Societal impact for patients with psoriasis: A nationwide Swedish register study

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Background: Psoriasis is an immune-mediated chronic inflammatory disease having a significant negative health impact. Psoriasis has societal impact; loss of productivity has been estimated at approximately 10% and it may influence the patient's financial status. Relationships between quality of life, disease severity, and cost of care need exploration. Understanding the disease burden is important for health policy and research allocation. Few studies address the research gaps in socioeconomics, comorbidity, and medication use.

Objective: Observing differences in education, income, employment status, marital status, health care consumption, and drug utilization between patients with psoriasis and matched controls.

Methods: Cohort study following socioeconomics and health care consumption for all psoriasis patients from the Swedish patient register. All individuals with a first diagnosis of psoriasis in outpatient or inpatient care from 2002 to 2013 were followed until death, emigration, or end of the study.

Results: Overall, 109,803 patients were included (mean age 51.2 years, 53% women) and matched with 1.08 million controls. The levels of education and income were similar, but the proportion employed was significantly lower for patients with psoriasis. There was a tendency for fewer patients with psoriasis to be married.

Limitations: Generalizability, lack of primary care diagnoses, and lack of early treatments (available from 2005).

Conclusion: Understanding of the socioeconomic impact of psoriasis is extended by showing reductions in employment. (JAAD Int 2021;3:63-75.)

Key words: disease burden; drug utilization; psoriasis; societal impact.

INTRODUCTION
Psoriasis is a common immune-mediated chronic inflammatory disease with worldwide impact on men and women of all ages, affecting 2%-4% of the Nordic population, corresponding to 200,000-400,000 individuals in Sweden. Psoriasis has a negative health impact and increases community resource use and health care consumption. Studies have shown societal impact; global loss of productivity among psoriasis patients was estimated to

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approximately 10%. Other studies have reported that patients with psoriasis lose 2.3 working days per month or 3 days per year in sick leave. In a review of studies published between January 2001 and May 2013, the economic burden of psoriasis was reported in 35 studies (11 countries). The most recent studies reported an annual cost per patient of €11,928 in Sweden, €8,372 in Italy, and €2,866-€6,707 in Germany.

Some costs were related to health care and others to sick leave and disability. Even though there are substantial costs associated with psoriasis, costs can be reduced with treatment. Though there are limited studies on patterns of health care consumption and sick leave, a Swedish study in patients with ankylosing spondylitis and psoriatic arthritis showed that sickness absences declined by 11.7 days for women and 7.6 days for men once psoriasis was diagnosed.

Patients with psoriasis also have more comorbidities, such as diabetes and hypertension, impacting work ability and lifestyle. A focus group in patients with psoriasis revealed that the disease has implications on health care consumption as a consequence of its impact on mental health and well-being. Besides medical symptoms, psoriasis may influence a patient’s income and finances.

Psoriasis prevalence has been relatively stable since the mid-2000s, and studies have demonstrated that patients with severe disease have an increased mortality risk. Understanding the disease burden is important for health policy and research allocation to improve patient outcomes. A number of studies have investigated cause-specific mortality in severe psoriasis, suggesting an association with the increased risk of stroke, cardiovascular disease, and other comorbid conditions. In a previous Swedish study, patients with severe psoriasis were reported to have higher overall mortality and higher cardiovascular disease risk, which is a strong determinant of excess mortality. Few studies addressed the research gaps socioeconomic, comorbidities, and medication use over time and to what extent there are disparities related to the degree of disease control.

The objectives of our study were to estimate and compare differences in education, income, employment, and marital status between patients with psoriasis and controls. Further, our study described and compared health care and drug utilization.

**CAPSULE SUMMARY**

- Psoriasis has a negative health impact and increases community resource use and health care consumption. Our study suggests lower societal productivity by reductions in employment, despite similar incomes to controls.
- There is need for long-term monitoring of patients with psoriasis shown by continued increased health care utilization as compared with controls.

**MATERIALS AND METHODS**

**Study design**

This longitudinal, matched cohort study included all adult patients (>17 years) with a diagnosis of psoriasis who were identified through national Swedish health registers between 1987 and 2013, refers to the date of diagnosis. The study design is illustrated in Fig 1 and described following.

**Setting**

The study was conducted in Sweden, a country of 10 million inhabitants with a comprehensive health care system that aims to ensure everyone’s equal access to health care. Swedish health care is decentralized to 21 regions and regulated by the Health and Medical Service Act. The high degree of self-governance following budget devolution, political majorities, and socio-demographic demands and structures have resulted in regional differences in quality of care, but efforts were taken to strengthen joint work. The National Board of Health and Welfare have issued guidelines for psoriasis, aimed at reducing regional differences, that contain recommendations around living habits, complicity, investigation, follow-up, and treatments.

**Data sources**

Data from Swedish national registers were linked through the unique personal identity number. Information on diagnoses, procedures, hospitalizations, and outpatient consultations in specialist care were collected from the National Patient Register (NPR) between 1987 and 2016 (Fig 1). Inpatient data were available from 1987 and outpatient data from 2001. Diagnoses between 1987 and 1997 were recorded using International Classification of Diseases (ICD), 9th revision; diagnoses between 1997 and the current time were recorded using ICD, 10th revision (Table 1). Information on drugs was collected from the Swedish Prescribed Drug Register (PDR) starting in July 2005. The Swedish PDR contains dispensed items, amount, and date of all filled prescriptions. Drugs were recorded using...
the Anatomical Therapeutic Chemical classification system. Information on deaths were collected from the Cause of Death Register. Migrations and county of residence were retrieved between 2005 and 2016 from the Total Population Register (TPR). Education, income, employment status, and marital status were obtained from the longitudinal integration database for health insurance and labor market studies, between 2004 and 2016. These socioeconomic variables are available only on a yearly basis.

Study population
The study population comprised of all individuals with a first diagnosis of psoriasis, including psoriatic arthritis, in the NPR from 2001 until 2013. A reference cohort was randomly sampled from the TPR (Fig 2). Individuals in the reference cohort are henceforth referred to as controls. All subjects were followed until death, emigration, or end of study (December 31, 2016).

Case cohort. Cases were identified from the NPR as patients experiencing at least 1 inpatient or outpatient hospital event for psoriasis (ICD-10: L40) or psoriatic arthritis (ICD-10: M070, M073). The earliest encounter with such diagnosis was the index date. Patients with at least 1 diagnosis of psoriatic arthritis during the first year after diagnosis were classified as having psoriatic arthritis; else they were classified as having psoriasis.

Reference cohort. The controls were randomly sampled from the TPR and matched 1:10 to the cases on year of birth, sex, and county of residence. The controls had no diagnosis of psoriasis or psoriatic arthritis prior to the index date. The controls were censored at diagnosis of psoriasis or psoriatic arthritis if that occurred during follow-up (later than December 31, 2013).

Outcomes studied
Outcomes were education (time to first increase in level of education), individual income, employment status, and marital status, as well as health care and drug utilization. All were recorded/calculated on a yearly basis.

Education was classified into three levels according to the Swedish educational system. Low education was ≤9 years (primary school), medium education was 10-12 years (secondary school), and high education was >12 years (college/university). Income was yearly individual income in Swedish crowns (SEK), 1SEK = 0.1 USD (December 2019). Employment status corresponded to employed or unemployed. Marital status was evaluated as proportions of marriage or registered partnership.

Health care utilization was measured as the number of outpatient visits and hospitalizations. Drug utilization was measured as the yearly number of unique substances per patient. Utilization of some pharmacological groups is also presented (Table II), selected as recommended for psoriasis treatment or as common medicines used in ambulatory care.

Statistical methods
Descriptive statistics are presented as numbers and proportions for categorical variables and means, medians, standard deviations, and interquartile ranges for continuous variables. No statistical hypotheses of differences at baseline were formulated or tested. All statistical models were adjusted for the matching variables and a comorbidity index based on the count of comorbidities at baseline. The models for socioeconomic variables also included baseline education. The time to first increase in education was analyzed using Cox regression. All other outcomes were compared over time, by year, because the socioeconomic variables were updated on a yearly basis, from 1 year before index until the end of follow-up. The corresponding generalized linear regression models were further adjusted for the calendar year and follow-up time. The two-sided alpha-level was 5%.

Observations between the matched groups were considered independent, whereas observations from the same group were considered dependent; therefore, cluster-robust sandwich estimators were used. Because of regional correlations and unobserved common patient characteristics, county was incorporated in the correlation structure of the generalized estimation equation. Analyses were conducted using SAS 7.15 (SAS Institute Inc., Cary, NC, USA).

If information on a particular variable was available, patients were assumed to have the factor if
there was evidence for its presence (i.e., absence of information was taken to mean absence of the condition). The exception was when “missing” was a possible value, in which case the missing value was retained. In general, subjects with missing information were dropped from the analysis. If a variable had a larger extent of missing values the category “missing” was added.

RESULTS

A total of 109,803 patients were included (mean age 51.2 years, 53% women), matched to 1.08 million controls (Fig 2).

There were minimal differences in sociodemographic characteristics between cases and controls at baseline (Table II). Both cases and controls had similar income and education and both groups were predominantly employed and were not married.

Most cases and controls had neither hospitalizations nor outpatient visits during the year before the index year (Table II). Slightly more patients with psoriasis had at least 1 outpatient consultation (0.4% vs 0.2%) or a hospitalization (4.8% vs 3.6%). Rheumatic diseases were more common among patients in whom psoriasis developed (4.4% vs 1.9%). Patients with psoriasis had higher proportions of comorbidities except dementia (0.4% vs 0.6%). There were differences in drug utilization during the year prior to index with the largest difference for topical corticosteroids (36% vs 7%).

Changes in socioeconomic status over time for cases compared with controls are illustrated in Figure 3 and listed in Table III.

No significant difference ($P = .38$) in time to first increase of education was found between cases and controls (Fig 3, A). There was no significant difference ($P = .99$) between cases and controls in income (Fig 3, B). There was a tendency toward slightly lower income in patients with psoriasis, with certain variation over time. Significantly lower income was observed at 8 years after diagnosis ($P = .0003$), when patients with psoriasis earned 66,000 SEK less than controls earned.

The largest difference between cases and controls ($P < .0001$) was employment status 2-10 years after index. The proportion of employment decreased among patients with psoriasis compared with that of controls during the first 6 years of follow-up, with 10% less patients with psoriasis being employed (Fig 3, C). For marital status, we found a significant difference ($P < .01$) after 4 years of follow-up for the remaining observable period (Fig 3, D). The difference in the proportions of registered partnerships was approximately 1.4%.

Health care consumption results are listed in Table IV. The differences in the mean number of outpatient visits (Fig 4, B) and unique prescription drugs (Fig 4, C) peaked in the year of the psoriasis diagnosis, when the mean difference for patients with psoriasis versus controls were 0.49 and 4.28,
| Comorbidity | Text | ICD10 |
|-------------|------|-------|
| Myocardial infarction incl. congestive heart failure | Acute myocardial infarction | I21 |
| | Subsequent myocardial infarction | I22 |
| | Old myocardial infarction | I252 |
| | Cardiomyopathy in diseases classified elsewhere | I43 |
| | Heart failure | I50 |
| | Rheumatic heart disease, unspecified | I099 |
| | Hypertensive heart disease with (congestive) heart failure | I110 |
| | Hypertensive heart and renal disease with (congestive) heart failure | I130 |
| | Hypertensive heart and renal disease with both (congestive) heart failure and renal failure | I132 |
| | Ischemic cardiomyopathy | I255 |
| | Dilated cardiomyopathy | I420 |
| | Other restrictive cardiomyopathy | I425 |
| | Alcoholic cardiomyopathy | I426 |
| | Cardiomyopathy due to drugs and other external agents | I427 |
| | Other cardiomyopathies | I428 |
| | Cardiomyopathy, unspecified | I429 |
| Peripheral vascular disease | Atherosclerosis | I70 |
| | Aortic aneurysm and dissection | I71 |
| | Thrombangiitis obliterans [Buerger] | I731 |
| | Other specified peripheral vascular diseases | I738 |
| | Peripheral vascular disease, unspecified | I739 |
| | Stricture of artery | I771 |
| | Aneurysm of aorta in diseases classified elsewhere | I790 |
| | Peripheral angiopathy in diseases classified elsewhere | I792 |
| | Chronic vascular disorders of intestine | K551 |
| | Other vascular disorders of intestine | K558 |
| | Vascular disorder of intestine, unspecified | K559 |
| | Presence of other cardiac and vascular implants and grafts | Z958 |
| | Presence of cardiac and vascular implant and graft, unspecified | Z959 |
| Cerebrovascular disease | Transient cerebral ischemic attacks and related syndromes | G45 |
| | Vascular syndromes of brain in cerebrovascular diseases | G46 |
| | Subarachnoid hemorrhage | I60 |
| | Intracerebral hemorrhage | I61 |
| | Other nontraumatic intracranial hemorrhage | I62 |
| | Cerebral infarction | I63 |
| | Stroke, not specified as hemorrhage or infarction | I64 |
| | Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction | I65 |
| | Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction | I66 |
| | Other cerebrovascular diseases | I67 |
| | Cerebrovascular disorders in diseases classified elsewhere | I68 |
| | Sequelae of cerebrovascular disease | I69 |
| | Transient retinal artery occlusion | H340 |

Continued
| Comorbidity                        | Text                                              | ICD10 |
|-----------------------------------|---------------------------------------------------|-------|
| Chronic obstructive pulmonary    | Bronchitis, not specified as acute or chronic     | J40   |
| disease                            | Simple and mucopurulent chronic bronchitis        | J41   |
|                                   | Unspecified chronic bronchitis                    | J42   |
|                                   | Emphysema                                         | J43   |
|                                   | Other chronic obstructive pulmonary disease        | J44   |
|                                   | Asthma                                            | J45   |
|                                   | Status asthmatic                                   | J46   |
|                                   | Bronchiectasis                                     | J47   |
|                                   | Coalworker pneumoconiosis                          | J60   |
|                                   | Pneumoconiosis due to asbestos and other mineral fibres | J61   |
|                                   | Pneumoconiosis due to dust containing silica      | J62   |
|                                   | Pneumoconiosis due to other inorganic dusts       | J63   |
|                                   | Unspecified pneumoconiosis                         | J64   |
|                                   | Pneumoconiosis associated with tuberculosis        | J65   |
|                                   | Airway disease due to specific organic dust        | J66   |
|                                   | Hypersensitivity pneumonitis due to organic dust   | J67   |
|                                   | Other specified pulmonary heart diseases           | I278  |
|                                   | Pulmonary heart disease, unspecified               | I279  |
|                                   | Chronic respiratory conditions due to chemicals, gases, fumes and vapors | J684  |
|                                   | Chronic and other pulmonary manifestations due to radiation | J701  |
|                                   | Chronic drug-induced interstitial lung disorders  | J703  |
| Dementia                           | Dementia in Alzheimer disease                      | F00   |
|                                   | Vascular dementia                                 | F01   |
|                                   | Dementia in other diseases classified elsewhere    | F02   |
|                                   | Unspecified dementia                              | F03   |
|                                   | Alzheimer disease                                  | G30   |
|                                   | Senile degeneration of brain, not elsewhere classified | G311  |
|                                   | Delirium superimposed on dementia                  | F051  |
| Diabetes (incl. complications)    | Type 1 diabetes mellitus                          | E10   |
|                                   | Type 2 diabetes mellitus                          | E11   |
|                                   | Malnutrition-related diabetes mellitus            | E12   |
|                                   | Other specified diabetes mellitus                 | E13   |
|                                   | Unspecified diabetes mellitus                     | E14   |
| Peptic ulcers                      | Gastric ulcer                                     | K25   |
|                                   | Duodenal ulcer                                    | K26   |
|                                   | Peptic ulcer, site unspecified                    | K27   |
|                                   | Gastrojejunal ulcer                                | K28   |
| Rheumatic disease                 | Seropositive rheumatoid arthritis                 | M05   |
|                                   | Other rheumatoid arthritis                        | M06   |
|                                   | Systemic lupus erythematosus                      | M32   |
|                                   | Dermatopolymyositis                               | M33   |
|                                   | Systemic sclerosis                                | M34   |
|                                   | Giant cell arteritis with polymyalgia rheumatica  | M315  |
|                                   | Other overlap syndromes                           | M351  |
|                                   | Polymyalgia rheumatic                             | M353  |
|                                   | Dermato(poly)myositis in neoplastic disease       | M360  |
| Cancer and metastatic solid tumor, excluding non-melanoma skin cancer | Malignant neoplasms, stated or presumed to be primary, of specified sites, except of lymphoid, hematopoietic and related tissue | C00-C43 |
|                                   | Malignant neoplasms, stated or presumed to be primary, of specified sites, except of lymphoid, hematopoietic and related tissue | C45-C75 |
|                                   | Malignant neoplasms of ill-defined, secondary and unspecified sites | C76-C80 |
|                                   | Malignant neoplasms, stated or presumed to be primary, of lymphoid, hematopoietic and related tissue | C81-C96 |
|                                   | Malignant neoplasms of independent (primary) multiple sites | C97-C97 |
respectively. Although the mean number of outpatient visits was only significantly different ($P < .0001$) up to 2 years of follow-up, the mean number of drugs was significantly larger, but with decreasing odds during the first 6 years of follow-up. At 7 years of follow-up, the mean number of hospitalizations was 22% higher for patients with psoriasis than that for controls ($P = .003$).

**DISCUSSION**

In this large cohort, we followed socioeconomic variables and health care consumption for all patients with a first diagnosis of psoriasis in an entire country for more than a decade. We used the comprehensive Swedish registers to address important research gaps. Previous studies on the impact of psoriasis on education and income have either been conducted in small selected populations not representing all socioeconomic groups or with a short follow-up period.

A key finding was the lower proportion of people with psoriasis being employed over time, whereas there was no significant difference in development of education or income. Although statistically significant, the absolute effect size of the difference in employment was small. It is important to point out that the interpretation of observed differences is a common issue with statistics addressing clinical or real-life significance.

There was a tendency that fewer patients with psoriasis were married over time. Patients with psoriasis had a high consumption of outpatient care and medicines during the first years after diagnosis, but differences declined over time. The explanation might be the diagnostic work-up close to the diagnosis followed by disease maintenance only. Future studies should consider further expanding this study result.

Differences between the cases and controls were identified already at the time of first diagnosis. Patients with psoriasis had more comorbidities and higher medicine use, reflecting the burden of comorbidity. Such differences between patients with psoriasis and healthy controls are well-known and were not subject to any hypotheses in the current study. A recent overview summarizing evidence from the literature in various populations and settings supported associations between psoriasis and a range of cardiometabolic diseases, gastrointestinal diseases, kidney disease, malignancy, infection, and mood disorders. In our study, the largest difference in drug treatment was observed for topical corticosteroids, which is not surprising because these are recommended as first-line treatment. Unfortunately, we could not differentiate by the severity of the disease, but the large proportion being treated before diagnosis may indicate diagnostic delay.
| Characteristics                          | Measure                                      | Psoriasis (cases) n (%) | Controls n (%) |
|----------------------------------------|----------------------------------------------|-------------------------|----------------|
| Age                                    |                                              |                         |                |
| 18–29                                  | 12,874 (12)                                  | 128,045 (12)            |                |
| 30–64                                  | 72,317 (66)                                  | 711,505 (66)            |                |
| 65+                                    | 24,612 (22)                                  | 240,257 (22)            |                |
| Mean                                   | 51.3                                         | 51.2                    |                |
| Standard deviation                     | 16.5                                         | 16.5                    |                |
| Sex                                    |                                              |                         |                |
| Female                                 | 58,517 (53)                                  | 633,659 (53)            |                |
| Male                                   | 51,284 (47)                                  | 555,951 (47)            |                |
| Diagnosis                              |                                              |                         |                |
| Psoriasis only                         | 106,318 (97)                                 | N/A                     |                |
| Psoriatic arthritis (including psoriasis) | 3,485 (3)                                  | N/A                     |                |
| Income*                                |                                              |                         |                |
| High                                   | 15,239 (19)                                  | 157,577 (20)            |                |
| Median-high                            | 16,392 (20)                                  | 156,531 (20)            |                |
| Median                                 | 17,024 (21)                                  | 155,653 (20)            |                |
| Median-low                             | 16,673 (21)                                  | 156,143 (20)            |                |
| Low                                    | 14,660 (18)                                  | 158,109 (20)            |                |
| Missing beginning 2005                 | 779 (1)                                      | 8,512 (1)               |                |
| Mean                                   | 2,016                                        | 2,033                   |                |
| Standard deviation                     | 3,402                                        | 3,288                   |                |
| Median                                 | 1,737                                        | 1,734                   |                |
| IQR                                    | 1,163                                        | 1,232                   |                |
| Education*                             |                                              |                         |                |
| ≤ 9 years                              | 19,643 (24)                                  | 189,307 (24)            |                |
| 9–12 years                             | 38,297 (47)                                  | 347,739 (44)            |                |
| >12 years                              | 21,573 (27)                                  | 238,017 (30)            |                |
| Missing beginning 2005                 | 1,254 (1.6)                                  | 17,462 (2.2)            |                |
| Employment*                            |                                              |                         |                |
| Yes                                    | 48,475 (60)                                  | 478,346 (60)            |                |
| No                                     | 31,935 (40)                                  | 310,381 (39)            |                |
| Missing beginning 2005                 | 357 (0.4)                                    | 3,798 (0.5)             |                |
| Marital status*                        |                                              |                         |                |
| In relationship                        | 37,515 (46)                                  | 365,103 (46)            |                |
| Not in relationship                    | 42,895 (53)                                  | 417,037 (53)            |                |
| Missing beginning 2005                 | 357 (0.4)                                    | 10,385 (1.3)            |                |
| Number of outpatient visits            |                                              |                         |                |
| 0                                      | 109,706 (99.6)                               | 107,932 (99.8)          |                |
| 1 to 2                                 | 451 (0.4)                                    | 2,270 (0.2)             |                |
| 3 to 5                                 | 12 (0)                                       | 43 (0)                  |                |
| 6 or more                              | 5 (0)                                        | 8 (0)                   |                |
| Number of hospitalizations             |                                              |                         |                |
| 0                                      | 121,053 (96)                                 | 1,205,459 (97)          |                |
| 1 to 2                                 | 4,639 (3.7)                                  | 34,814 (2.8)            |                |
| 3 to 5                                 | 513 (0.4)                                    | 3,353 (0.3)             |                |
| 6 or more                              | 67 (0.1)                                     | 538 (0.0)               |                |
| Number of ATC codes†                   |                                              |                         |                |
| 0                                      | 8,164 (14)                                   | 160,277 (28)            |                |
| 1 to 2                                 | 12,520 (22)                                  | 148,084 (26)            |                |
| 3 to 5                                 | 14,763 (26)                                  | 121,290 (22)            |                |
| 6 to 10                                | 13,354 (23)                                  | 87,861 (16)             |                |
| 11 or more                             | 8,729 (15)                                   | 45,661 (8)              |                |
| Comorbidities                          |                                              |                         |                |
| Myocardial infarction incl. congestive heart failure | 7,025 (5.5) | 52,926 (4.2) |                |
| Peripheral vascular disease            | 7,850 (6.2)                                  | 58,243 (4.7)            |                |
| Cerebrovascular disease                | 470 (3.7)                                    | 41,260 (3.3)            |                |
| Chronic obstructive pulmonary disease  | 8,799 (6.9)                                  | 65,701 (5.3)            |                |
| Dementia                               | 481 (0.4)                                    | 7,215 (0.6)             |                |
| Diabetes (incl. complications)         | 6,737 (5.3)                                  | 46,274 (3.7)            |                |
| Peptic ulcers                          | 2,300 (1.8)                                  | 18,177 (1.5)            |                |
| Rheumatic disease                      | 5,626 (4.4)                                  | 23,312 (1.9)            |                |
| Cancer and metastatic solid tumor      | 7,044 (5.6)                                  | 62,672 (5.0)            |                |

Continued
No difference was found for education and income, in contrast with other studies. The lack of association for education may be explained by the patient age when psoriasis was diagnosed (mean age 51 years). Sweden belongs to the countries with the highest proportion of people with higher education with median age for attainment of a candidate exam of 28 years. Lack of association with income may be explained by the Swedish social security system with benefits for all who are ill or disabled as well as for those who are unemployed.

The largest difference observed was for employment with 10% less patients with psoriasis being employed 6 years after first diagnosis, in line with another study estimating productivity loss in patients with psoriasis to around 10%. The small but significant association between marital status and psoriasis may indicate that there is perceived stigmatization, which may influence the quality of life also for partners, supported by questionnaire studies. It is, however, important to acknowledge difficulties in analyzing marital status and quality of life relationship because there is limited systematic data to inform this.

Our study provided new information on health care consumption and drug utilization patterns in patients with psoriasis. Although patients with psoriasis undoubtedly have higher use of health care when compared with controls, especially at the time of onset, there was some indication of significantly increased rates of inpatient utilization at 5 years of follow-up.

Furthermore, although there was an uptick in outpatient and prescription drug utilization within 1 year of onset, our findings suggest no difference in drug utilization between cases and controls 7 years after onset. This can have important policy implications as it relates to the duration of monitoring patients with psoriasis.

One study strength is the long observation period, because the Swedish setting allows for longitudinal observation of at least a decade. Few settings outside Nordic countries can observe patients in an entire country for such a long time. Nationwide coverage including all patients in Sweden with specialist care diagnosis of psoriasis, or psoriatic arthritis, is also a major strength, especially when adding controls. Another study strength is the national registers allowing for completeness and accuracy of the linkage through the unique personal identity number. A limitation of the study is its generalizability outside the Nordic region, where there are similar populations and health care systems. Another limitation is the lack of primary care diagnoses and lack of early treatments because of the late start (July 2005) of the PDR. In this study, 96.5% of all patients received their first diagnosis in outpatient care and 3.4% in inpatient care. Data from the region of Stockholm showed that 20% of all ambulatory care consultations between January 2015 and November 2019 in which psoriasis was diagnosed were in primary care (E. Dahlén, personal communication, December 12, 2019). However, most of these patients had at least one consultation in specialist care. In addition, because these are all consultations and not new diagnoses, the impact of not having primary care data was less problematic. Lastly, the variables used were those available in the Swedish national

### Table II. Cont’d

| Characteristic          | Measure                           | Psoriasis (cases) n (%) | Controls n (%) |
|-------------------------|-----------------------------------|-------------------------|----------------|
| Prescription medicines  |                                   |                         |                |
| A02 Ulcer drugs         |                                   | 59,804 (11)             |                |
| A10 Diabetes drugs      |                                   | 26,760 (5)              |                |
| B01A Antithrombotics    |                                   | 65,289 (12)             |                |
| C03, C07, C08, C09 Antihypertensives |               | 131,187 (23)            |                |
| C10 Lipid-lowering agents |                                 | 62,856 (11)             |                |
| D07 Corticosteroids, topical |                               | 37,808 (7)              |                |
| D05 psoriasis           |                                   | 370 (0)                 |                |
| H01 Corticosteroids     |                                   | 1,539 (0)               |                |
| L04 Immune suppressants |                                   | 5,097 (1)               |                |
| M01A NSAIDs             |                                   | 93,810 (17)             |                |
| N02 Analgesics          |                                   | 97,437 (17)             |                |
| N05 N06 Psychotropics   |                                   | 106,704 (19)            |                |
| R03 Asthma/COPD-drugs   |                                   | 42,721 (8)              |                |

ATC, Anatomical Therapeutic Chemical classification system; COPD, chronic obstructive pulmonary disease; IQR, interquartile range; NSAIDs, nonsteroidal anti-inflammatory drugs.

*Missing = The proportion of missing data for cases and controls with index dates from 2005 (n = 80,767 and 792,525, respectively). No data on socioeconomic variables were available for cases and controls with index dates before 2005.

1 Only assessed for patients (cases and controls) with an index date starting from 2007 (n = 57,511 and 562,687, respectively)
Fig 3. A, Psoriasis socioeconomic outcomes over time — level of education. B, Psoriasis socioeconomic outcomes over time — individual income. C, Psoriasis socioeconomic outcomes over time — employment status. D, Psoriasis socioeconomic outcomes over time — marital status. CI, Confidence interval.

Table III. Odds/mean ratios with 95% confidence intervals and numbers for socioeconomic outcomes for patients with psoriasis (cases) versus reference cohort (controls)

| Year after diagnosis | Income | Employment | Marital status |
|----------------------|--------|------------|---------------|
|                      | Numbers* | Median | Psoriasis vs controls | Proportion (Yes %) | Psoriasis vs controls | Proportion (Yes %) | Psoriasis vs controls |
|                      | Pso | Ctrl | Median | Pso | Ctrl | Mean ratio (95% CI) | Pso | Ctrl | Mean ratio (95% CI) | Pso | Ctrl | Mean ratio (95% CI) |
| −1                   | 80767 | 792525 | 1737 | 1734 | 1 (ref) | 60 | 61 | 1 (ref) | 47 | 47 | 1 (ref) |
| 0                    | 80767 | 792525 | 1803 | 1812 | 0.99 (0.97-1.00) | 60 | 61 | 0.97 (0.95-0.99) | 47 | 47 | 1.00 (1.00-1.01) |
| 1                    | 79833 | 777791 | 1885 | 1904 | 0.99 (0.97-1.00) | 59 | 61 | 0.96 (0.94-0.98) | 47 | 47 | 1.00 (0.99-1.01) |
| 2                    | 78753 | 764313 | 1962 | 1996 | 0.99 (0.97-1.00) | 59 | 60 | 0.94 (0.92-0.96) | 47 | 48 | 0.99 (0.99-1.00) |
| 3                    | 77674 | 751750 | 2024 | 2065 | 0.98 (0.96-1.00) | 58 | 60 | 0.93 (0.90-0.96) | 47 | 48 | 0.99 (0.98-1.00) |
| 4                    | 69423 | 671676 | 2062 | 2105 | 0.99 (0.97-1.01) | 57 | 59 | 0.93 (0.90-0.95) | 48 | 48 | 0.99 (0.98-1.00) |
| 5                    | 60643 | 586774 | 2093 | 2142 | 1.01 (0.97-1.05) | 56 | 59 | 0.91 (0.89-0.94) | 48 | 48 | 0.99 (0.97-1.00) |
| 6                    | 52733 | 510260 | 2129 | 2185 | 1.00 (0.97-1.03) | 56 | 58 | 0.90 (0.87-0.93) | 49 | 49 | 0.98 (0.97-1.00) |
| 7                    | 44804 | 432713 | 2164 | 2218 | 0.98 (0.96-1.00) | 55 | 58 | 0.91 (0.88-0.94) | 49 | 50 | 0.98 (0.97-0.99) |
| 8                    | 36812 | 355410 | 2179 | 2245 | 0.96 (0.95-0.98) | 54 | 56 | 0.91 (0.88-0.95) | 49 | 50 | 0.98 (0.96-0.99) |
| 9                    | 28312 | 273217 | 2195 | 2274 | 1.00 (0.96-1.03) | 53 | 56 | 0.90 (0.86-0.94) | 49 | 50 | 0.98 (0.96-1.00) |
| 10                   | 20067 | 193482 | 2224 | 2305 | 0.98 (0.95-1.01) | 53 | 55 | 0.90 (0.86-0.95) | 50 | 51 | 0.98 (0.96-1.00) |

CI, Confidence interval; Ctrl, control; OR, odds ratio; Pso, psoriasis.

*Starting from 2005.
Table IV. Incidence rate ratios and numbers for health care consumption outcomes for patients with psoriasis (cases) versus reference cohort (controls)

| Year | Pso Number | Ctrl Number | Pso Mean number | Ctrl Mean number | Pso vs Ctrl | IRR | Pso Number | Ctrl Number | Pso Mean number | Ctrl Mean number | Pso vs Ctrl | IRR | Pso Number | Ctrl Number | Pso Mean number | Ctrl Mean number | Pso vs Ctrl | IRR |
|------|-------------|-------------|-----------------|-----------------|-------------|-----|-------------|-------------|-----------------|-----------------|-------------|-----|-------------|-------------|-----------------|-----------------|-------------|-----|
| -1   | 109803      | 1079807     | 0               | 0               | 1           | 0.05| 0.04        | 1           | 57511           | 562687          | 5.47        | 3.61| 1           |             |                 |                 |             |     |
| 0    | 109803      | 1079807     | 0.49            | 0               | 421.11      | 0.1  | 0.08        | 1.03        | 57511           | 562687          | 8.02        | 3.74| 1.54        |             |                 |                 |             |     |
| 1    | 108730      | 1062706     | 0.68            | 0.03            | 16.96       | 0.08| 0.06        | 1.00        | 56838           | 552534          | 6.71        | 3.83| 1.83        |             |                 |                 |             |     |
| 2    | 107306      | 1045064     | 0.58            | 0.05            | 4.88        | 0.06| 0.05        | 0.99        | 56073           | 543275          | 5.75        | 3.51| 1.54        |             |                 |                 |             |     |
| 3    | 105788      | 1027437     | 0.7             | 0.16            | 1.75        | 0.06| 0.04        | 0.94        | 55285           | 534549          | 5.64        | 3.48| 1.61        |             |                 |                 |             |     |
| 4    | 97045       | 942353      | 0.71            | 0.19            | 0.96        | 0.04| 0.03        | 0.94        | 47345           | 458096          | 5.63        | 3.5 | 1.06        |             |                 |                 |             |     |
| 5    | 87828       | 852803      | 0.72            | 0.19            | 0.59        | 0.02| 0.02        | 0.99        | 38927           | 376839          | 5.4         | 3.4 | 1.05        |             |                 |                 |             |     |
| 6    | 79434       | 771771      | 0.78            | 0.22            | 0.38        | 0.02| 0.02        | 1.04        | 31353           | 303803          | 5.08        | 3.23| 1.55        |             |                 |                 |             |     |
| 7    | 71041       | 689735      | 0.83            | 0.26            | 0.26        | 0.03| 0.02        | 1.22        | 23729           | 229722          | 4.16        | 2.67| 1.52        |             |                 |                 |             |     |
| 8    | 62546       | 608094      | 0.95            | 0.33            | 0.40        | 0.03| 0.03        | 1.11        | 16086           | 155727          | 1.67        | 1.08| 1.01        |             |                 |                 |             |     |
| 9    | 53545       | 521650      | 1.08            | 0.45            | 0.52        | 0.04| 0.03        | 1.02        | 7895            | 76727           | N/A         | N/A | N/A         |             |                 |                 |             |     |
| 10   | 44815       | 437642      | 1.19            | 0.5             | N/A         | 0.06| 0.04        | 1.02        | N/A             | N/A             | N/A         | N/A | N/A         |             |                 |                 |             |     |

Ctrl, Control; IRR, incidence rate ratio; N/A, not available; Pso, psoriasis.

*Starting from 2005.
1Starting from 2007.
2Starting from 2006.
3After diagnosis.

![Fig 4](image-url) A. Psoriasis health care utilization and medicine use — number of hospitalizations. Incidence rate ratios with 95% confidence intervals from negative binomial regression. B. Psoriasis health care utilization and medicine use — number of outpatient visits. Incidence rate ratios with 95% confidence intervals from negative binomial regression. C. Psoriasis health care utilization and medicine use — number of drugs. Incidence rate ratios with 95% confidence intervals from negative binomial regression.
registers, but variables measured more often and/or at a more detailed level might have enhanced the comparisons.

In conclusion, our study extended the understanding of the socioeconomic impact of psoriasis by suggesting lower societal productivity, indicated by reductions in employment proportion, despite similar incomes to those of the control group. Further, the study indicated that there is room for improvement in the management of patients with possible diagnostic delay. It is also important to monitor health care utilization through at least 5 years as prescription drug utilization normalizes to that of healthy controls.

Anders Sundström, Mohammadhossein Hajiebrahim, Ina Anveden-Berglind, and Sean McElligott took part in conceptualizing the idea.

Conflicts of interest
Dr Linder and Dr Hägg are employees of the Centre for Pharmacoepidemiology. Karolinska Institutet, which receives grants from several entities (pharmaceutical companies, regulatory authorities, and contract research organizations) for performance of drug safety and drug utilization studies. Dr Wettermark is employed by the organizations) for performance of drug safety and drug companies, regulatory authorities, and contract research

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