EXPLORING THE INTERSECTION BETWEEN ARTIFICIAL INTELLIGENCE AND CHILDREN'S RIGHT TO HEALTH IN NIGERIA.

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ABSTRACT
Children's right to health, understood as every child's right to the highest attainable standard of health, is protected under international human rights law and Nigerian domestic law. It is central to children's survival, development, dignity and wellbeing. However, evidence from multilateral organisations indicates that Nigeria continues to record serious violations of this right and has not achieved Sustainable Development Goal 3.Existing scholarship has largely examined institutional, financial, infrastructural and social barriers to the realisation of children's health rights. Comparatively little attention has been given to the potential of emerging technologies, particularly artificial intelligence (AI), to strengthen the design and implementation of child-health programmes in Nigeria. This study therefore examines Nigeria's legal and institutional capacity to deploy AI in protecting children's right to health.The study adopts doctrinal and comparative legal methods. It analyses relevant provisions of the Constitution of the Federal Republic of Nigeria 1999, the Child Rights Act 2003, international human rights instruments, the Sustainable Development Goals, case law and relevant secondary literature.The study finds that the existing legal and policy framework has not adequately realised children's right to health. Conventional approaches, focused primarily on physical infrastructure and health-worker training, have not produced optimal outcomes, as reflected in persistent child mortality and Nigeria's failure to meet SDG 3. It argues that AI should be integrated as a complementary tool within broader legal, institutional and public-health reforms.

Keywords: Children's health, Human rights, Children's Rights to health, Nigerian law

1. Introduction

Children's health is foundational to the health, wellbeing and overall economic and social development of a country. Accordingly, prioritizing children's health results in significant

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improvement in the health of the adult population of the country. Devoting significant resources to children's health and early childhood development such as immunization and other post-natal healthcare can considerably decrease the burden of infectious and non-communicable diseases on the long term basis, substantially reduce the cost of healthcare and increases economic wellbeing of the country. The current state of health of the children will determine the quality of life and health of future generations with significant developmental consequences. A healthy adult population is more industrious, dynamic and creative leading to greater economic attainment and prosperity enabling the society to break the vicious cycle of poverty. On the other hand, high childhood disease burden can result in long-term high morbidity and mortality rates leading to reduced economic prosperity. Children's health also has profound impact on the intellectual advancement and educational accomplishment of the country because good physical and mental health are central to those achievements. The protection of children's health results in a healthy and highly educated population which nurtures and promotes technological and economic development. Children's health is, therefore, inexorably connected with the quality of future human resources of the country. Despite these inevitable and relentless nexuses between children's health and economic and social development and prosperity of the society both in the short term and long term basis, Nigeria has not made significant effort in prioritizing the right to health (RTH) of Nigeria's children.

A 2021 report, the Rights Tracker, released by the Human Rights Measurement Initiative (HRMI), showed that among the 18 Sub-Saharan African countries surveyed, Nigeria occupied the last position with 66.6% for children surviving to age 5. Compared with the other countries in sub-Saharan Africa, "Nigeria is performing worse than average when we look across the rights for which there is data, including the RTH of the child." In determining the measurement, the organisation adopted the criterion of "how well is the country doing compared to what we know is possible at that countries income level?"[3] By 2050 under-five deaths in sub-Saharan Africa is estimated at 60 per cent.[4] The neonatal period, the first month of a child, is regarded as the most crucial period for child survival. While the global neonatal mortality rate declined by 51 per cent

[3]NBS and UNICEF. 2017. Multiple Indicator Cluster Survey 2016-2017, Survey Findings Report. Abuja, Nigeria. Retrieved June 24, 2023, from https://rightstracker-2021-embargoed.web.app/en/metric/under-5-survival?region=sub-saharan-africa&income=lmi&treaty=iccpr&treaty=icescr&cgroup=not-oecd&cgroup=oic.

[4] Ibid 9

from 1990 to 2017, sub-Saharan Africa had the highest neonatal mortality rate in 2017 at 27 deaths per 1000 live births, while Southern Asia with 26 deaths per 1000 live births. Accordingly, a child born in sub-Saharan Africa or Southern Asia is nine times more likely to die in the first month than a child in a high-income country.[5] Nigeria's neonatal mortality rate in 2017 was 40 deaths per 1000 live births.[6] In 2017, Nigeria had one of the highest mortality rates in the world for children aged 5-14, with 20 deaths per 1000 live births.[7] These data are a flagrant violation of Nigeria's voluntarily assumed obligations in international law and, in particular, Goal 3 of the Sustainable Development Goals (SDG). To ameliorate this situation Artificial Intelligence(AI), especially Machine learning (ML), could be adopted to aid in the diagnosis and treatment of under-five children and thereby protect their right to health in Nigeria. However, there are presently no adequate laws, regulations, policies, ethical guides, governance rules and guidelines to provide the necessary legal framework for the deployment of machine learning for the protection of RTH of Nigeria's under-five children. Accordingly, this study explores what legal and governance changes are necessary to deploy AI for under-five diagnostics and treatment in Nigeria while protecting children's privacy and non-discrimination. In doing that, the work will map international, multilateral, regional and national treaties, guidelines and laws for the deployment of AI and offer them as models for the regulation and governance of AI for children's health. The next section of this study will undertake a conceptual clarification of the major principles contained in this study, the third section will explore the legal foundations of the RTH in Nigeria, the fourth section will focus on Artificial intelligence and its connection with the RTH of the child while the last section will deal with summary and conclusion.

2. Conceptual Clarification

2.1. Artificial Intelligence(AI)

An AI system means a "machine-based system designed to operate with varying levels of autonomy, that may exhibit adaptiveness after deployment and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments"[8]

[5] Ibid 12
[6] Ibid 14
[7] Ibid 17
[8] Art 3(1) EU AI Act, 2024

2.2. Child Health and Artificial Intelligence

Artificial Intelligence (AI) prompts computers to perform intelligent tasks that are analogous to that performed by human beings. AI refers to the capacity of a digital computer or computer-controlled robot to undertake tasks usually linked with intelligent beings. It means the task of developing systems imbued with the intellectual processes that are features of humans. These characteristics are the capacity to reason, ascertain meaning, generalize, or learn from the experiences of the past. AI is the form of intelligence established by machines in which those machines learn from experience, they adjust to the new inputs and perform tasks the same way human beings do.[9]

AI has applications in the field of medicine, health, voice and handwriting recognition and computer search engines.[10] The American Medical Association defined AI function in healthcare as "augmented intelligence". This is because they believe that the role of AI is to design and improve human intelligence and not to replace it.[11] AI has very many effective uses in diagnoses and treatment of diseases. Accordingly, it affords infinite prospects to carry out an efficient, specific and influential intervention. It has a wide application in various fields and an intelligent system ought to go through specific stages in order to achieve cognitive skills. These phases are acquisition, thinking and adaptive skills.[12] It enables clinical effectiveness, access and affordability of health care. The acquisition process is a fundamental process by which AI targets the gathering of data and produce a set of steps which will enable the conversion of data into valid information. These generated or produced steps are regarded as algorithms. These algorithms make available devices which contain formal directions on the way a task ought to be performed. The thinking process step is regarded as the reasoning process step. In this regard, AI carries out the task of selecting the exact algorithms directed at a specific outcome. The adaptive process is the tuning phase and its main characteristic is that the algorithms go through fine

[9] Sakthai, A. S., Niveda, S. & Srinitha, S. 2022. Future trajectory of healthcare with artificial intelligence. *Digital Health Transformation with Blockchain and Artificial Intelligence*. Ed. C. Chakraborty. Boca Raton: CRC Press. Pg. 161.

[10] Copeland, B.J. 2023. Artificial intelligence. *Encyclopaedia Britannica*. Retrieved July 3, 2023 from https://www.britannica.com/technology/artificial-intelligence.

[11] Sakthai, Niveda, & Srinitha, op. cit. (No 587). Pg. 161.

[12] Akarsh, Raj, & Sahoo, op. cit. (No 585). Pg. 145.

tuning and it ensures that the best result is achieved as much as possible. This process is also regarded as the self-correction process.[13]

2.3. Different Types of AI and their Application to Health

2.3.1. Machine Learning

This is a subdomain of AI. Machine learning (ML) enables us to build models by utilizing statistical techniques with the support of datasets. These models are later used in decision-making processes and is also used to perform predictions without the necessity of specific programming targeted at a particular task. It is one of the most useful forms of AI because of its versatility and great applicability. The extreme progress made in respect to ML is as a result of the development of new learning algorithms, methodologies and recent developments in the easy accessibility of data and less expensive computation. Machine learning is a core subdomain of AL. Machine learning has enabled a powerful and great revolution and transformation in the area of healthcare as a result of the fact that it is powered or driven by effective machine learning methods such as deep reinforcements, convolutional networks and Natural language processing.[14] Essentially, there are four types of Machine learning methodologies such as Supervised Learning, Unsupervised learning, Semi-supervised learning and Enhanced learning. The major task in supervised learning is to derive the function from the labelled training data which creates a set of training samples. In unsupervised learning, the models are trained by unlabelled dataset and decide the relationship. The models in reinforcement learning are trained to make a sequence of decisions and the system learns by the process of interaction and feedback.[15] In the area of healthcare, ML is used in precision medicine. In that regard ML is used to predict treatment schedules for the patient predicated on the patient's previous history or based on the state of health of the patient.[16] Machine learning algorithms are utilized in tasks involving radiology, cardiology, ophthalmology and other specialties. It is also useful in dermatology especially disease classification using clinical images.[17] Machine learning has been used in cardiology disease detection and in the automatic segmentation of the various components of the

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[13] Ibid.
[14] Shailaja, K., Seetharamulu, B. & Jabbar, M.A. 2018. Machine learning in healthcare: A review. *2nd International Conference on Electronics, Communication and Aerospace Technology (ICECA)*: 910–914.
[15] Sakthai, Niveda, & Srinitha, op. cit. (No 587). Pg. 163.
[16] Akarsh, Raj, & Sahoo, op. cit. (No 585). Pg. 146.
[17] Du, A. X., Emam, S., & Gniadecki, R. 2020. Review of machine learning in predicting dermatological outcomes. *Frontiers in Medicine* 7: 266.

heart.[18] Essentially, ML is crucial in diagnostic and treatment related tasks in the medical and health field.

2.3.2. Deep Learning

Deep learning (DL) is an aspect of ML and is concerned with the enabling high level functions in machines previously undertaking by human beings. Machines undertake these human functions by processing data and by interpreting patterns for the purposes of decision making. Deep learning processes are also regarded as Neural Networks (NN). Deep learning models are normally made up of numerous layers and the essence is to learn and elicit inferences from the data. It models normally undertake to unravel deep-lying patterns in datasets. This is done by using certain algorithms and stipulate the changes that are necessary at the parametric level in every single layer to achieve a perfect production or outcome.[19] It helps in redefining the healthcare sector by assisting the sector's professionals in finding out or discerning the unique prospects in data and enables a path-breaking uses. Deep learning simulates an intelligent system and collects data and applies its neural networks to enhance its computational capacity which enables it to make available accurate result. Neural network is a technique in AI that demonstrates to computers how to process data in the same manner that is stimulated by the human brain. It is subset of ML referred to as DL, NN uses interrelated or connected nodes or neurons in a layered structure that are similar to the human brain. Accordingly, NN constructs an adaptive system that are utilized by computers to learn from their mistakes and improve on them constantly.[20] Deep learning collects data and uses its neural networks to enhance the computational capacity of the computer as well as ensure accurate result. In the field of healthcare, DL is utilized in pathology, radiology, cancer detection and image-controlled surgical operations. These functions are done by DL with such a high precision which may not be attainable by human beings. Deep learning has a high possibility in the field of medical imaging and there is a likelihood of eliminating human intervention in image connected tasks in the future. It is utilized in MRI scans and CT scan images to draw certain inferences. DL is also used in the detection of cancer and brain tumour.[21]

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[18]Li, J.P., Haq, A.U., Din, S.U., Khan, J., Khan, A., & Saboor, A., 2020. Heart disease identification method using machine learning classification in e-healthcare. *IEEE Access* 8: 107562–107582.
[19] Akarsh, Raj, & Sahoo, op. cit. (No 585). Pg. 147.
[20] AWS. What is a Neural Network? Retrieved July 11, 2023, from https://aws.amazon.com/what-is/neural-network/.
[21] Ibid.

2.4. Childhood

Article 1of the Convention on the Rights of the Child (CRC) defines a child as "every human being below the age of 18 years, unless under the law applicable to the child, majority is attained earlier." Article 1 of the African Charter on the Rights and Welfare of the Child (ACRWC) defines a child as "For the purposes of this Charter, a child means every human being below the age of 18 years." The definition of a child by ACRWC is in exclusive sense because it does not permit any other definition of a child except as defined by the Charter. Accordingly, unlike the Convention on the Rights of the Child which permits a flexible definition of a child according to the state party's definition, the African Charter makes the age of 18 years as the absolute year for the attainment of majority irrespective of the stipulations of the municipal law. Nigeria's Child's Rights Act defined a child in a similar exclusive manner as the ACRWC when it provided that a child is a person who is less than eighteen years. However, under African traditional environment, the definition of a child is governed by situational elements and dynamics, as a result end of childhood takes diverse forms in different communities.[22] Both the CRC, ACRWC and CRA did not include customary concept of childhood in their definition of childhood. There is therefore need to address the gap in those treaties.

According to Osita Eze "Human rights represent demands or claims which individuals or groups make on society, some of which are protected by law and have become part of lex latta while others remain aspirations to be attained in the future."[23] Dowrick defines human rights as "those claims made by men, for themselves on behalf of other men, supported by some theory which concentrates on the humanity of man, on man as a being, a member of the human kind."[24] Umozurike defines human rights as "claims, which are invariably supported by law, made on the basis of their humanity. They apply regardless of race, colour, sex or other distinction and may not be withdrawn or denied by governments, people or individuals."[25] According to Cranston human rights are "something of which no one may be deprived without a great affront to justice.

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[22] Ekundayo O. 2018. Legal issues in adolescents' rights under medical treatment as a constituent of right to health. *Nigerian School Health Journal* 30.1: 140-146. Pg. 141.
[23] Olomojobi, Y. 2019. *Medical and health law*. Lagos: Princeton & Associates Publishing Co. Ltd. Pg. 3.
[24] Dowrick, F.E. Ed. 1979. *Human rights, problems, perspectives and texts*. Farnborough, Eng.: Saxon House. Pgs. 8-9.
[25] Olomojobi, op. cit. (No 216). Pg. 3.

There are certain deeds which should never be done, certain freedoms which should never be invaded, some things which are supremely sacred."[26]

Right to health of the child refers to access to healthcare in terms of receiving preventive, curative and rehabilitative medical care. It embraces prevention and treatment of childhood diseases through vaccination programmes and provision of essential medicines. The right includes access to adequate nutrition and clean water to support healthy growth and development of the child as well as living in a healthy environment with access to clean air and sanitation.

3. LEGAL AND POLICY FRAMEWORKS FOR PROTECTING CHILDREN'S RIGHT TO HEALTH IN NIGERIA

Laws, policies, principles, governance frameworks and ethical guides for the regulation of and deployment of the use of AI in health is patchy, fragmented and limited. There has been numerous principles and guidelines developed for the use of AI but there is no consensus on the best practices or ethical requirements because different legal regimes and governance models adopt each set of principles. Several international and regional institutions as well as domestic legal regimes have responded to these challenges, even though there are no binding global legal framework yet to deal with these difficulties.

3.1. International Legal and Policy Framework

3.1.1. Ethics and Governance of Artificial Intelligence for Health: WHO Guidance

The WHO issued the Guidance in 2021 which contains key ethical principles for use of AI for health. These ethical principles for the application of AI for health is meant to guide developers, users and regulators in improving and overseeing the design and deployment of the technology. Additionally, human dignity and the inherent worth of humans[27] are the central values and the foundation upon which other ethical values are founded.[28] These ethical principles are the protection of autonomy, promote human well-being, human safety and the public interest, ensure transparency, explainability and intelligibility and forster Responsibility and accountability

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[26] Ibid.

[27] Njoku, Nduka. Contextualizing Paediatric Euthanasia within the Framework of Children's Right, The Nigerian Juridical Review, Vol 17, 2022, p. 168. Available at https://tnjr.uneclaw.ng/index.php/tnjr/issue/view/5. Accessed on 7th July, 2026 at 11:27am. **DOI:** https://doi.org/10.56284/tnjr.v17i

[28] Ethics and governance of artificial intelligence for health: WHO guidance. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO. p. 39

Protection of autonomy

The use of AI can result in the circumstance in which decision-making could be transferred to machines. The principle of autonomy obligates that any extension of machine autonomy should not undercut human autonomy. In the healthcare background, the protection of autonomy means that human should remain in full control of healthcare systems and medical decisions.[29] AI systems ought to be designed patently and thoroughly to conform with the principles of autonomy and human rights with which they adhere. Additionally, AI systems should be designed to assist humans irrespective of whether they are medical personnel or patients in the making of informed consent. Protection of autonomy also involves the obligation to respect privacy, confidentiality and to ensure informed and valid consent by implementing relevant legal frameworks for data protection. These principles should be protected and enforced by the government. AI technologies such as machine learning should not be used for experimentation or manipulation of humans in the healthcare system without valid informed consent. The adoption of machine learning algorithms diagnosis, prognosis and treatment plans should be incorporated into the process of valid and informed consent.[30] The protection of the right of privacy, the confidentiality of patients data and establishing patients control over their data can be achieved through data protection laws. Data protection laws should empower people to access their own health data and to move or share the data as they wish. Data protection laws are becoming very important as a result of the fact that machine learning requires large amounts of data.[31]

Promote human well-being, human safety and the public interest

AI technologies especially machine learning should not be designed to harm people. These emerging technologies should satisfy regulatory requirements relating to safety, accuracy and efficacy before usage as well as ensure that efforts are made to guarantee quality control and improvement. As a result, developers and users of these technologies have an unremitting duty to measure and monitor the performance of AI algorithms to ensure that AI works as designed. Additionally, these stakeholders have a duty to assess whether AI has a detrimental effect on

[29] Ethics and governance of artificial intelligence for health: WHO guidance. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO. p. 41
[30] ibid
[31] Ibid

individual patients or groups.[32] Preventing harm to patients also demands that the use of AI does not lead to any mental or physical harm. In that regard, AI technologies such as machine learning that provide diagnosis that an individual cannot address as a result of lack of appropriate, accessible or affordable healthcare should be carefully managed and relevant safeguards should be put in place to protect individuals from stigmatization or discrimination that arise from their health status.

Ensure transparency, explainability and intelligibility

The WHO Guidance equally requires that machine learning and other AI technologies should be made to be intelligible or understandable to developers, users and regulators. Two methods of achieving this are by improving the transparency and explainability of AI. Transparency demands that sufficient information be published before the design and use of an AI technology. Such information should expedite important public consultation and discussion on how the AI technology is designed and how it should be used. Equally, transparency will enhance system quality and protect patient safety. In that regard, government regulators rely on transparency to conduct proper and effective oversight. Transparency of a machine learning technology must include the possibility of auditing the AI technology especially if something goes wrong the principle of transparency also entails accurate information regarding the assumptions and limitations of the technology, the operating protocols, the properties of the data and the development of the algorithm model.[33]

The WHO Guidance demands that AI should be explainable to the extent possible and in accordance to the capacity of those to whom the explanation is focused on. Stakeholders who might require an explanation should be well informed and the information should be tailored to each population such as marginalized populations. AI algorithms should be tested thoroughly in the locations in which the technology will be used in order to ensure that it meets standards of safety and efficacy. The validation process of AI technology should include the assumptions, operating protocols, data properties, output decisions of the technology. The test and evaluation of AI technologies ought to be regular, transparent and of sufficiently extensive to cover differences in the performance of the algorithm in accordance with the age, gender, ethnicity,

[32] Ibid p. 42

[33] Ethics and governance of artificial intelligence for health: WHO guidance.
Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO. pp. 26, 27

race and other appropriate human characteristics. In that regard, there should be vigorous, strong, independent oversight of such tests and evaluation to ensure safety and effectiveness. Additionally, health-care institutions, and public health agencies ought to regularly publish information about how decisions have been made for the use of an AI technology and how it will be evaluated occasionally, its uses, its known limitations and the role of decision-making, which can enable external auditing and oversight.[34]

Forster Responsibility and accountability

People require explicit, clear, transparent specification and description of the tasks that the systems can perform and the conditions and circumstance under which they can achieve the desired level of performance. This empowers health care providers to use an AI technology responsibly. Despite the fact that AI technologies perform specific duties, it is the obligation of human beings to ensure that they can perform those duties and that they are used under appropriate conditions. Responsibility in the adoption of AI can be secured by what the WHO Guidance calls human warranty. This warranty denotes evaluation by patients and medical professionals in the development and deployment of AI technologies. "In human warranty, regulatory principles are applied upstream and downstream of the algorithm by establishing points of human supervision."[35]The aim is to ensure that the AI algorithm rests on a machine-learning growth path that is medically effective, which can be interrogated and is ethically responsible and such algorithm should be validated by the regulatory agencies. Furthermore, if there is a problem in the application of an AI technology, there ought to be accountability and as a result applicable mechanisms should be approved to ensure interrogation by and redress for persons and groups who may be adversely affected by AI informed decisions. Such appropriate remedial mechanisms should include grant of access to prompt, effective remedies and redress from governments and companies that use AI for health care. Remedies available to adversely affected individuals should include compensation, rehabilitation, restitution sanctions when and where applicable and a guarantee of non-repetition.

[34] Ibid p. 27
[35] Ibid p. 28

The WHO Guidance provides that the use of AI technologies in medicine necessitates the attribution or designation of responsibility within a complex system in which accountability is distributed among numerous agents. When health decisions by AI technologies cause harm to individuals, responsibility and accountability procedures ought to unmistakeably identify the comparative roles of manufacturers and health professionals' users in the harm. As a result, institutions have not only legal liability for the use of AI algorithms but also a duty to assume responsibility for decisions made by the algorithms they use. The legal liability does not change even if it is not possible to explain in detail how the algorithms produce the results. In order to prevent diffusion of responsibility, a faultless responsibility model which means, collective responsibility, where all the agents involved in the development and use of an AI technology are held responsible may encourage all the stakeholders to act with integrity and thereby minimize harm. In that model, the real intention of each stakeholder or their ability to control an outcome are not considered since all the stakeholders are collectively responsible for the harm.[36]

Ensure inclusivity and Equity

By virtue of the WHO Guidance, inclusiveness requires that AI used in health care is designed to encourage the widest possible appropriate and equitable use and access without regard to age, gender, income, ability or other relevant characteristics. Inclusivity also requires that institutions such as regulatory agencies and health systems should recruit employees from diverse backgrounds, cultures and disciplines to develop, monitor and use AI technologies. AI ought to be designed by and assessed with the active involvement of those who are expected to use the technology or those who may be affected by it. These include AI technology providers and patients and the participation ought to be adequately diverse.[37] Moreover, AI technologies ought not be biased because bias constitutes a threat to inclusiveness and equity. This is also because bias represents an arbitrary departure from equal treatment. An illustration is a AI technology designed to diagnose cancerous skin lesions that is trained with data on one skin colour may possibly not generate accurate results for patients with a different skin colour thereby increasing the risk to their health. Certain biases may be unintended. Such unintended biases should be avoided or it may be identified and mitigated. Developers of AI algorithms ought to be aware of

[36] Ethics and governance of artificial intelligence for health: WHO guidance. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO. p. 28
[37] Ibid p.29

the possible biases in their design, implementation and adoption and the possible harm that biases can cause to individuals, groups and society. These stakeholders have an obligation to address prospective biases and prevent introducing or exacerbating health care disparities. AI technology developers must ensure that AI data especially data meant for training do not include sampling bias thereby ensuring their accuracy, completeness and diversity. In a situation where a racial or ethnic minority is under represented in a dataset, oversampling of that race or ethnic group relative to its population size may become necessary to guarantee that an AI system achieves the same quality of results in that population as in better represented groups.[38]

3.1.2. The Toronto Declaration

Beyond the WHO Guidance of AI, there is also the Toronto Declaration which is a significant document launched by the Amnesty International and the Access Now. The landmark document focuses on the protection of human rights in the age of artificial intelligence. The declaration underscores the necessity of applying existing international human rights standards to the development and adoption of machine learning systems. The fundamental principles established by the declaration are preventing discrimination, ensuring transparency and accountability and right to remedy. Under the Toronto Declaration, governments and private actors ought to find new ways to protect human rights when employing new technologies. This is because the new technologies pose new challenges to equality and representation of and impact on the diverse individuals and groups arise.[39] The use of machine learning technologies may lead to existing patterns of structural discrimination being reproduced and aggravated. An illustration is where a machine learning system have goals that create self-fulfilling markers of success and reinforce patterns of inequality. Another example is with respect to matters arising from non-representative or biased datasets[40]. The Declaration further provides that public and private sector actors must prevent and mitigate against discrimination risks in the design, development , application and use of machine learning technologies. These stakeholders ought to ensure that

[38] Ethics and governance of artificial intelligence for health: WHO guidance. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO. p. 29

[39] Art. 15, Toronto Declaration. Available at https://www.torontodeclaration.org/%20declaration-text/english/. Accessed on 16th March, 2026 at 5:42 am

[40] Art. 16

mechanisms and protocols granting access to effective remedy are in place before deployment and throughout the AI technologies lifecycle.[41]

The declaration emphasised that the principles of inclusion, diversity and equity must be considered in the development and use of machine learning systems in order to prevent discrimination especially against marginalized groups.[42] It pointed out that implicit and inadvertence bias through design creates another way of discrimination. This is more illustrated by the fact that the conception, development and adoption of machine learning technologies is mainly supervised by a specific group or sector of the society. Presently, the technology is mainly created, developed, applied and reviewed by companies based in certain countries and regions of the world. As a corollary, the persons behind the creation and development of the technology bring their biases and as a result have limited input from diverse groups in terms of race, culture, gender and social and economic contexts.[43]

The declaration urges states to identify risks associated with machine learning by thoroughly investigate the technology for discrimination risks prior to development or acquisition, prior to use and on an ongoing basis throughout the lifecycle of the machine learning system. The states can do that by conducting regular impact assessments prior to public procurement, during development, at regular signposts and throughout the adoption and use of the system to identify potential sources of discrimination. Additionally, states should take appropriate measures to mitigate risks identified through impact assessments. One way of doing that is by mitigating inadvertent discrimination or underrepresentation in data or systems; conducting dynamic testing techniques and pre-release trials; making sure that possible affected groups and field experts are included as actors with policymaking power in the design, testing and review phases; submitting machine learning systems for independent expert review where necessary. Finally, states are encouraged to subject machine leaning systems to live, regular tests and audits, scrutinising indicators of success for bias and self-fulfilling feedback loops and ensuring holistic independent reviews of machine learning systems given the background of human rights harms in a live

[41] Art. 17
[42] Art. 18 Toronto Declaration
[43] Art. 20

environment.[44] Furthermore, the Declaration made provisions for transparency, accountability, enforcement of oversight, promoting equality, holding private sector actors to account, mitigating discrimination in the use of machine learning system and the provision of effective remedy. These provisions are similar to the WHO Guidance of Artificial Intelligence in health. The Declaration as well as the WHO Guidance are not treaties and are therefore not binding on states.

3.1.3. The European Union Artificial Intelligence Act, 2024 (EU AI Act)

The purpose of the EU Artificial Intelligence Act include the laying down a uniform legal framework for the development, marketing, the deployment and the use of AI systems in the EU in order to ensure commitment to human centric and trustworthy artificial intelligence and at the same time protecting health, safety and fundamental rights.[45] The Act barred what it called prohibited AI practices and one of practices is the marketing, the deployment or the use of an AI system that exploits any of the vulnerabilities of a person or a specific group of persons due to their age, disability or a explicit social or economic situation, with the objective, or the effect, of materially distorting the behaviour of that person or a person belonging to that group in a manner that causes or is reasonably likely to cause that person or another person significant harm.[46] This provision is particularly relevant to children, who, as a result of their age are vulnerable. In that regard, no AI system should be marketed, adopted and used that will exploit the vulnerability of children especially Nigerian children,

The Act established a risk management system. It provided that a risk management system shall be established, implemented, documented and maintained in relation to high-risk AI systems.[47] A risk under the Act means the "combination of the probability of an occurrence of harm and the severity of that harm."[48] By the Act, a risk management system "shall be understood as a continuous iterative process planned and run throughout the entire lifecycle of a high-risk AI system, requiring regular systematic review and updating."[49] Such risk management system shall

[44] Art. 31
[45] Paragraph 1 of the Preamble to the EU Artificial Intelligence Act, 2024; Art 1 EU AI Act, 2024
[46] Art 5(1)(b)
[47] Art 9(1)
[48] Art. 3(2)
[49] Art 9(2)

have four steps. The first step of the risk-management system is " the identification and analysis of the known and the reasonable foreseeable risks that the high-risk AI system can pose to health, safety or fundamental rights when the high-risk AI system is used in accordance with its intended purpose."[50] In this regard, the risk management system involves the documentation, examination and scrutiny of the recognised risks and other risks that are reasonably predictable or probable that the high-risk AI system can pose to human health, safety or fundamental rights when it is used in accordance with its intended purpose. The second step of the risk-management system is the "establishment and evaluation of the risks that may emerge when the high-risk AI system is used in accordance with its intended purpose, and under conditions of reasonably foreseeable misuse."[51] This requires the setting up and the assessment of the risks that may likely arise when the high-risk AI system is used in terms of its envisioned purpose as well as realistically probable risk that may arise as a result its misapplication. The third step in the risk management system is the "evaluation of other risks possibly arising, based on the analysis of data gathered from the post-market monitoring system referred to in Article 27."[52] This step involves the assessment of other conceivable risks that may arise as a result of analysis of data collected from the post-market monitoring system. The fourth and final step in the risk management system is the "adoption of appropriate and targeted risk management measures designed to address the risks identified pursuant to point (a)."[53] This last step requires the implementation of suitable and directed risk management processes intended to resolve the risks identified pursuant to the first step.

The EU AI Act also made provisions for data and data governance. It provides that high-risk AI systems that make use of techniques or methods which involves the training of AI models with data must be developed on the basis of training, validation and testing data sets that accord with the quality criteria referred to in paragraphs 2 to 5 of the Article 10 whenever such data sets are used.[54] Of particular importance to health is the provision regarding the training, validation and testing of data. According to the Act, the training, validation and testing of data sets shall be subject to data governance and management practices appropriate for the intended purpose of the

[50] Art 9(2)(a)
[51] Art 9(2)(b)
[52] Art 9(2)(c)
[53] Art 9(2)(d)
[54] Art 10 (1)

high-risk AI system. The practices that concern health may be found in Art 10(2)(f) which provide for practice for "examination in view of possible biases that are likely to affect the health and safety of persons, have a negative impact on fundamental rights or lead to discrimination prohibited under Union law, especially where data outputs influence inputs for future operations" and Art 10(2)(g) that provides for "appropriate measures to detect, prevent and mitigate possible biases identified according to point f" These provisions are meant to prevent and mitigate biases in the use of data in the health care sector.

The Act also regulated the representation of data. Under the Act, the "training, validation and testing data sets shall be relevant, sufficiently representative and to the best extent possible, free of errors and complete in view of the intended purpose."[55] It further required that "data sets shall take into account, to the extent required by the intended purpose, the characteristics or elements that are particular to the specific geographical, contextual, behavioural or functional setting within which the high-risk AI system is intended to be used."[56] These two paragraphs are meant to ensure fair and equitable representation in data usage. In that regard, it will be possible to take into consideration the interests of minorities and vulnerable groups. Similar to the WHO Guidance and the Toronto Declaration, the EU AI Act stipulated that high-risk AI systems must be designed and developed in a manner as to ensure that their operation is sufficiently transparent to enable deployers to interpret a system's output and use it appropriately.[57] The high-risk system must be accompanied by the instructions for use that include concise, complete, correct and clear information that is relevant, accessible and comprehensive to deployers. The instruction must include the identity and contact details of the provider; the characteristics, capabilities and limitations of performance of the high-risk AI system; the changes to the high-risk system and its performance which have been pre-determined by the provider at the time of the initial conformity assessment; the human oversight measures referred to in Article 14, including the technical measures put in place to facilitate the interpretation of the outputs of the high-risk AI system by the deployers and the computational and hardware resources needed.[58]

[55] Art 10(3)
[56] Art 10(4)
[57] Art 13(1)
[58] Art 13 (3)

The Act equally provided for human oversight of AI. Under the Act, high-risk AI systems must be designed and developed in such a manner, which includes with appropriate human-machine interface tools, that they can be effectively overseen by natural persons or human beings during the period in which they are in use. The purpose of such human oversight must be to prevent or minimise the risks to health, safety or fundamental rights that may arise when a high-risk AI system is used in accordance with its intended purpose or under conditions of reasonably foreseeable misuse. Additionally, the oversight measures contemplated under the Act must be measures that are commensurate to the risks, level of autonomy and context of use of the high-risk AI system. This can be achieved through either of the following types of measures namely measures that are identified and built, when technically feasible, into the high-risk AI system by the provider before it is placed on the market or adopted for use and measures that are identified by the provider before marketing the high-risk AI system or using it and measures that are suitable to be implemented by the deployer.[59]

Article 27 of the EU AI Act requires fundamental rights impact assessment for high-risk AI systems. It obliges deployers of high-risk AI system who are bodies governed by public law or private establishments providing public services must undertake an assessment of the impact of high-risk AI systems on fundamental rights that the use of such system may produce.

3.1.4. The General Data Protection Regulation(GDPR)

The GDPR was developed by the European Public Service Union(EPSU) to regulate data protection, privacy and cybersecurity in public services and in trade unions. The GDPR affords public service workers and trade unionists in Europe an opportunity to improve how their personal data and privacy are dealt with.[60] The GDPR sets out seven guiding principles on how data can be collected and the legal basis for the processing of the data.

The principles of Lawfulness, Fairness and Transparency

These principles state that the legal reasons for collecting data must be established and some of these grounds are, example, that the processing must be founded on consent, public interest or legitimate interests. The principle of fairness means that data should be controlled in a manner

[59] Art 14(1)(2)(3)
[60] The Forward to the General Data Protection Regulation of the European Public Service Union, p.3

that people would expect to be reasonable. The principle of fairness extends to the manner data has been collected. For example, if somebody has been deceived to collect their data, the data controller is in breach of the principle of fairness.[61]

Purpose Limitation

Under this principle, personal data must be collected for specified, explicit and legitimate purposes and such data cannot be further processed in a manner that is incompatible with those purposes. A minimum of one reason that are specified for the collection of the data must be fulfilled in order to be allowed to start processing.[62]

Data Minimisation

Personal data should be adequate, relevant and limited to what is necessary. It is important to identify the amount of personal data that are needed for processing before any data collection takes place. Consequently, data should be adequate or sufficient, relevant or with clear link with the purpose and limited to fulfil the purposes for which they are processed.[63]

Accuracy

The data needs to be accurate and maintained up to date. There is no duty on the data controller to proactively ensure the accuracy of data and if he discovers that any of the data is inaccurate, incorrect or misleading, he should either delete or rectify the data immediately.[64]

Storage Limitation

The principle of storage limitation demands that that personal data should be gotten for a determined period of time and no longer that necessary. If the purpose for which the data was kept is no longer relevant or it is out of date, the personal data should be deleted or anonymised. The storage limitation principle therefore prevents personal data from becoming irrelevant, excessive, inaccurate or out of date. Accordingly, it encourages controllers to set policies on retention limits.[65]

Integrity and Confidentiality

This principle demands that personal data should be kept secure. To that extent, appropriate measures must be put in place to ensure security of the data which includes protection from

[61] General Data Protection Regulation. p.10
[62] ibid
[63] Ibid p.11
[64] Ibid
[65] Ibid p.12

unauthorised or unlawful processing. Such security measures also include protection against accidental loss, destruction or damages.

Accountability

The principle of accountability requires that the data controller is responsible and therefore accountable for compliance with the GDPR, putting in place all essential measures, such as the implementation of a privacy management framework.[66]

3.2. NATIONAL LEGAL FRAMEWRORK FOR ARTIFICIAL INTELLIGENCE IN NIGERIA

Presently, Nigeria has no specific AI legislation for health but AI for health is regulated by an amalgam of general laws especially the Nigeria Data Protection Act, 2023.

3.2.1. Nigeria Data Protection Act, (NDPA) 2023

The objectives of the NDPA include, among others, to safeguard the fundamental rights, freedoms and the interest of data subjects based on the Constitution of the Federal Republic of Nigeria, 1999; arrange for the processing of personal data; to support data processing practices that protect the security of personal data and the privacy of data subjects and to guarantee that personal data is processed in a fair, lawful and accountable manner and to safeguard data subjects' rights. Other objectives are to provide opportunities of recourse and remedies in the event of the violation of the data subjects rights.[67] The Act requires that data processors must ensure that personal data is processed in a fair, lawful and transparent manner; collected for a specified and legitimate purposes and processed in a way that ensures appropriate security of personal data. Processing data in a manner to ensure suitable personal security will necessarily include safeguarding data against unlawful processing, access, loss, damage or any form of data breach. A data processor under the Act has a duty to ensure confidentiality, integrity and availability of personal data.[68] Under the Act, data processing is deemed lawful where the data subject has granted consent and has not withdrawn consent for the explicit purpose or purposes for which personal data is to be processed or the data processing is essential for the performance of a data subject's contract or compliance with a legal obligation by the data subject. Data processing is also deemed lawful when it is done to protect the data subject's interest or the

[66] Ibid p.12
[67] S. 1(1)(a)(b)(c)(d)(e) National Data Protection Act, 2023
[68] S. 24 National Data Protection Act, 2023

public interest. It was also provided that interests in personal data processing must not be regarded as legitimate if it overrides the fundamental rights and freedoms of the data subject.[69] The Act made a detailed provision for the consent of the data subject. The silence or inactivity of the data subject must not constitute consent; the data subject must be informed of his right to withdraw consent before he granted his consent earlier. A request for consent of the data subject shall be in clear and simple language and accessible format. The consent of the data subject must be in the formative and not based on pre-selected confirmation while the consent may be provided in writing, orally or through electronic means.[70] The Act empowers the data controller to, prior to personal data processing, undertake a data privacy impact assessment where he believes that personal data processing may likely result in high risk to the rights and freedoms of a data subject by virtue of the personal data processing nature, scope, context and purposes.[71] The Act also made provision of the personal data processing of children or those who lack legal capacity to grant their consent. In such circumstances, the data controller must obtain the consent of the parent or legal guardian as a basis of consent under the Act.[72]

The Act makes provisions for the rights of a data subject. A data subject has the right under the Act to acquire without impediment and undue delay, confirmation whether the data controller is storing or otherwise processing personal data relating to the data subject. If that is the situation, the data subject may inquire the purposes of the processing, the categories of the personal data concerned, the recipients to whom the personal data have been or will be disclosed, the period the personal data will be stored and the existence of the right to request from the data controller rectification or erasure of personal data. The data subject may also inquire into the right to lodge a complaint with the commission; where the personal data of the data subject is not collected from the data subject, any available information as to their source, and the existence of automated decision-making, including profiling, the significance and envisaged consequences for the data subject.[73] The Act did not make provision as to how children may exercise theses rights but it is submitted that these rights can be exercised on behalf of children by their parents or lawful guardians. The data subject has a right under the Act to withdraw consent, at any time,

[69] S. 25(1)(2)
[70] S.26 (3)(4)(5)(6)(7)
[71] S. 28(1)
[72] S.31(1)
[73] S.34(1)

to the processing of personal data[74] and the data subject shall have the right to object to the processing of personal data relating to him.[75] The right to withdraw consent at any time and the right to object to the processing of personal data may be exercised on behalf of a child by his parents or lawful guardians. The Act prohibits subjecting a data subject to a decision that is based solely on automated processing of personal data which has the consequence of producing legal or significant effects concerning the subject data. This prohibition equally applies to children especially with respect to issues relating to their health. The Act also created exceptions to the general principle by stipulating that the principle shall not apply where such decision is necessary for entering into or the performance of a contract between the data subject and a data controller or where it is authorised by a written law, which establishes suitable measures to safeguard the fundamental rights and freedoms and the interests of the data subject. Another exception is that it will not apply where the decision is authorised by the consent of the data subject.[76] The Act protects the security, integrity and confidentiality of personal data in the possession of the data controller by protecting the personal data against accidental, unlawful destruction, loss, misuse, alteration, unauthorised disclosure or access.[77]

3.3. Legal Framework for Right to Health of the Child in Nigeria

Article 12 (2) (a) of the International Covenant on Economic, Social and Cultural Rights, 1976 (ICESCR), made specific provisions regarding the children's RTH. It provides that the steps to be taken by the State Parties to the covenant to achieve the full realization of the right shall include those necessary for the provision for the reduction of the stillbirth-rate and reduction of infant mortality rate and also for the healthy development of the child. By virtue of art 14(1) the African Charter on the Rights and Welfare of the Child (ACRWC) made general provision for securing the RTH of the child by stating that every child in the state parties to the Charter shall have the right to enjoy the best attainable state of physical, mental and spiritual health[78]. The Charter included the right to spiritual health as a component of the RTH of the child. According of Article 24 (1) of the Convention on the Rights of the Child (CRC), "States parties recognize

[74] S. 35 Nigeria Data Protection Act 2023
[75] S. 36 (1) Nigeria Data Protection Act 2023
[76] S.37(1)(a)(b)(c)
[77] S.39
[78] O. Aje-Famuyide and F. Anene. Universal Health Coverage and The Right to Health in Nigeria, U.I Law Journal, Vol. 10 N0. 1 (2020) Available at https://journals.ui.edu.ng/index.php/uilr/article/view/1062. Accessed on 25th September, 2025 at 3pm

the right of the child to the enjoyment of the highest attainable standard of health and to facilities for the treatment of illness and rehabilitation of health. States Parties shall strive to ensure that no child is deprived of his or her right of access to such health care services." The Constitution of the Federal Republic of Nigeria, 1999 (CFRN) is the organic and supreme law of Nigeria. It is the grundnorm and by virtue of that fact, all other laws in Nigeria derive their power, legitimacy and validity from the CFRN[79]. It is the measuring rod by which cogency and authority of other laws, executive, legislative and judicial powers and decisions are determined. Despite the fact that the CFRN is the supreme law of Nigeria, it does not expressly provide for the RTH of the child or right to health at all.

Regarding specific child centric legislation, Nigerian has adopted the CRC and enacted it as a national legislation through the Child Rights Act, 2003 (CRA). The right to the health of the child is granted under Section 13 of the CRA. Sub-section 1 of the section grants the right to the highest attainable state of physical, mental and spiritual health. This provision is similar to the grant of right to health under the ACRWC which prescribes the right to spiritual health as a component of the child's RTH. The right to spiritual health is not contained in the CRC. Sub-section 2 of the CRA imposed obligations on governments, parent, guardian, institution or organization responsible for the care of a child shall endeavour to provide the child the best attainable state of health.

4. APPLICATION OF AI IN CHILD HEALTH

Given the transformative impact of AI in healthcare, children's health is therefore no exception to the revolutionary effect of the technology. The critical role of AI in health care and children's health, in particular, stems from its capacity to analyse massive amounts of data and identify patterns which would, otherwise, be difficult to identify. These functions enable the technology to provide immense opportunities and offer insights on improving the health and wellbeing of children. Artificial Intelligence can be used as a mechanism for early disease detection and diagnosis. As a tool of predictive analytics, AI systems can analyse huge genetic data, vast amount of electronic health records and immense medical data for the purpose of identifying patterns leading to the prediction of the onset of childhood diseases. The advantage of this is that

[79] Section 1(1) of the CFRN, 1999

it affords the opportunity of early diagnosis and medical intervention thereby reducing childhood morbidity and mortality.

4.1. Machine Learning and diagnosis of Autism spectrum disorder

AI can be used in the early detection of Autism spectrum disorder which is a neurodevelopmental condition which is characterized by difficulties in social communication and interaction with restricted or repetitive pattern of behaviour, interest, or activity.[80] In the detection of ASD, there are no identifiable biomarkers, as a result the present gold standard in diagnostic criteria is to depend on behavioural observations managed by healthcare specialists. The reliability and validity of such diagnoses becomes issues when the subjectivity of the diagnostic outcome is being considered. The validity and reliability of the diagnostic outcome may be affected by such matters as differences in experience, professional training, lack of resources and the culture adaptability of the valuation.[81] In a 'A protocol for the diagnosis of autism spectrum disorder structured in machine learning and verbal decision analysis" study used verbal analysis and machine learning to improve the diagnostic accuracy of ASD, which resulted in a 20% improvement in diagnostic accuracy over conventional assessments.[82] Also a study titled "Identification of autism spectrum disorder via deep learning and the ABIDE dataset'. In that study, an SVM was used to differentiate children with ASD from healthy controls with a sensitivity of 88% and a specificity of 85%.[83] In another study, "Application of supervised machine learning for behavioural biomarkers of autism spectrum disorder based on electrodermal activity and virtual reality" revealed that machine learning models attained an accuracy of over 90% in identifying biometric patterns associated with ASD.[84] There are current studies that integrated supervised ensemble strategies in ASD gene prediction. For example, a study developed the hybrid ensemble-based classification (HEC)-ASD model, a gradient-based

[80] American Psychiatric Association. 2013. Diagnostic and Statistical Manual of Mental Disorder-5. 5th ed. Washington DC: American Psychiatric publishing. Retrieved June 6, 2024, from https://doi/book/10.1176/appi.books.9780890425787.

[81] Song, D. Y., et al. 2019. The Use of Artificial Intelligence in Screening and Diagnosis of Autism Spectrum Disorder: A Literature Review. *Journal of the Korean Academy of Child and Adolescent Psychiatry* 30.4: 145–152.

[82] Ramirez MAN, et al. Artificial Intelligence in diagnosis of pediatric neurodevelopmental disorders:a scoping review, World Journal of Pediatrics, 2026. https://doi.org/10.1007/s12519-025-00999-z. Andrade E, et al. A protocol for the diagnosis of autism spectrum disorder structured in machine learning and verbal decision analysis. Comput Math Methods Med. 2021;2021:1628959.

[83] Heinsfeld AS, et al. Identification of autism spectrum disorder using deep learning and the ABIDE dataset. Neuroimage Clin. 2018;17:16–23.

[84] Alcaniz Raya M, et al. Application of supervised machine learning for behavioral biomarkers of autism spectrum disorder based on electrodermal activity and virtual reality. Front Hum Neurosci. 2020;14:90.

learning approach that attained 88% accuracy for predicting ASD-associated genes through functional matrices and gene ontology.[85] Even though this particular study and similar studies focused on genetic data rather than behavioural or clinical biomarkers, they established the vigour and strength of supervised learning to improve and advance the early diagnosis of ASD through a multidimensional approach.[86] Although the World Health Organization put global prevalence estimate at 1 in 100 but study conducted among elementary and secondary schools in Southeastern Nigeria has revealed a prevalence rate of ASD to be 2.9% among children of 3 and 18 years while a sample of 85 children in Lagos State, Southwestern Nigeria of children with neurodevelopmental problems revealed a prevalence rate of 34.5%.[87] ASD in Nigeria is characterised by substantial diagnostic delays and absence of population-wide epidemiological data.[88] As a corollary, AI, especially Machine learning, could play significant role in the early diagnosis, detection and treatment of ASD in Nigeria.

4.2. **Clinical decision support systems and neurodevelopmental disorder**

Another pathway of deploying AI in paediatric healthcare is by integrating machine learning models into clinical decision support(CDS) systems in order to ascertain children at risk of specific diagnosis or clinical deterioration or decline to provide evidence-based recommendations. The deployment and use of AI models in clinical support (AI-CDS) may possibly have several advantages over traditional "rule-based" CDS models in paediatric care through improved model accuracy and with fewer false alerts and missed patients.[89] CDS has been defined as "computer systems designed to impact clinician decision making about individual patients at the point in time that these decisions are made."[90] Generally, CDS includes three steps: the first step is to acquire patient data, the second step is to summarise data and the

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[85] Ismail E, Gad W, Hashem M. HEC-ASD: a hybrid ensemble based classification model for predicting autism spectrum disorder disease genes. BMC Bioinform. 2022;23:554.

[86] Ramirez MAN, et al. Artificial Intelligence in diagnosis of pediatric neurodevelopmental disorders: a scoping review, World Journal of Pediatrics, 2026. https://doi.org/10.1007/s12519-025-00999-z.

[87] Bakare. M.O, et al. Autism Spectrum Disorders in Nigeria: A Scoping Review of Literature and Opinion on Future Research and Social Policy Directions. J Health Care Poor Underserved. 2019 ; 30(3): 899–909. doi:10.1353/hpu.2019.0063. p. 3. Available at https://pmc.ncbi.nlm.nih.gov/articles/PMC6815667/. Accessed on 21 May, 2026 at 11:00 am

[88] Ibid p.4

[89] Ramgopal S, et al. Artificial intelligence-based clinical decision support in pediatrics, Pediatric Research, (2023) 93: p. 334

[90] Ibid. p. 335; Berner, E. & La Lande, T. in Clinical Decision Support Systems (ed. Berner, E. S.) 3–22 (Springer, 2007).

third is to suggest an appropriate course of action.[91] With respect to paediatric care, CDS has been utilised in a diversity of applications which includes traumatic brain injury[92], screening for developmental disorders[93], urinary tract infections[94], asthma[95] and antibiotic infection[96].

4.3. AI and Predictive Modelling

The use of AI could overcome some of the limitations attributed to traditional CDS. Most predictive models in children have been derived by utilising more classical machine learning algorithms.[97] Examples of the use of such machine learning algorithms are models to identify patients at risk of urinary tract infection[98], bacterial meningitis[99], pneumonia[100] and serious bacterial infections[101]. These have been achieved by using readily understandable logistic regression or decision trees. In a study a number of the AI models achieved high accuracy in differencing paediatric pneumonia which reflects the potential in the automated classification of paediatric pneumonia on chest x-rays.[102] Within the context of paediatric acute care, ML models have been reported for a diversity of paediatric indications. Examples include the prediction of children with clinically important traumatic brain injury. By using optimal classification trees, investigators were able to identify children at risk of clinically important traumatic brain injury and compared it to a regularly used model developed through classification and regression tress. ML models can also be used to predict paediatric sepsis. In view of the complexity of sepsis with diagnosis, the presence of multiple or numerous overlapping diagnoses and the interaction of

[91] Ramgopal S, et al op cit. p. 335;

[92] Kuppermann, N. et al. Identification of children at very low risk of clinically important brain injuries after head trauma: a prospective cohort study. Lancet 374, 1160–1170 (2009).

[93] Carroll, A. E. et al. Use of a computerized decision aid for developmental surveillance and screening: a randomized clinical trial. JAMA Pediatr. 168, 815–821 (2014).

[94] Shaikh, N. et al. Development and validation of a calculator for estimating the probability of urinary tract infection in young febrile children. JAMA Pediatr. 172, 550–556 (2018).

[95] Hoeksema, L. J. et al. Accuracy of a computerized clinical decision-support system for asthma assessment and management. J. Am. Med. Inform. Assoc. 18, 243–250 (2011).

[96] Mullett, C. J., et al, Development and impact of a computerized pediatric antiinfective decision support program. Pediatrics 108, e75–e75 (2001).

[97] Ramagopal S, et al. op cit. p. 335

[98] Shaikh, N. et al. op cit. p. 172

[99] Nigrovic, L. E. et al. Clinical prediction rule for identifying children with cerebrospinal fluid pleocytosis at very low risk of bacterial meningitis. JAMA 297, 52–60 (2007).
Ramgopal, S. et al. A prediction model for pediatric radiographic pneumonia. Pediatrics 149, e2021051405 (2022).

[101] Kuppermann, N. et al. A clinical prediction rule for stratifying febrile infants 60 days and younger at risk for serious bacterial infections. JAMA Pediatr. 173, 342–351. https://doi.org/10.1001/jamapediatrics.2018.5501 (2019).

[102] Field, E.L. et al Efficacy of Artificial Intelligence in the Categorisation of Paediatric Pneumonia on Chest Radiographs: A Systematic Review. *Children* 2023, 10, 576

variables with each other, the early identification of child sepsis may be one that is especially well suited to an ML use to guide CDS[103]. ML approaches may precisely identify children with sepsis[104]. Sepsis is a major cause of paediatric disease and mortality in the world and 80% of infectious related deaths occur in low and middle income countries(LMICs),[105] including Nigeria. Children in LMICs, including Nigeria, are 18 times more likely to die under the age of five than children in higher income countries (HICS). This difference is caused by the relationship of several factors inter alia the inability to provide timely medical care partly due resource limitations.[106]A recent systemic review of the worldwide burden of paediatric and neonatal sepsis revealed an aggregate estimate of 48 sepsis cases and 22 severe sepsis cases in children per 100,000.[107] Nigeria is one of the highest contributor to under-five mortality globally and much of it is due to sepsis.[108] In a report titled, Levels and Trends in Child Mortality: Report 2024, updated by March 2025, jointly released by the UNICEF, World Health Organization (WHO), the World Bank, and the Population Division of the United Nations Department of Economic and Social Affairs (UN DESA), which make up the Inter-agency Group for Child Mortality Estimation (IGME),[109] half of the deaths among children under age 5 occurred in sub-Saharan Africa while another 30% per cent occurred in Southern Asia. By that report Nigeria's neonatal mortality rate was 34 per 1000 while under-five mortality rate was 105 per 1000 live births. A 2021 report, the Rights Tracker, released by the Human Rights Measurement Initiative (HRMI)[110], showed that among the 18 Sub-Saharan African countries surveyed, Nigeria occupied the last position with 66.6% for children surviving to age 5. These data clearly reveal a general breach of art. 25(2) of Universal Declaration of Human Rights (UDHR) 1948, art. 12 (2) (a) of the International Covenant on Economic, Social and Cultural Rights, 1976 (ICESCR), Goal 2 of the Sustainable Development Goals (SDG), art 14(1) the African Charter on the Rights and

[103] Ramagopal S, et al. op cit. p. 336

[104] Le, S. et al. Pediatric severe sepsis prediction using machine learning. Front. Pediatr. 7, 413 (2019).; Lamping, F. et al. Development and validation of a diagnostic model for early differentiation of sepsis and non-infectious SIRS in critically ill children-a data-driven approach using machine-learning algorithms. BMC Pediatr. 18, 1–11 (2018).

[105] Nwankwor OC, (2019) A National Survey of Resources to Address Sepsis in Children in Tertiary Care Centers in Nigeria. Front. Pediatr. 7:234. doi: 10.3389/fped.2019.00234. p.2

[106] ibid

[107] Ibid

[108] ibid

[109] Available at https://data.unicef.org/resources/levels-and-trends-in-child-mortality-2024/. Accessed on 21st October, 2025 at 1:00 pm

[110] Available at https://humanrightsmeasurement.org/wp-content/uploads/2022/05/HRMI-Annual-Survey-Report-2021.pdf. Accessed on 23/5/26 at 6:15 pm

Welfare of the Child (ACRWC), article 24 (1) of the Convention on the Rights of the Child (CRC), and section 13 Child Rights Act, 2003 (CRA). AI, especially, machine learning tools can be used in the diagnosis and treatment of children thereby reducing high children morbidity and mortality which may mitigate Nigeria's violation of the right to health of her children. AI can also be used in the prediction of infants with significant intra-abdominal injury. ML models have been developed to identify children with abdominal trauma who are at risk of intra-abdominal injury which requires intervention.[111]

AI can equally be used as a powerful tool for medical imaging analysis. In this regard, medical images such as CT scan, X-rays and MRIs can be analysed with AI with extraordinary accuracy and precision resulting in the early detection of health conditions prevalent amongst children such as congenital heart defects. The technology can also be used to analyse multifaceted and intricate genetic data in order to detect and classify rare genetic conditions in neonates and children enabling early medical intervention and custom-made or tailored treatment. By using AI to analyse and classify a child's peculiar genetic makeup and medical history, it can also offer a personalised treatment plans thereby maximizing medication dosages. This function of AI is uniquely valuable in the treatment of paediatric cancer and other chronic diseases.

AI could play a significant role in the prevention and treatment of Malaria. Malaria affects children and pregnant women and is a main reason for illness and death among children.[112] Malaria is a preventable and treatable disease but has attained epidemic proportions in some regions of the world. Seriously suffering and distressed children regularly and frequently die less than 72 hours after exhibiting symptoms of malaria. The children that survives the illness, the malaria disease drains vital nutrients from them which inexorably damages and blights their capacity for physical and intellectual growth. Of all the population groups in Nigeria, the most vulnerable are the under-five children and the under-five children in Nigeria experience of 2-4

[111] Pennell, C., et al. Risk assessment for intra-abdominal injury following blunt trauma in children: derivation and validation of a machine learning model. J. Trauma Acute Care Surg. 89, 153–159 (2020).; Ramgopal, S. & Horvat, C. M. Machine learning approaches for the identification of children at low risk of intra-abdominal injury requiring intervention. J. Trauma Acute Care Surg. 90, e128–e129 (2021).

[112] Nduka C. Njoku, Re-Examining Malaria Disease as a Factor in Children's Mortality Rate and its Impact on the Protection of Children's Right to Health and Wellbeing in Nigeria, International Review of Law and Jurisprudence (IRLJ) 7 (2) May 2025. p. 38. Available at https://nigerianjournalsonline.org/index.php/IRLJ/article/view/2607. Accessed on 7th July, 2026 at 2:33pm

occurrences per year and are responsible for about 90% of Nigeria's malaria mortality.[113] Consequently, about 36% of under-five mortality in Nigeria is as a result of malaria disease.[114] Ineffectual malaria treatment for under-five children has catastrophic consequences. As a result, early, timely, prompt and effective response or treatment of malaria for under-five produces positive clinical outcomes. Conversely, in circumstances where treatment is not available, delayed or ineffective, malaria can lead to severe and life-threatening complications.[115] Inexorably, AI could play a crucial role in the early detection of the disease and in the prompt and effective treatment of the diseases.

As pointed out earlier in this work, AI is an important tool in the diagnosis of certain health conditions such as congenital diseases that ails Nigerian children. In Nigeria and other sub-Saharan African countries, the most prevalent serious congenital disorders are heart defects, Down's syndrome and neural tube defects. Congenital heart diseases are cardiac defects that appear during the period of development of the heart in the intrauterine life.[116] The prevalence rate is estimated to be 7-8 per 1000 births.[117] The age group with the highest rate of recurrence of the disease are children between 1 and 30months.[118] Congenital heart disease constitute a public health challenge in countries with inadequate human and material resources such as sub-Saharan African countries like Nigeria.[119] Nigeria's prevalence of congenital heart defects is 26.09 per 1 million births in 2019. By deploying AI, it will lead to early identification, classification and treatment of the disorder. Thereby reducing and preventing childhood morbidity and mortality as a result of congenital disorders. Therefore, both the federal ministry of health and the ministries

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[113] Edelu, B. O., Ndu, I. K., Igbokwe, O. O., & Iloh, O. N. 2018. Severe falciparum malaria in children in Enugu, South East Nigeria. *Nigerian Journal of Clinical Practice* 21.10: 1349–1355; United States' Embassy in Nigeria. *Nigeria Malaria Fact Sheet 2011*. Retrieved Mar. 2, 2024 from https://cutt.ly/Qe16VFZn.

[114] Dasgupta, R. R., Mao, W., & Ogbuoji, O. 2022. Addressing child health inequity through case management of under-five malaria in Nigeria: an extended cost-effectiveness analysis. *Malaria Journal* 21.1: 81; United States' Embassy in Nigeria. *Nigeria Malaria Fact Sheet 2013*. Retrieved Mar. 2, 2024 from https://cutt.ly/fe16BTgy.

[115] Ibid.

[116] Zakaria Zakaria, A., Souley, K., Mahamat, K.Y., Ali, B.S., Yousra, H., Koché, T., & Ibrahim, T.A. 2021. Congenital Heart Disease: Epidemiological and Echocardiographic Aspects of 167 Cases at the Teaching Hospital of Lamorde/Niamey/Niger. *Cardiology & Vascular Research* 5.4.

[117] W.H.O. 2022. *Atlas of African Health Statistics 2022: Health Situation analysis of the WHO African Region – Country profiles*. Brazzaville: WHO Regional Office for Africa.

[118] Ibid.

[119] Zakaria Zakaria, A., Souley, K., Mahamat, K.Y., Ali, B.S., Yousra, H., Koché, T., & Ibrahim, T.A. 2021. Congenital Heart Disease: Epidemiological and Echocardiographic Aspects of 167 Cases at the Teaching Hospital of Lamorde/Niamey/Niger. *Cardiology & Vascular Research* 5.4.

of health of the various states in Nigeria should deliberately include AI and other health technologies in the prevention and treatment of congenital health conditions of Nigerian children.

Another childhood disease that can be prevented or treated with the aid of AI, is Diphtheria. It is controlled through primary prevention of the disease by safeguarding immunity of the population through vaccination.[120] It is also controlled by the secondary prevention of the spread of the disease by rapid investigation of close contacts to make certain that those infected receive timely treatment. Early detection of the disease is key to prevention and control and can be achieved through epidemiological surveillance. This can be done by ensuring access to laboratory facilities to guarantee reliable identification of corynebacterium diphtheriae toxins. Effective control of the disease requires provision of adequate diphtheria antitoxin for the management of the disease. Again, AI will be an indispensable tool in the early identification and characterisation of the disease to enure effective management. The various governments in Nigeria should train physicians especially paediatricians in the use of AI in the early identification of the disease.

5. Conclusion

The right to health of the child is a fundamental right protected by various international and domestic instruments. This right is unarguably central to the overall development of any nation given the fact that it impacts the health and wellbeing of the adult and future generations. Nevertheless, Nigerian children do not fully enjoy this fundamental right. The failure of the Nigerian state to protect the right to health of Nigerian children has led to gross violation of this right with attendant upsurge in child morbidity and mortality rates. The Nigerian constitution does not protect the right to health of children and there are no robust legal and policy frameworks to actualize the right. The use of Artificial Intelligence can play significant role in the protection of RTH of children in Nigeria. Artificial Intelligence can be useful in identification, diagnosis, classification and treatment of diseases. The early identification and diagnosis of diseases are important in the prevention and treatment of childhood diseases. In this regard, the federal government of Nigeria and the various state government should invest in the development and deployment of relevant Artificial Intelligence technologies in the diagnosis and treatment of childhood diseases especially vaccine-preventable diseases. Equally important is the

[120] Ibid. Pg. 798.

development of laws and policies that regulate AI in health technologies. These laws and policies will ensure the development and use of appropriate AI in health systems that will protect the right to health of the Nigerian children and ensure that necessary safeguards are established to ensure ethical and appropriate use of AI in health in Nigeria.