***Review Article***

**Psoriasis in Nigeria: The Critical Role of Genetic and Genomic Tools in Addressing a Predominantly Genetic Condition**

**ABSTRACT**

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| Psoriasis is an incurable chronic inflammatory skin condition that affects about 125 million people worldwide. While psoriasis commonly affects people in the West, it has been widely underreported in Africa, particularly Nigeria. Due to its rare occurrence, only a few studies have investigated the incidence and prevalence of psoriasis in the country. However, reports demonstrate a low prevalence of psoriasis in Nigeria, estimating only about 0.33% of sufferers. Access to treatment options has been challenging due to the unavailability and high costs associated with existing options. Genomic tools and research offer promising advancements for more effective and personalised treatment options. One of these is genome-wide association studies (GWAS), which has been instrumental in identifying new therapeutic targets. However, integrating these tools into clinical practice in Nigeria faces barriers such as limited funding, shortage of skilled personnel, inadequate infrastructure, and ethical concerns related to genetic research. This review highlights a need for comprehensive Nigerian population-based studies to accurately assess the prevalence of psoriasis and its impact in Nigeria. Also, it emphasises the need for increased investment in genomic research, capacity building for researchers and healthcare professionals, and public awareness about psoriasis in Nigeria. |

*Keywords: Psoriasis, Genetics, Genome-wide association studies, Dermatology.*

**1. INTRODUCTION**

Psoriasis is a common, chronic, non-communicable skin disorder with a disfiguring and disabling impact [1]. Psoriasis is characterised by scaly, thick, and erythematous lesions with sharply demarcated margins. The chronic and unpleasant symptoms of psoriasis contribute to a decrease in the quality of life of patients, often accompanied by depression, anxiety, and social isolation [2]. Psoriasis is associated with a complex interplay of multiple genetic risk foci, environmental risk factors, and excessive immunological abnormalities [3]. However, genetics largely determines an individual’s susceptibility, accounting for 70% of disease risk. According to Rendon and Schäkel [4], psoriasis shows dermatological manifestations in the forms of chronic plaque lesions, which account for 90% of disease cases, acute and self-limiting guttate type eruptions, seborrhoeic psoriasis and pustular lesion [5]. Beyond the dermatological impact, psoriasis is sometimes characterised by disorders such as joint disease, as seen in at least 10% of cases, cardiovascular diseases, and metabolic abnormalities [6]. Globally, psoriasis affects 2% to 3% of the population, which is estimated at 125 million people [7]. According to the [122], the prevalence of psoriasis ranges between 0.09% and 11.4% across various countries, making it a cause of concern. While most studies are conducted in Europe and North America, only a few exist from low and middle-income countries. Considerable gaps exist in the geographical areas that have reported on the prevalence of psoriasis. Psoriasis is predominant in Western countries and especially alarming in Europe, with Norway, France, and Portugal having prevalence rates of 4.6%, 4.42%, and 4.40%, respectively [125].

Various reports from sub-Saharan Africa have indicated that psoriasis is not as common as in other parts of the world [126, 127]. In Africa, psoriasis prevalence varies between 1.9% to 3.5% in Eastern African countries and 0.025% to 0.9% in West African countries [125]. However, Parisi et al. [5] acknowledged that the figures published in these studies might underestimate the true prevalence of the disease. This is because most of the data came from studies using databases, which only reflect people with psoriasis who sought healthcare and do not cover the undiagnosed population. In addition, Dairov [125] opined that the limited prevalence of psoriasis among people with coloured skin is due to the difficulties in diagnosing the condition. Psoriasis is rare and uncommon in Nigeria, ranging between 0.4% and 1.1% across different areas [128]. Due to the low incidence of psoriasis in Nigeria, research into how it affects the population is very limited. Thus, this study reviews the incidence of psoriasis in Nigeria, the genetic basis, clinical presentations, and the necessity of genome-based treatment strategies for the long-term management of psoriasis.

# 2. PREVALENCE OF PSORIASIS IN NIGERIA

Approximately 125 million people worldwide suffer from one or more types of Psoriasis [59]. Although common in the West, psoriasis has rarely been reported among Africans and even fewer among Nigerians. As reported in the Global Psoriasis Atlas [60], the prevalence of psoriasis in Western Europe was estimated to be 1.81%, 1.45% in Central Europe, 0.47% in Eastern Europe, and 1.34% in high-income Americas. The value was much lower in Sub-sahara African countries, including Nigeria, with a rate of 0.33%. However, Enigbokan et al. [61] opined that the perceived rarity of psoriasis may be attributed to the lack of data and research on the condition. This is due to reports from recent studies demonstrating an increasing incidence of psoriasis among Nigerians [61]. This rising trend has also been observed with other skin diseases in the country. Akinboro et al. [62] asserted that the prevalence of skin diseases within the country has witnessed a gradual rise and shift from infectious to non-infectious. The authors attributed this shift to the developing economy, industrialisation, improved healthcare facilities, and environmental cleanliness. These external factors may have triggered the diseases, contributing to the observed trends.

Several studies have investigated the prevalence and occurrence of different skin conditions in Nigeria. These reports indicated a high occurrence of papulosquamous disorders, eczema, dermatitis, hypersensitivity disorders, and autoimmune connective tissue disorders [62,63]. However, similar reports on psoriasis among the Nigerian population are very limited. It is important to highlight that only a few studies have examined the prevalence of psoriasis among Nigerians, excluding other related skin disorders. Additionally, the studies were conducted using data from patients who presented with psoriasis in dermatology outpatient clinics [64]. This further highlights the gap in psoriasis and the need for population-based research on this disorder to understand its prevalence and how it affects Nigerians.

Two of the studies available were conducted about three decades ago, while the other two are more recent. One such study investigated the prevalence of psoriasis vulgaris in the savannah regions of the country [65]. Although the study dates far back to the 1980s, the results provided valuable insights into the existence and incidence of psoriasis in the country. Obasi [65] reported that psoriasis had an incidence rate of 0.8%, appearing in only 44 of 5250 skin disorders examined. This study further highlighted the low morbidity rate among West Africans compared to Europeans and Americans.

Similarly, Jacyk [66] asserted that psoriasis is uncommon among Nigerians, with an estimated 0.8% of 9806 (78) skin disorders reported in northern Nigeria between 1977 and 1981. Compared with other African countries, Jacyk [66] reported that psoriasis had a lower incidence and burden rate in Nigeria. In contrast, the Global Psoriasis Atlas [60] statistics reported the same incidence rate in Nigeria and other Sub-Saharan African countries (0.33%). This is an exception to East-Subsaharan Africa, where the prevalence of psoriasis was 0.2%. According to Parisi et al. [5], these regional variations may be attributed to differences in climate conditions, geographical locations, genetic differences, age, and sex. Hence, there are differences in incidence rates across different countries and continents.

However, more recent studies confirm the increasing occurrence of psoriasis in Nigeria [7,64]. Ayanlowo and Akingkugbe [7] studied the clinical patterns of Psoriasis and its predisposing factors. The study reported that 124 of 11,015 participants were diagnosed with psoriasis, giving a prevalence rate of 1.13%. However, Husain [64] reported an occurrence of 0.6% in a larger population of 39,037 examined between 2001 and 2021. These differences may be due to the geographical location where the studies were conducted. Ayanlowo and Akinkugbe [7] conducted their study in Southwestern Nigeria, where psoriasis is considered indigenous. Both studies reported that males were likelier to present with psoriasis and other skin conditions than females. However, Husain [64] opined that females have an earlier onset than males, as evidenced by mean onset ages of 27.6 and 32.2 years, respectively. While it is necessary to note the increasing trend in psoriasis cases among the Nigerian population, the available studies are conducted on patients who attend dermatology clinics and are not population-based studies. Therefore, population-based studies are required to accurately ascertain the prevalence and incidence of psoriasis in Nigeria and Africa.

# 3. CLINICAL PRESENTATION OF PSORIASIS

The main clinical features of psoriasis are scaly, thick, and erythematous lesions that are usually itchy and hemorrhagic [22,23]. Depending on the psoriasis variant, these features vary from small skin patches to severe exfoliations [21,114]. Different variants of psoriasis include Plaque psoriasis, guttate psoriasis, erythrodermic psoriasis, pustular psoriasis, acral psoriasis, seborrheic psoriasis, and flexural psoriasis. Plaques are a common feature of psoriasis and occur in about 70-90% of patients with psoriasis [23]. Patients with plaque psoriasis show well-demarcated, round-oval discoid plaques covered with silvery white scales [27]. Ayanlowo and Akinkugbe [7], who investigated the clinical patterns of psoriasis in Nigerians, noted that plaque psoriasis was the most common variant presented. While plaque psoriasis was diagnosed in 82 of 124 patients (66.1%), pruritus was the most common symptom observed (91%). Similarly, Higgins's [132] study on psoriasis in the UK reported that about 80-90% of presentations are plaque psoriasis. Thus, these outcomes correlate with established studies, noting the frequency of plaque psoriasis [129].

Scalp, nail, and guttate psoriasis were also prevalent in Nigeria, affecting 50.8%, 29%, and 20.2% of the 124 patients with psoriasis, followed by Ayanlowo and Akinkugbe [7]. Guttate psoriasis primarily affects children and young adults, especially those with a history of the disease in their ancestry. This disease may result from streptococcal upper respiratory tract infection [28]. Naldi [26] reported that 10% of psoriatic patients with plaque psoriasis had guttate psoriasis during the disease pathogenesis. This may be due to their genetic similarity in association with the PSORS1 genetic loci [31,32]. Other presentations of psoriasis include erythrodermic psoriasis, which appears as erythema, scales, pruritus, or exfoliation covering at least 75% of the skin [33-35], and pustular psoriasis, which occurs when tiny sterile pustules and erythema coalesce into pus lakes [43]. In blacks, psoriasis is presented as violaceous or hyperpigmented plaques, which differs greatly from the pink-red scales observed in white patients [54,55]. The violet or purple-like lesions observed in black patients have made it difficult to diagnose psoriasis in people with very dark skin tones. Generally, black patients have a higher psoriasis area and severity index (PASI) score than whites, which might be because blacks are not aware of the signs and symptoms, thus presenting late into the disease. It might also be due to the difficulty in diagnosing the condition or the belief that psoriasis is rare among blacks.

4. GENETIC BASIS OF PSORIASIS

Over 40 genome regions are associated with psoriasis; 26 were discovered using GWAS, and 15 psoriasis susceptibility loci were identified in an Immunochip study [8]. Each region spans many genes; however, specific genes have been highlighted within each locus, contributing to increased individual susceptibility [8]. Harden et al. [9] reported that these genes span an array of functions that involve [antigen presentation](https://www.sciencedirect.com/topics/immunology-and-microbiology/antigen-presentation) (HLA-Cw6, [ERAP1](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/aminopeptidase), [ERAP2](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/erap2), MICA), the IL-23 axis (IL12Bp40, IL23Ap19, IL23R, [JAK2](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/janus-kinase), TYK2), T-cell development and T-cells polarisation ([RUNX1](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/runx1), [RUNX3](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/runx3), [STAT3](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/stat3), [TAGAP](https://www.sciencedirect.com/topics/medicine-and-dentistry/t-cell-activation), IL4, IL13), [innate immunity](https://www.sciencedirect.com/topics/immunology-and-microbiology/innate-immune-system) (CARD14, c-REL, TRAF3IP2, DDX58, IFIH1), and negative regulators of immune responses ([TNIP1](https://www.sciencedirect.com/topics/medicine-and-dentistry/calphobindin-ii), TNFAIP3, NFKBIA, ZC3H12C, IL36RN, [SOCS1](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/suppressor-of-cytokine-signaling-1)).

Preliminary genetic studies for psoriasis were conducted using linkage analysis in familial psoriasis. In a study to analyse three suggested psoriasis susceptibility loci, Enlund et al. [11] confirmed linkage to chromosome 6p (HLA region) and to 17q but not to 4q using a large Swedish set of families. The major histocompatibility complex (MHC) that primarily encodes genes involved in antigen presentation is found on chromosome 6p21.3 and contains the strongest susceptibility locus for psoriasis (PSORS1), which accounts for approximately 35%–50% of the genetic risk for psoriasis [12,13,109]. Dand et al. [10] further opined that PSORS1 contains the candidate gene corneodesmosin (CDSN), which encodes a desmosomal protein involved in keratinocyte cohesion and desquamation.

Confirming the association of HLA-Cw6 and psoriasis proved challenging as at least ten other genes were mapped to the just telomeric neighbourhood to HLA-C [14]. Several of these genes, including CDSN, HCR, and PSORS1C3, are expressed in skin cells and made very likely candidates for the PSORS1 gene as explained by the existence of multiple associated genes, which is a consequence of [linkage disequilibrium](https://www.sciencedirect.com/topics/neuroscience/linkage-disequilibrium) — the probability of particular alleles at two or more loci to be inherited together more often than would usually be predicted by chance [10]. Thus, the genes in this region are all associated with psoriasis because they are all in linkage disequilibrium. HLA-C\*06:02 is now confidently considered the most likely causal susceptibility allele since single nucleotide polymorphisms (SNPs) that tag this allele have generated the most significant association signals in subsequent case-control studies [10].

Within the PSORS-2 locus, on chromosome 17q-25, the CARD14 gene, which has been reported to be the most likely susceptibility gene, is found [15]. The CARD14 is a CARD-containing, membrane-associated guanylate kinase-like domain-containing protein (CARMA) family of scaffolding proteins that play a critical role in activating the NF-κB signalling pathway and recruiting IKK proteins [16]. PSORS-4 also contains the late cornified envelope (LCE) genes, which encode stratum corneum proteins involved in terminal epidermal differentiation. This locus has been implicated in psoriasis susceptibility in genome-wide association studies of both European and Chinese populations [17,18]. Further studies are required to identify genes responsible for the onset of psoriasis among the African population.

# 5. MANAGEMENT OF PSORIASIS IN NIGERIA AND FUTURE DIRECTIONS

Psoriasis is a chronic inflammatory disorder requiring various strategies to accurately diagnose and manage symptoms [67]. Over the years, an increasing understanding of the pathogenesis of psoriasis has led to advancements in diagnosis and treatment [68]. As psoriasis is a genetic condition, there are currently no curative therapies available. However, treatment strategies widely used focus on reducing the rapid spread of affected keratinocytes, enhancing the appearance of the condition on the skin, and improving patients' quality of life [69]. These strategies comprise topical agents (for managing mild psoriasis), biological agents, systematic agents, and phototherapy, administered based on the severity of the condition [22].

Foladun and Sabir [82] showed that topicals such as betamethasone cream and calcipotriol did not improve a 43-year-old psoriatic man who had the disease for five years. However, cyclosporine demonstrated improvements in the psoriasis of a Nigerian man. On the other hand, biologic, systemic agents, and phototherapy are not cost-effective for the average Nigerian. Ukonu and Ibekwe [130] investigated the cost implications and economic burden of psoriasis in Nigeria. The authors reported that the average cost of treatment varied depending on the severity and was tagged at N198,900, N261,633, and N323,708 for mild, moderate, and severe psoriasis, respectively. This poses a significant challenge as the average income of a federal employee is N930,000 per annum [131]. Thus, treating severe psoriasis will require almost half of a worker’s yearly income, making it unsustainable. In contrast, McKenna [133] opined that most people with psoriasis in the US are covered by health insurance. However, the out-of-pocket costs are about $2,400 per annum. These challenges have necessitated the search for longer-lasting personalised approaches to enhance patient outcomes and quality of life.

Studies have begun investigating genetic approaches to mitigate psoriasis recurrence and efficacy loss observed with biologic or topical agents [76]. GWAS is instrumental in diagnosing psoriasis and identifying specific genetic targets that are then used to design effective medications [68]. Consequently, Dand et al. [10] conducted a meta-analysis of GWAS to identify susceptibility alleles and potential therapeutic targets. The authors reported targets that have been identified using GWAS and that have been used to produce successful medications. These targets include IL-23A and IL-23B found at the 12q13.3 and 5q33.3 psoriasis susceptibility loci, respectively. They were important in producing the agent that targets interleukin-23 (IL-23).

Additionally, identifying the non-functional alleles of TYK2 was instrumental in developing deucravacitinib. Deucravacitinib inhibits the non-functional alleles, thereby increasing resistance to psoriasis. Furthermore, Dand et al. [10] identified genetic variants at the 5’ untranslated region of the interleukin receptor A (IL17RA) gene found on chromosome 22q11.1. This gene could potentially be targeted to reduce the inflammation associated with psoriasis and improve the array of precision-based therapeutics available.

Similarly, Brooks et al. [77] highlighted the importance of genome-based research in identifying genetic markers. Identifying genetic markers allows precise therapeutics to be developed, increasing the amount of potent, long-lasting drugs [77]. An emerging gene-based strategy is using small interfering RNA (siRNA) technology. siRNA are double-stranded RNA molecules that cleave specific complementary mRNA before translation, inducing sequence-specific gene silencing [78]. Due to the specificity and efficiency of this process, siRNA can silence any target gene. Therefore, Zhao et al. [76] conducted a systematic study highlighting the efficacy of siRNA and novel siRNA-delivery systems as an option for the targeted treatment of psoriasis. The authors suggested that siRNA-mediated gene silencing can potentially prevent keratinocyte proliferation and abnormal death. This approach involves silencing genes contributing to aberrant keratinocyte division, including Fibroblast Growth Factor Receptor 2, Nuclear Factor of Activated T Cells 2, and TRAF3 Interacting Protein 2 genes [76]. Doing this will diminish keratinocyte growth and development, conferring resistance to spreading psoriasis on the skin. The diagnostics and therapeutics of psoriasis are constantly evolving, leading to advancements in genomic strategies and precision-based techniques that improve the treatment and diagnosis of psoriasis.

# 6. BARRIERS TO IMPLEMENTING GENETIC AND GENOMIC TOOLS IN NIGERIA AND RECOMMENDATIONS

Global Genome-Wide Association Studies (GWAS) on psoriasis and other genetic diseases mostly employ sets of individuals and families in the West, excluding many African populations. This creates a research gap, and more data on African population genomics is needed to address it [88,90]. Parisi et al. [5] corroborated this by highlighting considerable gaps in research from these geographical areas, particularly low—and middle-income countries, with studies conducted mainly in Europe and North America.

According to Dand et al. [10], results from genetics studies are sometimes population-specific due to the heterogeneity of genome composition across human populations, and the exclusion of the African population, which harbours the highest genetic diversity, hinders global health equity. Also, extensive research is important to develop databases and other platforms for easy access to data on genomic variants and their associated genes and diseases [91,115], especially among African populations, as different populations must be sufficiently represented in genomic research [92].

However, efforts of research facilities in Nigeria, such as the African Centre of Excellence for Genomics of Infectious Diseases (ACEGID) at the Redeemer’s University and Covenant Applied Informatics and Communication Africa Centre of Excellence (CApIC-ACE) at Covenant University are currently bridging the genomics research gap. The Human Heredity and Health in Africa (H3Africa Consortium) initiative also corroborates the effort of research facilities in Nigeria by investing in the establishment of high-quality biorepositories in Africa, a bioinformatic network, and a strong training program that has developed skills in genomic data analysis and interpretation among bioinformaticians, wet-lab researchers, and healthcare professionals [93,116]. Therefore, emphasis must be placed on including more populations, especially Africans, in genetics research to facilitate the implementation of genomics-based approaches for diagnostic and therapeutic purposes [94].

## 6.1 Paucity of Research

Abdulghani et al. [106], who reviewed the management of psoriasis in Africa and the Middle East, suggested population-based research to provide in-depth data on the incidence and prevalence of psoriasis in African countries. The insights from this data will help understand differences in how psoriasis affects populations in Africa and the rest of the world. In addition, it will elaborate on factors that contribute to the observed differences and stimulate the public’s interest in learning more about its occurrence and management strategies [107,110]. Genomic research aims to reveal an individual’s genetic predisposition to diseases, usually by establishing a link between genotype and phenotype through genome-wide association studies (GWAS). Genetics and genomics research in Nigeria is not as widespread as it should be due to several factors. Funding of genomic research, which can be quite expensive in terms of cost, time, and computational resources required is important. Still, only about 0.2 – 0.4% of Nigeria’s gross domestic product (GDP) is allocated to funding research and development projects [95]. Many genetic researchers in Nigeria operate in relatively resource-scarce environments and have to fund these capital-intensive research projects either out of pocket or relying on private and international grants. The distressing nature of obtaining research funding results in the abandonment of novel research, which has impeded access to genetic information on the Nigerian population over time. To solve this, the Federal government can collaborate with research institutes and tertiary institutions to conduct population-based studies on psoriasis. In addition, there is a need to invest in research geared towards genome-based treatment to target psoriasis and its integration into healthcare practice in Nigeria. These studies will provide results that inform the country's diagnosis and therapeutics for psoriasis.

## 6.2 Shortage of Skilled Personnel

The complex nature of sequencing technologies, managing genomic datasets, and conducting genetic research drives a growing need to train African researchers with the skills and expertise to contribute to research in this area. This training will include strategies ranging from topical agents to precision/personalized-based genomic tools as they relate to the Nigerian population. With this, Nigeria will be better positioned to effectively respond to the rising trend of psoriasis incidence across the country. Another huge barrier to implementing personalised genomic medicine is the knowledge deficit among healthcare professionals. This is because many clinical practitioners are unaware of the latest trends in genomics technology and cannot interpret genetic testing results [97].

## 6.3 Infrastructure

Nigeria is faced with a general lack of infrastructure, which limits access to healthcare facilities to diagnose and manage psoriasis [108]. Furthermore, this lack affects the availability of resources to support research and clinical translation. This presents a major barrier to implementing genetic and genomic tools in general healthcare [93,100]. Investment is required to establish the framework to facilitate comprehensive DNA analysis, DNA sequencing, and genotyping facilities, biobanks for sample storage and their associated data, and researchers' access to technology. Extensive data infrastructure, information management systems for efficient data generation, and the establishment of facilities for clinical action and trials are also essential.

## 6.4 Data Generation and Data Sharing

A general apathy toward clinical trials due to ethical and societal apprehensions presents a problem with obtaining genetic data in Nigeria [94]. Apart from this, only relatively few people know about psoriasis in Nigeria. Disorders with low prevalence rates, like psoriasis, are poorly publicised and tend to be dismissed with more attention focused on other health priorities nationwide [104,113]. This has been largely responsible for patients presenting at health facilities at later stages of diseases, preventing the collection of genetic data during the early phases of disease progression [94]. Thus, it is important to create awareness about psoriasis, its causes, comorbidities, and types. This will result in enhanced knowledge of psoriasis and improved public perception, inclusion, and acceptance. The public should also be encouraged to volunteer as subjects in genetic studies, highlighting the benefits and addressing concerns.

**7. CONCLUSION**

Psoriasis affects about 3% of the world's population but is gravely underreported in many low and middle-income countries, with Nigeria inclusive. Genetic predisposition plays an excellent role in psoriasis, and essential genetic markers contribute to how susceptible an individual is to the disease. Psoriasis is managed over time with topical, oral, and systemic therapies. However, these therapeutic agents cause significant side effects and are often unavailable or ineffective for the average Nigerian. Genomic tools pose great potential in finding a long-lasting solution to psoriasis. However, there are many challenges to implementing genome-based treatments in Nigeria, including a lack of skilled personnel in the field of genomics and inadequate funding opportunities for genomic research. Thus, the government of Nigeria should allocate adequate funds to improve genomic research, while Nigerians should be sensitised to psoriasis and the treatment options available.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE**)

The author(s) hereby certify that no generative artificial intelligence (AI) tools such as Scalable Language Models (ChatGPT, COPILOT, etc.) or text-to-image generators were utilised in the authoring or editing of the paper.

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