SKIN

ORIGINAL RESEARCH

An Update on the Global Burden and Socioeconomics of Scabies: A Cross-Sectional Analysis from the Global Burden of Disease Study 2017

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ABSTRACT

Introduction: Scabies represents a significant burden worldwide, but epidemiologically, relation to socioeconomic status, and impact of recent global interventions remains largely unknown.

Methods: We analyzed global scabies trends from 2015 to 2017 in 195 countries worldwide through the Global Burden of Disease Study (GBD) database, including age-standardized prevalence rates, relationship to comorbidities, and age and sex patterns. We also compared scabies burden to a country's socioeconomic status by using disability-adjusted life years and socio-demographic index, respectively.

Results: The age-specific prevalence rate in 2017 demonstrated a right skewed distribution with a peak between 15 and 20 years of age, and a roughly equal male:female ratio across all ages. Scabies burden was higher in resource-poor countries. The world regions of Oceania, Southeast Asia, East Asia, and tropical Latin America had the greatest prevalence of scabies. The individual countries with highest scabies burden were Papua New Guinea (age-standardized DALYs 148.2), Solomon Islands (140.5), Kiribati (139.9), Timor-Leste (138.2) and the Maldives (134.9). A positive linear relationship exists between scabies burden and burden of rheumatic fever and bacterial skin disease.

Conclusion: The burden of scabies is highest in children, adolescents, tropical climates, and low-income countries. Rheumatic fever and bacterial skin disease burden is higher in areas where scabies burden is also higher. These global data may potentially serve as a purposeful measure for directing resources to improve the global burden of scabies.

INTRODUCTION

Common dermatoses represent a significant social impact worldwide with a few easily-treated disorders, such as scabies, disproportionately accounting for a greater amount of disability. Scabies is a parasitic infection of the skin caused by the mite *Sarcoptes scabiei* var. *hominis*. It is common worldwide, particularly in vulnerable populations including underprivileged societies, and institutional settings such as schools, nursing facilities, military camps, and prisons in resource-rich areas.

One measure of scabies disease morbidity is through disability-adjusted life years (DALYs), measured as Years of Life Lost due to premature mortality in the population plus the Years Lost due to Disability for people living with a health condition or its consequences.[1] One DALY can be thought of as one year of healthy life lost, and the sum of DALYs across a population is the burden of disease.[1] Furthermore, the socio-demographic index (SDI) was developed in 2016 to track key measures of socioeconomic development, predict health outcomes, monitor inequalities, and monitor the impact of interventions on health outcomes such as DALYs.[2,3] The SDI is a composite average of income per capita, years of schooling, and total fertility rate (TFR) used to identify where countries score on a spectrum of development on a scale of zero to one.[2] An SDI score of one represents the highest possible income per capita, greatest average number of years of schooling, and lowest TFR. Metrics such as DALYs and SDI may help dermatologists and key policy and decision makers interested in reducing global health disparities from scabies and its related comorbidities to focus their time and resources on interventions to help maximize public health impact.

A recent study showed scabies caused 0.18% of all DALYs in 2017, a decrease of 14% from the all global DALYs in 2015.[4,5] This decline is a promising sign of the impact of recent efforts, including the addition of scabies to the list of World Health Organization (WHO) Tropical Neglected Diseases in 2017, the formation of the International Alliance for the Control of Scabies in 2013, and the first consensus of a diagnostic criteria in 2018.[6,7] The relationship of scabies burden to socioeconomic status along with the indirect disability associated with scabies is important to consider. Infestation is frequently complicated by impetigo, cellulitis, and abscess due to *Streptococcus pyogenes* and *Staphylococcus aureus.*[6] Skin infection with *S. pyogenes* can also lead to the nonsuppurative complications of acute post-streptococcal glomerulonephritis and possibly acute rheumatic fever. Populations with higher scabies prevalence have increased rates of acute post-streptococcal glomerulonephritis leading to end-stage renal disease due to scabies lesions secondarily infected by *S. pyogenes*. These populations have also been impacted by the high mortality rate of *S. aureus* bacteremia associated with crusted scabies.[8] Global mortality is likely underestimated and a theoretical algorithm to estimate scabies-related burden has been proposed.[6]

In this observational cross-sectional analysis study, we show multiple global epidemiological and socioeconomic trends in scabies in 195 countries worldwide using the most current data from the 2017 Global Burden of Disease Study (GBD) database. We include age and sex patterns, scabies burden through DALYs, and provide comparisons to socioeconomic status. Furthermore, we investigate the relationship of scabies burden to the burden of comorbidities from secondary bacterial skin infections. This study aims to contribute to the growing body of research addressing global trends in scabies, especially in recent years following some positive interventions, and its potential relationship with socioeconomic status through GBD data.

METHODS

Our data was derived from publicly available GBD datasets from 2017. The GBD datasets provide data to compare the magnitude of diseases, injuries, and risk factors across

age groups, sexes, countries, regions, and time from 1990 to the present day for over 350 diseases in 195 countries.[9] The GBD project is led by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington in collaboration with over 3,600 researchers and over 145 countries worldwide.[9] An in-depth protocol is available from the IHME on data acquisition, and how it is incorporated, calculated, and published in the GBD study.[10]

We analyzed the annual percent change of scabies measured in DALYs per 100,000 in all 195 countries worldwide between 1990 and 2017 to comprise a list of the countries with the greatest increase and decrease (Table 1) in DALYs. We provided age patterns by sex and the total number of prevalent cases and age-specific prevalence rates of scabies on a global level and by region in 2017 (Figures 1 and 2). Age-standardized scabies DALYs per 100,000 were then compared to the absolute SDI values of all 195 GBD countries globally in 2017 (Figure 3). Statistical analysis of correlation between country wealth and scabies burden was performed using a two-tailed correlation analysis (Pearson's *r*) of the 2017 gross domestic product (GDP) per capita data from the World Bank and DALYs (World Bank). We estimated the burden of scabies compared to related comorbidities rheumatic fever and bacterial skin disease (Figure 4). Statistical analysis of correlation was again performed using a two-tailed correlation analysis using SPSS statistical software, version 25.0 (IBM Corp., Armonk, NY).

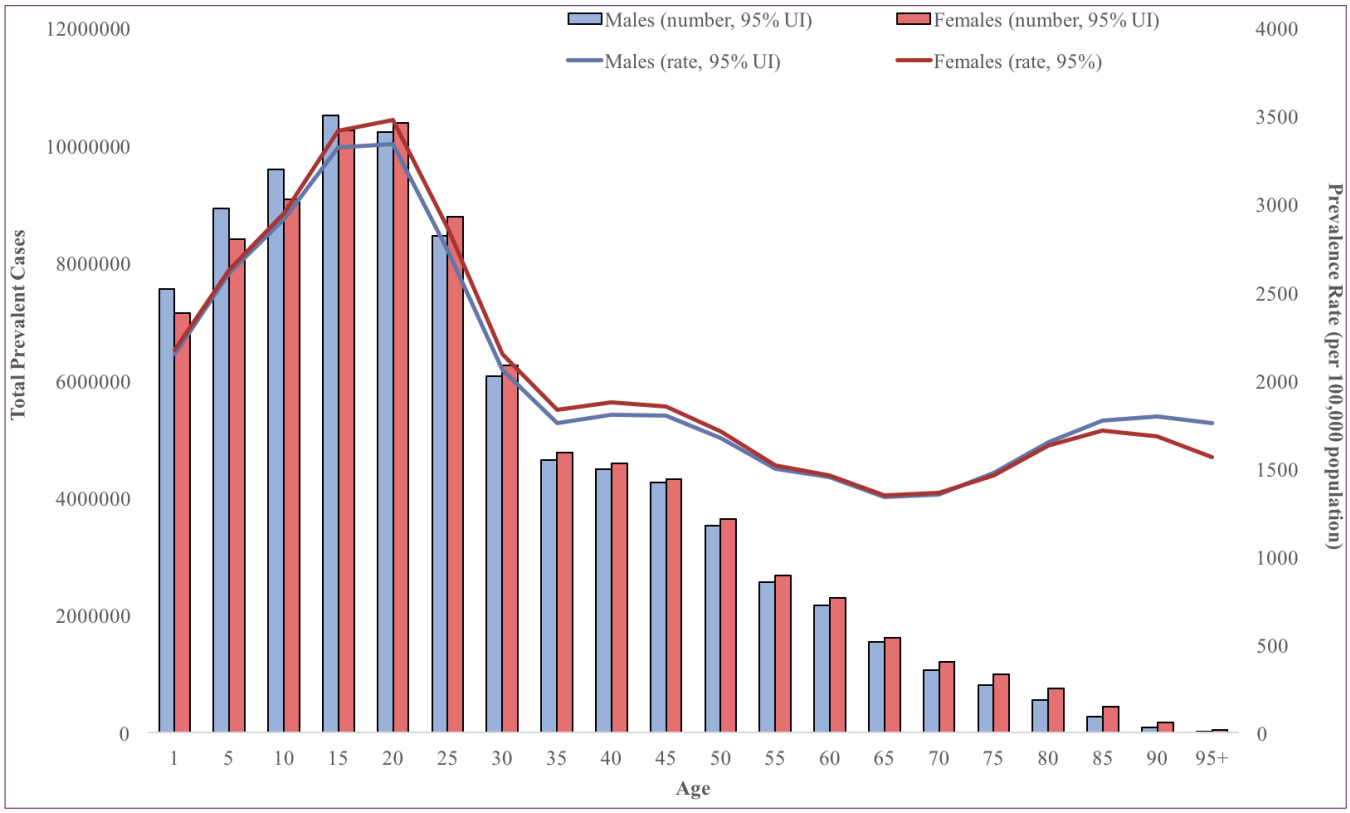
RESULTS

The age-specific scabies prevalence rates in 2017 demonstrated a right skewed distribution with a peak between 15 and 20 years of age, with roughly an equivalent number of males and females affected across all age groups (Figure 1). In a regional comparison of scabies prevalence by sex, Oceania ranked highest for both females (142 cases per 100,000) and males (146 cases per 100,000) (Figure 2). Southeast Asia ranked second (124 cases per 100,000 for females and males) and East Asia third (98 cases per 100,000 for females and males). Western Europe ranked lowest for both males and females (2 cases per 100,000). There does not appear to be a difference in prevalence between males and females in any particular region. A clustering of countries and regions with low SDI scores and high scabies DALYs, and vice versa, is seen when comparing age-standardized DALYs rates and SDI scores across all the countries surveyed by the GBD database in 2017 (Figure 3). Additionally, a moderate negative correlation

Table 1. Top 5 countries with greatest annual average percent increase and greatest annual average percent decrease of scabies from 2015 to 2017, measured in DALYs per 100,000.

Country	Average Annual % Change
Tanzania	0.87
Estonia	0.81
United States	0.45
American Samoa	0.36
Ghana	0.28
Fiji	-3.35
United Arab Emirates	-1.81
Timor-Leste	-1.75
Saudi Arabia	-1.53
The Maldives	-1.41

Figure 1: Age patterns by sex in 2017 of the total number of prevalent cases and age-specific prevalence rate of scabies at the global level.



(-0.58) was found between GDP per capita and scabies DALYs. The top five individual countries with the highest age-standardized DALY rates overall were Papua New Guinea (age-standardized DALYs 148.2), Solomon Islands (140.5), Kiribati (139.9), Timor-Leste (138.2) and the Maldives (134.9).

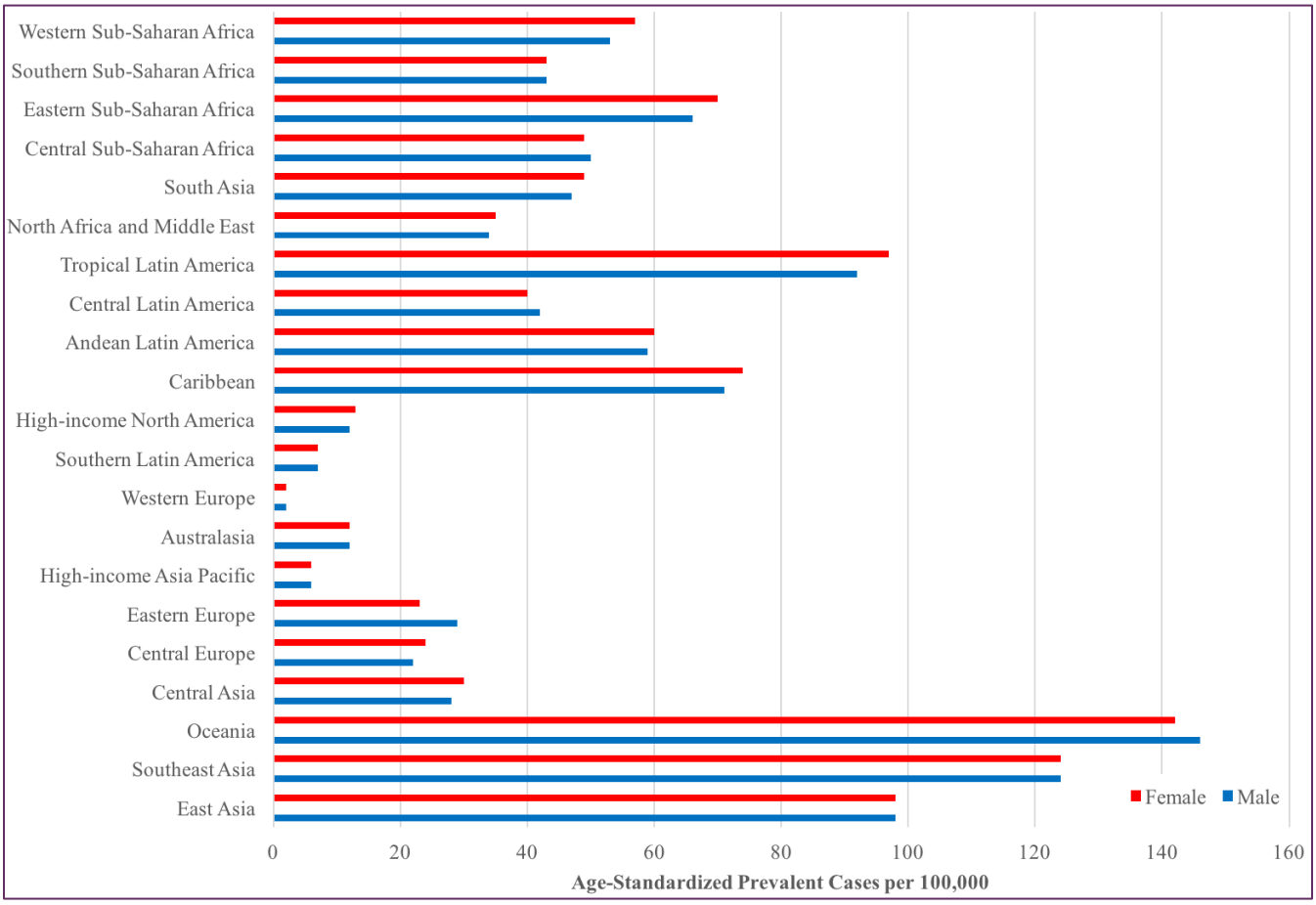
The countries with the greatest annual increase in DALYs from 2015 to 2017 include Tanzania (0.87), Estonia (0.81), United States (0.45), American Samoa (0.36), and Ghana (0.28). The countries with the greatest annual decrease in DALYs include Fiji (-3.35), United Arab Emirates (-1.81), Timor-Leste (-1.75), Saudi Arabia (-1.53), and the Maldives (-1.41).

When comparing scabies DALY rates and scabies comorbidity DALY rates across all 195 GBD countries in 2017, a positive linear relationship is seen with both rheumatic fever (r = 0.55) and bacterial skin disease (r = 0.46), both statistically significant at $p<0.05$ (Figure 4).

DISCUSSION

Scabies prevalence was highest among younger individuals, with a peak between 15 and 20 years of age. Geographically, scabies prevalence was highest in warmer, tropical climates. There was not a difference in prevalence between genders by age or regional comparisons. Our data also suggests that as country wealth decreases, scabies burden also increases. This concurs with previous studies demonstrating that overcrowding in hot tropical climates facilitates the rapid spread of the scabies mite. Low socioeconomic status can further

Figure 2: Age-standardized prevalence of scabies by sex and geographical region in 2017.



worsen disease burden for patients with scabies attributable to a lack of access to may contribute to a deficiency in timely and definitive management.[11]

Our results demonstrate a positive linear relationship between scabies burden and burden of rheumatic fever and bacterial skin infections. It is well documented that scabies infestation provides a portal of entry for bacteria, which supports our findings of higher burden of bacterial skin diseases in countries with higher burden of scabies. A previous study also demonstrated high rates of rheumatic heart disease in countries with high rates of scabies and impetigo, but low rates of streptococcal pharyngitis.[12] Confounding factors such as decreased healthcare in general, specialty care, and absence of public education, all of which access to healthcare, and thus antibiotic treatment may be considered in the development of rheumatic heart disease. However, a longitudinal study with an analysis adjusted for socio-economic status demonstrated that children aged 3 through 12 presenting for their first dental visit in Auckland, New Zealand with a diagnosis of scabies after enrollment had a 9-fold increase in acute rheumatic fever or chronic rheumatic heart disease compared to those without a scabies diagnosis.[13] Our results indicate a higher burden of rheumatic heart disease in those geographic areas of higher scabies burden, possibly attributable to skin co-infection with *S. pyogenes*, but this

Figure 3: Age-standardized DALYs rates from scabies by socio-demographic index (SDI) for 195 countries and territories in 2017.

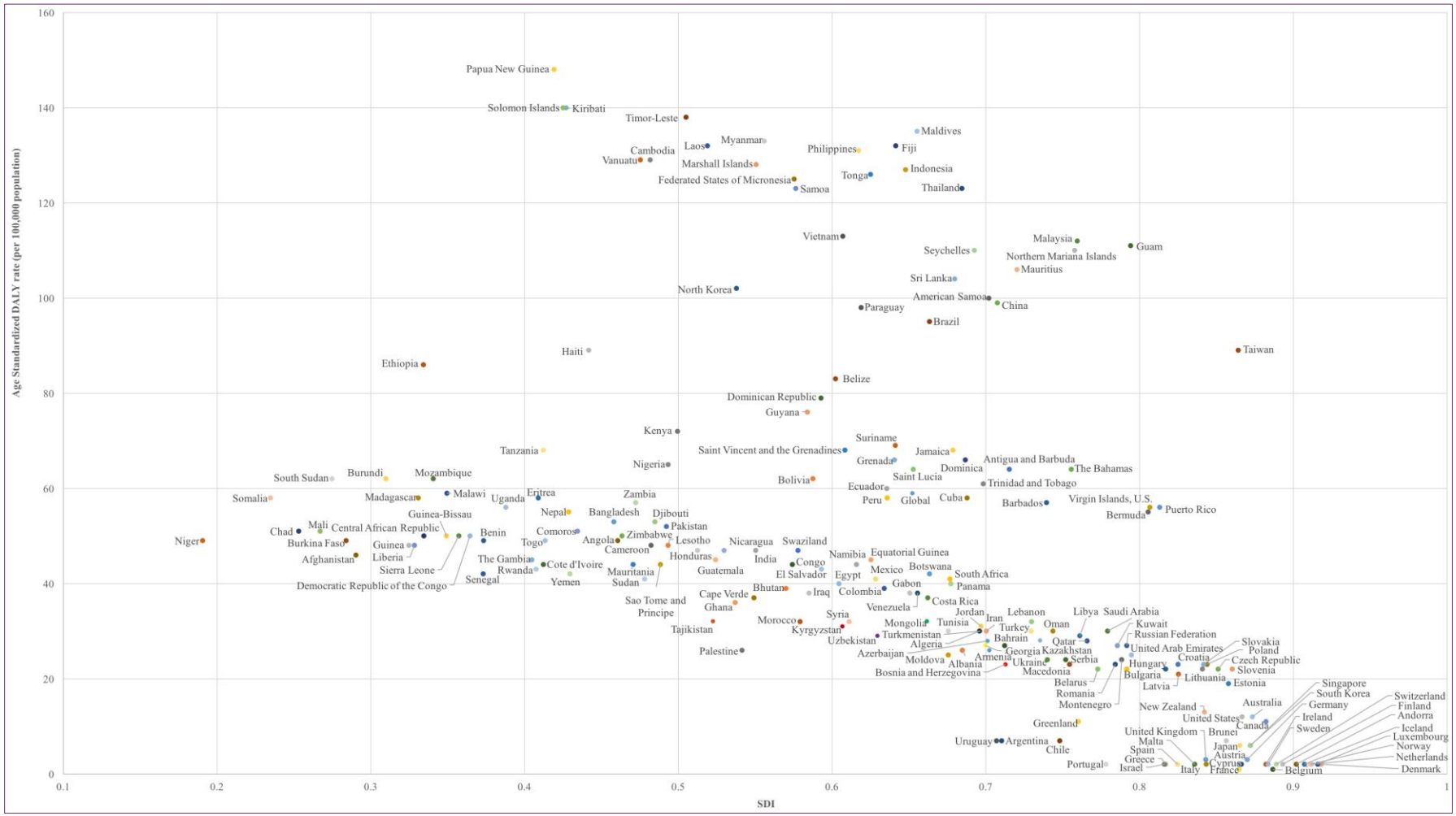
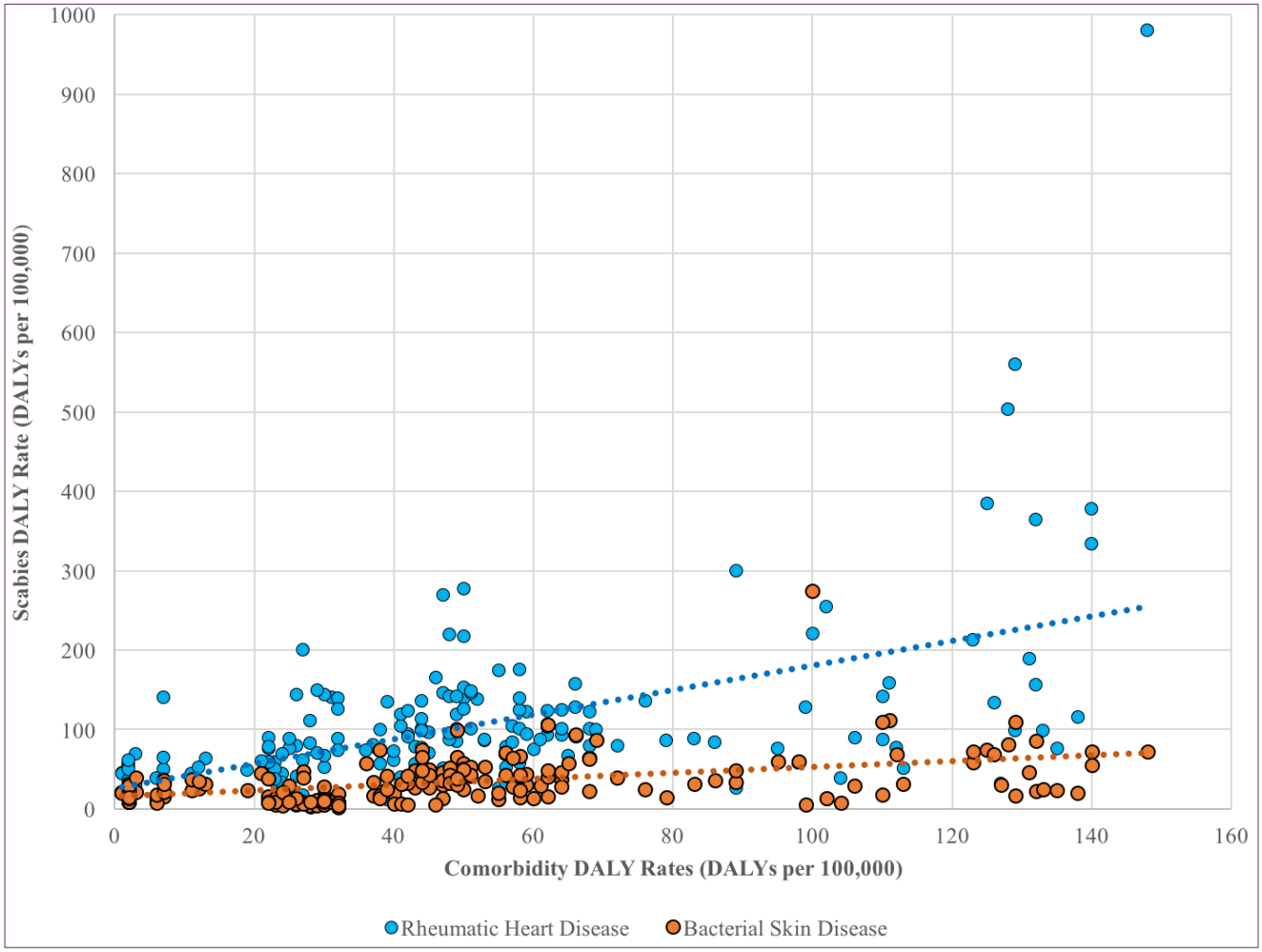


Figure 4: Scabies comorbidity DALY rates for rheumatic fever and bacterial skin disease, measured in DALYs per 100,000



relationship requires further examination.

The global contribution of scabies to DALYs from all diseases decreased from 0.21% in 2015 to 0.18% in 2017. Timor-Leste ranked third and Fiji fifth in 2015 for greatest scabies burden; both are in the top 5 countries with the greatest annual decline in scabies burden from 2015 to 2017. This data suggests that interventions currently underway in areas of high need are producing a positive impact. Perhaps the most impactful intervention has been the implementation of mass drug administration (MDA) in community-wide settings. In the SHIFT randomized trial, conducted in Fiji, ivermectin-based MDA reduced the prevalence of scabies by 94% at 12 months with sustained reductions demonstrated at 24 months.[14]

Limitations of the GBD Studies have been described, including inconsistent reporting of mortality by skin disease in assessing DALYs.[11] Disability only reflects a) symptoms such as itch and b) appearance including disfigurement, not capturing other complications such as secondary infection,

mental illness, etc. Additionally, the scabies burden estimates by the GBD only account for direct effects of scabies, not secondary complications such as bacterial infections, glomerulonephritis, and rheumatic fever. Although we also analyzed the burden estimates of rheumatic fever and bacterial skin diseases as they relate to scabies across all countries, there are confounding causes for these entities apart from scabies such as streptococcal pharyngitis. Regardless of these limitations, understanding the relationship between epidemiological factors, secondary complications, and socioeconomic status on geographical burden scabies is a valuable step in developing measurable, impactful, and sustainable interventions to reduce disease morbidity in both resource-rich and resource-poor countries.

CONCLUSION

Despite recent improvements, scabies continues to contribute to needless global suffering due to incorrect or delayed diagnosis, inadequate treatment, insufficient access to care, secondary complications, and social stigmatization. Dermatologists continue to face the challenge of raising global awareness and treating scabies to improve health care outcomes, quality of life and social inclusion. Lessons of success can be gleaned from countries with decreasing DALY rates, such as Fiji, and areas for improvement can be highlighted by countries with increasing DALY rates. Increased outreach, funding, collaboration, and development of new therapies are promising steps to overcome this challenge and reduce the global burden of scabies.

Abbreviations and Acronyms:
Disability adjusted life years (DALYs)
Global Burden of Disease Study (GBD)
Institute for Health Metrics and Evaluation (IHME)
Mass drug administration (MDA)
Socio-demographic index (SDI)
Total fertility rate (TFR)
World Health Organization (WHO)

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