Original Article

Burden of Skin and Subcutaneous Diseases in Iran and Neighboring Countries: Results from the Global Burden of Disease Study 2015

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Abstract

Background: Iran and its neighboring countries represent four world regions with unique cultures and geography. Skin diseases span a wide diversity of etiologies including infectious, inflammatory, autoimmune, vascular, neurogenic, and oncologic. The Global Burden of Disease Study (GBD) 2015 measures the burden from skin diseases in 195 countries.

Methods: Epidemiologic data were collected from literature review, survey data, and hospital inpatient/outpatient claims data. These raw data entered modeling using a Bayesian meta-regression tool, DisMod MR-2.1, which yielded prevalence estimates by age/sex/location/year. Prevalence estimates were combined with disability weights to yield years lived with disability (YLDs). YLDs are combined with years of life lost (YLLs), from mortality estimates, to yield disability-adjusted life years (DALYs). DALYs were obtained for 16 skin conditions and both sexes in Iran and 15 surrounding countries. The sociodemographic index (SDI) for each country was also correlated with skin disease DALY rate using the Pearson coefficient (r) with two-tailed *P*-value.

Results: There was no significant correlation between individual skin diseases and SDI. Acne and dermatitis caused the greatest burden and BCC the lowest burden of skin diseases in Iran and the other 15 countries. SCC and BCC were responsible for the largest discrepancy by sex, with higher burden in males compared to females.

Conclusion: Skin diseases, particularly dermatitis and acne, cause considerable burden in Iran and surrounding regions. Objective and transparent epidemiologic data such as GBD has the potential to inform and impact many facets of healthcare, research prioritization, public policy, and international partnerships.

Keywords: DALYs, global burden of disease study (GBD), Iran, skin

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Introduction

Iran, an ancient and diverse country, is home to many ethnic groups as well as a wide range of geographical terrains and environmental topography. With a terrain that spans desert, tropical rainforest, and mountainous regions, Iran presents risk factors that predispose to a range of skin diseases, such as ultraviolet exposure, environmental allergens, and arid climate.[1] Furthermore, the countries surrounding Iran represent unique and diverse populations encompassing four world regions, the Middle

East, Central Asia, Eastern Europe, and South Asia. Skin diseases are profoundly impacted by genetic factors and environmental exposures, and often vary from region to region within a country. A recent investigation revealed that skin diseases are the fourth leading cause of morbidity worldwide.[2] By bringing awareness of the impact of skin diseases to regional and global levels, dermatology assumes a critical role in the global health landscape. Diseases that disproportionately impact disadvantaged populations should be prioritized in research and policy efforts. For example, cutaneous leishmaniasis is a neglected tropical disease with the potential to cause significant disfigurement. Afghanistan and Iraq are amongst nine countries with significantly greater burden from cutaneous leishmaniasis compared to the mean and the region of North Africa and Middle East experienced an almost 2% median increase in its burden from 1990 to 2013.[3] These findings have implications for public policy at global, national, and local scales, as well as research, education, and medical innovation. An epidemiologic investigation into the burden of skin diseases in Iran and surrounding regions is warranted.

The Global Burden of Disease Study (GBD), based in the Institute for Health Metrics and Evaluation at the University of Washington, is a collaboration of over 1800 researchers across the globe.[4] The GBD is an analysis of the world literature on disease epidemiology including mortality, incidence, and prevalence. Sophisticated analytic tools are then used to generate morbidity and mortality metrics, which are combined into a single metric, the disability-adjusted life year (DALY). One DALY is equivalent to one year of healthy life lost. DALYs are generated for 315 diseases and injuries, including 16 skin condition categories, in 195 countries and territories, including Iran and 15 surrounding countries.[5] In addition, the GBD calculates a summary metric of development for individual countries called the Socio-demographic Index (SDI), composed of average income per person, educational attainment, and total fertility rate.[6] This paper presents GBD 2015 metrics for skin disease burden in Iran and compares DALY metrics amongst 15 neighboring countries using SDI estimates.

Methods

The 16 skin condition categories studied by the GBD 2015 are: dermatitis (including atopic, seborrheic, and contact dermatitis), acne vulgaris, psoriasis, alopecia areata, viral skin diseases, fungal skin diseases, pyoderma, cellulitis, scabies, melanoma, squamous cell carcinoma (SCC), basal cell carcinoma (BCC), pruritus, urticaria, decubitus ulcer, and other skin and subcutaneous diseases (includes miscellaneous skin conditions) (see Table 1 for ICD-10 definitions of GBD skin disease categories). In addition to Iran, the 15 countries representing 4 world regions include: Afghanistan, Bahrain, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, Turkey, United Arab Emirates (UAE) [Middle East], Armenia, Azerbaijan, Kazakhstan, Turkmenistan [Central Asia], Pakistan [South Asia], and Russia [Eastern Europe]. Detailed methods of the GBD estimation strategy have been published extensively;[2,7] a brief overview will be given here.

IHME team members and international skin experts performed a world literature search for skin disease incidence, prevalence, remission, duration, and severity and mortality risk. Over

Table 1. ICD-10 code definitions of 16 GBD skin disease categories

Skin disease category	ICD-10 code definition
Dermatitis	L20.0, L20.8-L20.9, L21-L21.1, L21.8-L21.9, L23-L23.2, L23.4-L23.9, L24-L24.9, L25-L25.5, L25.8-L25.9
Acne vulgaris	L70-L70.5, L70.8-L70.9
Psoriasis	L40-L40.5, L40.8-L40.9, L41-L41.5, L41.8-L41.9
Alopecia areata	L63-L63.2, L63.8-L63.9
Viral skin diseases	B07.0, B07.8-B07.9, B08.1
Fungal skin diseases	B35-B35.6, B35.8-B35.9, B36-B36.3, B36.8-B36.9, B43.0
Pyoderma	A46.0, A66-A66.9, A67-A67.3, A67.9, L01-L01.1, L02-L02.6, L02.8-L02.9, L04-L04.3, L04.8-L04.9, L05.0, L05.9, L08-L08.1, L08.8-L08.9, L98.0, N49.3
Cellulitis	L03-L03.91
Scabies	B86
Melanoma	C43-C43.9, D03-D03.9, D22-D23.9, D48.5
SCC	C44-C44.99, D04-D04.9, D49.2
BCC	C44-C44.99, D04-D04.9, D49.2
Pruritus	L29-L29.3, L29.8-L29.9
Urticaria	L50-L50.6, L50.8-L50.9
Decubitus ulcer	L89-L89.6, L89.8-L89.9
Other skin and subcutaneous diseases	B08.0, B08.2-B08.8, B85-B85.4, B87-B87.4, B87.8-B87.9, B88-B88.3, B88.8-B88.9, D86.3, L10-L10.5, L10.8-L10.9, L11-L11.1, L11.8-L11.9, L12-L12.3, L12.8-L12.9, L13-L13.1, L13.8-L13.9, L26.9, L27.2, L27.8-L27.9, L28-L28.2, L30-L30.5, L30.8-L30.9, L43-L43.3, L43.8-L43.9, L44-L44.4, L44.8-L44.9, L49-L49.9, L51-L51.3, L51.8-L51.9, L53-L53.3, L53.8-L53.9, L54.0, L55-L55.2, L55.8-L55.9, L56.2-L56.5, L56.8-L56.9, L57-L57.5, L57.8-L57.9, L58-L58.1, L58.9, L59.0, L59.8-L59.9, L60-L60.5, L60.8-L60.9, L62.8, L64.8-L64.9, L65-L65.2, L65.8-L65.9, L66-L66.4, L66.8-L66.9, L67-L67.1, L67.8-L67.9, L68-L68.3, L68.8-L68.9, L71-L71.1, L71.8-L71.9, L72-L72.3, L72.8-L72.9, L73-L73.2, L73.8-L73.9, L74-L74.5, L74.8-L74.9, L75-L75.2, L75.8-L75.9, L81-L81.9, L82-L82.1, L85-L85.3, L85.8-L85.9, L87-L87.2, L87.8-L87.9, L90-L90.6, L90.8-L90.9, L91.0, L91.8-L91.9, L92-L92.3, L92.8-L92.9, L94-L94.6, L94.8-L94.9, L95-L95.1, L95.8-L95.9, L97-L97.5, L97.8-L97.9, L98.2-L98.6, L98.8-L98.9, L99.0, L99.8

4000 data sources were extracted including case notifications, population-at-risk data, sero-prevalence data, disease and birth registries, active screening records, intervention coverage, vital registration, surveillance, community surveys, national surveys, outpatient hospital data, claims data from inpatient and outpatient visits, and inpatient hospital data. These data metrics were then analyzed in a Bayesian meta-regression modeling tool, DisMod-MR 2.0, to yield prevalence estimates, along with 95% uncertainty intervals, derived from 1000 draws from the posterior distribution for each cause by age-sex-country-year. Skin disease prevalence metrics were combined with disability weights (DW) to yield a skin disease morbidity metric, expressed as years lived with disability (YLDs), for each age-sex-country-year group. DWs are derived from 9 population surveys and an open-access internet survey to assess three levels of disfigurement severity with or without itch or pain.[8]

Mortality estimation was performed for six skin condition categories: melanoma, SCC, cellulitis, pyoderma, decubitus ulcer, and other skin and subcutaneous diseases. Mortality from all other skin conditions was assumed to be zero. A separate modeling tool, the Cause of Death Ensemble Model (CODEm) transforms cause-of-death metrics into age-sex-country-year mortality estimates. The number of deaths by age group was multiplied by corresponding standard life expectancy to yield the metric of years of life lost (YLLs).

Morbidity (YLD) and mortality (YLL) estimates are added for each age-sex-country-year group to yield DALYs. DALY metrics are reported as all-age absolute DALYs, all-age percent of total DALYs from all conditions studied by the GBD 2015, and age-standardized DALY rate per 100,000 persons. In addition, the median percent change in age-standardized DALY rate from years 1990 to 2015 and ratio of YLL/YLD age-standardized rates were collected for all skin diseases. Estimates were made for both sexes and 21 age groups (first week of life to 80+ years). Age-standardization was based on the standard population structure in 2010 – 2035 estimated by the United Nations Population Division.[9] Of note, under GBD classification, melanoma and keratinocyte carcinomas are included under the "cancers" category. Thus, the computation of age-standardized DALY rates of the "skin and subcutaneous diseases" category does not include skin cancers. In order to assess the skin conditions along with skin cancers for the present analysis, total all-age DALYs are presented and age-standardized DALY rates are presented only for individual diseases.

SDI values are publicly available and were obtained for Iran and the 15 surrounding countries.[10] SDI is calculated as the geometric mean of lag-distributed income per person, average educational attainment in those over 15 years of age, and total fertility rate. SDI values range from 0 (lowest level of development) to 1 (highest level of development). Correlation between age-standardized DALY rates and SDI estimates for the 16 countries was quantified using the Pearson product-momentum coefficient (r) with two-tailed *P*-value on Microsoft Excel, version 14.7.1. A two-tailed *P*-value < 0.05 was defined to reject the null hypothesis that no correlation exists.

Results

Skin diseases were responsible for a total of 422,892 all-age DALYs in Iran. In order of decreasing age-standardized DALY rate per 100,000 persons and percent of total all age DALYs from all causes in Iran, the skin diseases were: acne vulgaris (82.4, 95% CI: 39.2 – 153.0, 0.35%), dermatitis (82.0, 95% CI: 55.4 – 113.4, 0.33%), psoriasis (77.0, 95% CI: 53.7 – 104.4, 0.31%), viral skin diseases (66.1, 95% CI: 41.6 – 98.7, 0.27%), urticaria (60.6, 95% CI: 37.5 – 86.5, 0.25%), other skin diseases (53.8, 95% CI: 27.3 – 96.3, 0.20%), scabies (46.5, 95% CI: 25.5 – 78.1, 0.19%), fungal skin diseases (29.6, 95% CI: 11.6 – 63.1, 0.12%), melanoma (14.9, 95% CI: 10.6 – 18.4, 0.05%), pruritus (10.1, 95% CI: 4.9 – 18.4, 0.04%), alopecia areata (8.2, 95% CI: 5.0 – 12.1, 0.04%), SCC (7.4, 95% CI: 5.9 – 9.0, 0.02%), decubitus ulcer (5.5, 95% CI: 3.8 – 9.7, 0.014%), pyoderma (1.7, 95% CI: 1.1 – 2.7, 0.0061%), cellulitis (1.6, 95% CI: 1.1 – 2.8, 0.0054%), and BCC (6.8E-2, 95% CI: 3.2E-2 – 1.2E- 1, 0.00021%). In addition to Iran, acne vulgaris caused the greatest skin disease burden in five other countries: Russia (103.1 DALYs per 100,000 persons), Azerbaijan (101.2), Armenia (101.1), Turkmenistan (100.9), and Turkey (92.0) (see Table 2 and Figure 1 for DALY rates, Table 3 for DALY rankings). Amongst the skin conditions, BCC caused the lowest DALY rate in Iran and the other 15 countries.

In order of decreasing % total all-age DALYs from all causes amongst the collective 16 countries, the skin diseases were: dermatitis (4.0%), acne vulgaris (3.1%), psoriasis (2.9%), viral skin diseases (2.5%), urticaria (2.2%), scabies (1.9%), other skin (1.6%), fungal skin diseases (1.2%), melanoma (0.91%), pyoderma (0.46%), SCC (0.41%), pruritus (0.33%), alopecia areata (0.29%), cellulitis (0.28%), decubitus ulcer (0.17%), and BCC (0.0022%).

The countries with the highest and lowest age-standardized DALY rates, respectively, for each skin disease are as follows (see Table 2): dermatitis—Saudi Arabia (158.3, 95% CI: 106.4 – 219.3), Iran (82.0, 95% CI: 55.4 – 113.4); acne—Russia (103.1, 95% CI: 49.4 – 191.8), Afghanistan (73.5, 95% CI: 34.5 – 137.8); psoriasis—Pakistan (94.2, 95% CI: 65.7 – 129.4), Afghanistan (71.4, 95% CI: 49.8 – 96.8); viral skin diseases—Pakistan (79.3, 95% CI: 49.4 – 118.7), Qatar (59.8, 95% CI: 37.7 – 89.4); urticaria—Pakistan (63.1, 95% CI: 40.0 – 89.7), UAE (58.7, 95% CI: 36.2 – 84.3); other skin diseases—Bahrain (63.5, 95% CI: 35.6 – 109.2), Afghanistan (45.0, 95% CI: 23.0 – 80.5); scabies—Pakistan (74.3, 95% CI: 42.3 – 121.4), Iraq (34.3, 95% CI: 19.2 – 55.9); fungal skin diseases—Pakistan (41.2, 95% CI: 16.1 – 90.0), Iraq (23.3, 95% CI: 9.3 – 49.0); melanoma—Russia (64.5, 95% CI: 50.4 – 85.4), Saudi Arabia (4.1, 95% CI: 3.5 – 5.3); pruritus—Saudi Arabia (10.8, 95% CI: 5.1 – 19.6), UAE (9.7, 95% CI: 4.7 – 17.6); alopecia areata—Armenia (8.7, 95% CI: 5.3 – 13.0), Pakistan (8.0, 95% CI: 4.9 – 12.1); SCC—Afghanistan (26.1, 95% CI: 19.5 – 34.1), Pakistan (5.4, 95% CI: 4.5 – 6.5); decubitus ulcer—Bahrain (81.4, 95% CI: 55.2 – 144.6), Armenia (1.0, 95% CI: 0.7 – 1.4); pyoderma—Bahrain (56.0, 95% CI: 37.6 – 98.9), Azerbaijan (1.5, 95% CI: 0.9 – 2.3); cellulitis—Bahrain (34.2, 95% CI: 19.5 – 58.6), Azerbaijan (0.64, 95% CI: 0.47 – 0.82); BCC—Kazakhstan (1.4E-1, 95% CI: 6.3E-2 – 2.5E-1), Pakistan (5.4E-3, 2.5E-3 – 1.0E-2).

The ratio of YLL/YLD age-standardized rates is as follows for the six skin conditions with YLL (mortality) computations:

1) Melanoma: Afghanistan—11.3, Armenia—10.5, Azerbaijan—10.3, Bahrain—9.9, Iran—7.5, Iraq—8.4, Kazakhstan—9.9, Kuwait—9.5, Oman—10.4, Pakistan—9.9, Qatar—10.2, Russia—14.7, Saudi Arabia—9.8, Turkey—14.1, Turkmenistan—10.3, UAE—10.5.

Table 2. Age–standardized DALY rate per 100,000 persons with 95% CI from 16 skin conditions in Iran and 15 surrounding countries (skin conditions arranged by decreasing DALY rate in Iran)

(A) alphabetically countries A–K								
	Afghanistan	**Armenia**	**Azerbaijan**	**Bahrain**	**Iran**	**Iraq**	**Kazakhstan**	**Kuwait**
Acne vulgaris	73.5 (34.5–137.8)	101.1 (48.2–189.4)	101.2 (48.2–186.6)	83.1 (39.4–155.3)	82.4 (39.2–153.0)	79.1 (37.9–146.3)	101.7 (48.4–190.7)	85.2 (40.5–155.5)
Dermatitis	129.5 (85.6–180.1)	93.9 (62.5–132.9)	93.5 (62.1–131.5)	130.5 (86.2–182.5)	82.0 (55.4–113.4)	88.1 (59.5–123.1)	103.8 (69.7–144.6)	134.2 (90.34–186.6)
Psoriasis	71.4 (49.8–96.8)	93.2 (64.7–127.2)	93.6 (65.6–127.5)	77.3 (54.0–105.7)	77.0 (53.7–104.4)	76.3 (53.8–103.8)	93.5 (65.3–127.2)	78.7 (54.9–108.2)
Viral skin diseases	65.1 (41.2–96.9)	74.8 (46.9–110.9)	73.9 (46.4–109.8)	62.9 (39.9–93.4)	66.1 (41.6–98.7)	66.0 (41.6–98.5)	74.3 (46.9–109.9)	64.7 (40.9–96.6)
Urticaria	59.9 (37.5–85.1)	62.0 (37.9–88.7)	61.7 (37.8–88.7)	59.6 (36.9–85.2)	60.6 (37.5–86.5)	60.4 (37.3–85.7)	61.8 (38.1–88.9)	60.4 (37.4–85.8)
Other skin	45.0 (23.0–80.5)	48.6 (23.4–88.8)	50.9 (24.5–93.6)	63.5 (35.6–109.2)	53.8 (27.3–96.3)	50.0 (24.5–90.7)	52.3 (25.4–96.1)	56.6 (27.4–102.8)
Scabies	47.7 (26.9–79.2)	38.8 (21.9–62.9)	39.1 (21.9–63.4)	46.0 (25.5–78.3)	46.5 (25.5–78.1)	34.3 (19.2–55.9)	38.6 (22.0–63.0)	46.2 (25.8–76.8)
Fungal skin diseases	27.7 (10.9–58.8)	38.2 (15.0–80.4)	37.7 (14.9–79.0)	30.3 (12.0–63.6)	29.6 (11.6–63.1)	23.3 (9.3–49.0)	37.3 (14.8–78.4)	30.9 (12.1–65.7)
Melanoma	9.3 (5.0–17.1)	8.9 (7.2–10.4)	15.7 (12.6–18.6)	4.7 (3.6–6.1)	14.9 (10.6–18.4)	10.8 (7.9–14.0)	36.1 (29.0–58.9)	4.9 (3.6–8.8)
Pruritus	9.9 (4.8–18.1)	10.2 (4.9–18.8)	10.2 (4.9–18.6)	9.9 (4.74–18.2)	10.1 (4.9–18.4)	10.1 (4.8–18.34)	10.2 (4.9–18.7)	10.1 (4.8–18.3)
Alopecia areata	8.1 (5.1–12.1)	8.7 (5.3–13.0)	8.7 (5.4–13.0)	8.2 (5.1–12.2)	8.2 (5.0–12.1)	8.1 (5.0–12.2)	8.6 (5.4–12.9)	8.2 (5.1–12.3)
SCC	26.1 (19.5–34.1)	9.2 (8.0–10.6)	19.7 (16.8–22.8)	7.9 (6.32–9.6)	7.4 (5.9–9.0)	14.0 (10.4–18.2)	15.0 (13.6–16.5)	6.4 (5.3–7.7)
Decubitus ulcer	45.4 (16.5–78.3)	1.0 (0.7–1.4)	1.1 (0.8–1.4)	81.4 (55.2–144.6)	5.5 (3.8–9.7)	2.8 (2.0–4.3)	1.4 (1.0–1.8)	2.6 (1.9–3.3)
Pyoderma	38.5 (21.1–79.6)	1.8 (1.0–2.6)	1.5 (0.9–2.3)	56.0 (37.6–98.9)	1.7 (1.1–2.7)	22.8 (14.4–40.3)	1.9 (1.3–2.7)	7.1 (4.7–8.8)
Cellulitis	11.4 (6.0–23.0)	0.8 (0.5–1.0)	0.6 (0.5–0.8)	34.2 (19.5–58.6)	1.6 (1.1–2.8)	3.8 (2.4–7.3)	1.4 (1.0–1.8)	1.7 (1.2–2.1)
BCC	4.1E–2 (1.9E–2–7.5E–2)	1.2E–1 (5.6E–2–2.2E–1)	1.2E–1 (5.7E–2–2.3E–1)	2.8E–2 (1.3E–2–5.6E–2)	6.8E–2 (3.2E–2–1.2E–1)	4.0E–2 (1.8E–2–7.6E–2)	1.4E–1 (6.3E–2–2.5E–1)	3.7E–2 (1.7E–2–7.0E–2)

(B) alphabetically countries O–U								
	Oman	**Pakistan**	**Qatar**	**Russia**	**Saudi Arabia**	**Turkey**	**Turkmenistan**	**United Arab Emirates**
Acne vulgaris	81.9 (38.9–150.9)	88.5 (42.2–164.0)	83.2 (39.4–156.5)	103.1 (49.4–191.8)	83.6 (40.1–156.2)	92.0 (43.9–167.9)	100.9 (48.3–185.6)	84.5 (39.7–157.4)
Dermatitis	99.0 (66.5–137.9)	145.2 (98.2–200.7)	129.5 (86.0–181.4)	99.8 (67.7–139.5)	158.3 (106.4–219.3)	90.9 (61.6–125.0)	93.7 (63.5–131.2)	129.6 (85.1–181.7)
Psoriasis	76.6 (53.3–105.6)	94.2 (65.7–129.4)	77.6 (54.3–105.7)	93.7 (65.7–127.3)	77.1 (53.6–104.8)	77.7 (54.5–106.6)	93.5 (65.6–127.3)	78.3 (54.9–106.2)
Viral skin diseases	61.7 (38.9–92.0)	79.3 (49.4–118.7)	59.8 (37.7–89.4)	74.2 (46.9–109.9)	64.2 (40.6–95.5)	66.5 (41.8–98.1)	74.4 (46.8–110.3)	60.0 (37.7–89.5)
Urticaria	59.0 (36.7–84.5)	63.1 (40.0–89.7)	58.8 (36.1–83.4)	61.8 (38.2–88.8)	60.6 (37.2–86.9)	60.9 (37.9–87.4)	62.0 (38.2–89.7)	58.7 (36.2–84.3)
Other skin	54.0 (26.2–98.9)	48.7 (23.9–88.1)	58.1 (28.3–105.4)	52.8 (25.8–97.1)	52.4 (25.6–95.8)	52.0 (25.3–95.3)	50.6 (24.4–92.6)	56.0 (27.7–101.4)
Scabies	47.5 (26.2–79.2)	74.3 (42.3–121.4)	46.1 (25.3–78.8)	44.2 (24.9–71.5)	46.1 (26.2–74.5)	46.4 (25.2–77.1)	38.8 (21.6–62.6)	46.4 (25.9–77.1)
Fungal skin diseases	30.2 (12.0–65.2)	41.2 (16.1–90.0)	30.6 (12.0–64.7)	37.5 (14.8–78.8)	30.9 (12.2–64.9)	31.4 (12.5–67.2)	37.3 (14.7–78.7)	30.3 (12.0–64.5)
Melanoma	5.8 (4.5–7.3)	6.5 (5.1–8.0)	5.5 (4.1–7.7)	64.5 (50.4–85.4)	4.1 (3.5–5.3)	20.9 (17.4–35.2)	17.3 (14.7–25.2)	12.2 (6.8–20.7)
Pruritus	9.8 (4.7–18.2)	10.0 (4.8–18.3)	9.8 (4.7–17.8)	10.2 (4.9–18.4)	10.8 (5.1–19.6)	10.2 (4.9–18.6)	2.2 (1.4–3.3)	9.7 (4.7–17.6)
Alopecia areata	8.2 (5.0–12.2)	8.0 (4.9–12.1)	8.2 (5.0–12.3)	8.6 (5.3–13.0)	8.2 (5.0–12.2)	8.2 (5.0–12.2)	8.7 (5.3–13.0)	8.2 (5.0–12.2)
SCC	7.3 (5.8–8.9)	5.4 (4.5–6.5)	7.6 (5.7–9.8)	21.8 (19.7–23.9)	6.3 (5.5–7.2)	14.3 (12.7–15.9)	17.3 (15.3–19.5)	12.8 (9.8–16.7)
Decubitus ulcer	10.6 (5.4–16.2)	8.5 (5.2–14.4)	4.1 (2.7–5.6)	2.7 (1.7–3.6)	41.1 (18.4–55.1)	3.5 (2.1–4.7)	1.2 (0.9–1.5)	14.8 (7.6–24.4)
Pyoderma	31.4 (16.1–46.1)	22.2 (8.4–37.3)	24.3 (8.8–39.2)	8.1 (2.3–11.5)	9.1 (5.2–13.5)	3.7 (1.0–5.6)	2.2 (1.4–3.3)	24.0 (11.0–57.5)
Cellulitis	1.2 (0.82–1.5)	7.5 (3.7–15.5)	2.0 (1.2–2.8)	18.2 (3.3–25.8)	2.3 (1.6–3.3)	1.4 (0.7–1.9)	1.0 (0.7–1.3)	5.0 (2.9–9.7)
BCC	4.8E–2 (2.1E–2–9.2E–2)	5.4E–3 (2.5E–3–1.0E–2)	4.4E–2 (2.1E–2–8.4E–2)	1.1E–1 (5.3E–2–2.2E–1)	3.5E–2 (1.6E–2–6.4E–2)	9.1E–2 (4.2E–2–1.7E–1)	1.4E–1 (6.5E–2–2.6E–1)	4.7E–2 (2.1E–2–9.0E–2)

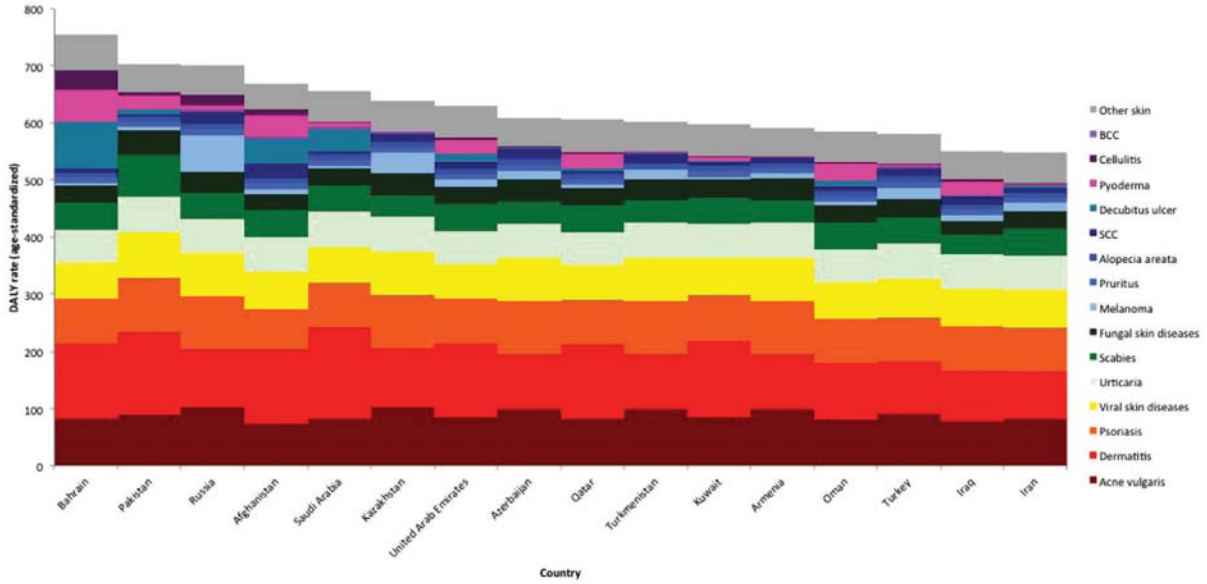

Figure 1. Age-standardized DALY rate per 100,000 persons from 16 skin diseases in Iran and 15 neighboring countries.

Table 3. Rank of age-standardized DALY rate amongst 16 skin conditions (first) and 246 total conditions (second) studied by GBD 2015 in Iran and 15 surrounding countries (skin conditions arranged by increasing DALY rank in Iran)

(A) alphabetically countries A-K								
	Afghanistan	**Armenia**	**Azerbaijan**	**Bahrain**	**Iran**	**Iraq**	**Kazakhstan**	**Kuwait**
Acne vulgaris	#2, #128	#1, #62	#1, #63	#2, #53	#1, #66	#2, #78	#2, #71	#2, #47
Dermatitis	#1, #85	#2, #65	#3, #69	#1, #38	#2, #67	#1, #72	#1, #69	#1, #38
Psoriasis	#3, #130	#3, #66	#2, #68	#4, #56	#3, #71	#3, #82	#3, #75	#3, #51
Viral skin diseases	#4, #135	#4, #79	#4, #84	#6, #69	#4, #77	#4, #86	#4, #89	#4, #57
Urticaria	#5, #140	#5, #84	#5, #91	#7, #72	#5, #82	#5, #91	#5, #101	#5, #63
Other skin	#8, #159	#6, #99	#6, #101	#5, #68	#6, #88	#6, #108	#6, #109	#6, #67
Scabies	#6, #155	#7, #112	#7, #114	#9, #94	#7, #98	#7, #137	#7, #125	#7, #78
Fungal skin diseases	#10, #183	#8, #113	#8, #116	#11, #123	#8, #119	#8, #154	#8, #127	#8, #100
Melanoma	#14, #210	#11, #172	#10, #157	#15, #199	#9, #162	#11, #183	#9, #130	#13, #186
Pruritus	#13, #207	#9, #169	#11, #172	#12, #172	#10, #173	#12, #188	#11, #179	#9, #160
Alopecia areata	#15, #212	#12, #174	#12, #180	#13, #180	#11, #185	#13, #194	#12, #186	#10, #167
SCC	#11, #185	#10, #171	#9, #150	#14, #181	#12, #189	#10, #173	#10, #168	#12, #179
Decubitus ulcer	#7, #158	#14, #221	#14, #221	#3, #54	#13, #198	#15, #222	#15, #222	#14, #203
Pyoderma	#9, #166	#13, #214	#13, #217	#8, #77	#14, #223	#9, #155	#13, #214	#11, #174
Cellulitis	#12, #201	#15, #228	#15, #231	#10, #113	#15, #224	#14, #216	#14, #223	#15, #211
BCC	#16, #252	#16, #239	#16, #240	#16, #241	#16, #247	#16, #247	#16, #242	#16, #241
(B) alphabetically countries O-U								
	Oman	**Pakistan**	**Qatar**	**Russia**	**Saudi Arabia**	**Turkey**	**Turkmenistan**	**United Arab Emirates**
Acne	#2, #57	#3, #90	#2, #55	#1, #67	#2, #55	#1, #54	#1, #67	#2, #62
Dermatitis	#1, #48	#1, #59	#1, #40	#2, #68	#1, #30	#2, #55	#2, #70	#1, #46
Psoriasis	#3, #60	#2, #86	#3, #61	#3, #75	#3, #57	#3, #62	#3, #71	#3, #68
Viral skin diseases	#4, #70	#4, #97	#4, #70	#4, #88	#4, #66	#4, #66	#4, #84	#4, #85
Urticaria	#5, #74	#6, #113	#5, #73	#6, #97	#5, #68	#5, #69	#5, #93	#5, #89
Other skin	#6, #80	#7, #133	#6, #74	#7, #105	#6, #76	#6, #81	#6, #100	#6, #91
Scabies	#7, #87	#5, #102	#7, #83	#8, #116	#7, #87	#7, #87	#7, #117	#7, #102
Fungal skin diseases	#9, #112	#8, #149	#8, #107	#9, #124	#9, #103	#8, #112	#8, #119	#8, #124
Melanoma	#14, #187	#14, #215	#13, #179	#5, #96	#14, #193	#9, #138	#9, #161	#12, #171
Pruritus	#11, #165	#10, #206	#10, #164	#12, #177	#10, #153	#11, #175	#11, #179	#13, #179
Alopecia areata	#12, #173	#12, #209	#11, #171	#13, #181	#12, #171	#12, #181	#12, #183	#14, #183
SCC	#13, #177	#15, #219	#12, #174	#10, #151	#13, #185	#10, #155	#10, #160	#11, #166
Decubitus ulcer	#10, #161	#11, #208	#14, #192	#15, #209	#8, #93	#14, #207	#14, #221	#10, #159
Pyoderma	#8, #108	#9, #175	#9, #114	#14, #184	#11, #164	#13, #203	#13, #213	#9, #136
Cellulitis	#15, #224	#13, #212	#15, #208	#11, #157	#15, #214	#15, #224	#15, #224	#15, #195
BCC	#16, #248	#16, #253	#16, #237	#16, #237	#16, #246	#16, #244	#16, #240	#16, #238

2) SCC: Afghanistan—8.8, Armenia—7.4, Azerbaijan—8.5, Bahrain—7.6, Iran—7.5, Iraq—8.4, Kazakhstan—7.8, Kuwait—6.7, Oman—7.7, Pakistan—7.4, Qatar—7.6, Russia—13.2, Saudi Arabia—7.4, Turkey—10.5, Turkmenistan—8.4, UAE—7.9.
3) Decubitus ulcer: Afghanistan—14.9, Armenia—3.8E-1, Azerbaijan—3.0E-1, Bahrain—14.6, Iran—1.8, Iraq—7.4E-1, Kazakhstan—4.3E-1, Kuwait—7.3E-1, Oman—4.0, Pakistan—3.2, Qatar—9.1E-1, Russia—6.4E-1, Saudi Arabia—7.7, Turkey—1.1, Turkmenistan—4.0E-1, UAE—4.0.
4) Pyoderma: Afghanistan—82.7, Armenia—1.8, Azerbaijan—1.4, Bahrain—108.8, Iran—3.9, Iraq—49.7, Kazakhstan—2.2, Kuwait—15.4, Oman—64.4, Pakistan—51.0, Qatar—48.7, Russia—7.6, Saudi Arabia—19.8, Turkey—8.6, Turkmenistan—2.5, UAE—50.0.
5) Cellulitis: Afghanistan—14.4, Armenia—9.3E-1, Azerbaijan—6.2E-1, Bahrain—19.1, Iran—2.0, Iraq—4.7, Kazakhstan—1.5, Kuwait—1.8, Oman—1.1, Pakistan—7.0, Qatar—1.9, Russia—7.9, Saudi Arabia—2.6, Turkey—1.7, Turkmenistan—1.2, UAE—4.7.
6) Other skin and subcutaneous diseases: Afghanistan—5.4E-2, Armenia—4.4E-3, Azerbaijan—3.7E-3, Bahrain—1.9E-1, Iran—5.8E-2, Iraq—1.5E-2, Kazakhstan—7.5E-3, Kuwait—8.3E-3, Oman—9.6E-3, Pakistan—5.3E-2, Qatar—1.6E-2, Russia—1.5E-2, Saudi Arabia—1.4E-2, Turkey—1.6E-2, Turkmenistan—4.4E-3, UAE—2.8E-2.

The remaining 10 skin conditions were assumed to have zero mortality, thus the YLL/YLD ratios are equal to zero.

Comparing male and female skin disease burden in Iran, the greatest discrepancy was observed for SCC, which caused a 3.8-fold greater age-standardized DALY rate in males compared to females (11.5, 95% CI: 8.8 – 14.5 males *vs.* 3.0, 95% CI: 2.1 – 4.1 females) (See Table 4). The remaining 15 countries demonstrated similar male predominance for SCC, which was most pronounced in Armenia where males had a 5-fold greater DALY rate compared to females (17.3, 95% CI: 14.6 – 20.2 males *vs.* 3.5, 95% CI: 2.7 – 4.4 females). Amongst the skin diseases, the largest male-to-female discrepancy was observed for BCC in Pakistan, where the age-standardized DALY rate in males was 27 times greater than females (1.0E-2, 95% CI: 4.8E-3 – 1.9E-2 males, 3.8E-4, 95% CI: 1.2E-4 – 8.6E-4).

In Iran, the burden caused by acne peaked in the age group of 15 – 19 years for both males and females, followed by the age groups of 10 – 14 and 20 – 24 years. Of infectious skin conditions, cellulitis peaked in the 80+ age group for both sexes, while females also demonstrated a peak in the 28 – 364 days age group, and pyoderma peaked in the 80+ year age group for both sexes. Scabies and fungal skin diseases peaked in the 1 – 4 year age group and viral skin diseases was greatest in the 5 – 9 year age group. Dermatitis caused more uniform burden throughout all age groups in males and females; psoriasis DALY rate increased steadily throughout all ages to peak in the 65 – 69 year age group. Decubitus ulcer, melanoma, and SCC were greatest in 80+ years. The age breakdown of the skin diseases in Iran amongst males and females is shown in Figure 2.

Median % change in DALY rate from 1990 – 2015 for the 16 skin diseases in Iran and surrounding neighbors is shown in Table 5. Changes greater than 1%, arranged in decreasing order, were observed for the following: cellulitis in Russia (+11.82%), BCC in Pakistan (+2.73%), pyoderma in Russia (+2.68%), SCC in Turkmenistan (+2.0%), and pyoderma in Afghanistan (+1.46%). Specifically in Iran, DALY rates did not change more than +/- 0.5% from 1990 to 2015.

Results from the Pearson correlation analysis between DALY rate and SDI demonstrated: acne r = 0.49, P = 0.056, dermatitis r = -0.13, P = 0.64, psoriasis r = 0.25, P = 0.35, viral skin diseases r = -0.12, P = 0.66, urticaria r = -0.13, P = 0.64, scabies r = -0.40, P = 0.13, fungal skin diseases r = 0.20, P = 0.46, melanoma r = 0.27, P = 0.31, pruritus r = -0.09, P = 0.75, alopecia areata r = 0.48 P = 0.06, SCC r = -0.27, P = 0.31, decubitus ulcer r = -0.24, P = 0.38, pyoderma r = -0.36, P = 0.17, cellulitis r = -0.07, P = 0.79, BCC r = 0.38, P = 0.14, other skin r = 0.64 P = 0.01.

Discussion

The miscellaneous 'other skin and subcutaneous diseases' category was the only skin disease with a significant correlation between DALY rate and SDI. However, the moderately positive correlation for acne vulgaris and alopecia areata approached statistical significance. Amongst skin diseases, dermatitis and acne dominate the majority of burden in Iran and the 15 surrounding countries. These two conditions also cause the greatest global skin disease burden.[2] By comparing the individual countries, unique patterns of disease burden become apparent. For example, of the 16 countries, Bahrain has the greatest burden from decubitus ulcer, pyoderma, and cellulitis. Bahrain is currently suffering from an obesity epidemic with 23% of men and 34% of women classified as obese.[11] The country also has one of the highest rates of diabetes in the world.[12] Obesity and diabetes alone are likely contributors to the greater burden observed from decubitus ulcer, pyoderma, and cellulitis. In comparison, Iran ranks in the bottom four in terms of DALY rate from acne, dermatitis, psoriasis, fungal skin diseases, alopecia areata, and pyoderma. This might be due to greater preventative interventions and overall health policy. However, given that these diseases cover diverse etiologies including inflammatory, autoimmune, and infectious, these findings for Iran may indicate the need for a more robust and improved skin disease registry in Iran, particularly in rural and lower-income regions.

Skin disease burden in Iran and its neighbors does demonstrates striking findings. BCC causes comparatively low burden in all 16 countries, but was the greatest in Kazakhstan, Turkmenistan, Azerbaijan, Armenia, and Russia. The rate of burden caused by melanoma was the highest in Russia and was almost double the rate in Kazakhstan, the country ranking second in terms of DALY rates caused by melanoma. Almost paradoxically, Russia and Kazakhstan have the lowest ultraviolet indices of the 16 countries, indicating lower sun exposure, while equatorial countries such as the UAE, Oman, Saudi Arabia, and Qatar have much higher sun exposure yet much lower skin cancer burden. Russia's increased burden from melanoma might be due to the predominance of Fitzpatrick skin types 1 – 3.[13] A brief literature search produces little information regarding tanning practices in Russia; however, cultural and religious coverings in Iran and surrounding Arabic countries likely reduce UV radiation and skin cancer risk.

Regarding infectious skin conditions, Pakistan had the highest burden caused by viral and fungal skin diseases and scabies, while Bahrain had the highest burden caused by pyoderma and cellulitis. Prior studies have demonstrated scabies and other infectious skin conditions to be the most common skin diseases throughout various areas of Pakistan, likely related to lower socioeconomic

Table 4. Age –standardized DALY rate with 95% CI in males and females from 16 skin conditions in Iran and 15 surrounding countries (skin conditions arranged by decreasing DALY rate in Iran)

(A) alphabetically countries A –K								
	Afghanistan	**Armenia**	**Azerbaijan**	**Bahrain**	**Iran**	**Iraq**	**Kazakhstan**	**Kuwait**
Acne vulgaris	70.8 (33.8 –132.5) 76.3 (36.0 –141.3)	96.1 (45.8 –180.5) 105.9 (50.7 –197.0)	96.6 (46.5 –176.9) 106.1 (51.0 –194.3)	80.7 (38.5 –149.8) 86.7 (40.8 –162.3)	79.4 (37.7 –148.3) 85.4 (40.9 –158.2)	75.9 (36.7 –140.9) 82.5 (39.0 –152.0)	96.9 (46.1 –182.2) 106.6 (0.9 –200.3)	82.3 (39.0 –150.7) 88.7 (41.8 –165.0)
Dermatitis	120.2 (79.9 –168.2) 139.3 (91.6 –196.3)	87.8 (58.4 –123.9) 99.7 (66.1 –140.6)	87.6 (59.0 –123.8) 99.5 (66.5 –138.7)	122.3 (80.6 –171.8) 141.0 (93.4 –198.3)	76.6 (51.6 –106.3) 87.5 (59.4 –121.1)	82.3 (55.8 –115.3) 94.0 (63.4 –131.0)	96.6 (65.4 –134.2) 110.7 (74.1 –154.0)	125.0 (84.1 –173.2) 144.8 (97.2 –201.5)
Psoriasis	70.6 (49.1 –95.7) 72.2 (50.7 –98.4)	92.8 (65.0 –127.1) 93.5 (64.4 –128.2)	93.3 (65.2 –129.0) 93.8 (65.0 –127.6)	77.1 (53.7 –105.9) 77.5 (53.8 –106.3)	76.4 (53.1 –104.6) 77.7 (54.3 –105.8)	74.0 (51.8 –100.7) 78.6 (55.0 –107.4)	93.0 (64.9 –126.8) 93.8 (65.7 –127.6)	78.2 (54.7 –107.8) 79.2 (55.0 –107.9)
Viral skin diseases	48.5 (30.6 –72.0) 82.7 (52.3 –122.9)	53.8 (34.0 –79.9) 93.8 (58.9 –139.5)	53.9 (34.2 –80.0) 93.7 (58.6 –138.7)	49.0 (30.7 –72.3) 83.3 (53.0 –123.9)	49.0 (30.7 –72.3) 83.6 (53.0 –125.0)	48.8 (30.8 –72.1) 83.3 (52.6 –123.7)	53.7 (34.0 –79.6) 93.6 (58.8 –138.5)	49.1 (30.9 –72.7) 83.7 (52.9 –125.1)
Urticaria	52.7 (32.5 –75.6) 67.4 (41.7 –95.3)	53.1 (33.0 –75.4) 70.9 (43.4 –102.7)	53.0 (33.0 –75.7) 70.8 (43.3 –102.5)	53.3 (33.3 –76.8) 68.0 (42.1 –97.2)	53.3 (32.8 –76.3) 68.3 (42.6 –97.6)	52.9 (32.2 –75.8) 68.0 (42.3 –96.3)	52.8 (32.9 –75.3) 70.7 (42.8 –103.1)	53.5 (33.0 –76.4) 68.4 (41.7 –97.6)
Other skin	45.1 (23.7 –79.2) 44.9 (22.3 –81.8)	47.2 (22.6 –87.0) (49.7 24.0 –90.7)	49.6 (23.6 –90.5) 52.2 (25.0 –96.2)	57.7 (30.3 –100.9) 71.6 (41.4 –121.5)	52.5 (26.4 –93.5) 55.0 (28.2 –99.5)	48.7 (23.7 –88.3) 51.1 (25.1 –93.5)	50.7 (24.5 –92.2) 53.5 (26.1 –99.1)	55.4 (26.7 –100.4) 58.1 (28.3 –106.1)
Scabies	47.3 (26.2 –79.5) 48.2 (27.3 –80.2)	38.4 (21.6 –63.0) 39.1 (22.2 –63.3)	38.8 (21.9 –63.2) 39.4 (22.4 –64.1)	45.7 (25.2 –77.8) 46.5 (25.7 –78.6)	46.0 (25.2 –77.2) 47.0 (25.7 –78.3)	34.1 (19.0 –55.6) (34.5 19.6 –56.1)	38.3 (21.8 –63.6) 38.9 (22.1 –63.3)	45.8 (25.3 –76.5) 46.8 (25.9 –78.0)
Fungal skin diseases	28.8 (11.4 –60.9) 26.6 (10.6 –56.3)	39.7 (15.7 –83.3) 36.7 (14.4 –77.9)	39.3 (15.6 –81.1) 36.1 (14.2 –76.7)	31.2 (12.4 –66.0) 29.0 (11.4 –63.0)	30.4 (11.9 –64.8) 28.8 (11.2 –61.1)	24.2 (9.7 –51.1) 22.3 (9.0 –46.5)	38.9 (15.3 –81.9) 35.9 (14.2 –75.0)	31.7 (12.5 –67.0) 29.9 (11.5 –64.1)
Melanoma	8.6 (4.1 –16.3) 10.1 (4.5 –22.6)	10.7 (7.3 –13.6) 7.4 (6.4 –8.7)	20.4 (14.4 –26.7) 11.7 (10.0 –13.7)	5.2 (3.6 –7.7) 4.0 (3.0 –5.0)	17.0 (9.3 –22.7) 12.6 (9.3 –16.8)	14.3 (9.0 –20.5) 7.5 (5.3 –10.3)	46.6 (32.2 –95.0) 28.3 (22.8 –37.9)	5.6 (3.6 –11.9) 4.0 (2.6 –6.1)
Pruritus	9.0 (4.4 –16.6) 10.8 (5.2 –19.7)	9.2 (4.4 –17.0) 11.1 (5.3 –20.5)	9.2 (4.5 –17.1) 11.1 (5.2 –20.4)	9.2 (4.4 –16.8) 11.0 (5.3 –20.0)	9.2 (4.4 –16.9) 11.1 (5.2 –20.1)	9.1 (4.3 –16.5) 11.0 (5.3 –20.1)	9.2 (4.4 –16.8) 11.1 (5.3 –20.3)	9.2 (4.4 –16.6) 11.1 (5.3 –20.6)
Alopecia areata	8.1 (5.0 –12.2) 8.0 (5.0 –12.0)	8.7 (5.3 –13.1) 8.6 (5.3 –12.9)	8.7 (5.4 –13.3) 8.6 (5.4 –12.9)	8.2 (5.1 –12.3) 8.1 (5.0 –12.2)	8.2 (4.9 –12.3) 8.1 (5.0 –12.3)	8.1 (5.1 –12.3) 8.1 (5.0 –12.3)	8.6 (5.4 –13.0) 8.6 (5.3 –13.0)	8.2 (5.0 –12.3) 8.1 (5.0 –12.3)
SCC	37.0 (25.3 –49.9) 16.0 (9.1 –24.8)	17.3 (14.6 –20.2) 3.5 (2.7 –4.4)	34.3 (28.4 –40.5) 7.3 (5.6 –9.4)	11.1 (8.5 –14.1) 3.8 (2.8 –4.9)	11.5 (8.8 –14.5) 3.0 (2.1 –4.1)	20.5 (13.9 –27.6) 8.2 (5.3 –12.2)	26.7 (23.7 –30.0) 6.9 (5.8 –8.1)	9.4 (7.5 –11.5) 2.3 (1.7 –3.0)
Decubitus ulcer	68.1 (16.2 –130.8) 25.1 (10.8 –45.4)	1.1 (0.82 –1.5) 0.95 (0.64 –1.3)	1.3 (1.0 –1.8) 0.85 (0.6 –1.1)	74.6 (40.8 –160.9) 91.5 (56.5 –174.8)	5.8 (3.5 –11.5) 5.1 (3.2 –10.2)	3.4 (2.3 –5.8) 2.4 (1.6 –4.1)	1.6 (1.1 –2.1) 1.2 (0.9 –1.6)	1.9 (1.3 –2.4) 3.6 (2.3 –4.7)
Pyoderma	58.7 (27.3 –135.6) 18.4 (7.7 –37.7)	2.1 (1.1 –3.1) 1.6 (0.77 –2.4)	1.8 (1.0 –2.9) 1.2 (0.7 –1.9)	50.4 (25.7 –106.9) 64.2 (36.1 –131.9)	2.0 (1.2 –3.8) 1.3 (0.8 –2.3)	26.9 (14.1 –55.4) 19.2 (9.9 –38.2)	2.2 (1.5 –3.3) 1.6 (1.0 –2.3)	5.8 (3.6 –7.7) 8.9 (4.8 –11.6)
Cellulitis	19.1 (9.3 –43.9) 3.9 (1.5 –9.0)	1.1 (0.65 –1.5) 0.49 (0.35 –0.65)	0.78 (0.6 –1.0) 0.50 (0.4 –0.7)	44.6 (21.3 –88.0) 21.7 (10.5 –39.5)	1.9 (1.2 –3.9) 1.3 (0.8 –2.4)	4.5 (2.4 –11.7) 3.4 (1.8 –6.8)	1.6 (1.1 –2.0) 1.2 (0.8 –1.7)	1.4 (1.0 –1.9) 2.0 (1.2 –2.6)
BCC	5.5E –2 (2.4E –2 –1.0E –1) 2.9E –2 (1.3E –2 –5.5E –2)	1.4E –1 (6.7E –2 –2.7E –1) 1.0E –1 (4.6E –2 –1.9E –1)	1.5E –1 (6.9E –2 –2.9E –1) 1.0E –1 (4.7E –2 –1.8E –1)	3.5E –2 (1.6E –2 –7.1E –2) 1.7E –2 (7.4E –3 –3.2E –2)	8.5E –2 (3.9E –2 –1.5E –1) 4.8E –2 (2.2E –2 –9.3E –2)	5.3E –2 (2.4E –2 –1.0E –1) 2.9E –2 (1.3E –2 –5.6E –2)	1.7E –1 (7.8E –2 –3.0E –1) 1.2E –1 (5.4E –2 –2.0E –1)	4.6E –2 (2.1E –2 –8.7E –2) 2.4E –2 (1.0E –2 –4.9E –2)

(B) alphabetically countries O –U								
	Oman	**Pakistan**	**Qatar**	**Russia**	**Saudi Arabia**	**Turkey**	**Turkmenistan**	**United Arab Emirates**
Acne	79.5 (37.9 –147.9) 85.9 (40.9 –158.8)	84.8 (40.0 –157.7) 92.5 (44.2 –170.7)	81.3 (38.2 –152.8) 87.5 (41.5 –163.0)	98.3 (47.0 –182.7) 107.9 (51.5 –200.5)	77.9 (37.6 –145.3) 90.4 (43.1 –168.9)	89.1 (42.4 –165.6) 94.9 (45.3 –172.7)	95.9 (45.8 –176.5) 106.0 (50.7 –195.7)	82.5 (38.9 –154.5) 88.6 (41.9 –166.2)
Dermatitis	93.0 (63.1 –129.6) 107.4 (72.0 –149.3)	135.1 (91.7 –186.2) 155.9 (105.2 –213.8)	122.3 (81.1 –172.7) 141.7 (92.9 –198.9)	91.2 (61.7 –126.9) 108.0 (73.4 –151.0)	144.3 (97.1 –200.1) 174.4 (118.5 –242.4)	84.4 (56.9 –117.4) 97.3 (65.2 –133.4)	87.6 (59.4 –122.4) 99.5 (66.5 –138.7)	122.2 (81.5 –172.1) 141.5 (92.1 –197.1)
Psoriasis	76.1 (53.3 –104.3) 77.3 (53.0 –106.1)	94.0 (65.6 –128.9) 94.4 (66.3 –129.3)	77.3 (53.6 –105.7) 78.3 (54.6 –106.6)	93.5 (65.1 –127.9) 93.7 (65.7 –127.0)	76.5 (53.1 –104.2) 77.6 (54.3 –105.5)	78.4 (54.6 –108.1) 77.2 (54.0 –105.4)	93.0 (64.7 –127.4) 93.9 (66.0 –128.3)	78.0 (54.3 –105.6) 79.1 (55.1 –107.7)
Viral skin diseases	48.8 (30.6 –72.3) 83.4 (52.7 –124.1)	56.3 (35.4 –84.1) 103.5 (64.0 –156.1)	49.1 (30.9 –72.7) 83.5 (52.7 –123.8)	53.7 (34.0 –79.3) 93.4 (58.5 –138.4)	48.6 (30.6 –72.2) 83.5 (52.5 –123.9)	49.0 (30.7 –72.9) 83.6 (53.0 –123.5)	53.9 (34.0 –79.0) 93.9 (59.0 –138.8)	49.0 (30.8 –72.8) 83.5 (52.7 –124.1)
Urticaria	53.0 (32.7 –75.9) 68.0 (42.4 –97.7)	54.3 (34.1 –77.1) 72.4 (45.3 –104.0)	53.4 (32.8 –76.9) 68.3 (42.6 –97.0)	52.9 (33.0 –76.2) 70.6 (42.8 –103.0)	56.7 (35.0 –81.1) 65.5 (40.4 –94.0)	53.4 (33.1 –76.4) 68.3 (42.2 –97.9)	53.0 (33.2 –76.3) 70.9 (43.4 –102.4)	53.3 (33.1 –76.5) 68.2 (42.2 –97.7)
Other skin	52.9 (25.7 –97.3) 55.7 (27.3 –101.8)	47.0 (23.4 –83.8) 50.6 (24.8 –92.2)	57.0 (27.6 –103.6) 60.5 (30.0 –109.6)	51.2 (24.7 –93.1) 54.0 (26.5 –100.2)	51.3 (24.7 –93.7) 53.8 (26.4 –98.2)	50.9 (24.9 –92.7) 53.0 (25.8 –97.6)	49.2 (23.6 –90.2) 51.8 (25.1 –94.6)	55.4 (27.2 –100.0) 57.8 (28.7 –106.0)
Scabies	47.1 (26.2 –78.8) 48.2 (26.5 –81.1)	73.4 (41.5 –120.2) 75.3 (42.9 –122.8)	45.8 (25.2 –78.5) 46.8 (25.3 –79.9)	48.9 (27.8 –78.9) 39.6 (22.4 –64.0)	45.5 (26.0 –73.1) 46.8 (26.5 –76.8)	45.9 (25.2 –77.1) 46.8 (25.3 –78.8)	38.5 (21.2 –62.6) 39.1 (21.7 –64.0)	46.0 (25.7 –76.6) 47.3 (26.2 –80.4)
Fungal skin diseases	30.9 (12.5 –66.1) 29.0 (11.2 –60.9)	44.1 (17.3 –96.7) 38.1 (15.0 –82.6)	31.3 (12.3 –66.1) 29.1 (11.3 –62.8)	39.1 (15.6 –81.7) 36.1 (14.1 –75.9)	31.9 (12.6 –67.4) 29.6 (11.7 –61.9)	32.5 (12.8 –69.4) 30.4 (12.2 –64.8)	39.0 (15.3 –80.8) 35.6 (14.0 –77.1)	30.9 (12.3 –65.7) 28.7 (11.1 –61.1)
Melanoma	5.8 (3.9 –8.1) 5.9 (4.6 –7.4)	6.3 (3.8 –8.7) 6.8 (5.1 –8.6)	5.7 (4.0 –8.5) 5.2 (3.7 –6.7)	66.0 (38.4 –109.0) 63.5 (53.4 –73.4)	4.7 (3.5 –6.6) 3.3 (2.9 –3.8)	29.8 (22.6 –60.3) 13.2 (11.6 –15.0)	24.8 (20.0 –41.6) 11.1 (9.6 –12.7)	13.0 (6.6 –23.0) 9.6 (5.3 –18.1)
Pruritus	9.2 (4.4 –17.1) 11.1 (5.3 –20.1)	9.1 (4.4 –16.6) 10.9 (5.3 –20.2)	9.2 (4.4 –16.8) 11.1 (5.3 –20.5)	9.2 (4.4 –16.7) 11.1 (5.3 –20.1)	9.9 (4.7 –17.9) 11.9 (5.7 –21.8)	9.2 (4.4 –16.9) 11.1 (5.3 –20.3)	9.2 (4.4 –16.9) 11.1 (5.3 –20.7)	9.2 (4.5 –16.7) 11.1 (5.4 –20.2)
Alopecia areata	8.2 (5.0 –12.4) 8.1 (4.9 –12.2)	8.0 (4.9 –12.2) 8.0 (4.9 –12.2)	8.2 (5.0 –12.3) 8.1 (5.0 –12.3)	8.6 (5.3 –13.1) 8.6 (5.3 –13.0)	8.2 (5.0 –12.2) 8.1 (5.1 –12.1)	8.2 (5.1 –12.3) 8.1 (5.0 –12.3)	8.7 (5.3 –13.0) 8.7 (5.4 –13.0)	8.2 (5.0 –12.1) 8.1 (5.1 –12.2)
SCC	10.8 (8.3 –13.5) 2.4 (1.7 –3.2)	8.2 (6.6 –10.2) 2.5 (1.8 –3.4)	10.2 (7.5 –13.4) 2.0 (1.4 –2.7)	36.5 (32.2 –40.6) 12.4 (10.5 –14.4)	10.6 (9.1 –12.2) 1.6 (1.4 –1.9)	22.8 (19.9 –25.8) 7.3 (5.9 –9.0)	29.2 (25.4 –33.4) 7.6 (6.0 –9.5)	15.9 (11.9 –20.8) 3.9 (2.6 –5.8)
Decubitus ulcer	2.1 (1.4 –2.9) 20.0 (9.2 –30.7)	11.3 (6.5 –23.3) 5.5 (2.8 –9.9)	3.7 (2.4 –5.4) 5.1 (2.8 –7.4)	3.2 (1.8 –4.5) 2.3 (1.3 –2.9)	48.4 (17.7 –69.9) 34.2 (14.1 –45.6)	4.1 (2.4 –5.7) 3.0 (1.6 –4.2)	1.4 (1.0 –1.9) 0.97 (0.7 –1.3)	14.8 (5.7 –28.4) 14.8 (6.4 –26.7)
Pyoderma	43.6 (19.1 –71.8) 17.4 (7.2 –27.4)	16.1 (7.4 –44.4) 29.1 (3.5 –63.5)	22.6 (7.3 –40.2) 28.3 (7.3 –47.9)	8.4 (2.1 –13.3) 7.7 (1.9 –10.1)	10.4 (4.6 –18.4) 7.8 (3.7 –13.3)	4.4 (1.0 –6.8) 3.1 (0.8 –4.9)	2.3 (1.4 –3.7) 2.2 (1.2 –3.2)	26.2 (11.1 –69.3) 18.6 (6.9 –44.1)
Cellulitis	1.3 (0.8 –1.8) 0.99 (0.7 –1.4)	9.1 (4.3 –23.6) 6.0 (1.4 –18.1)	1.9 (1.1 –2.8) 2.4 (1.2 –3.6)	21.4 (4.0 –33.1) 15.2 (2.3 –20.4)	2.5 (1.4 –4.0) 2.2 (1.3 –3.6)	1.5 (0.8 –2.1) 1.3 (0.6 –1.8)	1.3 (0.8 –1.8) 0.68 (0.5 –1.0)	5.5 (2.9 –11.8) 3.6 (1.7 –6.2)
BCC	5.9E –2 (2.7E –2 –1.2E –1) 3.0E –2 (1.3E –2 –5.8E –2)	1.0E –2 (4.8E –3 –1.9E –2) 3.8E –4 (1.2E –4 –8.6E –4)	5.1E –2 (2.4E –2 –9.8E –2) 2.7E –2 (1.2E –2 –5.4E –2)	1.5E –1 (7.0E –2 –2.8E –1) 9.5E –2 (4.5E –2 –1.8E –1)	4.4E –2 (2.0E –2 –8.0E –2) 2.5E –2 (1.2E –2 –4.7E –2)	1.2E –1 (5.6E –2 –2.4E –1) 6.5E –2 (2.9E –2 –1.2E –1)	1.7E –1 (8.0E –2 –3.E –1) 1.2E –1 (5.5E –2 –2.2E –1)	5.4E –2 (2.4E –2 –1.0E –1) 2.8E –2 (1.2E –2 –5.5E –2)

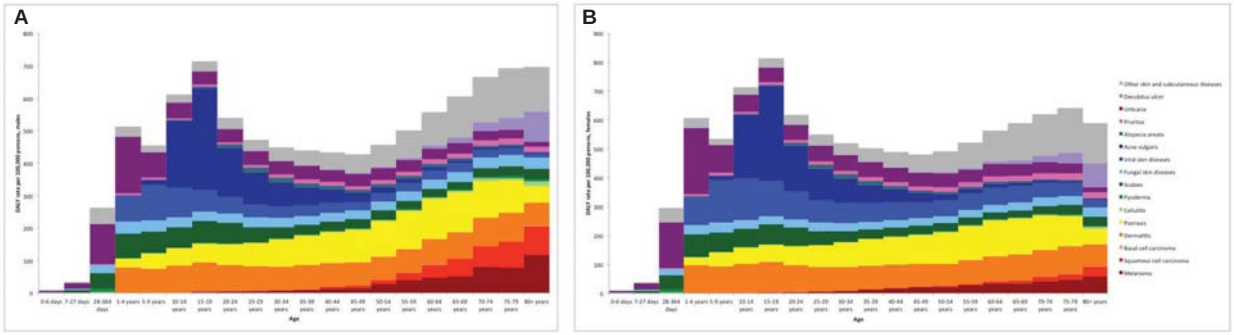

Figure 2. DALY rate per 100,000 persons from 16 skin diseases across human lifespan in Iran in (**A**) males and (**B**) females.

status, poor hygiene, and limited water supply.[14–16] Interestingly, of the 16 countries, Iraq had the lowest DALY rates from scabies and fungal skin diseases, despite years of war and neglect, which have resulted in widespread poverty, poor environmental health conditions, and damage to the water supply.[17] For the six skin conditions with mortality computations, the YLL/YLD ratio demonstrates the contribution of mortality over morbidity. The greatest ratios, indicating higher mortality, were caused by cellulitis. Bahrain and Afghanistan, in particular, had the greatest ratios caused by cellulitis, pyoderma, and decubitus ulcer. Russia and Turkey had the greatest YLL/YLD ratios from melanoma and SCC.

Comparing skin disease burden by sex reveals important discrepancies. The DALY rates from BCC and SCC in Iran were respectively 1.7 and 3.8 times greater in males compared to females. A similar male predominance of SCC and BCC was observed in Iran's neighbors. While the overall BCC burden was the lowest in Pakistan, this country demonstrated the greatest male predominance, with an age-standardized DALY rate caused by BCC 27 times greater in males compared to females. The Skin Cancer Foundation reports that both types of keratinocyte carcinoma, SCC and BCC, are more prevalent in males compared to women, likely impacted by the greater time spent under the ultraviolet radiation of the sun by men.[18] Another consideration is the disproportionately higher rates of tobacco use in men compared to women.[19] While a 2012 systematic review and meta-analysis found a statistically significant 50% increased odds for SCC in smokers, tobacco is yet to be identified as a causative factor for SCC.[20] In addition, as mentioned above, women throughout the 16 countries studied likely have reduced ultraviolet exposure due to wearing religious and traditional coverings that tend to block areas most at risk for keratinocyte carcinomas (e.g. head, face, upper body). In Iran, the remaining skin conditions caused predominantly similar burden in males and females, alike. However, the burden caused by decubitus ulcers in Oman was almost 10 times greater in men compared to women. The reasons for this surprising discrepancy are unclear but a possible reporting bias could be partially attributable.

It is important to emphasize Iran's borders with three different world regions. This is of particular importance to skin diseases, as similar environmental regions may share burden from distinct skin conditions. For areas where province-level information on prevalence or DALYs is lacking in Iran, surrounding regions with similar environmental factors can be used as an approximation. For example, Pakistan may serve as a surrogate for Iran's Sistan and Baluchestan provinces, Turkmenistan for North Khorasan, and Afghanistan for South Khorasan and Razavi Khorasan. As GBD data become increasingly comprehensive, even areas where data is lacking can be modeled using surrounding regional predictions.

The present analysis is the first effort to report on the burden of skin diseases in Iran and neighbors using a validated and comparable method. However, the GBD is subject to several important limitations. As mentioned in the methods section, the calculation of YLLs is dependent on a global standard life expectancy and the partial years of life lost as a result of morbidity from a particular disease. On the other hand, YLDs are based on disability weights assigned to varying levels of disability caused by a disease that lead to long-term morbidity. As such, this methodology assigns greater weight to death at a young age while mortality data assumes equal impact regarding age of death. Furthermore, disability adjustment using weights may not be universally acceptable, creating a potential bias when comparing various countries and regions.

In conclusion, skin diseases have an important impact in the global health landscape. This becomes increasingly apparent, as high-quality metrics of disease burden are available. The premise of the GBD is that a long healthy life is a universal goal for all populations. In addition, GBD results are now produced on a yearly basis, with continual input from the global collaborative community to improve existing data and add new studies.

As globalization revolutionizes our world, funding and interest in the field of global health have grown dramatically.[21] Dermatological diseases are among the most common diseases seen in primary care settings worldwide.[22,23] Disorders of the skin are physically and emotionally disabling, affecting every aspect of one's personal, professional, and social life. Never before has the role of dermatology in global health been so necessary.[24] Use of this evidence-based data on skin disease prevalence, morbidity, mortality, and impact on one's life could assist countries in the development of population health policies and allocation of funding for healthcare and research.

Iran has accomplished significant achievements by expanding access to health care and preventative services, particularly in rural areas.[25] Investigation and lifelong curiosity are at the cornerstone of further progress in healthcare. The impact of burden of disease metrics cannot be overstated. The GBD project is an ideal partner for national policy and healthcare bodies such as those of the I. R. of Iran. Working with the government of Iran, a high-quality epidemiologic study such as the GBD has the potential to inform

Table 5. Median percent change in age-standardized DALY rate from 1990-2015 from 16 skin conditions in Iran and 15 surrounding countries (skin conditions arranged by decreasing DALY rate in Iran)

(A) alphabetically countries A-K	Afghanistan	Armenia	Azerbaijan	Bahrain	Iran	Iraq	Kazakhstan	Kuwait
Acne vulgaris	5.7E-2%	3.9E-2%	3.2E-2%	5.5E-2%	7.7E-2%	5.6E-2%	2.9E-2%	5.1E-2%
Dermatitis	7.4E-3%	2.2E-3%	-2.2E-3%	-1.9E-3%	4.4E-3%	2.9E-3%	8.52E-06%	-1.3E-3%
Psoriasis	2.5E-2%	2.5E-2%	1.9E-2%	2.5E-2%	3.7E-2%	2.2E-2%	1.7E-2%	2.0E-2%
Viral skin diseases	2.8E-3%	5.9E-3%	-8.7E-3%	-1.4E-2%	3.4E-3%	2.5E-3%	9.3E-5%	-5.8E-3%
Urticaria	4.9E-3%	2.2E-3%	-4.8E-3%	-3.3E-3%	4.3E-3%	3.0E-3%	1.9E-3%	-8.6E-4%
Other skin	-4.5E-3%	3.9E-2%	3.5E-2%	-1.6E-2%	3.6E-2%	9.1E-3%	3.6E-2%	3.8E-2%
Scabies	-9.9E-2%	-1.2E-2%	-4.1E-2%	-1.6E-2%	-1.5E-2%	-3.0E-2%	-1.0E-2%	-9.0E-3%
Fungal skin diseases	4.9E-3%	1.3E-3%	2.1E-3%	1.7E-3%	2.1E-3%	1.3E-3%	8.4E-4%	-2.1E-5%
Melanoma	2.1E-1%	5.8E-1%	-3.8E-2%	-2.3E-1%	-2.6E-3%	2.6E-1%	1.1E-1%	-1.4E-1%
Pruritus	2.3E-3%	5.1E-3%	-2.4E-3%	-2.7E-3%	4.0E-3%	1.9E-3%	1.8E-3%	7.6E-4%
Alopecia areata	6.6E-3%	-2.0E-4%	1.1E-3%	1.7E-3%	2.0E-3%	3.4E-3%	-6.1E-4%	-5.7E-5%
SCC	-3.1E-2%	8.8E-1%	2.5E-1%	-3.8E-1%	1.3E-1%	6.7E-2%	2.8E-1%	-1.8E-1%
Decubitus ulcer	8.8E-2%	3.6E-1%	2.3E-1%	3.1E-1%	2.7E-1%	4.1E-2%	3.9E-1%	1.2E-1%
Pyoderma	1.5%	4.1E-1%	3.1E-1%	5.2E-1%	-9.6E-2%	1.7E-1%	3.4E-1%	6.1E-1%
Cellulitis	-1.5E-1%	4.7E-1%	2.7E-1%	3.3E-1%	7.6E-2%	-7.3E-2%	2.9E-1%	2.0E-1%
BCC	0.19%	0.47%	0.34%	0.096%	0.22%	0.20%	0.31%	0.25%

(B) alphabetically countries O-U	Oman	Pakistan	Qatar	Russia	Saudi Arabia	Turkey	Turkmenistan	United Arab Emirates
Acne	8.6E-2%	4.2E-2%	5.6E-2%	2.6E-2%	6.2E-2%	1.1E-1%	3.9E-2%	7.1E-2%
Dermatitis	-6.3E-3%	3.0E-4%	-4.4E-3%	1.6E-3%	6.4E-3%	4.4E-3%	5.3E-4%	-9.2E-4%
Psoriasis	4.1E-2%	2.4E-2%	2.7E-2%	1.4E-2%	3.0E-2%	2.6E-2%	2.5E-2%	3.5E-2%
Viral skin diseases	-3.6E-2%	6.6E-3%	-2.1E-2%	-3.6E-4%	7.9E-3%	2.3E-3%	-9.3E-5%	-2.0E-2%
Urticaria	-1.1E-2%	1.5E-3%	-4.3E-3%	8.7E-4%	3.5E-3%	3.0E-3%	1.5E-3%	-4.2E-3%
Other skin	3.0E-2%	3.9E-2%	2.9E-2%	1.4E-2%	2.3E-2%	3.5E-2%	3.2E-2%	-3.2E-2%
Scabies	-1.3E-1%	-1.5E-2%	-1.3E-2%	-5.6E-3%	-2.4E-2%	-1.1E-2%	-1.7E-2%	-3.8E-2%
Fungal skin diseases	5.5E-3%	-9.3E-4%	2.1E-3%	1.7E-3%	2.4E-3%	2.2E-3%	6.7E-4%	5.1E-3%
Melanoma	3.1E-1%	3.0E-1%	-6.7E-2%	2.6E-1%	1.4E-1%	-2.4E-1%	-3.6E-1%	1.4E-1%
Pruritus	-1.7E-2%	6.2E-3%	-1.0E-3%	2.2E-3%	3.3E-3%	6.8E-3%	2.0E-3%	-1.3E-2%
Alopecia areata	2.9E-3%	1.4E-3%	3.5E-3%	1.8E-3%	1.4E-3%	3.3E-3%	7.1E-4%	2.3E-3%
SCC	2.5E-1%	4.5E-2%	8.6E-2%	4.6E-1%	8.7E-2%	-4.3E-1%	2.0%	4.8E-3%
Decubitus ulcer	1.4E-1%	6.8E-2%	1.0E-3%	3.1E-1%	2.3E-1%	-1.4E-1%	3.1E-1%	4.2E-1%
Pyoderma	2.9E-1%	7.0E-1%	1.8E-1%	2.68%	9.8E-2%	-3.4E-1%	1.5E-1%	8.3E-1%
Cellulitis	6.8E-1%	-5.5E-2%	1.5E-2%	11.82%	1.9E-1%	-2.3E-1%	3.1E-1%	3.1E-1%
BCC	4.5E-1%	2.73%	2.8E-1%	3.5E-1%	1.2E-1%	5.1E-1%	3.1E-1%	2.9E-1%

and impact many facets of healthcare, research prioritization, public policy, and international partnerships.[26] The study of skin disease burden in Iran and surrounding regions reveals striking differences and similarities amongst close geographical neighbors. In the end, healthy life is a common goal for all human beings, regardless of socioeconomic status, ethnicity, or access to education.

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