Potential agenda item for the 156th session of the Executive Board of the WHO

Skin diseases contribute significantly to the global burden of disease. However, their primarily non-fatal nature leads to an underestimation of their potentially serious health and socioeconomic impact. They can be exacerbated by and in turn exacerbate the impact of existing trends such as climate change, disaster relief, economic growth, and sustainable development. Although individual conditions have been targeted ¹, efforts are lacking to recognize the health burden of skin diseases within an integrated and holistic approach. Holistically addressing skin diseases will allow for better health outcomes, access to remedies, and funding, especially for vulnerable groups.

Under Pillar 1 of Universal Health Coverage (SDG indicator 3.8.1), this proposal aims to accelerate programmatic action to reduce the incidence, prevalence, morbidity, disability, and death from skin diseases. This document has been co-developed by a broad coalition of civil society organizations including patient organizations, healthcare professionals, academia, and philanthropies which are committed to taking comprehensive action on the global public health impact of skin diseases. It seeks to provide a summary of the key issues facing vulnerable individuals and communities and a set of potential actions to help support and inform Member States on a potential agenda item for the Executive Board of the World Health Organization. The full list of organizations supporting this document is on the last page (Annex A).

Background information

According to the Global Burden of Disease 2021 data, skin diseases are a significant global health challenge². An estimated 2.03 billion individuals (25% of the world population) were diagnosed with a skin disease in 2021, and 4.69 billion new cases were added in the year. There are critical gaps and problems within the international health system. Each year, around 120,000 people die from complications of skin disease. According to Disability-Adjusted Life Years (DALYs), skin diseases resulted in 41.9 million years of full health loss in 2021. 93.3% of these years are lived with disability, resulting in a significant loss of quality of life and productivity. Despite the high prevalence and burden of skin diseases, research on its social determinants is scarce, wherein in 2024, dermatology ranked 30th out of 35 medical specialties in publication volume.³

Patients with psoriasis live an average of 6 years less than those not suffering from this disease, mainly due to the cerebro-cardiovascular complications. Scabies-related Group A Streptococcus bacterial skin infection is associated with long-term sequelae with significant systemic impact, including rheumatic heart disease in children from low-resource settings.⁴

The International Classification of Diseases ICD-11 identifies a wide range of causes of skin and subcutaneous diseases (SSCDs): infectious diseases - viral, bacterial, fungal, parasitic - cancer, immune disorders - including allergies, rare autoinflammatory and autoimmune diseases - endocrine, nutritional and metabolic disorders. It also includes mental health and behavioural conditions such as when patients

¹ Res. WHA44.9 / WHA69.21; WHO 2016; WHO 2019

² Ferrari, Alize J et al, 2024

³ Christensen et al., 2024

⁴ Engelman, 2013

perceive flaws in their own body and become preoccupied with them leading to repetitive behaviors such as excessive scratching or biting of the skin or pulling of hair, often leading to social avoidance. Skin diseases also occur as part of systemic diseases for example, foot ulcers occur in 15-25% of diabetes patients because of damage to their blood vessels. In addition to physical symptoms and comorbidities, skin diseases can directly or indirectly cause mortality.

Skin Diseases and Equity

The burden of skin diseases, measured in DALYs, varies according to income level. Globally, most new cases were in the 0-4-year age group, low-middle sociodemographic index (SDI) states had the highest burden, and it has increased since previous estimates. Low-income countries have a higher burden of infectious skin diseases (fungal infections, scabies, syphilis, and viral infections). High-income countries are primarily affected by inflammatory skin diseases (alopecia, acne, contact dermatitis, and psoriasis). Vulnerable groups are disproportionately affected by skin diseases. Skin conditions can disrupt children's developmental activities, including education, family life, and play, and lead to social phobias and anxiety disorders. In 2015, 165 million children were affected by atopic eczema, with persistent episodes of severe itching, and 160 million by infection with scabies and streptococci, particularly in low-resource settings. Women with visible skin conditions are disproportionately discriminated against when seeking employment or a partner, which has a significant impact on their self-esteem and decision-making. Disenfranchised groups such as the homeless, prisoners, and victims of violence suffer a disproportionate burden of skin conditions.

Discrimination, Stigma, and Mental Health

As a result of their high visibility, skin diseases affect a person's appearance and physical abilities representing one of the largest disease burdens associated with anxiety, low self-esteem, depression, isolation, loneliness, and suicide. They affect the quality of life and psychosocial well-being of patients, their families, carers and communities. People affected suffer stigma, discrimination, social rejection, and, in extreme cases, persecution and murder. Stigma affects their human rights, employment, development, and access to health. Across 27 European countries, participants found their condition to be personally (88.1%) and professionally (83%) embarrassing, 14.5% felt rejected, and 19.2% felt disgusted, yet, a Singapore study shows that psychodermatology is clearly understood in only 18% of dermatoses, with a higher coverage in Western populations and an under-reporting in Asian populations. Us study of Atopic Dermatitis (AD) found higher rates of fatigue, anxiety, sleep disturbance, and depression, leading to higher rates of divorce and separation and greater use of maladaptive coping mechanisms, including alcohol abuse (28.2%). In the UK, 30.6% of people with psoriasis were involved in alcohol misuse.

⁵ International Classification of Diseases - 11

⁶ Urban et al., 2020

⁷ Hay et al., 2015; Weisshaar et al. 2017

⁸ Williams et al., 2008 in Hay et al 2015

⁹ Haar et al 2014, Carapetis et al 1999

¹⁰ Kingman, 2005; Seth et al., 2017

¹¹ Yew et al., 2020; Dalgard et al., 2015

¹² Yew et al., 2020; Hay et al 2015; Dalgard et al., 2015; Koo, 2001; Seth et al., 2017; Ahmed et al., 2013

¹³ Yakupu et al., 2019; Dimitrov et al., 2017; Zhang et al., 2021; Hay et al 2015; Porter et al. 1986; Silveira et al., 2023; Seth et al. 2017.

¹⁴ Gisondi et al., 2023

¹⁵ Heratizadeh et al., 2017

¹⁶ Hua, 2018 in Yew et al.

¹⁷ Al-Jefri et al. 2017 in Yew et al., 2020

Socioeconomic Burden

Skin diseases cause significant health costs and loss of productivity in work and education. ¹⁸ Lack of cost-effective interventions, inappropriate treatments, and the cost of medications can drain a household's financial resources. ¹⁹ In limited-resource settings, costs are less researched and hard to estimate. ²⁰ Some may be unable to work, while those who can lose working days due to medical treatment. These needs can strain their working relationship with employers and cause shame and anger. ²¹ In addition, severe itching can reduce concentration at work or school. ²² A patient with AD loses about 28.9 productive days and, in total indirect costs, Saudi Arabia loses about \$364 million/year and the UAE around \$228 million/year. ²³

Access to Healthcare

Access to health services significantly impacts health outcomes. However, disparities in skin health services are widespread, with each region facing unique challenges and barriers to affordable, quality care. This health 'gap' is more acute in low-resource countries, though it remains a complex global issue.

<u>Care-seeking behavior</u>, including awareness, disease symptoms, proximity to health facilities, and previous experience, is a key barrier. ²⁴ Late diagnosis, often due to lack of access to healthcare services, cultural beliefs, and unawareness, leads to complications. Inadequate knowledge of basic wound care results in pressure ulcers or bedsores being a common cause of death in older, bedridden adults. Traditional medicine practices are often the first point of contact, followed by biomedical health facilities. The lack of integration between the two can delay diagnosis and treatment. ²⁵

<u>Direct and indirect healthcare costs</u> including loss of income, transport to health facilities, and unattended household responsibilities are significant barriers. ²⁶ In India, medications for skin diseases account for 68.9% of out-of-pocket spending. ²⁷ In some US counties, lack of insurance, poverty, and shortage of healthcare services limit access to care. ²⁸

Availability of trained healthcare workers significantly affects access to care. The large number of skin diseases, their low profile, and lack of funding make it difficult for non-specialists to diagnose and treat them accurately, with general practitioners lacking training in dermatology in both high- and low-income settings. As a result, patients are mis- or undiagnosed with decreased access to appropriate treatments and quality of life. Paradoxically, the 10 most common skin diseases account for most cases. With the right training and support for non-specialist local health teams, much of their global burden could be effectively addressed. In Latin America and the Caribbean, only 30-50% of dermatologists can correctly assess the severity of atopic dermatitis. ²⁹ In sub-Saharan Africa, with 0-3 dermatologists per million people ³⁰, and in Asia, health workers struggle to diagnose and manage severe skin and subcutaneous diseases. ³¹ The

¹⁸ Kingman, Sharon. in Bulletin of the World Health Organization, 2005

¹⁹ Hay et al 2015; Seth et al., 2017 in Yew et al., 2020

²⁰ Seth et al. 2017

²¹ Ayala et al., 2014; Andersen et al. 2020; Yew et al., 2020; Misery et al., 2020; Jensen et al., 2018; Hultin et al., 2020.

²² Kingman et al., 2005

²³ Gisondi et al., 2023

²⁴ Srinivas et al., 2018.

²⁵ Dlova et al., 2018; Srinivas, et. Al., 2018.

²⁶ Gómez et al., 2018.

²⁷ Ambade et al., 2022.

²⁸ Duniphin, 2023.

²⁹ Sanchez et al., 2021.

³⁰ Mosam et al., 2021.

³¹ McCollum et Al., 2022; Maria et al., 2019

increase in scabies cases worldwide has been attributed to treatment shortages, failures, and stigma. The treatment failure rate in scabies management across the various types of medical treatment regimens is 15.2%, attributable to causes such as drug resistance, and implementation issues, among others.³²

<u>Fragmented healthcare services</u> further complicate skin disease management. Delays in accessing treatment and care can increase the risk of developing associated complications, disability, and comorbidities such as cardiovascular disease and arthritis. The healthcare-seeking journey for patients with skin diseases is often protracted, and they traverse complex and lengthy pathways to access appropriate care. Even within countries, unequal geographic distribution of specialist healthcare providers most concentrated in the cities, contributes further to difficulties in accessing care for those living in remote areas. Sub-Saharan Africa and Asia suffer from disjointed care pathways with a lack of integration between dermatological care, wound management, physiotherapy, and mental health services.³³

<u>Basic woundcare knowledge</u> is lacking. Although wounds are ubiquitous and widely represented, woundcare is still rarely a priority in teaching at medical and nursing schools. Besides specialised health facilities, woundcare practice is still empiric. Education programs both pre and postgrad, encompassing more modern and proven woundcare concepts and the more efficient use of basic dressings could prove to be game changers for those suffering from wounds from all origins (dermatological, non-dermatological, traumatic).

Climate and Environmental Change

The change in climate and weather and land, air, water, and soil pollution affect the distribution, intensity, and frequency of dermatological conditions.³⁴ Factors associated with climate change have led to increased ultraviolet (UV) exposure. In 2019, 28% of all people of working age, or 1.6 billion people, were exposed to UV radiation, resulting in nearly 19,000 deaths from non-melanoma skin cancer in 183 countries in one year (65% men).³⁵ Climate change may exacerbate the symptoms of environmentally affected skin diseases and facilitate the spread of previously tropical diseases. The geographical incidence of infectious skin diseases is already shifting and expanding due to climatic conditions that favor microbial propagation.³⁶ Emerging diseases often present themselves with changes in the skin, as is the case of Mpox where the most common feature is a rash, occurring in 88.5% of cases with at least one symptom³⁷, WHO declared on the 14th of August Mpox Public Health Emergency of International Concern.

Air pollutants compromise the skin barrier and induce oxidative stress.³⁸ Inflammatory skin diseases are increasingly prevalent in high-income countries, with multi-component exposure to air pollution playing a key role. Pollutant exposure has been associated with an increased risk of developing inflammatory and immune-mediated diseases³⁹. Exposure to polluted water, often contaminated with bacteria and heavy metals, worsened by poor water quality management, poses a significant risk to skin health.⁴⁰ Increases in

³² Lawrence et al., 2024.

³³ Prochazka et al., 2020. Acosta Felquer et al., 2022; Gisondi, 2022

³⁴ Silva and Rosenbach, 2021

³⁵ WHO/ILO, 2021.

³⁶ Coates et al., 2019; Kaffenberger et al., 2017.

³⁷ WHO Situation Report, 2024

³⁸ Dijkhoff, et. al., 2020.

³⁹ Langan, et. al., 2020; Gu X., et. Al., 2024; Abolhasani et al., 2021; Cheng et al., 2020; Prieux et al., 2020; Prieux et al., 2020; Pham et al., 2015; Maria et al., 2019; Vogel et al., 2020.

⁴⁰ Arif et al., 2020; Lin Li et al., 2022.

temperature and changes in relative humidity and rainfall affect the behavior of skin disease vectors, including mosquitoes, ticks, sandflies, and snails, creating new and expanded areas of endemicity. Sandflies, vectors of cutaneous leishmaniasis, are increasingly moving north due to climate change. In 2018, 59% of US cases of cutaneous leishmaniasis were endemic. Climate change leads to more frequent extreme events, resulting in higher skin infection incidence caused by antibiotic-resistant bacteria, particularly gramnegative bacteria, fungi, and viruses. 66.3% of surveyed survivors of the 2004 Indian Ocean tsunami with traumatic wounds had skin and soft tissue infections due to contact with contaminated water, including multidrug-resistant bacteria. In addition, disaster-related migration often leads to overcrowding in temporary shelters and outbreaks of skin diseases, especially for low-income communities that are particularly vulnerable to climate-related dermatological impacts, including disaster-related adaptation and mitigation.

The journey from a mandate for skin NTDs to 'No UHC Without Skin Health for All'

Neglected tropical disease (NTD) efforts highlight the widespread, unmet burden of skin disease in communities. WHO-designated neglected diseases present signs and symptoms on the skin. These include Buruli ulcer, leprosy, lymphatic filariasis, leishmaniasis, mycetoma, fungal diseases, and scabies. Large-scale community campaigns have often found that most skin conditions are common diseases that, unlike targeted skin NTDs, are usually not treated free of charge, leaving many unattended. In the past, vertical programs addressed specific NTDs with little coordination. In 2017, the WHO collaborated with dermatologists and skin disease researchers, resulting in a manual "Recognizing Neglected Tropical Diseases through Changes in the Skin", followed by a diagnostic phone app with diagnostic tools for NTDs and 24 common skin diseases. In 2020, WHO published its SDG-aligned roadmap for NTDs (2021-2030), which sets global targets for the control, elimination or eradication of NTDs.

The 2022 Strategic Framework for Integrated Control and Management of Skin-Related NTDs identified areas for integration, such as training, clinical and laboratory diagnosis, wound and lymphoedema management, and self-care. A landmark meeting in Geneva in March 2023 brought stakeholders together with WHO Director-General Dr Tedros Adhanom Ghebreyesus and resulted in his commitment to improve support for skin NTDs in terms of resources, policy, and advocacy. Subsequently, World Health Assembly side events and briefings were held in May 2023 and March 2024 to address skin disease challenges and opportunities. These events led to the 77th World Health Assembly Side Event on "Skin Diseases as a Global Public Health Priority: No UHC Without Skin Health" in 2024. The need for cost-effectiveness has driven the integration of skin services, making policy more efficient and reducing stigma. Strengthening primary and higher levels of health care is now essential to address unmet needs, expand access, and develop practical solutions to achieve "Skin Health for All". ⁴⁷

⁴¹ Andersen et al., 2012; Balato et al., 2014; Kaffenberger et al. 2017; McIlwee et al., 2017; González et al., 2010.

⁴² McIlwee et al., 2018.

⁴³ Andersen et al., 2012.

⁴⁴ Hiransuthikul et al., 2005 in Balato et al., 2014

⁴⁵ Schachtel er al., 2019.

⁴⁶ Silva et al., 2021.

⁴⁷ WHO, 2018; WHO, 2023; WHO, 2020; WHO, 2022; https://www.who.int/initiatives/who-initiative-on-artificial-intelligence-for-skin-conditions

Current WHO Initiatives

- The <u>INTERSUN Global UV Program (2003)</u> addresses the health effects of UV radiation and promotes sun protection. The <u>Guidelines for HIV-Associated Skin and Oral Conditions (2014)</u> support healthcare providers in the management of HIV-associated skin conditions.
- <u>Neglected Tropical Diseases (NTDs) projects:</u> A hand-manual for healthcare workers and diagnostic app. The Roadmap for NTDs 2021-2030 (2020). A strategic framework for the integrated control and management of skin-related NTD (2022). The NTDs-led Global Initiative on AI for Skin Conditions.

Actions Needed

- Integrated and Holistic Care models are needed to improve access to skin disease management, offering comprehensive services such as dermatological management, wound care, physiotherapy, and mental health support. Improving the supply chain for essential medicines and equipment and integrating alternative and traditional medicine into primary health care can provide a more comprehensive approach. Training primary healthcare providers to address the dermatological effects of climate change and teledermatology can connect patients with experts for better care.
- **Recognition of the Socioeconomic Burden** is essential. Research into the social determinants of skin disease patterns helps to identify best practices in diagnosis and management. This research will inform the development of tailored interventions that address both medical and socio-economic factors.
- Dedicated Health Investment to train healthcare workers and increase the number of specialist
 dermatologists is key to effective management of skin disease. Support from member states, Ministries
 of Health, WHO, donors, the private sector, professional bodies, and patient organizations and sharing
 of experiences and challenges faced by Member States will enhance global efforts to improve skin health.
- Advocacy and Funding to Increase Research Capacity, are needed to lead to innovative diagnostic tools and treatments. Enhanced research capacity provides the necessary data for effective interventions.
- Climate Change Research on context-specific effects on skin disease patterns is essential. This
 research helps to understand how changing environmental conditions affect skin health and can develop
 strategies to mitigate these effects. Training healthcare providers to diagnose and treat climate-related
 dermatological problems is also essential.
- Expanding and Strengthening Global Skin Health Databases is critical for informing planning needs and monitoring progress. Robust data collection and analysis support effective planning, resource allocation, and evaluation of intervention outcomes, ensuring continuous improvement in skin disease management. The proposed resolution supports Member States in improving diagnosis, referral, access to medication, and data collection. Strengthening WHO's role in data collection, research, and health workforce training is key. These efforts will improve health outcomes and economic activity, addressing both the medical and socioeconomic impact of skin diseases.

Contact Details for further discussion

Health Diplomacy Alliance: <u>info@hdalliance.org</u> Katherine Urbáez: <u>kurbaez@hdalliance.org</u>

Annex A

The content of the document is supported by:

Global Organizations:



International Alliance of Dermatology Patient Organizations (GlobalSkin)



<u>International League of Dermatological Societies</u> (ILDS)



International Foundation for Dermatology (IFD)



Health Diplomacy Alliance (HDA)



Neglected Tropical Diseases Non- Governmental Organizations Network Skin Cross-Cutting Group (NNN Skin CCG)



Anesvad Foundation



World Alliance for Wound and Lymphedema Care



World Council of Enterostomal Therapists®

Regional Organizations:



Pan Africa Association of Wound Care Experts

National and Subnational Organizations:



Geneva University Hospitals

Bibliography

- Abolhasani R, Araghi F, Tabary M, Aryannejad A, Mashinchi B, Robati RM. The impact of air pollution on skin and related disorders: A comprehensive review. Dermatol Ther. 2021 Mar;34(2):e14840. doi: 10.1111/dth.14840. Epub 2021 Feb 12. PMID: 33527709.
- Acosta Felquer ML, Logiudice L, Galimberti ML et al. Treating the skin with biologics in patients with psoriasis decreases the incidence of psoriatic arthritis. Ann Rheum Dis 2022; 81:74–9.
- Ahmed A, Leon A, Butler DC, Reichenberg J. Quality-of-life effects of common dermatological diseases. Semin Cutan Med Surg. 2013 Jun;32(2):101-9. doi: 10.12788/j.sder.0009. PMID: 24049968.
- Aldo Morrone, Luigi Toma, and Gennaro Franco. "Skin Diseases Highlighting Essential Global Public Health Priorities." International Journal of Dermatology 44 (2005): 384–90.
- Al-Jefri K, Newbury-Birch D, Muirhead CR, et al. High prevalence of alcohol use disorders in patients with inflammatory skin diseases. Br J Dermatol 2017;177:837–844. 10.1111/bjd.15497
- Ambade M, Sarwal R, Mor N, Kim R, Subramanian SV. Components of Out-of-Pocket Expenditure and Their Relative Contribution to Economic Burden of Diseases in India. JAMA Netw Open. 2022;5(5):e2210040. doi:10.1001/jamanetworkopen.2022.10040
- Andersen, Louise K., Jana Hercogová, Uwe Wollina, and Mark D. P. Davis. "Climate Change and Skin Disease: A Review of the English-language Literature." *International Journal of Dermatology* 51, no. 6 (June 2012): 656–61. https://doi.org/10.1111/j.1365-4632.2011.05258.x.
- Andersen L, Nyeland ME, Nyberg F. Increasing severity of atopic dermatitis is associated with a negative impact on work productivity among adults with atopic dermatitis in France, Germany, the U.K. and the U.S.A. Br J Dermatol. 2020 Apr;182(4):1007-1016. doi: 10.1111/bjd.18296. Epub 2019 Sep 8. PMID: 31260080; PMCID: PMC7187138.
- Arif, A., Malik, M. F., Liaqat, S., Aslam, A., Mumtaz, K., and Afzal, A. (2020). 3. Water Pollution and Industries. Pure Appl. Biol. (PAB) 9 (4), 2214–2224. doi:10.19045/bspab.2020.90237
- Ayala F, Sampogna F, Romano GV, Merolla R, Guida G, Gualberti G, Paparatti UD, Amerio P, Balato N, Potenza C; Daniele Study Group. The impact of psoriasis on work-related problems: a multicenter cross-sectional survey. J Eur Acad Dermatol Venereol. 2014 Dec;28(12):1623-32. doi: 10.1111/jdv.12233. Epub 2013 Aug 21. PMID: 23962152.
- Balato, Nicola, Matteo Megna, Fabio Ayala, Anna Balato, Maddalena Napolitano, and Cataldo Patruno. "Effects of Climate Changes on Skin Diseases." Expert Review of Anti-Infective Therapy 12, no. 2 (February 2014): 171–81. https://doi.org/10.1586/14787210.2014.875855.
- Carapetis JR, Currie BJ, Kaplan EL. Epidemiology and prevention of group A streptococcal infections: acute respiratory tract infections, skin infections, and their sequelae at the close of the 20th century. Clin Infect Dis 1999; 28:205–10.
- Coates SJ, McCalmont TH, Williams ML. Adapting to the Effects of Climate Change in the Practice of Dermatology-A Call to Action. JAMA Dermatol. 2019 Apr 1;155(4):415-416. doi: 10.1001/jamadermatol.2018.5863. PMID: 30825413.
- Cheng Z, Liang X, Liang S, Yin N, Faiola F. A human embryonic stem cell-based in vitro model revealed that ultrafine carbon particles may cause skin inflammation and psoriasis. J Environ Sci (China). 2020 Jan;87:194-204. doi: 10.1016/j.jes.2019.06.016. Epub 2019 Jul 1. PMID: 31791492.
- Christensen EMM, Jemec GBE. Did We Forget about Social Determinants of Health in Dermatology? Acta Derm Venereol. 2024 Jan 22;104:adv34034. doi: 10.2340/actadv.v104.34034. PMID: 38248915; PMCID: PMC10811546.
- Dalgard FJ, Gieler U, Tomas-Aragones L, Lien L, Poot F, Jemec GBE, Misery L, Szabo C, Linder D, Sampogna F, Evers AWM, Halvorsen JA, Balieva F, Szepietowski J, Romanov D, Marron SE, Altunay IK, Finlay AY, Salek SS, Kupfer J. The psychological burden of skin diseases: a cross-sectional multicenter study among dermatological out-patients in 13 European countries. J Invest Dermatol. 2015 Apr;135(4):984-991. doi: 10.1038/jid.2014.530. Epub 2014 Dec 18. PMID: 25521458; PMCID: PMC4378256.
- Dayrit, Johannes F., Lunardi Bintanjoyo, Louise K. Andersen, and Mark Dennis P. Davis. "Impact of Climate Change on Dermatological Conditions Related to Flooding: Update from the International Society of Dermatology Climate Change Committee." *International Journal of Dermatology* 57, no. 8 (August 2018): 901–10. https://doi.org/10.1111/ijd.13901.
- Dayrit, Johannes F., Audi Sugiharto, Sarah J. Coates, Don Eliseo Lucero-Prisno, Mark Denis D. Davis, and Louise K. Andersen. "Climate Change, Human Migration, and Skin Disease: Is There a Link?" *International Journal of Dermatology* 61, no. 2 (February 2022): 127–38. https://doi.org/10.1111/jid.15543.
- Dijkhoff IM, Drasler B, Karakocak BB, Petri-Fink A, Valacchi G, Eeman M, Rothen-Rutishauser B. Impact of airborne particulate matter on skin: a systematic review from epidemiology to in vitro studies. Part Fibre Toxicol. 2020 Jul 25;17(1):35. doi: 10.1186/s12989-020-00366-y. PMID: 32711561; PMCID: PMC7382801.
- Dimitrov D, Szepietowski JC. Stigmatization in dermatology with a special focus on psoriatic patients. Postepy Hig Med Dosw (Online). 2017 Dec 11;71(0):1115-1122. doi: 10.5604/01.3001.0010.6879. PMID: 29225203.
- Dlova, N. C., Chateau, A. V., Khosa, N., Shenjane, A., Mkize, Z., Katibi, O. S., Grobler, A., Gwegweni, J. T. and Mosam, A. 2018. Prevalence of Skin Diseases Treated at Public Referral Hospitals in Kwazulu-Natal, South Africa. Brazilian Journal of Dermatology, 2018(178): 1-10.
- Duniphin DD. Limited Access to Dermatology Specialty Care: Barriers and Teledermatology. Dermatol Pract Concept. 2023 Jan 1;13(1):e2023031. doi: 10.5826/dpc.1301a31. PMID: 36892370; PMCID: PMC9946088.
- Engelman D, Kiang k, Chosidow O. et al. Towards the global control human scabies: introducing the International Alliance for the Control of Scabies. PLoS Negl Trop Dis 2013; 7(8):e2167. doi:10.1371/journal.pntd.0002167.
- Ferrari, Alize J et al. "Global incidence, prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021", The Lancet, Volume 403, Issue 10440, 2133 2161
- "Flohr, C., and R. Hay. "Putting the Burden of Skin Diseases on the Global Map." *British Journal of Dermatology* 184, no. 2 (February 2021): 189–90. https://doi.org/10.1111/bjd.19704.
- Freeman, Esther E. "A Seat at the Big Table: Expanding the Role of Dermatology at the World Health Organization and Beyond." *Journal of Investigative Dermatology* 134, no. 11 (November 2014): 2663–65. https://doi.org/10.1038/jid.2014.355.
- Gisondi P, Bellinato F, Targher G et al. Biological disease-modifying antirheumatic drugs may mitigate the risk of psoriatic arthritis in patients with chronic plaque psoriasis. Ann Rheum Dis 2022; 81:68–73. doi:10.1136/annrheumdis-2021-219961.
- Gisondi P, Puig L, Richard MA, Paul C, Nijsten T, Taieb C, Stratigos A, Trakatelli M, Salavastru C; EADV Burden of Skin Diseases Project Team. Quality of life and stigmatization in people with skin diseases in Europe: A large survey from the 'burden of skin diseases' EADV project. J Eur Acad Dermatol Venereol. 2023 Oct;37 Suppl 7:6-14. doi: 10.1111/jdv.18917. PMID: 37806002.
- Gómez L, Rivera A, Vidal Y, Bilbao J, Kasang C, Parisi S, Schwienhorst-Stich EM, Puchner KP. Factors associated with the delay of diagnosis of leprosy in north-eastern Colombia: a quantitative analysis. Trop Med Int Health. 2018 Feb;23(2):193-198. doi: 10.1111/tmi.13023. Epub 2018 Jan 9. PMID: 29230912.

- González C, Wang O, Strutz SE, González-Salazar C, Sánchez-Cordero V, Sarkar S. Climate change and risk of leishmaniasis in north america: predictions from ecological niche models of vector and reservoir species. PLoS Negl Trop Dis. 2010 Jan 19;4(1):e585. doi: 10.1371/journal.pntd.0000585. PMID: 20098495; PMCID: PMC2799657.
- Gu X, Li Z, Su J. Air pollution and skin diseases: A comprehensive evaluation of the associated mechanism. Ecotoxicol Environ Saf. 2024 Jun 15;278:116429. doi: 10.1016/j.ecoenv.2024.116429. Epub 2024 May 7. PMID: 38718731.
- Haar K, Romani L, Filimone R et al. Scabies community prevalence and mass drug administration in two Fijian villages. Int J Dermatol 2014; 53:739-45.
- Hay, R.J., M. Augustin, C.E.M. Griffiths, W. Sterry, and the Board of the International League of Dermatological Societies and the Grand Challenges Consultation groups. "The Global Challenge for Skin Health." *British Journal of Dermatology* 172, no. 6 (June 2015): 1469–72. https://doi.org/10.1111/bjd.13854.
- Health Service Executive Ireland, National Clinical Programme for Dermatology: a model of care for Ireland, n.d., Available at https://www.hse.ie/eng/about/who/cspd/ncps/dermatology/resources/national-clinical-programme-for-dermatology-a-model-of-care-for-ireland.pdf
- Heratizadeh A, Werfel T, Wollenberg A, et al. Effects of structured patient education in adults with atopic dermatitis: Multicenter randomized controlled trial. J Allergy Clin Immunol 2017;140(3):845–853. 10.1016/j.jaci.2017.01.029
- Hiransuthikul N, Tantisiriwat W, Lertutsahakul K, et al. Skin and soft-tissue infections among tsunami survivors in southern Thailand. Clin Infect Dis 2005; 41(10):e93-6
- Hua T, Silverberg JI. Atopic dermatitis in US adults: Epidemiology, association with marital status, and atopy. Ann Allergy Asthma Immunol 2018;121(5):622–624. 10.1016/j.anai.2018.07.019
- Hultin H, Lindholm C, Malfert M, Möller J. Short-term sick leave and future risk of sickness absence and unemployment—the impact of health status. BMC Public Health 2012;12:861 10.1186/1471-2458-12-861
- Jensen P, Zachariae C, Skov L, Zachariae R. Sleep disturbance in psoriasis: a case-controlled study. Br J Dermatol. 2018 Dec;179(6):1376-1384. doi: 10.1111/bjd.16702. Epub 2018 Aug 23. PMID: 29704428.
- Kaffenberger BH, Shetlar D, Norton SA, Rosenbach M. The effect of climate change on skin disease in North America. J Am Acad Dermatol. 2017 Jan;76(1):140-147. doi: 10.1016/j.jaad.2016.08.014. Epub 2016 Oct 11. PMID: 27742170.
- Kingman, Sharon. "Growing Awareness of Skin Disease Starts Flurry of Initiatives." Bulletin of the World Health Organization 83, no. 12 (December 2005): 891–92.
- Koo J, Lebwohl A. Psycho dermatology: the mind and skin connection. Am Fam Physician. 2001 Dec 1;64(11):1873-8. PMID: 11764865.
- Lawrence Mbuagbaw, Behnam Sadeghirad, Rebecca L Morgan, Dominik Mertz, Shahrzad Motaghi, Maryam Ghadimi, Ifeoluwa Babatunde, Babalwa Zani, Tejanth Pasumarthi, McKenzie Derby, Venkata N Kothapudi, Nicole R Palmer, Anton Aebischer, Thomas Harder, Felix Reichert, Failure of scabies treatment: a systematic review and meta-analysis, British Journal of Dermatology, Volume 190, Issue 2, February 2024, Pages 163–173, https://doi.org/10.1093/bjd/ljad308
- Langan SM, Irvine AD, Weidinger S. Atopic dermatitis. Lancet. 2020 Aug 1;396(10247):345-360. doi: 10.1016/S0140-6736(20)31286-1. Erratum in: Lancet. 2020 Sep 12;396(10253):758. doi: 10.1016/S0140-6736(20)31825-0. PMID: 32738956.
- Le Monde, La dermatologie est au bord du précipice, March 11 2023,
- Lim, Henry W. et al., The burden of skin disease in the United States, Journal of the American Academy of Dermatology, March 2017, Volume 76, Issue 5, 958 972.e2Mitja O, Marks M, Bertran L et al. Integrated control and management of neglected tropical skin diseases. PLoS Negl Trop Dis 2017. 11(1):e0005136. doi:10.1371/journal.pntd.0005136.
- Lin Li , Yang Haoran , Xu Xiaocang, Effects of Water Pollution on Human Health and Disease Heterogeneity: A Review, Frontiers in Environmental Science, Volume 10, 2022, https://www.frontiersin.org/journals/environmental-science/articles/10.3389/fenvs.2022.880246, DOI=10.3389/fenvs.2022.880246
- Maria Cristina Dias Da Silva, Elisabete Pimenta Araújo Paz; Experiences of people affected by leprosy in the health services: a hermeneutic approach; Leprosy Review; 2019; 90; 2; 172-182; DOI: 10.47276/lr.90.2.172
- McIlwee BE, Weis SE, Hosler GA. Incidence of Endemic Human Cutaneous Leishmaniasis in the United States. JAMA Dermatol. 2018 Sep 1;154(9):1032-1039. doi: 10.1001/jamadermatol.2018.2133. PMID: 30046836; PMCID: PMC6143046.
- McCollum, Rosalind, Hannah Berrian, Sally Theobald, Zeela Zaizay, Karsor Kollie, and Laura Dean. 2022. "Barriers and Enablers to Health-Seeking for People Affected by Severe Stigmatising Skin Diseases (SSSDs): A Scoping Review" Social Sciences 11, no. 8: 332. https://doi.org/10.3390/socsci11080332
- Misery L, Taïeb C, Schollhammer M, Bertolus S, Coulibaly E, Feton-Danou N, Michel L, Seznec JC, Versapuech J, Joly P, Corgibet F, Ezzedine K, Richard MA. Psychological Consequences of the Most Common Dermatoses: Data from the Objectifs Peau Study. Acta Derm Venereol. 2020 Jun 11;100(13):adv00175. doi: 10.2340/00015555-3531. PMID: 32449783; PMCID: PMC9175061.
- Mosam A, Todd G. Dermatology training in Africa: successes and challenges. Dermatol Clin 2021; 39:57-71. ISSN 0733-8635,ISBN 9780323835541, https://doi.org/10.1016/j.det.2020.08.006.
- Pham DM, Boussouira B, Moyal D, Nguyen QL. Oxidization of squalene, a human skin lipid: a new and reliable marker of environmental pollution studies. Int J Cosmet Sci. 2015 Aug;37(4):357-65. doi: 10.1111/ics.12208. Epub 2015 Mar 2. PMID: 25656265.
- Piérard Sl, Piérard Ge, and Hermanns Jf. "Greenhouse Gas-Related Climate Changes and Some Expected Skin Alterations," n.d.
- Porter JR, Beuf AH, Lerner A, Nordlund J. Psychosocial effect of vitiligo: a comparison of vitiligo patients with "normal" control subjects, with psoriasis patients, and with patients with other pigmentary disorders. J Am Acad Dermatol. 1986 Aug;15(2 Pt 1):220-4. doi: 10.1016/s0190-9622(86)70160-6. PMID: 3745526.
- Prochazka M, Timothy J, Pullan R, Kollie K, Rogers E, Wright A, Palmer J. "Buruli ulcer and leprosy, they are intertwined": Patient experiences of integrated case management of skin neglected tropical diseases in Liberia. PLoS Negl Trop Dis. 2020 Feb 5;14(2):e0008030. doi: 10.1371/journal.pntd.0008030. PMID: 32023242; PMCID: PMC7001903.
- Prieux R, Eeman M, Rothen-Rutishauser B, Valacchi G. Mimicking cigarette smoke exposure to assess cutaneous toxicity. Toxicol In Vitro. 2020 Feb;62:104664. doi: 10.1016/j.tiv.2019.104664. Epub 2019 Oct 25. PMID: 31669394.
- Sanchez J, Cherrez-Ojeda I, Galvan C, Garcia E, Hernández-Mantilla N, Londoño Garcia A, McElwee E, Rico Restrepo M, Rivas E, Hidalgo B. The Unmet Needs in Atopic Dermatitis Control in Latin America: A Multidisciplinary Expert Perspective. Dermatol Ther (Heidelb). 2021 Oct;11(5):1521-1540. doi: 10.1007/s13555-021-00595-9. Epub 2021 Aug 27. PMID: 34449071; PMCID: PMC8395384.
- Schachtel A, Boos MD. Pediatric dermatology and climate change: An argument for the pediatric subspecialist as public health advocate. Pediatr Dermatol. 2019 Jul;36(4):564-566. doi: 10.1111/pde.13819. Epub 2019 Apr 9. PMID: 30968450.
- Seth, Divya, Khatiya Cheldize, Danielle Brown, and Esther E. Freeman. "Global Burden of Skin Disease: Inequities and Innovations." *Current Dermatology Reports* 6, no. 3 (September 2017): 204–10. https://doi.org/10.1007/s13671-017-0192-7.
- Silva GS, Rosenbach M. Climate change and dermatology: An introduction to a special topic, for this special issue. Int J Womens Dermatol. 2021 Jan;7(1):3-7. doi: 10.1016/j.ijwd.2020.08.002. Epub 2020 Aug 19. PMID: 32838016; PMCID: PMC7435281.

- Silveira LP, Grijsen ML, Follador I, Dellatorre G. How persistent stigma and discrimination keep people with visible skin diseases out of jobs: vitiligo in Brazil today. Lancet Reg Health Am. 2023 May 30;23:100524. doi: 10.1016/j.lana.2023.100524. PMID: 37293393; PMCID: PMC10245094
- Srinivas G, Kumar S, Mohanraj R, Sekkizhar G, Muthuvel T, Lal V, Koemm B, Kasang C. Development and validation of a scale to assess attitudes of health care providers towards persons affected by leprosy in southern India. PLoS Negl Trop Dis. 2018 Sep 25;12(9):e0006808. doi: 10.1371/journal.pntd.0006808. PMID: 30252851; PMCID: PMC6177202.
- Urban K, Chu S, Giesey RL, Mehrmal S, Uppal P, Delost ME, Delost GR. Burden of skin disease and associated socioeconomic status in Asia: A cross-sectional analysis from the Global Burden of Disease Study 1990-2017. JAAD Int. 2020 Dec 10;2:40-50. doi: 10.1016/j.jdin.2020.10.006. PMID: 34409353; PMCID: PMC8362322.
- Vogel CFA, Van Winkle LS, Esser C, Haarmann-Stemmann T. The aryl hydrocarbon receptor as a target of environmental stressors Implications for pollution mediated stress and inflammatory responses. Redox Biol. 2020 Jul;34:101530. doi: 10.1016/j.redox.2020.101530. Epub 2020 Apr 18. PMID: 32354640; PMCID: PMC7327980.
- Weisshaar E, Apfelbacher C, Jäger G, Zimmermann E, Bruckner T, Diepgen TL, et al. 2006 in Seth, Divya, Khatiya Cheldize, Danielle Brown, and Esther E. Freeman. "Global Burden of Skin Disease: Inequities and Innovations." Current Dermatology Reports 6, no. 3 (September 2017): 204–10
- Williams H, Stewart A, von Mutius E et al. Is eczema really on the increase worldwide? J Allergy Clin Immunol 2008; 121:947-54.
- World Health Assembly. Elimination of leprosy: resolution of the 44th World Health Assembly. Geneva: World Health Organization, 1991, https://www.who.int/neglected_diseases/mediacentre/WHA_44.9_Eng.pdf.
- World Health Assembly, Addressing the burden of mycetoma, Agenda item 15.3 for the 69th World Health Assembly, Geneva, World Health Organization, 28 May 2016, Available at < https://iris.who.int/bitstream/handle/10665/252801/A69_R21-en.pdf
- World Health Organization, ICD-11 Classification of Dermatological Diseases, Available at https://icd.who.int/dev11/l-derma/en
- World Health Organization, Global Initiative on Artificial Intelligence for Skin Conditions, Available at https://www.who.int/initiatives/who-initiative-on-artificial-intelligence-for-skin-conditions
- World Health Organization Regional Office for the Western Pacific: Manila, Philippines, "WHO informal consultation on a framework for scabies control meeting report", 19-21 February 2019
- World Health Organization, WHO Mortality Database Skin Diseases, Available at < https://platform.who.int/mortality/themes/theme-details/topics/topic-details/MDB/skin-diseases
- World Health Organization, Global Report on Psoriasis, 2016, Available at https://iris.who.int/bitstream/10665/204417/1/9789241565189 eng.pdf>
- World Health Organization. Recognizing Neglected Tropical Diseases through changes in the skin: a training guide for front-line health workers, 1 June 2018
- World Health Organization, Skin-related neglected tropical diseases: WHO launches new version of the WHO Skin NTDs mobile application, 9 October 2023
- World Health Organization. Ending the neglect to attain the Sustainable Development Goals: a road map for neglected tropical diseases 2021-2030. 28 January 2021
- World Health Organization. Ending the neglect to attain the sustainable development goals: a strategic framework for integrated control and management of skin-related neglected tropical diseases. 2022, https://iris.who.int/handle/10665/355448. License: CC BY-NC-SA 3.0 IGO
- World Health Organization. The effect of occupational exposure to solar ultraviolet radiation on malignant skin melanoma and non-melanoma skin cancer: a systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury, 2021, License: CC BY-NC-SA 3.0 IGO.
- World Health Organization. WHO's first global meeting on skin NTDs calls for greater efforts to address their burden. 31 March 2023 https://www.who.int/news/item/31-03-2023-who-first-global-meeting-on-skin-ntds-calls-for-greater-efforts-to-address-their-burden.
- Yamanaka K. Skin Disease and Comorbidities. J Clin Med 2021 10:5754. doi: 10.3390/jcm10245754. PMID: 34945050; PMCID: PMC8707480. Yew, Yik Weng, Amanda Hui Yu Kuan, Lixia Ge, Chun Wei Yap, and Bee Hoon Heng. "Psychosocial Impact of Skin Diseases: A Population-
- Yew, Yik Weng, Amanda Hui Yu Kuan, Lixia Ge, Chun Wei Yap, and Bee Hoon Heng. "Psychosocial Impact of Skin Diseases: A Population-Based Study." Edited by Feroze Kaliyadan. *PLOS ONE* 15, no. 12 (December 31, 2020): e0244765. https://doi.org/10.1371/journal.pone.0244765.
- Yakupu A, Aimaier R, Yuan B et al. "The burden of skin and subcutaneous diseases: findings from the global burden of disease study 2019". Front Public Health 2023; 11:1145513. https://doi.org/10.3389/fpubh.2023.1145513.
- Zhang H, Yang Z, Tang K, Sun Q, Jin H. Stigmatization in Patients With Psoriasis: A Mini Review. Front Immunol. 2021 Nov 15;12:715839. doi: 10.3389/fimmu.2021.715839. PMID: 34867945; PMCID: PMC8634029.