

# Prevalence, incidence, gender and age distribution, and economic burden of psoriasis worldwide and in Kazakhstan

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## Abstract

**Aim:** This study aimed to conduct a literature review on the prevalence, incidence, gender and age distribution of psoriasis, as well as the economic burden of psoriasis worldwide, including Kazakhstan.

**Material and methods:** A literature review was conducted using keywords in PubMed, Scopus, Web of Science, eLibrary.ru databases, and Google Scholar to identify relevant articles.

**Results:** The prevalence of psoriasis varies by geographic location and race. However, psoriasis is predominantly common in Western countries and among people of European descent: in Norway (4.6%), France (4.42%), Portugal (4.4%), and the United States of America (3.0%). Significant differences in the prevalence of this disease were identified in Kazakhstan, ranging from 0.86% to 2.5%. In many Western countries, the incidence rate of psoriasis is significantly higher than the global incidence rate (57.8 cases per 100,000 population): in Denmark (199.5), Italy (230.62), and Israel (280), respectively. In Kazakhstan, the incidence rate is 35.0 per 100,000 population, which is almost 1.7 times lower than the global rate. Psoriasis affects both genders. There is a bimodal pattern of manifestation of psoriasis with early (type I) and late (type II) onset, which occurs in the age range of 30–40 years, and about 60 years. In addition, treating and providing medications to patients with psoriasis represents a significant economic burden for both the government and the patients themselves.

**Conclusion:** The study made it possible to determine the current epidemiological situation of psoriasis worldwide, including Kazakhstan, as well as to assess the economic burden of this disease.

**Keywords:** psoriasis, prevalence, incidence, gender and age distribution, economic burden.

## Introduction

Psoriasis is a common chronic, non-infectious, immune-mediated systemic disease caused by polygenic inheritance and induced by multiple environmental factors [1]. Psoriasis affects about 125 million people worldwide [2,3]. Along with skin manifestations, in 30% of patients with psoriasis, joints are also affected [3,4]. According to many studies, the most common clinical phenotype of psoriasis is plaque psoriasis. For instance, in Ethiopia – 62.9% [5], Egypt – 84.1% [6], Nigeria – 88.1% [7], Australia – 89% [8], Russia – 89.5% [9], India – 90% [10], Japan – 97.4% [11], and China – 97.06% [12], at the same time, mortality rates from all cases in

patients with psoriasis are 20% higher than in patients without psoriasis [13].

Psoriasis can begin at any age. However, data on the incidence of psoriasis show a clear bimodal age pattern of the onset of the disease; according to some data, the first and second peaks occur at 20-30 and 50-69 years [14,15], and according to other sources, at 30-39 and 60-69 years [16]. In 75% of cases, the disease manifests itself before the age of 40 [17]. Psoriasis affects both men and women equally, but is more common in non-Hispanic whites [14,15]. The disease leads to long-term physical and psychological complications [18] and entails significant costs since it mainly affects

people of working age, which leads to decreased productivity and significant indirect costs [19]. To date, there is no cure for psoriasis [20].

The prevalence of psoriasis varies around the world. Approximately 2-4% of the population in Western countries suffers from this disease [21]. The global age-standardized prevalence rate of psoriasis is 811 cases per 100,000 population, which is approximately 0.84% of the world's population, or about 64.6 million people. The highest prevalence rates of psoriasis have been reported in North America and Western Europe, and the lowest in the Asia and Western Pacific regions [22]. In particular, more than 4.5 million cases of psoriasis were registered worldwide in 2019.

The global age-standardized incidence rate of psoriasis is 57.8 cases per 100,000 population. The highest incidence rate of psoriasis was observed in Western Europe (204.5 cases per 100,000 people), followed by the region of Australasia (145.4) and North America (92.0) (with a high level of income), and the lowest incidence rate was detected in Southeast Asia (20.1), followed by central Latin America (20.7) and Eastern Sub-Saharan Africa (25.1) [23]. According to some estimates, the regional incidence of psoriasis varies from 0.4% in Asian countries to 11.43% in Norway, and among children and adolescents, from 0% in Taiwan to 2.1% in Italy [24,25]. In the United States of America, the prevalence of psoriasis among adults is about 3.0-3.2% [24,26]. The age distribution shows that the increase in the incidence of psoriasis begins at the age of 20, reaching a peak at 55-60 years. As reported, women are susceptible to this disease more often than men [22], and according to others, the incidence of psoriasis is the same in both genders [23].

## Aim of the study

To study the prevalence, incidence, gender and age distribution of psoriasis by country of residence and racial origin and determine its financial burden.

## Material and methods

The literature search was conducted using keywords in PubMed, Scopus, Web of Science, eLibrary.ru and cyberleninka.ru databases and the web search engine Google Scholar to identify articles relevant to the aim. The geography of the search covered all continents. The global prevalence of psoriasis among adults, in addition to reviewing the literature data, was estimated using the Prevalence Heat Map of the Global Psoriasis Atlas (<https://www.globalpsoriasisatlas.org>). The adaptation of heat maps was carried out using the program MapChart.net. Graphs on the dynamics of the incidence of psoriasis and dermatoses in Kazakhstan were compiled using Microsoft Excel 2021.

## Results

### *The prevalence of psoriasis*

Psoriasis' prevalence varies by geographic location and race. Meanwhile, the prevalence of psoriasis does not vary depending on patients' marital status, education, income, or health insurance status [24]. For instance, a high prevalence of psoriasis among adults in North America was registered in Canada at 2.44% [27] and in the United States of America at 3.0%, which indicates that approximately 7.55 million Americans suffer from this disease. In the United States of America, the highest prevalence of psoriasis was diagnosed among white

individuals at 3.6%, followed by other racial and ethnic groups (non-Hispanic, including multiracial) at 3.1%, Asian individuals at 2.5%, Hispanic individuals (including Mexican Americans and other Hispanics) at 1.9%, and African Americans at 1.5% [24]. According to available data, the prevalence of psoriasis in Brazil is 1.31-1.6% [28,29]. Moreover, the prevalence rate of this disease varies from 0.92% to 1.88%, which depends on the geographical region. The highest prevalence rates of psoriasis were recorded in the south (1.86%) and southeast (1.88%) of Brazil, where the local population is represented by immigrants from European countries, while in the north (0.92%) of the country, predominantly Indians live [28]. At the same time, there are many reports that psoriasis is rare in population with colored skin. The actual prevalence may be underestimated due to the lack of large-scale epidemiological studies. However, in Africa, especially in West Africa, psoriasis is indeed considered a relatively rare disease. The prevalence of psoriasis varies from 1.9% to 3.5% in East African countries (Kenya, Uganda, Tanzania) and from 0.025% to 0.9% in West African countries (Nigeria, Ghana, Mali, Angola) [7,30,31]. The prevalence of psoriasis in Australia varies widely, from 0.3 to 2.5% [32]. Interestingly, psoriasis is rare or absent among fool-blood Australian Aborigines. A survey of about three thousand such people in central, northern, and southern Australia found no cases of psoriasis [33]. Data on the prevalence of psoriasis in several countries are presented in Table 1 (see the next page).

From Table 1, it can be seen that the highest prevalence rates of psoriasis are observed in Western countries, in particular: in Norway: 11.4% [36]; Italy: 4.8% [46]; France: 4.42% [41]; Portugal: 4.4% [45]; Romania: 4.2% [47]; the United Kingdom: 2.8% [13]; Germany: 2.78% [39]; Spain: 2.69% [43]; and the lowest in Asian countries, such as Malaysia: 0.34% [53]; China: 0.47% [12]; South Korea: 0.54% [51]; Japan: 0.57% [52]; and Russia: 0.24% [35].

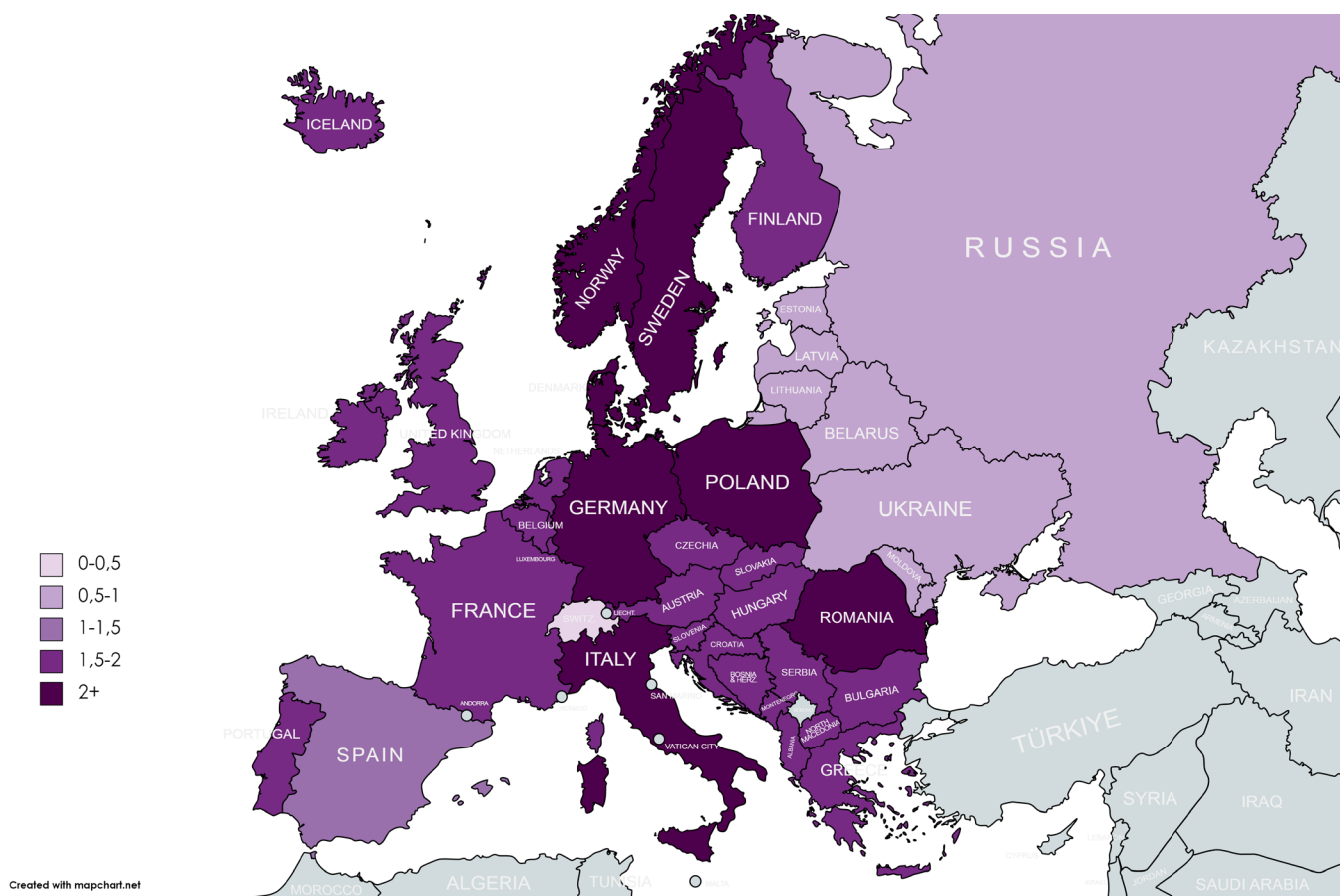
At the same time, according to the Global Psoriasis Atlas (GPA), the prevalence of psoriasis among adults in Europe ranges from 0.11% in Switzerland to 2.36% in Norway (Figure 1, see the next page) [34].

As can be seen from Figure 1, darker colors correspond to higher rates of psoriasis prevalence, while lighter colors correspond to lower rates. In Europe, according to the Global Psoriasis Atlas, the highest prevalence rates of psoriasis among adults are observed in the following countries: Norway (2.36%); Denmark (2.26%); Romania (2.24%); Germany (2.2%); Sweden (2.1%); Poland (2.06%); Italy (2.0%); France (1.94%); Finland, Iceland, the United Kingdom, Ireland, Belgium, Austria, and Greece (1.92%). At the same time, the lowest prevalence rates of psoriasis were recorded in Estonia, Latvia, Lithuania (0.59%), Switzerland (0.11%) [34].

One study reported that the prevalence rate of psoriasis in the United Kingdom (UK) was 2.8% (2815 cases per 100,000 population). Moreover, a significant relationship has been found between the prevalence of psoriasis and latitude; in particular, in the United Kingdom, there are about 6.5 new cases of psoriasis per 100,000 population for every degree increase in latitude. This finding supports the hypothesis that the prevalence of psoriasis varies depending on geographic location. In this regard, in countries more distant from the equator, psoriasis is more prevalent [13]. Several epidemiological studies from different regions of Spain showed the prevalence of psoriasis in the range of 2.3-2.69% and psoriatic arthritis at 0.75% (939 cases of psoriasis or psoriatic arthritis per 100,000 population) [42,43], and among children at 0.30% [44]. For instance, in the province of Lleida in northeastern Spain, the prevalence of

**Table 1** Data on the prevalence of psoriasis in several countries

Country	Year	Diagnosis method	Population, n	Age, years	Prevalence of psoriasis (%)	Prevalence among men (%)	Prevalence among women (%)	Prevalence under 18 years (%)	Literature
Kazakhstan	2017	Database	18.2 million	All ages	0.86	-	-	0.1	[34]
Russia	2010-2019	Analysis of statistic surveillance data	-	All ages	0.24	-	-	0.1	[35]
The United Kingdom	January 1, 1999–December 31, 2013	Database	15,436,637	All ages	2.8	2.81	2.83	-	[13]
Norway	1979-2008	Population-based study	33,803	20-79	4.8-11.4	-	-	-	[36]
	2004-2020	Database	272,725	All ages	3.8-4.6 (2015-2020)	-	-	-	[37]
Denmark	2003-2012	Database	5.7 million	All ages	2.22	1.03	1.18	0.4 (<19)	[38]
Germany	2009	Database	1,642,852	18>	2.78	2.94	2.59	-	[39]
	2009	Database	293,181	<18	-	-	-	0,45	[40]
France	September 01 – November 30, 2016	Survey (filling out a digital questionnaire)	20,012	15>	4.42	4.49	4.36	-	[41]
Spain	2013	Computerized telephone survey	12,711	All ages	2.3	2.7	1.9	0.5 (<16)	[42]
	June-September 2016	Computerized telephone survey	7,980	16>	2.69	2.78	2.61	-	[43]
	2010-2016	Database	398,701	All ages	1.72	1.88	1.56	0.30 (<18)	[44]
Portugal	May-November 2021	Phone questionnaire	6,381	15>	4.4	-	-	-	[45]
Italy	-	Review of articles	-	-	1.8-4.8	-	-	-	[46]
Romania	2018-2019	Questionnaire	1500	18>	4.2	-	-	-	[47]
Canada	2008-2012	Database	325,618	18>	2.44	-	-	-	[27]
The United States of America	2011-2014	Database	12,625	20>	3.0	2.8	3.2	-	[24]
Brazil	2015-2016	Telephone survey	8,947	All ages	1.31	1.47	1.15	-	[28]
	2008-2010	Prospective cohort study	15,105	35-74	1.6	-	-	-	[29]
China	2003	Questionnaire and dermatological examination	17,345	All ages	0.47	0.54	0.44	0.18	[12]
Taiwan	2000-2006	Database	5,864	All ages	0.19	0.23	0.16	-	[48]
	2006	Database	23 million	All ages	0.235	-	-	-	[49]
	2006-2017	Database	23.5 million	All ages	0.86	-	-	-	[50]
South Korea	January 2006 – December 2015	Database	51 million	All ages	0.54	-	-	-	[51]
Japan	2012-2018	Database	487,835	40>	0.57	-	-	-	[52]
	April 2010 – March 2011	Database	565,903	All ages	0.34	-	-	-	[11]
Malaysia	2010-2020	Database	1,164,724	All ages	0.34	0.39	0.29	-	[53]
India	-	Review of articles	-	All ages	0.44-2.2	-	-	-	[10]
Israel	2011-2017	Population-based study (analysis of electronic medical records)	71,094	All ages	3.8	-	-	-	[54]
	1999-2014	Population-based cross-sectional retrospective study	887,765	16-18	-	-	-	0.35	[55]
Australia	-	Review of articles	-	All ages	0.3-2.5	-	-	-	[32]
Nigeria	2001-2021	Retrospective review	39,047	All ages	0.6	-	-	-	[7]



**Figure 1** – Map of the prevalence of psoriasis among adults in Europe. Adapted from the Prevalence Heat Map of the Global Psoriasis Atlas. Created by MapChart.net

psoriasis was 1.72% [44]. At the same time, a comparatively higher prevalence was registered in Central Spain (2.5%), the region with the coldest and driest climate [42].

In Germany, over 1.5 million people suffer from psoriasis [56], and the prevalence of this disease among the adult population was 2.78% [39], and among children and adolescents, 0.45% [40]. By comparison, in Denmark, this rate is 2.2% [38]. Psoriasis is also a common disease in Italy, where the prevalence rate of psoriasis varies from 1.8% to 4.8% [46]. Also, a fairly high prevalence of psoriasis was identified in France (4.42%) [41], and Portugal (4.4%) [45]. Among Eastern European countries, a high prevalence rate of this disease was recorded in Romania – up to 4.2% [47].

A high population frequency (up to 4%) of the prevalence of psoriasis is observed in Scandinavian countries and among indigenous residents of the Far North in Russia [57]. Population-based studies conducted in Northern Norway among people aged 20 to 79 years showed an increase in the prevalence of psoriasis from 4.8% in 1979-1980 to 11.4% in 2007-2008. It was found that psoriasis developed as a result of the following precipitating factors: a higher body mass index, less physical activity during work and leisure, a lower level of education, and smoking [36]. Another study reports that the prevalence of psoriasis in Norway is 4.6%. At the same time, there is a difference in the prevalence of the disease depending on the geographical region. For instance, the prevalence of psoriasis in the west and middle of the country was 4.3%, in the south-eastern part, 4.6%, and in the north of the country, 6.1% (6140 patients per 100,000 population). According to the researchers, one possible explanation for the higher prevalence of psoriasis in northern Norway may be less sunlight and a colder climate. This circumstance limits the use of natural sunlight to reduce skin inflammation and, in addition,

can lead to decreased vitamin D levels. In addition, factors such as genetics and lifestyle may be involved [37].

Compared to some countries in Western Europe and North America with the relatively high prevalence of psoriasis, in many Asian countries, in particular Malaysia (0.34%) [53,58], China (0.47%) [12], Taiwan (0.19-0.86%) [49,50], South Korea (0.54%) [51], and Japan (0.34-0.57%) [11,52], the prevalence of the disease remains at a comparatively low level [59,60]. Geographical differences in the prevalence of this disease can be explained by the fact that psoriasis has a multifactorial etiology, resulting from a complex interaction between genetic and non-genetic factors [61].

According to GPA, the prevalence of psoriasis among adults ranges from 0.07% in Taiwan to 2.28% in Israel (Figure 2, see the next page) [34].

As can be seen from Figure 2, the following Asian countries have the highest prevalence rates of psoriasis: Israel (2.28%); Cyprus (1,92%); Kazakhstan, Uzbekistan, Kyrgyzstan, Turkmenistan, Tajikistan, and Mongolia (0.86%), Brunei (0.76%); Saudi Arabia (0.73%), and South Korea (0.7%). According to the GPA, in Russia, this rate is 0.51%. The lowest rates of psoriasis are observed in the following Asian countries: Taiwan (0.07%); North Korea (0.14%); China (0.21%); India (0.34%); Nepal (0.35%) [34]. It should be noted that, according to the developers of this resource, only 19% of countries have data on the prevalence and incidence of psoriasis. Accordingly, this resource cannot guarantee absolutely correct data on the epidemiological situation of psoriasis in particular countries [58].

One recent study reported that the prevalence of psoriasis in Malaysia was 0.34%. In a multi-ethnic Malaysian population, the prevalence of psoriasis was higher in patients of Indian





[56]. A comparatively low incidence of psoriasis was identified in Chile, where the national incidence rate of psoriasis is 22.7 cases per 100,000 population. At the same time, there was a high variation in incidence rates throughout the country, from 0.75 (central region) to 164.9 (below southern region) cases per 100,000 population [70].

In Asian countries, with the exception of Israel, where the average annual incidence rate is 280 cases per 100,000 population, including 92 cases per 100,000 among children (0-14 years) [54], the incidence of psoriasis is generally significantly lower than in Western countries. For instance, according to the latest data in Malaysia, the incidence rate was 34.2 cases per 100,000 population. Due to the fact that Malaysia is a multi-ethnic country, the incidence rate among ethnic groups of the population varies significantly: Indians: 52.5 cases per 100,000 population; Chinese: 38.0 cases per 100,000 population; and Malays: 30.0 cases per 100,000 population [53,58]. In Taiwan, this rate is 62-65 cases per 100,000 population [50].

It is reported that in Russia, the incidence rate of psoriasis is 65.3 cases per 100,000 population [67]. For comparison, in Israel, this rate reaches 305 new cases per 100,000 population (among individuals over 65 years old) [54]. In the city of St. Petersburg, the incidence rate of psoriasis is 75 cases per 100,000 population [66]. In Russia, the lowest incidence rates of psoriasis were noted in the Astrakhan region of the Southern Federal District (SFD), the Republic of Adygea SFD and the Belgorod region of the Central FD – 7.3; 12.6 and 14.8 cases per 100,000 population, respectively. At the same time, the highest incidence rates of psoriasis were recorded in the Khabarovsk Territory of the Far-Eastern FD, the Kurgan Region of the Ural FD and the Udmurt Republic of the Volga FD – 169.8; 163.0 and 143.4 cases per 100,000 population, respectively [71].

A study carried out in the Central Asian country of Kyrgyzstan showed that the incidence rate of psoriasis was 47.7 cases per 100,000 population. An uneven distribution of the disease, depending on the region, was revealed. The highest incidence of psoriasis was identified in Batken (110.5 cases per 100,000 population), Issyk-Kul (91.7 cases per 100,000 population), Naryn (65.9 cases per 100,000 population), and Jalal-Abad (48.5 cases per 100,000 population) regions, and the lowest in Chui (36.9 cases per 100,000 population), Osh (34.3 cases per 100,000 population) and Talas (10.6 cases per 100,000 population) regions. Also, low incidence rates registered in the cities of Osh (17.2 cases per 100,000 population) and Bishkek (32.9 cases per 100,000 population) [72].

According to 2023 data, the incidence rate of psoriasis in the population of Kazakhstan is 35.0 cases per 100,000

**Table 2** Psoriasis incidence rate per 100,000 population in Kazakhstan in comparison with several countries

Country	Incidence rate per 100,000 population, n	Literature
Kazakhstan	35,0	[73]
The global age-standardized incidence rate of psoriasis	57.8	[23]
Chile	22.7	[70]
Malaysia	34.2	[53]
Kyrgyzstan	47.7	[72]
The United States of America	63.8	[69]
Taiwan	65.0	[50]
Russia	65.3	[35]
The United Kingdom	129.0	[13]
Denmark	199.5	[38]
Italy	230.62	[46]
Israel	280.0	[54]

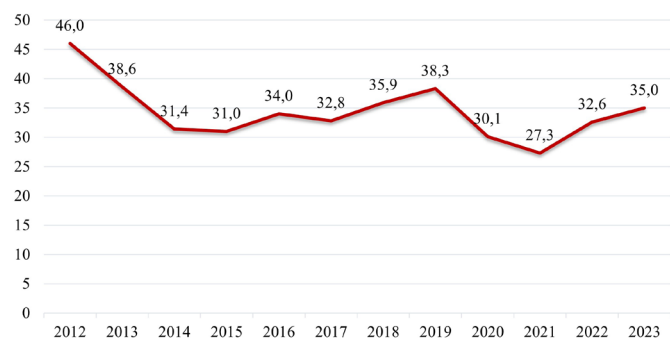
population [73]. Compared to other countries, the incidence of psoriasis in Kazakhstan is relatively low (Table 2).

Table 2 shows that in Kazakhstan, the incidence rate of psoriasis is almost 1.7 times lower than the global incidence rate (57.8 cases per 100,000 population) and is also significantly lower than the incidence rates of a number of countries: Russia – 1.9 times, the United Kingdom – 3.7 times, Denmark – 5.7 times and Israel – 8 times.

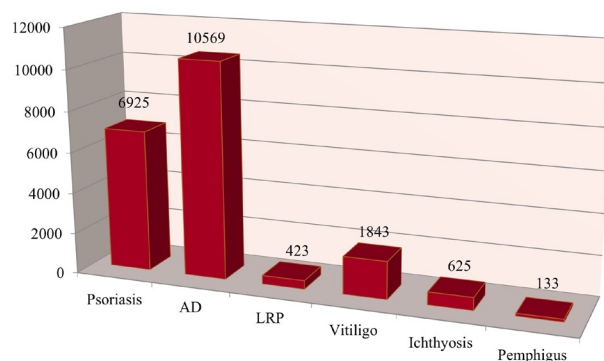
The dynamics of the incidence of psoriasis in Kazakhstan in the period from 2012 to 2023 are presented in Figure 3.

From Figure 3, it is clear that during this period, the incidence of psoriasis had a «wavy» trend with periods of both a stable decrease (2012-2015, 2019-2021) and an increase (2017-2019, 2021-2023) [73-78]. At the same time, in 2021, there was an increase in the number of hospitalized patients with psoriasis by 22.2%, from 333 patients in 2020 to 378 patients in 2021 [79]. According to data from the Kazakh Scientific Center of Dermatology and Infectious Diseases, in 2023, the diagnosis of psoriasis in Kazakhstan was confirmed for 6,925 patients, with an incidence rate of 35.0 cases per 100,000 population (Figure 4) [73].

As can be seen from Figure 4, in 2023, psoriasis (33.8% of the total number of dermatoses) was second after atopic dermatitis (51.5%) in terms of incidence among chronic dermatological diseases in Kazakhstan [73].



**Figure 3** – Dynamics of psoriasis incidence in the population of Kazakhstan in 2012-2023 per 100,000 population. The X-axis represents the period from 2012 to 2023. The Y-axis represents the incidence rate of psoriasis per 100,000 population



**Figure 4** – Incidence of dermatoses in Kazakhstan in 2023. AD – atopic dermatitis; LRP – lichen ruber planus

Psoriasis and eczema are the most common diseases in all regions of Kazakhstan, especially in environmentally unfavorable regions [80]. For instance, in the city of Turkestan in the South Kazakhstan region (now Turkestan), in the period from 2014 to 2016, there was an increase in the incidence of psoriasis from 12.6% to 16.7%, respectively [81]. Psoriasis affects urban residents more often than residents living in rural areas [78]. Possible factors for the development of psoriasis include neuropsychic disorders, previous infectious diseases, pathologies of the gastrointestinal tract and endocrine system, alcohol consumption, unfavorable climatic conditions, and hereditary factors. At the same time, a strong correlation was found between the seasonality of relapses and the allergic syndrome [74].

There is an increase in the number of severe forms of psoriasis that are resistant to various treatment methods, an increase in cases of joint involvement in the pathological process, which causes an increase in cases of long-term incapacitation and disability, as well as the formation of iatrogenic complications and a pronounced deterioration in the quality of life of patients [74]. In Kazakhstan, about 30% of patients have moderate or moderate-severe forms of psoriasis [82]. For comparison, in Japan, in most cases (86.2%), patients were diagnosed with mild psoriasis while 13.8% were diagnosed with moderate to severe psoriasis [52]. Moderate and severe psoriasis, was diagnosed in 7.27% of all patients with psoriasis in Spain [44]. It was revealed that in Kazakhstan, severe forms of psoriasis are most common among residents of the Atyrau, Almaty, and Kyzylorda regions, with a continuously relapsing course in patients in the Kostanay, Akmola, and Almaty regions [74].

#### *Gender distribution of psoriasis*

As mentioned earlier, psoriasis affects both genders. However, in some populations, psoriasis is diagnosed more often in women than in men, and vice versa. In some countries, there is an almost equal distribution of psoriasis by gender.

A situation with the gender distribution of psoriasis, when women suffer from psoriasis slightly more often than men, was identified in Germany [56], Norway [37], and Denmark [38] – 53.2%, 54%, and 54%, respectively. In the United States of America, the prevalence of psoriasis was also found to be slightly higher in women (3.2%) than in men (2.8%) [24], but practically equal incidence was recorded in men (62.8 cases per 100,000 population) and women (64.8 cases per 100,000 population) [69].

A higher prevalence and incidence of psoriasis in men have been identified in countries such as Brazil [28], Israel [54], Kazakhstan [74,75], Russia [9], Malaysia [53,58], Taiwan [48,50], China [12], Japan [11], Nigeria [7], Egypt [6], and Ethiopia [5]. In particular, psoriasis in Brazil is more often diagnosed in men (1.47%) than in women (1.15%) [28]. In Israel, psoriasis is slightly more prevalent among men (4.0%) than women (3.7%) [54]. The prevalence of psoriasis in Malaysia is 0.39% in men and 0.29% in women. At the same time, the incidence rate in this country is 40.7 per 100,000 population in men and 28.3 per 100,000 population in women [53,58]. In Taiwan, there is also a higher prevalence of psoriasis in men (0.23%) than in women (0.16%) [48]. Interestingly, in Taiwan, in patients under 30 years of age, psoriasis is diagnosed with almost the same frequency in both genders. However, the incidence rate increases substantially in male patients aged 30 years and older [50]. In China, a higher prevalence of the disease was also reported in men (0.54%) than in women (0.44%) [12]. The same situation occurs in Japan,

where psoriasis is more common in men (59.1%) than in women (40.9%) [11]. In India, psoriasis occurs twice as often in men than in women in the ratio (2.46:1) [10]. The trend in which psoriasis affects men more often is also observed in African countries. Specifically, in Nigeria [7], Egypt [6], and Ethiopia [5], men are more susceptible to psoriasis than women – 64.2%, 56.3%, and 54.4%, respectively. In Kazakhstan, a higher susceptibility to psoriasis in men was revealed in Mangistau (64.9%), North Kazakhstan (61.5%), Karaganda (59.7%), Akmola (58.5%), East Kazakhstan (56.1%), Kyzylorda (56.0%), West Kazakhstan (55.7%), South Kazakhstan (now Turkestan) (51.2%) regions, and women in Almaty (59.4%) and Pavlodar (58.8%) regions [74]. For comparison, in Russia, 60.5% of patients with psoriasis are men [9].

An almost equal distribution of psoriasis between both genders was observed in France (men – 4.49%; women – 4.36%) [41], the United Kingdom (men – 2.81%; women – 2.83%) [13], and Spain (men – 2.78%; women – 2.61%) [43]. But, according to other data, the prevalence of psoriasis in Spain is higher in men (1.88-2.7%) than in women (1.56-1.9%) [42, 44].

#### *Age distribution of psoriasis*

Psoriasis can develop at any age. However, the average age at which psoriasis occurs is 33 years. In women, psoriasis usually manifests at the ages of 16-22, or 55-60 years, and in men, 30-39, or 60-79 years [83,84]. This bimodal pattern of psoriasis is associated with two distinct subtypes of psoriasis: type I with onset before the age of 40 years and type II with onset after 40 years [85].

A study conducted in the United Kingdom revealed a clear bimodal pattern in the incidence of psoriasis depending on the age of the patient. In women, early-onset psoriasis (type I, diagnosed before the age of 40 years) is more often diagnosed at an earlier age than in men, and late-onset psoriasis (type II, diagnosed after the age of 40 years), on the contrary, is more often diagnosed in men [13]. A bimodal pattern of psoriasis manifests in Israel, with peaks at the ages of 30 and 60. In 48.9% of cases, psoriasis had an early onset and was diagnosed before 40 years of age (the average age of patients was 24.9 years). However, in 51.1% of cases, psoriasis had a late onset and was diagnosed after 40 years of age (mean age 59.7 years). Thus, the average age of onset of psoriasis was 42.4 years. The same gender distribution was observed both with the early and late onset of the disease [54]. Malaysia also revealed a bimodal trend in the age of onset of psoriasis, with the first and second peaks at the ages of 20-29 and 50-59 years. At the same time, in women, the disease begins much earlier (36.8 years) than in men (42.0 years) [53,58]. Interestingly, in Taiwan, the second peak of psoriasis development occurs at the advanced age of 80-89 years (type II, late onset), and the first peak is also observed at the age of 30-39 years (type I, early onset) [50]. A study carried out in Chile found that women had two peaks in incidence of psoriasis, one in childhood and adolescence (5-15 years) and a second in middle age (45-65 years), whereas men had one later peak (56-65 years) [70]. Another study showed that in Nigeria, 25% of patients developed psoriasis before age 20, and 71.4% developed psoriasis before age 40. Moreover, the average age at onset of the disease is 30.5 years. More than 60% of all patients with psoriasis are under 40 years of age. In women, psoriasis begins earlier than in men, with the average age of onset being 27.6 and 32.3 years, respectively [7]. Similar to Nigeria, in Egypt, the average age of onset is 30.5 years [6]. In all regions of Kazakhstan, the onset of psoriasis occurs at a young age: from



14±2.5 years in the Atyrau region and up to 28±4.0 years in the Kyzylorda region, which refers to type I psoriasis with early onset [74].

A Brazilian study noted an age-related increase in the prevalence of psoriasis: under the age of 30 years: 0.58%; from 30 to 60 years: 1.39%; and over 60 years, 2.29% [28]. A study conducted in Denmark revealed the following distribution of psoriasis prevalence depending on the age of patients: 0-19 years – 0.4%; 20-29 years – 1.4%; 30-39 years – 2.1%; 40-49 years – 2.7%; 50-59 years – 3.4%; 60-69 years – 4.1% and over 70 years – 3.8% [36]. A similar trend of increasing prevalence of psoriasis with age was revealed in the study conducted in Spain: up to 16 years – 0.5%; 16-29 years – 1.4%; 30-39 years – 2.7%; 40-49 years – 3.0%; 50-59 years – 3.2%; 60-69 years – 3.4% and over 70 years – 2.6% [42]. In Germany, there was a tendency for the prevalence of juvenile psoriasis to increase with age: from 0.13% at the age of 0-2 years to 0.67% at the age of 14-18 years [40]. In Chile, the minimum incidence of psoriasis was registered in the demographic age group 0-5 years: 4.9 cases per 100,000 population, and the maximum incidence rate was in the age group 55-65 years – 39.4 cases per 100,000 population. A decrease in incidence was observed in the age group over 75 years – 16.5 cases per 100,000 population [70]. An increase in the incidence of psoriasis has also been detected in the United States of America, where the peak incidence occurs in persons in the age group 70-79 years (92.3 cases per 100,000 population) [69]. In Ethiopia, psoriasis most often affects young people aged 18 to 34 years (48.9%), followed by children from 0 to 17 years (26.3%) and adults from 35 to 55 years (24.6%) [5]. Among patients with psoriasis in Kazakhstan, adults (18 years and older) predominate – 77.3% of cases of the total number of patients with psoriasis, followed by children (0-14 years old) – 16.0%, and adolescents (15-17 years old) – 6.7% [78].

Data from multiple studies show that the highest prevalence rates of psoriasis are observed in older people (Table 3).

As can be seen from Table 3, the highest prevalence rates of psoriasis are observed in the following age groups: in Germany – 60-69 years (4.15%) [39]; Denmark – 60-69 years (4.1%) [38]; Spain – 60-69 years (2.90-3.4%) [42,44]; Malaysia

– 50-59 years (0.67%) [53,58]; China – age groups 40-49 (0.92%) and over 70 years (0.92%) [12]. In France, a high prevalence of psoriasis was found in the age groups 35–49 and 50-64 years [41]; in Japan, 75-79 years [11]; and in Taiwan, 70-79 years, regardless of gender [50]. Moreover, in Taiwanese patients in the age group 70-79, there was an increase in the prevalence of the disease by more than 50% compared with patients in the age group 60-69 years [48-50].

The mean age of patients with psoriasis also varies between countries, for instance: in India – 33.6 years [10], Egypt – 39.3 years [6], Kazakhstan – 43.8 years [86], Denmark – 45 years [38], Russia – 46.1 years [9], Brazil – 49.1-52 years [28,86], Chile – 49.2 years [86], Norway – 47-53 years [37], Spain – 52.08 years [44], Australia – 52.3 years [8] and Japan – 56.7 years [11], respectively. In Kazakhstan, psoriasis is more often diagnosed in men of young working age (21-50 years) – 68.1% [74,75], while the age of onset of the disease is 23.4 years [87]. For comparison, the first symptoms of psoriasis in Romanians usually appear around the age of 50 [47]. In Russia, every fourth patient with psoriasis is a person over working age, that is, men aged 60 years and older and women aged 55 years and older [35].

#### *The economic burden of psoriasis*

Psoriasis is a serious disease that significantly deteriorates patients' quality of life. According to the National Psoriasis Foundation, 65% of surveyed patients with psoriasis noted that they experienced discrimination at work, at school, and in other public places [88]. Moreover, psoriasis is a disease that most people recognize as causing considerable morbidity and expense to patients. According to the Psoriasis Disability Index (PDI), two-thirds of respondents said that psoriasis had caused them to change the way they performed their usual daily activities; more than 50% wore clothes of different types and colors; more than 50% said their home became dirtier or unkempt; and more than a third had trouble going to the hairdresser or had difficulty playing sports [89].

The costs associated with decreased quality of life, disability, and absenteeism from work can be significant, increasing the overall costs associated with treating the disease [90,91]. Therefore, it is worth mentioning the economic burden of psoriasis associated with the significant costs of treatment and providing medications to patients with psoriasis. In particular, in the United States of America in 2020, the total medical and pharmacy care for 230,056 patients with psoriasis was about US\$1.7 billion, or over US\$7,000 per patient [92]. In Italy, the cost of treating psoriasis is estimated to range from €500 to €15,000, depending on the severity of the disease, the treatment used, and hospitalization [46]. In Australia, annual out-of-pocket expenditure on medical products was approximately AUD\$250 per person, or US\$162.79 (1999). However, costs ranged from zero to more than AUD\$2,000, or US\$1,292 per person, over a two-year period. The highest costs were for over-the-counter products purchased without a prescription [89].

In Kazakhstan, treatment of psoriasis is included in the List of Free Outpatient Medication Coverage and is financed within the framework of Compulsory Social Medical Insurance (CSMI) [82]. According to the annual report for 2021 of the Health Insurance Fund, psoriasis is among the 10 most costly diseases within the framework of CSMI, along with: mucopolysaccharidosis, hematological blood diseases, multiple sclerosis, muscular dystrophy, hypofunction, and other pituitary disorders; pituitary dwarfism; Shereshevsky-Turner syndrome;

**Table 3**

The highest prevalence rates of psoriasis by age groups in several countries

Country	Age group, years	Prevalence, %	Literature
Germany	50-59	3.62	[39]
	60-69	4.15	
	70-79	3.94	
Denmark	50-59	3.4	[38]
	60-69	4.1	
	Over 70 years	3.8	
Spain	50-59	3.2	[42]
	60-69	3.4	
	Over 70 years	2.6	
Malaysia	50-59	0.67	[53,58]
	60-69	0.66	
China	40-49	0.92	[12]
	50-59	0.91	
	Over 70 years	0.92	



unspecified Turner syndrome; primary pulmonary hypertension; Fabry disease; other sphingolipidoses; hormonally active pituitary tumors; acromegaly; and acute respiratory infections of the lower respiratory tract. 19.1 billion tenge, or US\$44.8 million, was spent on the purchase of medications and medical products for 309,977 patients with a confirmed diagnosis of this group of diseases. From this amount, 7.3%, or 1.4 billion tenge (about US\$3.3 million), were spent on providing 916 patients with psoriasis (about 3.6 thousand US dollars per patient) [93]. In 2022, according to the National Report on Primary Health Care in the Republic of Kazakhstan, psoriasis will also be among the highest-cost diseases in the CSMI. The amount prescriptions provided amounted to over 2.9 billion tenge (US\$6.3 million) [94].

## Discussion

Psoriasis is predominantly common in Western countries and among people of European descent. This may be due to the fact that countries located closer to the equator (Malaysia (0.34%) [53], Nigeria (0.6%) [7] and others) may suffer from insufficient diagnosis and underreporting, and countries further north (Norway (4.6%) [37], France (4.42%) [41], Portugal (4.4%) [45], the United States of America (3.0%) [24], the United Kingdom (2.8%) [13], Germany (2.78%) [39], Canada (2.44%) [27] and others) suffer from colder temperatures, which may affect the epidemiology and symptomatology of psoriasis [95, 96]. Analysis of available data shows significant differences in the prevalence of psoriasis in Kazakhstan, which varies widely from 0.86% [34] to 2.5% [65]. Such significant differences in the prevalence of psoriasis can probably be explained by the lack of large-scale population studies assessing the prevalence of this socially significant disease among the entire population of the country.

The global age-standardized incidence rate of psoriasis in the world is 57.8 cases per 100,000 population [23]. However, in many Western countries, the incidence rate is significantly higher than the global indicator; for example, in the United Kingdom – 129 cases per 100,000 population [13], Denmark – 199.5 [38], Italy – 230.62 [46], Israel – 280 [54], respectively. Compared to countries of the Western world with a high incidence of psoriasis, in many Asian countries this indicator is significantly lower or almost equal to the global incidence rate; for example, in Kazakhstan – 35.0 cases per 100,000 population [72], Malaysia – 34.2 [53,58], Kyrgyzstan – 47.7 [72], Taiwan – 65.0 [50], and Russia – 65.3 [35], respectively. The incidence rate of psoriasis in Kazakhstan is almost 1.7 times lower than the global incidence rate. Therefore, we can draw the encouraging conclusion that the incidence of psoriasis in the country is at a fairly low level.

Psoriasis affects both the male and female half of the world's population. However, studies show that in some Western countries (the United Kingdom, France), men and women suffer from psoriasis almost equally, or there is a slight predominance of psoriasis in women (Denmark, Germany, Norway, the United

States of America). The opposite situation in terms of gender differences in the prevalence of psoriasis is observed in Asia (Malaysia, China, Taiwan, and Japan), as well as in countries located closer to the equator (Brazil, Spain, Egypt, Ethiopia, and Nigeria), where psoriasis is much more common in the male half of the population. As in many countries in Asia and Africa, in Kazakhstan, psoriasis is more often diagnosed in men.

Psoriasis is characterized by a bimodal pattern of psoriasis manifestation with early (type I) and late (type II) onset [13,54,85]. The first peak of manifestation occurs at the age of 30-40 years [13,54], and the second at about 60 years [53,58]. At the same time, the highest prevalence rates of psoriasis are observed in people over 60 years old.

The economic burden of psoriasis is associated with the significant costs of treatment and providing medications to patients with psoriasis. This burden falls on both the government and the patients themselves and is associated with the need to visit a dermatologist, prescription or physician treatment, and hospitalization [19]. At the same time, in Kazakhstan, treatment of patients with psoriasis is carried out at the expense of the government within the framework of CSMI.

## Conclusion

An analysis of literature data was carried out on key epidemiological indicators, including the prevalence, incidence, gender and age distribution of psoriasis in the world and in Kazakhstan, and the economic burden of this disease was assessed.

**Limitations:** One of the limitations of the study is the lack of data on the epidemiology of psoriasis in all regions of Kazakhstan in recent years, which does not allow an accurate assessment of the prevalence of this disease in the country.

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