Global health implications of urticaria burden (1990–2021): a comprehensive analysis of trends across nations and regions

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Abstract

Introduction: Urticaria is a widespread dermatological disorder that substantially affects patients' quality of life. Current data on its worldwide impact are crucial for healthcare planning and resource distribution. By analyzing the Global Burden of Disease (GBD) Study 2021, we evaluated the burden of urticaria across global, regional, and national levels.
Material and methods: A comprehensive analysis was performed using data from the GBD 2021 study. Key metrics included prevalence, incidence, and age-standardized rates, all calculated per 100,000 people. The results were analyzed across demographic factors including age groups, gender, and geographical locations.
Results: From 1990 to 2021, global urticaria metrics demonstrated relative stability, with female patients consistently reporting higher rates. During this period, the number of prevalent cases increased from approximately 48 million to 66.5 million, with the age-standardized prevalence rate (ASPR) showing a slight rise from 866 to 868 per 100,000 population. The number of incident cases increased from about 85 million to 117 million, while the age-standardized incidence rate (ASIR) showed a marginal increase from 1,529 to 1,534 per 100,000. The global age-standardized DALY rate reached 52.1 per 100,000 in 2021, ranging from 27.7 in Portugal to 88.4 in Nepal. The disease burden was most pronounced in low-middle SDI regions and lowest in high SDI areas. At the country level, Nepal recorded the highest burden across all metrics, while Portugal showed the lowest.
Conclusions: Our analysis spanning three decades revealed that while the overall global burden of urticaria has remained relatively stable, there has been a modest upward trend in both prevalence and incidence. Notable disparities have emerged, with disproportionate impacts observed across different populations: females experience higher rates of the condition, and low-middle SDI regions shoulder a greater disease burden. These patterns highlight the importance of developing focused healthcare strategies and optimizing resource distribution, particularly in heavily affected regions. Given the inherent limitations of GBD data, these findings should be interpreted with appropriate caution.

Key words: urticaria, Global Burden of Disease, epidemiology, disability-adjusted life years.

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Introduction

Urticaria, commonly known as hives, is a skin condition characterized by raised, itchy welts that can appear suddenly and affect any part of the body [1]. This condition can be acute (lasting less than 6 weeks) or chronic (persisting for 6 weeks or more), and it significantly impacts the quality of life of affected individuals [2]. The Global Burden of Disease (GBD) study, a comprehensive worldwide observational epidemiological study, has been instrumental in quantifying health loss from hundreds of diseases, injuries, and risk factors [3]. Previous iterations of the GBD study have included urticaria among the skin conditions analyzed, highlighting its importance in the global health landscape [4–6]. The 2021 dataset incorporates new data sources, updated demographic and epidemiological models, and refined disability weights, providing more accurate estimates of disease burden.

Understanding the global, regional, and national burden of urticaria is crucial for several reasons. First, it allows for the comparison of urticaria's impact across different geographical areas and populations, helping to identify high-burden regions that may require targeted interventions. Second, monitoring the disease burden across time periods provides valuable insights into urticaria's evolving epidemiological patterns. Finally, quantifying the burden in terms of disability-adjusted life years (DALYs) provides a standardized measure that can be used to compare urticaria with other health conditions and inform resource allocation decisions [7].

While previous studies have examined the burden of urticaria, there is a need for up-to-date estimates that reflect the most recent data and methodological improvements in the GBD study [8]. This study builds upon existing literature by offering several unique contributions. First, it provides the most up-to-date analysis of global urticaria trends, incorporating data up to 2021, which captures recent shifts in disease patterns. Second, it presents a detailed examination of socio-demographic variations in disease burden, revealing previously unidentified disparities across different populations. Third, our analysis includes novel temporal comparisons spanning three decades (1990–2021), enabling the identification of long-term trends and patterns that were not evident in shorter-term studies. This study aims to provide a comprehensive analysis of the global, regional, and national burden of urticaria in 2021, using data from the GBD 2021. Our study specifically employs the GBD 2021 dataset, which represents the most comprehensive and updated global health database available. This latest iteration includes enhanced methodological refinements, improved data quality, and expanded coverage compared to previous versions. The 2021 dataset incorporates new data sources, updated demographic and epidemiological models, and refined disability weights, providing more accurate estimates of disease burden. By doing so, we seek to provide valuable information for healthcare providers, policymakers, and researchers working to address the impact of this common skin condition.

Material and methods

Data source

The GBD study, accessible via VizHub, served as the primary data source for evaluating urticaria's health effects. This resource encompasses extensive metrics on disease patterns, allowing researchers to monitor prevalence shifts and incidence rates. The study's established methodology, validated through previous investigations, ensures robust assessment of urticaria's worldwide implications [9]. The study applied ICD-10 classification standards [4, 5]. These standardized metrics enabled precise measurement of urticaria's functional impact on patients' wellbeing [9]. Data extraction from the GBD 2021 database encompassed prevalence, incidence, and DALYs with corresponding 95% uncertainty intervals (UIs). The DALY calculations integrated both disability duration and mortality impact. Regarding the handling of missing data, our analysis relied on the GBD 2021 database, which employs a systematic imputation approach to address gaps in raw data inputs from various sources, such as national surveys and registries [9]. Missing data were not excluded but imputed using the GBD's DisMod-MR 2.1 tool, a Bayesian meta-regression model that integrates available data with covariates to estimate disease burden in regions or years with incomplete reporting [7]. This imputation leverages spatial-temporal patterns and covariate relationships to ensure comprehensive coverage across all 204 countries and territories analyzed. The potential impact of this approach on our results is minimal, as the GBD methodology validates imputed estimates against observed data where available and incorporates imputation uncertainty into the 95% UIs reported for all metrics. Nations were categorized using the Socio-demographic Index (SDI), a composite measure combining income per capita, education levels among adults, and fertility rates. This classification resulted in five tiers from high to low SDI. The study proceeded under the University of Washington's IRB consent waiver and followed STROCSS reporting protocols [10].

Sociodemographic index

The SDI serves as a comprehensive metric of societal development, incorporating three fundamental dimensions: total fertility rate, average educational attainment, and per capita income. This composite measure is scaled from 0 to 1, where higher values reflect greater levels of socioeconomic development. Previous research has demonstrated robust correlations between SDI values and various health outcomes, including disease occurrence and mortality patterns across different populations. In our analysis, we categorized countries and regions into five distinct SDI quintiles: low, low-middle, middle, high-middle, and high. This stratified approach enabled us to systematically investigate the association between disease burden and socioeconomic development status, providing insights into how social and economic factors influence disease patterns across different development contexts.

Statistical analysis

To assess the trends in age-standardized rates (ASR) of urticaria incidence, DALYs, and prevalence, the study utilized the Estimated Annual Percentage Change (EAPC). The ASR was computed per 100,000 individuals utilizing the following formula:

$$\mathrm{ASR} = \frac{\sum_{i=1}^{A} a_i w_i}{\sum_{i=1}^{A} w_i} \times 100{,}000,$$

where a_i: the age-specific rate in i^{th} the age group; w: the number of people in the corresponding i^{th} age group among the standard population; A: the number of age groups.

The EAPC calculation utilized a regression model to characterize age-standardized rate patterns over the specified period [11, 12]. The model followed the equation: $Y = \alpha + \beta X + e$, where Y represents the natural logarithm of ASR, X denotes the calendar year, α is the intercept term, β represents the slope or trend, and e signifies the error term. The EAPC, calculated as $100 \times [\exp(\beta) - 1]$, reflects the annual percentage change. The 95% confidence interval (CI) for the EAPC was computed using linear regression. An increasing trend in ASR is indicated when both the EAPC and its 95% CI lower bound are positive, while a decreasing trend is determined when both the EAPC and its 95% CI upper bound are negative. The ASR is considered stable when neither condition is met. Spearman correlation analysis was employed to evaluate associations between SDI and urticaria ASR.

For future trend projections, we implemented a Bayesian age-period-cohort (BAPC) model using integrated nested Laplace approximations. Research has shown that BAPC provides enhanced coverage and precision compared to alternative prediction methodologies. The analysis was conducted using the R package BAPC, following established protocols from previous studies [11–14].

The 95% UIs reported for prevalence, incidence, and DALYs in this study were calculated using the GBD 2021 study's standard approach to propagating uncertainty, ensuring a robust representation of variability across diverse data sources [9]. This process involved synthesizing data from multiple inputs, such as national health surveys, registries, and published literature, each contributing estimates with inherent uncertainty due to sampling error, non-sampling error, and model specification [7]. To generate these UIs, the GBD methodology employed Bayesian statistical models that produced 1,000 draws from the posterior distribution of each estimate, incorporating uncertainties from data inputs and modeling assumptions [3]. For urticaria, where DALYs reflect years lived with disability (YLDs) without a mortality component, the posterior distributions were derived from prevalence estimates and disability weights, with UIs extracted as the 2.5th and 97.5th percentiles of these distributions [9]. The disability weights used in this study were adopted from the GBD framework, which assigns severity-specific values based on standardized health state descriptions validated through global population surveys [8]. For urticaria, these weights reflect the condition's impact on quality of life, with a weight of 0.027 assigned to mild cases, 0.051 to moderate cases, and 0.188 to severe cases of chronic urticaria, as established in prior GBD studies [4, 8]. The selection of 0.027 for mild cases represents a minimal but perceptible burden, corresponding to intermittent itching and minor discomfort that mildly disrupts daily activities, as determined by lay descriptions and expert consensus in the GBD 2013 skin disease analysis [4]. These weights were further refined in GBD 2021 to account for updated survey data and have been widely applied in dermatological burden assessments due to their consistency with patient-reported outcomes [9, 15]. The rationale for adopting these specific values lies in their empirical grounding in large-scale, cross-cultural disability surveys, ensuring comparability across diseases and regions, though they may underestimate the burden in cases with a significant psychological impact not fully captured by physical symptoms alone [16]. The uncertainty calculation methodology varied depending on the population coverage characteristics of the data sources. For inpatient sources with incomplete population coverage, which relied on the inpatient utilization envelope, uncertainty estimates were generated through 1,000 bootstrapped samples of the envelope and correction factor models, capturing variability in utilization patterns and adjustment processes [3]. In contrast, for inpatient sources with complete population coverage, uncertainty was quantified using Wilson's score interval approximation in combination with GBD population estimates [9]. Specifically, Wilson's approximation was applied to proportions such as prevalence and incidence rates, using the formula $\sigma^2 = [cf(1 - cf)/n + 1.96^2/4n^2]/(1 + 1.96^2/n)^2$, where cf denotes the cause fraction and n represents the sample size [11]. This method was particularly suitable for age-specific rates, ensuring that uncertainty was propagated through subsequent age-standardization steps, where rates were weighted against the GBD global age standard population [12]. For DALYs, additional uncertainty from disability weight assignments, derived from global health surveys, was integrated into the final UI computation [8]. This systematic approach ensured comprehensive consideration of various data sources and their inherent limitations, while maintaining methodological rigor across different population scenarios [7]. All point estimates in our results are presented with their corresponding 95% UIs to provide transparent communication of estimate precision, facilitating interpretation of the findings within the context of their statistical reliability.

All statistical analyses and visualizations were performed using R software (version 4.2.1; https://www.r-project.org/), utilizing specialized packages including BAPC (version 0.0.36) for Bayesian Age-Period-Cohort modeling, INLA (version 24.05.011) for integrated nested Laplace approximations, and ggplot2 (version 3.4.2) for data visualization. Geographic representations were generated using the rworldmap package (version 1.3.6).

Results

Global level

Key global trends from 1990 to 2021 revealed female predominance across all urticaria metrics, with women consistently showing higher rates of prevalence, incidence, and DALYs throughout the study period. During 1990-2021, global metrics for urticaria – including age-standardized prevalence, incidence, and DALY rates – maintained relative stability, though demonstrating a slight upward trend (Figures 1–3, Supplementary Figures S1, S2). The absolute number of urticaria cases increased substantially over the study period. Global prevalence showed significant growth, rising from approximately 48 million cases in 1990 to

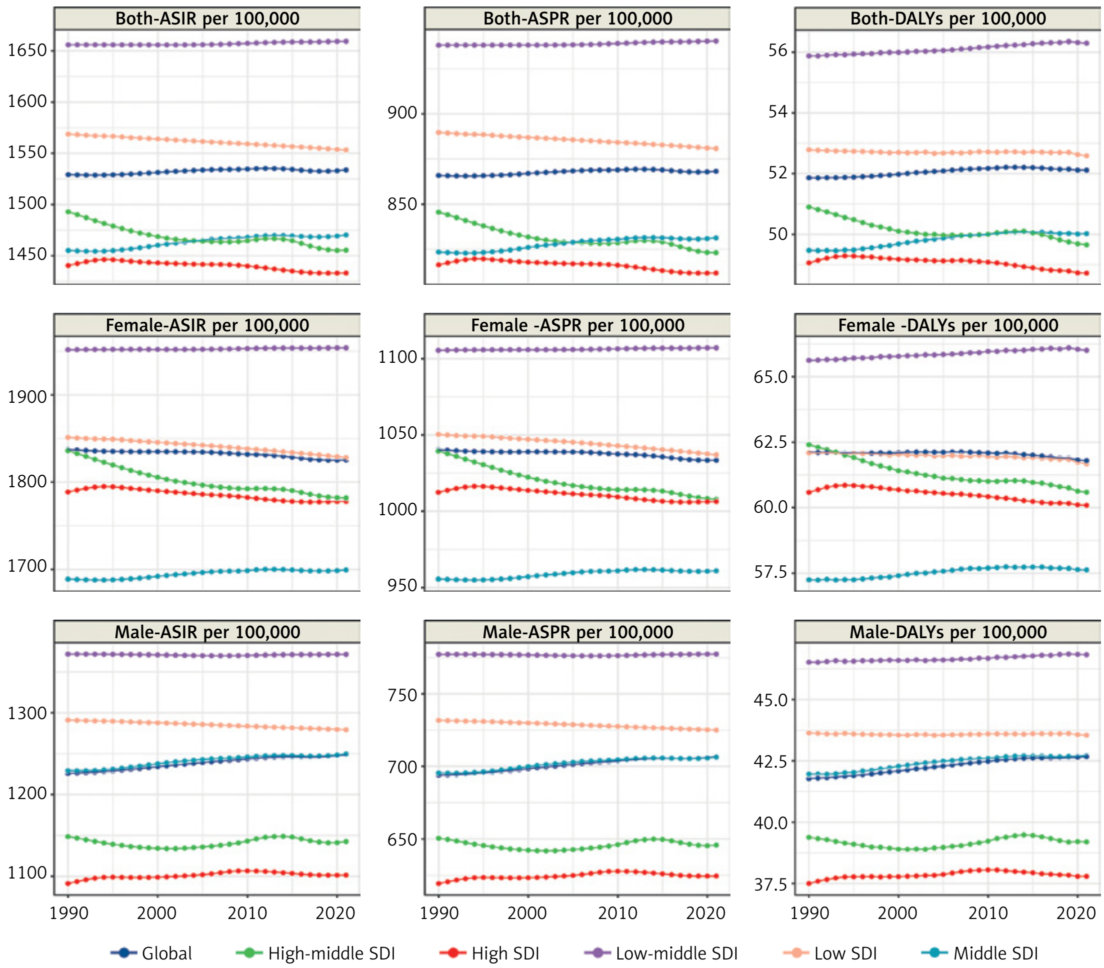

Figure 1. Trends in urticaria incidence, prevalence and disability-adjusted life-years from 1990 to 2021

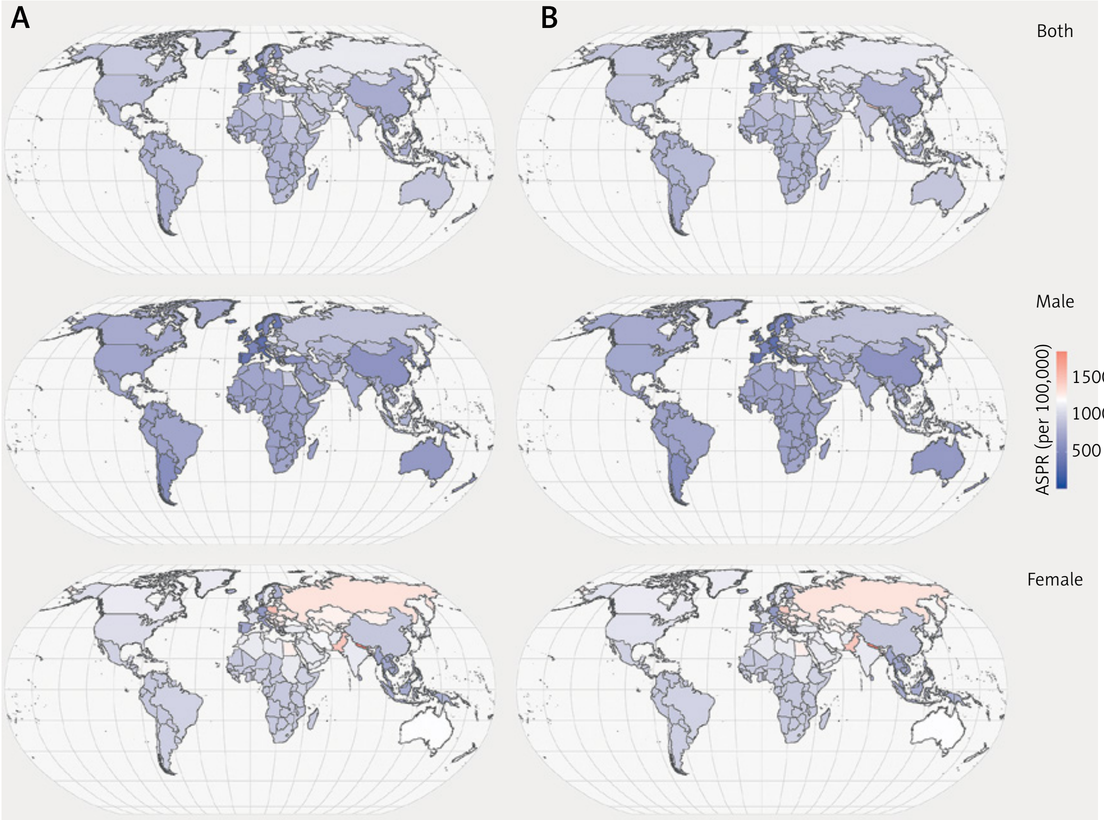

Figure 2. Global disease burden of urticaria prevalence rate for both sexes in 204 countries and territories in 1990 (**A**) and 2021 (**B**)

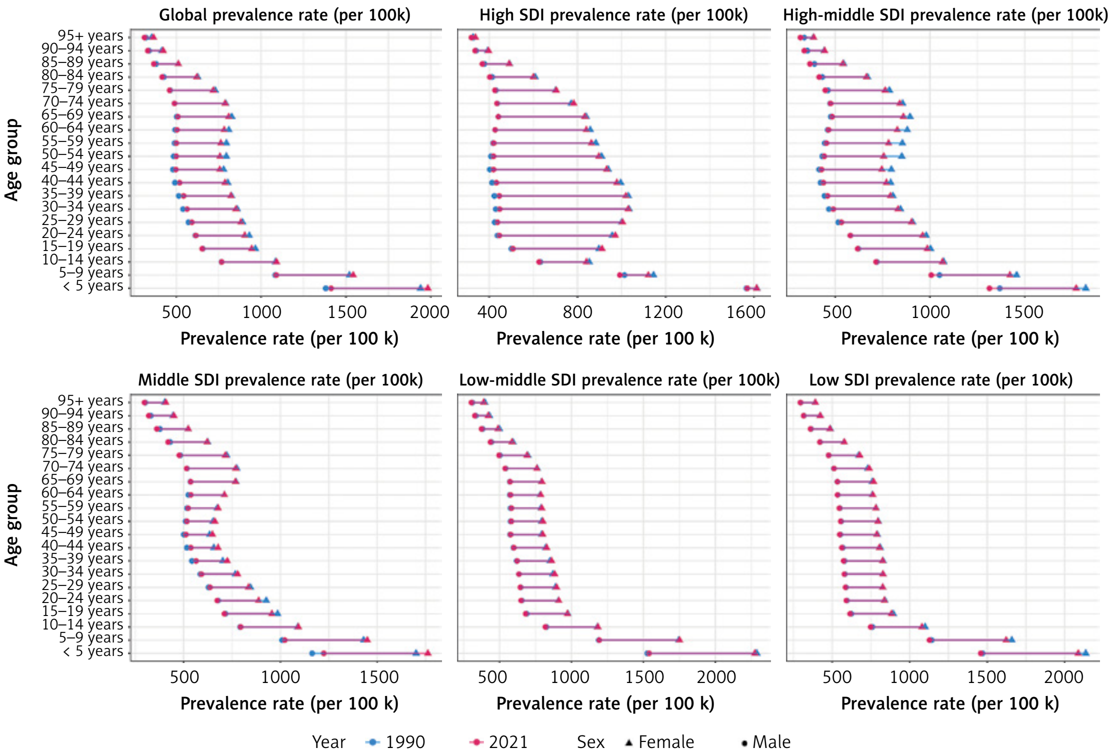

Figure 3. Urticaria prevalence by age group, global and 5 SDI regions

Table I. Global and regional trends in urticaria burden: prevalence, incidence and disability-adjusted life years (1990–2021)

Location	Number_1990	ASR_1990	Number_2021	ASR_2021	EAPC_95%CI
Prevalence					
Global	47949599.9 (42267752.5–54859773.6)	865.9 (768.8–980.8)	66483473.1 (59240737.9–74912351)	868.2 (770.1–983.9)	0.01 (0.01–0.02)
High SDI	6828858.4 (6218360.8–7448623.8)	816.4 (741.8–894.9)	8028033.9 (7361520.3–8706736.6)	811.8 (743.9–881.5)	–0.03 (–0.04—0.02)
High-middle SDI	8837628.8 (7835142.3–9968301.7)	845.5 (751.8–956.7)	9746756.4 (8635392–10849931.6)	823.1 (731.4–930.9)	–0.07 (–0.08—0.06)
Middle SDI	14916607.3 (13027199.4–17217750)	823.4 (727.2–937.6)	19408812.5 (17170607.7–21832234)	831.3 (734.3–945.6)	0.04 (0.03–0.04)
Low-middle SDI	12139945 (10535794.1–14101397.4)	938 (826.5–1070.8)	18325173.9 (16084595.1–21033948.4)	940.3 (829.4–1072)	0.01 (0.01–0.01)
Low SDI	5181387.9 (4475888.7–6050860.2)	889.7 (787.1–1010.7)	10923086.1 (9462523.4–12737026.4)	880.8 (779.4–1001)	–0.03 (–0.03—0.03)
Andean Latin America	335866.8 (291660.5–391343.6)	809 (715.9–926.7)	528249.5 (466691–602119.3)	807.4 (714.5–924.8)	–0.01 (–0.01—0.01)
Australasia	179587.1 (158058.7–200698.8)	913.3 (800.7–1030.8)	263445.1 (231811.5–296231.2)	913.6 (800.9–1031.5)	0 (0–0)
Caribbean	296288.3 (259762.6–341187.5)	809.6 (716.3–927.4)	367985.9 (327375.3–417346.4)	808.6 (715.5–926.2)	0 (–0.01–0)
Central Asia	806048.8 (700837.8–939089.1)	1055.5 (930–1211.7)	1012588 (890717.7–1166158.1)	1051.2 (926–1207.3)	–0.01 (–0.01—0.01)
Central Europe	1314862 (1172858.9–1476105.3)	1136.5 (1012.9–1293.1)	1074238.6 (974176.5–1174861.1)	1123.2 (1011–1259.4)	–0.02 (–0.03—0.01)
Central Latin America	1498305.6 (1295470.7–1748451.1)	833.1 (734.9–950.7)	2034889.9 (1802073.3–2308852.6)	833.1 (734.9–950.8)	0 (0–0)
Central Sub-Saharan Africa	520618.6 (447850.9–611751.3)	810.3 (716.8–928.2)	1250244.9 (1075069.7–1468729.4)	809.6 (716.2–927.2)	0 (0–0)
East Asia	9395337.9 (8171870.5–10725167.5)	757.9 (668.2–859.6)	10197608.3 (9018535.7–11352663.7)	755 (666–855.9)	–0.01 (–0.01—0.01)
Eastern Europe	2335239.8 (2075309.7–2656041.3)	1107.1 (974.7–1273.5)	1955545.7 (1735832.1–2202028.6)	1104.1 (971.7–1270.4)	–0.01 (–0.01–0)
Eastern Sub-Saharan Africa	1855118.2 (1587751.2–2185011.9)	826.7 (730.6–944.8)	3937339 (3395051.1–4624174.5)	826.4 (730.3–944.7)	0 (0–0)
High-income Asia Pacific	1294552.5 (1145642–1453565.7)	800.9 (708–910.4)	1247414.3 (1103087.8–1392996.1)	795.2 (702–905.8)	–0.02 (–0.02—0.02)
High-income North America	2361733.8 (2223624–2507285.9)	889.2 (833.4–949.2)	2966538.6 (2823147.4–3120305.8)	907.4 (856.6–962.3)	0.02 (0–0.03)
North Africa and Middle East	3503700.3 (3037752.7–4065357.7)	935.3 (824.6–1059.5)	5879513.1 (5167959.6–6683121.6)	936.1 (825.8–1058.6)	0 (0–0)
Oceania	51493.7 (44324.7–60285)	716.5 (633.8–820.6)	105967.3 (92170.1–123055.4)	716.3 (633.6–820.4)	0 (0–0)
South Asia	11932924.2 (10323453.1–13902832.5)	981.1 (865–1118.1)	18051767.7 (15889938–20618136.7)	991 (874.1–1128.3)	0.03 (0.03–0.04)
Southeast Asia	3821404.1 (3267811.5–4440115.2)	770.4 (673.9–879)	5282580.7 (4652156.7–6016038.8)	772.3 (675.8–881.4)	0.01 (0.01–0.01)
Southern Latin America	387682.7 (341594.2–440738)	774.8 (684.8–880.5)	490657 (435787.8–551958)	773.2 (683.4–878.8)	–0.01 (–0.01–0)
Southern Sub-Saharan Africa	485413.8 (419333–566402.9)	844.5 (745–965.3)	684103.9 (599944.4–784385.8)	842.7 (743.6–962.5)	–0.01 (–0.01—0.01)
Tropical Latin America	1370264 (1188818.7–1596515.2)	853.5 (752.5–974.2)	1832023.6 (1619863.4–2063092.8)	852.8 (752.1–973.3)	0 (0–0)

Table I. Cont.

Location	Number_1990	ASR_1990	Number_2021	ASR_2021	EAPC_95%CI
Western Europe	2339998.3 (2095507.9–2592739.8)	591.5 (528–657)	2676140.8 (2391111.9–2999731.8)	594.2 (530.1–659.6)	0.01 (0.01–0.02)
Western Sub-Saharan Africa	1863159.3 (1600576–2187657.4)	829.4 (732.2–947.3)	4644631.2 (3988325.1–5458941.4)	832.9 (735.2–950.6)	0.02 (0.01–0.02)
Incidence					
Global	84870287.7 (74471430.3–96206256.1)	1529.2 (1355.9–1720.4)	117014586.7 (104106687.5–131017655.6)	1533.7 (1358.4–1726.1)	0.01 (0.01–0.02)
High SDI	12013222 (10903535.7–13056847.9)	1440.5 (1305–1581.4)	14079257.9 (12902343.8–15194708)	1433.2 (1306.2–1562.7)	–0.03 (–0.03—0.02)
High-middle SDI	15562601.4 (13747970.3–17554842.8)	1493 (1319.1–1687.1)	17088012 (15281289.4–19039589.2)	1455.4 (1284.5–1643.6)	–0.06 (–0.08—0.05)
Middle SDI	26381570.2 (22861494.2–30152041)	1455.2 (1279.8–1647.5)	34111958.3 (30322915.2–38259154.4)	1470.2 (1296.8–1664)	0.04 (0.04–0.05)
Low-middle SDI	21567075 (18626717.1–25121343.4)	1655.9 (1460.8–1877.5)	32280117.6 (28340844–36817198.1)	1659.3 (1463.9–1881.7)	0.01 (0.01–0.01)
Low SDI	9266175.6 (7987866.1–10818998.1)	1568.8 (1384.3–1772.9)	19364373 (16701703.8–22431478.8)	1553.2 (1369.3–1755.9)	–0.03 (–0.03—0.03)
Andean Latin America	595604.8 (513146.3–688782.9)	1427.7 (1254–1619.5)	930801.8 (815403.2–1052997.1)	1425 (1251.8–1616.5)	–0.01 (–0.01—0.01)
Australasia	314973.3 (275399.2–353096)	1606.4 (1409.7–1807.2)	460469.2 (408743.6–514989.3)	1606.9 (1410.4–1807.1)	0 (0–0)
Caribbean	524579.5 (456668.5–597897.7)	1428.8 (1254.9–1620.6)	647900.1 (572969.6–731077.7)	1427.1 (1253.5–1618.7)	0 (–0.01–0)
Central Asia	1425004.4 (1233438.3–1662470.7)	1858.4 (1631.9–2128.1)	1785237.3 (1564393.1–2047034.3)	1850.8 (1624.9–2118.6)	–0.01 (–0.01—0.01)
Central Europe	2302245.2 (2054412.4–2577093.1)	2002 (1779.1–2256.8)	1882131.2 (1718275.9–2059994.6)	1978.6 (1775.5–2205.4)	–0.02 (–0.03—0.01)
Central Latin America	2656877.9 (2287219.5–3065669.6)	1470.5 (1294–1672.2)	3575563.6 (3160408.2–4044192.6)	1470.6 (1294.4–1672.1)	0 (0–0)
Central Sub-Saharan Africa	934445.5 (800962.2–1098296.3)	1429.9 (1256.1–1621.8)	2216273.7 (1896766.9–2587924.2)	1428.7 (1255.1–1620.5)	0 (0–0)
East Asia	16587890.5 (14438709.1–18827803.7)	1340.6 (1174.9–1518.8)	17881000.8 (15888928.2–19889549.1)	1335.7 (1170.9–1512.8)	–0.01 (–0.01—0.01)
Eastern Europe	4089345.6 (3617805.4–4652994.9)	1950.4 (1712.7–2226.4)	3415281.2 (3055402.7–3852189.6)	1945.3 (1707.7–2221.1)	0 (–0.01–0)
Eastern Sub-Saharan Africa	3327060.6 (2846215.1–3899647.8)	1459.2 (1283.3–1657.6)	6982001.4 (5976343–8100225.9)	1458.7 (1283–1656.3)	0 (0–0)
High-income Asia Pacific	2269081.7 (2018885.6–2525975)	1413.2 (1246.7–1602.6)	2180386.5 (1945361.4–2415679.1)	1403.5 (1237.7–1592.6)	–0.02 (–0.02—0.02)
High-income North America	4167786.4 (3891444.1–4424307.7)	1569.6 (1461.6–1669.2)	5212824.6 (4928539.2–5490011.9)	1602.3 (1507.4–1697.2)	0.02 (0–0.04)
North Africa and Middle East	6205135.4 (5382133.1–7150075.1)	1648.2 (1454.9–1855.7)	10333263.8 (9078983.9–11654636.9)	1649.2 (1452.7–1854.3)	0 (0–0)
Oceania	91768.8 (78813.9–106141.5)	1267 (1110.9–1447.7)	188595.6 (163024.5–216049.9)	1266.6 (1110.7–1447)	0 (0–0)
South Asia	21174483.6 (18271044.9–24673949.1)	1732.9 (1532.9–1964.1)	31750830.1 (27981913.9–35987583.3)	1750.4 (1549.6–1983.8)	0.03 (0.03–0.04)
Southeast Asia	6781514.4 (5839077.7–7892179.8)	1364 (1195.7–1552.4)	9320761.1 (8169561.9–10598437.1)	1367.4 (1198.5–1557.1)	0.01 (0.01–0.01)
Southern Latin America	683546.7 (601402.1–776646.6)	1366.5 (1207.3–1546.2)	858760.1 (760580.3–964415.2)	1363.5 (1204.5–1542.9)	–0.01 (–0.01–0)

Table I. Cont.

Location	Number_1990	ASR_1990	Number_2021	ASR_2021	EAPC_95%CI
Southern Sub-Saharan Africa	860760.6 (740923.5–994835.1)	1490.6 (1313.6–1694)	1205698.4 (1054612–1374689.2)	1487.4 (1311.2–1690.6)	–0.01 (–0.01—0.01)
Tropical Latin America	2411698.5 (2087198.6–2772148)	1506.7 (1327.6–1709.3)	3225591.9 (2861312.6–3627287.4)	1505.5 (1326.6–1707.6)	0 (0–0)
Western Europe	4122693.6 (3696833.9–4549909.7)	1046.1 (934.2–1152.8)	4699073.4 (4215315.5–5224837.9)	1051 (938.2–1158.4)	0.02 (0.01–0.02)
Western Sub-Saharan Africa	3343790.7 (2865450.9–3893068.1)	1463.9 (1287.2–1664.7)	8262140.8 (7083539.9–9646574.6)	1470.1 (1293.7–1671.4)	0.02 (0.01–0.02)
Disability-adjusted life years					
Global	2883965.8 (1901100.8–4148606.8)	51.9 (34.2–74)	3980785.7 (2616526.4–5658916.6)	52.1 (34.2–74.6)	0.02 (0.02–0.03)
High SDI	407851.2 (271007.3–564299)	49.1 (32.5–68.4)	474107.6 (319807.7–654608.9)	48.7 (32.4–67.9)	–0.03 (–0.04—0.03)
High-middle SDI	531999.2 (351270.6–760869.8)	50.9 (33.6–72.9)	580992.2 (385870–812504)	49.7 (32.8–71.3)	–0.06 (–0.07—0.05)
Middle SDI	901697.2 (590647.7–1306059.3)	49.5 (32.6–71)	1163498 (766555.9–1651853)	50 (32.9–71.7)	0.05 (0.04–0.05)
Low-middle SDI	729194.5 (483601.9–1052096.7)	55.9 (36.7–79.6)	1100557.9 (723199.1–1586913.2)	56.3 (36.9–80.8)	0.03 (0.03–0.03)
Low SDI	310507.5 (205470.2–446798.2)	52.8 (34.9–75.1)	658544.7 (433933.5–954939)	52.6 (34.6–75.1)	0 (–0.01–0)
Andean Latin America	20323.9 (13208.7–29597.1)	48.6 (31.8–68.6)	31808.4 (20921.1–45536.3)	48.6 (32–69.5)	0.01 (0–0.01)
Australasia	10704.4 (7045.6–15127.2)	54.7 (36–77.3)	15592.6 (10334.1–21662)	54.7 (36.1–77.1)	0 (0–0.01)
Caribbean	17851.2 (11744.9–25768.6)	48.6 (32.1–69.3)	21976.7 (14679.9–30747.2)	48.4 (32.2–68.2)	–0.01 (–0.01—0.01)
Central Asia	48785.6 (32627.7–69669.1)	63.5 (42.5–90)	61169.1 (40654.7–86175)	63.4 (42.2–89.2)	0 (0–0)
Central Europe	78923.4 (52229.3–111608.9)	68.6 (45.6–97.4)	63712 (42613.3–88216.6)	67.9 (45–96.1)	–0.01 (–0.02–0)
Central Latin America	90783.8 (59452–130939.2)	50 (33–71.3)	122211.4 (79840.4–173929)	50.1 (33–71.4)	0 (0–0.01)
Central Sub-Saharan Africa	31223.9 (20575.7–44849.6)	48 (31.8–67.7)	75498.2 (49518.5–109722.9)	48.3 (31.7–69.1)	0.03 (0.03–0.04)
East Asia	569589.1 (374797.4–818972.7)	45.8 (30.2–65.5)	611099.3 (403293.1–851181.3)	45.7 (30.1–65.3)	0 (0–0)
Eastern Europe	139727.3 (92728.8–196473.1)	66.7 (44.1–94.6)	115877.9 (76979–162086.9)	66.6 (44.3–95.1)	0 (0–0.01)
Eastern Sub-Saharan Africa	111539.3 (73029.5–161214.5)	49.2 (32.5–70)	238191.7 (154681.7–345949.4)	49.5 (32.8–70.6)	0.03 (0.03–0.03)
High-income Asia Pacific	77771.7 (51197.6–109327.2)	48.4 (32–68.6)	73904.3 (49352.5–103065.6)	48.1 (31.6–69)	–0.02 (–0.02—0.02)
High-income North America	141244.6 (94985.3–193953.7)	53.5 (36–73.7)	175019.4 (119120.5–241261.7)	54.4 (36.6–75.7)	0.01 (–0.01–0.02)
North Africa and Middle East	211870.3 (140472.2–301189.5)	56 (36.9–79.1)	353237.2 (231209.4–499205.3)	56.1 (36.8–79.2)	0.01 (0.01–0.01)
Oceania	3109.2 (2035.5–4580.5)	42.9 (28.3–61.8)	6409.4 (4240.7–9370.7)	43 (28.4–61.6)	0.01 (0.01–0.01)
South Asia	714744.7 (473850.6–1029626.7)	58.3 (38.5–83.2)	1080670.7 (710574.2–1561556.5)	59.2 (38.9–85.5)	0.05 (0.05–0.06)

Table I. Cont.

Location	Number_1990	ASR_1990	Number_2021	ASR_2021	EAPC_95%CI
Southeast Asia	231228.1 (151002.2–338049.8)	46.3 (30.3–66.4)	318322.3 (209660.5–457172.6)	46.5 (30.6–66.9)	0.02 (0.02–0.03)
Southern Latin America	23283.7 (15217.8–33167.4)	46.5 (30.4–66.3)	29271 (19248.3–41645.1)	46.4 (30.5–66.5)	0 (–0.01–0)
Southern Sub-Saharan Africa	29277.5 (19158.1–42295.2)	50.5 (33.1–72.3)	40889.1 (26981.3–57895.1)	50.2 (33.3–70.9)	–0.01 (–0.02—0.01)
Tropical Latin America	82310.9 (53880.2–117737.9)	50.9 (33.7–72.7)	108928.7 (71558–152535.6)	51 (33.5–72)	0.01 (0.01–0.01)
Western Europe	137865.6 (92158.1–190280.7)	35.2 (23.3–48.8)	156547.1 (105210.9–215997.8)	35.3 (23.5–49)	0.02 (0.01–0.02)
Western Sub-Saharan Africa	111807.8 (73566.7–161005.1)	49.3 (32.6–70.3)	280449.1 (182820.1–406223.3)	49.8 (32.8–70.9)	0.04 (0.03–0.05)

66.5 million cases by 2021. The ASPR demonstrated a modest increase from 865.9 per 100,000 in 1990 to 868.2 per 100,000 in 2021, with an EAPC of 0.01 (95% CI: 0.01–0.02) (Table I, Figure 1).

Similarly, incident cases showed marked expansion, with global numbers increasing from 84,870,287.7 in 1990 to 117,014,586.7 in 2021. The ASIR showed a slight rise from 1529.2 per 100,000 in 1990 to 1533.7 per 100,000 in 2021, with an EAPC of 0.01 (95% CI: 0.01–0.02) (Table I, Figure 1). Regarding disease burden, the global age-standardized DALY rate was 52.1 per 100,000 (95% CI: 34.2–74.6), with an EAPC of 0.02 (95% CI: 0.02–0.03) (Table I, Figure 1), indicating a small but consistent increase in disease burden over time.

Regional level

The analysis of urticaria burden across SDI regions in 2021 revealed several key patterns. Low-middle SDI regions showed the highest burden across all metrics, while high SDI regions demonstrated the lowest overall rates. High-middle SDI regions experienced the greatest decrease in all health indicators from 1990 to 2021, with ASIR declining from 1,493 to 1,455.4 per 100,000. Both middle and low-middle SDI regions showed increases, with middle SDI ASIR increasing from 1,455.2 to 1,470.2 per 100,000, and low-middle SDI ASIR rising from 1,655.9 to 1,659.3 per 100,000. Women consistently showed higher rates across all SDI groups, while men in high SDI regions maintained the lowest rates. Among females, those in middle SDI regions consistently exhibited the lowest rates. These patterns highlight significant sociodemographic and gender-based disparities in urticaria burden globally.

Regional analysis of urticaria burden in 2021 demonstrated marked geographic variations. Central Europe recorded the highest ASPR at 1,123.2 per 100,000, followed by Eastern Europe and Central Asia, while Western Europe had the lowest at 594.2 per 100,000. South Asia showed the strongest increase in prevalence (EAPC: 0.03), contrasting with High-income Asia Pacific's significant decrease (EAPC: –0.02). For ASIR, Central Europe led with 1,978.6 cases per 100,000, while Western Europe reported the lowest at 1,051 per 100,000. The EAPC trends for incidence paralleled those of prevalence, with South Asia showing the highest increase and High-income Asia Pacific the largest decline. Age-standardized DALY rates exhibited similar patterns, with Central Europe reporting the highest (67.9 per 100,000) and Western Europe the lowest (35.3 per 100,000). South Asia demonstrated the strongest upward trend in DALYs (EAPC: 0.05), while High-income Asia Pacific showed the most significant decrease.

National level

At the national level, the 2021 data reveal striking variations in urticaria burden across countries. Nepal emerged as the country with the highest ASIR, ASPR, and age-standardized DALY rates simultaneously. In stark contrast, Portugal consistently demonstrated the lowest figures across these three metrics (Figures 3–5, Supplementary Table SI–SIII). The EAPC in prevalence showed the most significant upward trend in Kuwait, while Equatorial Guinea and Poland exhibited the steepest decreasing trends. Among the 204 countries and territories analyzed in 2021, there was substantial variation in urticaria burden. For ASIR, Portugal had the lowest rate at 843.6 per 100,000 population (95% UI: 741.5–956.4), while Nepal showed the highest at 2,594.7 per 100,000 population (95% UI: 2,289.1–2,838.4). The pattern was similar for DALYs, with Portugal reporting the lowest age-standardized rate at 27.7 per 100,000 people (95% UI: 18.4–38.8), and Nepal showing the highest at 88.4 per 100,000 people (95% UI: 57.1–124.9). The absolute numbers of DALYs

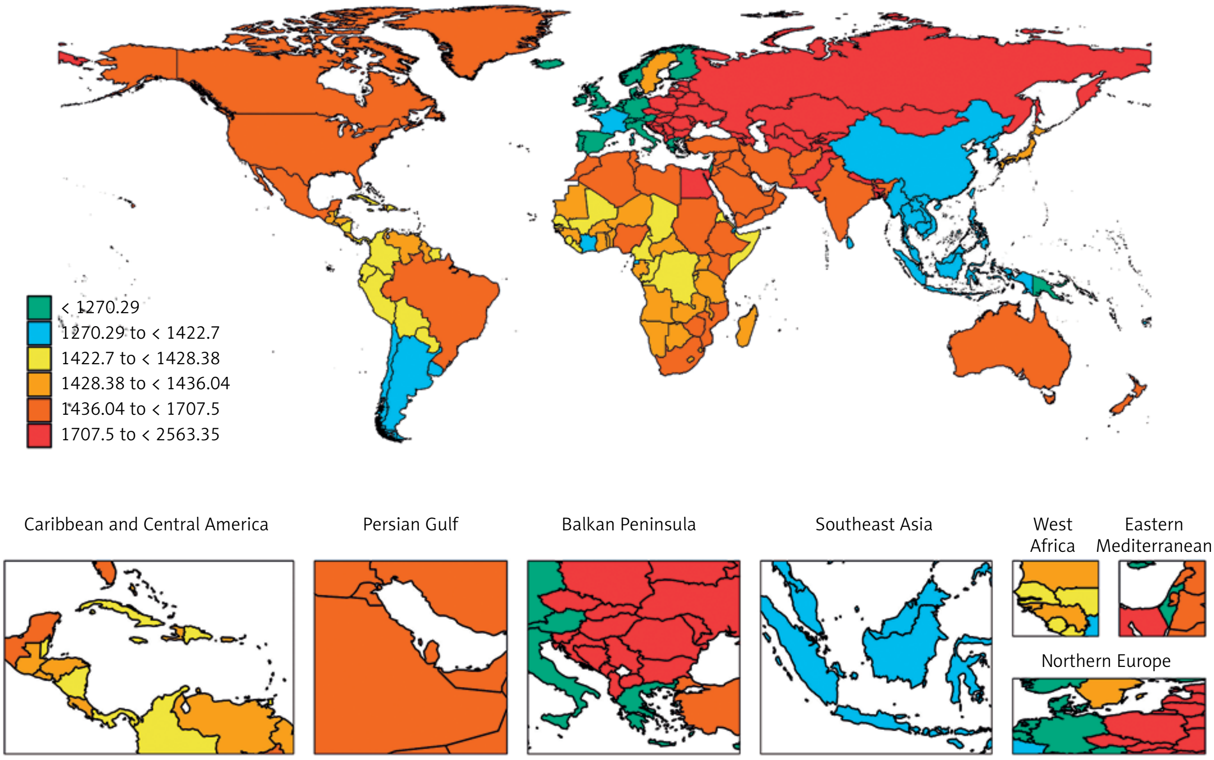

Figure 4. Global disease burden of urticaria incidence rate for both sexes in 204 countries and territories in 2021

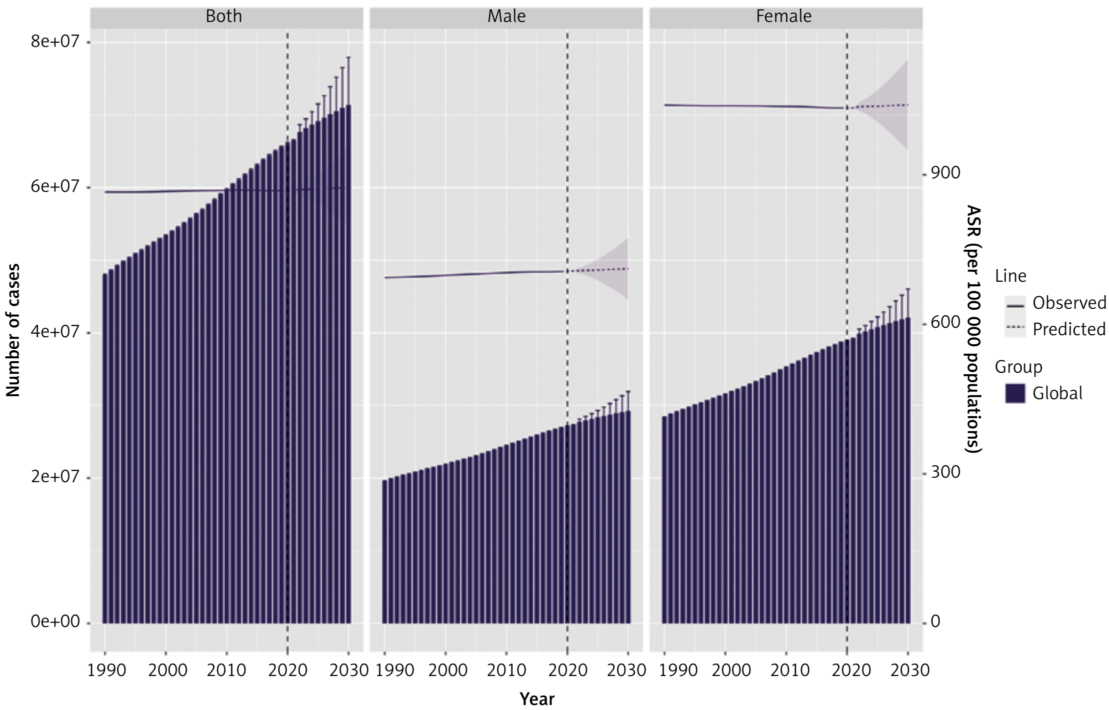

Figure 5. Future forecasts of GBD in urticaria prevalence

ranged dramatically, from a mere 0.6 (95% UI: 0.4–0.8) in Tokelau to an overwhelming 758,210.3 (95% UI: 497,902.1–1,090,861.4) in India, underscoring the vast differences in population size and disease burden across nations.

Age and sex patterns

In 2021, urticaria prevalence demonstrated distinct age and gender patterns. Children under 5 years showed the highest prevalence rates globally, with rates progressively declining as age increased (Figure 3). Throughout most age groups, females maintained higher prevalence rates compared to males. The gender disparity diminished in the oldest age group (90+ years), where prevalence rates became similar between males and females. Notably, when compared to 1990, the age group of 25–69 years showed an interesting shift: prevalence rates for females decreased, while those for males increased. This trend suggests a changing pattern in urticaria prevalence across genders within this specific age range over the 32-year period. Compared to global levels, high SDI regions exhibited more pronounced gender disparities in prevalence rates across various age groups. However, in children under 5 years old, both genders showed the highest prevalence rates with minimal differences between them. Notably, in economically advanced high SDI and high-middle SDI regions, prevalence rates for most age groups were lower in 2021 than in 1990. This pattern suggests that while gender differences in urticaria prevalence persist and are more marked in developed areas, there has been an overall improvement in prevalence rates over the three decades, particularly in more affluent regions. In 2021, the global incidence rates of urticaria were highest among children under the age of five, with a general trend of decreasing rates as age increased. Across most age groups, females exhibited higher incidence rates compared to males. However, this gender disparity diminished in the oldest age category, with individuals aged 90 years and above showing similar incidence rates for both males and females. This pattern highlights the age-dependent nature of urticaria onset and the shifting gender dynamics in incidence rates across the lifespan. In the high-middle SDI regions, a notable trend emerged for females aged 10 to 79 years. The incidence rate for this demographic showed a significant decrease compared to 1990 levels. The DALY rates analysis revealed a trend similar to that of prevalence, with DALYs decreasing with age. Compared to 1990, the DALYs for urticaria in 2021 showed distinct age-related trends. For children aged 0–9 years, there was an increase in DALYs, indicating a higher burden of disease in this young age group. In contrast, for individuals aged 15–84 years, DALYs decreased compared to 1990 levels. The consistent observation of higher prevalence and incidence rates among females across most age groups prompts further exploration of the underlying mechanisms driving these gender differences. While hormonal influences, such as estrogen's role in modulating allergic responses, and behavioral factors, such as differential healthcare-seeking patterns, may contribute, immunological mechanisms likely play a significant role. Females may exhibit a heightened Th2 immune response, characterized by increased production of interleukins (e.g., IL-4, IL-5) that promote allergic inflammation, potentially amplifying urticaria susceptibility and severity compared to males, who tend toward a Th1-dominant profile [4–7]. This sex-based immunological divergence could be linked to X-chromosome-encoded genes, such as those regulating immune cell function, which may predispose females to enhanced mast cell activation and histamine release – key processes in urticaria pathogenesis. Additionally, differences in innate immunity, including variations in toll-like receptor expression or skin barrier function, might exacerbate female vulnerability to environmental triggers. These immunological factors could interact with hormonal fluctuations (e.g., during puberty or pregnancy) and behavioral tendencies (e.g., greater exposure to allergens through cosmetic use), compounding the observed gender disparity [8]. Such mechanisms warrant further investigation to fully elucidate their contribution relative to hormonal and behavioral influences, potentially informing targeted therapeutic strategies.

Future forecasts of global burden of urticaria

Future forecasts from the GBD study depicted in Figure 5 reveal stable global urticaria ASPR trends. The data demonstrate a sustained higher burden among females compared to males throughout the projected period. This gender-based difference manifests not only in prevalence but also in ASIR and age-standardized DALYs, as illustrated in Supplementary Figures S3 and S4. Based on these epidemiological findings, healthcare providers and researchers should consider implementing sex-specific strategies for urticaria treatment and investigation. However, while the BAPC approach is robust for short- to medium-term forecasts, its limitations in long-term prediction accuracy merit consideration. One key limitation is its reliance on the assumption that past trends in age, period, and cohort effects will persist, which may not hold if significant epidemiological shifts – such as breakthroughs in treatment, changes in environmental exposures, or alterations in diagnostic practices – occur beyond 2021. Additionally, the model's precision depends on the quality and consistency of historical data, which can vary across regions, particularly in low SDI settings with sparse or imputed inputs. Over extended time horizons, these uncertainties compound, potentially reducing accuracy as projections extrapolate further from the observed data.

Discussion

This comprehensive analysis of the GBD 2021 data provides an updated and detailed overview of the global, regional, and national burden of urticaria. Our findings reveal important trends and disparities in the prevalence, incidence, and DALYs associated with urticaria across different geographical regions, SDI quintiles, and age groups, and between sexes. These insights are crucial for informing health policy, resource allocation, and future research directions in the management of urticaria.

Global trends

Our analysis shows that while the absolute numbers of urticaria cases have increased substantially from 1990 to 2021, the age-standardized rates have remained relatively stable. This pattern suggests that population growth and aging are primary drivers of the increased absolute burden, rather than a rise in age-specific rates. This stability in age-standardized rates, despite significant demographic changes, can be attributed to several factors. First, the age-standardization methodology rigorously normalizes demographic shifts, enabling robust longitudinal analysis across different time periods. Second, the relatively consistent prevalence of common urticaria triggers – including environmental allergens, pharmaceutical agents, and dietary factors – throughout the study timeframe may have contributed to the observed rate stability. Third, the counterbalancing effects of improved healthcare accessibility and diagnostic capabilities against advances in therapeutic management and preventive interventions likely resulted in the maintenance of relatively stable standardized rates over time. The slight increase in ASPR from 865.9 per 100,000 in 1990 to 868.2 per 100,000 in 2021, and in ASIR from 1529.2 per 100,000 to 1533.7 per 100,000 over the same period, indicates a marginal but consistent upward trend in the global burden of urticaria. These findings align with previous studies that have reported a stable or slightly increasing trend in urticaria prevalence over time [15]. The stability in age-standardized rates despite improvements in healthcare and increased awareness of allergic conditions is noteworthy and warrants further investigation into the underlying factors maintaining this burden. Possible explanations include improved diagnostic practices leading to better recognition of urticaria cases, changes in environmental factors or lifestyle habits that may offset potential improvements in management, and the chronic nature of some urticaria subtypes, which may contribute to persistent prevalence rates. However, this stability may also reflect broader epidemiological shifts beyond demographic changes alone. Improvements in healthcare access, particularly in high and high-middle SDI regions, could enhance case detection and reporting, potentially counteracting reductions in true incidence or prevalence that better management might achieve. Evolving diagnostic criteria, such as those outlined in international guidelines updated over the study period, may have refined the identification of urticaria, increasing reported rates without a corresponding rise in underlying disease frequency. Additionally, environmental factors – such as rising pollution levels, climate change-induced allergen proliferation, or shifts in dietary patterns – could contribute to sustained or slightly increased rates by triggering urticaria in susceptible populations. These factors may interact with population growth and ageing, complicating the attribution of stability solely to demographic trends, and suggest a dynamic interplay of extrinsic influences that merits deeper exploration in future research.

The global age-standardized DALY rate of 52.1 per 100,000 in 2021 underscores the significant impact of urticaria on quality of life and productivity. While this figure may seem modest compared to some other chronic conditions, it is important to consider the high prevalence of urticaria and its often underestimated impact on daily functioning and well-being [16]. The persistent burden of urticaria, as reflected in the DALY rates, highlights the need for continued efforts in improving management strategies and developing more effective treatments.

Our analysis revealed distinct age-related patterns in the burden of urticaria, with the highest prevalence and incidence rates observed in children under 5 years of age, and a general trend of decreasing rates as age increased. This pattern aligned with previous studies suggesting that urticaria often manifests in early childhood [17]. The high burden in young children may be attributed to several factors, including the developing immune system, increased environmental exposures, food allergies, and susceptibility to infectious triggers [18–21].

Our findings showed a higher prevalence of urticaria among females compared to males, which is consistent with previous epidemiological studies. The observed gender disparity can be explained by several potential mechanisms. First, hormonal factors, particularly estrogen, may play a crucial role in modulating immune responses and inflammatory processes involved in urticaria development. Second, differences in healthcare-seeking behaviors between males and females might contribute to this disparity, as females generally demonstrate higher rates of medical consultation. Third, females may have increased exposure to certain urticaria triggers through occupational and lifestyle factors. Additionally, genetic and immunological differences between genders could influence disease susceptibility and manifestation [22, 23].

Regional trends

Our analysis revealed significant regional variations in the burden of urticaria, with low-middle SDI regions consistently showing the highest age-standardized prevalence, incidence, and DALY rates, while high SDI regions demonstrated the lowest. This inverse relationship between SDI and urticaria burden is intriguing and may be attributed to several factors. The hygiene hypothesis suggests that the more sanitized environments typically found in high SDI countries might paradoxically provide some protection against the development of urticaria [24]. Differences in healthcare access and quality across SDI quintiles likely play a role, with high SDI regions generally having more advanced healthcare systems, potentially leading to better management and control of urticaria symptoms, thereby reducing its overall burden [25]. Environmental factors such as pollution, which tend to be more prevalent in rapidly developing low-middle SDI regions, may contribute to the higher incidence and prevalence of urticaria in these areas [26]. Dietary factors, genetic predisposition, and variations in lifestyle may also contribute to these regional differences. To further elucidate the high burden in low-middle SDI regions, specific environmental, genetic, and socioeconomic factors warrant closer examination. Environmental conditions, such as elevated exposure to air pollution from industrial growth or biomass burning, common in low-middle SDI regions such as South Asia and parts of Sub-Saharan Africa, could exacerbate urticaria by triggering allergic responses or skin irritation in vulnerable populations. Genetic factors may also contribute, as populations in these regions might exhibit a higher prevalence of polymorphisms associated with atopic conditions, increasing susceptibility to urticaria compared to high SDI populations with different genetic profiles. Socioeconomically, limited access to dermatological care and antihistamine treatments in low-middle SDI settings – often due to inadequate healthcare infrastructure, low income levels, or supply chain challenges – may result in prolonged symptom duration and higher DALYs, as untreated or poorly managed cases persist. Additionally, overcrowding and poor sanitation, prevalent in urbanizing low-middle SDI areas, could heighten exposure to infectious triggers or allergens, further elevating the burden. These factors contrast with high SDI regions, where better environmental regulations, genetic diversity from varied ancestry, and robust healthcare systems likely mitigate urticaria severity and prevalence.

Geographic analysis of urticaria burden reveals distinct regional patterns, with South Asia experiencing the most substantial impact across ASIR, ASPR, and age-standardized DALY metrics. In contrast, Western Europe and High-income North America reported comparatively lower rates, while Sub-Saharan Africa and Southeast Asia maintained elevated disease burdens. Multiple factors likely contribute to these regional disparities, including environmental conditions, genetic factors, cultural practices, healthcare accessibility, and socioeconomic determinants.

National trends

The striking variations in urticaria burden at the national level provide valuable insights for targeted interventions and resource allocation. Nepal emerged as the country with the highest ASIR, ASPR, and age-standardized DALY rate, while Portugal consistently demonstrated the lowest figures across these metrics. Other countries with notably high burdens included Bangladesh, Pakistan, and several countries in Sub-Saharan Africa. Countries in Western Europe, North America, and parts of East Asia generally showed lower burdens. Several factors may contribute to these national disparities, including genetic predisposition, with certain populations potentially having a higher genetic susceptibility to urticaria. Environmental factors, such as local climate, pollution levels, and exposure to specific allergens or irritants, can vary significantly between countries. National cuisine and food consumption patterns may influence the prevalence of food-induced urticaria. The quality of healthcare, availability of specialist care, and access to effective treatments can greatly impact the management and burden of urticaria. Socioeconomic factors, including national income levels, urbanization, and living conditions, can affect exposure to triggers and access to care. Certain cultural habits or traditional remedies may also influence the development or management of urticaria [27–29].

The relative stability of global age-standardized rates over the 1990–2021 period, coupled with our future projections, suggests that the burden of urticaria is likely to persist in the coming years. Several factors may influence future trends in urticaria burden, including climate change, urbanization, advances in treatment, changing diagnostic criteria, population aging, and global health initiatives [30–33]. These factors underscore the need for continued research, improved management strategies, and targeted public health interventions to address the persistent burden of urticaria across diverse populations and settings.

These findings highlight the need for targeted interventions in regions with high disease burden. Based on our analysis, we propose several specific policy recommendations: (1) strategic resource allocation to high-burden regions, including the establishment of specialized urticaria care centers and training programs for healthcare providers; (2) implementation of standardized diagnostic and treatment protocols to ensure consistent quality of care across different healthcare settings; (3) development of region-specific health education programs to improve disease awareness and early recognition; (4) enhancement of healthcare accessibility through telemedicine initiatives, particularly in underserved areas; and (5) creation of national registries to better monitor disease patterns and treatment outcomes. These interventions should be tailored to local healthcare infrastructure and socioeconomic conditions while maintaining consistency with international guidelines.

This research faces several methodological limitations that warrant consideration. First, our reliance on insurance claims data likely underestimates the true prevalence of urticaria, as it excludes cases managed in outpatient settings, those seeking alternative treatments, and individuals without insurance coverage. Second, our dataset lacks differentiation between acute and chronic urticaria subtypes, which limits our ability to assess the specific burden of each condition and their respective healthcare needs. Third, potential regional bias exists due to underrepresentation of certain populations, particularly in rural areas and among socioeconomically disadvantaged groups who may have limited access to healthcare services. This limitation is particularly significant as it introduces selection bias that likely affects our burden estimates, especially in low and low-middle SDI regions where healthcare access disparities are more pronounced. In these settings, individuals with limited financial resources, those living in remote areas, or marginalized populations may face substantial barriers to receiving urticaria diagnosis and treatment. Consequently, our reported figures may substantially underestimate the true burden among these vulnerable populations. Furthermore, this selection bias may artificially diminish the observed disparity between high and low SDI regions, as the most affected individuals in low-resource settings might remain entirely uncounted within formal healthcare systems. Additionally, diagnostic inconsistencies arise from the predominance of emergency doctors over dermatologists in urticaria diagnosis. Methodological hurdles include temporal shifts in prevalence and diagnostic criteria, alongside medical advancements, making it difficult to pinpoint causes of burden changes. Varied data collection methods and study designs contribute to result discrepancies.

In conclusion, our comprehensive analysis of the GBD 2021 data highlights the persistent global burden of urticaria, with notable regional, age-related, and gender-based disparities that underscore the need for targeted health policy responses. The stability of age-standardized rates amidst rising absolute case numbers, driven by population growth and aging, alongside higher burdens in low-middle SDI regions and among females, calls for strategic interventions to mitigate this condition's impact on quality of life and productivity. General strategies such as healthcare optimization and gender-specific treatments offer a foundational approach to addressing these challenges. To enhance practical applicability, we propose concrete recommendations building on these principles. For healthcare optimization, implementing routine screening programs for urticaria in primary care settings, particularly in low-middle SDI regions with high burdens, could facilitate early diagnosis and management, leveraging cost-effective tools such as patient symptom questionnaires and skin prick testing where resources permit. Targeted intervention programs, such as community-based antihistamine distribution initiatives in underserved areas, could reduce symptom duration and DALYs by improving access to first-line treatments. For gender-specific strategies, we recommend developing tailored treatment protocols for females, such as integrating anti-inflammatory therapies that address heightened Th2 immune responses, potentially identified through biomarker screening (e.g., IL-4 levels) during routine health checks. Additionally, public health campaigns aimed at women in high-prevalence age groups (e.g., 10–79 years) could promote awareness of urticaria triggers and encourage timely care-seeking, supported by educational materials distributed through maternal and child health programs. These specific measures, grounded in our findings, aim to translate epidemiological insights into actionable policies, enhancing resource allocation and intervention efficacy across diverse settings. Collectively, these efforts underscore the importance of continued research and policy innovation to alleviate the global burden of urticaria effectively.

Availability of data and materials

GBD study 2021 data resources are available online from the Global Health Data Exchange (GHDx) query tool (http://ghdx.healthdata.org/gbd-results-tool).

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Ethical approval

Not applicable.

Conflict of interest

The authors declare no conflict of interest.

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