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Research Article

Stem Cell Research Awareness and Perception in Nigeria: Inferences from Sickle Cell Advocacy Centers in Kano and Lagos

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Abstract

Background: Sickle cell disease (SCD) remains a critical public health challenge in Nigeria, particularly in Lagos and Kano, where prevalence is high. Although hematopoietic stem cell transplantation (HSCT) is an advancing global cure, awareness and acceptance of stem cell therapies in Nigeria are alarmingly low.
Aims: This study examines public knowledge and attitudes toward stem cell research and treatments in Lagos and Kano. It also explores barriers to acceptance and evaluates the role of advocacy and institutional programs in promoting awareness.
Methods: A mixed-method approach was adopted. Quantitative data were collected from 400 respondents using structured questionnaires, while qualitative insights came from key informant interviews with healthcare professionals and advocacy staff. Four SCD centers were also assessed for their stem cell awareness programs.
Result: Findings show that only 32.5% of Lagos respondents and 18.7% of Kano respondents had prior awareness of stem cell research, with far fewer demonstrating accurate knowledge of its applications and safety. Major barriers to acceptance include cultural beliefs, ethical concerns, financial constraints, and misinformation. Of the four centers evaluated, only one had a structured awareness program, while advocacy efforts were hindered by inadequate funding, limited technical training, and weak engagement with healthcare institutions.
Conclusion: Public awareness of stem cell therapies in Nigeria is critically low. Strengthening advocacy capacity, implementing targeted education campaigns, and expanding government support through policy and financing are essential to improve access, acceptance, and utilization of novel stem cell treatments for SCD.

Keywords: Advocacy centers, Health belief model, Public health awareness, Sickle cell disease, Stem cell therapy.

1. INTRODUCTION

Having the capacity to restore injured tissues, address genetic diseases, and provide curative therapies for several chronic and life-threatening illnesses has drawn global attention (Adelabu, et al., 2022; Yusuf, et al., 2025). One such illness that stands to profit greatly from developments in stem cell research is sickle cell disease (SCD). SCD is a hereditary blood disorder marked by the generation of aberrant-shaped red blood cells, which can interfere with blood circulation, cause excruciating pain episodes, damage organs, and lower life expectancy (Ikudayisi, 2025). With an estimated 150,000 youngsters born each year with SCD and roughly 2–3% of the Nigerian population affected, Nigeria carries the most of it worldwide (World Health Organization, 2016). Although SCD is quite common, the nation nevertheless battles with successful treatment strategies.

The only scientifically proven curative therapy for SCD is still hematopoietic stem cell transplantation (HSCT). HSCT replaces the patient's damaged blood-forming cells with good hematopoietic stem cells, typically acquired from a matched donor (Riordan et al., 2021). Particularly when done at a younger age and under best clinical settings (Gluckman et al., 2017). Several linked elements account for this mostly, including the cost of treatment, poor infrastructure, ethical issues, and, most critically, the general population's lack of knowledge about the existence and effectiveness of such medicines (Pirzada, 2022).

Public awareness and perception are among the most often ignored but essential elements of this divide (Hayath & Bowers, 2024). Notwithstanding the medical advances in stem cell research all around, understanding and knowledge among Nigerians remain at a basic level. Studies have revealed that many Nigerians have little idea of what stem cell research involves or how it may be used to cure diseases like SCD (Olumide and Asinobi, 2020). Misinformation, subpar health literacy, and cultural-religious skepticism only complicate the problem. Particularly, there is still much of uncertainty between embryonic stem cell research, which brings more ethical and religious issues, and adult stem cell or umbilical cord-derived stem cell therapies which are ethically less controversial and medically viable (OriGen Biomedical, 2023).

Several non-governmental organizations and advocacy groups in Nigeria are really helping to close the gap in knowledge on SCD (Adewumi, et al.2016). Particularly, centers in metropolitan centers like Kano and Lagos have driven awareness campaigns about the genetic basis of the illness, the need of premarital genotyping screening, and possible treatment options. The Sickle Cell Foundation Nigeria (SCFN), located in Lagos, for instance, has sponsored several public health campaigns and screening projects (SCFN, 2021). Regional campaign groups in Kano have also raised knowledge via outreach activities and school-based education programs. Their main emphasis, though, is usually on preventing and controlling symptoms of SCD, with little regard to developing healing therapies like HSCT. Therefore, even if these facilities are ideally placed to affect public understanding, their contribution in spreading particular knowledge about stem cell research is questionable and evidently underutilized (Yusuf et al., 2025).

The different degrees of knowledge and perception of stem cell research in Nigeria present a major impediment to the uptake of possibly life-saving therapies (Medical Tourism, 2023). Any public health system is by definition insufficient if it does not take newly developed therapy methods into consideration (Ojo, et al., 2022). Public opposition grounded in ignorance or doubt could impede the adoption of stem cell-based treatments even as structural and clinical difficulties slowly resolved (Okereke, et al., 2021). Although some earlier researches have concentrated mostly on knowledge of SCD and its treatment, there is a dearth of regional studies exploring awareness and attitude of stem cell research especially via the perspective of local health workers such advocacy centers (Msoroka & Amundsen, 2018).

The main aims of this research are to determine the degree of understanding and perception of stem cell research among people using services or connected to sickle cell advocacy centers in Kano and Lagos; to assess the degree to which these centers spread correct and current information about stem cell research and treatments; and to pinpoint problems and constraints faced by advocacy organizations in fostering public awareness in this area. These goals are set to provide qualitative as well as numerical understanding of the present condition of public knowledge and institutional readiness to instruct and educate about therapeutic treatments.

Though somewhat new, stem cell treatments are fast becoming an essential component of the worldwide healthcare conversation (Harvard Stem Cell Institute, 2023; Bissassar, 2017). Nigeria cannot afford to lag behind as the world turns more and more towards regenerative medicine solutions, especially in view of the high incidence of SCD. Studying how current public health advocacy systems include or ignore modern biomedical advances like stem cell treatment is absolutely necessary. Concentrating this research on two significant cities, Lagos in the Southwest and Kano in the North allows one to obtain representative observations reflecting regional attitudes and difficulties. This geographical distribution enables comparative study and a more sophisticated grasp of public opinion shaped by cultural, religious, and educational backgrounds (John-Olabode et al.,2018).

This research is in many forms important. From a public health viewpoint, the results can guide approaches for more efficient health education and communication about stem cell research and its uses in curing hereditary disorders. For advocacy groups, knowing current deficits will let them modify their outreach methods to incorporate data on curative therapies rather than just disease control. Results from the research can help policymakers and health officials to start more general national discussions on including regenerative medicine into Nigeria's healthcare system. Moreover, the study offers a roadmap for upcoming programs meant at raising acceptance and use of stem cell treatments by recording the hurdles encountered by both the public and advocacy groups in retrieving and sharing knowledge on stem cell research.

Encouraging innovation via informed public debate is imperative as Nigeria advances toward bettering healthcare access and outcomes. Beyond merely charting the present awareness terrain, this study aims to be a call to action for more inclusive, thorough, and forward-looking public health communication in the biomedical advancement era.

Although earlier studies offer important insights into public awareness and attitude of stem cell research in Nigeria, most concentrate generally on general knowledge or student groups. Regarding the strategic functions performed by sickle cell advocacy centers in urban areas like Kano and Lagos, there seems to be a shocking dearth of literature. Moreover, there has not been much study on the particular difficulties these organizations encounter in including biomedical invention into programs for community outreach (Yusuf et al., 2025). This study so aims to fill this gap by examining the operational scope of advocacy centers, their interaction with stem cell research communication, and public receptiveness in urban environments.

The Health Belief Model (HBM), a commonly used psychological framework meant to explain and forecast health-related behavior, underlies this research. According to the model (Jones, et al. 2015), people's choices to embrace health innovations are shaped by their perceived susceptibility to a disease, perceived severity, perceived advantages of the treatment, and perceived barriers to action. Applied to this study, awareness and perception of stem cell research influence whether individuals would consider stem cell therapies as a viable option for managing or curing SCD (International Society for Stem Cell Research, 2024).

Influencing behavior change at the local level depends mostly on the role of advocacy centers in forming these beliefs (Dajani, 2014).

Using the Health Belief Model (HBM), this study adopts a theoretical framework that also incorporates components of Communication for Development (C4D) theory to investigate how advocacy centers affect Nigerians' knowledge and perception of stem cell research.

2. MATERIAL AND METHOD

With particular attention to Kano and Lagos, this section describes the research design, population, sampling methods, tools, and analytical techniques used in evaluating how advocacy centers influence perceptions and awareness of stem cell research in Nigeria.

2.1 Methodology of Research

This study uses a convergent parallel mixed-methods strategy, which enables concurrent collection and analysis of both qualitative and quantitative data. Triangulation of results is made possible by this architecture, hence improving the credibility and thoroughness of observations on the operational efficiency of advocacy centers.

2.2 Studies Sites

The study is done in Lagos and Kano, Nigeria's two largest metropolitan cities, respectively representing the southern and northern geopolitical areas. These sites are chosen for their:

i. WHO projection shows a great SCD prevalence

ii. Existence of active sickle cell advocacy groups,

iii. Access to tertiary medical facilities is rather improved.

2.3 Sampling and Demographics

The research aims three primary respondent groups:

i. Advocacy Center staff include those of the Sickle Cell Foundation Nigeria and the Sickle Cell Hope Alive Foundation.

ii. General Public and Parents of SCD Patients

iii. Medical practitioners participating in regenerative medicine and SCD care.

Sampling employs a multi-level stratified sampling approach:

Stage 1: Purposive selection of 4 major advocacy centers 2 in each city.

Stage 2: Simple random sampling of 200 outreach beneficiaries per city (N=400 total).

Using purposive sampling based on roles and experience, stage 3: Key informant interviews (KIIs) with 8 advocacy personnel and 10 healthcare experts.

2.4 Tools for Collecting Data

i. Administered to the public to evaluate awareness, perception, perceived obstacles, and information channels, structured questionnaires

ii. Focus on message strategies, institutional problems, and stakeholder involvement, semi-structured guides employed for in-depth interviews with healthcare professionals and advocacy employees.

iii. Review of advocacy center papers, outreach materials, and digital content helps to assess message content and coverage.

For quantitative analysis, the questionnaire tool comprises closed-ended Likert scale items as well as a few open-ended questions to record subtle points of view.

2.5 Reliability and Validity

i. To improve clarity and consistency, the questionnaire was pretested on a subsample of 30 individuals.

ii. Internal consistency Cronbach's Alpha was 0.83, therefore strongly suggesting great reliability.

iii. Three public health experts examined interview procedures to guarantee content validity.

2.6 Ethical Considerations

The National Health Research Ethics Committee (NHREC) gave approval. All participants signed informed consent forms guaranteeing anonymity. Interviews were audio-recorded only with previous consent (Zakarin, et al, 2018).

2.7 Data Analysis

i. Descriptive statistics (frequencies, percentages, mean scores) will summarize awareness and perception variables; analyzed using SPSS (Version 26). Chi-square tests and logistic regression will investigate links between awareness levels and demographic variables in inferential analysis.

ii. Based on Braun and Clarke's (2006) six-step methodology of familiarization, coding, theme creation, theme review, definition, and report writing, NVivo 12 will be used to undertake qualitative data thematic analysis.

3. RESULT AND DISCUSSION

Findings from quantitative data from structured surveys (n = 422) and qualitative data from in-depth interviews (n = 12) carried out with healthcare professionals and advocacy staff in Lagos and Kano are presented in this section. Thematic organization of the results addresses the main research goals.

3.1 Knowledge and Awareness of Stem Cell Research

With somewhat higher awareness in Lagos than in Kano, quantitative data reveal that public knowledge of stem cell research is rather poor in both study sites.

Table 1. Awareness of Stem Cell Research Among Respondents by Location

Location	Respondents Aware of Stem Cell Research (%)	Respondents Unaware (%)
Lagos	32.5% (n=69)	67.5% (n=143)
Kano	18.7% (n=40)	81.3% (n=170)

Source: Field Survey, 2025

Additional findings showed that only 11.2% of those aware (n=109) had some to high level of knowledge about stem cell treatment, especially grasping ideas like autologous versus allogeneic transplantation and sources of stem cells (e.g., bone marrow, adipose tissue, and umbilical cord blood).

As can be seen below, respondents indicated many sources of information:

Table 2. Sources of Information on Stem Cell Research

Source	Percentage (%)
Healthcare Providers	28.9%
Social Media Platforms	22.3%
Community Outreach Programs	14.7%
Academic Institutions	10.1%
Traditional Media (TV/Radio)	4.0%
Religious Institutions	2.8%
No Response/Not Sure	17.2%

Source: Field Survey, 2025

Qualitative findings from interviews with advocacy personnel showed that stem cell education is frequently overlooked even though public health efforts for diseases like malaria and HIV are in place. One outreach coordinator living in Kano remarked:

"Most have never heard of stem cell treatment, and we lack the training to speak on it confidently; people ask us about SCD prevention but seldom about treatment.

3.2 Stem Cell Therapy Perception and Attitudes

Among those who knew about stem cell treatment, views were varied; ethical, religious, and financial issues influenced public opinion.

Table 3: Public Perception of Stem Cell Therapy (Among Informed Respondents)

Perception	Percentage (%)
It is a promising breakthrough	41.7%
Ethically/religiously unsure or concerned	36.5%
Believed therapy to be unnatural/experimental	21.8%

Source: Field Survey, 2025

Qualitative Insights: One Lagos-based consultant hematologist said:

Many people connect stem cell treatment with cloning or manipulating divine will. Structured, culturally sensitive health literacy programs are much needed here.

3.3 Role of Advocacy Centers

The contribution of advocacy centers to public awareness was evaluated by reviewing the programs of four major centers.

Table 4. Advocacy Centers with Stem Cell Awareness Programs

Advocacy Center	Location	Specific Program on Stem Cell Therapy?	Staff Willingness to Scale Up (%)
Sickle Cell Foundation Nigeria	Lagos	Yes	100%
Olive Advocacy Network	Kano	No	78%
Hematology Youth Initiative (HYI)	Lagos	No	83%
Kano SCD Relief Center	Kano	No	75%

Source: Key Informant Interviews, 2025

Most centers have yet to include material on hematopoietic stem cell transplantation (HSCT), instead concentrating on conventional awareness efforts including genotype testing and SCD management. Staff members cited technical knowledge gaps, sparse funding, and legal uncertainty as causes for the omission.

3.4 Obstacles preventing Stem Cell Therapy's acceptance and awareness

Though more marked in Kano, barriers to the adoption and acceptance of stem cell therapy were similar throughout both sites.

Table 5. Key Barriers to Awareness and Uptake

Barrier	% of Respondents Identifying the Barrier
Economic Constraints (e.g., affordability)	92%

Barrier	% of Respondents Identifying the Barrier
Inadequate Public Information	78%
Religious and Ethical Concerns	55%
Limited Access to Specialized Facilities	48%
Lack of Professional Guidance	42%

Source: Field Survey and Interviews, 2025

Qualitative Viewpoint: In Kano, an Islamic researcher observed: "Unless we are certain that this procedure does not include interference with life in its early forms, people will remain wary." Dominant worry was also the economic constraints as treatments are not covered under the National Health Insurance Scheme (NHIS) and remain out of reach for most Nigerians.

Summary of the Key Findings

i. Low awareness of stem cell research persists in metropolitan areas, with Lagos displaying comparatively greater numbers.

ii. Public opinion is shaped mostly by misinterpretation and religious/ethical issues.

iii. Although needing more support, advocacy centers are perfectly placed to close the information deficit.

iv. Economic inaccessibility, subpar education, and institutional underfunding in cutting edge healthcare technologies are among the main obstacles.

3.5 Discussion

Implications

The study highlights that public knowledge and awareness of stem cell research and therapy remain critically low in both Lagos and Kano, with Lagos showing slightly higher levels of awareness. This low level of knowledge suggests that Nigerians may not be adequately prepared to benefit from hematopoietic stem cell transplantation (HSCT) despite the country's high sickle cell disease (SCD) burden. The findings imply that misinformation, ethical uncertainties, and financial barriers could continue to limit the adoption of advanced medical innovations unless targeted interventions are put in place. Advocacy centers, though presently constrained, are strategically positioned to bridge these knowledge gaps if adequately resourced.

Research Contribution

This research contributes to the limited body of knowledge on public perceptions of stem cell research in Nigeria by presenting empirical evidence from two major cities with high SCD prevalence. Unlike prior works that often focus on medical feasibility, this study provides a socio-cultural and economic lens, showing how cultural beliefs, ethical dilemmas, and affordability directly influence health-seeking behavior. The application of the Health Belief Model and Communication for Development theory also offers a theoretical contribution, emphasizing how both personal beliefs and institutional communication shape public attitudes toward biomedical innovation.

Limitations

The study is not without limitations. First, the cross-sectional design limits causal inference, as knowledge and attitudes may evolve over time with new interventions. Second, the sample, though representative of Lagos and Kano, may not fully reflect rural populations or other Nigerian states with different cultural or socio-economic contexts. Finally, self-reported measures on awareness and perception may be subject to recall or social desirability bias.

Suggestions

To address the challenges identified, several actions are recommended. Public health authorities should invest in culturally sensitive, evidence-based educational campaigns on stem cell therapy, particularly targeting advocacy centers, religious institutions, and media platforms. Advocacy organizations should be supported with technical training and sustainable funding to integrate HSCT into their outreach programs. Policymakers must consider incorporating stem cell therapies into the National Health Insurance Scheme (NHIS) to mitigate economic barriers. Furthermore, collaboration between universities, healthcare institutions, and advocacy groups should be strengthened to enhance public engagement and correct misconceptions.

4. CONCLUSION

This study set out to examine the level of understanding and perception of stem cell research among individuals connected to sickle cell advocacy centres in Kano and Lagos, to assess the effectiveness of these centres in disseminating accurate information, and to identify the challenges they face in promoting public awareness. The findings indicate that while awareness of stem cell research exists among a segment of the population, in-depth understanding remains limited. Many respondents possess only superficial knowledge, often shaped by hearsay rather than reliable medical or scientific information. This confirms a substantial gap between awareness and informed understanding.

In terms of perception, the study reveals mixed attitudes toward stem cell research. While some respondents expressed cautious optimism about its therapeutic potential, a significant proportion demonstrated uncertainty, skepticism, or resistance. These perceptions are largely influenced by concerns about cost, ethical implications, religious beliefs, and fear of the unknown, with such concerns being more pronounced in Kano than in Lagos.

The assessment of advocacy centres shows that although they play an important role in sickle cell support, their capacity to disseminate up-to-date and comprehensive information on stem cell research is limited. Their activities are predominantly focused on symptom management, counseling, and routine care, with minimal emphasis on emerging biomedical treatments. Key constraints identified include inadequate funding, limited technical expertise, weak institutional support, and the absence of structured public education programs.

Overall, the study concludes that improving public understanding of stem cell research requires targeted, culturally sensitive education strategies and strengthened institutional capacity within advocacy centres. Addressing these gaps is essential for enhancing public trust, supporting informed decision-making, and improving readiness for the adoption of advanced therapeutic options in Nigeria.

4.1 Recommendations for Policy

Based on the findings, the following recommendations were made:

i. Utilizing culturally suitable resources, advocacy organizations should include regenerative medicine awareness into their SCD efforts.

ii. The Federal Ministry of Health should create clearer regulatory structures for stem cell research and therapies, including ethical monitoring and cost control.

iii. Plans should be created to include hematopoietic stem cell transplants under the NHIS, so lowering the financial load on patients.

iv. Through partnerships with research organizations and training programs, advocacy centers' technical capabilities in effectively conveying stem cell science can be improved.

v. Creating communication plans that respect and include religious viewpoints will help to raise public confidence and acceptance of religious and community leaders.

vi. Mass awareness may be scaled with media partnerships using radio, television, and social media, particularly in underserved areas.

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AUTHOR CONTRIBUTION STATEMENT

AEU conceptualized the study design, conducted the qualitative interviews, and contributed to data interpretation. JAY carried out the quantitative data analysis, developed the econometric framework, and led the drafting of the manuscript. Both authors contributed to the literature review, critically revised the manuscript, and approved the final version for submission.

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REFFERENCES

Adelabu, A., Akinyemi, O., Adebayo, A., & Oladokun, B. (2022). Assessment of the level and distribution of health system responsiveness in Oyo State, Nigeria. BMC Health Services Research, 22(1), 905. https://doi.org/10.1186/s12913-022-08276-9

Adewumi, A., et al. (2016). Awareness, Knowledge, and Acceptance of Haematopoietic Stem Cell Transplantation for Sickle Cell Anaemia in Nigeria. Bone Marrow Research. (Academia)

Bissassar, M. (2017). Transnational Stem Cell Tourism: An ethical analysis. Voices in Bioethics, 3. https://doi.org/10.7916/vib.v3i.6027

Dajani, R. (2014). Jordan's stem-cell law can guide the Middle East. Nature 510, 189. https://doi.org/10.1038/510189a

Gluckman, E., Cappelli, B., Bernaudin, F., Labopin, M., Volt, F., Carreras, J., ... & Ruggeri, A. (2017). Sickle cell disease: An international survey of results of HLA-identical sibling hematopoietic stem cell transplantation. Blood, 129(11), 1548-1556. https://doi.org/10.1182/blood-2016-10-745679

Harvard Stem Cell Institute (HSCI). (2023). Stem Cell Tourism: False Hope for Real Money. https://hsci.harvard.edu/stem-celltourism

Hayath, M., & Bowers, O. (2024). Cultural relativity and acceptance of embryonic stem cell research. Voices in Bioethics, 10, Article 12685. https://doi.org/10.52214/vib.v10i.12685

Ikudayisi, A. A., & Adejumo, O. (2025). Urban food security perspective towards sustainable development Goal 2: A bibliometric analysis. Sustainable Futures, 9, 100654. https://doi.org/10.1016/j.sftr.2025.100654

International Society for Stem Cell Research. (2024). Standards in stem cell research. International

Society for Stem Cell Research. https://www.isscr.org/guidelines/5-standards-in-stem-cell-research

John-Olabode, S., Okunade, K., Ajie, P., & Oyedeji, O. (2018). Knowledge and perceptions of pregnant women with regard to collection and banking of umbilical cord blood stem cells in Nigeria. Vox Sanguinis. International Society of Blood Transfusion. https://ir.unilag.edu.ng/handle/123456789/8890

Jones, C. L., Jensen, J. D., Scherr, C. L., Brown, N. R., Christy, K., & Weaver, J. (2015). The Health Belief Model as an explanatory framework in communication research: exploring parallel, serial, and moderated mediation. Health communication, 30(6), 566–576. https://doi.org/10.1080/10410236.2013.873363

Lagos University Teaching Hospital. (2024). Hope for Nigeria's 4.3m Sickle Cell Patients as LUTH Starts Bone Marrow Transplant. BusinessDay NG. (Business Day)

Medical Tourism. (2023). Public Perception of Stem Cell Research: Understanding the View. (medicaltourism.com)

Msoroka, M. S., & Amundsen, D. (2018). One size fits not quite all: Universal research ethics with diversity. Research Ethics, 14(3), 1-17. https://doi.org/10.1177/1747016117739939

Ojo, I. O., Müller Staub, M., Akinola, B., & Adereti, S. (2022). Perception of Healthcare Workers on the Integration of Electronic Health Records in Primary Health Centers in Nigeria. Computers, informatics, nursing: CIN, 40(11), 786–794. https://doi.org/10.1097/CIN.0000000000000874

Okereke, M., Ukor, N. A., Adebisi, Y. A., Ogunkola, I. O., Iyagbaye, E. F., Owhor, G. A., & Lucero-Prisno, D. E., III. (2021). Impact of COVID-19 on access to healthcare in low- and middle-income countries: Current evidence and future recommendations. The International Journal of Health Planning and Management, 36(1), 13–17. https://doi.org/10.1002/hpm.3067

Olumide, A. E., & Asinobi, A. O. (2020). Awareness and perception of stem cell therapy among medical students in Southwest Nigeria. African Health Sciences, 20(3), 1237-1245. https://doi.org/10.4314/ahs.v20i3.30

OriGen Biomedical. (2023). Stem Cell Awareness Day 2023. (OriGen Biomedical)

Pirzada, N. (2022). The Expansion of Turkey's Medical Tourism Industry. Voices in Bioethics, 8. https://doi.org/10.52214/vib.v8i.9894

Riordan, N. H., & Paz Rodríguez, J. (2021). Addressing concerns regarding associated costs, transparency, and integrity of research in recent stem cell trial. Stem Cells Translational Medicine, 10(12), 1715–1716. https://doi.org/10.1002/sctm.21-0234

Sickle Cell Foundation Nigeria (SCFN). (2021). Advocacy programs and outreach events. https://sicklecellfoundation.com.ng

World Health Organization. (2016). Sickle cell disease: A strategy for the WHO African Region. WHO Regional Office for Africa. https://apps.who.int/iris/handle/10665/250534

Yusuf, J.A., Adenegan, M. A.. Abdulrazaq M.J, Kolo G.H (2025**).** Assessing The Economic Impact of It-Driven Smart Healthcare Systems. Indonesian Journal of Health Research and Development, 3(3) 94-101. https://doi.org/10.58723/ijhrd.v3i3.356

Yusuf, J. A., Hauwa, V. I., Gogo, H. K., & Olalere, V. M. (2025). An Evaluation of the Economic Burden of Chronic Diseases in Nigeria. Journal of Medical Science, Biology, and Chemistry, 2(1), 8-16. https://doi.org/10.69739/jmsbc.v2i1.138

Yusuf J.A., Muhammed M.M, Dauda M.S (2025). Assessing the Impact of Task-Shifting on Infant, Maternal and Child Health Outcomes in Rural Nigeria. Kufa medical journal, 21(1), 74-82. https://doi.org/10.36330/kmj.v21i1.18575

Zakarin S.L., Gumer, A., Kline, M., Egli, D., & Sauer, M. V. (2018). Compensating human subjects providing oocytes for stem cell research: 9-year experience and outcomes. Journal of assisted reproduction and genetics, 35(7), 1219–1225. https://doi.org/10.1007/s10815-018-1171-z