19.2 [2.2 – 164.0], p = 0.007	OR 5.8 [1.13 – 30.3], p = 0.03
All diseases	OR 15.3 [1.8 – 130.1], p = 0.012	OR 5.9 [1.13 – 30.3], p = 0.03

1 = International Classification of Primary Care
2 = Odds ratio

Table 3b: GP consultations of children aged 3 months – 17 years admitted for severe bacterial infections and matched controls: odds ratios, 95% confidence intervals and p-values

Diagnoses according to ICPC[1]	Cases (N = 92) vs GP controls (N = 551)	Cases (N = 92) vs Hospital controls (N = 529)
Skin diseases (S01 – S99)	OR[2] 2.5 [0.7 – 9.9], p = 0.17	OR 1.0 [0.3 – 3.5], p = 0.98
Other diseases	OR 34.8 [16.6 – 73.2], p < 0.0001	OR 2.6 [1.6 – 4.2], p < 0.0001
All diseases	OR 27.2 [13.7 – 53.2], p < 0.0001	OR 2.4 [1.5 – 4.0], p = 0.002

1 = International Classification of Primary Care
2 = Odds ratio

Repeated analysis of consultations for skin diseases within 30 days prior to the hospital admission of the cases showed similar results, as did repetition of the analysis restricted to the most severe cases (N = 44) and their controls.

Discussion

We tested the null hypothesis that there is no difference between children admitted for sepsis or bacteraemia and other children as to consulting a GP for skin diseases in a period of 14 days before admission to hospital. We found that there is an association between skin diseases presented to the GP and subsequent hospitalization for sepsis or bacteraemia among GP controls but not for hospital controls.

We performed the same analysis in cases and controls younger than three months and found an even stronger relationship, though not significant. This lack of significance is probably due to the small number of cases in this age group.

From a clinical point of view the difference between cases and controls may not be very relevant. The probability that a case consulted the GP for skin diseases prior to their hospital admission is only about 5% and therefore not a point of departure for GPs to reduce the risk of sepsis and/or bacteraemia considerably by diagnosing and treating skin diseases appropriately. However, considering cases younger than 3 months (N = 9) about 22% consulted the GP for skin diseases prior to their hospital admission which means that GPs may have possibilities in this age group to reduce the risk of sepsis and/or bacteraemia considerably by diagnosing and treating skin diseases appropriately. We recommend replication of our study in a larger dataset for this age group.

Compared with both control groups our cases visited the GP about two times as high with both infectious skin diseases and atopic skin diseases as well, which could support the association between sepsis or bacteremia and infectious and atopic skin diseases [1,2,9,12,14].

In all age groups we found odds ratios concerning GP consultations for other diseases than skin diseases that are considerably high and significantly different ($p < 0.0001$) compared to the odds ratios for skin diseases. This finding indicates that there is a very strong association between GP consultations for other diseases than skin diseases, 14 days prior to hospital admission, and being hospitalized for sepsis or bacteraemia.

These two large and representative datasets enabled us to assess accurately odds ratios among cases and their matched controls and to test our hypothesis. By matching our cases and controls on age, gender and region we adjusted for differences concerning these variables and also for other socio-demographic characteristics (**table 1**). To limit the seasonal variation of the GP consultations we selected only the consultations that took place within 14 days prior to the admission date of the case to whom the controls were linked to.

Overall the odds ratio for a GP consultation concerning skin diseases among cases versus GP controls 14 days prior to the admission of the cases is higher compared to the odds ratio among cases versus hospital controls. Our findings are in accordance with an earlier finding by Infante-Rivard [22] that inferences of severe childhood diseases using hospital controls in comparison with population controls resulted in odds ratios closer to the null value.

Conclusions

There is evidence that children who were admitted due to sepsis or bacteraemia consulted the GP more often for skin diseases prior to their admission, than other children, but the differences are not clinically relevant which means that there is little opportunity for GPs to reduce the risk of sepsis and/or bacteraemia considerably by diagnosing and treating skin diseases appropriately.

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Appendix 1

To select our sepsis cases we used the ICD-9 code [20].
We used the following codes and subcodes:

036	Meningococcal infection
036.0	Meningococcal meningitis
036.1	Meningococcal encephalitis
036.2	Acute meningococcaemie (meningococcal septicemia)
036.3	Waterhouse-Friderichsen
036.4	Meningococcal heart disease (carditis, endocarditis, myocarditis, pericarditis)
036.8	Other meningococcal infections (optic neuritis)
036.9	Meningococcal infection, unspecified

038	Septicaemia
038.0	Streptococcal septicaemia
038.1	Staphylococcal septicaemia
038.2	Pneumococcal septicaemia
038.3	Septicaemia due to anaerobes
038.4	Septicaemia due to other Gram-negative organisms (Haemophilus Influenzae, E.Coli, Pseudomonas, Serratia)
038.8	Other specified septicaemias

041	Bacterial infection in conditions classified elsewhere
041.0	Streptococcus
041.1	Staphylococcus
041.2	Pneumococcus
041.3	Friedlander's bacillus
041.4	Escherichia coli (E.coli)
041.5	Haemophilus influenzae (H. influenzae)
041.6	Proteus (mirabilis, morganii)
041.7	Pseudomonas
041.8	Other
041.9	Bacterial infection, unspecified

320	Bacterial meningitis, not elsewhere classified
320.0	Haemophilus meningitis
320.1	Pneumococcal meningitis
320.2	Streptococcal meningitis

320.3 Staphylococcal meningitis
320.8 Meningitis due to other specified bacteria
320.9 Meningitis due to unspecified bacterium

383 Mastoiditis and related conditions
383.0 Acute mastoiditis (abscess of mastoid, empyema of mastoid)

420 Acute pericarditis
421 Acute and subacute endocarditis
421.0 Acute and subacute bacterial endocarditis

481 Pneumococcal pneumonia
482 Other bacterial pneumonia
482.0 Pneumonia due to Klebsiella pneumoniae
482.1 Pneumonia due to Pseudomonas
482.2 Pneumonia due to H. Influenzae
482.3 Pneumonia due to Streptococcus
482.4 Pneumonia due to Staphylococcus
482.8 Pneumonia due to other specified bacteria
482.9 Bacterial pneumonia, unspecified
483 Pneumonia due to other specified organism

513 Abscess of lung and mediastinum
513.0 Abscess of lung
513.1 Abscess of mediastinum

580 Acute glomerulonephritis (includes: acute nephritis)
590 Infections of kidney
590.1 Acute pyelonephritis (acute pyelitis, acute pyonephrosis)

711 Arthropathy associated with infections
711.0 Pyogenic arthritis (arthritis due to E. coli, H. influenzae, Pneumococ, Staphylococ, Streptococ)

730 Osteomyelitis, periostitis, and other infections involving bone
730.0 Acute osteomyelitis

Appendix 2

The S-chapter (skin diseases) of the International Classification of Primary Care (ICPC) [18]:

S01	Pain / tenderness of skin
S02	Pruritus
S03	Warts
S04	Lump / swelling localized
S05	Lumps / swellings generalized
S06	Rash localized
S07	Rash generalized
S08	Skin colour change
S09	Infected finger / toe
S10	Boil / carbuncle
S11	Skin infection post-traumatic
S12	Insect bite / sting
S13	Animal / human bite
S14	Burn / scald
S15	Foreign body in skin
S16	Bruise / contusion
S17	Abrasion / scratch / blister
S18	Laceration / cut
S19	Skin injury other
S20	Corn / callosity
S21	Skin texture symptom / complaint
S22	Nail symptom / complaint
S23	Hair loss / baldness
S24	Hair / scalp symptom / complaint
S26	Fear of cancer of skin
S27	Fear of skin disease other
S28	Limited function / disability(s)
S29	Skin symptom / complaint other
S70	Herpes zoster
S71	Herpes simplex
S72	Scabies / other acariasis
S73	Pediculosis / skin infestation other
S74	Dermatophytosis
S75	Moniliasis / candidiasis skin

S76 Skin infection other
S77 Malignant neoplasm of skin
S78 Lipoma
S79 Neoplasm skin benign / unspecified
S80 Solar keratosis / sunburn
S81 Haemangioma / lymphangioma
S82 Naevus / mole
S83 Congenital skin anomaly other
S84 Impetigo
S85 Pilonidal cyst / fistula
S86 Dermatitis seborrhoeic
S87 Dermatitis / atopic eczema
S88 Dermatitis contact / allergic
S89 Diaper rash
S90 Pityriasis rosea
S91 Psoriasis
S92 Sweat gland disease
S93 Sebaceous cyst
S94 Ingrowing nail
S95 Molluscum contagiosum
S96 Acne
S97 Chronic ulcer skin
S98 Urticaria
S99 Skin disease other

8

Summary and general discussion

Summary

The increasing proportion of skin diseases, especially infectious and allergic skin diseases, encountered in general practice represents a substantial part of the morbidity in children. Only limited information is available about the epidemiology of skin diseases in children in general practice and many questions in this field are still unanswered. In this thesis, after a general overview of all skin related morbidity in children in general practice, we will focus on the changes in the incidence and management of infectious skin diseases during the past decades.
Moreover, we aim to identify determinants that are associated with the incidence of infectious skin diseases in children encountered in general practice in order to provide tools for improvement of general practice care and prevention of infectious skin diseases and their complications.
We performed an observational study comparing data of the two Dutch national surveys. The setting of the research was general practice as, in the Netherlands, the majority of skin diseases were diagnosed and treated by general practitioners.

In **chapter 2** we compared incidence rates of all skin diseases presented by children aged 0 – 17 years in general practice between 1987 and 2001.
The incidence rate of all skin diseases combined in general practice decreased between 1987 and 2001. Among infants (<one year) the incidence rate increased. Girls presented more skin diseases to the GP. In the southern part of the Netherlands children consulted their GP more often for skin diseases compared to the northern part. Children of non-western immigrants presented relatively more skin diseases to the GP. In general practice incidence rates of specific skin diseases such as impetigo, dermatophytosis and atopic dermatitis increased in 2001, whereas warts, contact dermatitis and skin injuries decreased.

In **chapter 3** we describe the epidemiology and management of impetigo in children in general practice. Impetigo is the most common bacterial skin infection in children. Results from two points in time (1987 and 2001) are compared.
The incidence rate of impetigo increased from 16.5 (1987) to 20.5 (2001) per 1000 person years under 18 years old ($p < 0.01$). In both years, the incidence was significantly higher in summer, in rural areas and in the southern region of the Netherlands, compared to winter, urban areas and northern region respectively. Socio-economic status was not associated with the incidence rate. From 1987 to 2001, there was a trend towards prescribing topical antibiotic treatment (from 40% to 64%), especially fusidic acid cream and mupirocin cream.

In **chapter 4** a comparison over time of the incidence rate and management of acne in children and adolescents is presented. Acne is a mulifactorial disease in which the *Propionibacterium acnes* plays an important role and therefore acne is considered a bacterial skin infection.
The incidence rate of acne in general practice decreased from 20.0 (1987) to 11.8 (2001) per 1000 person years. Girls, adolescents aged 15-19 years and non-western immigrants consulted the general practitioner more often with acne compared to boys, other age groups and western immigrants respectively. Overall, general practitioners treated acne according to the clinical guideline.

In **chapter 5**, warts, the most common (viral) skin disease in children in general practice, is examined in more detail. Self-reported prevalence and trends in incidence rates and management in children in general practice are identified over time.
The self-reported prevalence of warts in children is 6.2%, and 23.3% of these children consulted the general practitioner for warts. The incidence rate of warts in general practice decreased from 44.5 (1987) to 32.1 (2001) per 1000 person years. Girls, especially in puberty, and children of natives consulted the general practitioner more often with warts compared to boys and children of non-western immigrants respectively. General practitioners treated the majority of warts by applying cryotherapy with salicylic acid on the second place.

In **chapter 6** we determine the incidence and management of dermatophytosis in children in general practice, and assess trends between 1987 and 2001.
Dermatophytosis is a common skin infection in children. Although the epidemiology is relatively unknown it is becoming a major health problem in some countries.
Compared to 1987, in 2001 the total incidence rate of dermatophytosis in children in general practice increased. Infants (< one year), girls, children in rural areas and children of non-western immigrants more often consulted the GP for dermatophytosis in 2001 compared to older children, boys, children from urban areas and natives respectively.
GPs generally follow the clinical guideline for the treatment of dermatophytosis in children.

In **chapter** 7 we explored the association between skin diseases, especially skin infections, and severe bacterial infections requiring hospitalization in children**.** Sepsis or bacteraemia, however rare, is a significant cause of high mortality and serious complications in children. Skin diseases are considered to be an important causal factor in children who are hospitalized due to sepsis or bacteraemia. Therefore we hypothesize that these critically ill children suffer more often from skin diseases, especially skin

infections, and initially consult the general practitioner more often for that reason than other children.

We found odds ratios for skin related GP consultations of 3.4 (95% CI:[1.1 – 10.8], p = 0.03) in cases versus GP controls and 1.4 (95% CI:[0.5 – 3.9], p = 0.44) in cases versus hospital controls. Children younger than three months had an odds ratio (cases / GP controls) of 9.2 (95% CI: [0.81 - 106.1], p = 0.07) and 4.0 (95% CI: [0.67 – 23.9], p = 0.12) among cases versus hospital controls. Although cases consulted the GP more often with skin diseases than their controls, the probability of a GP consultation for skin disease was only 5% among cases.

There is evidence that children who were admitted due to sepsis or bacteraemia consulted the GP more often for skin diseases than other children, but the differences are not clinically relevant indicating that there is little opportunity for GPs to reduce the risk of sepsis and/or bacteraemia considerably by managing skin diseases appropriately.

General discussion

The main objective of this thesis is to evaluate the epidemiology and management, and clinical consequences of (infectious) skin diseases in children in general practice. This thesis provides an overview of skin diseases presented by children in general practice with special attention for the most frequent infectious skin diseases such as impetigo, warts, dermatophytosis and acne.
This chapter discusses our findings, the general implications, the strengths and limitations of the study, and provides suggestions for future studies.

Increasing incidence of skin diseases?

An important finding, with considerable consequences for health care workers in general practice, is the declining incidence rate of skin diseases in children. In 2001, the incidence rate decreased by about 10% compared with 1987. However, it is not clear whether this decrease is a consequence of a changing frequency of skin diseases in the general population or whether a change in help seeking behaviour has occurred. Initial analysis of data from the same surveys by Otters et al [1] showed a decrease of the overall consultation rate by 22% in Dutch general practice between 1987 and 2001. Considering this decrease in consultation rate we could expect an even lower incidence rate of skin diseases in 2001 in Dutch general practice. In the Netherlands no comparable data about trends in the incidence rate of skin diseases in general practice is available.

In part, the decreasing incidence rate of skin diseases in general practice could be a consequence of changing consultation behaviour. We assume that, in 2001, there is a higher threshold for contacting general practice by children for which there are several arguments:

Parents postpone consulting the general practitioner in 2001?

- It is possible that parents nowadays are better informed and more confident on how to handle self-limiting health problems themselves, and therefore will wait longer before contacting general practice. This is supported by recent analyses which showed that expectations of general practice care are lower for common and often self-limiting health problems [2,3]. Most skin diseases are common and/or self-limiting.
- Since September 1999, the costs of frequently used self-care drugs are no longer reimbursed by health insurance, which could have been a reason for consulting the general practitioner in 1987 [2].
- Nowadays more over-the-counter medications are available for which no prescription of the general practitioner is needed. Probably, nowadays patients use primarily

over-the-counter medication or other self-care strategies for minor ailments [2,3] and do not seek medical help or consult their general practitioner in a later phase of the disease. We assume that the most skin diseases are minor ailments.

- Possibly, a societal phenomenon of the past years could also explain the decrease of consultation rate in Dutch general practice. Nowadays it is much more common for both parents to have daytime jobs, either full- or part-time. Consequently, children may consult general practice less frequently and only if considered necessary by parents.

General practitioners keep off consultation in 2001?

- Possibly, due to the higher workload [4], general practitioners keep off consultation for childhood conditions longer in 2001 than in 1987. In general, most skin diseases in children have a benign course, and a 'wait and see' advice is often justified. Therefore it is possible that general practitioners instruct their assistants to select more strictly when parents call to make an appointment. As a possible consequence, these parents may wait longer to contact general practice in a future episode of illness in their child.

Changing childhood skin morbidity pattern in general practice between 1987 and 2001?

Children presented a different skin morbidity pattern in 2001 than in 1987. Overall the incidence rate of allergic, bacterial and fungal skin diseases in general practice increased whereas viral skin diseases decreased during the past decades.

For example the incidence rate of atopic eczema in general practice increased during the past decades. Considering the decline in overall consultation rate in general practice we could assume that the frequency of atopic eczema in the population has increased which is in accordance with previous studies [5,6]. This increase can be explained by the well-known hygiene theory. This theory states that the decrease in exposure to infectious pathogens (smaller families, increase of hygienic customs) gives rise to an increase of allergies and allergy related diseases [7,8,9].

However, parallel with the increasing incidence rates of atopic eczema, increasing incidence rates of impetigo and dermatophytosis are also observed in general practice. This is an unexpected finding and it is hypothesized that the increased close contacts between children in day care facilities and after school activities may be associated with the higher occurrence of these skin infections in 2001 compared to 1987. A clinical review by Sladden et al reported an increase of the population-based frequency of dermatophytosis in the UK and the USA which is becoming a major health problem and Afro-Caribean children are usually affected [10]. Currently, it is estimated that more than

13% of all 0-17 year olds belong to ethnic minority groups, compared with less than 7% two decades ago.

The increased incidence rate of impetigo in general practice may also reflect a rising tendency of medical attention-seeking; the unsightly aspect of (facial) impetigo may now be less acceptable to parents than before. Also, there seems to be more pressure from school for the child to undergo antibiotic treatment before they can be permitted at school again. Possible explanations for an increased incidence at the population level are either a change in human behaviour, such as increased traveling or, alternatively, increased virulence of S. *aureus* [11]. Also, arise of antibiotic resistance in staphylococci has been reported [12].

Conversely, acne vulgaris which we considered as a bacterial skin infection showed a substantial decrease in incidence rate in general practice of 41% during the past decades. This decrease is two fold as high as the decrease of the overall consultation rate in general practice. Probably the population-based frequency of acne vulgaris has decreased during the past decades which is in accordance with a previous study [13].

Viral skin diseases (e.g. warts, mollusca contagiosa) showed also a decrease in incidence rate which is in parallel with the declining overall consultation rate in general practice. We assessed a self-reported prevalence of warts in children (0-17 years) of 6.2%. A previous Dutch study performed in 1959 among schoolchildren reported a prevalence of 7.2%; the self-reported prevalence in our study among children of the same age (5-14 years) is 7.8% indicating that the prevalence has hardly changed over time [14].

Are the incidence rates of skin diseases in general practice and its changes related to socio-demographic characteristics?

Age: overall we found the highest incidence rate of skin diseases encountered in general practice in young children, especially in infants (under one year) which is consistent with previous studies [15,16]. The overall incidence rate in infants increased strikingly between 1987 and 2001 whereas it decreased or remained stable in other age categories. We observed a similar trend in dermatophytosis. Impetigo and dermatophytosis more often occurred in young children whereas warts and acne more often occurred in older children and adolescents.

Gender: in 2001 girls presented more skin diseases in general practice than boys, however the frequency of most skin diseases in the population is similar in both gender or even higher in boys [17,18]. We observed a similar trend in the most frequent infec-

tious skin diseases such as warts, dermatophytosis and acne. Probably girls are more sensitive for the esthetic aspects of skin diseases.

Regional variation: overall there is a north-south gradient of skin diseases presented to the general practitioner with the highest incidence rate in the southern part of the Netherlands. This is a very striking observation for a small country like the Netherlands. It is of interest to know whether the frequency of skin diseases in the population is higher in the southern part of the Netherlands. A sub-analysis of our data showed that the overall GP consultation rate in children (0-17 years) is significantly higher in the south compared to the north. Among the four most frequent infectious skin diseases (impetigo, warts, dermatophytosis, acne) only impetigo showed a similar trend.

The twofold higher incidence rate of impetigo in the south compared with the north is striking. Climatic differences within the country are small and seem to offer no explanation. We propose that staphylococcal transfer from pigs to humans may explain the geographical gradient. There is a concentration of pig farming in the southern provinces of the country, where approximately 10 times as many pigs are bred as in the northern provinces [19]. It has been shown that pig farmers in France were more frequently nasal carriers of *S. Aureus* than matched non-farmers [20].
No comparable data concerning regional variation of skin diseases in the Netherlands is available about children.

Urbanization level: there seems to be a relation between incidence rate of skin diseases in general practice and urbanization level. Between 1987 and 2001, the overall incidence rate of skin diseases in general practice increased in rural areas and decreased or remained stable in suburban and urban areas. We observed a similar trend in impetigo and dermatophytosis. It is suggested elsewhere that children in rural areas are more exposed to infectious pathogens due to the larger number of animals and farms [21]. Probably, the population-based frequency of infectious (bacterial and fungal) skin diseases increased in rural areas between 1987 and 2001. Actually, with the decreasing overall consultation rate we would expect also a decrease of the incidence rate of skin diseases in general practice in urban areas but this did not change between 1987 and 2001. Probably children in urban areas are suffering more from skin diseases. In part, this is in accordance with 'the pollution hypothesis' meaning that children in urban areas have a higher chance in developing atopic diseases [21,22]. Crowding in urban areas could be a potential factor in spreading infectious skin diseases. The incidence rate of acne and warts in general practice seems not to be related with urbanization levels.

Ethnic origin: the incidence rate of skin diseases encountered in general practice is related to the ethnic origin. Children from non-western parents presented overall more skin diseases to the general practitioner which is in parallel with the higher overall consultation rate among these children [1]. However, we can not rule out whether the population-based frequency of skin diseases is higher in children of non-western immigrants. Previous studies reported the racial predisposition of some skin diseases; viral warts especially occurs in white children [23] whereas tinea capitis occurs most frequently in Afro-Caribbean children [24]. This is in accordance with our results. Except for viral warts children of non-western immigrants presented more often with impetigo, dermatophytosis and acne to the general practitioner.

Seasonal variability: in general practice the incidence rate of all skin diseases combined was higher in the warmer months (summer, spring) and lower in the colder months (winter, autumn). No comparable data on this topic is available. Similar trends were found in dermatophytosis and impetigo whereas in acne it was the other way around. The incidence rate of warts is not related to season. These findings are consistent with previous studies [13,16].

Socio-economic status: we found higher incidence rates of skin diseases combined in the lower socio-economic classes, which is consistent with previous studies [25,26]. From the four most frequent infectious skin diseases (impetigo, dermatophytosis, warts, acne) only dermatophytosis showed a similar trend. Contrary to our results van de Lisdonk et al [16] reported higher incidence rates of impetigo and acne in the lower social classes in general practice.

Did general practitioners' management of skin diseases in children change between 1987 and 2001?

Nowadays, general practitioners see a different pattern of skin diseases in children than in 1987. It is of interest whether or how this shift is reflected in general practitioners' management. Referral to secondary health care and drug prescription are focused on and these issues are discussed in the next part of this chapter. Moreover, the guidelines issued by the Dutch College of General Practitioners could have affected general practitioners' management [27,28,29].

General practitioners increasingly handle more skin problems themselves and refer fewer children to secondary health care compared to 1987. In 2001, the referral rate of the four most frequent infectious skin diseases (impetigo, warts, dermatophytosis and acne) decreased substantially compared to 1987. Prescription patterns of general practitioners also changed between 1987 and 2001. Probably, these changes were induced by the introduction of the national practice guidelines, issued by the Dutch College of

General Practitioners, for diagnosis and treatment of diseases. In general, Dutch general practitioners prescribed treatments according to the national practice guideline and/or evidence-based knowledge on the effectiveness of different therapies concerning impetigo, dermatophytosis and acne.

However, Dutch general practitioners treated warts applying a different strategy than is recommended in literature [30]. Although there is only weak evidence for cryotherapy with liquid nitrogen general practitioners treated the majority of patients with warts by applying cryotherapy and with salycilic acid on the second place, indicating that general practitioners do not follow the evidence-based knowledge on the effectiveness of the treatment. Probably the use of liquid nitrogen is simple, cheap and safe. More randomized controlled trials are needed to confirm or to reject the effectiveness of liquid nitrogen.

General practitioners' referral rate of warts decreased from 6.1% (1987) to 3.1% (2001). Practices applying cryotherapy with liquid nitrogen for the treatment of warts have a significant lower referral rate than practices that do not apply liquid nitrogen. This may reflect that general practitioners believe in the effectiveness of liquid nitrogen due to their experiences in daily practice and this should not necessarily imply that liquid nitrogen is effective

The Dutch College of General Practitioners has not yet issued a guideline for the treatment of warts. Probably general practitioners need a guideline to hold on. The development of a treatment guideline is needed which could be based on evidence-based knowledge of the effectiveness of the therapy and or consensus.

Over-the-counter medication: Nowadays more and more over-the-counter medications are available. Several topical drugs are obtainable without a prescription of the general practitioner concerning the treatment of warts, dermatophytosis and acne. There is a trend that more and more patients are applying self-care [3] and do not seek medical help or consult the general practitioner in a later phase of the disease after it becomes clear that the self-care does not improve the complaints adequately. This could have consequences for the general practitioners' management and choice of treatment. This could for example, explain that general practitioners sometimes apply another treatment strategy than is recommended in the national practice guidelines. Although at present we do not have a clear insight in what proportion of children primarily apply self-care strategies.

Do infectious skin diseases predict serious complications?

Skin infections are almost always curable, but some may lead to serious complications such as nephritis, carditis, arthritis and sepsis if the diagnosis is delayed and/or treatment is inadequate [31,32,33,34,35,36,37,38]. It is of interest to know whether general practitioners could play a role in preventing such complications by diagnosing and treating skin diseases timely and appropriately. We found that there is little difference between children being admitted in hospital for sepsis or bacteraemia and other children as to consulting a general practitioner for skin diseases in a period of 14 days before admission to hospital.

Moreover, general practitioners could only play a role in preventing such complications if children with skin diseases consulted their general practitioner in time. A Dutch study performed in children aged 0-14 years reported that 28% of those with skin diseases consulted the general practitioner [39].

From a clinical point of view the difference with regard to skin diseases between children being admitted to hospital due to sepsis or bacteraemia and other children is not relevant. The probability that a child being admitted to hospital due to sepsis or bacteraemia consulted the general practitioner for skin diseases prior to their hospital admission is only about 5% and therefore not a point of departure for general practitioners to reduce the risk of sepsis and/or bacteraemia considerably by diagnosing and treating skin diseases appropriately.

Strenghts and limitations of the study

These two large representative and comprehensive surveys enabled us to assess current epidemiological data of skin diseases presented by children in general practice. We were able to identify a trend in the incidence rates of skin diseases encountered in general practice between 1987 and 2001. These two surveys also enabled us to compare general practitioners' management between 1987 and 2001.

The data of the second National Survey (2001) enabled us also to assess the self-reported prevalence of warts in the population and what proportion of children that reported to suffer from warts consulted their GP for that reason. Although the health interview had a response rate of 65%, the responders were representative for the Dutch population [40].

It is inevitable that comparison of nation-wide surveys of such magnitude has limitations and these should be considered when interpreting the results of this thesis. There

were small differences in the design of the two national surveys, which might disturb the comparability of data.

Firstly, three-month incidence rates of 1987 were weighted to one-year incidence rates and this may lead to skewed incidence rates (for 1987), especially if disease-specific episodes consist of more than one contact.

Secondly, some of the differences in occurrence may be explained by the fact that ICPC coding was not performed equally in both surveys. We assume that coding by clerks in 1987 more often led to a specific diagnostic ICPC code, than in 2001, where general practitioners coded themselves leading to more symptom codes. These differences should be considered when comparing incidence rates of both surveys.

Thirdly, in the present study the accuracy of diagnoses made by the GPs could be a subject of debate. Concordance of GP's diagnoses with dermatologists' diagnoses have been shown to be around 50% [41]. In our analysis we assumed that the diagnoses made by the participating GPs were correct. In 2001 the participating GPs were trained in coding the diagnoses correctly using ICPC codes. Overall these trained GPs classified diagnoses correctly in about 81% of the test cases [40].

Fourthly, because of the underrepresentation of deprived and urban areas in the survey of 1987, the population was weighted to correct for morbidity presented in these areas. In common disorders in children such as respiratory tract infections and most skin diseases, comparability of rates between both surveys will be more valid. However, in rare diseases the weight factor may lead to skewed rates.

Fifthly, for this study data of only two points in time were available. Actually to identify a trend of the incidence rates of skin diseases in general practice data of multiple points in time are needed.

General implications

Health care

This thesis provides an overview of current childhood skin morbidity as presented in general practice and changes over the past decades. Dutch general practitioners are provided with a frame of reference for their own daily practice.

Incidence rates of skin diseases in children in general practice are related to socio-demographic characteristics such as age, gender, urbanization, region, season, socio-economic status and ethnic origin. Knowledge about these contributing factors may be useful tools for preventive actions and to provide appropriate advices to patients. The striking regional variation, especially in impetigo, and the racial predisposition (e.g. warts, dermatophytosis) could be useful in diagnosing the disease.

This thesis shows that children presented a different skin morbidity pattern in general practice in 2001 compared to 1987. They presented more infectious (bacterial and fungal) and atopic skin diseases. These emerging skin problems should be monitored in order to assess the future health burden and should be intervened if and where necessary.

In addition, general practitioners seem to manage childhood skin problems increasingly themselves, implying that referrals to secondary care are made more selectively. Specialists in secondary care, especially dermatologists to whom children with skin diseases are usually referred to, should be aware of this trend in order to make a better judgement of morbidity that is presented to them.
Overall, general practitioners follow evidence-based knowledge on the effectiveness of different therapies and/or the national practice guideline, issued by the Dutch College of General Practitioners.

Health care research
This thesis not only provides an overview of current childhood skin morbidity as presented in general practice and changes over the past decades, but also reference material of skin diseases for future studies. Consequently, this overview of childhood skin morbidity and its changes over time may direct the future research agenda.

The childhood population of this study and their use of primary and secondary care are representative for the population and demand of care of the near future. Moreover, the children studied in this survey are representative for futures' adolescents and adults. Future studies on emerging skin problems (bacterial, fungal and atopic) are necessary in order to introduce preventive strategies. The Dutch Health Council and public health workers should be aware of trends therein in order to optimize the assessment of the need of future's health services.
For instance, more dermatological expertise might thus be implemented in the vocational training programmes and continuing medical education programmes for GPs and primary health care workers.

Recommendations for future studies
The emerging skin diseases such as infectious (bacterial and fungal) and atopic skin diseases should be monitored in order to assess the future health burden and should be intervened if and where necessary. Based on the results of our study, the major issues to be evaluated in the future include:

As part of the issue of antibiotic resistance, more studies that establish the contribution of a given treatment for impetigo to the development of bacterial resistance, such as Ravenscroft [12], are desirable. Our hypothesis that there may be causality in the association of the incidence of impetigo and the location of the pig farming industry in the southern part of the Netherlands merits further study. This research would consist of bacteriological typing and comparison of staphylococcal strains derived from impetigo patients in different regions of the country and from pigs.

Other questions that need to be answered are whether prompt treatment of impetigo reduces contagiousness or prevents epidemics, and whether barring affected children from school is an effective measure towards prevention. Research trying to establish the untreated course of impetigo would be very useful.

Considering the increasing incidence rate of dermatophytosis in general practice, which is most pronounced in rural areas and in children of non-western origin, more epidemiological research on the population-based frequency of dermatophytosis and medical help-seeking behaviour are needed.

Although there is a considerable lack of evidence on the effectiveness of cryotherapy by using liquid nitrogen Dutch general practitioners widely used this therapeutic option for warts. More randomized controlled trials are needed to study the effectiveness of cryotherapy.

Considering the striking and substantial decrease of the incidence rate of acne in children and adolescents in general practice more studies on the population-based frequency of acne and medical help-seeking behaviour are needed.

We currently do not have a clear insight in the use of over-the-counter medication. Additional studies are necessary to assess what proportion of children and adolescents with skin diseases, especially warts, dermatophytosis and acne apply self-care strategies.

Finally, it is recommendable to repeat these nation-wide surveys at time intervals of five to ten years in order to identify trends in occurrence of diseases, medical help-seeking behaviour and management strategies.

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Samenvatting

Huidziekten vormen een belangrijk deel van de totale morbiditeit gepresenteerd door kinderen aan de huisarts. In de afgelopen twee decennia zagen we een toename van huidziekten gepresenteerd aan de huisarts door kinderen van 0–17 jaar. Er is relatief weinig bekend over de epidemiologie van huidziekten in de huisartspraktijk.
In dit proefschrift wordt er in de eerste plaats een overzicht gegeven van alle aan de huisarts gepresenteerde huidziekten door kinderen waarna er meer in detail wordt gekeken naar de veranderende incidentie van infectieuze huidziekten in de afgelopen decennia, en het beleid van de huisarts.
Verder wordt er geprobeerd determinanten te identificeren die geassocieerd zijn met de incidentie van infectieuze huidziekten. Kennis over eventuele determinanten zou kunnen bijdragen aan een adequate preventie van infectieuze huidziekten en mogelijke complicaties. Wij hebben een observationele studie uitgevoerd waarbij wij gebruik hebben gemaakt van de data van beide Nationale Studies.
Alle studies uit dit proefschrift zijn in de huisartspraktijk uitgevoerd aangezien bijna alle huidziekten bij kinderen door de huisarts worden gediagnostiseerd en behandeld.

In **hoofdstuk 2** wordt er een overzicht gegeven van de incidentiecijfers van alle aan de huisarts gepresenteerde huidziekten door kinderen (0–17 jaar) in 1987 en 2001.
Tussen 1987 en 2001 is de totale incidentie van de aan de huisarts gepresenteerde huidziekten gestegen. Zuigelingen (< 1 jaar), meisjes, kinderen uit de zuidelijke provincies van Nederland en kinderen van niet westerse immigranten consulteren vaker de huisarts voor een huid gerelateerd probleem ten opzichte van oudere kinderen, jongens, kinderen uit centraal en noordelijk Nederland en kinderen van autochtone Nederlanders. Verder is de incidentie van impetigo, dermatophytosis and atopisch eczeem gestegen tussen 1987 en 2001, terwijl wratten, contacteczeem en huidbeschadigingen een daling laten zien van de incidentie bij kinderen in de huisartspraktijk.

In **hoofdstuk 3** worden de epidemiologie en het beleid van de huisarts met betrekking tot impetigo bij kinderen beschreven. Impetigo is de meest voorkomende bacteriële huidinfectie bij kinderen. Resultaten van twee meetpunten (1987 en 2001) worden vergeleken.
Het incidentiecijfer van impetigo is gestegen van 16.5 (1987) naar 20.5 (2001) per 1000 persoonsjaren bij kinderen jonger dan 18 jaar, een statistisch significant verschil. Zowel in 1987 alsook in 2001 zagen we dat in de zomer, op het platteland en in de zuidelijke provincies van Nederland kinderen vaker impetigo aan de huisarts presenteerden. Sociaal-economische klasse is niet geassocieerd met de incidentie van impetigo. Tussen 1987 en 2001 zijn er veranderingen opgetreden met betrekking tot de behandeling van

impetigo: huisartsen zijn veel meer locale antibiotica gaan voorschrijven (van 40% naar 64% van alle recepten), waarbij fusidinezuurcreme and mupirocinecreme het meest worden voorgeschreven.

In **hoofdstuk 4** vergelijken we de incidentie van acne in de huisartspraktijk en het beleid van de huisarts bij kinderen en adolescenten op twee meetpunten (1987 en 2001). Acne is een multifactoriële huidziekte waarbij de *Propionibacterie acnes* onder andere een belangrijke rol speelt bij het ontstaan van acne.
De incidentie van acne in de huisartspraktijk is gedaald van 20.0 (1987) naar 11.8 (2001) per 1000 persoonsjaren. Meisjes, adolescenten uit de leeftijdscategorie 15-19 jaar en niet-westerse immigranten consulteren de huisarts vaker met acne klachten dan jongens, adolescenten uit andere leeftijdscategorieën en autochtone Nederlanders. In het algemeen behandelen huisartsen acne volgens de bestaande richtlijnen.

In **hoofdstuk 5** bestuderen wij de epidemiologie van wratten en behandelstrategieën van de huisarts. Wratten worden veroorzaakt door een virus en vormen de meest voorkomende huidziekte bij kinderen.
De zelf-gerapporteerde prevalentie van wratten bij kinderen is 6.2%; 23.3% van de kinderen die rapporteren last te hebben van wratten consulteren de huisarts hiervoor.
De incidentie van wratten bij kinderen in de huisartspraktijk is gedaald van 44.5 (1987) naar 32.1 (2001) per 1000 persoonsjaren. Meisjes, met name in de puberteit, en kinderen van autochtone Nederlanders consulteren de huisarts vaker voor wratten dan jongens en kinderen van niet-westerse immigranten. Huisartsen behandelen het overgrote deel van de wratten door deze te bevriezen middels vloeibare stikstof. Van de meest toegepaste therapieën staat salicylzuur op de tweede plaats.

In **hoofdstuk 6** worden de epidemiologie en het beleid van de huisarts met betrekking tot dermatophytosis bij kinderen beschreven.
Dermatophytosis is een veel voorkomend schimmelinfectie van de huid bij kinderen. Ofschoon de epidemiologie relatief weinig is opgehelderd, is de incidentie van dermatophytosis bij kinderen in sommige landen excessief gestegen in de afgelopen decennia.
Tussen 1987 en 2001 is de totale incidentie van dermatophytosis bij kinderen in de huisartspraktijk gestegen. Zuigelingen (< 1 jaar), meisjes, kinderen op het platteland, kinderen van niet-westerse immigranten consulteren vaker de huisarts voor dermatophytosis dan oudere kinderen, kinderen uit verstedelijkte gebieden en kinderen van autochtone Nederlanders.
In het algemeen volgen huisartsen de behandelrichtlijnen bij de behandeling van dermatophytosis bij kinderen.

In **hoofdstuk 7** wordt de associatie tussen huidziekten, in het bijzonder huidinfecties, en een ziekenhuisopname ten gevolge van sepsis of bacteraemie bij kinderen (0–17 jaar) geëxploreerd. Sepsis of bacteraemia komt relatief weinig voor, maar gaat gepaard met een hoge mortaliteit en/of ernstige complicaties. Er lijkt een causaal verband te bestaan tussen huidziekten en een ziekehuisopname voor sepsis of een ernstige bacteriële infectie.

Wij hebben de volgende hypothese getest: kinderen die opgenomen zijn geweest voor sepsis of bacteraemie hebben vaker last van huidziekten vóór de opname en bezoeken dientengevolge de huisarts vaker voor een huidprobleem dan andere kinderen.

We vinden odds ratios van 3.4 (95% BI:[1.1 – 10.8], p = 0.03) voor huisarts consultaties betreffende een huidziekte in cases vergeleken met een controlegroep uit de huisartspraktijk 'GP' controles en 1.4 (95% BI:[0.5 – 3.9], p = 0.44) in cases vergeleken met een controlegroep uit het ziekenhuis 'hospital' controles. Kinderen jonger dan drie maanden hebben een odds ratio (cases / GP controles) van 9.2 (95% BI: [0.81 - 106.1], p = 0.07) en 4.0 (95% BI: [0.67 – 23.9], p = 0.12) in cases versus hospital controles. Slechts 5% van de cases consulteren de huisarts voor een huidziekte vóór hun opname.

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Curriculum Vitae

Robbert SA Mohammedamin werd op 1 juni 1968 geboren te Paramaribo (Suriname). Na het afronden van het voortgezet onderwijs begon hij de studie geneeskunde in 1989 aan de Erasmus Universiteit te Rotterdam en legde het artsexamen met goed gevolg af in 1996.

Van 1996 tot 2001 werkte hij als arts-assistent niet in opleiding op diverse klinische afdelingen te weten Urologie (ErasmusMC Rotterdam), Interne Geneeskunde (Oogziekenhuis Rotterdam), Cardio-thoracale chirurgie (LUMC Leiden) en Spoedeisende Hulp (MCH Haaglanden).

Hij startte de huisartsopleiding in 2001 aan de Universiteit van Maastricht en liep zijn eerstejaars stage te Venray (opleider H. Schraven). Hij liep zijn derdejaars stage te Brielle (opleider B. Ponsioen) en rondde in 2003 de huisartsopleiding af aan het Erasmus MC te Rotterdam. Aansluitend begon hij aan zijn promotietraject. Van 2003 tot 2005 is hij verbonden geweest als huisarts-onderzoeker op de afdeling Huisartsgeneeskunde van het Erasmus MC te Rotterdam waar hij aan de in dit proefschrift beschreven studies heeft gewerkt. In juni 2005 behaalde hij het Master of Science diploma in de Klinische Epidemiologie aan de Netherlands Institute for Health Sciences (NIHES).

In juli 2006, tijdens de Annual Scientific Meeting (ASM) van de Society for Academic Primary Care (SAPC), te Keele in Engeland, werd zijn abstract gebaseerd op hoofdstuk 7 van dit proefschrift tot beste uitgeroepen en ontving hij de SAPC/EGPRN (European General Practitioners' Research Network) award.