Global epidemiology and clinical spectrum of rosacea, highlighting skin of color: Review and clinical practice experience

Andrew F. Alexis, MD, MPH,[a] Valerie D. Callender, MD,[b] Hilary E. Baldwin, MD,[c] Seemal R. Desai, MD,[d,e] Marta I. Rendon, MD,[f] and Susan C. Taylor, MD[g]

New York, New York; Glenn Dale, Maryland; Morristown, New Jersey; Plano and Dallas, Texas; Boca Raton, Florida; and Philadelphia, Pennsylvania

Rosacea has been reported less frequently among individuals with skin of color than in those with white skin, but rosacea is not a rare disease in this population. In fact, rosacea might be underreported and underdiagnosed in populations with skin of color because of the difficulty of discerning erythema and telangiectasia in dark skin. The susceptibility of persons with highly pigmented skin to dermatologic conditions like rosacea, whose triggers include sun exposure, is probably underestimated. Many people with skin of color who have rosacea might experience delayed diagnosis, leading to inappropriate or inadequate treatment; greater morbidity; and uncontrolled, progressive disease with disfiguring manifestations, including phymatous rosacea. In this article, we review the epidemiology of rosacea in skin of color and highlight variations in the clinical presentation of rosacea across the diverse spectrum of patient populations affected. We present strategies to aid in the timely diagnosis and effective treatment of rosacea in patients with skin of color, with an aim of promoting increased awareness of rosacea in these patients and reducing disparities in the management of their disease. (J Am Acad Dermatol 2019;80:1722-9.)

Key words: diagnosis; disease management; erythema; ethnicity; flushing; race; rhinophyma; telangiectasia.

In people with skin of color, rosacea is an often unrecognized disorder.[1-5] In a 1993-2010 US National Ambulatory Medical Care Survey on the racial/ethnic distribution of patients with rosacea, it was found that 2% of rosacea patients were black, 2.3% were Asian or Pacific Islander, and 3.9% were Hispanic or Latino.[5] Worldwide, the reported prevalence of rosacea in people with skin of color has varied, with estimates as high as 40 million cases[2] and rates up to 10%.[6,7] Despite these estimates, epidemiologic reports often position rosacea as a disease of fair-skinned people with Celtic and North European heritage (Fitzpatrick skin phototypes I and II), leading to the erroneous

From the Skin of Color Center, Mount Sinai St. Luke's and Mount Sinai West, Icahn School of Medicine at Mount Sinai, New York[a]; Callender Dermatology and Cosmetic Center, Glenn Dale[b]; Acne Treatment and Research Center, Morristown[c]; Innovative Dermatology, PA, Plano[d]; Department of Dermatology, University of Texas Southwestern Medical Center, Dallas[e]; Rendon Center, Boca Raton[f]; and Perelman School of Medicine, University of Pennsylvania, Philadelphia.[g]

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Correspondence to: Andrew F. Alexis, MD, MPH, Department of Dermatology, Mount Sinai St. Luke's and Mount Sinai West, 1090 Amsterdam Ave, Ste 11B, New York, NY 10025. E-mail: alexisderm@yahoo.com.

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perception that rosacea does not occur in people with skin of color.[7-15]

Because of the lower index of suspicion for rosacea among patients with darker skin, delayed diagnosis might occur. This population often experiences misdiagnoses[3,5] and symptoms that persist beyond a year.[4,5,8,9,11,16-19] Delayed diagnosis could lead to advanced disease, inadequate treatment, greater morbidity, loss of sight in ocular rosacea, and disfigurement with disease progression (eg, rhinophyma and otophyma).[6,20-29]

The purpose of this article is to highlight rosacea as a global disease; review evidence of potential gaps in diagnosis and management in patients with skin of color; and provide real-world clinical strategies to support disease awareness, accurate diagnosis, and appropriate therapy in this often-overlooked population.

CAPSULE SUMMARY

- Rosacea is infrequently reported among nonwhite populations worldwide, but difficulty detecting its characteristics in darker skin might be leading to its underdiagnosis.
- This paper provides strategies for recognizing and treating rosacea in persons with skin of color.
- This information might help reduce disparities in managing rosacea across diverse populations with the disease.

GLOBAL EPIDEMIOLOGY OF ROSACEA

Rosacea has been reported in countries whose populations have significant proportions of people with skin of color throughout Africa, Asia, and South America, with rates up to 10%.* Although only 15 cases of rosacea were observed in a South African dermatology clinic over an 8-year period, during which 6700 patients were examined, all of these cases occurred in patients with Fitzpatrick skin phototype V (n = 6) or VI (n = 9).[3] Likewise, an epidemiologic study in Colombia reported a rosacea prevalence of <3%, but ~12% of the 291 patients with rosacea had Fitzpatrick skin phototype IV or V.[19] An even greater percentage was revealed in a study of 168 Korean patients with rosacea; nearly 40% of these patients had Fitzpatrick skin phototype IV or V.[36] Supplemental Table I (available at http://www.jaad.org) provides a review of rosacea prevalence in populations with skin of color around the world.*

Rosacea diagnosis in patients with darker skin has also been reported in European countries. An analysis of 348 workers in Estonia showed a 20% prevalence of rosacea, with 55% of cases occurring in patients with Fitzpatrick skin phototypes I and II, as would be expected.[9] Yet, the Estonian study also showed that ~38% of the patients had Fitzpatrick skin phototype III and 7% had phototype IV.[9]

CLINICAL ASPECTS OF ROSACEA IN SKIN OF COLOR

Studies conducted globally have shown a correlation between rosacea and factors such as hotter climate and increased sun exposure.[16,27,35] In addition, clinical characteristics commonly identified in rosacea among people with skin of color include higher proportions of women than men,† presence of papules and pustules,[9,16,17] an association with prior steroid use[16,17] and demodicidosis,[17,33] sun exposure as a frequent trigger,[16,19] prior misdiagnoses,[3,5] and symptoms that have persisted beyond a year (Supplemental Table II; available at http://www.jaad.org).[13,25,28,36,39-47] A noteworthy number of patients with ocular rosacea symptoms was found in studies from Korea,[36] Italy,[41] and Saudi Arabia.[44]

Although erythema is observed in patients with skin of color, persistent facial erythema is reported less frequently than papules and pustules, which might be due to the difficulty of visualizing erythema in dark skin.[43] Postinflammatory hyperpigmentation, more common in skin of color, can also mask erythema.[1,48,49] A variant of rosacea that might be seen more frequently in patients with skin of color is the granulomatous subtype, which often involves perioral and periocular lesions and might not manifest with typical signs of rosacea, such as flushing or persistent erythema.[4,50] Perhaps because of the difficulty in visualizing persistent erythema in darker skin, the diagnosis of rosacea in these patients might be made in later stages—such as after facial disfigurement has occurred.[29] Delayed diagnosis has been reported in substantial numbers of Asian patients,[23,24,26,51-55] African patients in Europe[22] and North America,[6,56] and some South American patients (Supplemental Table III; available at http://www.jaad.org).[20,22-24,26,27,51-56]

PATHOPHYSIOLOGY OF ROSACEA IN SKIN OF COLOR

The decreased propensity for flushing observed in Fitzpatrick skin phototype VI[29,57] could be

*3,5,11,12,16,17,19,30-35

†3,9,11,16,17,19,31,34,35,37,38

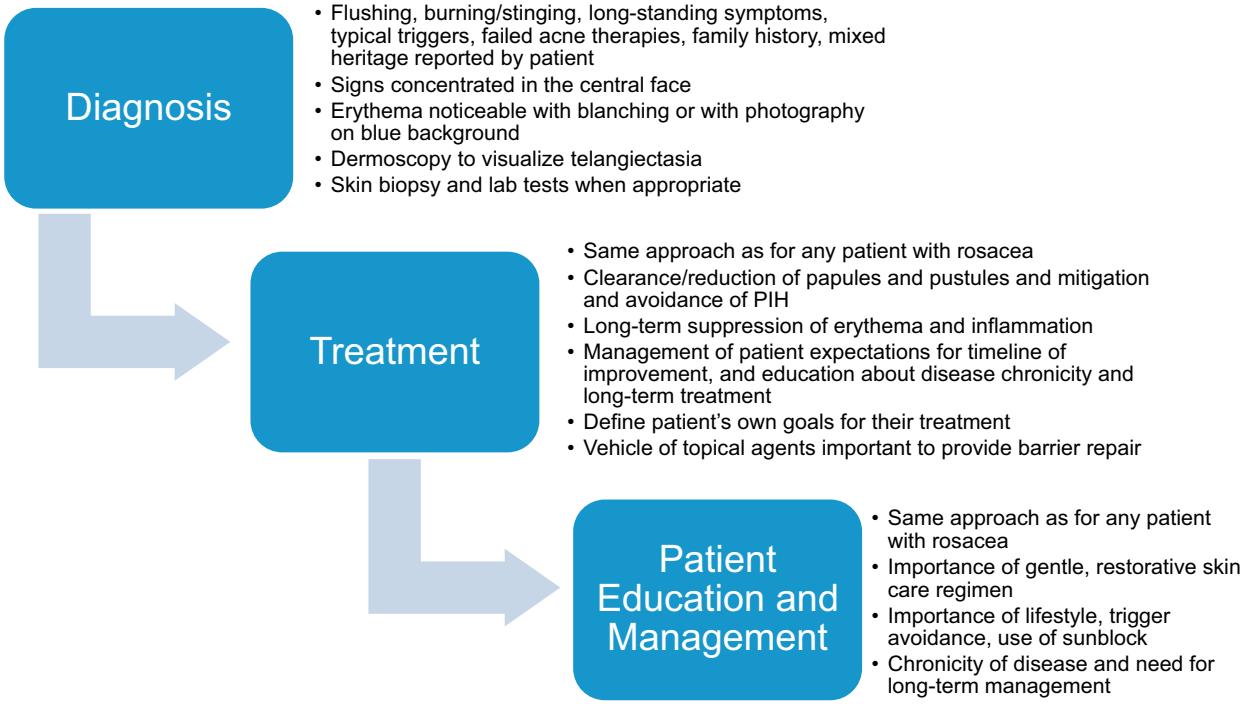

Fig 1. Considerations for diagnosis and treatment of rosacea in patients with skin of color. *PIH*, Postinflammatory hyperpigmentation.

explained by studies of skin circulation and generalized microvascular endothelial function in various populations.[58-60] In studies of microvascular endothelial function, the skin blood-flow response to reactive hyperemia after occlusion and local heating was examined; these studies suggested differences in the microvascular structure and function between white patients and Afro-Caribbean, Korean, and Southeast Asian patients, who all displayed lower vascular endothelial function. Nevertheless, any physiologic differences that exist for skin of color do not change the risk factors for rosacea, and people with skin of color encounter the same rosacea triggers.[4]

CLINICAL PRACTICE INSIGHTS AND RECOMMENDATIONS

A proposed paradigm for diagnosing and treating rosacea in patients with skin of color on the basis of our clinical experience appears in Fig 1.

Patient history

In our experience, a key component of accurate diagnosis of rosacea in a patient with skin of color is consideration of the patient's self-reported observations and history. Does the patient describe experiencing a warm sensation over the face, or flushing? Does the patient recognize his or her own redness, or erythema? The patient might report burning or stinging in association with skin care products.[8] A patient with rosacea often has a history of acne diagnosis and failed acne treatments[8,26] and might report having had unrelieved symptoms for many years.[6,22-24,55] A patient with rosacea will also describe an onset of symptoms that corresponds to typical rosacea triggers, such as heat, spicy foods, and stress.[4]

Another important indicator of rosacea is family history.[2] The patient might have mixed ancestry that includes individuals with a higher genetic predisposition for rosacea. The patient might describe a family history of rosacea or, in the absence of a rosacea diagnosis in the affected relative, a history of signs and symptoms of rosacea.[2,9,10]

Recognition of signs and symptoms of rosacea

It is important to understand that the signs of rosacea are the same regardless of skin color, but the clinical appearance might be influenced by constitutive skin pigmentation. Because erythema and telangiectasia might be difficult to recognize in darker skin, a heightened awareness of other signs is warranted when evaluating a patient with skin of color. For example, be attentive to signs concentrated in the central face and be aware that erythema might not be readily visible (Fig 2). Skin characteristics of rosacea in a patient with skin of color, outside of readily visible erythema or

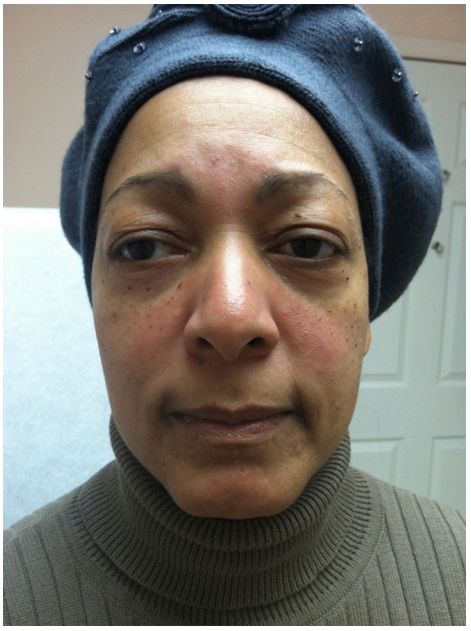

Fig 2. Erythema in an African American woman with Fitzpatrick skin phototype V. Patient photograph provided courtesy of Susan C. Taylor.

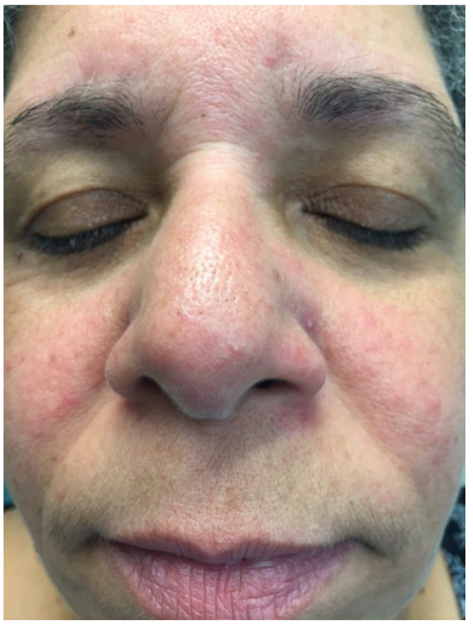

Fig 3. Papular rosacea in a Hispanic woman with Fitzpatrick skin phototype IV. Patient photograph provided courtesy of Susan C. Taylor.

telangiectasia, might include dry appearance, edema, and hyperpigmentation.

We have used different strategies to assess whether erythema or telangiectasia are present. Testing the skin for blanching by using a magnifying glass or microscope slide can help in visualizing redness; if the skin pales when pressed under the glass or slide, erythema is present. Photographing the patient on a dark blue background can make the redness of the patient's skin more readily visible. Adequate lighting is needed to assess telangiectasia in dark skin. Use of a dermatoscope might help with identification of telangiectasia by differentiating the pigment of the skin versus the blood vessels.

Another key sign to consider is the presence of facial acneiform papules and pustules, which are often present with rosacea in skin of color (Fig 3). Typically, these papules and pustules occur without comedones, distinguishing rosacea from acne.[8] Ocular symptoms, such as itching, foreign body sensation, and irritation, might be present. Thickening of the nasal and medial cheek skin may signal early phymatous changes associated with rosacea.

Considerations for differential diagnosis

Table I displays differential diagnoses to aid in identifying conditions commonly mistaken for rosacea in skin of color.[4,8,27,37,50,61-65] In patients with facial erythema, collagen vascular diseases, including lupus erythematosus and dermatomyositis, may be considered. A skin biopsy might also reveal granulomatous characteristics of rosacea[53] or can be used to test for common comorbidities, such as demodicidosis.[17,33] In addition to lupus erythematosus, seborrheic dermatitis and keratosis pilaris rubra should also be ruled out.[27] Note that granulomatous rosacea can resemble sarcoidosis, which is more common in patients of African ancestry.[8] Rosacea can also look similar to a skin condition that affects primarily black children, facial Afro-Caribbean childhood eruption (Table I).[62]

In considering differential diagnoses, be aware that inflammatory lesions of acne are often located beyond the central face (eg, chest, back, or arms). Prior misdiagnosis of rosacea as seborrheic dermatitis is not uncommon and might lead to administration of topical steroids, as noted in the case report literature. The authors have noted that topical steroid use might cause hypopigmentation, atrophy, and telangiectasias.

Treatment of rosacea in patients with skin of color

The treatment approach for rosacea in skin of color is similar to that in lighter skin types, involving the same topical, oral, laser, light-based, or surgical treatments targeted to the patient's individual signs of rosacea[66,67]—although data on the treatment of rosacea in this patient population are limited.[4] Patients with skin of color might have unique clinical

Table I. Differential diagnoses for rosacea in patients with skin of color

Diagnosis	Features
Acne vulgaris	Pustules and erythematous papules on face and upper trunk, usually accompanied by open and closed comedones and no telangiectasia, with initial onset typically occurring in adolescence and young adulthood[4,8,27,61]
Steroid acne	Acne vulgaris induced by steroid-containing topical agents; patient will have history of using such products[4]
Contact dermatitis	Skin inflammation or rash that is usually itchy; condition associated with exposure to chemical or physical allergens or irritants; condition might involve erythema, scaling, blistering, thickening, or cracking of skin in a localized or diffuse presentation, sometimes with pain, burning, or stinging[65]
Seborrheic dermatitis	Skin inflammation occurring near eyebrows, ears, nose, and glabellar region[27]
Periorificial dermatitis	Self-limiting eruption of erythematous papules and pustules near mouth, nose, and eyes, primarily in young women[50]
Facial Afro-Caribbean childhood eruption	Self-limiting, monomorphic flesh-colored or hypopigmented papules, especially around mouth, ears, and eyelids, primarily in black children, usually male[62]
Keratosis pilaris rubra	Marked erythema and keratotic follicular papules covering cheeks and proximal arms[27]
Lupus erythematous	Erythematous rash spanning cheeks and nasal bridge in butterfly pattern[27,37]
Sarcoidosis	Granulomatous disorder usually involving multiple organs and affecting middle-aged and older patients with comorbid hypertension, thyroid disease, type 2 diabetes mellitus, hearing loss, or eye disease; facial manifestations characterized by persistent plaques with papules and nodules, often asymptomatic[63]
Dermatomyositis	Red or purplish rash along with edema commonly manifesting on eyelids; on knuckles or fingers along with scaly, red papules in V pattern on neck, in shawl pattern on shoulders, or on trunk, extremities, scalp, or face; often accompanied by muscle weakness; more commonly found in female patients[64]

Table II. Recommended skin-care regimen for rosacea patients with skin of color

Recommended types of products	Product types to avoid
Gentle, nonalkaline, fragrance-free, emollient cleanser once per day in the evening	Alcohol-based cleansers, astringents, or abrasive exfoliating cleansers
Silicone-based moisturizer daily	Nonsilicone-based moisturizers
Light, water-based cosmetics (but powders are preferable to creams)	Cosmetics with iridescent effects
Physical sunblock (eg, zinc oxide)	Chemical sunscreens (if sensitivity reported)

features that need to be addressed during rosacea treatment, such as postinflammatory pigment alteration and the risk of developing this complication on administration of laser and light-based therapies. The treatment approach for rosacea might also need to include cultural and geographic variations in skin care that might affect skin condition.[68] For example, patients with skin of color might be accustomed to using skin lighteners or brighteners, astringent or abrasive skin care products, or occlusive moisturizers such as shea butter or cocoa butter. In the authors' experience, exfoliation is common in East Asian populations (eg, Korean), and patients of sub-Saharan African ancestry might use shea or cocoa butter products. There also are geographic factors that tend to trigger rosacea, such as variations in temperature, humidity, sun exposure, or local popularity of spicy food. However, the goals of treatment for patients with skin of color remain straightforward: clearance and reduction of papules and pustules, mitigation and avoidance of postinflammatory hyperpigmentation, long-term suppression of erythema and inflammation, management of patients' expectations for timeline of improvement, and education about disease chronicity and long-term treatment.

Take care to define the patient's own goals for his or her treatment—is the patient concerned about persistent erythema, even if others might not be able to visualize it? The use of topical medications

to address vascular involvement might be warranted.[69-71] Other topical treatments can provide a hydrating barrier to promote repair, but some vehicles might irritate or inflame skin (eg, ethanolic gels). Vehicles such as foams, creams, and aqueous gels might be less irritating. To ensure preferred vehicle formulation, avoidance of generic substitutions for prescription topical agents might be necessary. Topical medication might be supplemented with oral medications to reduce inflammation of papules and pustules. In a study on the evaluation of oral sub-antimicrobial–dose doxycycline in rosacea, similar efficacy and safety were found between patients with Fitzpatrick skin phototypes I-III and phototypes IV-VI.[11] Likewise, unpublished analyses from clinical trials of topical oxymetazoline cream in patients with persistent erythema of rosacea indicated similar efficacies in patients with Fitzpatrick skin phototypes I-III and those with phototypes IV-VI (Allergan plc, data on file).

Laser and light-based therapies may be considered for reducing the capillary network of the skin or for resurfacing of phymatous changes. The selection of the device must be based on suitability for Fitzpatrick skin phototypes IV-VI. Anecdotal and published evidence point to the effectiveness and safety of microsecond-pulsed, 1064-nm neodymium:yttrium-aluminum-garnet laser treatment in patients with skin of color.[72,73] With laser devices, the use of lower fluences is recommended to reduce the risk for pigmentary or scarring complications.

Another important dimension of the rosacea treatment paradigm for patients with skin of color is counseling on appropriate skin care (Table II). A critical component is the use of sunscreen or a physical sunblock. In addition, patients should be counseled on rosacea trigger identification, management, and avoidance, including dietary, environmental, and lifestyle triggers.

CONCLUSION

Rosacea is reported less frequently in individuals with skin of color, but knowledge and practice gaps are likely to contribute to underdetection and suboptimal management in populations with darker skin. Current reports of rosacea in patients with skin of color point to a large pool of undiagnosed patients. Recent case series including patients with skin of color who present with phymatous manifestations after a long history of symptoms are consistent with delayed diagnosis, which might be related to the misperception that rosacea is rare in this patient population. Increased awareness of rosacea in these patients and of the strategies for recognizing and treating the disease might aid in timely diagnosis and effective treatment, thereby reducing disparities in disease management.

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Supplemental Table I. Estimated rosacea prevalence in populations with skin of color, by region

Continent, country	N	Prevalence, %	% Female	Mean patient age, y	Relevant clinical findings	Study description	Reference
Africa							
Ghana	2254	0	NA	NA	NA	Retrospective dermatology clinic database review, Jan 1991-Dec 1995	Doe et al, 2001[30]
South Africa	6700	0.2	93.3	47	Prior acne diagnoses; 15 (100%) patients with rosacea had Fitzpatrick skin types V or VI; 6 (40%) Fitzpatrick skin type V patients had erythema, telangiectasia, and erythematous papules; 9 (60%) Fitzpatrick skin type VI patients had skin-colored papules; no flushing; 1 (7%) had ocular symptoms and extrafacial lesions	Retrospective chart review, 2008-2015	Dlova, Mosam, 2017[3]
Tunisia	244	0.2 (hospital prevalence)	71.7	49	27 (11%) had brown skin, dark eyes, and black hair; 199 (81.5%) had erythema; 156 (64%) had sun exposure trigger; 29 (12%) had ETR, 168 (69%) had PPR, 9 (3.7%) had rhinophyma, 8 (3.3%) had granulomatous rosacea, 28 (11%) had steroid-associated rosacea, 41 (17%) had ocular rosacea	Retrospective dermatology database review, Jan 1990-May 2003	Khaled et al, 2010[16]
Asia							
China	1908	3.4	NA	NA	Rosacea significant risk factor for dry eye syndrome (OR 3.7)	Retrospective case-controlled ophthalmologic study, Dec 2009-Dec 2013	Yang et al, 2015[31]

Continued

Supplemental Table I. Cont'd

Continent, country	N	Prevalence, %	% Female	Mean patient age, y	Relevant clinical findings	Study description	Reference
China	860	10.6	NA	NA; patients 12-84 y enrolled with 21-30 y being largest age group	Demodicidosis significant risk factor for rosacea (OR 8.1); 9 (9.9%) had ETR, 65 (71.4%) had PPR, 17 (18.7%) had PHY; cases of steroid-associated dermatitis	Case-controlled dermatologic survey	Zhao et al, 2011[17]
China, Malaysia, and Indonesia	13,215	0.97	43.1	NA; patients 12-20 y enrolled	NA	Cross-sectional survey of Han adolescents, Aug 2002-Oct 2005	Zhang et al, 2008[32]
Middle East							
Turkey	67 (biopsy samples)	53.1 ETR, 21.9 PPR (in 32 biopsy samples with demodicidosis)	NA	NA	Association with demodicidosis	In vitro study of biopsy samples from dermatology patients referred to parasitology laboratory, May 2012-May 2013	Cengiz et al, 2014[33]
North America							
United States	31.5 million rosacea visits	2.0 African American, 2.3 Asian or Pacific Islander, 3.9 Hispanic or Latino	NA	NA	Prior diagnoses of contact dermatitis/eczema or urticaria in nonwhite populations	Retrospective review of National Ambulatory Medical Care Survey data, 1993-2010	Al-Dabagh et al, 2014[5]
United States	1421	0.7 African American, 1.3 Asian, 0.1 American Indian or Alaska Native, 0.4 Native Hawaiian or Pacific Islander, 4.5 other (of 826 patients with PPR)	71.5	NA	Rosacea patients: 33.3% (n = 275) Fitzpatrick skin type III, 15.7% (n = 130) type IV, 3.6% (n = 30) type V, and 0.4% (n = 3) type VI	Prospective study	Alexis et al, 2012[11]
United States	401	33 (redness or erythema)	NA	NA; patients aged 20-80 y enrolled	NA	Data from self-reported survey of Arab Americans from 3 southeast Michigan locations	El-Essawi et al, 2007[34]
United States	20.8 million visits by Hispanics or Latinos	Hispanics or Latinos, 2.8	NA	NA	NA	Retrospective review of National Ambulatory Medical Care Survey for leading diagnoses for dermatology visits, 1993-2009	Davis et al, 2012[12]

Continued

Supplemental Table I. Cont'd

Continent, country	N	Prevalence, %	% Female	Mean patient age, y	Relevant clinical findings	Study description	Reference
South America							
Colombia	10,204	2.85	76	49	136 (46.7%) of rosacea patients had Fitzpatrick skin types III-V; 132 (45.3%) had ETR, 142 (48.7%) had PPR, 14 (4.8%) had PHY, 3 (1%) had ocular; hot weather (66%, 192) and sun exposure (61%, 178) most common triggers	Cross-sectional multicenter study of outpatient dermatology visits, Jul-Aug 2014	Rueda et al, 2017[19]
Peru	3294	1.97	NA	NA	Increased temperature significantly associated with rosacea frequency (OR 3.0) and also associated with increased rosacea severity	Observational hospital database study, Jan 2004-Dec 2007	Gutierrez et al, 2010[35]

Fitzpatrick skin type refers to skin photosensitivity scale whereby type I is the lightest skin and always burns and VI is the darkest and never burns.[15]
ETR, Erythematotelangiectatic rosacea; *NA*, not available; *OR*, odds ratio; *PHY*, phymatous rosacea; *PPR*, papulopustular rosacea; *UV*, ultraviolet.

Supplemental Table II. Clinical findings from global studies conducted in populations with skin of color and rosacea diagnosis

Continent, country	Study demographics	Relevant clinical findings	Study description	Reference
Asia				
China	68 female patients excluding rhinophyma; mean age 32.5 y (treated group) and 33.5 y (control group)	70.5% with ETR, 29.4% with PPR, disease duration for <1 y in 23 patients, 1-5 y in 34 patients, >5 y in 11 patients	Randomized, controlled study, Feb 2003-Feb 2004	Yu et al, 2006[28]
Japan	13 male patients; mean age 46.9 y	Erythema and papules in 69.2%; spironolactone short course improved itching and erythema	Prospective study of relationship between rosacea and sebaceous glands	Aizawa, Niimura, 1992[39]
Korea	18 patients; median age 49 y; 72.2% female	Fitzpatrick skin type IV in 61%; ETR in 88.9%, PPR in 11.1%	Randomized, open-label, split-face study evaluating pulsed-dye laser for rosacea, Aug 2009-Mar 2010	Kim et al, 2011[40]
Korea	168 patients; mean age 47.8 y; 69.6% female	Fitzpatrick skin type III in 56.5%, IV in 32.7%, V in 7.1%; ETR in 96.4%, PPR in 50.6%, ocular in 14.3%, PHY in 4.8%; rosacea signs were persistent erythema (85.1%), transient erythema, telangiectasia, and papulopustules (72%), burning/stinging (69.6%), dryness (39.3%), and ocular involvement (12.5%)	Retrospective review, 2002-2007	Bae et al, 2009[36]
Europe				
Italy	90 patients; median age 51.5 y; 56.7% female	*Helicobacter pylori* in 48.9%; *Demodex folliculorum* in 16.6%; rosacea signs were flushing (n = 14), erythematous lesions (n = 43), papulopustular lesions (n = 27), rhinophyma (n = 6), and ocular complications (n = 7)	Prospective study, Jan 2012-Jan 2013	Gravina et al, 2015[41]
United Kingdom	108 British patients aged 21-87 y; 49.1% female	Fitzpatrick skin type VI in 13.75%*; rosacea signs were erythema (n = 105), papules (n = 90), pustules (n = 72), rhinophyma (n = 15); steroid-associated rosacea (n = 32), history of migraine (n = 58), ocular complaints (n = 38), and *D. folliculorum* (n = 20)†	Dermatologic assessments over 18-mo period	Sibenge, Gawkrodger, 1992[42]

Continued

Supplemental Table II. Cont'd

Continent, country	Study demographics	Relevant clinical findings	Study description	Reference
Germany	135 patients; mean age 52.0 y; 87% female	Fitzpatrick skin type III in 31%, type IV in 8%; ETR in 64%; PPR most common in skin type IV; mean disease duration 20.4 y	Single-center, noninterventional, cross-sectional observational study, Jan-May 2010	Tan et al, 2013[43]
Germany, Russia	119 German and Russian patients; mean age 41.8 y; 74.8% female	Fitzpatrick skin type III in Germany was 39.0% and in Russia was 40.5%; type IV in Germany was 1.2% and in Russia was 8.1%; overall prevalence in types IV-VI was 3.4%; ETR in 67.2%	Multicenter, interventional, cross-sectional study in Germany and Russia, 2013-2014	Tan et al, 2016[13]
Middle East				
Saudi Arabia	50 female patients; mean age 42.2 y	Fitzpatrick skin type IV in 40%, V in 18%, VI in 42%; PPR in 100%; moderate-to-severe erythematotelangiectatic symptoms in 92%; ocular symptoms in 64%; extrafacial lesions in 14%; hyperpigmentation and hypopigmentation rare	Prospective study, Feb 2010-May 2011	Al Balbeesi, Halawani, 2014[44]
Egypt	15 female patients; mean age 43.5 y	Fitzpatrick skin type III in 100%	Prospective study on laser treatment of ETR	Salem et al, 2013[45]
North America				
Mexico	30 skin samples from 30 patients; mean age 43.3 y; 60% female	*D folliculorum* in 80%	Hospital-based in vitro studies of skin biopsies to study rosacea, 1975-2010	Rios-Yuil, Mercadillo-Perez, 2013[46]
United States	2587 patients; mean age 38.8 y; 16% African American, ~11% races other than white or African American	~27% of patients prescribed topical treatment for rosacea were nonwhite	Longitudinal cohort study of Medicaid database, Jan 2002-Dec 2006	Jayawant et al, 2008[25]
United States	40 patients; mean ages 41.6 y and 38.8 y for 2 treatment arms; 70% Hispanic; 2.5% black; 80% female	100% patients had 3-30 papules or pustules, ≤2 nodules, and moderate-to-severe erythema at baseline based on inclusion criteria	Randomized, double-blind, placebo-controlled trial for treatment of rosacea	Sanchez et al, 2005[47]

Fitzpatrick skin type refers to skin photosensitivity scale whereby type I is the lightest skin and always burns and VI is the darkest and never burns.[15]
ETR, Erythematotelangiectatic rosacea; *PHY*, phymatous rosacea; *PPR*, papulopustular rosacea.
*Of 80 patients with rosacea in whom Fitzpatrick skin phototype was assessed.
†Of 25 patients with rosacea in whom the presence of *D. folliculorum* was assessed.

Supplemental Table III. Rosacea in patients with skin of color involving delayed diagnosis

Case(s)	Symptom duration, y	Rosacea type	Clinical features	Comorbidities	Reference
382 Korean patients, 39 with rhinophyma; mean age 56 y; 12.8% female	4.55 (mean)	Rhinophyma	Rhinophyma accompanied by other facial rosacea subtypes in 30.7% of patients, supporting possibility of progression	NA	Kim et al, 2017[24]
2 Japanese men, ages (a) 59 y and (b) 66 y	(a) 2; (b) Unclear	(a) Persistent telangiectatic; (b) PHY	(a) Telangiectasia on the nose; (b) large follicular orifices and edema	(a) Scalp angiosarcoma; (b) esophageal cancer	Tokunaga et al, 2014[51]
2 Japanese men, ages (a) 86 y and (b) 63 y	(a) 2; (b) NA	(a) Rosacea with steroid-induced component; (b) ETR	(a) Telangiectasia on the nose; (b) facial erythema and flushing	NA	Tsunoda et al, 2014[52]
Japanese man age 53 y	NA, prior acne diagnosis	Granulomatous	Telangiectasia in the upper dermis and perifollicular granulomas, lack of comedones	Edema, conjunctivitis	Uhara et al, 2000[53]
Japanese man, age 50 y	2, prior lupus diagnosis	Rosacea with steroid-induced component	Demodicidosis, butterfly rash—like papules and erythematous lesions	HIV	Yamaoka et al, 2014[54]
Japanese woman, age 60 y	7	Rosacea with steroid-induced component	Erythema on nose, acneiform eruptions	NA	Yamamoto et al, 1993[55]
2 Japanese men, ages (a) 57 y and (b) 60 y	(a) 5-6; (b) long history	Rhinophyma	Erythema on nose	NA	Furukawa et al, 1994[23]
Singaporean woman, age 32 y	2, prior acne diagnosis	Rosacea fulminans	Erythema, edema, and multiple pustules; painful facial eruption	NA	Koh et al, 2014[26]
West Indian man from United Kingdom, age 38 y	Since birth	Rhinophyma	Chronic inflammatory infiltrate	NA	Khoo, Saad, 1980[22]
Spanish man, age 42 y	3	Rosacea with extrafacial component	Scalp involvement, multiple tiny papules and nonfollicular pustules	NA	Miguel-Gomez et al, 2015[27]

Continued

Supplemental Table III. Cont'd

Case(s)	Symptom duration, y	Rosacea type	Clinical features	Comorbidities	Reference
African American men ages (a) 56 y and (b) 73 y	(a) 7, prior pseudofolliculitis barbae diagnosis; (b) 20, prior hidradenitis suppurativa diagnosis	(a) Gnathophyma; (b) otophyma	(a) Cystic follicular dilatation, dermal scarring, psoriasiform epidermal hyperplasia, and chronic follicular inflammation; (b) deep perivascular dermatitis, perifolliculitis, and dilated capillaries	NA	Ezra et al, 2009[6]
African American man, age 60 y	NA	Rhinophyma	Large nodular rhinophyma, thickened cobblestone skin	NA	Redett et al, 2001[56]
2 Chilean men ages (a) 29 y and (b) 54 y	NA	Rosacea fulminans and ocular involvement, steroid-induced component	Papulopustules, cysts, edema, draining sinuses	NA	Sanz-Motilva et al, 2012[20]

ETR, Erythematotelangiectatic rosacea; *NA*, not available; *PHY*, phymatous rosacea.