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Mapping opportunities for the earlier diagnosis of psoriasis in primary care settings in the UK

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Authors' contributions

Maha Abo-Tabik had full access to all of the data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis.

Study concept and design: Abo-Tabik, Parisi, Morgan, Ashcroft and Griffiths.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Abo-Tabik.

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Study supervision: Parisi, Willis, Ashcroft and Griffiths.

What's already known about this topic?

- Many people suffer needlessly from psoriasis due to missed or delayed diagnosis.
- Primary care professionals are most often the first point of contact for people with psoriasis.
- The diagnosis of psoriasis can be a challenging task for non-dermatologists.

What does this study add?

Examining electronic health records from general practices showed that:

- The diagnosis of psoriasis may be missed or delayed.
- People with undiagnosed psoriasis (missed or delayed diagnosis) have an increased frequency of GP consultations from five years before their diagnosis of psoriasis is confirmed.
- Individuals with psoriasis are often prescribed topical corticosteroids and/or topical antifungal medications before being diagnosed with psoriasis. These medications may mask the signs of psoriasis.

Summary

Background

The diagnosis of psoriasis may be missed or delayed in primary care settings.

Aim

To examine trends of healthcare events prior to a diagnosis of psoriasis.

Design and Setting

Two matched case-control studies using electronic healthcare records delineated from the Clinical Practice Research Datalink (CPRD GOLD and Aurum) in the UK.

Method

Individuals aged 18 years or above with an incident diagnosis of psoriasis (cases) between 1st of January 2010 and 29th December 2017 were identified and matched by age, sex and general practice with six individuals without psoriasis (controls). Healthcare activities including clinical diagnoses, recorded clinical features and prescribed medications were examined and their annual incidence rates (IR) and incidence rate ratios (IRR) with 95% confidence intervals for 10 years before the index date were compared between cases and controls.

Results

17,320 psoriasis cases and 99,320 controls were included from CPRD GOLD, and 11,442 cases and 65,840 controls were extracted from CPRD Aurum. Data from CPRD GOLD showed that people with psoriasis were up to eight-times more likely to be diagnosed with pityriasis rosea at six months (IRR 7.82 (95%CI 4.09-14.95)) before the index date than controls. Cases were twice as likely to be diagnosed with eczema 1.90 (1.76 -2.05), or tinea corporis 1.99 (1.74-2.27) one year before diagnosis. Cases were also more likely to report certain clinical features suggestive of psoriasis (including dry skin, rash, skin texture changes and itching) than controls up to five years before index date. The most frequently reported clinical feature was rash with IRR of 2.71(2.53-2.92) at one year before diagnosis. Cases were prescribed topical corticosteroids 1.97 (1.88-2.07) or topical antifungals 1.92 (1.78-2.07) in the year before diagnosis twice as often as controls. Data from CPRD Aurum showed similar results to CPRD GOLD.

Conclusion

Potential missed opportunities for the earlier diagnosis of psoriasis were identified from the medical records of patients with the disease. Findings from this case-control study suggest that the diagnosis of psoriasis may be missed or delayed for up to five years for some individuals hence leading to a potentially detrimental delay in establishing an appropriate treatment regimen.

Introduction

Psoriasis is a systemic, inflammatory, long-term disease with characteristic clinical signs[1]. It affects the quality of life of affected individuals to a substantial degree [2], however, its overall effect often extends beyond the skin, being associated with other medical conditions such as psoriatic arthritis [3], cardiovascular disease [4], respiratory diseases [5], liver disease [6] and depression [7]. Disease progression in psoriasis is unpredictable in that some patients have mild disease that is stable for many years, while for others, it quickly progresses to moderate-to-severe disease [2]. Thus, psoriasis is a complex health problem that requires a comprehensive care approach for both early diagnosis and treatment. The global prevalence of psoriasis is estimated to be 0.59% in adults and about 0.47% in the overall population [7], and psoriasis affects around 3% of the general population in the United Kingdom [8].

Epidemiological studies suggested that the burden of psoriasis is greater in high-income countries of North America and Europe than other regions [9]. In 2014, the World Health Organization (WHO) highlighted that many people in the world suffer needlessly from psoriasis due to an incorrect or delayed diagnosis. The WHO also emphasised the psychological and pathological consequences of a delayed or incorrect diagnosis of psoriasis and recognised this as a global

concern [(10,11)].
Present treatment approaches are aimed at providing individualised care which focuses on improving the signs and symptoms of the rash while proactively screening for and treating any associated comorbidities [12]. More recently, increasing efforts are being made to trial the impact of early intervention targeting complete clearance which may improve control of psoriasis and may also modify disease course and burden [13]. To address this, psoriasis cases need to be recognised early.

The impact of the delay in the diagnosis and treatment of psoriatic arthritis has previously been investigated and it has been suggested that a 6-month or longer delay in this diagnosis and initiation of treatment is associated with deterioration in patients' quality of life in comparison with shorter periods [14]. In the case of psoriasis, a multicentre international observational study reported on the diagnostic delay and estimated this to be 1.6 ± 4.8 years on average [15].

The diagnosis of psoriasis relies on the identification of clinical features, which are incorporated into clinical diagnostic criteria [16]. However, its variable clinical presentation and resemblance to other skin conditions (e.g., eczema and tinea corporis) make it difficult to recognise, especially in those populations where access to specialist dermatology care is restricted which may result in missed or delayed diagnosis.

In many countries, including the UK, primary care professionals represent the first point of contact for people with dermatological conditions including psoriasis [17]. Despite being one of the most commonly seen skin conditions in a primary care setting, there is a lack of studies on missed or delayed diagnosis of psoriasis.

The primary aim of this study was to examine the electronic health records (EHR) of individuals with and without psoriasis and to investigate incident rates of other differential diagnoses, characteristic clinical features, and treatments.

Methods

Data source, participants and study design

We used data from the Clinical Practice Research Datalink (CPRD). The CPRD is one of the largest databases of longitudinal health records from primary care in the world. Data from CPRD are divided into two databases depending on the IT system the general practice uses for their patient management. General Practices using Vision software contribute to CPRD Gold [18], whilst those using EMIS web software contribute to CPRD Aurum [19]. CPRD GOLD has contributing general practices from across the UK whereas CPRD Aurum collects anonymised health records from general practices predominately in England. The population coverage of the dataset is considered to be representative in terms of age, gender, ethnicity and geographical distributions of the UK general population [18,19)].

The study was approved by the Independent Scientific Advisory Committee (ISAC) for Medicines and Healthcare products Regulatory Agency database research (ISAC approval 18_308R) in the UK and is reported in line with the recommendations of the RECORD statement [20]. This case-control study was conducted using de-identified EHR that were extracted by a third party and anonymised before they were made available for research purposes. Thus, no patient consent was required.

Participants were included as incident cases of psoriasis diagnosed between 1 January 2010 and 29 December 2017. Each individual with psoriasis was matched with six eligible individuals without a diagnosis pf psoriasis. The matching was undertaken on calendar time (index date of cases), the exact year of birth, gender, and registered general practice.

Clinical events of interest

An *a priori* list of clinical events that could potentially be related to missed opportunities for psoriasis diagnosis in primary care settings was identified. Clinical events of interest were grouped into three categories: (i) differential diagnosis for psoriasis; (ii) clinical features; and (iii) prescribed medications (Table S1 in the supporting information). Diagnoses and clinical features were identified by Read codes. The list of clinical events was reviewed by an experienced dermatologist (CEMG) to ensure clinical relevance to the aims and objectives of the study.

Differential diagnosis

Potential differential diagnoses of psoriasis included seborrheic dermatitis, other eczema (including contact dermatitis, atopic dermatitis, neurodermatitis, discoid eczema, asteatotic eczema and hand dermatitis), tinea capitis, candidal dermatoses, and pityriasis rosea.

Clinical features

We examined the number of times that cases, and controls consulted their General Practitioner (GP) with clinical features that were considered suggestive of psoriasis. Clinical features that may precede a diagnosis of psoriasis included itching, dry skin, rash, and changes in skin texture (scale, plaque and crust).

Prescribed medications

We identified two groups of medications that are often prescribed for people before their diagnoses of psoriasis is confirmed. These included topical corticosteroids from section 13.4 British National Formulary (BNF) and topical antifungals from section 13.10.2 BNF [21].

Data analysis

Descriptive statistics were used to calculate the median and interquartile range (IQR) for demographic characteristics. We considered age at index date, gender, geographical region at the general practice level, and socioeconomic status based on the index of multiple deprivation (IMD) as a measure of socioeconomic deprivation of residential neighbourhood [22-24] which was linked at general practice level. We also considered the frequency of GP visits. Absolute numbers (i.e., total numbers of cases and controls) and their frequency (or proportion) were used to report on demographic data analysis.

We calculated incidence rates (IR) and 95% confidence intervals (95%CI) for each clinical event (differential diagnosis, clinical features and prescribed medication) per 1000 person-year for each year within 10 years before the index date for individuals with and without psoriasis. We also calculated the incidence rate ratio (IRR) and 95% CIs for each clinical event at 6 months, 1 year, 3 years and 5 years before index date for cases and controls.

Results

CPRD GOLD dataset

Demographic characteristics

The study population was extracted from 796 participating GP practices. 17,320 individuals with incident diagnosis of psoriasis were identified from CPRD GOLD and matched to 99,320 individuals without psoriasis diagnosis. The baseline demographic characteristics are described in Table 1. Median (IQR) age at index date was 51 years (36-64) and 50 (36-64) for cases and controls, respectively; 52%, female and 48% male for both groups.

Frequency of GP consultations

Overall, individuals with psoriasis were more likely to visit their GP than those without psoriasis. Visits to the GP practices for individuals with psoriasis increased during the 5-year period before the index date by almost 60%, from a median (IQR) of 7 (2-13) per year at five years before index date to 11 (5-19) visits per year at one year before index date. Whereas the frequency of GP consultations for those without psoriasis showed a less noticeable increase from 5 (2-12) to 8 (4-15) over the same 5-year period before index date.

Clinical events

Differential diagnosis

Psoriasis cases were more likely to receive a diagnosis of pityriasis rosea, eczema, seborrheic dermatitis, tinea corporis and candidal dermatoses than those in the comparator group from five years before index date.

The incidence rates of being diagnosed with one of the aforementioned skin conditions were markedly higher for the psoriasis group than those without psoriasis in the final year before index date, as shown in Table 2.

Individuals with psoriasis were almost eight times more likely to be diagnosed with pityriasis rosea (Figure 1a) and twice as likely to be diagnosed with seborrheic dermatitis (Figure 1b) and eczema (Figure 1d) within the year before index date than those in the comparator group.

In addition, individuals with psoriasis were 2.5 times more likely to be diagnosed with tinea capitis (Figure 1c) and 1.5 times more likely to be diagnosed with candidal dermatoses (Figure 1e) in the final year before index date than those without psoriasis.

Clinical features

People with psoriasis more frequently reported rash, dry skin, skin texture changes (including scales, plaque, and crust) than those without psoriasis diagnosis before index date, as shown in Table 2.

The most frequently reported clinical feature was skin rash (Figure 2a). Those who ended up with a psoriasis diagnosis were four times more likely to report skin rash at the final year before index date than the comparator group.

Cases were twice as likely to report dry skin (Figure 2b) and skin texture changes (Figure 2c) at the final year before index date than controls.

Individuals in the psoriasis group were only slightly more likely to report itching than those in the non-psoriasis group (Figure 2d).

Prescribed medications

There was an increasing likelihood of a person from the psoriasis group being prescribed topical corticosteroids or topical antifungal medication closer to the index date compared to the comparator group, as shown in Table 2.

Those with confirmed psoriasis diagnosis were almost twice as likely to be prescribed topical corticosteroids (Figure 3a) or topical antifungals (Figure 3b) within the final year before the index date (i.e., date of documented psoriasis diagnosis) than those in the non-psoriasis group. Closer to the index date, (at six months before a confirmed psoriasis diagnosis) cases were 2.5 and 2.3 times more likely to receive topical corticosteroids and topical antifungal medication respectively, than controls.

The IRR for all investigated clinical events at 6 months, 1 year, 3 years and 5 years before index date is shown in Table 2.

CPRD Aurum dataset

Data from CPRD Aurum showed similar findings to CPRD GOLD. 11,442 people with incident psoriasis diagnosis and 65,840 without psoriasis were included in this study.

The baseline demographic characteristics of the study cohort are shown in (Table S2 in the supporting information). The median (IQR) was 50 (35-64) years for both cases and controls. Female: male ratio was similar for cases and controls with almost 52% female and 48% male patients. Study population was extracted from 176 GP practices contributing to the CPRD Aurum database.

The frequency of GP consultations increased steadily from seven visits in five years before index date to 12 visits in the final year before index date, as shown in Table S2 in the supporting information.

Trends for incidence rates for the examined clinical events (differential diagnosis, clinical features and prescribed medication) were all similar to the findings from CPRD GOLD. The annual incidence rate for the investigated possible missed clinical events is shown in Figures S1-S3 in the supporting information. The IRRs are shown in Table S3.

Discussion

Summary

To our knowledge, this is the first study to retrospectively analyse data collected from medical records to investigate primary care consultations prior to a diagnosis of psoriasis. This has resulted in the identification of premonitory clinical events that could potentially be related to a diagnosis of psoriasis before it is made. We found that people with psoriasis were more likely to visit general practices than those without psoriasis from five years prior to index date.

Cases had higher chances of being diagnosed with skin conditions other than psoriasis prior to the index date (i.e., date of confirmed psoriasis diagnosis) than controls. Such skin conditions included pityriasis rosea, eczema and/ or fungal infections. Additionally, we found higher reporting of symptoms related to psoriasis such as rash, dry skin and skin texture changes in individuals who eventually developed psoriasis than those without psoriasis.

Individuals with psoriasis were more likely to be prescribed a topical corticosteroid or antifungal medication before a documented diagnosis of psoriasis than were controls. The frequent use of these medications could mask signs and symptoms of psoriasis and contribute to further delay in diagnosis.

All the examined healthcare events (i.e., differential diagnosis, clinical features, and prescribed medications) tend to increase through five years before index date among people with psoriasis. Hence, suggesting possible delays in psoriasis diagnosis of up to five years for some individuals.

Strengths and limitations

The main strength of the study is that we conducted two independent case-control studies using primary care EHRs (CPRD GOLD and CPRD Aurum) and report similar findings between the two studies. Additionally, data recorded in the electronic health records are recorded prospectively thereby minimising the risk of recall bias.

The main limitation of this study is that only individuals aged 18 years or above were included in this study thus missed opportunities for psoriasis diagnosis among younger individuals at risk were not explored.

The other limitation is the lack of comparison across skin of colour. Psoriasis presents differently on different skin colours [16,25,26] and the lack of experience on recognising psoriasis on darkly pigmented skin could potentially be a factor in a missed or delayed diagnosis.

Comparison with existing literature

Studies on the clinical diagnosis of psoriasis has been limited. Our recent international e-Delphi study undertaken by the Global Psoriasis Atlas (GPA) reached consensus on a set of clinical examination-based diagnostic criteria for chronic plaque psoriasis [16]. These diagnostic criteria were developed to facilitate psoriasis case recognition by non-dermatologists (such as primary healthcare professionals) in an attempt to improve psoriasis diagnosis in settings where access to specialist dermatology care is restricted. In this e-Delphi study we also captured the different clinical presentation of psoriasis across wide ethnic backgrounds and different affected body sites (i.e., different psoriasis clinical phenotypes).

Implications for Research and/or practice

Missing a diagnostic opportunity implies that an alternative approach could have enabled an earlier and correct diagnosis [27]. For the practising clinician, data from this study raises awareness regarding a missed or misdiagnosis of psoriasis among primary care physicians and emphasizes the need to improve non-dermatologists' diagnostic skills for psoriasis via specifically designed training courses (e.g., online training tool) to encourage them to follow the consensus-agreed diagnostic criteria when suspecting a diagnosis of psoriasis [16].

Physicians should consider the possibility of psoriasis in people with the following medical history and symptoms and signs of a skin condition:

1. Frequent GP consultations for their skin-related complaints.

2. Received a diagnosis of seborrheic dermatitis, other eczema (including contact dermatitis, atopic dermatitis, neurodermatitis, discoid eczema, asteatotic eczema and hand dermatitis), tinea capitis, candidal skin infections, and/or pityriasis rosea in the past.

3. Frequently reporting itching, dry skin, rash, and skin texture changes (scale, plaque and crust).

4. Being prescribed topical corticosteroids and/or topical antifungal medication with no or minimal improvement.

Timely diagnosis of psoriasis may promote early targeted, person-specific treatment, advice about psoriasis and lifestyle, and screening for and treatment of comorbidities thereby improving disease course and burden and reducing the chance of cumulative life-course impairment [12,28,29]. Nevertheless, early diagnosis of psoriasis could also encourage changes to a healthier lifestyle.

Lifestyle changes such as weight loss, reducing alcohol intake and smoking cessation have been suggested as possible favourable psoriasis disease course-modifiers [30,31].

The findings from this study have shown that people with psoriasis have increased healthcare interactions for several years before a diagnosis of psoriasis is made. Our results support the need to investigate further whether a missed opportunity for

diagnosis of CPP could be prevented by following expert agreed diagnostic criteria for the condition[16].

Furthermore, future work might be needed to explore the pre-diagnostic period of psoriasis using data from secondary care settings.

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Ethical Approval

The study was approved by the Independent Scientific Advisory Committee (ISAC) for Medicines and Healthcare products Regulatory Agency database research (ISAC approval 18_308R) in the UK.

Conflict of interest and Disclosure

C.E.M. Griffiths has received honoraria and/or research grants from AbbVie, Almirall, BMS, Celgene, Eli Lilly Janssen, LEO pharma, Novartis, Pfizer, Sandoz, Sun Pharmaceuticals and UCB Pharma.

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Table 1: Baseline demographic characteristics of the study population (CPRD GOLD).

Total		Psoriasis case (n= 17,320)	Control (n= 99,320)
Sex n (%)	Male	8,282 (47.82)	47,491(47.82)
	Female	9,038 (52.18)	51,829 (52.18)
Age at index Median (IQR)[1]		51 (36-64)	50 (36-64)
Region n (%)	London	2,457 (14.19)	14,023 (14.12)
	South England	7,227 (41.73)	41,626 (41.92)
	Midlands and east England	3,831 (22.12)	21,924 (22.07)
	North England	3,805 (21.97)	21,747 (21.89)
Number of GP consultations before index date Median (IQR)	4–5 years prior to index date	7 (2-13)	5 (2-12)
	3–4 years prior to index date	8 (3-15)	6 (2-12)
	2–3 years prior to index date	8 (3-16)	6 (2-13)
	1–2 years prior to index date	10 (5-18)	8 (4-15)
	0–1 year prior to index date	11 (5-19)	8 (4-15)
Socioeconomic status IMD[2] quintile n (%)	1 (least deprived)	4,020 (23.21)	23,997 (24.16)
	2	3,830 (22.11)	22,405 (22.56)
	3	3,422 (19.76)	19,553 (19.69)
	4	3,343 (19.30)	18,775 (18.90)
	5 (most deprived)	2,695 (15.56)	14,533 (14.63)

[1] IQR: Interquartile range.

[2] IMD: Index of multiple deprivation.

Table 2: Incidence rate ratios of clinical events recorded 6 months, 1, 3 and 5 years before index date (CPRD GOLD).

Clinical events	IRR (95% CIs) 6 months	IRR (95% CIs) 1 Year	IRR (95% CIs) 3 Year	IRR (95% CIs) 5 Year
Seborrheic dermatitis	2.34 (1.82-3.00)	1.97(1.65-2.35)	1.49(1.33-1.66)	1.27(1.33-1.38)
Eczema.	2.23 (1.99- 2.50)	1.90(1.76 -2.05)	1.41(1.35-1.48)	1.23(1.18-1.28)
Tinea capitis	2.52(2.09-3.03)	1.99(1.74-2.27)	1.43(1.32-1.56)	1.25(1.17-1.34)
Candida skin infections	1.46 (1.32-1.74)	1.44(1.29 -1.61)	1.28(1.20 -1.37)	1.15(1.08-1.21)
Pityriasis rosea	7.82 (4.09-14.95)	3.24 (2.24-5.27)	1.71(1.28-2.27)	1.38 (1.09 -1.75)
Dry skin	2.05 (1.54 -2.72)	1.52 (1.24-1.86)	1.38 (1.22 -1.57)	1.8 (1.06-1.30)
Rash	4 (3.62 -4.41)	2.71 (2.53-2.92)	1.63 (1.55 -1.71)	1.32 (1.27 -1.38)
Skin texture changes	2.17 (1.69-2.29)	1.55 (1.39 -1.37)	1.23 (1.14-1.31)	1.13 (1.06 -1.20)
Itching	1.39 (1.00 -1.93)	1.54 (1.22 -1.94)	1.26 (1.10-1.45)	1.18 (1.05 -1.32)
Topical corticosteroids	2.58 (2.39-2.79)	1.97 (1.88 -2.07)	1.46 (1.42 -1.5)	1.24 (1.21 -1.27)
Topical antifungal treatment	2.32 (2.08-2.59)	1.92 (1.78 -2.07)	1.43 (1.36-1.49)	1.24(1.20-1.29)