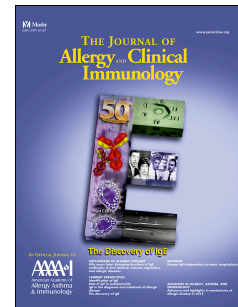


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Allergy and immunology in Africa: Challenges and unmet needs

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CURRENT PERSPECTIVE

Allergy and immunology in Africa: challenges and unmet needs

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Competing Interests

The authors have no competing interests to declare relevant to this article.

Key words: Africa; allergy; asthma; aeroallergens; food allergy; immunology; primary immunodeficiency; HIV.

ABSTRACT

The tremendous increase in allergy in the African Continent cannot simply be explained by the change in public hygiene. There are many “pre-hygiene” communities with sewage contaminated water supplies, helminth infestations, bare-footedness and poor housing and still there is a high prevalence of allergic disease. Africans may be exposed to many risk factors facilitating severe asthma and wheezing including airborne viruses, smoke, indoor dampness, cockroaches, and poor access to healthcare. Although the reporting on food allergy is inadequate to perform systematic reviews or meta-analyses, the available data suggest that food allergy is under-diagnosed. The rate of new HIV infections in high-prevalence settings in Africa remains unacceptably high. While the annual number of new HIV infections in Sub-Saharan Africa has declined lately, new HIV infections in the Middle East and North Africa region have increased; however, the current prevalence of 0.1% is still among the lowest globally. Africa is densely populated and consanguineous mating is high in some areas of north and sub-Saharan Africa. This allows for emergence of many autosomal recessive primary immunodeficiency diseases (PIDs). There is urgent need for the establishment of PIDs registries, stem cell transplantation facilities, and neonatal screening programs. To address these expanding problems and perform local cutting-edge research, Africans need to be empowered by motivated governments, dedicated funds, and compassionate scientific partnership.

Africa, optimistically termed the continent of the future is burdened by many infectious and non-communicable diseases. Allergy and immunodeficiency represent a significant sector of the health care burden and the lack of immunological expertise across the continent is highlighted by the limited publication output from many countries.¹

The tremendous increase in allergy cannot simply be explained by the change in public hygiene. In Africa, there are many “pre-hygiene” communities with sewage contaminated water supplies, helminth infestations, bare-footedness and poor housing and still there is a high prevalence of allergic disease.² Africans may be exposed to many risk factors facilitating severe asthma and wheezing including airborne viruses, smoke, indoor dampness, cockroaches and poor access to healthcare.³ There are few allergy specialists due to the prevailing healthcare infrastructure and/or to the lack of recognition of allergy as a clinical specialty. This phenomenon is described by the World Health Organization as the knowledge/practice gap.⁴ Moreover, many African countries are currently affected by conflict and fragility. An internal conflict associates the volatile situations particularly in North Africa since 2012 with an indirect impact on the vulnerability to asthma as social factors may adversely affect the level of patient’s asthma control.⁵

Although published data on the nature and prevalence of asthma from Africa are scant, there is trend towards increase in rate and severity. Data from the International Study of Asthma and Allergies in Childhood (ISAAC) reveals an increase in the prevalence of allergic rhinitis and eczema as well. There are considerable variations in the prevalence of wheeze (4.0–21.5%), allergic rhinoconjunctivitis (7.2–27.3%), and eczema (4.7–23.0%) between countries and between centers within the same country. However, consistently high asthma prevalence rates are reported from Cape Town (20.3 %), Polokwane (18.0 %), Reunion Island (21.5 %), Brazzaville (19.9 %), Nairobi (18.0 %), Urban Ivory Coast (19.3 %) and Conakry (18.6 %), rates that are comparable to Western Europe.⁵ An adapted version of the ISAAC questionnaire was distributed to a sample of 2,645 school children (11–15-yr-olds) from Cairo. The overall prevalence of wheeze ever, wheeze during the last year and physician-diagnosed asthma were 26.5%, 14.7% and 9.4%, respectively. The prevalence of rhinoconjunctivitis was 15.3%.³ Based on a telephone survey, the age- and gender-adjusted asthma prevalence was 3.45% in Algeria, 3.89% in Morocco and 3.53% in Tunisia.⁶

The rates of exercise-induced asthma and sensitization doubled over a period of ten-years among Ghanaian children and adolescents.⁷ Globally, the upward trend in allergic diseases has been associated with urbanization.⁵ However, a study on 13-14 yr old Nigerian children reported a comparable prevalence of asthma in rural (7.5%) and urban communities (8%).⁸ The pro-allergic environmental factors, abundant both in rural and urban tropical communities, include foods, animals, birds, house dust mites, mold spores, and stinging insects.⁵ Papular urticaria, one of the particularities of allergy in Africa, caused by flea and mosquito bites is regularly seen in children in hot and humid settings. It was reported in 6.8% of children in Mali, 6.7 - 14.6% from various studies in Nigeria and in 1-2% of subjects from a multi-center population-based survey from Ghana, Gabon, and Rwanda.^{5,9-11}

Helminth infestation is common in the African continent. According to the hygiene hypothesis, effective de-worming may enhance allergy risks. Helminth parasites are believed to induce regulatory immune responses that dampen atopic responses, but this remains controversial. The ongoing Lake Victoria Island Intervention Study on Worms and Allergy-related diseases (LaVIISWA) is expected to address this debate. It is a cluster-randomized trial evaluating the risks and benefits of intensive versus standard anthelmintic treatment on allergy-related diseases.¹² The relationship to atopic response was assumed to be dependent on the intensity of infestation. Schistosome infection intensity was negatively associated with the skin prick reactivity, mite-specific IgE and the ratio of IgE/IgG4 in a high-transmission Zimbabwean village.¹³

Although documentation is poor, a wide range of aeroallergens has been observed across the continent (Table 1).^{8,14-24} A World Atlas of Aeroallergens was generated by the World Allergy Organization. Much emphasis has been put on outdoor aeroallergens; nevertheless, data on indoor aeroallergens have been included from some locations and is being expanded. Certain pollens are abundant in the continent such as olive pollens in North Africa and Maize pollen in Zimbabwe.²⁵ Reports on latex sensitization from the African continent are scanty; one report from Egypt showed a rate of 4% in children with various allergic diseases.²⁶ Caution should be taken in reporting sensitization to cat in tropical areas endemic for parasites, as they can induce anti- α -gal antibodies that cause false positive binding to the α -gal moiety of the cat allergen, Fel d 5. Component-resolved testing may be necessary to avoid this diagnostic confusion.¹⁰

Although food allergy has been perceived as being rare in Africa, the available data suggest that it is under-diagnosed. The reporting on food allergens is inadequate to perform systematic reviews or meta-analyses due to heterogeneity in research methods and foods tested.¹⁰ In Zimbabwe, the reported prevalence rates of sensitization to predominant food allergens were 24% for potato, 21% for peanut, 15% for rice (15 %), 14% for carrot (14 %), 13% for soya, 13% for hazelnut and 11% for wheat.¹⁶ Other regionally significant food allergens may include pineapple (Ghana), okra (Nigeria), and mopane worm (Botswana).²⁷ Peanuts are frequently consumed in Africa, but severe allergic reactions are rare. It was assumed that there is natural clinical tolerance to peanut in African patients.²⁸ Peanut sensitization was reported in 7 out of 100 Egyptian asthmatic children; three of them had a positive oral challenge.²⁹

The rate of new HIV infections among young women and their male sexual partners in high-prevalence settings in Africa remains unacceptably high (Figure 1). Eastern and southern Africa is home to half of the world's people living with HIV. This region made progress in reducing new HIV infections among children between 2010 and 2015, but new HIV infections among adults are not declining fast enough.³⁰ While the annual number of new HIV infections in Sub-Saharan Africa has declined by 33% since 2005, new HIV infections in the Middle East and North Africa (MENA) region have increased by 31% since 2001; however, the current prevalence of 0.1% is still among the lowest rates globally.³¹ Since 2007, tremendous efforts have been made to scale up voluntary male circumcision, condom use, and viral suppression. Gaps in access to HIV testing and treatment are largest in western and central Africa and the MENA region.³⁰ The social and political unrest in North Africa in the last few years had potential serious implications on HIV control in the form of disrupted implementation of prevention and advocacy programs and interference with service delivery.³¹

It has been estimated that 988,000 people suffer from primary immunodeficiency diseases (PIDs) in Africa.³² Africa is densely populated and consanguineous mating is high with rates exceeding 60% in some areas of north and sub-Saharan Africa.³³ This allows for emergence of rare autosomal recessive disorders including many PIDs. In spite of steady improvement, PIDs are still under diagnosed in the African continent; barely 2500 patients have been diagnosed.³² Reasons include lack of resources and immunological expertise.¹ Patterns and spectrum of PIDs differ from one center to another in countries which lack national registries. In Egypt, one center reported that 30% of its series had combined immunodeficiency and 18% had predominantly antibody disorders,³⁴ whereas in a preceding study by

Reda et al,³⁵ similar to international trends, antibody deficiencies were the most common category (35.9%). In South Africa, antibody deficiencies predominate (51%) followed by well defined syndromes (24%).³⁶ In the Tunisian registry, there is particularly high proportion of combined Immunodeficiencies and congenital phagocyte defects.³⁷ In Morocco, 27.4% of registered PIDs are well defined syndromes and 22.7% are predominantly antibody deficiencies.³⁸ Specific ethnic populations were recognized to have a higher incidence of certain types of PIDs due to founder mutations. For example, ADA-SCID in the Somali population³⁹ and mutation of the RFXANK gene associated with MHC class II deficiency in North Africa.⁴⁰ The overall mortality rate from PIDs among Africans is high ranging from 25%³⁶ to 34.5 %, mainly observed with combined immunodeficiencies.³⁷ There is urgent need for the establishment of registries for PIDs, and hematopoietic stem cell transplantation facilities, as well as neonatal screening programs. Created in 2008, the African Society for Immunodeficiencies (ASID) is working towards the establishment of an African PID registry, which may interface with other international registries at a later stage.³²

Finally, sequential lifestyle changes in the African continent have impacted the expression and outcome of many allergy/immunology disorders. In order for Africans to address this expanding field of health care and to be able to perform local cutting-edge research, they need to be empowered by motivated governments, dedicated funds, and compassionate scientific partnership.

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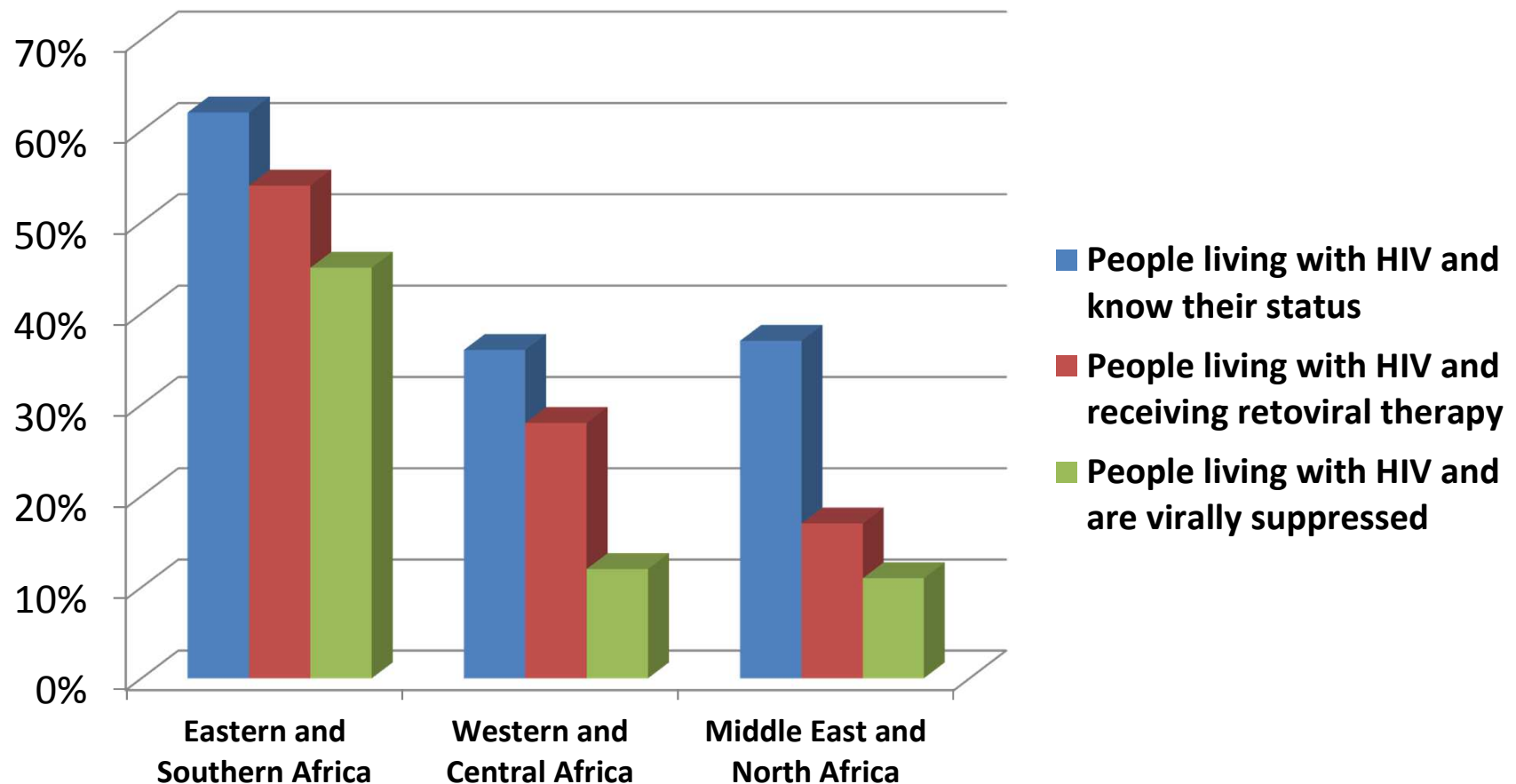
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Table (1): Some published data on aeroallergens in Africa from cross sectional studies

Authors	Setting	Study Population	Methods	Main Findings
Mbatchou Ngahane et al (2016) ¹³	Cameroon	600 adult medical students (mean age 22.6 ± 2.7 yrs) from Douala	SPT	D. pteronyssinus (24.2 %), D. farinae (22.8 %), B. tropicalis (23.3 %) and the cockroach B. germanica (15.2 %) were the most common sensitizing allergens.
Jeevarathnum et al (2015) ¹⁴	South Africa	85 Children (1-18 yrs) with allergic rhinitis and/or asthma from the coastal KwaZulu-Natal Province (KZN) and Johannesburg	SPT	Higher prevalence of B. tropicalis allergy in the tropical humid northern KZN region (52%) than Johannesburg (3%).
Hossny et al (2014) ¹⁵	Egypt	100 children (1–7 yrs) with asthma from Cairo	SPT	Sensitization to one or more HDM strains was reported in 24%; 12% of subjects were sensitive to D. pteronyssinus, 11%, to D. farinae, 7% to L. destructor, 6% to T. putrescentiae, and 4% to A. siro.
Pefura-Yone et al (2014) ¹⁶	Cameroon	201 adolescents and adults (median age 36 yrs) with asthma from Yaounde	SPT	Sensitization to D. pteronyssinus, D. farinae and B. tropicalis was found in 53.2%, 49.8% and 47.8% of patients, respectively.
Pefura-Yone et al (2014) ¹⁷	Cameroon	184 adults with asthma (median age 38 yrs) from Yaounde	SPT	Sensitization rate to the cockroach B. germanica cockroach was 25.5%
Oluwole et al (2013) ⁸	Nigeria	170 students; 13-14 yrs old; enrolled within ISAAC study	SPT	Sensitization to cat hair, cockroach, mango blossom, and mouse epithelium was more frequent in 85 asthmatics than in 85 matched healthy controls.
El-Ghoneimy et al (2013) ¹⁸	Egypt	Children with asthma (n: 87), allergic rhinitis (n: 56) and allergic conjunctivitis (n: 57) from Alexandria	SPT	The most common sensitizing pollen was Rye grass pollen followed by English plantain then Lamb's quarters pollens.
Seedat et al (2010) ¹⁹	South Africa	50 consecutive adults with allergic rhinitis from the Free State	SPT and/or ImmunoCAP RAST	Sensitization rates to house-dust mites, T. urticae and B. germanica were 46%, 46% and 38% respectively. Storage mite sensitization was not common.
Mpairwe et al (2008) ²⁰	Uganda	20 women with asthma, 25 with eczema and 95 matched controls from Entebbe	SPT	Sensitivity to any allergen 30.7%, B. tropicalis 10.9%, Dermatophagoides mix 16.8%, and cockroach 15.8%. SPT results were significantly associated with a history of asthma but not eczema.
Benzarti et al (2002) ²¹	Tunisia	500 adults from Sousse area (general population)	SPT	21.8% were sensitized to house dust mites (D. pteronyssinus, D. farinae) and 18.2% to pollens (Olive-tree, Graminees, Parietaire).
Sunyer et al (2000) ²²	Tanzania	608 adult women from Ifakara (general population)	Specific IgE	Positive specific IgE to D. pteronyssinus or cockroach were not associated with presence of asthma.
El-Gamal et al (1995) ²³	Egypt	51 children (5-12 yrs) with asthma from Cairo	Specific IgE	Cockroach specific IgE was detected in 43 subjects (84%), seven of whom (13%) showed a high response (≥ 1.5 IU/ml).

A. siro: Acarus siro; B. germanica: Blattella germanica cockroach; B. tropicalis: Blomia tropicalis; D. farinae: Dermatophagoides farinae; D. pteronyssinus: Dermatophagoides pteronyssinus; L. destructor: Lepidoglyphus destructor; SPT: skin prick test; T. putrescentiae: Tyrophagus putrescentiae.



African HIV Status by Region

Adapted from: Prevention gap report; UNAIDS 2016.

http://www.unaids.org/sites/default/files/media_asset/2016-prevention-gap-report_en.pdf