ESJ Natural/Life/Medical Sciences Peer-reviewed

Prevalence of Thalassemia Among Children Aged 0 to 15 Years in Africa from 2007 to 2025: A Systematic Review and Meta-Analysis

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Doi:10.19044/esj.2025.v21n36p14

Submitted: 05 November 2025
Accepted: 25 December 2025
Published: 31 December 2025

Cite As:
Habibatou, I.A., Ounoussa, T., Zaratou, A., Nadakou, N.T., Oumou, H., Aminata, M.D., Doudou, Z.A., Abdoulaye, O. & Boutchi, M. (2025). *Prevalence of Thalassemia Among Children Aged 0 to 15 Years in Africa from 2007 to 2025: A Systematic Review and Meta-Analysis.* European Scientific Journal, ESJ, 21 (36), 14.
https://doi.org/10.19044/esj.2025.v21n36p14

Abstract

Thalassemia is a genetic blood disorder that reduces hemoglobin production, leading to anemia and related complications. Thalassemia is

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

widespread in Africa due to factors like historical malaria prevalence, migrations, and genetic factors. In Africa, there are few studies on thalassemia, leading to confusion with sickle cell disease because of a lack of diagnostic tools. Thalassemia remains a major public health issue in the region. This meta-analysis aimed to provide an update on the prevalence of thalassemia in Africa from 2007 to 2025.

A systematic literature search was conducted across the PubMed, AJOL, and Google Scholar databases to identify studies published between 2007 and 2025, using specific inclusion and exclusion criteria. Quality assessment was performed using the Mixed Methods Appraisal Tool (MMAT) for prevalence studies. The heterogeneity of the included studies was assessed using the I^2 and Q statistics. Funnel plots and Egger tests were performed to determine publication bias in this meta-analysis. The pooled 95% confidence interval (95% CI) prevalence of thalassemia across studies was determined using a generic random-effects inverse-variance method.

Eleven studies involving 26025 children, including 2889 cases of thalassemia, were included. Prevalence rates were pooled using random-effects models due to high observed heterogeneity ($I^2 > 75.0\%$, p-value < 0.05). The overall prevalence of thalassemia was 13.4% (95% CI 8.5-19.1%, $I^2 = 99.1\%$). Subgroup analyses showed that the pooled prevalence of thalassemia was 14.0% (95% CI, 0-33%; $I^2 = 98.5\%$) in newborns, 22.0% (95% CI, 11-33%; $I^2 = 98.8\%$) in patients ≤ 5 years of age and 6.0% (95% CI, 3.0-9.0%; $I^2 = 82.6\%$) in patients over 5 years of age. The prevalence of alpha-thalassemia carriers was 18% (95% CI, 7-28%; $I^2 = 99.2\%$) and beta-thalassemia 9% (95% CI, 6-12%; $I^2 = 98.6\%$).

This meta-analysis revealed a high prevalence of thalassemia among children aged 0 to 15 years in Africa. The study underscores the importance of screening programs, public awareness campaigns, and genetic counseling services to address thalassemia in Africa. Policy recommendations include implementing national screening programs and increasing healthcare resources to improve early detection and management of thalassemia.

Keywords: Prevalence, Thalassemia, Systematic review, Meta-analysis, Africa

Introduction

Thalassemia is an inherited disorder characterized by a deficit in haemoglobin synthesis due to mutations in the α-, β-, and δ-globin genes, leading to inefficient erythropoiesis. The World Health Organization (WHO) has classified thalassemia as a significant global health problem and includes it in the assessment of the worldwide burden of disease. In low-income countries, most children with thalassemia die before the age of five, while

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carriers in high-income countries often experience chronic illnesses. Thalassemia accounts for 3.4% of deaths in children under five globally and 6.4% in Africa (Tuo et al., 2024).

Worldwide, thalassemia affects around 4.4 in 10,000 live births. Transmission is autosomal recessive, regardless of sex (Smith Yolanda, 2022). Approximately 5 to 7% of the world's population carries a thalassemia gene, meaning that more than 400 million people are carriers of some form of thalassemia (mostly minor), and around 60,000 children are born each year with a significant form of thalassemia that requires treatment (UNFPA, 2022).

The prevalence of thalassemia is highest in India, the Mediterranean basin, the Middle East, Southeast Asia, and Africa**.** Alpha-thalassemia is the most common form of thalassemia worldwide. Approximately 1-3% of the African population is believed to carry a thalassemia gene, with 18.2% of these individuals having clinically significant hemoglobinopathies (Baird et al., 2022).

Beta-thalassemia, in particular, is widespread in Sub-Saharan Africa due to historical malaria prevalence, migration, and genetic factors (Obeagu, 2025). Alpha-thalassemia is also prevalent, notably in East Africa and specific populations in central Africa (WHO, 2025).

Thalassemia is suspected in patients with microcytic anaemia and normal or elevated ferritin levels. Clinical manifestations vary from asymptomatic to transfusion-dependent severe forms. Haemoglobin electrophoresis may reveal features standard to the different thalassemia subtypes, but genetic testing is required to confirm the diagnosis (Baird et al., 2022)**.** Regular blood transfusions and iron chelation therapy improve the prognosis of homozygous β-thalassemia. Life expectancy for sufferers has increased considerably, from a mere decade to around 30 years (Isaiah et al., 2024).

Increasing global migration has introduced thalassemias into many regions where they were not originally endemic (Kattamis et al., 2020). In Africa, particularly, there are few studies on thalassemia, and it is often confused with sickle cell disease due to limited diagnostic resources (Origa, 2017). Few countries keep patient registers, and in many others, children die from the most serious transfusion-related syndromes before they are even diagnosed (Angastiniotis & Lobitz, 2019). Diagnosis and early intervention are challenging due to the lack of awareness among the general public and healthcare professionals about the genetic nature of thalassemia and its associated risks (Li et al., 2024; Obeagu, 2025).

Hence, this meta-analysis aims to update the prevalence of thalassemia in Africa from 2007 to 2025. The goal is to provide valuable data to optimize patient management programs, allocate medical resources, and shape health policies.

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Materials and Methods

Search strategy

This review was carried out in accordance with the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) recommendations for conducting and reporting the results of this meta-analysis.

Eligibility criteria

To be included, articles had to be available in full text, written in English or French, and report original studies presenting quantitative data on the prevalence of thalassemia in newborns and children up to 15 years in Africa. Studies with an analytical component were also included.

Laboratory diagnostic analyses, experimental and animal research, studies conducted outside Africa, review articles, case reports, and case series, as well as conference abstracts and editorials, were excluded.

In addition, research that was not relevant to the study objective or did not provide the required data on the epidemiological profile of thalassemia was excluded from this systematic review.

Study selection strategy

A systematic literature review was conducted to identify articles reporting the prevalence of thalassemia among children in Africa. Several searches were conducted in PubMed, Google Scholar, and the African Journal Online (AJOL), and 11 studies were included in the final analysis. Our search strategy used various relevant keywords: “Prevalence”, “Thalassemia”, AND “Africa”.

Two authors (IAH and TO) independently reviewed the studies and made the selection decision. The third author reviewed the discrepancies (BM). No discrepancies were reported.

Quality assessment and risk-of-bias analysis

Independent reviewers (IAH, TO) critically appraised the included studies to ensure reliability and consistency of results. The Mixed Methods Assessment Tool (MMAT) (Hong et al., 2018), a critical appraisal tool, was used to assess the quality of the included studies. The MMAT assesses different study designs, including qualitative studies, randomized controlled trials, non-randomized studies, quantitative descriptive studies, and mixed-methods studies. The criteria for evaluating study quality are detailed in Supplementary Table 1.

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Data extraction

Appropriate data from each eligible study were independently extracted by two reviewers (IAH and TO), with disagreements resolved through discussion. A third researcher (MDA) confirmed the eligibility of included studies before they were included in the analysis. The following data were extracted: name of first author, year of publication, country, sample size, and prevalence of thalassemia.

Statistical analysis

Data were analyzed using RStudio version 4.4.1. The prevalence and distribution of thalassemias were grouped by country, age group, and thalassemia type. A narrative summary of the results was produced, highlighting trends, geographical variations, and factors associated with thalassemia prevalence. For the meta-analysis, meta (Balduzzi et al., 2019) and metafor (Viechtbauer, 2010) software were used to calculate the pooled percentage and 95% confidence interval (CI) using a random-effects model. Subgroup meta-analyses were performed by age group and thalassemia type, according to the prevalence of thalassemia.

Statistical heterogeneity between studies was assessed using the heterogeneity statistic and the inconsistency index ($I^2 > 75\%$). A p-value of < 0.05 was considered substantial heterogeneity. A funnel plot and Egger's weighted regression test were used to detect publication bias in the meta-analysis. The funnel plot asymmetry, combined with a significant Egger's test (p-value < 0.05), indicates publication bias.

Results

The literature search yielded 1165 unique studies after title and abstract screening; 30 articles were eligible for full-text review and were reviewed in detail. Finally, 11 articles (El-Beshlawy et al., 2007; El-Shanshory et al., 2023; Barker et al., 2017; Brito et al., 2022; Engle-Stone et al., 2017; Gahutu et al., 2012; Laghmich et al., 2019; Macharia et al., 2020; Osman et al., 2020; Suchdev et al., 2014; Siala et al., 2008) were included in our systematic review. The selection process is illustrated in Figure 1.

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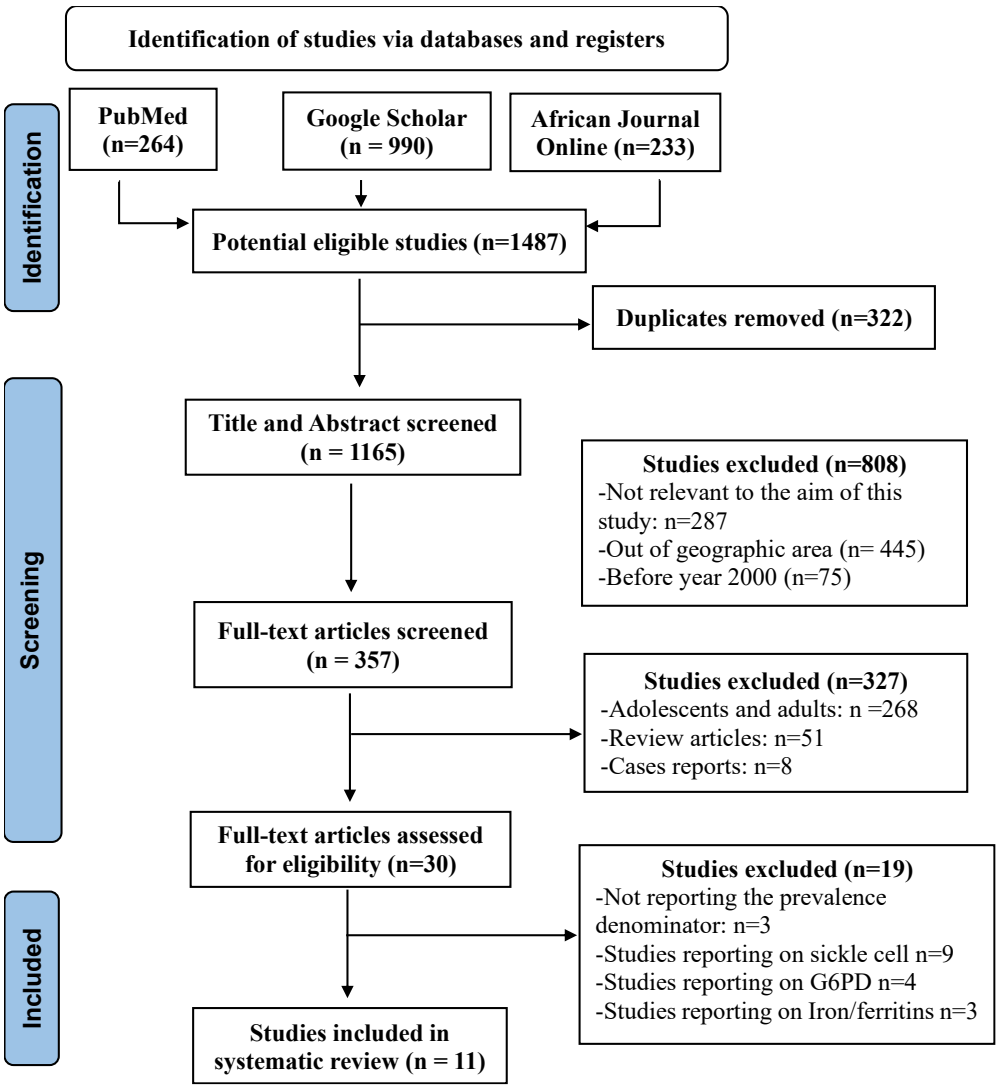

Figure 1: Diagram of literature search and study selection

Characteristics of included studies

This review included 11 studies: 10 cross-sectional and 1 cohort (Macharia et al., 2020). The 11 studies were published between 2007 and 2023 in 9 African countries (Figure 2): Egypt (n =2), Democratic Republic of Congo (n =1), Mozambique (n =1), Cameroon (n =1), Rwanda (n =1), Morocco (n =1), Kenya (n =2), Sudan (n =1) and Tunisia (n =1). Table 1 summarizes the basic characteristics of the populations studied.

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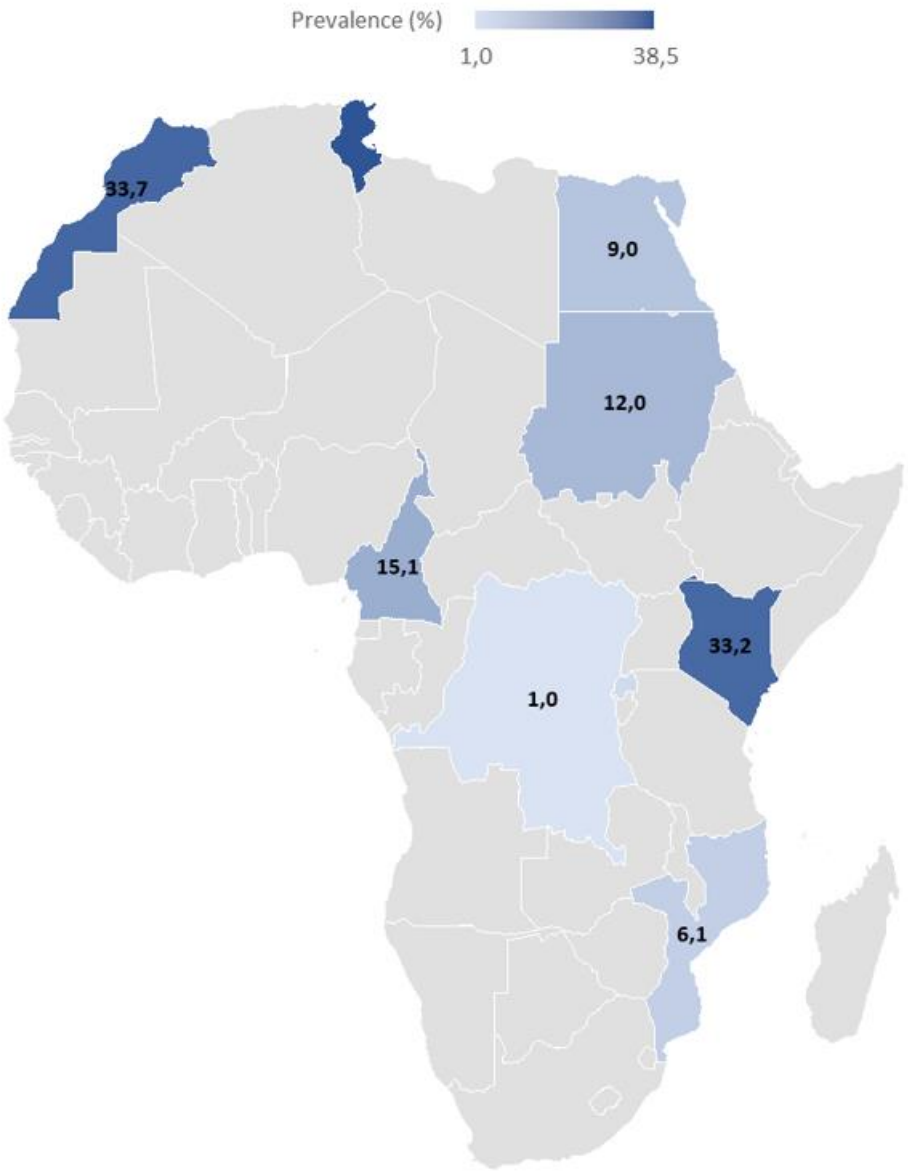

Figure 2: The prevalence of thalassemia disease in Africa

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Table 1: Characteristics of the included studies

Authors, Year of publication	Country	Study design	Sample seize	Study population	Gender Male n (%)	Type of thalassemia	Proportion of thalassemia (%)	Technique used	Mutations
El-Beshlawy et *al*., 2007 (El-Beshlawy et al., 2007)	Egypt	Cross-sectional study	1000	Randomly selected children 5-16 years	-	β-thalassemia	9.0	-	-
El-Shanshory et *al*. 2023 (El-Shanshory et al., 2023)	Egypt	Cross-sectional study	4320	Randomly selected students 14-18 years	2172 (50.0)	β-thalassemia	6.1	High-performance liquid chromatography	-
Barker et *al*., 2017 (Barker et al., 2017)	Democratic Republic of Congo	Cross-sectional study	744	Randomly selected children 6-59 months	372 (50.0)	α-thalassemia	12.0	PCR	α3.7
Brito et a*l*., 2022 (Brito et al., 2022)	Mozambique	Cross-sectional study	232	Non-probability sampling of newborns	115 (49.0)	α-thalassemia	33.2	PCR Sequencing	α3.7/4.2/-α3.7/4.2 (9.9%)
Engle-Stone et *al*., 2017 (Engle-Stone et al., 2017)	Cameroon	Cross-sectional study	291	Randomly selected children 12-59 months	154 (53.0)	α-thalassemia	33.7	PCR	homozygous heterozygous − α3.7 deletion
Gahutu et *al*., 2012 (Gahutu et al., 2012)	Rwanda	Cross-sectional study	749	Randomly selected children 0-59 months	-	α-thalassemia	15.1	PCR	α +-thalassaemia
Laghmich et *al*., 2019 (Laghmich et al., 2019)	Morocco	Cross-sectional study	1658	Randomly selected newborn	933 (56.0)	α-thalassemia	1.0	PCR	α3.7 deletion (0.33%) α4.2 deletion (0.12%) *ααα*anti 3.7 deletion (0.06%) HS-40 deletion (0.03%) --Med I deletion (0.03%)
Macharia et *al*., 2020 (Macharia et al., 2020)	Kenya	Cohort Study	15577	Randomly selected children 3-12 months	-	β-thalassemia	11.4	PCR Sequencing	β0-CD22 (GAA→TAA) β0-Initiation codon (ATG→ACG) β0-IVS1−3′ end del 25 bp β+-IVS-I−110 (G→A)
Osman et *al*., 2020 (Osman et al., 2020)	Sudan	Cross-sectional study	67	Randomly selected patients 12-17 years	28 (42.0)	α-thalassemia	3.0	PCR	α3.7 deletion (2.99%)
Suchdev et *al*., 2014 (Suchdev et al., 2014)	Kenya	Cross-sectional study	858	Randomly selected children 6-35 months	429 (50.0)	α-thalassemia	38.5	PCR	-
Siala et *al*., 2008 (Siala et al., 2008)	Tunisia	Cross-sectional study	529	Randomly selected newborn	-	α-thalassemia	7.4	PCR Sequencing	α2 -globin gene (αcd23−GAG→Stop), α1 -globin gene (αcd119−CCT→TCT),

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Proportion of thalassemia in Africa

A total of 26025 participants were included in this systematic review. We determined the prevalence of thalassemia as the proportion of a given population affected by thalassemia. The children studied, in whom thalassemia (type α or β) had been diagnosed, belonged to varied age groups. Age categories were refined as follows: newborn, under-5, and over-5 years old (Table 1). The overall combined prevalence of thalassemia was 13.4% (95% CI, 8.5-19.1%, I^2 = 99.1%) (Figure 3).

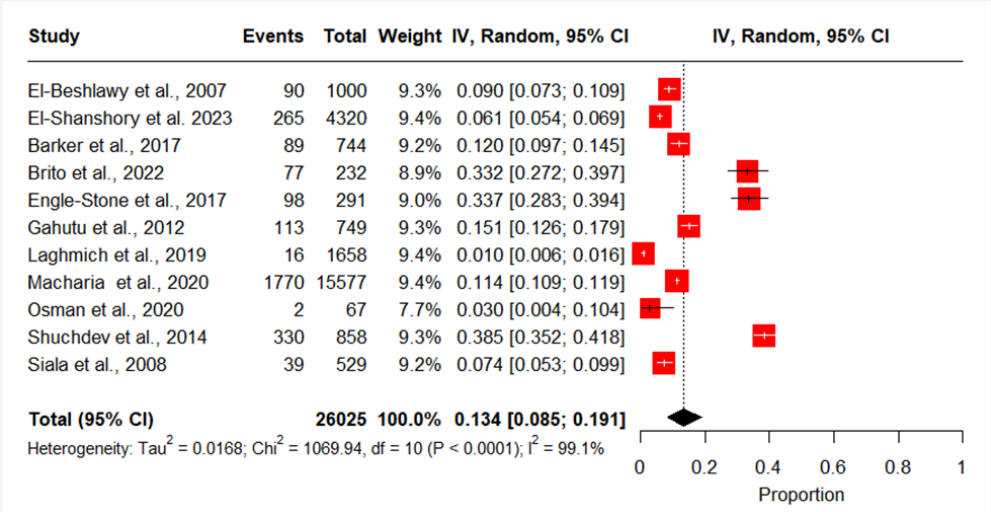

Figure 3: Prevalence of thalassemia in Africa

Subgroup analysis

Figures 3 and 4 show the subgroup analysis of thalassemia prevalence by age category and thalassemia type. Subgroup analysis by age category revealed that the newborn, under-5, and over-5 age groups, respectively, had 14% (95% CI: 0-33%), 22% (95% CI: 11-33%), and 6% (95% CI: 3-9%) prevalence of thalassemia (Figure 4).

Subgroup analysis by thalassemia type revealed that the prevalence of alpha-thalassemia was 18% (95% CI: 7-28%) and beta-thalassemia 9% (95% CI: 6-12%) (Figure 5).

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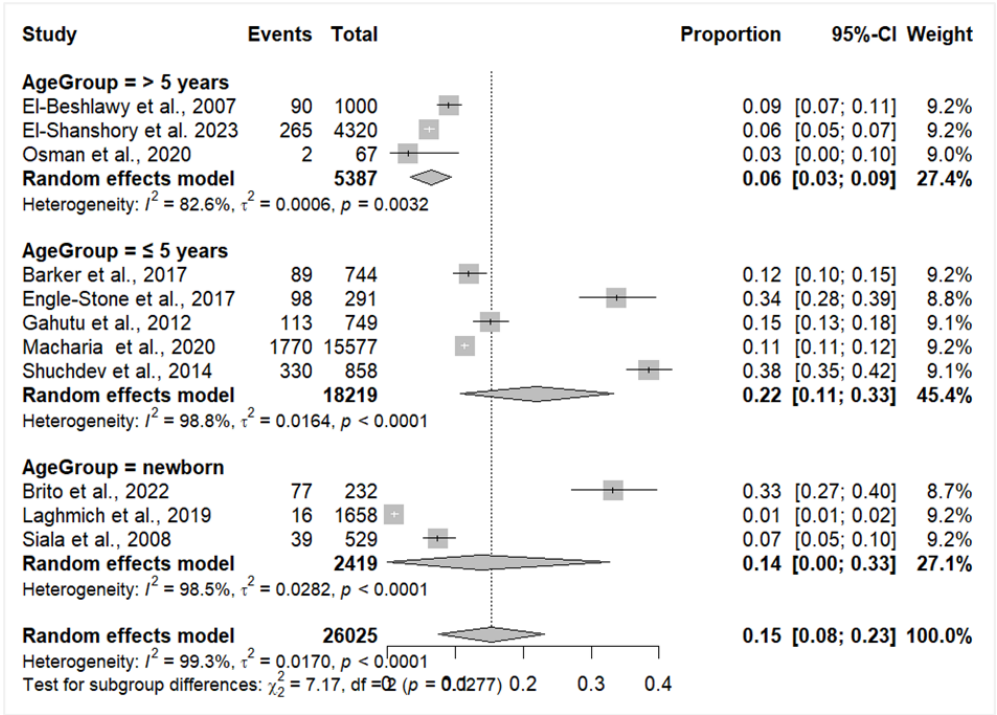

Figure 4: Analysis by patient age subgroup

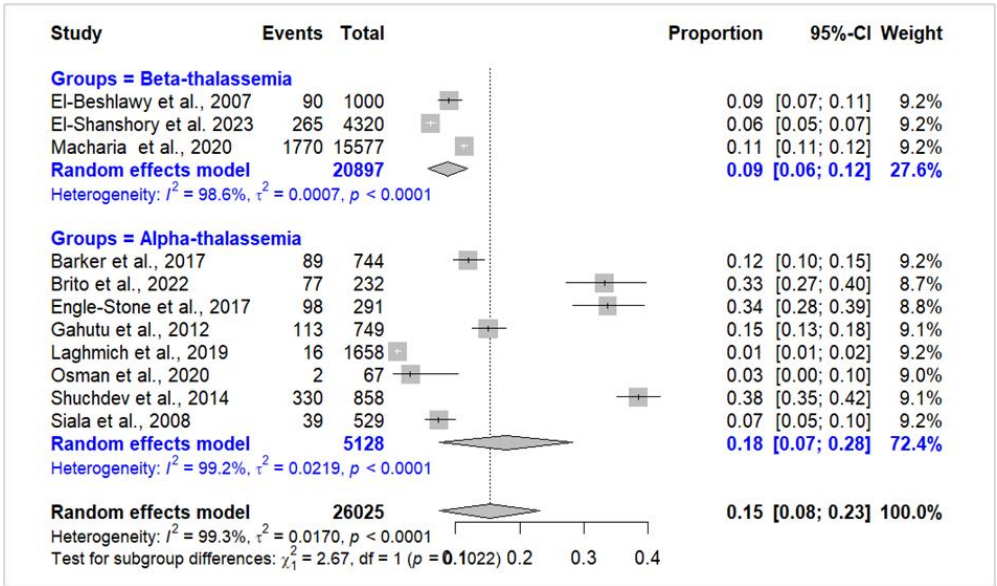

Figure 5: Analysis by thalassemia type subgroup

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Study quality and assessment of risk of bias

The included studies were visually assessed for publication bias using a funnel plot. The funnel plot asymmetry indicated publication bias (Figure 6). Similarly, Egger's test revealed significant publication bias ($p < 0.0001$).

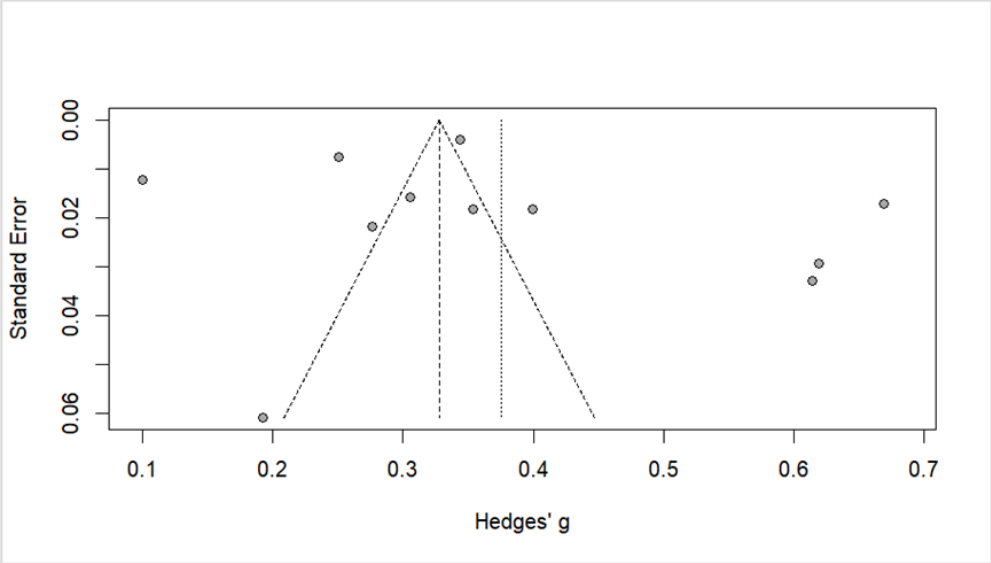

Figure 6: Funnel plot for publication bias of pooled prevalence of thalassemia in Africa from 2007 to 2025

Discussion

This systematic review aimed to determine the prevalence of thalassemia in Africa. This systematic review included 11 observational studies conducted in Africa. These studies included 2889 cases of thalassemia among 25025 children.

Prevalence of thalassemia

The meta-analysis, which included studies conducted between 2007 and 2025, estimated the prevalence of alpha-thalassemia at 18.0% (95% CI, 7.0-28.0%; $I^2 = 99.2\%$) and beta-thalassemia at 9.0% (95% CI, 6.0-12.0%; $I^2 = 98.6\%$). The present study contributes to the existing literature by providing a valuable database for accessing thalassemia data.

This research is motivated by the need to reinforce current knowledge and to estimate the prevalence of thalassemia in Africa. Although thalassemia is widely studied in other parts of the world, there is a paucity of research specific to Africa. This meta-analysis aims to fill this gap by providing a contextualized understanding of childhood thalassemia in the African setting.

The overall combined prevalence of thalassemia was 13.4% (95% CI, 8.5-19.1%). The prevalence of thalassemia (carrier or affected) varied across countries, from 1% in the DRC to 38.5% in Tunisia. This result is comparable

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to that of Rao et al., who reported that thalassemia prevalence can range from 10% to 20% in sub-Saharan Africa (Rao et al., 2024).

Newborns, children under 5 years, and children over 5 years had respectively 14% (95% CI: 0-33%), 22% (95% CI: 11-33%), and 6% (95% CI: 3-9%) prevalence of thalassemia.

Sub-Saharan Africa, which has one of the highest malaria burdens in the world, also has a high rate of thalassemia gene mutations, particularly in populations living in areas where malaria is endemic (Egesa et al., 2022; Li et al., 2024).

In addition, sub-Saharan Africa faces various systemic barriers to healthcare infrastructure, including limited access to diagnostic centres, blood transfusion services, and specialized medical care, which hinder effective management of thalassemia (Obeagu, 2025).

The prevalence of alpha-thalassemia was 18% (95% CI: 7-28%), and that of beta-thalassemia was 9% (95% CI: 6-12%). Similar to some research, 5-10% of residents in Africa may carry the thalassemia gene. The prevalence rate may vary by country or region. For example, in countries such as Nigeria, Kenya, and Ghana, the proportion of beta-thalassemia carriers ranges from 5 to 10% (Obeagu, 2025).

Diagnosis, surveillance, and regional variability

The importance of thalassemia in sub-Saharan Africa is particularly pronounced in countries located in the equatorial belt, where malaria transmission is high (Obeagu, 2025). Because they interact with malaria resistance and thalassemia, especially α-thalassemia, these conditions are common. In Kenya and Tanzania, approximately 40–50% of the population has gene deletions that cause α-thalassemia (Mugisha Emmanuel, 2025). Our findings revealed that β-thalassemia is rare but has been reported in Egypt and Kenya. This result is similar to that reported by Twum et al., who found that β-thalassemia is more prevalent in northern Africa, with Algeria and Morocco showing the highest prevalence (Twum et al., 2023). Increasing these carrier rates increases the risk of children inheriting the disease, particularly beta-thalassemia major, which can lead to severe anaemia and requires ongoing medical care. The epidemiology of β-thalassemia is evolving due to several factors. Migration, the introduction of β-thalassemia prevention initiatives, and increased survival rates are among these causes (Kattamis et al., 2020).

Furthermore, the extent of thalassemia in sub-Saharan Africa is frequently underestimated, as screening for this condition is not systematic. Many individuals with mild forms of the disease may remain undiagnosed or be misdiagnosed with other forms of anaemia (Isaiah et al., 2024; Vichinsky, 2016).

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Policy recommendations

This study provides crucial epidemiological information on paediatric thalassemia in Africa. To prevent and control paediatric thalassemia worldwide, these data are essential for allocating resources and developing public health strategies. It is crucial to set up national programs for compulsory screening for thalassemia through premarital and neonatal screening. It is also essential to target young adults with information about thalassemia and its consequences, to reduce intermarriage among thalassemia carriers and lower the incidence of the disease.

We make practical policy recommendations based on the findings of this study, such as encouraging thalassemia screening programs and public awareness campaigns in Africa, strengthening international cooperation and aid, increasing investment in healthcare resources and infrastructure, training healthcare professionals, implementing economic support policies, and promoting genetic counselling services. By raising public awareness of thalassemia and increasing early detection rates, these actions aim to reduce the disease's impact in Africa significantly (Li et al., 2024).

Strengths and limitations of the study

The study's strength was that it accounted for a large number of children with thalassemia. The majority of the studies included in this meta-analysis used large sample sizes, which is thought to be one of the factors affecting the study's power. Additionally, the search strategy was comprehensive, utilizing numerous electronic databases, and the included articles are of higher quality.

However, the main limitation of this systematic review is the lack of data from other countries on the continent, as well as on mortality rates and risk factors. The quality of the prevalence studies was limited by methodological problems, including non-randomized sampling, heterogeneity in the populations examined, and the lack of standardized diagnostic tests. High heterogeneity is a significant feature of these results, evident in all groups ($I^2 = 99.1\%$). This means that the studies included vary significantly in terms of methodology, geographical location, types of population examined, and methods of thalassemia diagnosis. This heterogeneity limits the generalizability of prevalence estimates and highlights the need for greater standardization of surveillance methods. This highlights the importance of harmonized studies in the future, using standardized methodologies, to accurately assess thalassemia prevalence.

Conclusion

The current review revealed a high prevalence of thalassemia among children aged 0 to 15 years in Africa. Despite some countries having strategies

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in place, the high prevalence of thalassemia suggests that current management practices may be inadequate or not being followed effectively. The study underscores the importance of screening programs, public awareness campaigns, and genetic counseling services to address thalassemia in Africa. Policy recommendations include implementing national screening programs and increasing healthcare resources to improve early detection and management of thalassemia.

While the study provides valuable epidemiological data, limitations such as heterogeneity in study methodologies and limited data from specific regions underscore the need for standardized surveillance methods in future research.

Authors' Contributions

IAH, TO, and MB participated in the conceptual design and development of the current study. HO, TO, and AZ assisted in the design and analysis of the search strategies. IAH conducted searches, screened, and reviewed the literature, producing data extraction and spreadsheets with assistance from MDA and TO, who reviewed and screened studies, performed data extraction, and provided additional support. When a consensus could not be reached, the articles were reviewed by BM. IAH, NTN, and TO contributed to the data analysis. NTN constructed geographic maps, and TO developed R code to analyze the extracted data. All the authors participated in the initial quality assessment of the included studies. IAH drafted the manuscript, which was reviewed and revised by TO, AZ, HO,ZAD and OA. BM coordinated and directed the research and reviewed and revised the manuscript. All authors read and approved the final manuscript.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

References:

1. Angastiniotis, M., & Lobitz, S. (2019). Thalassemias : An Overview. *International Journal of Neonatal Screening*, *5*(1), 16. https://doi.org/10.3390/ijns5010016
2. Baird, D. C., Batten, S. H., & Sparks, S. K. (2022). Alpha- and Beta-thalassemia : Rapid Evidence Review. *American Family Physician*, *105*(3), 272-280.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

3. Balduzzi, S., Rücker, G., & Schwarzer, G. (2019). How to perform a meta-analysis with R : A practical tutorial. *BMJ Ment Health*, *22*(4), 153-160. https://doi.org/10.1136/ebmental-2019-300117
4. Barker, M. K., Henderson, A. M., Naguib, K., Vercauteren, S. M., Devlin, A. M., Albert, A. Y., Bahizire, E., Tugirimana, P. L., Akilimali, P. Z., Boy, E., Green, T. J., & Karakochuk, C. D. (2017). Serum Soluble Transferrin Receptor Concentrations Are Elevated in Congolese Children with Glucose-6-Phosphate Dehydrogenase Variants, but Not Sickle Cell Variants or α-Thalassemia. *The Journal of Nutrition*, *147*(9), 1785-1794. https://doi.org/10.3945/jn.117.252635
5. Brito, D. R. A., Mutchamua, J. R., Chilundo, B., & Pinto, F. P. D. (2022). Electrophoretic and molecular profile of the hemoglobinopathies in newborns at a reference hospital in Mozambique. *Rendiconti Lincei. Scienze Fisiche e Naturali*, *33*(2), 283-293. https://doi.org/10.1007/s12210-022-01073-w
6. Egesa, W. I., Nakalema, G., Waibi, W. M., Turyasiima, M., Amuje, E., Kiconco, G., Odoch, S., Kumbakulu, P. K., Abdirashid, S., & Asiimwe, D. (2022). Sickle Cell Disease in Children and Adolescents : A Review of the Historical, Clinical, and Public Health Perspective of Sub-Saharan Africa and Beyond. *International Journal of Pediatrics*, *2022*, 3885979. https://doi.org/10.1155/2022/3885979
7. El-Beshlawy, A., Kaddah, N., Moustafa, A., Mouktar, G., & Youssry, I. (2007). Screening for beta-thalassaemia carriers in Egypt : Significance of the osmotic fragility test. *Eastern Mediterranean Health Journal*, *13*(4), 780-786.
8. El-Shanshory, M. R., Sherief, L. M., Yahia, S., Ragab, S. M., Mansour, A. K., Hassab, H. M., Hesham, M. A., Ahmed, A. S., Beshir, M. R., El Fotoh, W. M. A., El Naby, S. A. A., Alllah, A. M. G., Khalifa, N. A., Soliman, M. A., El-Dahtory, F., El-Farahaty, R. M., Osman, E., Elhabyan, A., El-Lateef, A. E. A., … Eid, A.-R. (2023). Beta Thalassemia Carrier Rate : Problem Burden among High School Children. *Current Pediatric Reviews*, *19*(2), 203-209. https://doi.org/10.2174/1573396318666220624142349
9. Engle-Stone, R., Williams, T. N., Nankap, M., Ndjebayi, A., Gimou, M.-M., Oyono, Y., Tarini, A., Brown, K. H., & Green, R. (2017). Prevalence of Inherited Hemoglobin Disorders and Relationships with Anemia and Micronutrient Status among Children in Yaoundé and Douala, Cameroon. *Nutrients*, *9*(7), 693. https://doi.org/10.3390/nu9070693
10. Gahutu, J.-B., Musemakweri, A., Harms, G., & Mockenhaupt, F. P. (2012). Prevalence of classic erythrocyte polymorphisms among 749

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

children in southern highland Rwanda. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, *106*(1), 63-65. https://doi.org/10.1016/j.trstmh.2011.09.002

11. Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M. P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M. C., Vedel, I., & Pluye, P. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for Information*, *34*(4), Article 4. https://doi.org/10.3233/EFI-180221
12. Isaiah, A., Kwaifa, I. K., Abdulrahman, Y., & Sunday, O. A. (2024). Prevalence of Thalassemia in Nigeria : Pathophysiology and Clinical Manifestations. *Clinical Medicine And Health Research Journal*, *4*(2), 806-815. https://doi.org/10.18535/cmhrj.v4i2.325
13. Kattamis, A., Forni, G. L., Aydinok, Y., & Viprakasit, V. (2020). Changing patterns in the epidemiology of β-thalassemia. *European Journal of Haematology*, *105*(6), 692-703. https://doi.org/10.1111/ejh.13512
14. Laghmich, A., Ismaili, F. A., Barakat, A., & ... (2019). Alpha-thalassemia in North Morocco : Prevalence and molecular spectrum. *BioMed Research International, 7, 2080352.* https://doi.org/10.1155/2019/2080352
15. Li, Y., Wei, W., Gan, Y., Xie, X., Qin, P., Teng, L., & Jiang, L. (2024). Global, Regional, and National Epidemiology of Thalassemia in Childhood from 1990 to 2021. *Journal of Biosciences and Medicines*, *12*(12), 361-379. https://doi.org/10.4236/jbm.2024.1212029
16. Macharia, A., Mochamah, G., Uyoga, S., & ... (2020). β-Thalassemia pathogenic variants in a cohort of children from the East African coast. *Molecular Genetics & Genomic Medicine*, *8 (7)*, e1294. https://doi.org/10.1002/mgg3.1294
17. Mugisha Emmanuel, K. (2025). Hemoglobinopathies and Red Blood Cell Disorders : A Genetic Perspective on Anemia in East Africa. *Eurasian Experiment Journal of Scientific and Applied Research*, *7*(3), 6-10.
18. Obeagu, E. I. (2025). Thalassemia in Sub-Saharan Africa : Epidemiology, diagnosis, and management – a narrative review. *Annals of Medicine and Surgery*, *87*(6), 3523-3536. https://doi.org/10.1097/MS9.0000000000003270
19. Origa, R. (2017). β-Thalassemia. *Genetics in Medicine: Official Journal of the American College of Medical Genetics*, *19*(6), 609-619. https://doi.org/10.1038/gim.2016.173
20. Osman, H. A., Hamid, M. M. A., Ahmad, R. B., Saleem, M., & Abdallah, S. A. (2020). Prevalence of 3.7 and 4.2 deletions in

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Sudanese patients with red cells hypochromia and microcytosis. *BMC Research Notes*, *13*(1), 65. https://doi.org/10.1186/s13104-020-4933-5

21. Rao, E., Kumar Chandraker, S., Misha Singh, M., & Kumar, R. (2024). Global distribution of β-thalassemia mutations : An update. *Gene*, *896*, 148022. https://doi.org/10.1016/j.gene.2023.148022
22. Siala, H., Ouali, F., Messaoud, T., Bibi, A., & Fattoum, S. (2008). alpha-Thalassaemia in Tunisia : Some epidemiological and molecular data. *Journal of Genetics*, *87*(3), 229-234. https://doi.org/10.1007/s12041-008-0036-0
23. Smith Yolanda. (2022, août 30). *Thalassemia prevalence*. News Medical. https://www.news-medical.net/health/Thalassemia-Prevalence.aspx
24. Suchdev, P. S., Ruth, L. J., Earley, M., Macharia, A., & Williams, T. N. (2014). The burden and consequences of inherited blood disorders among young children in western Kenya. *Maternal & Child Nutrition*, *10*(1), 135-144. https://doi.org/10.1111/j.1740-8709.2012.00454.x
25. Tuo, Y., Li, Y., Li, Y., Ma, J., Yang, X., Wu, S., Jin, J., & He, Z. (2024). Global, regional, and national burden of thalassemia, 1990–2021 : A systematic analysis for the global burden of disease study 2021. *eClinicalMedicine*, *72*, 102619. https://doi.org/10.1016/j.eclinm.2024.102619
26. Twum, S., Fosu, K., Felder, R. A., & Sarpong, K. A. N. (2023). Bridging the gaps in newborn screening programmes : Challenges and opportunities to detect haemoglobinopathies in Africa. *African Journal of Laboratory Medicine*, *12*(1), 8.
27. UNFPA. (2022, mars 30). *State of the World Population Report 2022*. https://wcaro.unfpa.org/sites/default/files/pub-pdf/en_swp22_report-web_-_29_march_1_0.pdf
28. Vichinsky, E. (2016). Non-transfusion-dependent thalassemia and thalassemia intermedia : Epidemiology, complications, and management. *Current Medical Research and Opinion*, *32*(1), 191-204. https://doi.org/10.1185/03007995.2015.1110128
29. Viechtbauer, W. (2010). Conducting Meta-Analyses in R with the metafor Package. *Journal of Statistical Software*, *36*(3), 1-48. https://doi.org/10.18637/jss.v036.i03
30. WHO. (2025). *Atlas of African Health Statistics 2022 : Health situation analysis of the WHO African Region — Summary report*. World Health Organization. https://iris.who.int/server/api/core/bitstreams/a6021e5d-0ec0-4203-94b9-6fe1fff7aa0d/content

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Appendix

Table 1: Quality of the included papers, Mixed Methods Appraisal Tool (MMAT)

Category	Criteria	El-Beshlawy et *al.*, 2007	El-Shanshory et *al.* 2023	Barker et *al.*, 2017	Brito et *al.*, 2022.	Engle-Stone et *al.*, 2017	Gahutu et *al.*, 2012	Laghmich et *al.*, 2019	Macharia et *al.*, 2020	Osman et *al.*, 2020	Suchdev et *al.*, 2014	Siala et *al.*, 2008
Screening questions	S1. Are there clear research questions?											
	S2. Do the collected data allow the research questions?											
4. Quantitative descriptive studies	4.1. Is the sampling strategy relevant to address the research question?											
	4.2. Is the sample representative of the target population?											
	4.3. Are the measurements appropriate?											
	4.4. Is the risk of nonresponse bias low?											
	4.5. Is the statistical analysis appropriate to answer the research question?											
	Total score	**12**	**14**	**14**	**14**	**14**	**12**	**14**	**14**	**11**	**12**	**10**
	Legend	Yes = 2	Partially = 1	No = 0								