Abstract: Background: Previous studies showed conflicting results regarding the mortality risk in psoriasis patients with respect to disease severity and presence of psoriatic arthritis. This study aimed to determine the mortality risk in patients with mild and severe psoriasis and patients with psoriatic arthritis (PsA). Methods: A nationwide population-based cohort study was conducted based on data from the Taiwan National Health Insurance Research Database between 2002 and 2012. Incident psoriasis subjects were classified into two groups: psoriasis without arthritis and psoriasis with arthritis. Patients who had received systemic therapy and/or phototherapy were classified as having severe psoriasis; otherwise, patients were classified as having mild psoriasis. Control subjects without psoriasis were selected to match each psoriasis patient from the database within the same observational period. Cox proportional hazards analysis was used to compare the hazard ratio (HR) of time to death. Results: A total of 106,701 patients with psoriasis were included in this study. After controlling for demographics and comorbidities, psoriasis patients had a higher mortality risk compared with the control group (HR 1.41; 95% confidence interval (CI) 1.36 to 1.46). Compared with psoriasis alone, the mortality risk was not increased for PsA (HR = 1.01; 95% CI 0.93 to 1.10). Besides, severe psoriasis did not increase mortality risk compared with mild psoriasis (HR = 1.0; 95% CI 0.95 to 1.06). Conclusions: Patients with psoriasis had a higher mortality risk compared with control subjects, whereas psoriasis severity and presence of PsA had no impact on mortality risk in psoriasis patients.

Keywords: psoriasis; psoriatic arthritis; mortality; National Health Insurance Research Database

1. Introduction

Psoriasis and psoriatic arthritis (PsA) are chronic disabling diseases that have a substantial negative impact on a patients’ quality of life, resulting in a great physical, emotional, and social
burden [1]. An increasing trend in psoriasis and psoriatic arthritis prevalence has been observed in several countries [2–7], making them serious global problems.

Over the past decade there has been greater recognition of increased mortality associated with psoriasis [7–10], particularly due to cardiovascular disease [10,11]. Mortality studies have been carried out for psoriatic arthritis as well [8,10,12–17]. Most of the studies have been limited by their small sample size and selection bias in community- or hospital-based studies [12,14–18]. Besides, it is unclear whether disease severity and presence of PsA are associated with mortality risk in psoriasis patients. This study aimed to investigate the mortality risk in psoriasis patients with respect to the psoriasis severity and presence of PsA.

2. Materials and Methods

2.1. Data Source

A cohort study was conducted using data from the National Health Insurance Research Database (NHIRD), which covered over 99.9% of the nearly 23 million people in Taiwan between 2000 and 2012. The NHIRD database contains registration files and original reimbursement claims data, including demographic characteristics, outpatient and inpatient services, diagnostic codes, procedures performed, and details of prescriptions and comorbidities. The NHIRD has been widely used in epidemiological studies [19–26]. Previous studies have confirmed the high accuracy and validity of the NHIRD in recording psoriasis [10]. This study was performed in accordance with the Helsinki Declaration and was approved by the National Health Research Institutes and the Institutional Review Board of Taipei Veterans General Hospital (IRB: 2015-02-011CC).

2.2. Study Population and Study Design

We enrolled patients with a new diagnosis of psoriasis in the NHIRD between 1 January 2000, and 31 December 2001. Subjects with prior psoriasis diagnosis were excluded. The date of the first psoriasis diagnosis was defined as the index date, which was the start of follow-up for these patients. Subjects were considered to have psoriasis only if the diagnosis was made by dermatologists or rheumatologists and the condition occurred in an inpatient setting or required three or more outpatient visits. Psoriasis was identified by International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) codes 696.0, 696.1, and 696.8. Patients were classified into groups with PsA, which were identified using ICD-9-CM code 696.0 during the same period; otherwise, patients were considered to have psoriasis without PsA (PsO). Psoriasis severity was classified as mild and severe. Severe psoriasis was defined as disease requiring systemic therapy and/or phototherapy. All other cases were classified as mild psoriasis.

2.3. Matched Controls without Psoriasis

For each patient with psoriasis, one matched control without psoriasis were randomly selected from the database within the same observational period. These subjects were matched for age and sex.

2.4. Outcome Measurement

Since the National Health Insurance is a mandatory universal health insurance program open to all Taiwanese residents, withdrawal from the insurance is almost always due to death. All study subjects were followed from the index date to withdrawal from the insurance or 31 December 2012, whichever date came first. Subjects with the condition mentioned were considered censored in the analysis.

2.5. Systemic Treatment

Systemic treatment was defined as any systemic anti-psoriatic therapy, including methotrexate, azathioprine, cyclosporine, systemic retinoids, mycophenolate mofetil, hydroxyurea, and biologic agents (i.e., etanercept, adalimumab, or ustekinumab).
2.6. Statistical Analysis

The demographic information of patients was compared by using $\chi^2$ tests for categorical variables and t-tests for continuous variables. Death rates per 1000 patient-years and 95% confidence intervals (CIs) were calculated according to psoriasis status. Cox proportional hazards analysis was used to compare the mortality risks. The model was adjusted for age, sex, socioeconomic status, residence (urban, suburban, or rural), and comorbidities (hypertension, diabetes mellitus, dyslipidemia, coronary artery disease, stroke, connective tissue disease, renal disease, chronic liver disease including cirrhosis and hepatitis, chronic obstructive pulmonary disease, and cancer). A two-sided $p$ value of <0.05 was considered to represent a statistically significant difference. All data processing and statistical analyses were performed with Stata version 12 (Stata Corporation, College Station, TX, USA) and statistical analysis software (SAS) version 9.1 (SAS Institute, Cary, NC, USA).

3. Results

A total of 106,701 patients with incident psoriasis were identified. Among them, 8795 patients had PsA, and 22,542 patients had severe psoriasis. Baseline characteristics are shown in Table 1. The mean age was similar in patients with psoriasis (mean, standard deviation (SD) = 45.1 (18.7) years) and control subjects (mean (SD) = 45.1 (18.8) years). Compared with matched control subjects, psoriasis patients had a higher prevalence of multiple comorbidities, including hypertension, diabetes mellitus, dyslipidemia, coronary artery disease, stroke, connective tissue disease, renal disease, chronic liver disease, cirrhosis and hepatitis, chronic obstructive pulmonary disease, and cancer.

| Variables                                      | Patients with Psoriasis ($n = 106,701$) | Controls ($n = 106,701$) | $p$   |
|------------------------------------------------|----------------------------------------|--------------------------|-------|
| Total number of patients with psoriasis        | 106,701                                |                          |       |
| Psoriatic arthritis                            | 8795                                  | 8.2                      |       |
| Psoriasis with phototherapy                     | 13,742                                | 12.9                     |       |
| Psoriasis with systemic therapy                 | 14,314                                | 13.4                     |       |
| Psoriasis with phototherapy or systemic therapy | 22,542                                | 21.1                     |       |
| Sex                                            |                                        |                          |       |
| Male                                           | 62,766                                | 58.8                     | 1.00  |
| Female                                         | 43,935                                | 41.2                     |       |
| Socioeconomic status                           |                                        |                          |       |
| Low                                            | 55,814                                | 52.3                     | <0.001|
| Medium                                         | 31,281                                | 29.3                     |       |
| High                                           | 19,606                                | 18.4                     |       |
| Residence                                      |                                        |                          |       |
| Urban                                          | 62,902                                | 59                       | <0.001|
| Suburban                                       | 34,364                                | 32.2                     |       |
| Rural                                          | 9435                                  | 8.8                      |       |
| Comorbidity                                    |                                        |                          |       |
| Hypertension                                   | 36,156                                | 33.9                     | <0.001|
| Diabetes mellitus                              | 19,769                                | 18.5                     | <0.001|
| Dyslipidemia                                   | 26,474                                | 24.6                     | <0.001|
| Coronary artery disease                        | 16,224                                | 15.2                     | <0.001|
| Stroke                                         | 11,412                                | 10.7                     | <0.001|
| Connective tissue disease                      | 6599                                  | 6.2                      | <0.001|
| Renal disease                                  | 7993                                  | 7.5                      | <0.001|
| Chronic liver disease, cirrhosis and hepatitis | 23,107                                | 21.7                     | <0.001|
| Chronic obstructive pulmonary disease           | 20,599                                | 19.3                     | <0.001|
| Cancer                                         | 7511                                  | 7                        | <0.001|
As shown in Table 2, PsA patients (mean (SD) = 44.5 (16.4) years) were younger on average than PsO patients (mean (SD) = 45.2 (18.9) years). Patients with PsA were more likely to have a comorbidity including dyslipidemia (26.3% vs. 24.7%, \( p < 0.001 \)), connective tissue disease (20.8% vs. 4.9%, \( p < 0.001 \)), renal disease (8.1% vs. 7.4%, \( p < 0.001 \)), and chronic liver disease, cirrhosis and hepatitis (26.5% vs. 21.2%, \( p < 0.001 \)) and were more likely to have received systemic treatment (45% vs. 10.6%, \( p < 0.001 \)) or phototherapy (23.4% vs. 11.9%, \( p < 0.001 \)) than those with PsO. On the contrary, the incidence of coronary artery disease (15.3% vs. 14.1%, \( p = 0.003 \)), stroke (10.8% vs. 9.1%, \( p < 0.001 \)), chronic obstructive pulmonary disease (19.5% vs. 17.3%, \( p < 0.001 \)), and cancer (7.1% vs. 6.4%, \( p = 0.02 \)) was higher in PsO patients than in PsA patients.

| Table 2. Characteristics of psoriatic patients according to existence of arthritis. |
|-----------------------------------|----------------------------------|-------------------|-------------------|-----------------|------------------|
| Variables                         | Psoriatic Patients               | \( p \)            |                   |                 |                  |
|                                   | without Arthritis | with Arthritis |                   |                 |                  |
| Total number of patients          | 97,906 | 91.8 | 8795 | 8.2            |                  |
| Sex                               |                   |                   |                   |                 |                  |
| Male                              | 57,532 | 58.8 | 5234 | 59.5 | 0.17            |
| Female                            | 40,374 | 41.2 | 3561 | 40.5 |                  |
| Comorbidity                       |                   |                   |                   |                 |                  |
| Hypertension                      | 33,140 | 33.9 | 3016 | 34.3 | 0.40            |
| Diabetes mellitus                 | 18,158 | 18.6 | 1611 | 18.3 | 0.60            |
| Dyslipidemia                      | 24,161 | 24.7 | 2313 | 26.3 | <0.001          |
| Coronary artery disease           | 14,982 | 15.3 | 1242 | 14.1 | 0.003           |
| Stroke                            | 10,616 | 10.8 | 796  | 9.1  | <0.001          |
| Connective tissue disease         | 4771   | 4.9  | 1828 | 20.8 | <0.001          |
| Renal disease                     | 7285   | 7.4  | 708  | 8.1  | 0.04            |
| Chronic liver diseases, cirrhosis, and hepatitis | 20,776 | 21.2 | 2331 | 26.5 | <0.001 |
| Chronic obstructive pulmonary disease | 19,080 | 19.5 | 1519 | 17.3 | <0.001 |
| Cancer                            | 6947   | 7.1  | 564  | 6.4  | 0.02            |
| Received phototherapy             | 11,684 | 11.9 | 2058 | 23.4 | <0.001          |
| Received systemic treatment       | 10,359 | 10.6 | 3955 | 45   | <0.001          |

A shown in Table 3, the mean age was similar in patients with mild psoriasis (mean (SD) = 45.1 (19.0) years) and severe psoriasis (mean (SD) = 5.0 (17.6) years). Compared with patients with mild psoriasis, those with severe psoriasis were more likely to have comorbidities of hypertension (36.7% vs. 33.1%, \( p < 0.001 \)), diabetes mellitus (20.6% vs. 18%, \( p < 0.001 \)), dyslipidemia (27.3% vs. 24.1%, \( p < 0.001 \)), connective tissue disease (11.5% vs. 4.8%, \( p < 0.001 \)), renal disease (9% vs. 7.1%, \( p < 0.001 \)), chronic liver disease including cirrhosis and hepatitis (25.9% vs. 20.5%, \( p < 0.001 \)), and cancer (7.8% vs. 6.8%, \( p < 0.001 \)).

During an average of 5.2 (SD 3.1) years of follow-up, the mortality rate was 15.8 per 1000 person-years in psoriasis patients. Compared with control subjects, psoriasis patients had a significantly higher risk of mortality (incidence rate ratio = 1.46; 95% CI 1.41 to 1.51) after multivariable adjustment (hazard ratio (HR) = 1.41; 95% CI 1.36 to 1.46) (Table 4). Both mild and severe psoriasis and presence and absence of PsA are associated with an increased mortality risk. Patients with PsA did not have a higher mortality risk compared with those with PsO (HR = 1.01; 95% CI 0.93 to 1.10). There was no significant difference in mortality risk between patients with severe psoriasis and those with mild psoriasis (HR = 1.00; 95% CI 0.95 to 1.06).
Table 3. Characteristics of psoriatic patients according to disease severity.

| Variables                        | Psoriatic patients |   |   |   |
|----------------------------------|--------------------|---|---|---|
|                                  | Mild               | % | Mild | % | Severe | % |   |   |   |
| Total number of patients         | 84,159             | 78.9 | 22,542 | 21.1 |   |   |   |   |   |
| Sex                              |                    |   |   |   |   |   |   |   |   |
| Male                             | 47,978             | 57 | 14,788 | 65.6 | <0.001 |   |   |   |   |
| Female                           | 36,181             | 43 | 7,754  | 34.4 |   |   |   |   |   |
| Comorbidity                      |                    |   |   |   |   |   |   |   |   |
| Hypertension                     | 27,873             | 33.1 | 8,283 | 36.7 | <0.001 |   |   |   |   |
| Diabetes mellitus                | 15,134             | 18 | 4,635  | 20.6 | <0.001 |   |   |   |   |
| Dyslipidemia                     | 20,315             | 24.1 | 6,159 | 27.3 | <0.001 |   |   |   |   |
| Coronary artery disease          | 12,675             | 15.1 | 3,549 | 15.7 | 0.01 |   |   |   |   |
| Stroke                           | 9103               | 10.8 | 2,309 | 10.2 | 0.01 |   |   |   |   |
| Connective tissue disease        | 4,000              | 4.8 | 2,599  | 11.5 | <0.001 |   |   |   |   |
| Renal disease                    | 5970               | 7.1 | 2,023  | 9 | <0.001 |   |   |   |   |
| Chronic liver diseases, cirrhosis, and hepatitis | 17,274 | 20.5 | 5,833 | 25.9 | <0.001 |   |   |   |   |
| Chronic obstructive pulmonary disease | 16,289 | 19.4 | 4,310 | 19.1 | 0.43 |   |   |   |   |
| Cancer                           | 5,749              | 6.8 | 1,762  | 7.8 | <0.001 |   |   |   |   |

Table 4. Risk of mortality in psoriatic patients.

|                                | Number of Participants | Number of Deaths | Number of Deaths per 1000 Person-Years | Incidence Rate Ratio (95% CI) | Age- and Sex-Adjusted HR (95% CI) | Multivariable-Adjusted HR * (95% CI) |
|--------------------------------|------------------------|------------------|----------------------------------------|-----------------------------|-----------------------------------|-------------------------------------|
| Control                        | 106,701                | 5998             | 10.8                                   | 1                          | 1                                 | 1                                   |
| Total number of psoriatic patients | 106,701              | 8626             | 15.8                                   | 1.46 (1.41–1.51) | 1.48 (1.44–1.53)                  | 1.41 (1.36–1.46)                     |
| Psoriatic patients without arthritis | 97,906             | 8053             | 16                                     | 1.49 (1.44–1.54) | 1.48 (1.43–1.53)                  | 1.41 (1.36–1.46)                     |
| Psoriatic patients with arthritis | 8,795                 | 573              | 12.6                                   | 1.17 (1.07–1.27) | 1.56 (1.43–1.70)                  | 1.52 (1.39–1.66)                     |
| Mild psoriatic patients         | 84,159                | 6780             | 16.1                                   | 1.50 (1.44–1.55) | 1.48 (1.43–1.53)                  | 1.41 (1.36–1.46)                     |
| Severe psoriatic patients       | 22,542                | 1,846            | 14.5                                   | 1.34 (1.27–1.41) | 1.51 (1.43–1.59)                  | 1.43 (1.35–1.51)                     |
| Psoriatic patients without arthritis | 97,906             | 8053             | 16                                     | 1                          | 1                                 | 1                                   |
| Psoriatic patients with arthritis | 8,795                 | 573              | 12.6                                   | 0.79 (0.72–0.86) | 0.99 (0.91–1.08)                  | 1.01 (0.93–1.10)                     |
| Mild psoriatic patients         | 84,159                | 6780             | 16.1                                   | 1                          | 1                                 | 1                                   |
| Severe psoriatic patients       | 22,542                | 1,846            | 14.5                                   | 0.90 (0.85–0.95) | 0.99 (0.94–1.05)                  | 1.00 (0.95–1.06)                     |

* Adjusted for age, sex, socioeconomic status, residence, hypertension, diabetes mellitus, dyslipidemia, coronary artery disease, stroke, connective tissue disease, renal diseases, chronic liver diseases and cirrhosis and hepatitis, chronic obstructive pulmonary disease, and cancer. CI, confidence interval; HR, hazard ratio.

4. Discussion

In this nationwide population-based study, we found that psoriasis patients with or without arthritis and with mild or severe psoriasis have a significantly increased risk of mortality compared with the control subjects. Our findings are in agreement with those of prior studies [8,10,27,28]. In the studies by Wong et al. [15], Ali et al. [16], and Mok et al. [18], PsA patients had a 1.62-fold, a 1.36-fold, and 1.59-fold increased mortality risk, respectively. However, Wilson et al. [17] and Buckley et al. [12] did not find a significant increase in mortality in PsA patients compared with the general population. Two recent population-based cohort studies showed conflicting results. Ogdie et al. [8] found that the death rate in 8706 PsA subjects did not differ from that of the general population, whereas Lee et al. [10] found increased mortality in 9572 PsA patients.

Several studies investigated the mortality risk in psoriasis patients with respect to disease severity [8,10,11,26–28]. Among these studies, four suggested an increased mortality in both patients...
with mild and severe psoriasis compared with the general population [8,10,27,28]; one reported a significant higher risk of mortality in patients with severe psoriasis [11]. Another study identified that severe but not mild psoriasis as associated with an increased risk of death [29]. Growing evidence suggests a link between psoriasis and other comorbidities. Psoriasis patients are more likely to have malignancy, cardiovascular disease, metabolic syndrome, obesity, and diabetes mellitus, particularly in those with PsA and severe skin disease [27,28,30–32], which could explain the higher mortality risk observed in psoriasis patients. However, in our study, the psoriasis severity and presence of PsA had no impact on the overall mortality risk in psoriasis patients. The non-significant mortality difference between PsO patients and PsA patients could be explained by higher prevalence of cardiovascular disease and malignancy in PsO patients. Compared with the studies of Ogdie et al. [8] and Lee et al. [10] which enrolled only adult patients (age ≥ 18 years), our study included patients aged under 18 years. Since younger patients are less vulnerable to morbidity and mortality, the inclusion of these patients in our cohort might partially explain the nonsignificant effects of psoriasis severity on mortality risk in psoriasis patients. However, further studies are needed to determine the underlying explanations for our findings.

The strengths of our study include the large sample size, a population-based cohort study design, reliable psoriasis diagnosis made by dermatologists and rheumatologists, and a more comprehensive control of potential confounding factors. However, potential limitations of our study should be considered. First, since the NHIRD data did not include clinical assessments, it is not possible to classify psoriasis severity based on clinical measures such as the Physician Global Assessment and Psoriasis Assessment Severity Index. The use of treatment patterns as a marker for psoriasis severity may introduce misclassification bias. It is possible that some untreated patients with severe psoriasis were misclassified as having mild psoriasis. Nevertheless, previous studies have affirmed the reliability and validity of using these methods for grouping severe psoriasis [33–36]. Second, there could be a “healthy user” effect in that patients with severe psoriasis need to be healthy enough to be prescribed the therapies, which would result in an underestimate of mortality risk. Third, instead of confirming death with the death certificate data, we identified death using the subjects’ withdrawal from insurance. Withdrawal from insurance could be due to a renunciation of citizenship. However, this method has been validated in a previous study [37]. Fourth, the information regarding causes of mortality is lacking in our database, therefore, precluding us from further analysis in this study. Finally, the Taiwanese population is predominantly of Chinese descent and caution is needed in extrapolating the results to other ethnic groups.

5. Conclusions

In summary, our study demonstrated that there was a significantly increased risk of mortality in psoriasis patients. Both mild and severe psoriasis and presence and absence of PsA were associated with an increased mortality risk, whereas the psoriasis severity and presence of PsA had no impact on mortality risk in psoriasis patients. These findings urge physicians to provide comprehensive health assessments and preventive health practices to psoriasis patients even with mild skin disease and no PsA.

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References

1. Chiu, H.-Y.; Wang, T.-S.; Chen, P.-H.; Hsu, S.-H.; Tsai, Y.-C.; Tsai, T.-F. Psoriasis in Taiwan: From epidemiology to new treatments. *Dermatol. Sin.* 2018, 36, 115–123. [CrossRef]

2. Kurd, S.K.; Gelfand, J.M. The prevalence of previously diagnosed and undiagnosed psoriasis in US adults: Results from NHANES 2003–2004. *J. Am. Acad. Dermatol.* 2009, 60, 218–224. [CrossRef] [PubMed]

3. Danielsen, K.; Olsen, A.O.; Wilsgaard, T.; Furberg, A.S. Is the prevalence of psoriasis increasing? A 30-year follow-up of a population-based cohort. *Br. J. Dermatol.* 2013, 168, 1303–1310. [CrossRef] [PubMed]

4. Ferrandiz, C.; Bordas, X.; Garcia-Patos, V.; Puig, S.; Pujol, R.; Smandia, A. Prevalence of psoriasis in Spain (Epiderma Project: Phase I). *J. Eur. Acad. Dermatol. Venereol.* 2001, 15, 20–23. [CrossRef] [PubMed]

5. Ferrandiz, C.; Carrascosa, J.M.; Toro, M. Prevalence of psoriasis in Spain in the age of biologics. *Actas Dermosifiliogr.* 2014, 105, 504–509. [CrossRef] [PubMed]

6. Wang, T.S.; Hsieh, C.F.; Tsai, T.F. Epidemiology of psoriatic disease and current treatment patterns from 2003 to 2013: A nationwide, population-based observational study in Taiwan. *J. Dermatol. Sci.* 2016, 84, 340–345. [CrossRef] [PubMed]

7. Springate, D.A.; Parisi, R.; Kontopantelis, E.; Reeves, D.; Griffiths, C.E.; Ashcroft, D.M. Incidence, prevalence and mortality of patients with psoriasis: A U.K. population-based cohort study. *Br. J. Dermatol.* 2017, 176, 650–658. [CrossRef] [PubMed]

8. Ogdie, A.; Haynes, K.; Troxel, A.B.; Love, T.J.; Hennessy, S.; Choi, H.; Gelfand, J.M. Risk of mortality in patients with psoriatic arthritis, rheumatoid arthritis and psoriasis: A longitudinal cohort study. *Ann. Rheum. Dis.* 2014, 73, 149–153. [CrossRef] [PubMed]

9. Masson, W.; Rossi, E.; Galimberti, M.L.; Krauss, J.; Navarro Estrada, J.; Galimberti, R.; Cagide, A. Mortality in patients with psoriasis. A retrospective cohort study. *Med. Clin.* 2017, 148, 483–488. [CrossRef] [PubMed]

10. Lee, M.S.; Yeh, Y.C.; Chang, Y.T.; Lai, M.S. All-Cause and Cause-Specific Mortality in Patients with Psoriasis in Taiwan: A Nationwide Population-Based Study. *J. Investig. Dermatol.* 2017, 137, 1468–1473. [CrossRef] [PubMed]

11. Abuabara, K.; Azfar, R.S.; Shin, D.B.; Neimann, A.L.; Troxel, A.B.; Gelfand, J.M. Cause-specific mortality in patients with severe psoriasis: A population-based cohort study in the UK. *Br. J. Dermatol.* 2010, 163, 586–592. [CrossRef] [PubMed]

12. Buckley, C.; Cavill, C.; Taylor, G.; Kay, H.; Waldron, N.; Korendowych, E.; McHugh, N. Mortality in psoriatic arthritis—A single-center study from the UK. *J. Rheumatol.* 2010, 37, 2141–2144. [CrossRef] [PubMed]

13. Shbeeb, M.; Uramoto, K.M.; Gibson, L.E.; O’Fallon, W.M.; Gabriel, S.E. The epidemiology of psoriatic arthritis in Olmsted County, Minnesota, USA, 1982–1991. *J. Rheumatol.* 2000, 27, 1247–1250. [PubMed]

14. Alamanos, Y.; Papadopoulos, N.G.; Voulgaris, P.V.; Siozos, C.; Psychos, D.N.; Tympanidou, M.; Drosos, A.A. Epidemiology of psoriatic arthritis in northwest Greece, 1982–2001. *J. Rheumatol.* 2003, 30, 2641–2644. [PubMed]

15. Wong, K.; Gladman, D.D.; Husted, J.; Long, J.A.; Farewell, V.T. Mortality studies in psoriatic arthritis: Results from a single outpatient clinic. I. Causes and risk of death. *Arthritis Rheum.* 1997, 40, 1868–1872. [CrossRef] [PubMed]

16. Ali, Y.; Tom, B.D.; Schentag, C.T.; Farewell, V.T.; Gladman, D.D. Improved survival in psoriatic arthritis with calendar time. *Arthritis Rheum.* 2007, 56, 2708–2714. [CrossRef] [PubMed]

17. Wilson, F.C.; Icen, M.; Crowson, C.S.; McEvoy, M.T.; Gabriel, S.E.; Kremers, H.M. Time trends in epidemiology and characteristics of psoriatic arthritis over 3 decades: A population-based study. *J. Rheumatol.* 2009, 36, 361–367. [CrossRef] [PubMed]

18. Mok, C.C.; Kwok, C.L.; Ho, L.Y.; Chan, P.T.; Yip, S.F. Life expectancy, standardized mortality ratios, and causes of death in six rheumatic diseases in Hong Kong, China. *Arthritis Rheum.* 2011, 63, 1182–1189. [CrossRef] [PubMed]

19. Chang, Y.T.; Chen, T.J.; Liu, P.C.; Chen, Y.C.; Chen, Y.J.; Huang, Y.L.; Jih, J.S.; Chen, C.C.; Lee, D.D.; Wang, W.J.; et al. Epidemiological study of psoriasis in the national health insurance database in Taiwan. *Acta Derm. Venereal.* 2009, 89, 262–266. [CrossRef] [PubMed]

20. Dai, Y.-X.; Chen, T.-J.; Chang, Y.-T. Skin care services and disease prevalence in Taiwan: A nationwide study. *Dermatol. Sin.* 2018, 36, 124–130. [CrossRef]
21. Tu, H.-P.; Yu, C.-L.; Lan, C.-C.E.; Yu, S. Prevalence of schizophrenia in patients with psoriasis: A nationwide study. *Dermatol. Sin.* 2017, 35, 1–6. [CrossRef]

22. Yu, S.; Tu, H.-P.; Yu, C.-L.; Lee, C.-H.; Hong, C.-H. Is psoriasis an independent risk factor of renal disease? A nationwide retrospective cohort study from 1996 to 2010. *Dermatol. Sin.* 2017, 35, 78–84. [CrossRef]

23. Dai, Y.X.; Chen, M.H.; Chen, T.J.; Lin, M.H. Patterns of Psychiatric Outpatient Practice in Taiwan: A Nationwide Survey. *Int. J. Environ. Res. Public Health* 2016, 13, 955. [CrossRef] [PubMed]

24. Dai, Y.X.; Chen, T.J.; Chang, Y.T. Urban-rural disparities in office-based dermatological services in Taiwan—A nationwide survey. *Rural Remote Health* 2018, 18, 4730. [CrossRef] [PubMed]

25. Dai, Y.X.; Chen, T.J.; Chang, Y.T. Ambulatory practice of dermatologists in Taiwan: A nationwide survey. *J. Chin. Med. Assoc.* 2018, 81, 729–734. [CrossRef] [PubMed]

26. Li, C.Y.; Dai, Y.X.; Chen, Y.J.; Chu, S.Y.; Chen, T.J.; Wu, C.Y.; Chen, C.C.; Lee, D.D.; Chang, Y.T. Cancer Risks in Vitiligo Patients: A Nationwide Population-Based Study in Taiwan. *Int. J. Environ. Res. Public Health* 2018, 15, 1847. [CrossRef] [PubMed]

27. Svedbom, A.; Dalen, J.; Mamolo, C.; Cappelleri, J.C.; Mallbris, L.; Petersson, I.F.; Stahle, M. Increased cause-specific mortality in patients with mild and severe psoriasis: A population-based Swedish register study. *Acta Derm. Venereol.* 2015, 95, 809–815. [CrossRef] [PubMed]

28. Salahadeen, E.; Torp-Pedersen, C.; Gislason, G.; Hansen, P.R.; Ahlehoff, O. Nationwide population-based study of cause-specific death rates in patients with psoriasis. *J. Eur. Acad. Dermatol. Venereol.* 2015, 29, 1002–1005. [CrossRef] [PubMed]

29. Gelfand, J.M.; Troxel, A.B.; Lewis, J.D.; Kurd, S.K.; Shin, D.B.; Wang, X.; Margolis, D.J.; Strom, B.L. The risk of mortality in patients with psoriasis: Results from a population-based study. *Arch. Dermatol.* 2007, 143, 1493–1499. [CrossRef] [PubMed]

30. Onumah, N.; Kircik, L.H. Psoriasis and its comorbidities. *J. Drugs Dermatol.* 2012, 11, s5–s10. [PubMed]

31. Ryan, C.; Kirby, B. Psoriasis is a systemic disease with multiple cardiovascular and metabolic comorbidities. *Dermatol. Clin.* 2015, 33, 41–55. [CrossRef] [PubMed]

32. Sommer, D.M.; Jenisch, S.; Suchan, M.; Christophers, E.; Weichenthal, M. Increased prevalence of the metabolic syndrome in patients with moderate to severe psoriasis. *Arch. Dermatol. Res.* 2006, 298, 321–328. [CrossRef] [PubMed]

33. Chiu, H.Y.; Huang, H.L.; Li, C.H.; Yin, Y.J.; Chen, H.A.; Hsu, S.T.; Lin, S.J.; Tsai, T.F.; Ho, S.Y. Increased risk of glomerulonephritis and chronic kidney disease in relation to the severity of psoriasis, concomitant medication, and comorbidity: A nationwide population-based cohort study. *Br. J. Dermatol.* 2015, 173, 146–154. [CrossRef] [PubMed]

34. Asgari, M.M.; Wu, J.J.; Gelfand, J.M.; Salman, C.; Curtis, J.R.; Harrold, L.R.; Herrington, L.J. Validity of diagnostic codes and prevalence of psoriasis and psoriatic arthritis in a managed care population. *Pharmacoepidemiol. Drug Saf.* 2013, 22, 842–849. [CrossRef] [PubMed]

35. Lofvendahl, S.; Theander, E.; Svensson, A.; Carlsson, K.S.; Englund, M.; Petersson, I.F. Validity of diagnostic codes and prevalence of physician-diagnosed psoriasis and psoriatic arthritis in southern Sweden—A population-based register study. *PloS ONE* 2014, 9, e98024. [CrossRef] [PubMed]

36. Yeung, H.; Takeshita, J.; Mehta, N.N.; Kimmel, S.E.; Ogdie, A.; Margolis, D.J.; Shin, D.B.; Attor, R.; Troxel, A.B.; Gelfand, J.M. Psoriasis severity and the prevalence of major medical comorbidity: A population-based study. *JAMA Dermatol.* 2013, 149, 1173–1179. [CrossRef] [PubMed]

37. Lien, H.M.; Chou, S.Y.; Liu, J.T. Hospital ownership and performance: Evidence from stroke and cardiac treatment in Taiwan. *J. Health Econ.* 2008, 27, 1208–1223. [CrossRef] [PubMed]