

# Dermatoses of the Caribbean: Burden of skin disease and associated socioeconomic status in the Caribbean



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**Introduction:** Dermatologic disease represents a significant burden worldwide, but the regional effect of skin disease in the Caribbean and how it relates to socioeconomic status remain unknown.

**Objective:** This study aims to measure the burden of skin disease in the Caribbean from epidemiologic and socioeconomic standpoints.

**Methods:** We selected Global Burden of Disease Study data sets to analyze disability-adjusted life-years (DALYs) and the annual rate of change of dermatoses between 1990 and 2017 in 18 Caribbean countries and the United States. The principal country-level economic factor used was gross domestic product per capita from the World Bank.

**Results:** Countries with lower gross domestic product per capita had higher DALYs for dermatology-related infectious diseases, urticaria, asthma, and atopic dermatitis. Countries with higher gross domestic product per capita had higher DALYs of cutaneous neoplasms, contact dermatitis, psoriasis, and pruritus. Several Caribbean countries were among the top worldwide for annual increase in DALYs for melanoma, nonmelanoma skin cancers, bacterial skin disease, and total skin and subcutaneous diseases.

**Conclusion:** Despite promising ongoing interventions in skin disease, better support is needed in both resource-rich and -poor areas of the Caribbean. DALYs can serve as a purposeful measure for directing resources and care to improve the burden of skin disease in the Caribbean. (JAAD Int 2020;1:3-8.)

**Key words:** acne vulgaris; atopic dermatitis; basal cell carcinoma; Caribbean; cellulitis; contact dermatitis; decubitus ulcer; dermatoepidemiology; disability-adjusted life-years (DALYs); filariasis; fungal skin diseases; Global Burden of Disease Study (GBD) database; global medicine; gross domestic product (GDP) per capita; health care disparities; health equity; HIV; leishmaniasis; melanoma; nonmelanoma skin cancer (NMSC); oral cancer; pruritus; psoriasis; pyoderma; scabies; socioeconomic status; squamous cell carcinoma; syphilis; tuberculosis; urticaria; viral skin diseases.

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## INTRODUCTION

Resources exist describing the prevalence and incidence of skin disease globally, but the burden of skin disease in the Caribbean and how it relates to socioeconomic status are largely unknown.<sup>1</sup> A measurement of the morbidity of skin disease is disability-adjusted life-years (DALYs), measured as years of life lost because of premature mortality in the population plus the years lost because of disability for people living with a health condition or its consequences.<sup>2</sup> Some dermatoses are noted to have disproportionately high DALYs compared with their corresponding prevalence.<sup>3</sup> Reasons cited for the large number of people continuing to live with disabling skin conditions in resource-poor settings include lack of resources, public education, and specialty care, all of which may contribute to a lack of timely and definitive management.<sup>4</sup> Demographic and climate change have also led to an increase in tropical skin conditions. The World Health Organization's adoption of a skin neglected tropical diseases strategy and the World Bank group's ongoing Caribbean Community strategy, reaching nearly \$2 billion in aid, are both promising steps in recognizing and addressing skin disease in the Caribbean.<sup>5</sup>

Understanding the geographic burden of skin disease is an essential component in developing measurable, influential, and sustainable interventions to reduce disease morbidity in both resource-rich and -poor countries. This observational study seeks to compare the relationship between the burden of skin disease in the Caribbean and socioeconomic status in 2017, and also to analyze the annual percentage change of common cutaneous diseases between 1990 and 2017. Comparisons to the United States and all 195 countries worldwide are provided to highlight various trends in health disparities. To our knowledge, this investigation discussing dermatoses in the Caribbean has not been addressed by previous studies.

## METHODS

The principal country-level economic factor used to measure socioeconomic status was 2017 gross domestic product (GDP) per-capita data from the

World Bank.<sup>6</sup> Information on the DALYs of the most common dermatoses was obtained from the latest Global Burden of Disease Study 2017 data sets. These data sets were organized by each of the 18 Caribbean countries, the Caribbean as a whole, and the United States for comparison.<sup>7</sup> Three broad categories of dermatoses were analyzed for each

country: neoplastic, infectious, and inflammatory. Countries were ordered in a heat table with rows from left (lowest GDP) to right (highest GDP), and each country was numerically ranked from 1 (highest DALYs) to 20 (lowest DALYs) for each disease. Statistical analyses of correlations between DALYs and GDP per capita were performed with a 2-tailed linear regression with SPSS Statistics (version 25.0, IBM Corp, Armonk, NY). Significance was set to

$P < .05$ . Strength of correlation was described with the guide that Evans<sup>8</sup> suggested for the absolute value of  $r$ . We also measured the annual percentage change of skin and subcutaneous disease, melanoma, nonmelanoma skin cancer, lip and oral cancer, seborrheic dermatitis, contact dermatitis, pruritus, alopecia areata, bacterial skin diseases (cellulitis and pyoderma), fungal skin disease, and decubitus ulcer, measured in DALYs per 100,000 in the Caribbean and all 195 countries worldwide between 1990 and 2017.

## RESULTS

Bermuda's GDP per capita (\$60,727) ranks higher than that of the United States (\$53,535), with a large range trailed by Haiti (\$1,600).<sup>6</sup> There was a very strong negative correlation between DALY ranking and GDP per capita for contact dermatitis (−0.80) and psoriasis (−0.87), a strong negative correlation for melanoma (−0.70) and pruritus (−0.69), and a moderate negative correlation for nonmelanoma skin cancer (−0.50), basal cell carcinoma (−0.57), and squamous cell carcinoma (−0.49) (Fig 1). In other words, as country GDP per capita increases, the DALY ranking approaches 1 (higher DALYs) for these diseases. In contrast, there was a very strong positive correlation between DALY ranking and GDP per capita for urticaria (0.80) and scabies (0.88), a strong positive correlation between atopic dermatitis (0.60), syphilis (0.63), and tuberculosis (0.67), and a moderate positive correlation between asthma

### CAPSULE SUMMARY

- Understanding the regional influence of dermatologic disease is critical to developing a concerted and sustained global effort toward reducing this burden.
- A relationship exists between socioeconomic status and certain dermatoses. Resources should be directed at countries with high disability-adjusted life-years to create influential interventions in the Caribbean.

*Abbreviations used:*

DALY: disability-adjusted life-year  
GDP: gross domestic product

(0.49), viral skin infection (0.57), and HIV/AIDS (0.47). An outlier to both of these trends was Cuba, which, despite ranking seventh lowest for GDP per capita, had high DALY rankings for neoplastic categories (first for nonmelanoma skin cancer overall, second for basal cell carcinoma, first for squamous cell carcinoma, and first for lip/oral cancer) and surprisingly low DALY rankings for infectious diseases (18th for tuberculosis, 19th for HIV/AIDS, 15th for scabies, 18th for viral skin infections, and 19th for syphilis).

In addition, the annual percentage change of skin and subcutaneous disease in the Caribbean and 195 total countries worldwide was analyzed from 1990 to 2017, and the countries composing the top 10th percentile in the world were recorded (Table D). Grenada (third), US Virgin Islands (fourth), and Suriname (fifth) ranked in the top 5 countries globally for the greatest increase overall in skin and subcutaneous disease DALYs. Belize (fourth), the US Virgin Islands (seventh), and Jamaica (eighth) ranked in the top 10 globally for annual increase in melanoma DALYs. Nine Caribbean countries ranked

in the top 10th percentile worldwide for nonmelanoma skin cancer, including St Vincent and the Grenadines (first), Grenada (second), and Guyana (third). The US Virgin Islands ranked fourth in lip and oral cancer, 18th in seborrheic dermatitis, and sixth in pruritus. St Lucia and Grenada ranked 10th and 13th, respectively, for contact dermatitis. Belize and St Lucia ranked 18th and 19th, respectively, for alopecia areata. Twelve countries ranked high for bacterial skin diseases (cellulitis and pyoderma), with Trinidad and Tobago (first), Cuba (second), Antigua and Barbuda (third), Grenada (fourth), St Lucia (fifth), and Suriname (sixth) at the top. For fungal skin diseases, Puerto Rico ranked second. Seven Caribbean countries were included in the top 10th percentile for decubitus ulcers.

Last are a few interesting trends by specific disease. Suriname had the highest DALYs of leishmaniasis in the Caribbean from 1990-2017. Haiti consistently had the highest DALYs of tuberculosis in the Caribbean, with a slight decrease from 1990-2004 and then a steady plateau.

**DISCUSSION**

Our results demonstrated that countries with higher GDP per capita had higher DALYs of cutaneous neoplasms (melanoma and nonmelanoma skin cancer) and 3 inflammatory dermatoses (contact dermatitis, psoriasis, and pruritus). Melanoma and

	HAI	GUY	BEL	JAM	SUR	CAR	CUB	STV	DOM	DOR	STL	GRE	A/B	T/T	BAR	PR	BAH	VIR	USA	BER
Melanoma	15	17	18	16	13	14	9	6	12	20	7	10	5	19	11	8	4	2	1	3
NMSC	19	18	15	17	16	6	1	4	11	8	14	9	10	20	13	7	12	5	2	3
BCC	19	16	17	18	13	9	2	10	8	15	11	7	12	20	4	3	14	5	1	6
SCC	19	16	15	18	17	6	1	4	11	8	14	9	10	20	13	7	12	5	2	3
Lip/oral cancer	17	19	20	18	16	10	1	2	4	13	7	6	15	14	9	11	8	3	12	5
Acne vulgaris	15	13	6	4	19	9	16	18	8	7	11	17	5	20	12	2	3	10	1	14
Psoriasis	20	19	18	12	16	14	6	15	10	17	11	13	8	9	5	3	7	4	1	2
Contact dermatitis	20	18	19	14	16	15	4	13	7	17	8	11	10	9	5	3	12	6	1	2
Pruritus	20	18	19	15	13	14	5	12	9	16	10	8	7	6	4	3	11	2	17	1
Alopecia areata	20	19	18	9	15	13	7	14	11	12	5	16	2	2	8	10	4	17	1	6
Pyoderma	9	14	12	15	3	11	18	7	4	19	8	1	10	16	2	5	13	6	17	20
Decubitus ulcer	14	19	17	8	7	13	18	5	2	20	10	3	9	15	1	11	6	4	16	12
Urticaria	1	3	2	7	5	6	17	9	14	4	11	10	13	12	16	18	8	15	20	19
Asthma	1	6	8	12	9	2	16	11	3	19	7	13	17	5	15	4	14	10	20	18
Atopic dermatitis	1	4	2	8	6	7	19	9	12	5	13	10	15	14	18	17	11	16	3	20
Viral	2	4	3	8	6	7	18	9	12	5	13	11	15	14	17	19	10	16	1	20
Cellulitis	16	17	13	18	7	14	12	5	2	19	6	9	11	8	1	10	15	3	4	20
Scabies	1	4	2	7	6	5	15	8	9	3	11	10	12	14	16	17	13	18	20	19
Fungal	7	16	19	14	13	9	5	10	8	18	12	6	15	11	4	1	17	3	20	2
Syphilis	1	7	8	5	6	3	19	10	14	2	4	16	15	13	11	17	9	12	20	18
HIV/AIDS	1	3	5	10	7	6	19	8	15	4	18	17	14	9	12	16	2	13	20	11
Tuberculosis	1	2	5	14	10	4	18	7	6	3	8	13	16	11	15	17	9	12	19	20
Leishmaniasis		2	4		1	3				5										
Filariasis	2	1				3														

**Fig 1.** Country ranking by highest (1) to lowest (20) disability-adjusted life-years, ordered from left (least wealthy) to right (most wealthy) by gross domestic product per capita. A/B, Antigua and Barbuda; BAH, Bahamas; BAR, Barbados; BCC, basal cell carcinoma; BEL, Belize; BER, Bermuda; CAR, Caribbean; CUB, Cuba; DOM, Dominica; DOR, Dominican Republic; GRE, Grenada; GUY, Guyana; HAI, Haiti; JAM, Jamaica; NMSC, nonmelanoma skin cancer; PR, Puerto Rico; SCC, squamous cell carcinoma; STL, St Lucia; STV, St Vincent and Grenadines; SUR, Suriname; T/T, Trinidad and Tobago; USA, United States; VIR, US Virgin Islands.

**Table I.** Top 20 (10th percentile) world rankings of Caribbean countries by annual percentage change from 1990 to 2017, measured in disability-adjusted life-years per 100,000

Disease	Caribbean country	World ranking
Skin and subcutaneous disease	Grenada	3
	US Virgin Islands	4
	Suriname	5
Melanoma	Belize	4
	US Virgin Islands	7
Nonmelanoma skin cancer	Jamaica	8
	St Vincent and Grenadines	1
	Grenada	2
	Guyana	3
	Antigua and Barbuda	5
	US Virgin Islands	7
	Dominican Republic	15
	St Lucia	16
	Suriname	18
	Jamaica	20
Basal cell carcinoma	Trinidad and Tobago	18
Squamous cell carcinoma	St Vincent and Grenadines	1
	Grenada	2
	Guyana	3
	Antigua and Barbuda	5
	US Virgin Islands	7
	Dominican Republic	15
	St Lucia	16
	Suriname	18
	Jamaica	20
	Lip and oral cancer	US Virgin Islands
St Vincent and Grenadines		9
Cuba		13
Belize		15
Seborrheic dermatitis	US Virgin Islands	18
Contact dermatitis	St Lucia	10
	Grenada	13
Pruritus	US Virgin Islands	6
	St Lucia	14
	Trinidad and Tobago	15
	St Vincent and Grenadines	16
	Grenada	17
	Puerto Rico	19
Alopecia areata	Belize	18
	St Lucia	19
Bacterial skin disease	Trinidad and Tobago	1
	Cuba	2
	Antigua and Barbuda	3
	Grenada	4
	St Lucia	5
	Suriname	6
	Guyana	8
	St Vincent and Grenadines	10
	Bermuda	11
	Puerto Rico	13
	US Virgin Islands	15
Dominica	16	

Continued

**Table I.** Cont'd

Disease	Caribbean country	World ranking
Fungal skin disease	Puerto Rico	2
	US Virgin Islands	8
	Bermuda	15
	Cuba	19
Decubitus ulcer	Grenada	4
	Trinidad and Tobago	5
	Suriname	6
	St Lucia	7
	Antigua and Barbuda	8
	Bermuda	10
	Cuba	17

nonmelanoma skin cancer are recognized to be some of the few malignancies that are more common among the more affluent.<sup>9</sup> One proposed reason for this is the easier access to intermittent high sun exposure such as during sun-seeking vacations among the affluent.<sup>9</sup> However, melanoma survival has previously been reported as poorer in more deprived groups, described as a survival “deprivation gap.”<sup>10</sup> In contrast to the previous studies focusing on 5-year survival, our results examining DALYs demonstrated lower disability and mortality associated with melanoma and nonmelanoma skin cancer in less affluent countries. These data suggest a need for further investigation in countries with higher GDP per capita, which typically have better access to health education and resources, yet are experiencing higher DALYs of skin cancers despite these advantages.

Our results also showed that countries with lower GDP per capita had higher DALYs for dermatology-related infectious diseases (scabies, viral skin infections, syphilis, HIV/AIDS, and tuberculosis) and 3 other inflammatory dermatoses (urticaria, asthma, and atopic dermatitis). The inverse correlation between DALYs and GDP per capita for dermatology-related infectious diseases may stem from lack of resources, public education, and specialty care, contributing to a lack of timely and definitive management.<sup>4</sup> In particular, high household density was found in a Tanzanian study to be more important in transmissible skin disease than salary, literacy, the use of shoes, distance to a water source, and quality of home construction.<sup>11</sup> The hygiene hypothesis supports an increased risk of atopic conditions (eg, asthma, atopic dermatitis) in industrialized countries.<sup>12</sup> However, DALYs are not a direct measurement of the prevalence of disease. Thus, our results demonstrating that countries with the lowest GDP per capita experienced the highest DALYs of atopy-related conditions suggest a

higher relative burden of people living with atopic conditions in resource-poor settings.

Cuba did not fit the above-mentioned trends. Despite spending approximately half the proportion of its GDP on health care compared with the United States (7.5% versus 14.6%, respectively), Cuba has had remarkably low rates of infectious diseases during the past few decades.<sup>13</sup> Several reasons have been postulated for this success, including increased attention to primary care prevention, access to care, nutrition support via the Cuban ration card system, subsidized quality housing, and sanitation efforts.<sup>13</sup> On the other hand, noncommunicable diseases have been increasing in Cuba during the past few decades; cancer remains the leading cause of death since 2012 and its effect on DALYs is increasing. The reason for this is not entirely known but could be due to lifestyle factors, including high tobacco consumption.<sup>14</sup>

Furthermore, our results show the striking number of Caribbean countries composing the greatest rate of change annually of DALYs during the past few decades, indicating the high need in this region for attention to skin and subcutaneous diseases. As mentioned previously, lack of resources, public education, and specialty care may contribute to the large number of people continuing to live with disabling skin conditions.<sup>4</sup> In addition, an interplay of demographic, cultural, political, socioeconomic, and geographic factors likely contributes to the large variation and trend of increasing DALYs among the various Caribbean countries ranking among the highest in the world for annual percentage change of several skin and subcutaneous diseases from 1990 to 2017. The Caribbean Islands' population is composed of individuals from diverse backgrounds, including Indigenous peoples, Europeans, Africans, East Indians, Portuguese, and Chinese (Caribbean Community). This has contributed to not only the spread of disease but also a unique cultural belief system. For example, many Caribbean families believe "bad blood" causes skin rashes and eruptions. Instead of seeking medical treatment, they will try to "wash out" their blood with home remedies such as drinking tea or taking laxatives.<sup>15</sup>

Although the Caribbean spends on average 6.2% of its GDP on health care, social inequalities are persistent because of lack of efficiency in terms of access to care and population health indicators.<sup>16,17</sup> Inefficacy of the public health system and failure to recognize the increasing disease prevalence may be contributing to the higher burden of skin disease. Haiti, which has the highest tuberculosis prevalence in the Americas and highest DALYs in the Caribbean,

has many barriers to adequate case identification of this disease, including underfunding and understaffing of the health care sector. Furthermore, the devastating earthquake of 2010 further compromised an already struggling health care system, including the destruction of the main tuberculosis treatment center.<sup>18</sup> Geographic factors also play a role in other communicable diseases in the Caribbean. For example, in 2012, the expansion of illegal small-scale gold mining and the associated use of mercury in Suriname were declared to be detrimental to the forest and its ecosystems. These geographic factors likely influenced the high levels of leishmaniasis in this country.<sup>19</sup> Although not recorded with our Global Burden of Disease Study analysis, another example of geographic influence is chikungunya, a virus causing a morbilliform rash transmitted by *Aedes*. It first appeared in the Caribbean Islands in 2013 because of global trade routes, but the rapid expansion in the local setting can be attributed to longer vector presence as a result of increasing precipitation and temperature.<sup>20</sup> Dermatologists should be able to recognize these expanding infectious diseases and be aware of seasonal changing patterns.

Researchers interested in addressing the health care needs of the Caribbean may elect to focus their time and resources by targeting dermatoses with the highest respective DALYs in conjunction with GDP per-capita data to reduce health disparities. Limitations of the Global Burden of Disease Study have been described.<sup>4</sup> In the case of skin, disability reflects only symptoms such as itch and appearance including disfigurement, not capturing other complications such as secondary infection, mental illness, and cardiovascular complications. The true burden of skin disease in the Caribbean as measured by DALYs is likely underestimated because they do not account for the previously mentioned factors in these vulnerable populations in whom complications are more likely to develop. Additionally, the Global Burden of Disease Study has inconsistent reporting of mortality by skin disease in assessing DALYs. Despite these limitations, a greater focus on reducing the morbidity of dermatoses with high DALYs would be an effective approach to reduce the burden of dermatoses in the Caribbean.

Variations in DALYs and GDP per capita are not unique to the Caribbean. Lessons of success can be gleaned from countries with low DALYs, such as Cuba with infectious diseases, and areas for improvement can be highlighted by countries with high DALYs. Our findings may be observed in other geographic regions and could be used to help guide dermatologic care of

populations outside the Caribbean. Additional research is needed to better direct dermatologists interested in health outreach and reducing health care disparities in the Caribbean on how to best allocate their time and resources in reducing the burden of skin disease. We hope to inspire future research to assess the influence of socioeconomic status on common dermatoses to help identify and close the gap in global health disparities.

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