MEDICAL NEXUS Magazine

A PUBLICATION OF NILE UNIVERSITY MEDICAL STUDENTS ASSOCIATION

A COMPENDIUM OF COMMON DISEASES IN NIGERIA

INTEGRATION FOR ENHANCED HEALTHCARE

HEALTH INFORMATION UPDATE

A DETAILED REVIEW OF COMMON DISEASES FOR HEALTH STUDENTS

FOREWORD

It is with great honor that I write the foreword for this groundbreaking publication, MedicalNexus: A Compendium of Common Diseases in Nigeria, produced by the Nile University Medical Students Association (NUMSA). This magazine stands as a clear reflection of our students' dedication to their studies and their deep-seated commitment to contributing meaningfully to the health sector in Nigeria.

By compiling a comprehensive review of common diseases prevalent in our country, the students have showcased the spirit of Beyond Degrees. This effort goes beyond academic excellence, highlighting the practical application of knowledge and the desire to impact real lives. It is a testament to the values we uphold at Nile University of fostering leadership, innovation, and a passion for solving the pressing challenges of our time.

Nigeria’s healthcare landscape is complex, and it requires a well-equipped generation of professionals ready to tackle these challenges head-on. MedicalNexus is not only an academic resource but also a strategic tool for current and future healthcare practitioners, helping bridge the gap between theory and practice for enhanced healthcare delivery in Nigeria.

I commend the editors and contributors for their hard work and vision in bringing this publication to life. It is initiatives like this that remind us that the future of healthcare in Nigeria is bright, driven by dedicated individuals like those behind this compendium. I hope that all who read MedicalNexus find it as informative and inspiring as I do.

Professor Dilli Dogo
Vice Chancellor,
Nile University of Nigeria

EDITORS

Emmanuel Oranwusi U.

EDITOR-IN-CHIEF

Emmanuel Oranwusi Uchenna, is a 600-level medical student at Nile University, serving as the President of the Nile University Medical Students' Association (NUMSA) for the 2023/2024 academic year. He is also the editor-in-chief of The Medical Nexus, a groundbreaking compendium focused on cataloging and addressing common diseases in Nigeria. His leadership of **The MedicalNexus** reflects his passion for improving healthcare in Nigeria by providing accessible and localized medical knowledge that benefits both the public and medical professionals.

As NUMSA President, I have been pivotal in organizing health conferences, community outreach programs, and student mentorship initiatives, all aimed at making a positive impact on public health, medical education, promoting student empowerment and fostering collaboration within the medical community. My advocacy extends beyond NUMSA, as I actively champions health awareness campaigns, such as those for World Malaria Day and World HIV Day, ensuring that critical health issues are brought to the forefront.

My dedication to both academic excellence and social responsibility positions him as a promising future leader in Nigeria's healthcare sector, where his vision for a more effective healthcare system is clear.

Abdul-Azeez Ibrahim O.

DEPUTY EDITOR-IN-CHIEF 1

AbdulAzeez Olugbenga Ibrahim, is a 600-level medical student at Nile University and the Speaker of the House for NUMSA. I am passionate about making an impact in my community and improving health of those around me. This magazine aims to educate the public, raise health awareness, and promote healthy lifestyles. It highlights advances in treatment, shares entertaining stories, and supports medical professionals in addressing health concerns in cultural contexts.

At NUMSA, I have participated in initiatives like community outreaches and mentoring programs for students, fostering collaboration and growth within our association. Alongside my studies, I run Stratify, a digital services business helping businesses grow in the online space. I believe in giving more than you receive and find inspiration in teamwork, meaningful conversations, and quality time with loved ones.

Maryam Jibrin Wunti

DEPUTY EDITOR-IN-CHIEF 2

Maryam Jibrin Wunti, is a 600-level medical student at Nile University and Vice President of Internal Affairs for the Medical Student Association (NUMSA), dedicated to improving healthcare for women, children, and those at risk of cardiovascular diseases. Through NUMSA's magazine (**MEDICALNEXUS**), she focuses on public education, raising health awareness, and promoting healthy lifestyles, while also highlighting research and treatment advancements to empower individuals and support medical professionals.

I have contributed to various initiatives, including community outreach programs that educate the public on common illnesses and organize mentorship programs for students facing challenges. My experiences in tutoring junior medical students and collaborating on healthcare initiatives have deepened my commitment to fostering a supportive environment and making a positive impact on my peers and community.

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Dr. Nubwa Medugu, FWACP, MBBS, is a Clinical Microbiologist and Infectious Disease Specialist, currently serving as the Head of Medical Microbiology and Immunology at Nile University of Nigeria. A Marie Curie Fellow, she holds an MSc in Infectious Diseases from the University of London.

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My greatest achievement is bringing a smile to a woman after she has lost hope.

Quotable quotes:

"Being a female doctor is not just about breaking barriers, but living fulfilled..

Dr Jibril IMRAN

Dr. Jibril has the following academic qualifications: MBBS, Sokoto (2010); MSc Medical Microbiology and Parasitology, Ilorin (2017), Fellow West African College of Physician (FWACP Lab. Medicine 2022). He is currently a senior lecturer in the department of Medical Microbiology and Immunology, Nile University of Nigeria Abuja. He is happily married with children.

He started his academic career at the A.U.D Primary School, Isale-Bonni then racing through Ifelodun Grammar School and Irepo Grammar School all in Igboho. He had a brief stop at the Agric department of the University of Ilorin from where he took off after three sessions for CHS/UDUS. While in Med school, Dr Jibril served at various levels in ISMA, member MSRA, member UDUMSA caretaker committee, UDUMSA Director of Standing Committee on Publication (SCOPUB), MSSN Protocol committee chairman, and also as the chairman of the graduating year committee (Medical class 2009).

THE NILE '24 EXPERIENCE

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He hails from Bichi, Kano state. He attended Hagagawa primary school Bichi, Govemment Secondary School Kazaure(Jigawa state), Science Secondary Dawakin Tofa and Bayero University Kano. He graduated from University of Ilorin, Nigeria. He is married and has children. His hobbies include learning and teaching.

Dr Lilian EKWEM

Dr Lilian Ekwem is a graduate of the prestigious Ahmadu Bello University, Zaria. She is a chief consultant Paediatrician with a special interest in neonatology and haematology. She is the current Head of Paediatrics at Wuse District Hospital, Abuja, and a lecturer in the Paediatrics Department of the faculty of health sciences, Nile University of Nigeria, Abuja.

She enjoys interracting with other colleagues in her field of practice with the purpose of keeping abreast with current global best practices. She has attended several local and international conferences, has participated in a number of scientific research studies and co-authored articles published in reputable journals. She is married with children and enjoys listening to music, dancing, reading novels, playing badminton, charity engagements, and spending quality time with her family.

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Dr Sotimehin ADETOUN

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Dr. S has extensive paediatric and child health experience and has played pivotal roles in undergraduate medical student and postgraduate doctoral training over the years. She also has operational and executive experience in health strategy and policy planning and implementation as well as health systems administration. She is passionate about the delivery of quality health care in Nigerian facilities and raising the living standards of women and children within her circle of influence.

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INTRODUCTION

The global health landscape is rapidly evolving, with new challenges emerging alongside long-standing health issues. Medical students are at the forefront of addressing these challenges, as they will be the frontline responders and innovators within future healthcare systems. This magazine represents a peer-to-peer educational initiative, written by medical students, for medical and health sciences students, with each chapter developed under the guidance of a supervising lecturer. The goal is to comprehensively explore a wide range of health conditions, highlighting their clinical significance and public health implications, while fostering collaboration among future healthcare professionals.

The topics covered span infectious diseases, chronic conditions, and maternal and child health—issues especially relevant in regions across the Global South. This initiative aims to equip medical students with the critical knowledge they need to navigate both local and global healthcare challenges, providing insights into disease mechanisms, epidemiological trends, and effective interventions.

Infectious Diseases: A Global Health Challenge

Infectious diseases continue to pose major health challenges worldwide, particularly in Global South regions, where healthcare systems are often stretched thin. Diseases such as diarrhoeal illnesses, cholera, and schistosomiasis cause significant morbidity and mortality, especially among children and vulnerable populations. The high burden of these diseases is exacerbated by poor sanitation, lack of access to clean water, and inadequate healthcare infrastructure.

For instance, diarrhoeal disease is one of the leading causes of death in children under five across the Global South, including Nigeria. Improved sanitation, water quality, and vaccination programs can drastically reduce this burden. In the case of cholera, outbreaks often follow natural disasters or arise in conflict zones, highlighting the critical importance of rapid response and public health preparedness.

Schistosomiasis, a neglected tropical disease, affects millions of people in countries like Nigeria, leading to long-term complications such as liver and bladder damage. Understanding the lifecycle of these parasites and developing targeted interventions are vital components of control strategies. This peer-led magazine offers a platform for medical students to share insights and strategies for tackling these health issues in under-resourced settings.

Emerging Infectious Threats: Monkeypox and Ebola Virus

Emerging infectious diseases such as monkeypox and Ebola virus serve as stark reminders of the ongoing global health security threats, particularly in the Global South.

Zoonotic diseases, often originating in animal reservoirs, can quickly escalate into public health emergencies. Recent cases of monkeypox in Nigeria underscore the importance of early detection, rapid response, and community-based containment strategies. Medical students must be equipped with knowledge of how these diseases spread and how to respond effectively to prevent community transmission.

Ebola virus, although currently under control, remains a potent threat, with its ability to cause widespread outbreaks. During the 2014 West African Ebola crisis, Nigeria played a pivotal role in containing the virus through coordinated public health interventions. Learning from these experiences, this generation of medical students

is better prepared to respond to future outbreaks, contributing to global health security and the protection of vulnerable populations.

Non-Communicable and Chronic Diseases: A Growing Burden

Non-communicable diseases (NCDs) such as mental health disorders and sickle cell anaemia present significant public health challenges in Nigeria and throughout the Global South. Despite their increasing prevalence, NCDs are often underdiagnosed and undertreated. For example, mental health conditions, including depression and anxiety, are often overlooked, with stigma acting as a barrier to care. Training medical students to address mental health issues holistically—incorporating both medical and psychological approaches—will improve health outcomes in affected communities.

Sickle cell anaemia, which affects millions in Nigeria, requires a multidisciplinary approach, involving genetic counselling, long-term care strategies, and pain management. Advancements in gene therapy hold promise for the future, but many Nigerians still face limited access to these innovations. Equitable healthcare is crucial in this context, and through peer education, medical students are encouraged to seek solutions that bridge gaps in care.

Maternal and Child Health: Key to Health System Strengthening

Maternal and child health remain central to health system strengthening efforts in Nigeria and other countries in the Global South. Complications during pregnancy and childbirth, such as haemorrhage, infection, and pre-eclampsia, contribute significantly to maternal mortality rates, particularly in rural areas where access to skilled healthcare providers is often limited. Addressing these issues requires both clinical knowledge and an understanding of the broader social determinants of health. Medical students, under the guidance of their lecturers, have researched these areas extensively, providing practical solutions for improving maternal healthcare outcomes.

Breastfeeding, a key pillar of child survival strategies, is often hindered by cultural norms, misinformation, and lack of support. Through peer education, this magazine encourages students to advocate for policies and educational programs that promote breastfeeding, aiming to improve infant nutrition and reduce mortality rates.

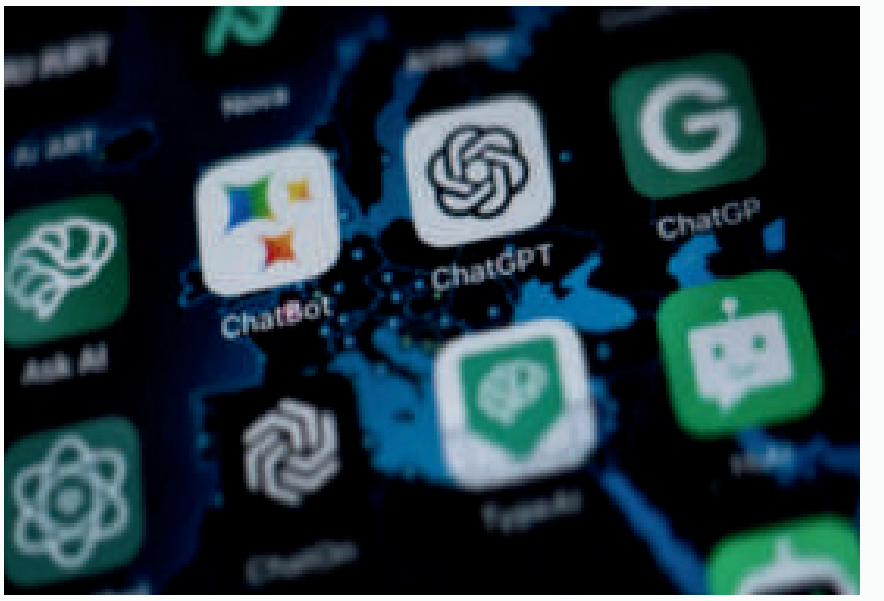
Healthcare in Nigeria: Progress and Challenges

Nigeria's healthcare system faces many challenges, including limited infrastructure and disparities in healthcare access, particularly in rural areas. While the country has made progress in areas like malaria prevention and vaccination programs, many communities still struggle to access basic healthcare services. Strengthening primary healthcare systems, improving healthcare worker training, and addressing the social determinants of health are crucial for overcoming these challenges.

This magazine highlights the importance of empowering medical students to lead in these efforts. As the next generation of healthcare professionals, students must be equipped with the skills and knowledge to address the systemic issues that impede access to care. This includes not only medical training but also advocacy for healthcare policies that prioritize underserved populations.

Preparing Medical Students for the Future of Medicine

As healthcare systems worldwide face rapid technological advancements, the role of medical students in shaping the future of medicine becomes increasingly important.



Innovations such as artificial intelligence in diagnostics and personalized medicine are already transforming global healthcare systems, and medical students must be prepared to leverage these advancements. This magazine is a product of such collaboration, with each chapter representing the collective knowledge of students working together under the guidance of experienced lecturers.

In conclusion, the articles within this magazine serve as a peer-led educational resource designed to provide medical students with the knowledge and tools they need to navigate the complex health challenges of today and tomorrow. By understanding the biological, social, and policy dimensions of disease, future healthcare professionals can play a pivotal role in advancing healthcare and improving health outcomes in Nigeria, the Global South, and the world at large.

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DIARRHOEAL DISEASE

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INTRODUCTION

Diarrhoea is a common gastrointestinal disorder characterized by the frequent passage of loose or watery stools, often accompanied by symptoms such as abdominal cramps, bloating, and general body weakness. While most cases of diarrhoea are mild and self-limiting, severe diarrhoea can lead to life-threatening dehydration, especially in vulnerable populations such as children under five, the elderly, and individuals with weakened immune systems (WHO, 2023).

Diarrhoea remains a significant public health challenge, particularly in low-resource settings where poor sanitation and limited access to clean drinking water contribute to high transmission rates. Globally, diarrhoea is a leading cause of mortality in young children, contributing not only to death but also to malnutrition and impaired growth. (Lamberti, 2012).

DEFINITION

Diarrhoea is medically defined as the passage of three or more loose or liquid stools per day, or more frequently than is normal for the individual. The severity and duration of diarrhoea vary widely, and it is generally classified into three categories (CDC, 2023)

- **Acute Diarrhoea:** Lasts less than 14 days and is usually caused by infections. It is the most common type and is often related to food poisoning or viral infections.
- **Persistent Diarrhoea:** Lasts more than 14 days but less than four weeks. Persistent diarrhoea may be caused commonly by bacteria infections or malabsorptive conditions.
- **Chronic Diarrhoea:** Persists for four weeks or longer and is often associated with underlying health issues such as irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), or malabsorption syndromes.

TYPES/MECHANISMS

1. **Secretory Diarrhoea:** This occurs when there is an increase in the secretion of fluids and electrolytes into the intestines, overwhelming the body's ability to reabsorb them. This type of diarrhoea can occur with infections (e.g., cholera), certain medications, or tumours that secrete hormones (e.g., VIPomas). It is characterized by large volumes of watery stool that continue even when the patient is fasting (Farthing, 2004).
2. **Osmotic Diarrhoea:** Results from the ingestion of poorly absorbed solutes, such as lactose in lactose-intolerant individuals or excessive intake of artificial sweeteners like sorbitol. The non-absorbable substances draw water into the intestinal lumen, leading to diarrhoea. This type of diarrhoea typically stops with fasting. (Guerrant, 2001).
3. **Exudative Diarrhoea:** Caused by inflammation of the intestinal mucosa, leading to the secretion of mucus, blood, and pus into the stool. Common causes include infections (e.g., Shigella, Campylobacter), inflammatory bowel disease (IBD), and ischemic bowel disease. (Thapar & Sanderson, 2004.)
4. **Motility-Related Diarrhoea:** This type of diarrhoea is caused by increased gut motility, resulting in insufficient time for the

absorption of water and nutrients causing a reduced transit time. Conditions such as irritable bowel syndrome (IBS), diabetes, and post-surgical complications can lead to motility-related diarrhoea (CDC, 2023).

AETIOLOGY

The causes of diarrhoea can be broadly divided into infectious and non-infectious causes:

1. **Infectious Causes:**
    a. **Viral:** Rotavirus is the leading cause of diarrhoea in children, while Norovirus is a common cause in adults, especially in outbreaks. Enteric adenovirus and astrovirus also contribute to viral diarrheal diseases. (Guerrant, 2001).
    b. **Bacterial:** Escherichia coli, Salmonella, Shigella, Campylobacter, and Vibrio cholerae are major bacterial pathogens associated with diarrheal disease. Clostridium difficile is a notable cause of antibiotic-associated diarrhoea. (Thapar & Sanderson, 2004).
    c. **Parasitic:** Giardia lamblia, Entamoeba histolytica, and Cryptosporidium spp. are common parasites associated with diarrheal illness, particularly in low-resource settings. (WHO, 2023).
2. **Non-Infectious Causes:**

- Food Intolerances: Lactose intolerance and gluten intolerance (celiac disease) o are common causes of chronic diarrhoea.
- **Medications:** Antibiotics, laxatives, and medications that affect gut motility can cause diarrhoea as a side effect (Farthing, 2004).
- **Malabsorptive Conditions:** such as chronic pancreatitis, cystic fibrosis, and short bowel syndrome impair nutrient absorption, leading to diarrhoea (Guerrant, 2001).
- **Inflammatory Bowel Diseases:** Crohn's disease and ulcerative colitis cause chronic inflammation in the gastrointestinal tract, resulting in diarrhoea (Thapar & Sanderson, 2004).
- **Endocrine Disorders:** Hyperthyroidism, Addison's disease, and diabetes can affect gastrointestinal function, leading to diarrhoea.
- **Functional Disorders:** Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder that can lead to diarrhoea (Farthing, 2004).

PATHOPHYSIOLOGY

Diarrhoea results from a disruption in the normal balance between fluid absorption and secretion in the gastrointestinal (GI) tract. The body typically absorbs the majority of fluids that enter the Gl tract, but when this process is impaired, excess fluid is lost in the form of diarrhoea. The pathophysiology can be explained through four primary mechanisms:

1. **Secretory Diarrhoea:** This occurs when the intestinal epithelial cells secrete excessive amounts of water and electrolytes into the gut lumen. Bacterial toxins, such as those produced by Vibrio cholerae and Escherichia coli, increase the production of cyclic adenosine monophosphate (CAMP), which leads to the secretion of chloride ions into the gut. Sodium and water follow the chloride, resulting in large volumes of watery diarrhoea (Farthing, 2004). Hormonal disorders, such as VIPomas, can also cause secretory diarrhoea.
2. **Osmotic Diarrhoea:** In osmotic diarrhoea, poorly absorbed substances in the intestine draw water into the lumen to maintain osmotic balance. This can occur in conditions like lactose intolerance, where unabsorbed lactose leads to water retention in the intestine, or with the ingestion of non-absorbable compounds. like sorbitol. Osmotic diarrhoea typically improves or stops with fasting (Lamberti, 2012).
3. **Exudative Diarrhoea:** Exudative diarrhoea is associated with mucosal damage and inflammation. Infections or conditions like IBD lead to the loss of fluids, electrolytes, and blood in the stool. This type of diarrhoea is often accompanied by bloody stools and may be seen in severe bacterial infections like Shigella or in chronic inflammatory diseases like Crohn's disease. (Thapar & Sanderson, 2004).
4. **Motility-Related Diarrhoea:** When intestinal motility is increased, there is insufficient time for water and nutrients to be absorbed. This can occur in conditions like irritable bowel syndrome (IBS) or after gastrointestinal surgeries that alter bowel anatomy. In diabetic patients, autonomic neuropathy may cause abnormal gut motility, leading to diarrhoea. (Guerrant, 2001).

CLINICAL PRESENTATION

The symptoms of diarrhoea vary depending on its type and underlying cause. Common clinical features include:

- **Frequent loose or watery stools:** This is the hallmark of diarrhoea, with stool consistency ranging from loose to entirely watery.
- **Abdominal cramps or pain:** Often generalized, the pain may be particularly pronounced in the lower abdomen, especially with mucoid stool.

- **Nausea and vomiting:** These symptoms are common in viral gastroenteritis and can exacerbate fluid loss, leading to dehydration. (Walker, Perin, & Katz, 2013)
- **Fever:** A frequent sign of infectious diarrhoea, especially in bacterial or parasitic infections.
- **Dehydration:** A serious complication, especially in children and the elderly, dehydration is marked by dry mucous membranes, reduced skin turgor, sunken eyes, lethargy, and decreased urine output (CDC, 2023)
- **Blood or mucus in the stool:** Common in exudative diarrhoea, particularly in dysentery caused by invasive organisms such as Shigella or Entamoeba histolytica, or in inflammatory bowel diseases, usually associated with tenesmus. (Thapar & Sanderson, 2004)
- **Weight loss and fatigue:** Chronic diarrhoea, particularly in malabsorptive conditions, can lead to significant weight loss, fatigue, and malnutrition. (Farthing, 2004)

DIAGNOSIS OF DIARRHOEA: FROM HISTORY TAKING TO INVESTIGATIONS

Diarrhoea can be acute, persistent, or chronic, and proper diagnosis involves a systematic approach that starts with a thorough history and proceeds to physical examination, targeted investigations, and treatment.

1. **History Taking**
   - **Duration:**
     - Acute diarrhoea: Lasts less than 14 days (often infectious).
     - Persistent diarrhoea: Lasts 14-30 days.
     - Chronic diarrhoea: Lasts more than 30 days (suggests non-infectious causes like IBS, malabsorption, etc.).
   - **Stool Characteristics:**
     - Watery diarrhoea: Suggests secretory causes like infections (e.g., cholera) or osmotic diarrhoea (e.g., lactose intolerance).
     - Bloody diarrhoea (dysentery): May indicate invasive infections (e.g., Shigella, E. coli, Campylobacter) or inflammatory conditions (e.g., ulcerative colitis).
     - Fatty stools (steatorrhea): Points to malabsorption syndromes (e.g., celiac disease, chronic pancreatitis).
   - **Associated Symptoms:**
     - Fever: Suggests an infectious cause.
     - Vomiting: Common in viral gastroenteritis or food poisoning.
     - Abdominal pain: Severe pain might indicate inflammatory or ischemic causes.
     - Weight loss: Seen in chronic diarrhoea due to malabsorption or malignancy.
     - - Tenesmus: Indicates possible rectal inflammation (e.g., proctitis or IBD). Exposure History:
   - **Travel history:** This could suggest traveller's diarrhoea or parasitic infections (e.g., *Giardia, Entamoeba histolytica).
   - **Nutritional History:** A poorly stored or contaminated food history could suggest foodborne illnesses, method of feeding e.g; bottle feeding, food storage, weaning method, who prepares the food, volume and frequency of feeds, etc.
   - **Medication use:** Antibiotics can cause diarrhoea via C. difficile infection or as part of antibiotic-associated diarrhoea.
   - **Family and Social History:**
     - Infectious outbreaks: Consider family members with similar symptoms.
     - Immunocompromised status: HIV patients are prone to opportunistic infections like Cryptosporidium, CMV
     - source of drinking water, cooking water, good personal hygiene, food and eating preparation, waste & sewage disposal, parent's of occupation and income, total number of children/ family size.
   - **Others:** Immunization history (Rotavirus), Developmental milestones, etc.

2. **Physical Examination**
   - Vital signs: Check for signs of dehydration (tachycardia, hypotension) and temperature.
   - Abdominal examination: Look for distension, tenderness, or signs of peritonitis.
   - Skin turgor and mucous membranes: Signs of dehydration.
   - Digital rectal exam: May reveal blood stained/ mucoid stool or masses.

3. Investigations

Investigations depend on the suspected cause based on the history and physical exam. Common investigations include:

- **Stool Microscopy:**
  - - Stool culture: For bacterial causes like Salmonella, Shigella, Campylobacter.
  - - Stool ova and parasites (O&P): To rule out parasitic infections like Giardia, Entamoeba.
  - - Faecal occult blood test (FOBT): To detect blood, suggesting invasive or inflammatory causes.
  - - Faecal fat test: To diagnose steatorrhea and malabsorption syndromes. - Faecal leukocytes or lactoferrin: Suggests bacterial invasion or inflammation (e.g., IBD, infection).
  - - Clostridium difficile toxin: Especially if the patient has had recent antibiotic use.

- **Blood Tests:**
  - - Full blood count: Elevated white cell count may indicate infection or inflammation.
  - -Blood culture (in cases of suspected bacterial sepsis).
  - - Electrolytes: Helps assess dehydration and metabolic disturbances like hypokalaemia.
  - - C-reactive protein (CRP): Elevated in inflammatory causes (IBD, severe infections).
  - - Serum albumin: To assess for malnutrition or chronic disease.
- **Imaging:**
  - - Abdominal X-ray or CT scan
  - - Ultrasound: Useful in suspected gallbladder or pancreatic disease.
  - - Colonoscopy: Helps in diagnosing IBD, polyps, and malignancy.
  - - Upper GI endoscopy with biopsy: If malabsorption syndromes are suspected (e.g., celiac disease).

KEY DIAGNOSTIC DIFFERENCES BETWEEN CHILDREN AND ADULTS

- **AETIOLOGY**
  - **CHILDREN:** Viral infections, food intolerances, genetic disorders
  - **ADULTS:** Bacterial infections, chronic diseases, medications
- **HISTORY FOCUS**
  - **CHILDREN:** Growth, feeding, immunization status
  - **ADULTS:** Travel, medication use, chronic conditions
- **PHYSICAL EXAMINATION**
  - **CHILDREN:** Hydration status, growth parameters
  - **ADULTS:** Subtle dehydration signs, abdominal examination
- **INVESTIGATIONS**
  - **CHILDREN:** Stool for rotavirus, reducing substances, genetic testing
  - **ADULTS:** Stool for C. difficile, faecal calprotectin, endoscopy
- **COMPLICATIONS**
  - **CHILDREN:** Growth and developmental delays
  - **ADULTS:** Chronic diseases and functional disorders

COMPLICATIONS OF DIARRHOEA

1. Dehydration
2. Malabsorption
3. Electrolyte imbalance [hyponatremia, hypokalaemia, metabolic acidosis]
4. Malnutrition
5. Transient lactose intolerance
6. Chronic diarrhoea
7. Systemic infection (meningitis, arthritis, pneumonia) especially with *Salmonella* infections
8. Sepsis
9. Haemolytic-uremic syndrome (much more common in children, especially with E. coli O157:H7)
10. Toxic megacolon
11. Rectal prolapse.
12. Reactive arthritides (*Salmonella, Shigella, Yersinia, Campylobacter, Giardia* organisms)
13. Acute kidney injury
14. Thrombotic thrombocytopenic purpura or TTP (E coli O157:H7)
15. Guillain-Barré syndrome (Campylobacter organisms)

MANAGEMENT

The management of diarrhoea involves a multifaceted approach that aims to restore fluid and electrolyte balance, address the underlying cause, and provide supportive care.

1. **Fluid and Electrolyte Management:**

The primary concern in diarrhoea is dehydration due to the loss of fluids and electrolytes. This is especially important in children and elderly patients.

- **Oral Rehydration Therapy (ORT):**
  - WHO Oral Rehydration Solution (ORS): A solution containing sodium, potassium, chloride, and glucose is the gold standard for mild to moderate dehydration.
  - Administration: prepared by mixing one sachet in 1 litre of water then small, frequent sips are recommended, particularly in children. For mild dehydration, 50-100 mL/kg of ORS should be given over 4 hours and for moderate dehydration 75ml/kg over 4-6 hours.
  - Homemade salt sugar solution: In settings where commercial ORS is unavailable, a mixture of salt and sugar (1 level teaspoon(3ml) of salt + 10 level teaspoon (or 5 cubes) of sugar + 600mls of water) can be used.
  - Intravenous (IV) Fluids:
    - Indicated in cases of severe dehydration, shock, or when the patient is moderately dehydrated but cannot tolerate oral intake.
    - Also, if the child is > 3 months, has large volume stools, or the enteral route is threatened.
    - Ringer's lactate or normal saline (0.9% NaCl) is typically used. In severe dehydration fluid resuscitation begins with a bolus of 20-30 mL/kg over 30-60 minutes in > 1 yr or infants respectively to elicit shock, followed by maintenance fluids based on the patient's ongoing losses and requirements.

- **Electrolyte Replacement:**
  - **Sodium**: Replaced via ORS or IV fluids.
  - **Potassium**: Supplementation is essential, especially when there are signs of hypokalaemia (muscle weakness, cramps, or arrhythmias). This is found in ORS, but in severe cases, potassium may be added to IV fluids or potassium-containing IV fluids.
  - **Bicarbonate**: Can be added to IV fluids if metabolic acidosis is severe, often in cases of cholera or persistent vomiting.

2. Pharmacological Management:
The use of medications in diarrhoea depends on the underlying cause and the severity of symptoms.
Antibiotics:
Generally, not recommended for most cases of acute diarrhoea, which are viral in nature. They are indicated for bacterial causes like:
  - Shigella: Ciprofloxacin or azithromycin.
  - Campylobacter: Azithromycin.
  - Clostridioides difficile: Metronidazole or oral vancomycin.
  - Traveller's diarrhoea: Ciprofloxacin or azithromycin.

In cases of cholera: Ciprofloxacin, Ofloxacin, Doxycycline, or azithromycin can be used to reduce the duration and severity.

Antimotility agents:
Loperamide: Can be used in adults to reduce stool frequency in non-bloody, non-febrile diarrhoea, but should be avoided in children and patients with bloody diarrhoea or suspected bacterial infections, as it may prolong the illness (generally not recommended in children).
Probiotics:
  - Help restore the gut's normal flora and may shorten the duration of diarrhoea, especially in antibiotic-associated diarrhoea or viral gastroenteritis, especially if taken up to 2 weeks.
  - - Probiotic strains like Lactobacillus and Saccharomyces boulardii have shown benefit.

Zinc supplementation:
Recommended by the WHO for children with acute diarrhoea. Zinc supplementation (10-20 mg per day for 10-14 days) has been shown to reduce the severity and duration of diarrhoea and improve intestinal absorption.

3. Considerations in Children:
Children are more vulnerable to the effects of dehydration and malnutrition due to diarrhoea, making prompt and appropriate treatment critical.
- Breastfeeding and feeding:
  - Continue breastfeeding during and after diarrhoea episodes, as breast milk provides not only hydration but also nutrients and immune protection.
  - Exclusive breastfeeding for infants under six months helps prevent dehydration and provides protective antibodies.
  - Monitoring for malnutrition: Children with chronic or recurrent diarrhoea should be evaluated for failure to thrive and potential underlying conditions like malabsorption syndromes (e.g., celiac disease) or food allergies.

4. Dietary Considerations: Nutrition plays an important role in the recovery and management of diarrhoea, particularly in preventing malnutrition and further dehydration.
- Early refeeding is encouraged, especially in children. Food should be reintroduced as soon as possible after rehydration to prevent malnutrition and promote recovery of intestinal function.
- Simple, digestible foods: Start with starchy foods (e.g., rice, potatoes), yogurt, bananas, and toast. These foods are easy to digest and can help with stool consistency.
- High-fat or greasy foods should be avoided, as they can aggravate diarrhoea.
- Sugary drinks (soft drinks, fruit juices) and artificial sweeteners (e.g., sorbitol) should also be avoided, as they can worsen osmotic diarrhoea.
- In cases of post-infectious diarrhoea, temporary lactose intolerance is common, especially in children. Lactose-containing foods should be avoided if they worsen symptoms. Lactose-free formula may be necessary for infants recovering from gastroenteritis.
- Yogurt containing active cultures of probiotics can help restore normal gut flora and reduce the duration of diarrhoea
- The BRAT diet (bananas, rice, applesauce, tomatoes) is often recommended for children and adults as it provides easily digestible food that helps firm up stools as well as being rich sources of potassium.

In children, nutritional supplements may be necessary, particularly in cases of malnutrition or chronic diarrhoea. Vitamin and mineral deficiencies (e.g., zinc, vitamin A, iron) should be corrected.

PREVENTION
Prevention of diarrhoea is essential, particularly in children, as it is a leading cause of morbidity and mortality worldwide in under 5s especially in LMIC like Nigeria. Effective prevention strategies focus on improving hygiene, ensuring access to clean water, promoting proper sanitation, and adopting vaccination, proper waste and sewage disposal and nutritional interventions. Below are key measures for the prevention of diarrhoea:

1. Water, Sanitation, and Hygiene (WASH) Interventions: Diarrhoea is commonly caused by consuming contaminated water. Ensuring access to clean, safe drinking water is vital, and can be achieved by employing community enlightenment.

Proper Sanitation is also important. The availability and proper use of latrines or toilets can significantly reduce the transmission of pathogens by reducing open defecation, and contamination of water sources.

Prevent open defecation through community education and the construction of proper sanitation facilities.

- Hand Hygiene: Regular handwashing with soap and water, especially before eating, after using the toilet, and after handling diapers, can dramatically reduce the incidence of diarrhea.
- **Food Hygiene:** Cook food thoroughly, especially meats and eggs except vegetables, and store food at safe temperatures, wash fruits and vegetables with clean water before eating.

2. Vaccination:

- **Rotavirus Vaccination:** Rotavirus is the leading cause of severe diarrhoea in infants and young children. Vaccination is one of the most effective ways to prevent diarrhoea caused by this virus, it is administered to infants starting at 6 weeks of age.
- **Cholera Vaccination:** In areas where cholera is endemic or during outbreaks, oral cholera vaccines (such as; Hillchol, Shanchol, Dukoral, and Euvichol) can be effective in preventing cholera, which causes severe watery diarrhoea.

3. Breastfeeding and Nutrition: Breastfeeding exclusively for the first six months of life provides infants with essential nutrients and antibodies that protect against infections, including diarrhoea. Continued breastfeeding during and after diarrhoea episodes helps prevent malnutrition and aids in recovery.
Complementary Feeding: After six months, the introduction of safe and appropriate complementary foods while continuing breastfeeding helps ensure adequate nutrition.

4. Environmental Controls: Maintain proper sanitation by disposing of household waste and faecal matter properly. Ensure proper sewage systems and avoid contaminating water sources with human or animal waste.

Ensure that livestock or pets do not contaminate water or food sources. Proper hygiene when handling animals or animal products is crucial.

5. Education and Awareness: Educating communities about the importance of hygiene, sanitation, and proper nutrition can help prevent diarrhoea.

Teaching children about hand hygiene and safe drinking water practices in schools can have a large impact on reducing the incidence of diarrhoea.

Ensure schools have access to clean water and functional sanitation facilities.

6. Preventing Antibiotic-Associated Diarrhoea: Avoid unnecessary antibiotic use, which can disrupt the gut flora and lead to antibiotic-associated diarrhoea, including infections with Clostridioides difficile.

If antibiotics are necessary, consider the use of probiotics during antibiotic therapy to maintain a healthy gut microbiome. Other vaccinations like measles, BCG, DPT, ROTA, etc.

7. REGULAR DEWORMING: 3 monthly deworming by households, especially in children. It can be done during outreaches for communities.

DIARRHOEA IN SPECIAL POPULATIONS

The Immunocompromised

Diarrhoea is a frequent complication of infection with the human immunodeficiency virus (HIV), significantly affecting the gastrointestinal tract. In Africa, HIV was once referred to as "slim disease" due to its association with severe diarrhoea, weight loss, malnutrition, and eventual death. Prior to the introduction of highly active antiretroviral therapy (HAART), the severity of diarrhoea worsened as immune function declined, contributing to high morbidity and mortality among patients. (Krones, 2012).

Patients with compromised immune systems, such as those with HIV, solid organ transplants, or hematologic malignancies, are particularly susceptible to gastrointestinal infections caused by various pathogens. These infections often result in more severe clinical outcomes in immunocompromised individuals than in healthy people. Common culprits include bacterial pathogens like Salmonella and Campylobacter, which cause more aggressive and prolonged infections in HIV-positive individuals. Parasitic infections such as those caused by Cryptosporidium and Giardia are also prevalent, along with viral agents like cytomegalovirus (CMV), especially in advanced AIDS cases. (Krones, 2012).

Other causes of diarrhoea include drug-induced

cases, particularly from immunosuppressive drugs like mycophenolate mofetil (MMF) and calcineurin inhibitors used in transplant patients. Diarrhoea may also manifest in congenital immunodeficiency syndromes, such as selective IgA deficiency and severe combined immunodeficiency, with various aetiologies depending on the specific immunodeficient condition. (Krones, 2012). Management of diarrhoea in this group of people is similar to that outlined properly.

The Pregnant

Diarrhoea is a very common condition that can affect anyone, including women who are pregnant. According to the American College of Gastroenterology (ACG), there is no up-to-date research about the prevalence of diarrhoea in pregnant women. During pregnancy, diarrhoea may arise from hormonal or physical changes. However, it can also be unrelated to pregnancy and result from an infection or underlying bowel disorder. (Rachel Nall, 2019).

Diarrhoea can lead to severe dehydration and malnutrition, which can be harmful to the woman and foetus, and a pregnant woman should receive immediate medical care if she experiences any of the following symptoms: (Rachel Nall, 2019).

PROGNOSIS OF DIARRHOEA

Acute Diarrhoea is Usually Self-limiting and has good prognosis, when the underlying cause is identified and treated. The presence of the following features in a patient with acute diarrhoea for over 4 weeks may indicate poor prognosis: (C. Micheal Gibson, 2020).

- Weight loss
- Rectal bleeding
- Immunosuppression
- Haemolytic uremic syndrome with EHEC infection
- Gillian barre syndrome with campylobacter infection
- Toxic megacolon
- Tenesmus
- Associated psychological factors
- Somatization
- Dietary causes of diarrhoea
- Age > 50 years
-

The outlook for chronic diarrhoea depends on the cause. If you can treat an inflammatory bowel disorder, infection, or other digestive problem, your stools should gradually return to normal. If you don't have a medical condition, keeping a food journal, watching your diet, and making lifestyle changes may also provide relief. The important thing is that you don't ignore the problem. (Valencia & Elaine K. Luo, 2019).

CASE STUDIES

Case 1

A 66-Year-Old Man with Chronic Watery Diarrhoea (Shin, Seo , Younghoon Kim, MyungAh, & Se , 2022).

Presentation: A 66-year-old man presented with chronic watery diarrhoea, weight loss, and hypotension. He had a history of hypertension and diabetes but no known allergies or recent medication changes. (Shin, Seo , Younghoon Kim, MyungAh, & Se , 2022).

Clinical Findings: On admission, he exhibited severe dehydration, hypotension (66/29 mmHg), and metabolic acidosis (pH 6.985). Blood tests showed elevated urea nitrogen (117.6 mg/dL) and creatinine (11.62 mg/dL), indicating acute renal failure. (Shin, Seo , Younghoon Kim, MyungAh, & Se , 2022).

Investigations: Abdominal CT and MRI revealed a 5.2 cm mass in the pancreatic tail, suggestive of a neuroendocrine tumour (NET). Stool tests were negative for infections. (Shin, Seo , Younghoon Kim, MyungAh, & Se , 2022).

Diagnosis: The patient was diagnosed with a vasoactive intestinal peptide-secreting tumour (VIPoma) based on elevated serum VIP levels (290 pg./mL) and imaging findings. (Shin, Seo , Younghoon Kim, MyungAh, & Se , 2022).

Treatment: Initial management included fluid resuscitation and vasopressors. Octreotide was administered to control diarrhoea. The patient underwent distal pancreatectomy, resulting in symptom resolution and normalization of VIP levels. (Shin, Seo , Younghoon Kim, MyungAh, & Se , 2022).

Prognosis: Post-surgery, the patient showed significant improvement with no recurrence of symptoms. Follow-up is recommended to monitor for potential recurrence. (Shin, Seo , Younghoon Kim, MyungAh, & Se , 2022).

Case 2

Presentation: A 24-year-old man returning from a travel of 3 months (he passed through different countries) was well on his return but presented 3 days later with severe diarrhoea which has now been present for 2 weeks. (Parveen & Michael, 2013).

Clinical Findings: On admission, he is dehydrated and has lost over 5kg in weight (Parveen & Michael, 2013).

Investigations: FBC, E/U/Cr, LFT's. Send stools for ova, cysts, and culture. Rehydration with oral glucose/electrolyte solution initially. IV fluids are not usually necessary. Vomiting might need to be treated with an anti-emetic (Metoclopramide 10mg X 3/day). (Parveen & Michael, 2013).

Diagnosis: This is not acute diarrhoea because the patient did not have diarrhoea when he returned to the UK. As a returning traveler, he may have non-acute diarrhoea due to Giardiasis, Cryptosporidiosis, Amoebiasis, Tropical sprue, Schistosomiasis or strongyloidiasis. (Parveen & Michael, 2013).

Treatment: Stool samples showed no abnormal findings. Giardiasis is very likely in this patient and treatment with metronidazole 2g a day for 3 successive days was given, with dramatic improvement. (Parveen & Michael, 2013).

CONCLUSION

Diarrhoea, a disease of fluid and electrolyte imbalance, is an important worldwide cause of morbidity and mortality among infants and children, especially in developing countries. However, it is also very much a nutritional disease. This is primarily because during periods of diarrhoea, nutrient intake and absorption are dramatically decreased, which results in undernutrition even when sufficient food is available. (Baqui, Heinzen, Santosham, & Black, 2005).

Sixty per cent of the 10 million deaths among children younger than 5 years old are associated with malnutrition. Approximately 2 million of the deaths are due to diarrhoea. Repeated episodes of diarrhoea result in malnutrition, which in turn puts the child at an increased risk of recurrent infections, including diarrhoea. To break this cycle, diarrheal episodes should be managed with appropriate fluid and nutritional therapy. (Baqui, Heinzen, Santosham, & Black, 2005).

In adults, diarrhoea in most cases isn't something to be concerned about and will resolve itself without medical treatment. However, it is important to seek medical help when there is persistent vomiting, persistent diarrhoea, dehydration and significant weight loss, anyone who experiences diarrhoea after surgery, spending time in the hospital, or after using antibiotics should seek medical attention. If a person has diarrhoea and it lasts more than 7 days, they should consult a doctor urgently (Markus MacGill & Cynthia Taylor Chavoustie, MPAS, PA-C, 2024).

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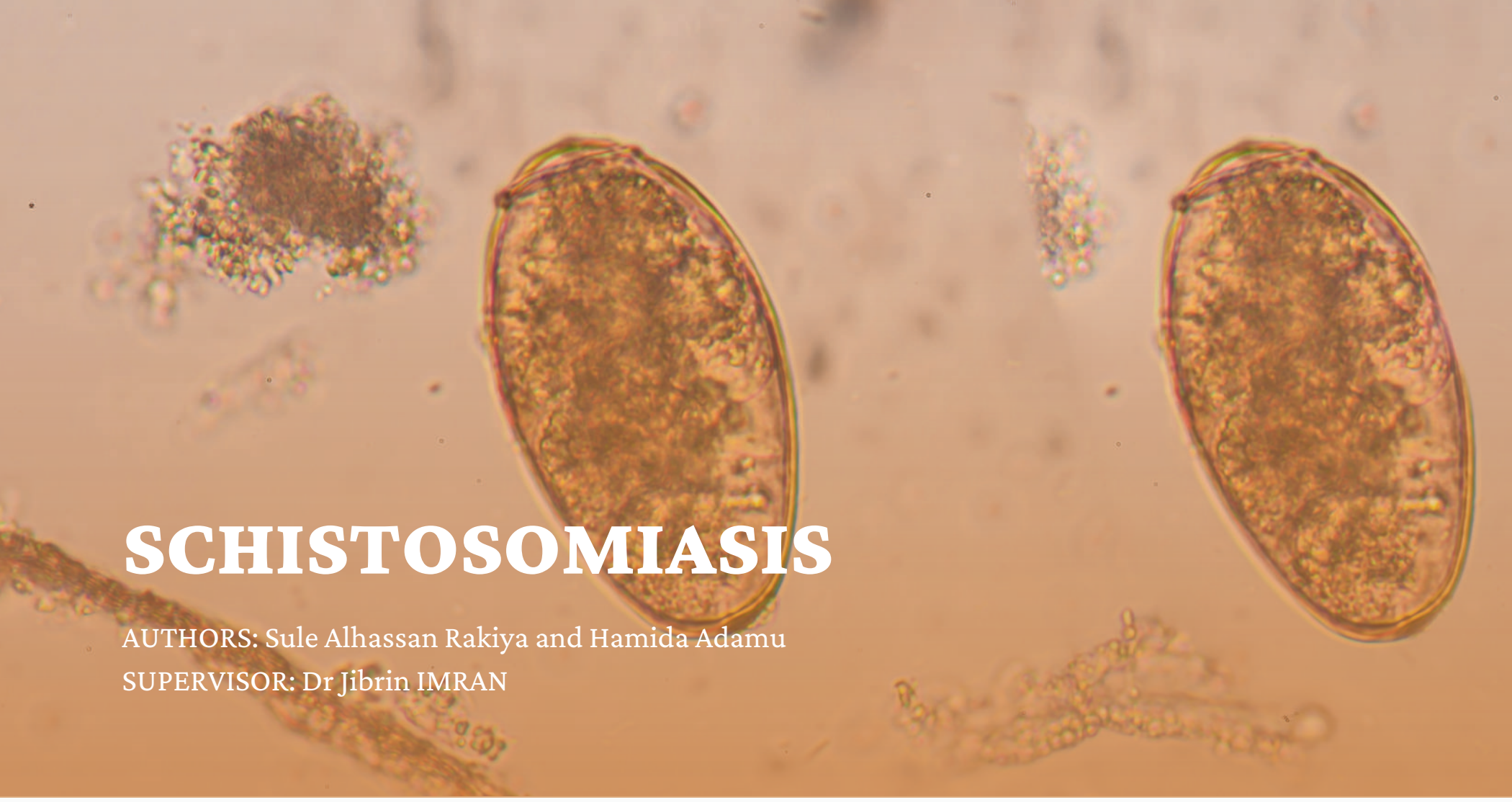

SCHISTOSOMIASIS

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INTRODUCTION

Schistosomiasis, also known as bilharziasis, is a neglected tropical disease caused by small parasitic blood trematodes (flukes) of the genus Schistosome. It is a significant global public health concern. Humans are infected during routine agricultural, domestic, occupational, and recreational activities which expose them to infested water source. The three main species infecting humans are Schistosoma haematobium, S. japonicum, and S. mansoni. Three other species, more localized geographically, are S. mekongi, S. intercalatum, and S. guineensis (previously considered synonymous with S. intercalatum). There have also been a few reports of hybrid schistosomes of cattle origin (S. haematobium, x S. bovis, x S. curassoni, x S. mattheei) infecting humans. Unlike other trematodes, which are hermaphroditic, Schistosoma spp. are dioecous (individuals of separate sexes). (Center For Disease Control and Prevention, 2024)

HISTORY

The German pathologist Theodore Maximilian Bilharz (1825 to 1862) was the first to describe schistosomiasis in humans. After doing autopsies on infected patients in Egypt, he discovered male and female schistosomal worms in both the portal system and bladder. He also described the eggs with their peculiar, pointed terminal projection. He named the worm Distomum (Schistosoma) haematobium. In 1847, Yoshinao Fujii (1818 to 1895) was the first to describe the symptoms of schistosomiasis in Japan. (COON, 2005)

EPIDEMIOLOGY

Schistosomiasis affects approximately 200 million people worldwide with an estimated 650 million people at risk of infection. It is endemic in 76 countries, although it is estimated that 85% of the people affected live in African with at least 90% requiring treatment. It is prevalent in tropical and subtropical areas, especially in poor communities that lack access to safe drinking water and adequate sanitation.

Table: Parasite species and geographical distribution of schistosomiasis

	Species	Geographical distribution
Intestinal Schistosomiasis	*Schistosoma mansoni*	Africa, the Middle East, the Caribbean, Brazil, Venezuela and Suriname
	Schistosoma japonicum	China, Indonesia, the Philippines
	Schistosoma mekongi	Several districts of Cambodia and the Lao People's Democratic Republic
	Schistosoma guineensis and related *S. intercalatum*	Rain forest areas of central Africa
Urogenital schistsomiasis	*Schistosoma haematobium*	Africa, the Middle East, Corsica (France)

(World Health Organization, 2023)

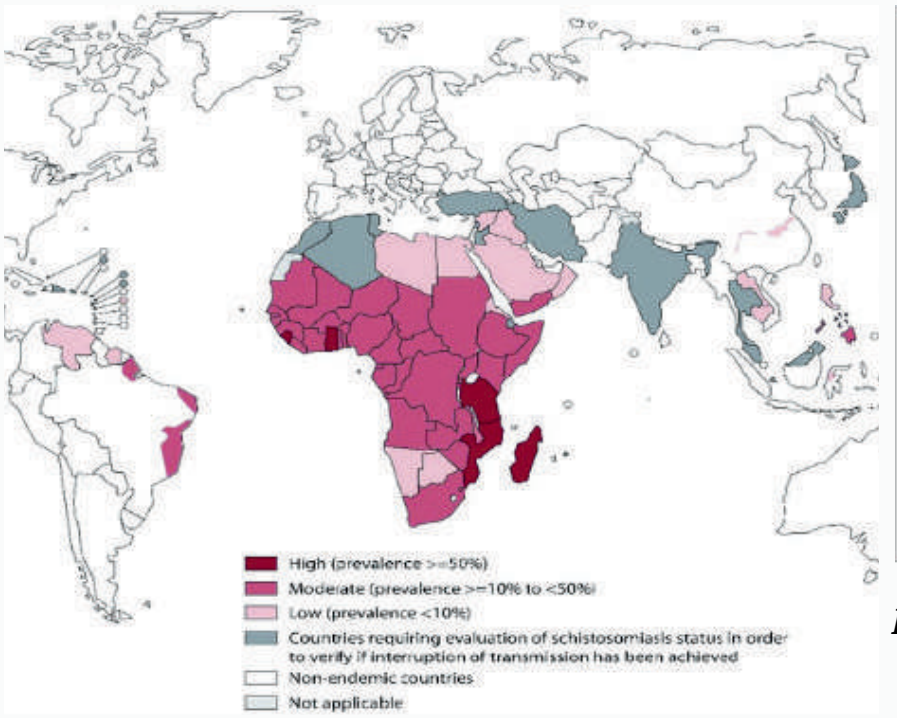

Figure 1 Worldwide geographical distribution of schistosomiasis

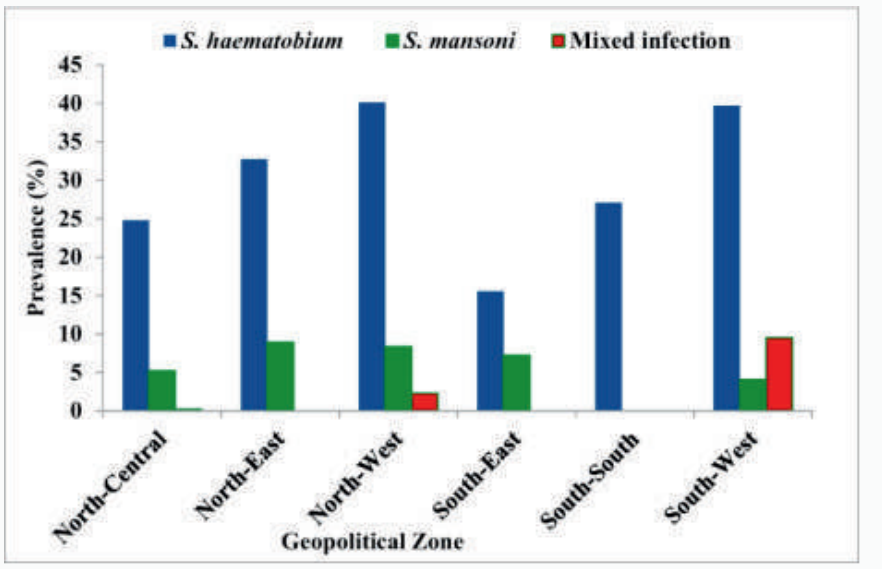

Figure 2 The Prevalence of Schistosomiasis in Nigeria

The Epidemiology of Schistosomiasis in Nigeria

A reviewed survey data deposited in the Global Neglected Tropical Diseases database and many other articles on the prevalence and distribution of Schistosoma haematobium in Nigeria, This survey focused on the northern and middle belt regions where the conditions for transmission, such as stagnant water bodies, are more prevalent. Schistosoma haematobium surveys conducted over the period of 50 years using different diagnostic tools revealed that Ogun State has the highest prevalence, followed by Ekiti state, while the lowest prevalence was recorded in Adamawa. No incidence of Schistosoma haematobium was recorded for states such as Akwa Ibom, Bayelsa, Nasarawa, Jigawa and Gombe. In terms of endemicity, this review has shown that Nigeria is divided into four zones: hyperendemic, moderately endemic, low endemic, and no endemic zones. A survey of 47 (15%) of the 323 dams in Nigeria revealed that 45 out of the 47 dams are located in the hyperendemic zone, while the remaining two are located in the moderately endemic zone. Twenty (43%) of the total surveyed dams harbored Bulinus globosus and/or Biomphalaria pfeifferi, the local intermediate hosts of schistosomes, and 18 of these are located in the hyperendemic zone, while the other two are in the moderately endemic zone. It was conclude that there is an urgent need to carry out a nationwide survey to help in planning, coordinating, and evaluating schistosomiasis control activities. (Ezeh, Onyekwelu, Shan, Akinwale, & Wei, 2019)

MICROBIOLOGY OF SCHISTOSOME

CLASSIFICATION

- Domain: Eukaryota
- Kingdom: Animalia
- Phylum: Platyhelminthes (flat worms)
- Class: Trematoda
- Subclass: Digenea
- Order: Strigeidae
- Family: Schistosomatidae
- Subfamily: Schistosomatinae
- Genus: Schistosoma
- Species: Schistosoma mansoni, Schistosoma japonicum, Schistosoma haematobium, Schistosoma intercalatum, Schistosoma mekongi.

MORPHOLOGICAL FEATURES

Adult worms measure 7 to 20 mm for males and 7 to 26 mm for females. The adult worms reside in the blood vessels of the small intestine, large intestine, or bladder. The male has a gynecophoral canal, which extends the length of the male, wherein the female worm resides. This provides a safe environment, facilitates mating and fertilization for the female worm.

Figure 3 Schistosoma In copula

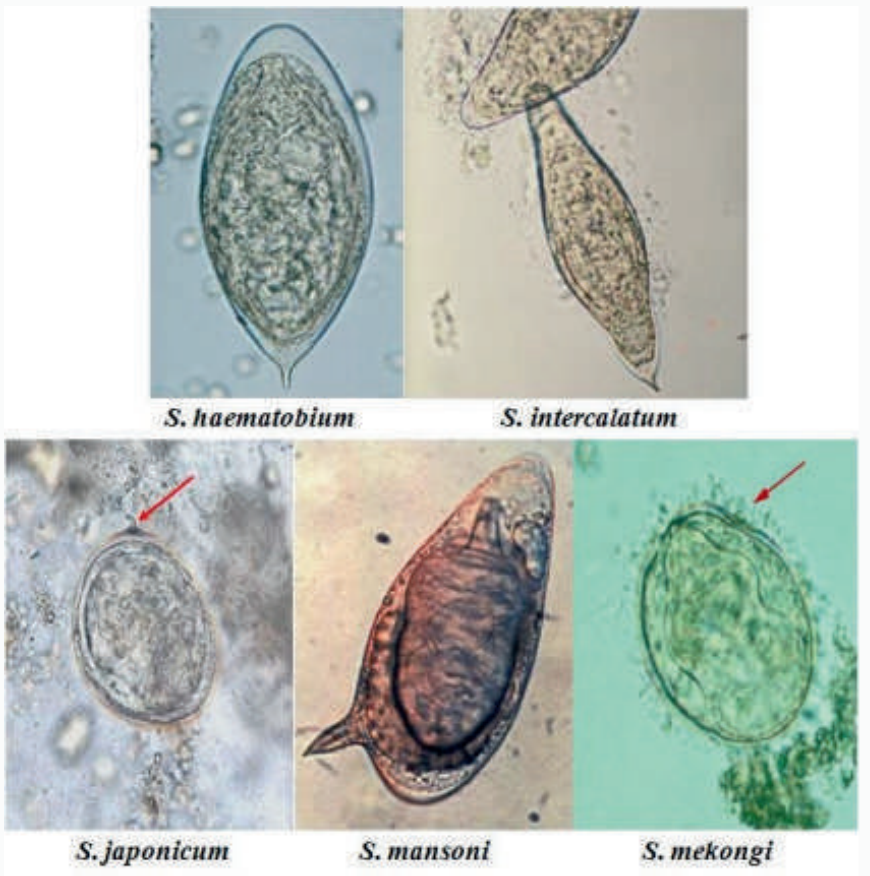

Figure 4 Egg morphology of Schistosoma

THE HOST

Various animals such as cattle, dogs, cats, rodents, pigs, horses, and goats, serve as reservoirs for *S. japonicum*, and dogs for *S. mekongi*. *S. mansoni* is also frequently recovered from wild primates in endemic areas but is considered primarily a human parasite and not a zoonosis.

Intermediate hosts are snails of the genera *Biomphalaria,* (*S. mansoni*), *Oncomelania (S. japonicum*), *Bulinus* (*S. haematobium, S. intercalatum, S. guineensis*). The only known intermediate host for *S. mekongi* is *Neotricula aperta*. (Center For Disease Control and Prevention, 2024).

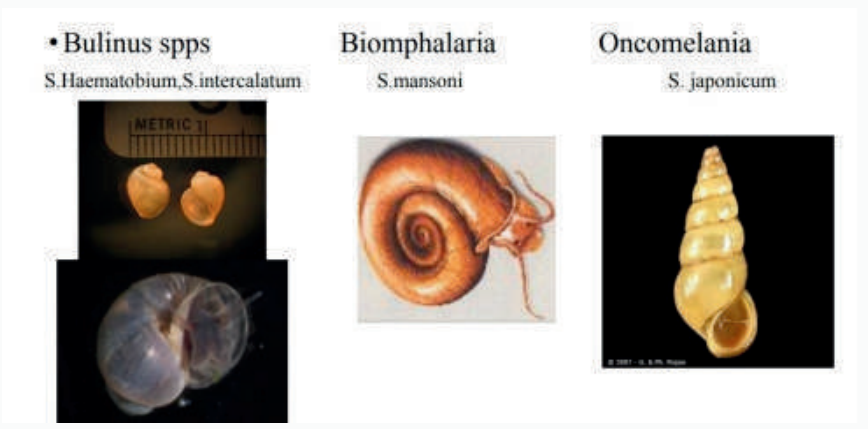

Figure 5 THE INTERMEDIATE HOST

LIFE CYCLE

The fork tailed cercaria is the infective stage and is found in fresh water. The cercaria gains access into the human host by penetrating the skin after which it differentiates into larval forms called schistosomulae. The schistosomulae migrates host skin and gains access into the lymphatic system. It then travels to the lungs, stays there for 3-8 days (70% are eliminated). From the lungs it migrates to the liver portal system and matures into male and female adult worms.

In the liver, the female inserts herself into the gynecophoral canal of the male forming a pair. The adult worm then migrates to their respective favoured site:

- S. mansoni: mesenteric venules of the large bowel
- S. haematobium: perivesical venous plexus surrounding the bladder.
- S. japonicum: mesenteric veins of small intestine

The female worms release eggs which are excreted in the urine and feces into fresh water. The eggs hatch releasing miracidia. Miracidia infects first intermediate host (which is a snail).

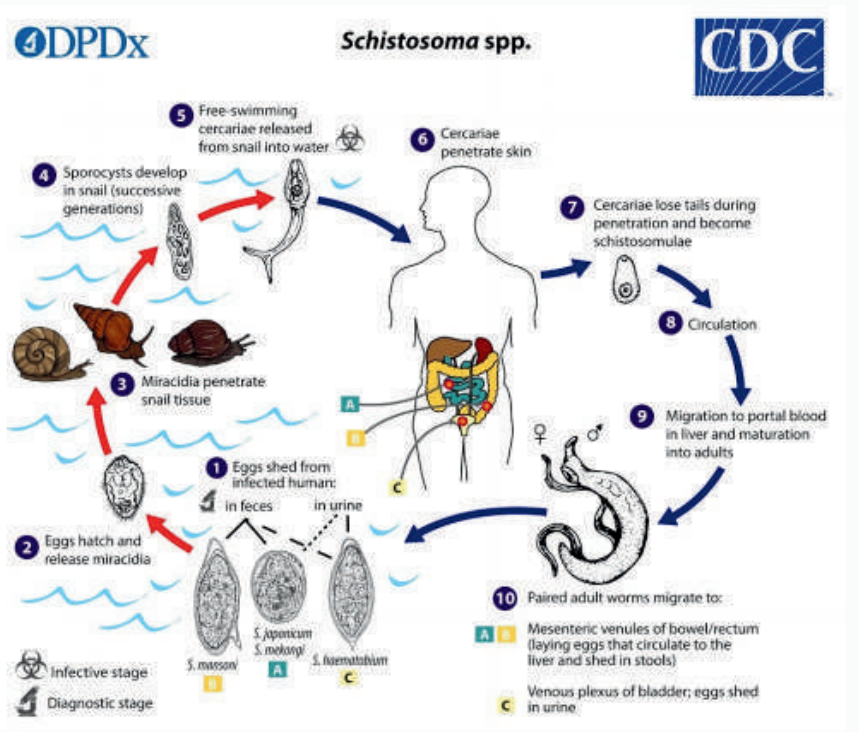

Figure 6 THE LIFE CYCLE

CLINICAL FEATURES

The clinical presentations of schistosomiasis depend on the stage of the disease which includes:

1. STAGE OF INVASION: CERCARIAL DERMATITIS
2. STAGE OF MATURATION: ACUTE SCHISTOSOMIASIS
3. STAGE OF ESTABLISHED INFECTION
4. STAGE OF LATE INFECTION AND SEQUELAE

STAGE OF INVASION: CERCARIAL DERMATITIS

Penetration of the skin by cercariae, leads to occurrence of dermatitis (cercarial dermatitis or « 'swimmer's itch' ») and can be associated with the death of cercariae in the skin.
A transient immediate hypersensitivity reaction that occurs 10 to 15 min after exposure is

followed by a more prolonged, delayed reaction, which develops after 12 to 24 h and may persist for up to 15 days.

The lesion is characterized by a small, red, pruritic, macular rash, which progresses to papules, possibly accompanied by vesicle formation and oedema. Pustules may form if secondary infection occurs, and residual pigmentation may persist for months.

ACUTE SCHISTOSOMIAISIS

This is characterized by fever (intermittent or remittent with evening peaks), rigors, sweating, headache, malaise, muscular aches, profound weakness, an unproductive, irritating cough, abdominal pain or swelling, nausea, vomiting, diarrhoea, and loss of weight. Other features include oedema, a generalized soft lymphadenopathy, a tender enlarged liver, enlarged and soft spleen, stuporous, visual impairment or papilledema. Severe central nervous system manifestations.
Eggs become detectable in the faeces about 6 weeks after exposure.

CHRONIC INFECTION

- Symptoms of chronic infection caused by eggs that travel to various parts of body.
- Eggs remain trapped in host tissues à secrete Ags à granulomatous inflammatory immune response.

STAGE OF ESTABLISHED INFECTION

S. mansoni

- **Intestinal Schistosomiasis**
  - Wall of colon is damaged as eggs pass through.
  - There are marked initial and toxic allergic symptoms. The large intestine and rectum are typically involved with polyposis, papules, abscesses, ulcers, papillomata, fistulae.
  - Inflammatory response à ulcers, inflammatory polyps which can lead to fibrosis.
  - **Clinically**: diarrhea, abdominal pain
  - **Diagnosis** is by finding ova in faeces.
  - Eggs can also accumulate in the appendix leading to appendicitis.

- **Hepatosplenic schistosomiasis**
  - Eggs carried via the portal vein with corresponding inflammatory reaction and eventual fibrosis.
  - Granulomatous response and granulomas are walled off with fibrous tissue à fibrosis obstructs portal veins à portal hypertension
  - Esophageal varices (dilated esophageal veins, which drain the liver, rupture of this veins cause bleeding which can lead to death. This process is caused directly by portal hypertension.
  - Splenomegaly (enlarged spleen, due to fibrosis) and ascites.

S. japonicum.

- **Oriental Schistosomiasis**
  - Initial toxic and allergic symptoms are marked and can lead to myocarditis and death.
  - Intestinal lesions are similar to those with S. mansoni infection and small intestine is often involved.
  - Hepatic involvement/infection occurs as for S. mansoni infection.
  - The brain may also be involved.

S. haematobium.

- **Urogenital schistosomiasis**
  - Initial toxic and allergic symptoms are not marked, but the bladder and ureter are typically involved.
  - Terminal hematuria, dysuria, frequency, and suprapubic pain.

STAGE OF LATE INFECTION

- Eggs lodge themselves in wall of bladder & can develop into polyps which can erode, ulcerate & cause hematuria (blood cells in urine)
- Eggs lodge in ureters and urethra, cause lumps and lesions à hydroureters, hydronephrosis; urinary retention, dribbling, ureteric colic
- Female genital schistosomiasis is a form of schistosomiasis that affects the female reproductive system, primarily caused by Schistosoma haematobium. The eggs lodge in ovaries, the uterus, vagina, cervix, and fallopian tubes. The eggs trigger local immune response, leading to chronic inflammation, fibrosis, and the formation of granulomas. **Clinical manifestations** include: pelvic pain, genital ulcers or lesions, vaginal discharge, dyspareunia and Infertility.
- Uremia.
- There may be cystitis and calculus formation, with calcification and squamous cell carcinoma.

S. mansoni and S. japonicum infections, is associated with:

- intermittent diarrhoea, with or without the passage of blood or mucus.
- The colon may be tender.
- In between the episodes of diarrhoea, the stools are normal.
- Bleeding from oesophageal varices
- Haematemesis.
- Melaena.
- Blood loss is frequently massive, and exsanguination is the usual cause of death rather than hepatic coma.

DIAGNOSIS

Microscopic Detection

- Take stool or urine sample to detect eggs.
- S. haematobium eggs are oval and have a spike at the tip
- S. japonicum eggs small and almost spherical with tiny spine
- S. mansoni eggs have a spike on the side (spine)

Imaging studies

- Photomicrography of bladder in S. hematobium infection, showing clusters of the parasite eggs with intense eosinophilia
- CT scan – can detect liver or intestinal involvement, while
- MRI can detect involvement of the central nervous system.
- Tissue **biopsy** (rectal biopsy and biopsy of the bladder) for histopathological examination which may demonstrate eggs when stool or urine examinations are negative.

Immunological method

- **Antibody** or antigen detection using ELISA, Western blot, and point of care test kits.
- Molecular methods – using the polymerase chain reaction for the detection of parasite DNA.

TREATMENT

- Praziquantel- the drug of choice for all species
- Metrifonate à against S. haematobium
- Niridazole à against S. japonicum
- Oxamniquine à against S. mansoni

PREVENTION

- Avoid swimming in fresh, stagnant water (running water is better, still not safe). Individual protection with use of boots and waterproof clothing's.
- Harder in endemic areas à people are dependent on nearby freshwater.
- Focused on health education.
- Molluscicides can be used to eliminate snails.
- Proper irrigation systems and engineering are key.
- Such water should be boiled before drinking or left to stand for at least 2 days before use for other purposes such as washing. Should contact with water occur, the skin should be immediately rubbed vigorously with a towel; the water should not be allowed to evaporate, as this aids cercarial penetration.
- Soap and alcohol also kill cercariae, and cercaricidal barrier creams can be used.

CONCLUSION

This is one of the neglected tropical diseases of great public health concern across the world.

Furthermore, one of the important at-risk groups for schistosomiasis is women that do most domestic chores (e.g., washing of clothes) in infested water. Female genital schistosomiasis (FGS) is one of the neglected tropical diseases caused by Schistosoma haematobium that affects the female genital tract. Women from Sub-Saharan Africa are highest contributors to the 56 million women infected globally (WHO, 2022). The common presentations of FGS are abnormal vaginal discharge, vaginal bleeding, painful urination, painful sexual intercourse, and associated increased risk of HIV transmission. Late presentation or poorly treated FGS could result in infertility, chronic pelvic pain, psychosocial distress, etc. This can be misdiagnosed for other sexually transmitted diseases.

The world Health Organization's (WHO) agenda on elimination of schistosomiasis transmission among human and as a public health concern by the year 2030 requires the contributions and supports of all and sundry. Initiatives such as collaboration with other sectors such as WASH and One Health are highly advocated in attaining the WHO 2030 target.

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Paediatrics and child health in a tropical region

Nelson's Textbook of Paediatrics

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CHOLERA

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INTRODUCTION

Cholera is an acute diarrheal infection caused by ingesting food or water contaminated with the bacterium *Vibrio cholerae* (1). Cholera is a disease that has shaped the course of human history and challenged the fabric of society. Despite efforts to eradicate it, cholera continues to remain endemic in various communities, its eradication an ongoing battle. This review discusses the history of cholera, its biological and clinical features, measures taken, and the challenges faced in its eradication.

CHOLERA PANDEMICS

The origins of cholera are believed to be in the Ganges River Delta in India, where the bacterium naturally occurs (2). The first recorded instances of cholera-like illness date back to texts from ancient India and Greek medicine (3,4). However, the global spread of cholera did not begin until modern times.

The first cholera pandemic occurred in the Bengal region of India, from 1817 through 1824. It spread across Asia to Southeast Asia, the Middle East, Africa, and the Mediterranean. This spread was propagated through trade routes (5). The second cholera pandemic began in 1829 and spread to Europe and the Americas. This pandemic led to the first significant public health reforms, especially in Europe. The third pandemic began in 1852 and lasted till 1860 and is said to have erupted in India. This was considered the most virulent and deadly. It quickly spread to all continents, with Africa being the most affected (6). The third pandemic is known for the 1854 outbreak in London, where Dr. John Snow's pioneering epidemiological work demonstrated that cholera was spread through contaminated water, not air (miasma theory), marking a major advance in public health science (7).

The fourth and fifth pandemics began in 1863 and 1881 respectively and are said to be less severe than the previous pandemics (6). Scientific advancements, including the development of the cholera vaccine by Waldemar Haffkine in 1892, began to reduce the impact of cholera in Europe. (8) The sixth pandemic lasted from 1899 to 1923 and was especially lethal in India, in Arabia, and along the North African coast. During this period, Europe and North America experienced fewer outbreaks due to improvements in water treatment and sanitation. (6)

The seventh and currently ongoing pandemic began in 1991 in South Asia and spread to Africa in 1971 and America in 1991. The WHO also noted that cholera has become endemic in many countries. In 2017, WHO announced a global strategy, Ending Cholera: A Global Roadmap to 2030. It was aimed at reducing cholera deaths by 90% by 2030. (1)

Cholera has a notable history in Nigeria, marked by periodic outbreaks and ongoing public health challenges. The disease first appeared in Nigeria during the second cholera pandemic, affecting coastal cities like Lagos. Major outbreaks occurred in the 1970s and 1990s, with the 2009 outbreak in northern regions highlighting the need for improved sanitation and public health infrastructure. Cholera continued to be endemic, with significant outbreaks in 2010 and 2018, driven by poor sanitation and access to clean water. (9)

From 2021 to 2022, Nigeria faced severe outbreaks, exacerbated by flooding and conflicts, prompting government and international responses, including vaccination campaigns.
In 2024, Nigeria experienced a severe cholera outbreak with cases rising by 220% compared to the previous year. As of October 2024, the Nigeria Centre for Disease Control (NCDC) reported over 10,800 suspected cases and 359 deaths, significantly higher than in 2023. Lagos state has been particularly affected, contributing 43% of the national total, while Adamawa, Jigawa, Kano, Borno, and Katsina states have also reported high case numbers. (10)

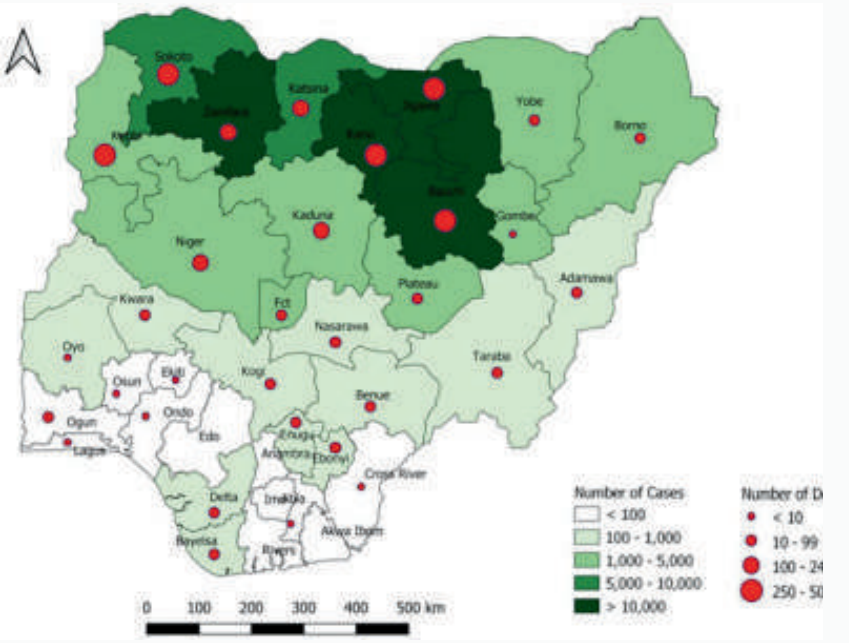
EPIDEMIOLOGY

Vibrio cholerae is estimated to be the cause of 3 million instances of diarrheal disease and 100,000 fatalities globally each year. However, accurate estimates of the morbidity and death attributed to cholera are lacking due to the disease being largely underreported.

Cholera mostly affects areas with poor access to sanitary facilities and clean water; it can spread both endemically and epidemically. Approximately 50 countries, primarily in Asia and Africa, have recorded cholera cases in the last five years, making them endemic.

V. Cholera-related epidemics have spread to South and Central America, Africa, Asia, the Middle East, and the Caribbean. Epidemics can occur over a large geographic region; for instance, the strain implicated in the 2010 outbreak in Haiti was subsequently associated with outbreaks in the neighboring countries of the Dominican Republic, Cuba, and Mexico. (11)
Nigeria reported 2102 cases and 63 deaths with a Case Fatality Rate (CFR) of 3% across 33 states since January 2024. In 2024, Nigeria reported 1094 new cases of cholera and 41 related fatalities, yielding a CFR of 3.7%. Compared to the preceding month, there has been an 1143% increase in cases and a 1950% increase in deaths. The spike in cases in June was especially concerning, especially because almost half of all cases reported in the nation this year have occurred in Lagos state. (12)

Below is a map showing the distribution of cholera in Nigeria. (13)



TRANSMISSION

Cholera is primarily transmitted through the consumption of water or food contaminated with the bacterium *Vibrio cholerae*. The main routes of transmission include:

- **Contaminated Water:** The most common means of transmission is drinking water contaminated with *Vibrio cholerae*, often due to poor sanitation systems.
- **Contaminated Food:** Food exposed to unsanitary conditions or contaminated water can harbor cholera bacteria.
- **Person-to-Person Contact:** Direct contact with an infected person's feces or vomit can transmit cholera.
- **Fecal-Oral Transmission:** The bacteria spread when fecal matter contaminates food or water, common in areas with poor sanitation.
- **Environmental Reservoirs:** The bacteria can survive in brackish waters and within aquatic organisms, acting as sources for human outbreaks.

Aetiology

The development of the diarrheal disease cholera is attributed to the consumption of food or water contaminated by the toxigenic strains of micro-organisms, vibro cholerae, and subsequent intestinal colonization. The intestinal colonization by the micro-organism is initiated by feco-oral ingestion of the organism, directly insinuating a compromise in water integrity, contamination via fomites (hand to mouth), or exposure of food to the action of mechanical vectors of the bacteria. Freshly shed feces are highly infectious 24 hours after release into the environment and can survive for long periods outside the body, greatly increasing the rate of infection. These forms of transmission are more common in developing countries and countries ravaged by war or famine (14).

Factors that Play a Role in The Spread of Cholera

- **Environmental Factors:** V. cholerae has two major reservoirs humans and water.
- **Host Factors**; Malnutrition increases susceptibility to cholera (15). Blood type O also has twice the incidence rate, but the cause is unknown (15).

Infection rates are lower in regions where the disease is endemic. Large outbreaks of the disease are linked to contamination of the communal water supply with the feces of an infected host.

PATHOPHYSIOLOGY

Due to the intestinal tropic nature of the organism, the organism must pass through the upper GI tract and the stomach, surviving the low pH of the gastric secretions to perform its pathogenic effects. However, the organism is not resistant to the acidic nature of the stomach and requires a large inoculum size to survive (15).
the infectious dose of *V. cholerae* required to exert pathophysiological effects may vary depending on the method of contamination;

Via Water: 10^3 – 10^6 organisms [15]
Via Food: 10^2 – 10^4 organisms [15]

The gastric susceptibility to *V. cholerae* can be greatly increased by the regular use of antacids, histamine receptor blockers, and proton pump inhibitors.

Toxic strains of the organisms elicit clinical disease by releasing enterotoxins that promote the secretion of fluids and electrolytes into the lumen of the small intestine.

Enterotoxin comprises an A1 subunit that activates adenylate cyclase to increase cAMP. cAMP then inhibits the absorption of sodium and chloride from the microvilli increasing the secretion of chloride and water from the crypt cells.

The result is watery diarrhea with isotonic electrolyte concentrations to those of plasma, leading to severe dehydration and probable death. (14-18)

CLINICAL PRESENTATION

Cholera is characterized by three cardinal signs; Diarrhoea, Vomiting, and Dehydration

- **Diarrhea**: Profuse watery diarrhea is a hallmark of cholera. Cholera should be suspected if a patient above 5 years develops severe dehydration (14). Patients with severe disease may have a stool volume of more than 250mL/kg body weight per day (19) producing a rice water-like stool in appearance.
- **Vomiting**: Vomiting may be caused by associated symptoms of cholera such as acidaemia (19) or may not be present at all.
- **Dehydration**: If left untreated, diarrhea and vomiting lead to isotonic dehydration, which can lead to acute tubular necrosis and renal failure (19). The dehydration ensuing from the disease therefore produces a water loss proportional between the three fluid compartments of the body. (19)

Diagnosis of Cholera

Diagnosing cholera requires a combination of clinical suspicion, especially in regions where cholera is endemic or during outbreaks, and laboratory confirmation to establish the presence of *Vibrio cholerae.*

When to Suspect Cholera
Cholera should be considered in any patient presenting with acute watery diarrhea, particularly if rapid and severe dehydration occurs. The World Health Organization (WHO) provides specific guidelines for cholera diagnosis based on the geographical context and outbreak status:

- **In areas where cholera has not been declared:**

- For patients aged 2 years and older, cholera should be suspected if they present with acute watery diarrhea (defined as 3 or more loose stools per day, lasting no longer than 14 days) accompanied by severe dehydration or in cases where they die from acute watery diarrhea with no other plausible cause.
- **A confirmed case of cholera** is defined as any person infected with Vibrio cholerae O1 or O139, confirmed by stool culture, serological agglutination, or polymerase chain reaction (PCR).

- **In areas where a cholera outbreak has been declared:**

Any person presenting with acute watery diarrhea, or who has died from acute watery diarrhea, should be suspected of cholera.

Outbreak Definitions
· **A suspected cholera outbreak** is identified when two or more suspected cholera cases, or one suspected cholera case with a positive rapid diagnostic test (RDT), are reported within the same surveillance unit within 7 days.
· **A probable diagnosis** is made when the number of suspected cholera cases with a positive RDT result surpasses a pre-defined threshold, taking into account the number of suspected cases tested.
· **A confirmed cholera** outbreak is established when at least one locally acquired case of cholera is confirmed within a surveillance unit.

Clinical diagnosis

Cholera presents with characteristic symptoms, and a high index of suspicion is critical, particularly during outbreaks or in endemic regions. The hallmark features of cholera include:

- Profuse watery diarrhea (often described as "rice water stool" due to its pale, milky appearance).
- Vomiting, frequently without nausea.
    - Signs of severe dehydration, including:
    - Dry mouth and tongue
    - Low blood pressure
    - Rapid pulse
    - Loss of skin turgor
    - Intense thirst

Laboratory diagnosis

Laboratory confirmation plays a crucial role in the definitive diagnosis of cholera. Several methods can be used:

- **Stool Culture**: The gold standard for cholera diagnosis, stool culture involves isolating *Vibrio cholerae* using selective media, such as Thiosulfate Citrate Bile Salts Sucrose (TCBS) agar. Alternative media, such as Tellurite Taurocholate Gelatin Agar (TTGA), can also be used. Once cultured, further identification can be performed using biochemical tests or serotyping to determine the specific strain (O1 or O139).
- **Dark-Field Microscopy:** This method detects the motility of *Vibrio cholerae* and can provide a preliminary diagnosis. However, it is not commonly used due to its lower sensitivity and specificity.
- **Polymerase Chain Reaction (PCR):** PCR is a highly sensitive and specific method for detecting *Vibrio cholerae* DNA in stool samples. Despite its accuracy, it requires specialized equipment, which limits its use in resource-poor settings.
- **Rapid Diagnostic Tests (RDTs):** When laboratory facilities are unavailable or limited, the Crystal VC RDT can be used to screen stool samples for *Vibrio cholerae* O1 or O139. A dipstick is employed to detect the presence of the cholera pathogen. However, like dark-field microscopy, RDTs lack sensitivity and specificity, and a positive result should be confirmed by stool culture for definitive diagnosis.

Differential diagnosis

symptoms such as watery diarrhea, and dehydration are not unique to cholera and can be found in a wide range of diseases such as rotavirus infection, enterotoxigenic E coli infection, giardiasis, norovirus infections all present with acute diarrheal diseases. It is important to distinguish cholera by carrying out efficient laboratory testing [21]

Treatment

The treatment of cholera should be immediate due to the presence of severe dehydration that can lead to shock and ultimately death in hours. The main goal of treatment focuses on rapid rehydration to replace the extensive loss of body fluids and electrolytes.

Rehydration therapy

- **Oral rehydration salts**- it is a fluid mixture made of glucose, sodium, potassium, and chloride the WHO/UNICEF standard sachet is to be dissolved in 1 liter of clean water, although adults may need about 6 liters to treat moderate dehydration on day 1 of treatment. The WHO recommends using low osmolality ORT and it should be given in small frequent sips whether vomiting is present or not. [23]
- **Intravenous fluids**- Recommended in cases of severe dehydration or shock where a patient can't drink enough ORS. Ringer's lactate is the preferred solution because it contains more vitamin K and bicarbonate[24]
- **Antibiotics** –This is only required in severe cases/endemic areas. It is given to shorten the duration of diarrhoea and reduce the volume of rehydration fluid required. Common drugs such as azithromycin, doxycycline, and ciprofloxacin, Antibiotics should serve as an adjunct and not a replacement for rehydration therapy. [24]
- **Zinc supplementation in children**—zinc decreases the duration and severity of diarrhoea in children, it also serves as an adjunctive therapy.[23]
- **Nutrition**- patients should start feeding with clean, safe, and healthy foods as soon as it is possible to do so, breastfeeding should continue.[23]

Prevention and Control

Prevention and control focus on reducing the transmission of V. cholerae, emphasis should be made on improving water quality, hygiene, environmental sanitation, and vaccination.

- **Water supply** – effective water treatment is essential to prevent the outbreak of cholera. Measures such as boiling, filtration, chlorination, and safe storage should be carried out.[25]
- **Hand hygiene**- Washing of hands with soap and water and using an alcohol-based hand sanitizer, should be done after toilet use, before and after eating, and before and after food preparation. [25]
- **Food hygiene**- raw, undercooked food mostly seafood (especially shellfish) should

- be avoided, and fruits and vegetables should be peeled before eating.[25]
- Environmental sanitation-- Proper sewage disposal in clean and functional latrines/toilets tends to reduce transmission
- pit latrines, should be dug away from water bodies (wells included). Open defecation should be abolished in communities.[25]
- **Surveillance and early detection**- cholera surveillance systems are necessary in high-risk regions to monitor the outbreak of cholera and efficiently detect cases so rapid response can be initiated to limit the spread. (23)
- **Community awareness programs -** The people should have extensive knowledge on cholera and its preventive measures. Campaigns should be organized using radio, social media, posters, community meetings, and school programs to educate people on cholera prevention and actions to take during an outbreak. [23]

Oral cholera vaccines (OCVs)
Currently, there are three WHO prequalified oral cholera vaccines:

- **Dukoral**: This vaccine is a killed whole-cell vaccine that includes the cholera toxin B subunit. It requires administration with a buffer solution (sodium bicarbonate) to enhance its efficacy. Dukoral is recommended for individuals aged 2 years and older, and it requires two doses for optimal protection, with the second dose administered at least one week after the first.
- **Shanchol**: A bivalent vaccine containing killed cells of *Vibrio cholerae* serogroups O1 and O139. It does not require a buffer for administration, making it easier to deploy in resource-limited settings. Shanchol is also administered in two doses, with the second dose recommended at least two weeks after the first. This vaccine is safe for all age groups, including infants as young as one year.
- **Euvichol-Plus:** Similar to Shanchol, Euvichol-Plus is a bivalent vaccine that protects against both O1 and O139 serogroups. It also does not require a buffer for administration and requires two doses for optimal protection. Clinical studies have demonstrated its safety and efficacy.

Efficacy and Duration of Protection: The protective efficacy of OCVs typically ranges from 65% to 85% in the first six months post-vaccination, gradually declining over time. Booster doses may be necessary to maintain immunity, particularly in high-risk populations or areas with ongoing cholera transmission.

Recommendations for Use: OCVs are recommended for individuals living in or traveling to endemic areas, especially during outbreaks. They are particularly beneficial for high-risk groups, including children under five, individuals with compromised immune systems, and populations residing in cholera-prone regions. The integration of vaccination with other cholera prevention strategies, such as improved water, sanitation, and hygiene (WASH) interventions, is crucial for effectively reducing cholera incidence.

Injectable Cholera Vaccines (ICVs)
In addition to oral vaccines, there are also injectable cholera vaccines, which are typically less commonly used due to their limitations in terms of accessibility and acceptability.

- **Whole-Cell Vaccines:** These vaccines consist of killed whole cells of Vibrio cholerae. Historically, they were used in some countries but have largely been replaced by oral vaccines due to the lower acceptance of injections in many populations. The protective efficacy of injectable whole-cell vaccines is variable and often requires multiple doses.
- **Subunit Vaccines:** Research into subunit vaccines, which target specific components of the cholera toxin, is ongoing. These vaccines aim to elicit a strong immune response with fewer side effects. However, as of now, there are no WHO prequalified injectable subunit cholera vaccines available for public use.

Limitations of Injectable Vaccines: ICVs may be less desirable in endemic regions due to the need for healthcare infrastructure to administer injections and the potential for increased pain and discomfort compared to oral vaccines. They may also require multiple doses to achieve effective immunity, which can be logistically challenging in outbreak settings.

CHALLENGES IN MANAGING CHOLERA

- **Climate Change:** the rising global temperatures and extreme weather events such as floods and droughts, have exacerbated the epidemics of cholera by increasing water contamination and limiting clean water access. In the prelude to the 2022 United Nations Climate Change Conference (COP27), it was noted that floods and rising sea levels have affected environmental hygiene leading to waterborne and diarrhoeal diseases, with extreme weather conditions negatively impacting water supply. [28][31]

- **Inadequate access to clean water, sanitation, and hygiene (WASH):** This particularly occurs in rural areas, overcrowded environments, camps for refugees and internally displaced people and conflict-affected areas. These regions are exposed to open defecation, poor hygiene, and the use of unsafe water sources. [29][31]
- **Shortage of cholera vaccines:** The cholera vaccine shortage in Nigeria in 2024 is driven by both global and local challenges. On a global scale, the supply of oral cholera vaccines (OCVs) has not kept pace with rising demand, as countries around the world face increasing outbreaks. This global supply constraint severely affects Nigeria's ability to secure enough vaccines for its population. Logistical challenges within Nigeria, such as inadequate cold chain infrastructure and difficulties reaching remote or conflict-affected areas, further complicate vaccine distribution. Additionally, with the surge in cases, the demand for vaccines has exceeded supply, forcing health authorities to prioritize hotspots, leaving other regions vulnerable. Financial and political constraints also play a role, as limited resources and inconsistent government support have delayed and disrupted vaccination efforts. [29]
- **Inadequate healthcare infrastructure**: this includes limited access to healthcare facilities, shortage of trained healthcare workers, and inadequate surveillance and response system. These factors combined make it difficult to detect and respond to cholera outbreak promptly. The Nigeria Centre for Disease Control (NCDC) has reported that out of Nigeria's over 700 local government areas, many do not have functioning health facilities capable of providing timely treatment for cholera. [29]

GLOBAL EFFORT AND FUTURE DIRECTIONS

Global Task Force on Cholera Control (GTFCC): is a network of governmental and non-governmental organizations, UN agencies, and scientific partner institutions that helps coordinate activities for cholera control. This initiative, led by the WHO, is a coalition of organizations working to reduce cholera deaths by 90% by 2030 through targeted vaccination campaigns, improving healthcare, and long-term preventive strategies. [26] In October 2017, GTFCC partners launched a strategy for cholera control; Ending Cholera: A Road Map to 2030. The global road map focuses on three strategies:

- **Early detection and quick response to contain outbreaks**: this strategy focuses on containing outbreaks, through early detection and rapid multisectoral response including community engagement, strengthening surveillance and laboratory capacity, health systems and supply readiness, and supporting rapid response teams.
- **A targeted approach to improve prevention**: this involves multi-sectoral cooperation of partners and countries to focus on specific geographic areas that experience a high incidence or prevalence of cholera cases. Cholera transmission can be stopped in these areas through measures including improved WASH and use of oral cholera vaccines.
- **Coordination of human, technical, and financial resources:** the processes of coordination and partnership occur at local and global levels. This provides a strong framework to support countries and intensify efforts to control cholera, building upon country-led cross-sectoral cholera control programs and supporting them with human, technical and financial resources. [26][27] With the commitment of countries, partners, and donors, the GTFCC is working to achieve the goals in the global roadmap.
- **Future Vaccine Strategies:** A single dose of an OCV induces a vibriocidal response among exposed populations, as observed in previous clinical trials. A single dose of an OCV was shown to be efficacious (57%) among those above 5 years of age, however, no protective efficacy was observed for those below 5 years of age. Studies on the use of booster doses of OCVs have been conducted in Bangladesh, which showed that children who received a single dose of an OCV 3 years earlier showed significantly increased vibriocidal antibody responses after receiving one booster dose of an OCV compared to those who did not receive an OCV earlier. These results suggest that boosting with one dose of an OCV augmented the immune responses in children. [32]

Large campaigns of two doses of an OCV were conducted in 2017 among the Rohingya population in Bangladesh. The study revealed a significant increase in vibriocidal antibody titers 14 days following the first dose of the OCV. Similarly, another study conducted during a humanitarian crisis in South Sudan showed that only one dose of an OCV was immunogenic and induced short-term antibodies. [32]

CONCLUSION

Vibrio cholerae causes periodic cholera epidemics in several regions around the globe. The disease requires immediate treatment as it can lead to death within hours in patients with moderate to severe cholera. With the development of i.v. fluids, ORS, and Zinc therapy,

progression to severe dehydration and mortality. [32]

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DIPHTHERIA

DIPHTHERIA: A COMPREHENSIVE REVIEW FOR MEDICAL STUDENTS

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INTRODUCTION

Diphtheria is a serious, contagious disease caused by toxin-producing strains of the bacteria *Corynebacterium diphtheriae*. This bacteria primarily spreads through respiratory droplets when an infected person coughs, sneezes, or talks. Diphtheria can also spread through contact with objects contaminated by the bacteria, such as utensils or tissues. Importantly, not everyone who contracts the bacteria shows symptoms; some can be asymptomatic carriers who continue to spread the infection for weeks without knowing it.

Before the introduction of the diphtheria vaccine in the 1930s, the disease was widespread and a leading cause of childhood mortality worldwide. The diphtheria toxin can cause damage to the respiratory tract, but its effects can extend throughout the body, leading to complications like myocarditis (inflammation of the heart muscle), neuritis (nerve damage), and kidney failure. Early symptoms of diphtheria include fever, sore throat, and swelling of the neck glands, often referred to as "bull neck." The infection can also cause a thick, gray pseudomembrane to form in the throat, which can obstruct the airway.

Vaccination is the most effective way to prevent diphtheria. The vaccine contains a diphtheria toxoid (an inactivated form of the toxin), which stimulates the immune system to produce protective antibodies. Despite the availability of a safe and effective vaccine, recent outbreaks have occurred in regions where vaccination rates have declined, highlighting the ongoing need for immunization programs.

EPIDEMIOLOGY

Diphtheria was once a significant cause of illness and death in children before vaccines were developed. The widespread introduction of the diphtheria vaccine has greatly reduced the number of cases globally, particularly in high-income countries. However, the disease continues to pose a threat in parts of the world with inadequate vaccination coverage.

Global Perspective

According to the World Health Organization (WHO), diphtheria continues to occur sporadically in various parts of the world, particularly in regions with low vaccine coverage or disruptions in healthcare systems. Outbreaks have been documented in parts of Southeast Asia, Eastern Europe, and Africa.

The most significant diphtheria outbreak in recent decades occurred in the Newly Independent States (NIS) of the former Soviet Union from 1990 to 1995, following the dissolution of the Soviet Union. This epidemic caused more than 157,000 cases and 5,000 deaths, primarily affecting older adults who had not received booster vaccinations. The epidemic was largely attributed to interruptions in vaccination programs and economic instability during this period.

Smaller outbreaks have been reported in various parts of the world:

- **India:** Diphtheria remains endemic in some areas, particularly in rural and underserved regions where vaccination rates are lower. In 2017, India reported more than 3,000 cases, underscoring the ongoing public health threat in the region.

- **Yemen**: In 2017, Yemen experienced a significant diphtheria outbreak amid the country's ongoing civil war. As of 2020, over 3,000 cases were reported, with more than 180 deaths. The conflict severely hampered vaccination efforts, leading to the spread of the disease.
- **United States**: While diphtheria is rare in the U.S. due to high vaccination coverage, isolated cases have been reported in recent years, primarily linked to international travel or unvaccinated individuals.

Epidemiology in Nigeria

Nigeria has experienced periodic outbreaks of diphtheria, with a notable increase in cases since June 2023. Between June and August 2023, Nigeria reported 5,898 suspected cases from 59 Local Government Areas (LGAs) across 11 states, with Kano state being the epicenter of the outbreak. The majority of cases have been linked to unvaccinated or partially vaccinated individuals, highlighting gaps in vaccine coverage.
The WHO has classified Nigeria's diphtheria outbreak as a high-risk event at the national level, though the risk to neighboring countries remains low. Public health measures, including mass vaccination campaigns, enhanced surveillance, and case management, are ongoing efforts coordinated by the Nigeria Centre for Disease Control (NCDC) in collaboration with WHO and other international partners.

AETIOLOGY

Diphtheria is caused by the bacteria *Corynebacterium diphtheriae*, which can infect the respiratory tract, skin, or other body tissues. The bacteria release a potent exotoxin, which is responsible for the serious complications of the disease. This toxin inhibits protein synthesis in cells, leading to cell death and tissue damage.

Modes of Transmission

- **Respiratory Droplets**: The primary mode of transmission is through airborne droplets expelled when an infected person coughs, sneezes, or talks.
- **Fomites**: Diphtheria can also be spread through contact with objects contaminated by respiratory secretions, such as shared utensils, tissues, or cups.
- **Cutaneous Diphtheria**: Skin infections can occur, especially in tropical climates or in people with poor hygiene. Cutaneous diphtheria is transmitted through contact with infected skin lesions or open wounds.

Carriers and Disease Spread

Even individuals who do not show symptoms of diphtheria can carry the bacteria and transmit the infection to others. Asymptomatic carriers
- can continue to shed the bacteria for up to six weeks, making early identification and isolation of carriers crucial in outbreak settings.

PATHOPHYSIOLOGY

The virulence of Corynebacterium diphtheriae lies in its ability to produce a powerful exotoxin. Once the bacteria colonize the respiratory tract, they adhere to the mucosal lining and release the diphtheria toxin. This toxin consists of two fragments:

- **Fragment B**: Binds to the surface of susceptible host cells and facilitates the entry of the toxin into the cell.
- **Fragment A**: Once inside the cell, this fragment inhibits elongation factor 2 (eEF2), which is crucial for protein synthesis. This inhibition results in the disruption of protein production, leading to cell death and tissue necrosis.

In the respiratory form of diphtheria, the local effects of the toxin lead to the formation of a thick, gray pseudomembrane in the throat and nasal passages, which can obstruct the airway and cause difficulty breathing. The systemic spread of the toxin can result in damage to distant organs, including the heart, kidneys, and nervous system.

Complications from Toxin Spread

- **Myocarditis:** The toxin can damage heart muscle cells, leading to arrhythmias and heart block, which may cause circulatory collapse.
- **Neuritis:** The toxin can cause nerve damage, particularly affecting cranial nerves and peripheral nerves, leading to muscle weakness, paralysis, or difficulty swallowing.
- **Kidney Damage:** The toxin can also affect renal function, leading to acute kidney injury.

TRANSMISSION

Diphtheria is primarily spread through respiratory droplets, but transmission can also occur via direct contact with infected skin lesions or fomites. In cutaneous diphtheria, contact with open wounds or sores can spread the bacteria to the skin or respiratory tract of others. Given the highly contagious nature of the disease, individuals exposed to diphtheria patients or carriers are at risk, particularly in close-contact settings or areas with low vaccination coverage.

The WHO has introduced updated terminology for pathogens that spread through the air, including diphtheria, using the term "infectious respiratory particles" (IRPs) to encompass a wide range of airborne transmission modes. This terminology highlights the importance of understanding the different ways respiratory

pathogens like diphtheria can spread.

DIAGNOSIS

The diagnosis of diphtheria is based on both clinical symptoms and confirmatory laboratory tests. Given the potentially rapid progression of the disease, early diagnosis and treatment are critical.

Clinical Features

- **Pseudomembrane Formation**: The formation of a thick, grayish membrane in the throat, tonsils, or nasal passages is a hallmark of diphtheria.
- **Bull Neck**: Swollen lymph nodes and tissue inflammation can cause significant swelling of the neck.
- **Other Symptoms**: These include sore throat, fever, nasal discharge, difficulty swallowing, and respiratory distress.

Laboratory Diagnosis

- **Throat Swab and Culture**: A sample from the throat or nasal passages is cultured to confirm the presence of *Corynebacterium diphtheriae*. However, culture results may take several days, so treatment should begin before confirmation if clinical suspicion is high.
- **Elek Test**: This immunoprecipitation test determines whether the isolated strain produces diphtheria toxin, distinguishing between toxigenic and non-toxigenic strains.
- **PCR (Polymerase Chain Reaction)**: PCR testing can rapidly detect the tox gene responsible for toxin production, providing faster confirmation than culture or Elek testing.

In severe cases, additional diagnostic tests like blood work and electrocardiograms (ECGs) may be required to assess for complications such as myocarditis.

TREATMENT

The treatment of diphtheria focuses on three key goals: neutralizing the toxin, eradicating the bacteria, and managing complications. Diphtheria can be life-threatening, especially in unvaccinated individuals, so early, aggressive treatment is essential.

1. Diphtheria Antitoxin:

o The administration of diphtheria antitoxin is the most critical aspect of treatment. It neutralizes circulating toxins but cannot reverse the damage already done by the toxin. The antitoxin should be given as early as possible and is typically administered intravenously or intramuscularly. The dosage depends on the severity of the disease, with higher doses required for severe cases involving myocarditis or extensive pseudomembrane formation.

2. Antibiotics:

Antibiotics such as penicillin or erythromycin are used alongside the antitoxin to eradicate Corynebacterium diphtheriae and prevent its spread. The typical duration of antibiotic therapy is 14 days. Prophylactic antibiotics may also be given to close contacts of diphtheria patients to reduce the risk of transmission.

3. Supportive Care:

In severe cases, the pseudomembrane can obstruct the airway, necessitating urgent interventions such as intubation or a tracheostomy. Patients with myocarditis or nerve involvement may require close monitoring in an intensive care unit. Management of fluid balance, electrolyte disturbances, and cardiac function is essential. Bed rest and adequate hydration are important components of supportive care, especially as diphtheria often causes systemic toxicity and fatigue.

COMPLICATIONS

Diphtheria can cause a variety of complications, many of which are life-threatening. The diphtheria toxin's effects on the heart, nervous system, and kidneys are particularly dangerous.

1. **Cardiac Complications:**

Myocarditis, an inflammation of the heart muscle, is one of the most serious complications of diphtheria. It can cause arrhythmias, heart block, or even heart failure. Electrocardiograms (ECGs) in diphtheria patients often show a prolonged P-R interval and ST/T wave changes, which are early indicators of myocardial involvement.

2. **Neurological Complications:**

Neurologic complications include paralysis of the cranial nerves, which may lead to difficulty swallowing, muscle weakness, and regurgitation of food and liquids. In severe cases, diphtheria can cause peripheral neuropathy, affecting the nerves in the extremities. Rarely, encephalitis (inflammation of the brain) may occur, particularly in children.

3**. Respiratory Obstruction:**

The pseudomembrane formed by the diphtheria infection can obstruct the upper airway, causing breathing difficulties. If untreated, this can lead to suffocation or require emergency interventions such as tracheostomy or intubation.

4. **Septicemia and Toxic Shock Syndrome:**

o If the bacteria or its toxins enter the bloodstream, diphtheria can cause septicemia, leading to a widespread infection. Toxic shock syndrome (TSS) can also occur as the immune system reacts to the toxins, resulting in multi-organ failure and death.

CURRENT CHALLENGES

Global and Local Challenges

Diphtheria continues to present challenges to global public health, particularly in areas with unstable healthcare systems or conflict zones where vaccination efforts are disrupted. For instance:

- **In Nigeria**, the ongoing outbreak, which began in May 2022, has led to over 13,000 suspected cases and more than 600 deaths as of October 2023. The hardest-hit states include Kano, Yobe, Katsina, and Bauchi, with children aged 1-14 being disproportionately affected. Contributing factors include population growth, climate-related water shortages, and gaps in vaccine coverage.
- **Yemen and Other Conflict Zones:** Countries experiencing conflict, such as Yemen, face similar challenges, with diphtheria outbreaks exacerbated by the breakdown of healthcare systems and poor living conditions.

Healthcare Access and Vaccine Distribution

Healthcare access is a critical issue in controlling diphtheria outbreaks. In regions with poor infrastructure, such as northern Nigeria, logistical challenges, security concerns, and a shortage of healthcare personnel have hindered efforts to reach affected communities. The limited availability of diphtheria antitoxin (DAT) and intravenous antibiotics further complicates treatment efforts.

Efforts by the Nigerian Centre for Disease Control (NCDC), in collaboration with WHO, Médecins Sans Frontières (MSF), and other partners, aim to increase vaccine coverage and treatment access. The deployment of National Rapid Response Teams and the use of digital reporting platforms have improved case detection, but security challenges and migration continue to hamper these efforts.

CONCLUSION

The resurgence of diphtheria in Nigeria and other regions underscores the importance of maintaining high vaccination coverage to prevent outbreaks of vaccine-preventable diseases. The current outbreak in Nigeria highlights the vulnerability of populations with low immunization rates, where more than 60% of confirmed cases involve unvaccinated individuals.

Diphtheria's complications, including myocarditis, neuritis, and respiratory obstruction, can be fatal if not treated promptly. Public health measures, such as mass vaccination campaigns, enhanced surveillance, and education, are essential to controlling the disease. However, ongoing challenges, including conflicts, migration, and resource shortages require sustained international cooperation and investment.

Looking forward, improving healthcare infrastructure, expanding vaccination programs, and addressing the underlying social and environmental factors contributing to disease spread will be key to preventing future diphtheria outbreaks.

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EBOLA VIRUS

A REVIEW OF EBOLA VIRUS: PATHOPHYSIOLOGY, CLINICAL PRESENTATION, DIAGNOSIS, TREATMENT, PREVENTION AND IMPACT IN NIGERIA.

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OVERVIEW

Ebola virus disease (EVD) is a highly lethal infectious disease caused by the Ebola virus, which primarily affects humans and non-human primates. First identified in 1976, the disease has since become a significant public health concern, particularly in sub-Saharan Africa. EVD is characterized by a spectrum of severe clinical manifestations, including fever, vomiting, and hemorrhagic symptoms, with case fatality rates ranging from 25% to 90%, depending on the outbreak context. The 2014-2016 West African outbreak highlighted the devastating impact of EVD, resulting in over 11,000 deaths and drawing global attention to its epidemiology and transmission dynamics.

The disease is predominantly transmitted through close contact with infected animals and humans, with human-to-human transmission posing a considerable risk, especially in healthcare settings lacking appropriate infection control measures. Nigeria's first major outbreak in 2014 resulted in 20 confirmed cases and 8 deaths, underscoring the need for effective surveillance, preparedness, and response strategies to mitigate future outbreaks.

The pathophysiology of EVD involves extensive immune system dysregulation and multi-organ failure, primarily due to the virus's ability to replicate rapidly within host cells. Although there is no specific antiviral treatment for EVD, supportive care, including fluid and electrolyte management, remains critical in the treatment of affected individuals. Vaccination efforts, particularly the deployment of the rVSV-ZEBOV vaccine, represent a significant advancement in prevention strategies.

This article explores the complex landscape of EVD in Nigeria, detailing its etiology, epidemiology, clinical presentation, diagnosis, treatment, and prevention measures. It will also examine the unique complications faced by Nigeria during the 2014 outbreak and the ongoing challenges in managing EVD, ultimately reflecting on the lessons learned to enhance preparedness for future public health emergencies.

INTRODUCTION

Ebola virus disease (EVD) is a severe illness in humans and non-human primates caused by the Ebola virus. The disease was first identified in 1976 near the Ebola River in the Democratic Republic of Congo (WHO, 2023). Symptoms include fever, muscle pain, headache, and sore throat, followed by vomiting, diarrhea, and, in severe cases, internal and external bleeding (CDC, 2023).

EVD has a high mortality rate, with case fatality rates varying between 25% and 90% depending on the outbreak (Feldmann & Geisbert, 2011). The virus gained significant attention during the 2014-2016 West African outbreak, which caused over 11,000 deaths (Kuhn & Jahrling, 2015).

EPIDEMIOLOGY

EVD primarily affects sub-Saharan Africa, with significant outbreaks recorded in the Democratic Republic of Congo, Sudan, Uganda, and West Africa. The 2014-2016 outbreak in Guinea, Sierra Leone, and Liberia was the most extensive and deadly (WHO, 2023). EVD continues to pose a risk due to its presence in animal reservoirs, particularly fruit bats. Human-to-human transmission in healthcare settings also remains a significant concern during outbreaks (CDC, 2023).

Nigeria experienced its first major outbreak in 2014, which resulted in 20 confirmed cases and 8 deaths (NCDC, 2022). Since then, sporadic cases have been reported, highlighting the need for ongoing surveillance and preparedness (Okonkwo et al., 2023).

The case fatality rate for EVD can reach up to 90% in some outbreaks, emphasizing the disease's lethality (CDC, 2023).

AETIOLOGY

EVD is caused by the Ebola virus, part of the *Filoviridae* family. There are five known species of the virus, including Zaire ebola virus, which is the most lethal and responsible for most outbreaks (Feldmann & Geisbert, 2011). The Ebola virus is an enveloped, single-stranded RNA virus that replicates within host cells, causing severe tissue damage and hemorrhagic fever (Kuhn & Jahrling, 2015).

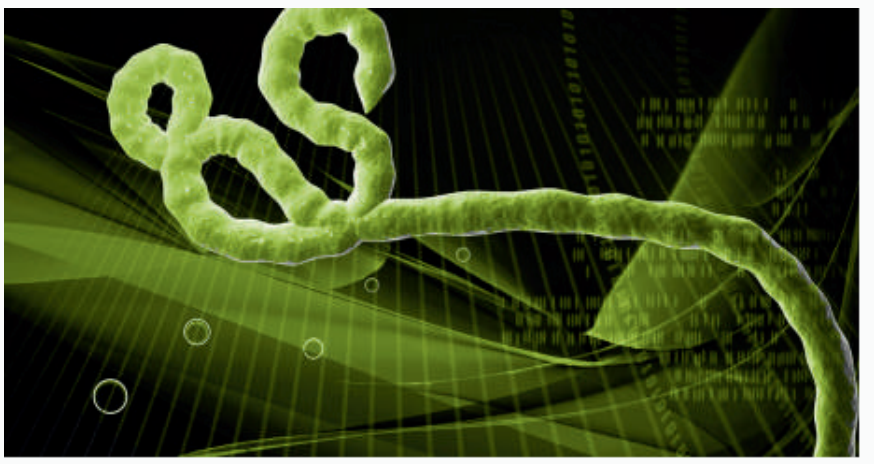
TRANSMISSION

The Ebola virus is transmitted to humans through close contact with infected animals, particularly fruit bats, and other primates (CDC, 2023). Once in the human population, it spreads through direct contact with bodily fluids of infected individuals or contaminated objects, especially in healthcare settings where personal protective equipment is not adequately used (WHO, 2023). Survivors can carry the virus in certain bodily fluids, such as semen, for months, which can lead to sexual transmission (Feldmann & Geisbert, 2011).

Ebola Virus Disease (EVD): Pathophysiology, Clinical Presentation, Diagnosis, Treatment, and Prevention

Pathophysiology

Ebola Virus Disease (EVD) is caused by viruses from the genus Ebolavirus in the Filoviridae family. The virus enters the host through mucosal surfaces, breaks in the skin, or parenterally (Brown et al., 2017). The virus primarily targets cells of the immune system, particularly macrophages, dendritic cells, and monocytes, leading to rapid viral replication and dissemination throughout the body. Once inside the cells, the virus hijacks the host's machinery to produce more viral particles, which are released to infect surrounding tissues and organs (Letafati, Ardekani, Karami, & Soleimani, 2023).



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The immune system responds with a massive release of cytokines, causing a "cytokine storm," which results in widespread inflammation and tissue damage. This hyperactivation of the immune system leads to vascular leakage, organ damage, and disseminated intravascular coagulation (DIC), which manifests as bleeding and hemorrhagic complications (Moghadam, Omidi, & Bayrami, 2015). Key organs such as the liver, kidneys, and adrenal glands are particularly affected, leading to multi-organ failure. Endothelial cells and platelets are also infected, which compromises the integrity of the vascular system and contributes to hemorrhagic symptoms (Tiffany, Vetter, Mattia, Dayer, & et al., 2016).

The high mortality rate associated with EVD is due to the combination of direct viral damage to organs and the host's dysfunctional immune response. Fatal cases often exhibit severe fluid and electrolyte imbalances, hypovolemic shock, and multi-organ failure.

CLINICAL PRESENTATION

The incubation period for Ebola virus typically ranges from 2 to 21 days, with most cases presenting symptoms between days 8 and 10 after exposure (Centers for Disease Control and Prevention [CDC], 2023). The clinical course of EVD is often divided into early, advanced, and late stages.

- **Early Stage:** Initial symptoms are non-specific and can resemble those of other endemic infections such as malaria, typhoid, or influenza. These symptoms include fever, severe headache, muscle pain, fatigue, and malaise (Brown et al., 2017). Gastrointestinal symptoms such as nausea, vomiting, diarrhea, and abdominal pain typically develop soon after the onset of fever, often leading to dehydration.
- **Advanced Stage:** As the disease progresses, patients may experience systemic manifestations including confusion, lethargy, and profound fatigue. Hemorrhagic manifestations, such as petechiae, ecchymosis, and bleeding from mucous membranes, can develop in about 30% to 50% of cases (Letafati et al., 2023). In severe cases, bleeding occurs from the gastrointestinal tract, gums, or puncture sites.
- **Late Stage:** In critical cases, multi-organ failure ensues. Acute kidney injury, liver damage (manifesting as jaundice), and respiratory distress are common in fatal cases (Tiffany et al., 2016). Neurological complications such as encephalopathy, seizures, and coma can also occur in the later stages of the disease (Billioux, Smith, & Nath, 2016).

Survivors of EVD frequently experience long-term complications, including post-Ebola syndrome, which is characterized by persistent joint and muscle pain, chronic fatigue, and ocular problems such as uveitis (Tiffany et al., 2016).

DIAGNOSIS

Timely diagnosis of EVD is crucial for effective isolation, treatment, and prevention of transmission. Diagnosis typically involves a combination of clinical evaluation and laboratory testing.

- **Clinical Evaluation:** A high index of suspicion is necessary for patients presenting with symptoms consistent with EVD, especially if they have epidemiological risk factors such as recent travel to an outbreak area or contact with confirmed cases (Ohuabunwo, Ameh, Oduyebo, Ahumibe, & et al., 2016).
- **Laboratory Testing:**
  - **Reverse Transcriptase Polymerase Chain Reaction (RT-PCR):** This test is the gold standard for confirming Ebola virus infection, as it detects viral RNA in the blood during the acute phase of the disease. RT-PCR can typically detect the virus within days of symptom onset, allowing for early diagnosis (CDC, 2023).
  - **Antigen Detection ELISA:** This test can detect viral proteins (antigens) in patient samples and is used as a rapid diagnostic test in field settings. It is less specific than RT-PCR but useful for rapid screening.
  - **Serological Testing:** Serological tests are used to detect antibodies (IgM, IgG) against the Ebola virus. These tests are typically used to confirm past infections or in late-stage disease when the viral load decreases (Brown et al., 2017).
- **Other diagnostic tests** include; liver and kidney function tests, coagulation profiles to assess bleeding risk, and imaging studies to evaluate organ damage. Early diagnosis is key to preventing transmission and initiating life-saving interventions.

TREATMENT

There is no specific antiviral treatment for Ebola virus infection approved for widespread use, but supportive care is the cornerstone of EVD management. Treatment aims to stabilize the patient and manage complications through the following interventions:

- **Fluid and Electrolyte Management:** Patients often experience significant fluid loss due to vomiting and diarrhea, leading to dehydration and electrolyte imbalances. Aggressive rehydration with intravenous fluids and electrolyte replacement is critical to maintaining hemodynamic stability (Letafati et al., 2023).
- **Oxygenation and Hemodynamic Support:** Patients with respiratory distress may require supplemental oxygen or mechanical ventilation. Blood pressure support with vasopressors may be needed in cases of septic or hypovolemic shock (Oleribe, Oladipo, Nwachukwu, & Abimbola, 2014).
- **Investigational Treatments:** Several experimental therapies have been developed and tested, particularly during the 2014-2016 West African outbreak. Two monoclonal antibody treatments, Inmazeb and Ebanga, have been approved for use in the treatment of EVD. These therapies have been shown to reduce mortality in patients when administered early in the course of the disease (WHO, 2021). Other investigational treatments include antiviral agents such as Remdesivir, which has demonstrated some efficacy in inhibiting viral replication (Brown et al., 2017).
- **Post-Ebola Syndrome Management:** For survivors, long-term follow-up is necessary to address lingering complications such as joint pain, chronic fatigue, and mental health issues (Tiffany et al., 2016). There is no specific antiviral treatment for EVD; supportive care remains the cornerstone of management. This includes intravenous fluids and electrolyte replacement. Recently developed monoclonal antibodies and vaccines have shown promise in clinical trials (Annual Review of Virology, 2019). The Ervebo vaccine has been approved for use against the Zaire strain of the virus (WHO, 2023).

PREVENTION

Prevention strategies are critical for controlling the spread of Ebola virus, especially in outbreak-prone regions. Prevention measures focus on minimizing human exposure to the virus and controlling transmission through effective public health interventions:

- **Vaccination**: The recombinant vesicular stomatitis virus-Zaire Ebola virus (rVSV-ZEBOV) vaccine has been a major breakthrough in preventing EVD. It has been deployed in mass vaccination campaigns targeting high-risk populations, including frontline healthcare workers and individuals in outbreak zones. The vaccine provides significant protection against the Zaire strain of the Ebola virus (Brown et al., 2017).
- **Infection Control Practices:** Strict infection control measures are necessary to prevent nosocomial transmission. Healthcare workers must use personal protective equipment (PPE), including gloves, masks, gowns, and face shields, when caring for patients with suspected or confirmed EVD

- (Ohuabunwo et al., 2016). Proper hand hygiene, sterilization of equipment, and safe disposal of medical waste are essential components of infection prevention.
- **Contact Tracing and Quarantine:** Early detection of EVD cases and contact tracing are vital to limiting the spread of the virus. Suspected cases should be isolated, and individuals who have had close contact with confirmed cases should be quarantined and monitored for symptoms for 21 days (CDC, 2023).
- **Safe Burial Practices:** The Ebola virus can persist in the bodies of deceased individuals, making burial practices a significant risk factor for transmission. Safe burial protocols include wearing PPE and handling the body in a way that minimizes exposure to bodily fluids (WHO, 2021).
- **Public Awareness and Education:** Community engagement and education are essential for preventing future outbreaks. Public health campaigns should focus on educating populations in high-risk areas about Ebola transmission, symptoms, and the importance of seeking medical care early (Ayenigbara, 2014).

COMPLICATIONS OF EBOLA VIRUS IN NIGERIA

Ebola Virus Disease is characterized by a range of clinical symptoms that may lead to severe complications. In Nigeria, as in other affected countries, complications varied depending on the severity of the infection.

1. **Neurological Complications:** Survivors of EVD in Nigeria reported significant neurological issues such as meningitis, encephalitis, and other brain-related illnesses. Studies indicate that the virus can infect and damage the central nervous system, leading to long-term neurological sequelae such as chronic headaches, seizures, and cognitive dysfunction (Billioux et al., 2016).
2. **Ocular Complications:** Another common complication among Ebola survivors in Nigeria was ocular problems, including uveitis (inflammation of the eye), which, if untreated, can lead to blindness. Studies from Sierra Leone, another West African nation, have indicated that persistent viral particles in the eye can result in vision impairment (Tiffany et al., 2016).
3. **Mental Health and Psychological Effects:** The Ebola outbreak also brought with it significant mental health challenges. The fear of infection, coupled with witnessing death on a large scale, caused post-traumatic stress disorder (PTSD), depression, and anxiety among survivors, families, and healthcare workers (Ayenigbara, 2014). The stigma attached to the disease further exacerbated these psychological issues, leaving survivors ostracized in many communities.

- **Physical Debilitation and Long-Term Health Effects:** Survivors in Nigeria, much like in other regions, experienced long-term physical debilitation. Chronic joint and muscle pain, fatigue, and weakness were common among patients who recovered from EVD, sometimes lasting months or even years. These complications severely impacted their ability to return to normal life and earn a livelihood (Moghadam et al., 2015).

PUBLIC HEALTH RESPONSE

The Nigerian government has implemented various strategies to combat EVD outbreaks. These include community education, contact tracing, and vaccination campaigns targeting high-risk populations (NCDC, 2022). The establishment of Ebola Treatment Units has been crucial in managing confirmed cases while preventing further transmission.

CURRENT CHALLENGES IN MANAGING EBOLA IN NIGERIA

Despite Nigeria's successful containment of the 2014 outbreak, several challenges continue to hinder effective management and preparedness for potential future outbreaks.

1. **Healthcare Infrastructure:** One of the major challenges Nigeria faced during the outbreak, and which remains relevant today, is the lack of an adequate healthcare infrastructure. While Nigeria managed to contain the outbreak in 2014, this success was largely due to the rapid international response and support (Ohuabunwo et al., 2016). The country's healthcare system remains underfunded and understaffed, which leaves it vulnerable to future outbreaks.
2. **Public Awareness and Education:** Despite the success of public awareness campaigns during the 2014 outbreak, there remains a challenge in ensuring sustained education and awareness about EVD. Misinformation, cultural beliefs, and distrust in the healthcare system continue to pose barriers to the successful management of infectious diseases like Ebola (Ayenigbara, 2014). Ensuring that the public understands the risks and prevention measures is vital to containing future outbreaks.
3. **Post-Ebola Syndrome and Survivor Care**: Nigeria continues to face challenges in caring for survivors who experience what is now called post-Ebola syndrome (PES). This syndrome refers to the array of lingering physical and psychological symptoms that persist after the virus has cleared from the body. The country lacks a robust system for follow-up care of Ebola survivors, and many patients have limited access to the medical and psychological support they need to recover fully (Vetter et al., 2016).

4. **Epidemiological Surveillance and Preparedness:** Nigeria's epidemiological surveillance system has improved since 2014 but remains underdeveloped in rural areas. Effective surveillance is critical for early detection and response to future outbreaks. Ensuring timely data collection, information sharing, and rapid response mechanisms is a continuous challenge for Nigerian health authorities. Any delays in identifying and isolating Ebola cases could lead to widespread transmission, especially in urban slums where living conditions make containment more difficult (Ohuabunwo et al., 2016).
5. **International Collaboration:** Nigeria's response to the Ebola outbreak in 2014 was bolstered by strong international cooperation. However, sustaining such partnerships and securing long-term financial and technical support for preparedness initiatives remain challenging (Moghadam et al., 2015). Future outbreaks may not always benefit from the same level of international intervention, making it crucial for Nigeria to invest in self-reliance.

CONCLUSION

The Ebola outbreak in Nigeria serves as a significant case study of how quick and decisive action can contain a potentially catastrophic public health crisis. Nigeria's success in 2014 was the result of a coordinated response that combined public health expertise, swift isolation measures, and international support. However, challenges remain in ensuring the country is better prepared for future outbreaks. The need for improved healthcare infrastructure, better public health education, and continued support for survivors is critical in mitigating the long-term impact of the virus also, continued investment in surveillance, research for effective treatments and vaccines, and community engagement are essential for controlling future outbreaks.
As the threat of emerging infectious diseases remains ever-present, Nigeria must build on the lessons learned from the Ebola crisis. The country's healthcare system needs stronger investment in disease surveillance, training, and healthcare resources to ensure it can respond effectively to future public health emergencies. Finally, care for survivors should become a national priority, as post-Ebola complications continue to affect the lives of those who survived the disease but are left battling its long-term effects.

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MONKEYPOX

MPOX VIRUS: A COMPREHENSIVE REVIEW AND ITS IMPACT IN NIGERIA.

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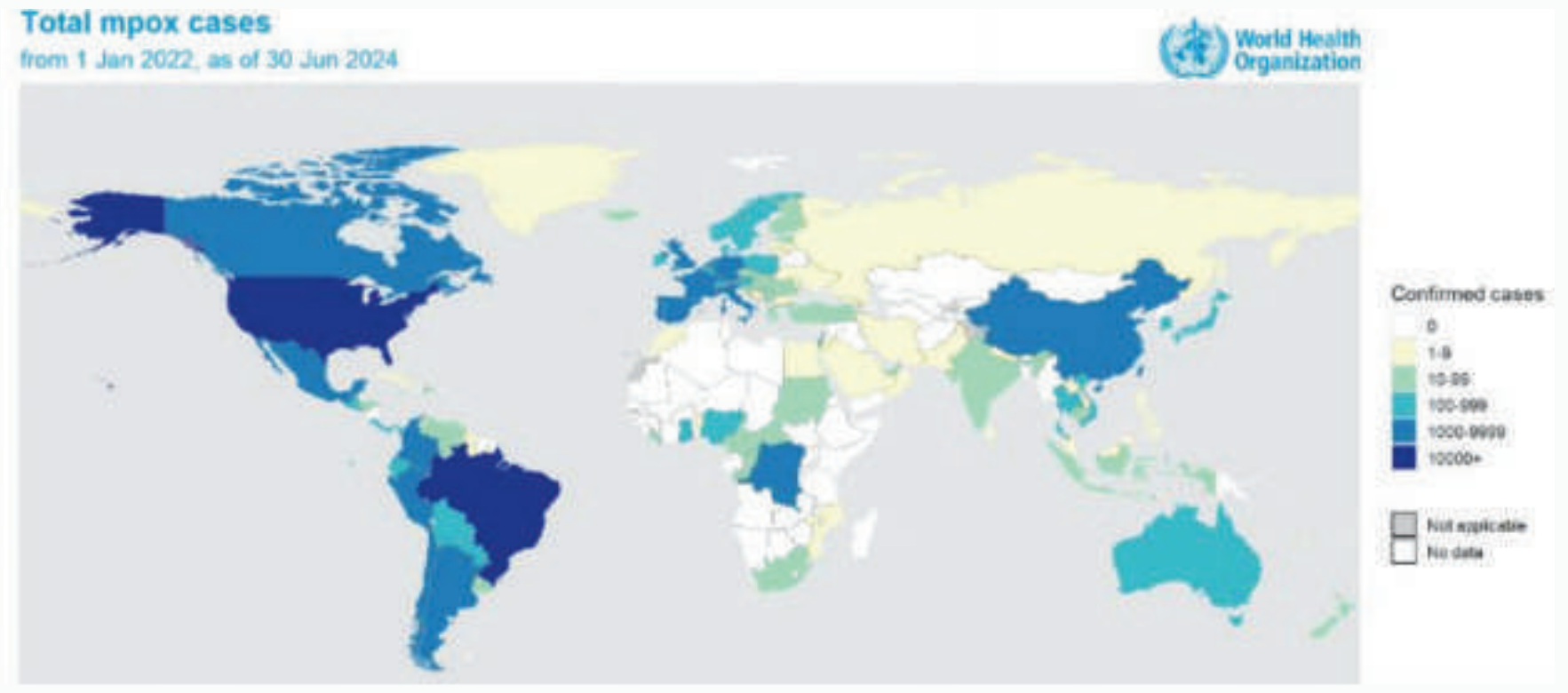
INTRODUCTION

Mpox is a viral zoonotic disease caused by the monkeypox virus (MPXV), a member of the Orthopoxvirus genus in the family Poxviridae. First discovered in 1958 in a colony of monkeys kept for research, the virus is primarily endemic in central and west Africa. However, recent outbreaks have brought Mpox to global attention, highlighting its potential as an emerging infectious disease of international concern. Recent data indicate an increase in cases, prompting public health concerns (WHO, 2022).

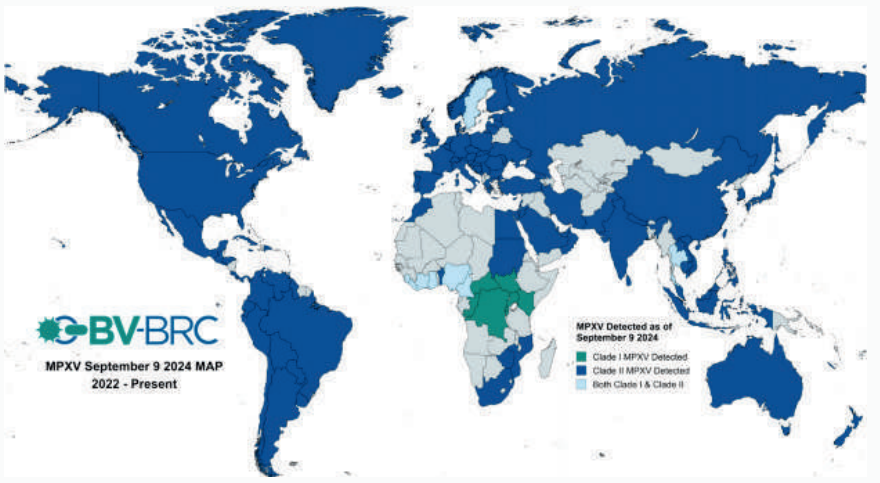
Mpox presents with symptoms similar to smallpox, albeit generally less severe. The disease typically begins with fever, headache, muscle aches, and exhaustion, followed by a characteristic rash. While historically confined to specific regions in Africa, the 2022 global outbreak demonstrated the virus's capacity for wider geographical spread, prompting renewed research and public health initiatives (CDC, 2022).

EPIDEMIOLOGY

Mpox has been endemic in several central and West African countries, including the Democratic Republic of the Congo, Nigeria, Cameroon, and the Central African Republic. Sporadic cases and outbreaks have occurred in non-endemic countries, usually linked to international travel or imported animals (Bunge et al., 2022).



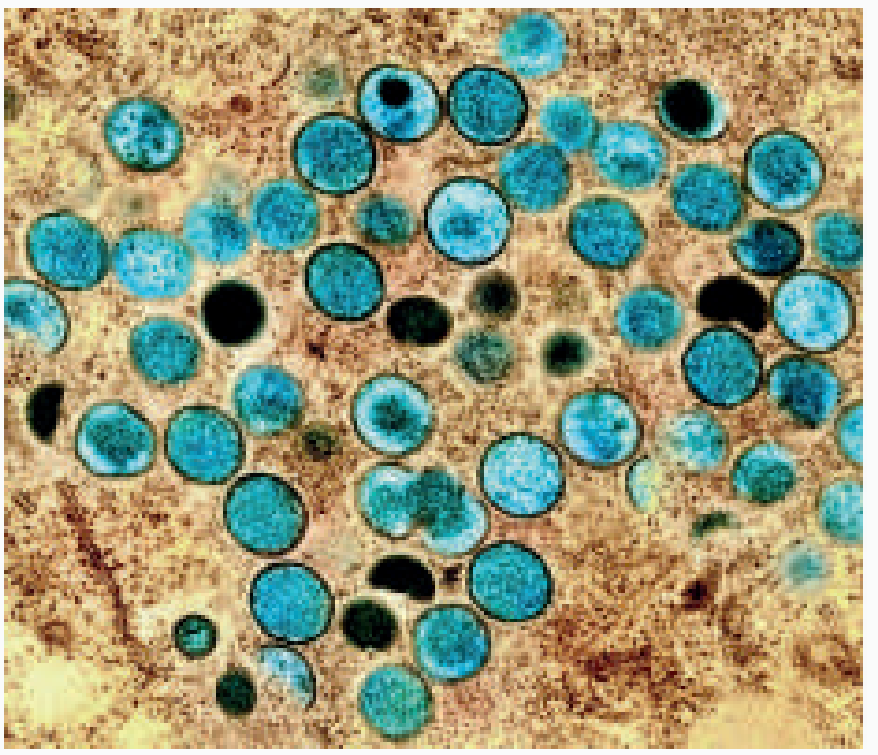
The 2022 global outbreak marked a significant shift in the epidemiology of monkeypox. Between January 1 and December 31, 2022, over 83,000 confirmed cases were reported from 110 countries, with the majority occurring in countries that had not historically reported Mpox (WHO, 2023). This outbreak highlighted the potential for sustained human-to-human transmission outside endemic regions.



As of August 2024, Nigeria reported 48 confirmed Mpox cases across 20 states, including the Federal Capital Territory, Abuja (AA News, 2024). The disease typically presents with mild symptoms such as fever and skin lesions, with recovery occurring within weeks. No fatalities have been recorded during the current outbreak (BBC News Pidgin, 2024).

AETIOLOGY

Monkeypox is caused by the Mpox virus, a double-stranded DNA virus belonging to the Orthopoxvirus genus. Two distinct genetic clades have been identified: the Central African (Congo Basin) clade and the West African clade. The West African clade, associated with milder disease, was responsible for the 2022 global outbreak (Alakunle et al., 2020).



The virus shares similarities with variola virus (which causes smallpox) and vaccinia virus (used in smallpox vaccines), explaining the cross-protection observed in individuals previously vaccinated against smallpox (Petersen et al., 2019).

TRANSMISSION

Mpox is transmitted through contact with infected animals or contaminated materials. Human-to-human transmission can occur via direct contact with lesions or respiratory droplets (Nature, 2024). Factors contributing to its spread include poverty and inadequate healthcare facilities (Okonkwo et al., 2023).
These various routes entails:

1. **Animal-to-human transmission:** This occurs through direct contact with the blood, bodily fluids, or cutaneous or mucosal lesions of infected animals. In Africa, evidence of Mpox virus infection has been found in many animals, including rope squirrels, tree squirrels, Gambian pouched rats, dormice, and different species of monkeys (WHO, 2022).

2. **Human-to-human transmission:** This can result from close contact with respiratory secretions, skin lesions of an infected person, or recently contaminated objects. Transmission via respiratory droplets typically requires prolonged face-to-face contact (CDC, 2022).

3. **Vertical transmission:** The virus can be transmitted from mother to fetus via the placenta, leading to congenital Mpox (Mbala et al., 2017).

During the 2022 outbreak, human-to-human transmission through close physical contact, particularly in sexual networks, emerged as a significant route of spread (Thornhill et al., 2022).

PATHOPHYSIOLOGY

Upon entry into the human body, the monkeypox virus initially replicates at the inoculation site. It then spreads to local lymph nodes before a primary viremia occurs, leading to viral spread to other organs. The virus has a particular tropism for skin and mucous membranes, explaining the characteristic rash (Nishiura, 2012).

The incubation period for Mpox is usually from 6 to 13 days but can range from 5 to 21 days. During this time, the virus evades the host's immune system through various mechanisms, including the production of immunomodulatory proteins that interfere with the host's interferon response (Hammarlund et al., 2005).

The development of skin lesions is a result of viral replication in epidermal cells, leading to cell death and inflammation. The progression of

these lesions through various stages (macules, papules, vesicles, pustules, and scabs) is a hallmark of the disease (McCollum & Damon, 2014).

CLINICAL PRESENTATION

The clinical presentation of Mpox typically occurs in two phases:

1. **Invasion Period (0-5 days):** Characterized by fever, intense headache, lymphadenopathy (swelling of lymph nodes), back pain, myalgia (muscle aches), and intense asthenia (lack of energy). Lymphadenopathy is a distinctive feature of Mpox compared to other diseases that may initially appear similar, such as chickenpox (WHO, 2022).

2. **Skin Eruption (within 1-3 days after onset of fever):** The rash tends to be more concentrated on the face and extremities rather than on the trunk. It affects the face (in 95% of cases), palms of the hands and soles of the feet (in 75% of cases). The rash evolves sequentially from macules (flat-based lesions) to papules (firm, raised lesions), vesicles (clear fluid-filled lesions), pustules (pus-filled lesions), and finally to crusts which dry up and fall off (CDC, 2022)

The number of lesions can vary from a few to several thousand. In severe cases, lesions can coalesce until large sections of skin slough off. Lesions in the mouth, genitalia, and eyes have also been reported (Adler et al., 2022).

The illness typically lasts for 2-4 weeks. The severity of illness can vary but is generally milder for the West African clade compared to the Congo Basin clade (Beer & Rao, 2019).

DIAGNOSIS

Accurate diagnosis of Mpox requires laboratory confirmation due to its similarity with other rash illnesses. The primary diagnostic methods include:

1. **Polymerase Chain Reaction (PCR):** This is the preferred laboratory test due to its accuracy and sensitivity. PCR blood tests are limited in their use because the virus is found in the blood only for a short duration at the onset of symptoms (WHO, 2022).

2. **Antigen and Antibody Detection Methods**: These can be used for diagnosis, but they're less accurate than PCR. They're more useful for surveillance and retrospective analysis of outbreak dynamics (CDC, 2022).

3. **Virus Isolation:** While it can provide additional information, this method is not recommended due to the high biosafety requirements (Petersen et al., 2019).

4. **Electron Microscopy:** This can be used to visualize the characteristic brick-shaped orthopoxvirus virions, but it cannot differentiate between orthopoxviruses (Li et al., 2021).

Clinical diagnosis can be challenging due to the similarity of Mpox with other rash illnesses such as chickenpox, measles, bacterial skin infections, scabies, syphilis, and medication-associated allergies. Lymphadenopathy during the prodromal stage of illness can be a clinical feature to distinguish Mpox from chickenpox or smallpox (WHO, 2022).

TREATMENT

Treatment for Mpox is primarily supportive, focusing on symptom management, complication prevention, and infection control. However, several antiviral treatments have shown promise:

1. **Tecovirimat:** Originally developed for smallpox, this antiviral has been approved for Mpox treatment in the European Union and has been used under an expanded access protocol in the United States (O'Laughlin et al., 2022).

2. **Brincidofovir and Cidofovir:** These antivirals have shown efficacy against poxviruses in vitro and in animal studies (Adler et al., 2022).

3. **Vaccinia Immune Globulin Intravenous (VIGIV):** This may be considered for severe cases, although its efficacy against Mpox has not

PREVENTION

Prevention strategies for Mpox include:

1. **Vaccination:** The smallpox vaccine is about 85% effective in preventing Mpox. There are currently two vaccines available for mpox, which are recommended by WHO's Strategic Advisory Group of Experts on Immunization. These vaccines are also approved by WHO-listed national regulatory authorities and individual countries, including Nigeria and the Democratic Republic of Congo. The vaccine can be administered before exposure (pre-exposure prophylaxis) or after contact with someone who has mpox (post-exposure prophylaxis). If given after exposure, the vaccine should be administered within 4 days of contact.

2. **Isolation of Infected Individuals:** People with Mpox should be isolated until all lesions have crusted, scabs have fallen off, and a fresh layer of skin has formed underneath (CDC, 2022).

3. **Personal Protective Equipment (PPE):** Healthcare workers and others in close contact with infected individuals should use appropriate PPE, including gowns, gloves, eye protection, and respiratory protection (WHO, 2022).

4. **Avoiding Animal Reservoirs:** In endemic areas, avoid contact with animals that could harbor the virus, particularly sick or dead animals in areas where Mpox occurs (Beer & Rao, 2019).

5. **Public Health Measures:** These include contact tracing, surveillance, and public education about transmission routes and symptoms (Bunge et al., 2022).

COMPLICATIONS AND LONG-TERM EFFECTS

While most cases of Mpox are self-limiting, complications can occur, especially in individuals with compromised immune systems, children, and pregnant women. Potential complications include:

1. **Secondary Bacterial Infections:** These can occur at the sites of skin lesions and may require antibiotic treatment (McCollum & Damon, 2014).
2. **Pneumonia:** Viral pneumonitis can occur, particularly in severe cases (Adler et al., 2022).
3. Encephalitis: Though rare, inflammation of the brain has been reported in some cases (Ogoina et al., 2020).
4. **Corneal Scarring and Vision Loss:** Eye involvement can lead to long-term visual impairment (Mbala et al., 2017).
5. **Sepsis:** In severe cases, particularly with the Congo Basin clade, sepsis can occur and may be life-threatening (Beer & Rao, 2019).

The long-term effects of Mpox are still being studied. Some patients report persistent fatigue and mental health impacts, similar to other infectious diseases. Scarring from skin lesions can also have long-term psychological effects (Adler et al., 2022).

PUBLIC HEALTH RESPONSE

The Nigerian government has implemented several measures to control the outbreak, including vaccination campaigns and health education initiatives. A shipment of 10,000 vaccine doses was received from the U.S. to aid in containment efforts (AA News, 2024). The Nigeria Centre for Disease Control (NCDC) has activated emergency response protocols and established treatment centers in affected regions (NCDC, 2022).

CURRENT CHALLENGES AND FUTURE DIRECTIONS

The global outbreak of Mpox in 2022 highlighted several challenges and areas for future research:

1. **Surveillance and Early Detection:** Improving global surveillance systems to detect and respond to outbreaks quickly is crucial (Bunge et al., 2022).

2. **Vaccine Equity and Distribution:** Ensuring equitable access to vaccines, particularly in endemic regions, remains a challenge (WHO, 2023).

3. **Antiviral Development:** While some antivirals show promise, more research is needed to develop and test treatments specifically for Mpox (O'Laughlin et al., 2022).

4. **Understanding Transmission Dynamics:** The 2022 outbreak revealed new transmission

patterns, particularly among sexual networks. Further research is needed to understand these dynamics fully (Thornhill et al., 2022).

5. **Stigma Reduction:** Efforts are needed to reduce the stigma associated with Mpox, which can hinder testing and treatment-seeking behaviors (WHO, 2022).

6. **One Health Approach:** Given the zoonotic nature of Mpox, a One Health approach that considers human, animal, and environmental health is crucial for prevention and control (Alakunle et al., 2020).

7. **Climate Change Impact:** As climate change alters ecosystems, the potential for increased human-animal contact and changes in the geographic range of animal reservoirs needs to be studied and addressed (Petersen et al., 2019).

CONCLUSION

Mpox, once considered a rare tropical disease, has emerged as a global public health concern. The 2022 outbreak demonstrated the virus's potential for sustained human-to-human transmission outside endemic regions, highlighting the need for continued vigilance, research, and global cooperation. While significant progress has been made in understanding and managing Mpox, challenges remain in surveillance, treatment, and prevention. As the world becomes increasingly interconnected, addressing these challenges will be crucial in mitigating the impact of Mpox and other emerging infectious diseases.

While Mpox remains a public health challenge in Nigeria, ongoing efforts to enhance surveillance and vaccination are crucial for controlling its spread. Continued collaboration among health agencies and communities will be essential for effective management.

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CONCLUSION

In conclusion, breastfeeding is a very important part of childhood life and its importance cannot be overemphasized since its benefits to mother and child are so numerous, providing essential nutrients, promoting emotional bonding, and supporting long-term health. Breastfeeding is not only natural and cost-effective, but it has a way to nourish infants and also contributes to the well-being of families and communities. Certain challenges may arise, but with proper support, education, and societal changes, breastfeeding can become a more accessible and normalized practice. Skilled counseling and support should be provided prenatally and post-partum to all mothers to prevent and address self-reported insufficient milk and avert the introduction of pre-lacteal feeds or commercial milk formula (CMF) early on because they are major risk factors for the premature termination of exclusive breastfeeding and any breastfeeding. Health professionals, mothers, families, and communities must be provided with better educational support and skill development, free from commercial influence, to understand unsettled baby behaviors as an expected phase of human development. Society encouraging a breastfeeding-friendly environment benefits everyone, ensuring that mothers can provide the best start for their babies' lives.

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MALARIA

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INTRODUCTION

Malaria is a life-threatening disease caused by parasites of the genus Plasmodium, transmitted to humans through the bite of infected female Anopheles mosquitoes. Despite considerable progress in reducing its prevalence, malaria remains a major global health burden, particularly in tropical and subtropical regions. (WHO 2022)

Global Epidemiology:

Malaria affects approximately 241 million people worldwide, with most cases occurring in sub-Saharan Africa. Other regions affected include Southeast Asia, South America, and parts of the Middle East. The disease is endemic in 87 countries, putting nearly half of the world's population at risk. (WHO 2022)

In 2021, malaria caused an estimated 627,000 deaths globally, with over 75% of these deaths occurring in children under the age of five. The African region bears the highest malaria mortality burden, accounting for about 95% of deaths worldwide.

The five species of Plasmodium that cause malaria in humans are:

- Plasmodium falciparum (most deadly and most prevalent in Africa).
- Plasmodium vivax (common in Asia and Latin America).
- Plasmodium malariae.
- Plasmodium ovale.
- Plasmodium knowlesi (primarily in Southeast Asia).

Mode of Transmission: Malaria is transmitted primarily by the bite of infected Anopheles mosquitoes, which thrive in warm, humid environments. Transmission is higher in areas with standing water, where mosquitoes breed.
The groups most at risk for severe malaria include:

- Children under five: They account for the majority of malaria deaths due to their lack of immunity.
- Pregnant women: Malaria during pregnancy can lead to maternal anemia, stillbirth, low birth weight, and infant mortality.
- People with compromised immunity: HIV-positive individuals or those living in areas with unstable transmission are at greater risk for severe disease.
- Travelers: Non-immune individuals traveling to endemic areas are highly susceptible to malaria.

Endemicity of Malaria

WHO classified Malaria endemicity based on the spleen rate in children aged 2-9 years. The spleen rate is the number of palpable enlarged spleens per 100 individuals of similar age. Based on this, we have the following classifications:

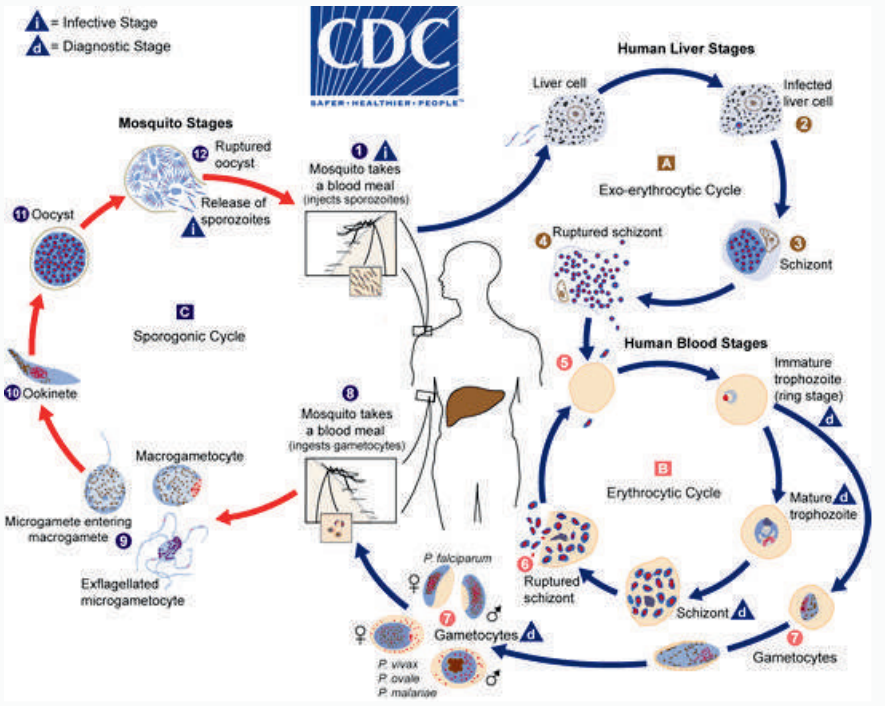
- Hypo endemic -Spleen and parasite rates 1–10%
- Mesoendemic - Spleen rates 11–50%, parasite rates <20%
- Hyperendemic – Spleen and parasite rates constantly > 50% but <70%
- Holoendemic – Spleen and parasite rates constantly > 70%

High Transmission Areas (>1 case/1000 population): Areas with high transmission

occurring throughout the year although there may be marked seasonal variation (Stable malaria). Older children and adults living in these areas may be less likely to have severe disease. This is the prevailing transmission condition for Holoendemic and Hyperendemic levels of endemicity.

Low Transmission Areas (< 1 case/1000 population): There is an intermittent transmission that may be annual, bi-annual, or variable (Unstable malaria). All strata of the population are subject to malaria during transmission seasons. The prevailing condition for hypoendemicity and meso-endemicity. Some of such places have significant implications for resistance

Epidemic Malaria: Periodic or occasional sharp increase of malaria in a given Indigenous community



LIFE CYCLE OF THE MALARIA PARASITE (source: CDC)

- Definitive host: Female Anopheles mosquitoes
- Intermediate host: Man

Asexual cycle

- Sporozoites are released into the blood, and carried to the liver
- Liver cycle (pre or exoerythrocytic cycle): Sporozoites transform into trophozoites Pre-erythrocytic schizont undergoes schizogony to produce merozoites.
- Merozoites infect RBCs transform to early trophozoites (ring form) late trophozoites erythrocytic schizont undergoes schizogony to produce merozoites.
- Release of merozoites leads to the appearance of clinical manifestations.
- Merozoites either attack RBCs to repeat the cycle or transform into gametocytes which infect mosquitoes.

Sexual cycle (Sporogony):

- Begins when gametocytes infect the female anopheles mosquito and then transform to gametes zygote ookinete (penetrates the gut wall) oocyst sporozoites (goes to salivary wall).

SEVERE MALARIA

Parasite biomass:

Plasmodium falciparum can invade red blood cells (RBCs) of all ages, leading to exponential parasite growth and high infection levels if untreated. In contrast, Plasmodium vivax targets only young RBCs, limiting its ability to multiply. Early cytokine responses help control infection, but if unchecked, excessive cytokines lead to immune complications, causing reduced oxygen use, impaired red cell function, and upregulation of adhesion molecules like ICAMs, especially in the brain and placenta. This imbalance can result in severe conditions like cerebral malaria. Additionally, P. falciparum-infected RBCs become rigid and adhesive, causing them to stick to blood vessel walls (cytoadherence) and form rosettes with uninfected RBCs, leading to microvascular obstruction and organ damage in the brain, heart, lungs, liver, and placenta.

- **Invasion:**
  - **Adhesion**: Parasites use surface proteins to attach to host cells.
  - **Penetration**: They breach host barriers via mechanical means or by secreting enzymes.
  - **Cellular Uptake:** Some induce host cells to engulf them.
- **Replication:**
  - **Asexual Reproduction:** Many replicate through binary fission or multiple fission.
  - **Sexual Reproduction:** Some reproduce sexually, producing eggs or larvae.
  - **Resource Utilization:** Parasites hijack host nutrients and machinery for growth.
- **Host Evasion:**
  - **Antigen Variation:** They change surface proteins to avoid immune detection.
  - **Immune Modulation:** Parasites can suppress host immune responses.
  - **Physical Barriers:** Some form protective structures or biofilms.
  - **Latency:** Many enter dormant states to evade surveillance.

CLINICAL MANIFESTATION OF MALARIA

- **Simple/Uncomplicated malaria:** This is symptomatic infection with malaria parasitemia without evidence of vital organ dysfunction. The main manifestations of malaria in this group include fever, chills, rigors, headaches, and body pains. Others are malaise, nausea, vomiting, and joint weakness.

Severe/Complicated malaria: Severe malaria is defined as one or more of the following clinical

and laboratory features, occurring in the absence of an identified alternative cause and in the presence of P. falciparum parasitemia.

CLINICAL FEATURES OF SEVERE MALARIA

- Impaired consciousness or unrousable coma
- Prostration, i.e. generalized weakness so that the patient is unable to walk or sit up without assistance
- Multiple convulsions – more than two episodes in 24 h
- Deep breathing, respiratory distress (acidotic breathing)
- Circulatory collapse or shock, systolic blood pressure < 70 mm Hg in adults and < 50 mm Hg in children
- Clinical jaundice plus evidence of other vital organ dysfunction
- Haemoglobinuria
- Abnormal spontaneous bleeding
- Pulmonary edema (radiological)

LABORATORY FINDINGS:

- Hypoglycaemia (blood glucose < 2.2 mmol/l or < 40 mg/dl)
- Metabolic acidosis (plasma bicarbonate < 15 mmol/l)
- Severe normocytic anaemia (Hb < 5 g/dl, packed cell volume < 15%)
- Haemoglobinuria
- Hyperparasitaemia (> 2%/100 000/µl in low-intensity transmission areas or > 5% or 250 000/µl in areas of high stable malaria transmission intensity)
- Hyperlactataemia (lactate > 5 mmol/l)
- Renal impairment (serum creatinine > 265 µmol/l).

PROGNOSIS:

- **Simple Malaria Recovery**: Generally good with prompt treatment. Most patients recover within a few days to weeks.
- **Severe Malaria (**Clinical indicators)
  - Very young children (age under 3 years)
  - Deep coma
  - Respiratory distress (acidosis)
  - Papilloedema and/or retinal oedema

Laboratory indicators

  - Hyperparasitaemia (>250 000/µl or >5%)
  - Age distribution of the parasite at admission (>20% trophozoites or schizonts)
  - Blood glucose less than 2.2 mmol/l (<40 mg/dl)
  - Very high plasma concentrations of tumor necrosis factor (TNF)

DIAGNOSIS OF MALARIA

a. microscopic examination
b. Non microscopic test

Microscopic examination

This involves the staining and direct visualization of the parasite under the microscope.

- **Quantitative buffy coat (QBC) tests:** a new technique for fast malaria diagnosis. Consists of mixing blood with acridine orange and then centrifuging in a capillary tube which is read directly with a fluorescent microscopy

- **Peripheral smear study:** Giemsa or Leischman-stained smears of peripheral blood [Gold standard]. Both thick & thin smears should be examined.
  - **Thick film:** Identifies degree of parasitisation.
  - **Thin film:** Identify the Plasmodium species.

A single negative blood smear does not exclude malaria. Repeat smears may be required.

Degree of Parasitaemia

Malaria severity is classified based on parasitaemia, or the density of parasites in the blood:

- **Mild Parasitaemia:** Fewer than 10,000 parasites/µL. Symptoms are mild, and patients typically respond to oral treatment.
- **Moderate Parasitaemia:** 10,000–100,000 parasites/µL. Symptoms worsen, and closer monitoring is required.
- **Severe Parasitaemia:** Over 100,000 parasites/µL, often leading to complications like cerebral malaria or organ failure. Immediate intravenous therapy and intensive care are needed.

Non-microscopic test

These tests involve the identification of the parasitic antigen or the anti-plasmodial antibodies or the parasitic metabolic products. They include:

- Rapid Diagnostic tests
- Polymerase Chain Reaction
- Detection of antibodies by Radioimmunoassay, immunofluorescence or enzyme immunoassay

Rapid Malaria Tests (RDTs)

Three antigens were utilized:

1. **Histidine-rich protein-2 detection test kit:**
This is a dipstick antigen capture assay, using a monoclonal antibody against P. falciparum histidine-rich protein-2 (PFHRP-2). It is rapid, sensitive, and specific for Falciparum PFHRP-2 is produced by the asexual stages and gametocytes of P. falciparum). A potential problem with the

dipstick test is that the circulating antigen will be detectable for many days even after the elimination of viable P. falciparum from the blood stream. A positive test may not always indicate an active infection

2. **Plasmodium lactate dehydrogenase test**

- This is a rapid malaria detection test which

utilizes a dipstick coated with monoclonal antibodies against the intracellular metabolic enzyme parasite lactate dehydrogenase (pLDH).

- Differentiation of malaria parasites is based on antigenic differences between the pLDH isoforms
- Since pLDH is produced only by live Plasmodium parasites, this test can differentiate live from dead organisms

3**. Plasmodium Aldolase**

- Plasmodium aldolase is an enzyme of the parasite glycolytic pathway expressed by the blood stages of P. falciparum as well as non-falciparum parasites
- Monoclonal antibodies against plasmodium aldolase are pan-specific in their reaction

Polymerase chain reaction

The polymerase chain reaction (PCR) uses enzymes to mass replicate a portion of a deoxyribonucleic acid (DNA) strand for easier analysis, such as searching for genes of interest.
The polymerase chain reaction (PCR) is used to make huge numbers of copies of a piece of DNA.
This technique allows for the detection of particular species of the malaria parasite thus facilitating the differentiation of recrudescence from reinfection in monitoring efficacy of anti-malarial drugs.

Detection of Antimalarial antibodies

Malarial antibodies can be detected by immunofluorescence or enzyme immunoassay. It is useful in epidemiological surveys, for screening potential blood donors, and occasionally for providing evidence of recent infection in non-immunes.

In the future, the detection of protective antibodies will be important in assessing the response to malaria vaccines.

Challenges in Malaria Diagnosis

- Reliance on high skills, electricity, waiting time for results, unavailable in remote rural areas, subjectivity, lack of QA, etc
- Overdiagnosis of malaria
- Poor malaria microscopy skills & reporting
- Detection of low-density parasitemia: false negatives
- High dependence on clinical diagnosis of febrile illness
- Varied performance of Malaria RDTs

MALARIA TREATMENT

- Specific measures – antimalarial drugs
- General – supportive measures:
  - Antipyretic agents
  - Rehydration – oral or IV
  - Blood transfusion
  - Anti-emetics and feeding
- Treatment of associated conditions

TREATMENT OF UNCOMPLICATED MALARIA

1. Artemisinin-based Combination Therapy (ACT)

ACT is the first-line treatment for **uncomplicated Plasmodium falciparum malaria**, the most dangerous species. ACT combines an artemisinin derivative with a partner drug to prevent resistance and ensure rapid parasite clearance.
Common ACT combinations:

- Artemether-lumefantrine (AL): Commonly used, administered twice daily for three days.
- Artesunate-amodiaquine (ASAQ): An alternative in some regions, given once daily for three days.
- Dihydroartemisinin-piperaquine (DHA-PPQ): Administered once daily for three days, often used in Southeast Asia and some African countries.

Note: ACT is recommended for all forms of uncomplicated P. falciparum malaria except in cases where specific drug resistance is known.

2. Chloroquine or ACT for Plasmodium vivax and Plasmodium ovale

- Chloroquine remains the first-line treatment in regions where P. vivax is sensitive to it. It is typically given for three days.
- Where chloroquine resistance is present (e.g., in parts of Southeast Asia and Oceania), ACT (commonly artemether-lumefantrine) is used.

In Nigeria, the commonly used ACT is Artemether-Lumefantrine supplied in fixed-dose combination tablets containing 20 mg artemether and 120 mg lumefantrine

Adult dose:

- Six-dose regimen:
  - first day: 4 tablets initially, then 4 tablets 8 hours later
  - second day: 4 tablets 2x daily
  - third day: 4 tablets 2x daily

Pediatric dose:

Several tablets per dose taken according to the adult schedule depending on the patient's weight:

- 5-14 kg: 1 tablet
- 15-24 kg: 2 tablets

- 25-34 kg: 3 tablets
- >35 kg: 4 tablets

TREATMENT OF SEVERE MALARIA

1-Artesunate
Available in the United States from the CDC through an IND protocols.
Adult dose:
Intravenous: artesunate, 2,4 mg/kg, then 2.4 mg/kg at 12, 24, and 43 hours.
Pediatric dose:
Intravenous: for children >20 kg, same dosing as adults; for children €20 kg use 3.0 mg/ kg at 0, 12, 24, and 48 hours

2-**Artemether**
Adult dose:
Intramuscular: artemether, 3.2 mg/kg on the first day then 1.6 mg/kg daily for 4 days
Pediatric dose:
Intramuscular: same dosing as for adults.

SUPPORTIVE CARE

- Fluid and Electrolyte Management
  - Patients with severe malaria are often hypovolemic, but aggressive fluid administration should be avoided due to the risk of pulmonary edema
  - Use isotonic fluids (e.g., normal saline) with careful monitoring of urine output and hemodynamic status.

- **Blood Transfusions**

Severe anemia hemoglobin <5 g/dL or hematocrit <15%) is common in complicated malaria. Blood transfusion is indicated in cases of severe anemia or significant blood loss.

- **Antipyretics**

paracetamol is used to reduce high fever and alleviate discomfort. Avoid non-steroidal anti-inflammatory drugs (NSAIDs) due to the risk of gastrointestinal bleeding.

- **Anticonvulsants**

Seizures are common in cerebral malaria. Benzodiazepines (e.g., diazepam or lorazepam) are used to control seizures, and phenobarbital may be given for seizure prophylaxis in high-risk cases.

- **Management of Hypoglycaemia**

Hypoglycaemia is common, especially in patients treated with quinine or children. Regular monitoring of blood glucose levels and administration of IV glucose when needed are essential

- **Respiratory Support**

Patients with acute respiratory distress syndrome (ARDS) or severe respiratory complications may require oxygen therapy or mechanical ventilation.

MANAGEMENT OF COMPLICATIONS

Cerebral Malaria
Cerebral malaria, characterized by altered consciousness or coma, requires immediate treatment with IV artesunate and supportive care, including managing seizures and intracranial pressure.

Renal Failure
Acute kidney injury (AKI) may occur, requiring careful fluid balance and, in severe cases, dialysis.

Metabolic Acidosis
Metabolic acidosis can occur due to lactic acid buildup from tissue hypoxia. Treatment focuses on correcting underlying hypovolemia and oxygenation.

Coagulopathy
Severe malaria can lead to disseminated intravascular coagulation (DIC). Monitoring coagulation status and treating with fresh frozen plasma or platelets when necessary is crucial.

SWITCHING TO ORAL THERAPY

- After 24–48 hours of parenteral treatment (once the patient is stable and can tolerate oral medications), switch to oral ACT to complete the course of therapy.
- For P. falciparum, a 3-day ACT regimen is used.

MALARIA IN SPECIAL GROUPS – IMMUNOCOMPROMISED, CHILDREN, PREGNANCY, ELDERLY

In Nigeria, malaria presents a significant public health challenge, particularly affecting vulnerable groups such as immunocompromised individuals, children, pregnant women, and the elderly. These groups are more susceptible to severe outcomes due to the physiological or immunological factors that impair their ability to combat the malaria parasite effectively.

Immunocompromised Individuals

In individuals with weakened immune systems, such as those living with HIV/AIDS, malaria can lead to more severe complications, including higher parasitemia levels and increased risk of treatment failure. The immunosuppressed state reduces the body's capacity to mount an effective immune response against Plasmodium falciparum, leading to more prolonged and intense infections. Co-infection with HIV further complicates the clinical management of malaria, requiring integrated care approaches to address both conditions effectively (Adeleke & Afolabi, 2020).

Children

Children under five years old are particularly vulnerable to malaria due to their underdeveloped immune systems. In Nigeria, malaria remains the leading cause of morbidity and mortality in this age group, with a substantial proportion of deaths resulting from severe complications such as cerebral malaria and severe anaemia (World Health Organization [WHO], 2022). Malaria control efforts targeting children, including the use of insecticide-treated nets (ITNs) and intermittent preventive treatment in infants (IPTi), are critical in reducing this burden.

Pregnant Women

Pregnancy significantly increases the risk of malaria due to immunological changes that reduce a woman's resistance to infections. Pregnant women in malaria-endemic regions like Nigeria are at higher risk for complications such as anemia, miscarriage, and low birth weight in newborns. Malaria during pregnancy also increases maternal mortality. The World Health Organization recommends intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine as an essential intervention to protect both the mother and fetus from the harmful effects of malaria (Okafor et al., 2021).

Elderly

While malaria predominantly affects younger populations, the elderly are not immune to its effects. Age-related immune senescence can reduce the ability of older individuals to fight off infections. In Nigeria, elderly individuals with chronic conditions such as diabetes or cardiovascular disease are at a heightened risk of severe malaria and complications, including acute respiratory distress syndrome (ARDS) and renal failure (Adediran & Adeoye, 2019).

Congenital malaria

Congenital malaria occurs when malaria parasites are transmitted from a pregnant woman to her fetus, either transplacentally or during childbirth. Neonatal malaria is the occurrence of malaria in a newborn within the first few weeks of life, typically acquired either congenitally or through mosquito bites after birth.

Symptoms in neonates usually appear within the first few days to a few weeks after birth and may include fever, poor feeding, irritability, lethargy, pallor, hepatosplenomegaly (enlarged liver and spleen), and jaundice. In severe cases, the neonate may develop complications such as anemia, respiratory distress, or hypoglycemia.

The treatment of congenital and neonatal malaria must be prompt and appropriate, as delays in treatment can lead to severe complications, including death.

Uncomplicated Congenital and Neonatal Malaria
The World Health Organization (WHO) recommends the use of artemisinin-based combination therapies (ACTs) for the treatment of uncomplicated malaria. However, for neonates and infants under 5 kg, artesunate, amodiaquine, or quinine can be used, depending on availability and drug tolerance.

Artesunate-Amodiaquine: This combination is commonly used in Nigeria for neonatal malaria. The dosing must be carefully calculated based on the neonate's weight. **Artesunate component:** 4 mg/kg per day for 3 days. **Amodiaquine component:** 10 mg/kg per day for 3 days.

Severe Congenital and Neonatal Malaria

- Intravenous (IV) Artesunate: This is the recommended treatment for severe malaria in neonates. IV artesunate is preferred due to its rapid action and low toxicity. Dosage: 2.4 mg/kg of body weight per dose. Administered at 0 hours, 12 hours, and 24 hours, then once daily until the patient can tolerate oral medication.
- Intravenous Quinine: Quinine can be used if artesunate is unavailable. Close monitoring is required due to potential side effects, including hypoglycemia, which is common in neonates.
- Supportive Care: In cases of severe malaria, supportive care is crucial. This includes treating complications such as hypoglycemia, anemia, respiratory distress, and jaundice. Blood transfusions may be needed for severe anemia.

Prevention of Congenital and Neonatal Malaria

- **Malaria Prevention in Pregnancy:** Preventing malaria in pregnant women is the key to preventing congenital malaria. Interventions include:
  - **Intermittent Preventive Treatment in Pregnancy (IPTp):** The use of sulfadoxine-pyrimethamine (SP) for IPTp is recommended for all pregnant women in malaria-endemic regions, including Nigeria. This treatment helps reduce the risk of maternal malaria, placental infection, and congenital malaria.
  - **Insecticide-Treated Bed Nets (ITNs)**: Pregnant women should sleep under ITNs to prevent mosquito bites and reduce the risk of malaria transmission.
  - **Early Diagnosis and Treatment:** Prompt diagnosis and treatment of malaria in pregnancy are essential to

- prevent complications that can lead to congenital malaria.

- **Postnatal Preventive Measures:**
  - Insecticide-Treated Bed Nets for Newborns: Newborns should be protected from mosquito bites by sleeping under ITNs.
  - Health Education: Educating mothers and caregivers on the importance of malaria prevention strategies, such as

the use of bed nets is crucial in reducing the incidence of neonatal malaria.

PREVENTION AND CONTROL STRATEGIES

1. Vector Control Strategies: Insecticide-treated nets (ITNs) and Indoor Residual Spraying (IRS)

Insecticide-treated nets (ITNs) and indoor residual spraying (IRS) are two of the most effective vector control strategies employed in Nigeria. ITNs, when properly used, can reduce malaria transmission by providing a physical barrier and killing mosquitoes that come into contact with the insecticide. The large-scale distribution of ITNs in Nigeria has been linked to significant declines in malaria incidence, particularly in rural areas (National Malaria Elimination Programme [NMEP], 2020).

IRS involves the spraying of long-lasting insecticides on the walls and ceilings of homes to kill mosquitoes that rest indoors. This strategy has proven effective in reducing malaria transmission, especially in areas with high transmission rates. In Nigeria, the IRS has been implemented in certain high-burden states, although the sustainability of this approach is challenged by financial and logistical constraints (WHO, 2022).

2. Chemoprophylaxis in High-Risk Populations

Chemoprophylaxis, the use of medication to prevent malaria, is particularly important for high-risk groups, including travelers, pregnant women, and children in highly endemic regions. In Nigeria, chemoprophylaxis with drugs like atovaquone-proguanil or mefloquine is recommended for non-immune travelers. For pregnant women, IPTp remains the cornerstone of prevention, helping to reduce the incidence of maternal malaria and associated complications (Okafor et al., 2021). Additionally, seasonal malaria chemoprevention (SMC) has been successfully implemented in northern Nigeria, significantly reducing malaria cases among children under five (NMEP, 2020).

3. Vaccines for Malaria Prevention: Developments and the Role of RTS, S/AS01

The RTS, S/AS01 malaria vaccine represents a significant breakthrough in malaria prevention. It is the first vaccine to show partial protection against Plasmodium falciparum malaria in young children. In Nigeria, the introduction of this vaccine could be a game-changer, especially in regions with high transmission rates. While the vaccine does not provide complete immunity, clinical trials have shown that it can reduce severe malaria cases by 30% to 40% when administered alongside other malaria control measures, such as ITNs and chemoprophylaxis (Olotu et al., 2022).

4. Public Health Campaigns and Education in Endemic Areas

Public health campaigns play a crucial role in educating communities about malaria prevention and control. In Nigeria, awareness campaigns led by the Ministry of Health and non-governmental organizations (NGOs) focus on promoting the use of ITNs, encouraging early treatment-seeking behavior, and emphasizing the importance of environmental management to reduce mosquito breeding sites (NMEP, 2020). School-based programs also educate children on malaria prevention, fostering long-term behavioral changes in malaria-endemic communities.

5. Role of Community Health Workers in Early Detection and Treatment

Community health workers (CHWs) are vital to malaria control efforts in Nigeria, particularly in rural and hard-to-reach areas. CHWs are often the first point of contact for individuals with malaria symptoms, playing a crucial role in early detection, treatment, and referral. They are trained to diagnose malaria using rapid diagnostic tests (RDTs) and administer artemisinin-based combination therapy (ACT) as first-line treatment. Their involvement has significantly improved access to timely and effective malaria care, particularly in underserved populations (Ajayi et al., 2019).

CHALLENGES IN MALARIA CONTROL AND ELIMINATION

1. **DRUG RESISTANCE: MECHANISMS AND THE EMERGENCE OF ARTEMISININ-BASED COMBINATION THERAPY (ACT)-RESISTANT P. FALCIPARUM.**

Emergence
ACT resistance was first reported in 2008 in Western Cambodia which spread to neighboring countries (Thailand, Myanmar, Laos), and is now detected in Africa, Asia, and South America.

Mechanisms

A. **Mutations in the propeller domain of the Kelch family protein, PfKelch13 gene (K13) leads to partial resistance of ACT**. Artemisinin (ART) as a pro-drug is primarily activated by heme derived from hemoglobin catabolism in the food vacuole which can react with a variety of cellular targets such as encoding Kelch protein on the parasite's ER so it can regulate unfolded protein response and generate ROS to disrupt cellular protein homeostasis. The molecular mechanisms of K13-mediated ART resistance involve reduced Hb uptake/digestion and increased cellular stress response by disrupting UPR and decreasing ROS-mediated damage.

Mutations in other genes such as AP-2μ (adaptor protein-2 μ sub-unit), UBP-1 (ubiquitin-binding protein-1), and Falciparum 2a that interfere with hemoglobin uptake and digestion also increase resistance to ARTs. ART resistance has facilitated the development of resistance to the partner drugs, resulting in rapidly declining ACT efficacy.

B. Amplification of the PfMDR1 gene leads to multi-drug resistance. PfMDR1 gene codes for P-glycoprotein homolog 1(PGH1) which acts as an efflux pump for antimalarial drugs. Amplification of the gene will lead to over-expression of the PGH1 protein causing enhanced efflux of antimalarial drugs resulting in reduced intracellular drug concentration and consequently, decreased drug efficacy.

The **molecular markers** for resistance to the partner drugs are mostly associated with point mutations in the two food vacuole membrane transporters PfCRT and PfMDR1, and amplification of pfmdr1 and the two aspartic protease genes plasmepsin 2 and 3. It has been observed that mutations in these genes can have opposing effects on sensitivities to different partner drugs, which serve as the principle for designing triple ACTs and drug rotation.

C. Increased expression of PfATPase4 reduces oxidative stress in P. falciparum. It is a Plasma membrane Ca2+-ATPase that maintains calcium homeostasis and regulates the parasite's stress response. Increased expression of PfATPase4 will lead to enhanced calcium efflux which will decrease intracellular calcium levels resulting in reduced oxidative stress sensitivity and damage making the parasite less susceptible to ART.

D. Enhanced efflux of artemisinin reduces ROS damage. ART enters the parasite via passive diffusion and generates ROS causing cellular damage in the parasite. Enhanced efflux of Artemisinin through PfATPase4 and PfMDR1 pump decreases its intracellular concentration which reduces artemisinin's efficacy and increases its IC50 values (concentration required for 50% inhibition) and consequently reduces the parasite clearance rates.

2. Insecticide resistance: challenges in vector control

Reduced susceptibility of vectors to insecticides due to target site insensitivity, metabolic resistance (enzyme-mediated detoxification), penetration resistance (reduced insecticide uptake),behavioral resistance (changed vector behavior), overuse/misuse of insecticides, lack of rotation/alternation of insecticides, cross-resistance between insecticides, or genetic adaptation of vector populations can lead to challenges such as reduced efficacy of insecticides, increased vector populations, resurgence of diseases, limited availability of effective insecticides, difficulty in implementing integrated pest management (ipm) strategies, climate change and environmental factors such as flooding and temperature increase to promote parasite thriving, and urbanization.

3. Sociocultural and economic barriers in malaria prevention and treatment

Sociocultural Barriers:

- Limited health literacy due to limited access to education, information, and healthcare services especially in rural areas leading to misconceptions about malaria transmission and treatment.
- Cultural practices such as traditional medicine, delayed seeking care etc, and traditional beliefs and practices influencing net use and IRS.
- Social stigma associated with malaria due to limited community engagement and awareness.
- Gender roles and decision-making dynamics

Economic Barriers:

- Poverty and limited financial resources
- High costs of treatment and prevention measures
- Inadequate access to healthcare services
- Limited availability of effective treatments
- Opportunity costs e.g. lost productivity due to illness
- Inefficient healthcare systems and funding allocation
- Economic inequality and disparities

Other Challenges:

- Rural-urban disparities in access to healthcare
- Inadequate infrastructure (e.g., healthcare facilities, transportation)
- Conflict zones and displaced populations affecting malaria control including cross-border transmission and migration.
- Climate change and environmental factors

These barriers can lead to delayed or inadequate treatment, increased morbidity and mortality, reduced effectiveness of malaria control programs, perpetuation of poverty and inequality, and strained healthcare systems.

4. Gaps in healthcare infrastructure, particularly in remote and underserved regions.

- Inadequate funding and resources/under-funding of the Health Sector: Insufficient funding allocation to the health sector, with
- Nigeria allocated only 3.30% to 3.76% of its GDP to health between 2010 and 2017.
- Lack of effective/inadequate surveillance and monitoring systems: Nigeria's surveillance system struggles to track and quantify the burden of malaria, especially in private healthcare sectors and community levels.
- Limited tools for eliminating malaria e.g., vaccines, diagnostics.
- Limited Access to Healthcare: Many Nigerians live in areas with poor environmental conditions, lacking basic sustainable infrastructures like clean water, electricity, and sanitation resulting in increased morbidity and mortality.
- Shortage of Healthcare Workers: Community health workers are scarce, making it difficult to educate and engage communities in malaria prevention and treatment leading to strained healthcare systems.

Understanding the life cycle of the parasite, pathogenesis, and treatment is crucial for control and elimination of malaria. To overcome these challenges, a multifaceted approach is necessary, involving governments, international organizations, civil society, and local communities.

CONCLUSION

Malaria continues to pose a significant health challenge in Nigeria, particularly among vulnerable populations such as children, pregnant women, the elderly, and immunocompromised individuals. Through the implementation of effective prevention and control strategies, such as ITNs, IRS, chemoprophylaxis, and the emerging RTS, S/AS01 vaccine, alongside public health education and the crucial role of community health workers, Nigeria has made significant progress in its fight against malaria. However, sustained efforts are needed to maintain these gains and achieve the global targets for malaria elimination.

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NUMSA TAKING ACTION AGAINST MALARIA

The malaria outreach program, conducted on May 4, 2024, in the Anguwan Rogo community, aimed to deliver preventive and curative interventions to affected communities. The program included free malaria testing using rapid diagnostic tests (RDTs), treatment for positive cases, and educational campaigns on malaria prevention. A team of medical students and healthcare workers from The Nile Clinic screened 100 individuals, with 35 testing positive for malaria—those who tested positive received artemisinin-based combination therapies (ACTs) and follow-up instructions.

The program also distributed 10 waste baskets and provided lectures on proper waste disposal and environmental hygiene to prevent malaria transmission. Educational sessions emphasized the importance of using insecticide-treated bed nets (ITNs), eliminating mosquito breeding sites, and seeking early treatment. The outreach program successfully treated malaria cases, raised awareness about prevention strategies, and contributed to the long-term reduction of malaria in the community. It also provided medical students with hands-on experience in patient management and evidence-based health practices, promoting hygiene and community engagement.

HUMAN IMMUNODEFICIENCY VIRUS

A REVIEW OF HUMAN IMMUNODEFICIENCY VIRUS (HIV): PATHOPHYSIOLOGY, CLINICAL PRESENTATION, DIAGNOSIS, TREATMENT, PREVENTION AND IMPACT IN NIGERIA.

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SUPERVISOR: DR NUBWA MEDUGU

Abstract

HIV remains a significant public health challenge in Nigeria, with approximately 1.9 million people living with the virus as of 2020. Despite progress in treatment and prevention, issues such as stigma, inadequate funding, and limited access to services persist. This review evaluates current epidemiological trends, control measures, and recommendations for improving the national response to HIV.

Introduction

Human Immunodeficiency Virus (HIV) is a retrovirus that targets the immune system, specifically CD4+ T cells, leading to progressive immune dysfunction. If left untreated, HIV infection can progress to Acquired Immunodeficiency Syndrome (AIDS), characterized by severe immunosuppression and increased susceptibility to opportunistic infections and malignancies (Deeks et al., 2015). Since its identification in the early 1980s, HIV has become a global pandemic, with an estimated 38.4 million people living with HIV worldwide as of 2021 (UNAIDS, 2022).

Epidemiology

HIV continues to be a major global public health issue. While new HIV infections have been reduced by 40% since the peak of the epidemic in 1998, significant challenges remain. In 2021, there were approximately 1.5 million new HIV infections and 650,000 AIDS-related deaths globally (UNAIDS, 2022). The epidemic disproportionately affects certain regions and populations, with sub-Saharan Africa accounting for about two-thirds of the global total of new HIV infections (Kharsany & Karim, 2016).

Nigeria has the highest HIV burden in Sub-Saharan Africa, with a prevalence rate of approximately 2.1% among adults aged 15-49 (UNAIDS, 2020). The epidemic is primarily driven by heterosexual transmission and affects diverse demographics across the country.

The HIV prevalence has fluctuated over the years, with significant regional variations. States like Benue and Rivers report higher rates of 5.7% and 5.2%, respectively (National Agency for the Control of AIDS NACA, 2021). The epidemic is generalized, with no community exempt from its impact.

Aetiology

HIV belongs to the genus Lentivirus within the family Retroviridae. There are two types of HIV: HIV-1 and HIV-2. HIV-1 is responsible for the majority of infections globally and is further classified and subtypes. HIV-2 is less pathogenic and primarily found in West Africa (Sharp & Hahn, 2011).

Transmission

HIV is transmitted through the exchange of certain body fluids from infected individuals, including blood, breast milk, semen, and vaginal secretions. The most common modes of transmission are:

1. Unprotected sexual intercourse
2. Sharing of contaminated needles and syringes
3. Mother-to-child transmission during pregnancy, childbirth, or breastfeeding
4. Transfusion of contaminated blood products (rare in countries with robust blood screening programs). (CDC, 2023)

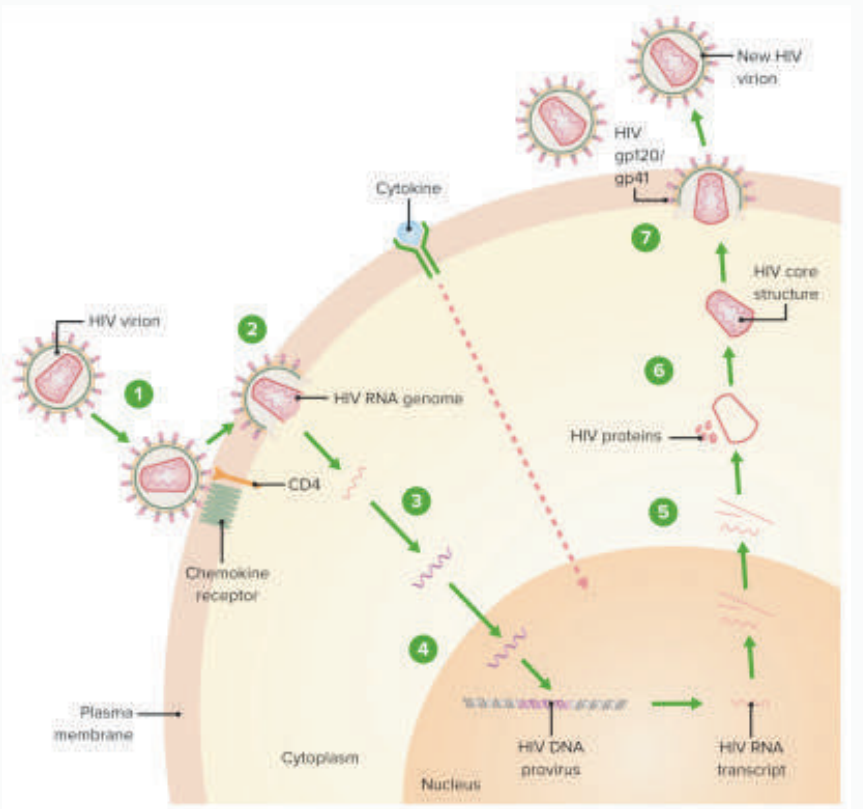
Pathophysiology

HIV primarily infects CD4+ T lymphocytes, macrophages, and dendritic cells. The virus binds to the CD4 receptor and co-receptors

(typically CCR5 or CXCR4) on the cell surface, facilitating entry into the host cell. Once inside, the viral RNA is reverse-transcribed into DNA, which integrates into the host cell genome. This integrated viral DNA, known as provirus, can remain latent or be transcribed to produce new viral particles (Maartens et al., 2014).

The progression of HIV infection can be divided into three main stages:

1. **Acute HIV Infection:** Characterized by high viral replication and a significant drop in CD4+ T cell count.
2. **Chronic HIV Infection (Clinical Latency):** A period of clinical stability with ongoing viral replication at lower levels.
3. **AIDS:** Defined by severe immunodeficiency (CD4+ T cell count <200 cells/µL) and increased susceptibility to opportunistic infections and malignancies. (Deeks et al., 2015)



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Clinical Presentation

The clinical manifestations of HIV infection vary depending on the stage of the disease:

Acute HIV Infection
- Flu-like symptoms (fever, fatigue, myalgia)
- Lymphadenopathy
- Pharyngitis
- Rash
- Headache
-These symptoms typically appear 2-4 weeks after infection and may last for several weeks

Chronic HIV Infection
- Often asymptomatic
- Persistent generalized lymphadenopathy may be present
- Some patients may experience constitutional symptoms or minor opportunistic infections

AIDS
- Recurrent or severe opportunistic infections (e.g., Pneumocystis jirovecii pneumonia, Candidiasis)
- AIDS-defining malignancies (e.g., Kaposi's sarcoma, non-Hodgkin lymphoma)
- Severe weight loss (HIV wasting syndrome)
- Neurological complications (e.g., HIV-associated dementia).

(Maartens et al., 2014; Deeks et al., 2015)

Diagnosis

Early diagnosis of HIV is crucial for timely treatment initiation and prevention of transmission. The following methods are commonly used for HIV diagnosis:

1. **Antibody/Antigen Tests:**
   a. - Fourth-generation tests detect both HIV antibodies and the p24 antigen
   b. - Can detect HIV infection as early as 2-3 weeks after exposure
   c. - Usually performed as an initial screening test
2. **Nucleic Acid Tests (NAT):**
   a. - Detect HIV RNA
   b. - Used for early diagnosis (can detect HIV about 10-33 days after infection)
   c. - Also used to monitor viral load in individuals undergoing treatment
3. **Western Blot or Immunofluorescence Assay:**
   a. - Used as confirmatory tests
   b. - Detect specific HIV antibodies
4. **Rapid Tests:**
   a. - Provide results in 30 minutes or less
   b. - Useful for point-of-care testing and in resource-limited settings

(CDC, 2023; WHO, 2022)

Treatment

The primary goal of HIV treatment is to suppress viral replication, preserve immune function, and prevent disease progression. The standard of care is antiretroviral therapy (ART), which typically involves a combination of three or more antiretroviral drugs.

Antiretroviral therapy (ART) has improved outcomes significantly; however, only about 44% of those living with HIV have access to treatment (World Health Organization WHO, 2021). The Nigerian government aims to achieve the UNAIDS 95-95-95 targets by 2030 through enhanced surveillance and expanded access to treatment (UNAIDS, 2020).

The main classes of antiretroviral drugs include:

1. Nucleoside Reverse Transcriptase Inhibitors (NRTIs)
2. Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTIs)
3. Protease Inhibitors (PIs)
4. Integrase Strand Transfer Inhibitors (INSTIs)
5. Entry Inhibitors

Current guidelines recommend initiating ART in all individuals diagnosed with HIV, regardless of CD4+ T cell count (DHHS, 2023). The choice of regimen depends on various factors, including drug resistance, comorbidities, and potential drug interactions.

In addition to ART, the management of HIV involves:

- Regular monitoring of CD4+ T cell count and viral load
- Screening and prophylaxis for opportunistic infections
- Management of comorbidities and drug toxicities
- Adherence support and counseling

(DHHS, 2023; Saag et al., 2020)

Prevention

HIV prevention strategies have evolved significantly over the years and now include a combination of behavioral, biomedical, and structural approaches:

1. **Behavioral Interventions:**
   a. Promotion of safer sex practices (condom use, reduction in number of sexual partners)
   b. Education and counseling
2. **Biomedical Interventions:**
   a. Treatment as Prevention (TasP): Effective ART reduces the risk of HIV transmission
   b. Pre-exposure prophylaxis (PrEP): Daily antiretroviral medication for high-risk HIV-negative individuals
   c. Post-Exposure Prophylaxis (PEP): Short-term antiretroviral treatment after potential HIV exposure
   d. Voluntary Medical Male Circumcision: Reduces the risk of female-to-male sexual transmission
3. **Structural Interventions:**
   a. Needle exchange programs for people who inject drugs
   b. Laws and policies to reduce stigma and discrimination
   c. Efforts to address social and economic factors that increase HIV risk
4. **Prevention of Mother-to-Child Transmission (PMTCT):**
   a. ART for HIV-positive pregnant women
   b. - Antiretroviral prophylaxis for infants
   c. - Safe infant feeding practices

(WHO, 2022; UNAIDS, 2022)

Challenges

Key challenges include persistent stigma, inadequate funding, and insufficient integration of prevention strategies into healthcare systems (Okonkwo et al., 2022). Stigma remains a barrier to testing and treatment uptake, contributing to ongoing transmission rates.
Recommendations
To strengthen the response to HIV in Nigeria:

- Increase funding for HIV programs.
- Enhance community education to reduce stigma.
- Expand access to testing and ART.
- Integrate prevention strategies into primary healthcare.

Impact of HIV/AIDS in Nigeria
Nigeria remains a focal point in the global fight against HIV/AIDS, currently ranking second in the world for the highest-burden of the disease. As of 2020, approximately **1.9 million people** are living with HIV (PLHIV), which accounts for a significant proportion of the global burden (UNAIDS, 2020). In 2019 alone, an estimated **107,112 new infections** were recorded, reflecting approximately **38%** of new infections in the West and Central African region.

Health Impact
The health implications of HIV/AIDS are profound, straining Nigeria's healthcare system. The progression from HIV to Acquired Immunodeficiency Syndrome (AIDS) increases susceptibility to opportunistic infections, leading to significant morbidity and mortality, particularly among young adults. The World Health Organization (WHO) estimates that Nigeria accounted for about **20%** of global AIDS-related deaths in 2020, underscoring the urgent need for improved access to treatment and care services. In 2015, approximately **260,000 children** aged **0-14 years** were living with HIV, with 41,000 new infections occurring that year. Alarmingly, only 17% of these children had access to antiretroviral therapy (ART), highlighting critical gaps in pediatric care.

The **2018 Nigeria HIV/AIDS Indicator and Impact Survey (NAIIS)** revealed an HIV prevalence rate of **1.3%** among individuals aged **15–49 years**, an improvement from the **3.4%** reported in the 2012 National HIV/AIDS Reproductive Health and Survey (NARHS). Despite these gains, the total number of individuals affected by HIV/AIDS remains alarmingly high, necessitating ongoing public health efforts.

Prevalence among Key Populations
The 2014 Integrated Biological and Behavioural Surveillance Survey (IBBSS) highlighted that key populations, including men who have sex with

men (MSM), female sex workers (FSW), and people who inject drugs (PWID), have particularly high prevalence rates. MSM exhibited a prevalence rate of **22.9%**, followed by FSW at **14.4%** and PWID at **3.4%.** Recent modeling studies have estimated a national HIV prevalence of **2.1%** (95% CI: **1.5–2.7%**) among adults aged **15–49 years**, translating to approximately 2 million PLHIV. This figure contrasts with previous estimates of **1.4%** from the 2018 NAIIS and **1.8 million** as estimated by UNAIDS in 2022. The prevalence varies significantly across states, with **Benue** having the highest rate at 5.7%, followed by **Rivers** (5.2%), **Akwa Ibom** (3.5%), **Edo** (3.4%), and **Taraba** (3.0%), while **Jigawa** exhibits the lowest prevalence at 0.3%.

Socioeconomic Impact

The socioeconomic repercussions of the HIV epidemic are substantial, imposing costs on individuals, families, and communities. Stigma and discrimination against people living with HIV often lead to social exclusion and loss of employment, exacerbating poverty. Households affected by HIV may experience reduced income due to illness and increased healthcare expenditures, creating a cycle of poverty and health disparities. Children orphaned due to AIDS face significant challenges, including limited access to education and basic needs, perpetuating the cycle of disadvantage.

Impact on Public Health Initiatives

The response to HIV in Nigeria is impeded by persistent stigma and discrimination, which discourage individuals from seeking testing and treatment. This stigma not only affects the mental well-being of those living with HIV but also poses significant barriers to public health initiatives aimed at reducing transmission rates. Furthermore, inadequate funding and resource allocation for HIV programs hinder the implementation of effective prevention and treatment strategies. Although improvements in access to ART have been made, only about **44%** of people living with HIV are currently receiving treatment, highlighting the urgent need for policy changes and increased investment in healthcare infrastructure (World Health Organization, 2021).

Policy and Community Responses

In response to the HIV epidemic, the Nigerian government has set ambitious goals, including the **UNAIDS 95-95-95 targets**, which aim for **95%** of people living with HIV to know their status, **95%** of those diagnosed to receive ART, and **95%** of those on ART to achieve viral suppression by **2030**. Achieving these targets requires a multi-sectoral approach involving collaboration among government agencies, civil society, and international partners. Community-based interventions that promote awareness, education, and testing can help reduce stigma and increase access to services.

Conclusion

Despite significant progress in HIV prevention and treatment, the virus remains a major global health challenge. Continued efforts in research, prevention, and care are essential to achieve the UNAIDS 95-95-95 targets (95% of people living with HIV know their status, 95% of those diagnosed receive ART, and 95% of those on ART achieve viral suppression) and to ultimately end the AIDS epidemic (UNAIDS, 2022).

While Nigeria has made strides in managing HIV, a multi-faceted approach addressing social determinants of health is essential for further progress. Continued collaboration among government agencies, international partners, and civil society is vital for achieving long-term goals in combating the epidemic.

Future directions in HIV research include the development of long-acting antiretroviral formulations, novel approaches to target the HIV reservoir, and ongoing efforts towards an effective HIV vaccine. Additionally, addressing social and structural barriers to HIV prevention and care remains crucial in the global response to the epidemic.

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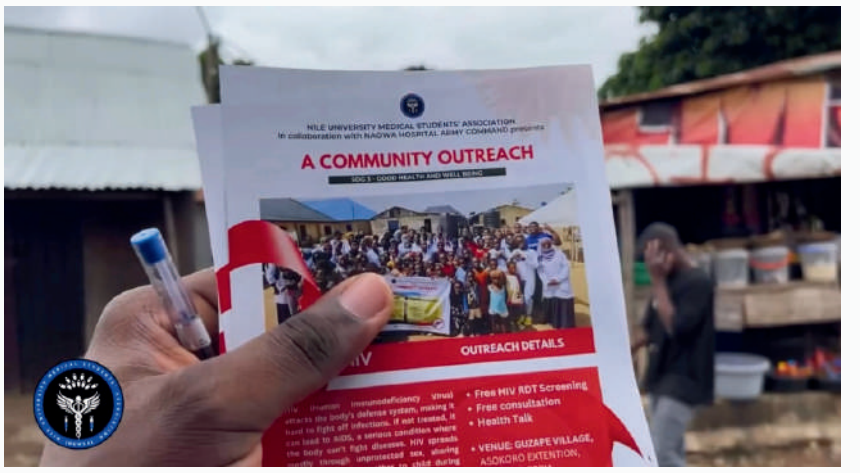

OUR MANDATE

As future healthcare professionals, we have witnessed firsthand the transformative power of quality information on Nigeria's healthcare landscape. Driven by this insight, we are committed to addressing the pressing health challenges facing our communities.

On August 24, 2024, the Nile University Medical Students Association (NUMSA) collaborated with NAOWA Hospital Army Command to execute a comprehensive HIV awareness and screening outreach program at Guzape Village. This initiative sought to:

1. Educate the public on HIV/AIDS prevention and management.
2. Dispense with misconceptions and stigma surrounding the disease.
3. Provide complimentary HIV testing services.
4. Facilitate referrals for further care and support.

This outreach program exemplifies our dedication to improving healthcare outcomes and promoting wellness in underserved populations.

CHILD HEALTH

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SUPERVISOR: DR OMA AMADI

INTRODUCTION TO CHILD HEALTH

Child health refers to the well-being of children from birth through adolescence, focusing on their physical, emotional, social, and cognitive development. It encompasses not only the absence of disease or infirmity but also the promotion of overall wellness, development, and the ability to grow into healthy adults. Good child health sets the foundation for a productive and fulfilling life, impacting future education, economic prospects, and contributions to society.

Ensuring child health is crucial because the early years are critical for growth and development. Healthy children are more likely to reach their full potential physically, cognitively, and emotionally, while children with poor health are at a higher risk for long-term developmental delays and chronic illnesses. Intervening early in life to prevent or treat health issues can reduce morbidity and mortality rates and improve quality of life.

Determinants of Child Health

Child health is influenced by several factors which can either promote health or increase vulnerability to disease. They include:

- **Biological Factors:**
  - Genetics: A child's genetic makeup can predispose them to certain health conditions, such as congenital disorders or inherited metabolic diseases.
  - **Birth weight:** Low birth weight or preterm births can lead to poor health outcomes, including developmental delays, malnutrition, and increased susceptibility to infections.
  - **Nutrition**: Adequate nutrition is fundamental to child growth. Malnutrition, whether due to insufficient food intake or poor diet, can lead to stunted growth, impaired cognitive development, and weakened immunity.

- **Environmental Factors:**
  - **Sanitation and access to clean water**: Poor sanitation and lack of access to clean water are significant contributors to childhood diseases such as diarrhea and parasitic infections.
  - **Housing conditions:** Crowded, unsanitary living conditions and exposure to pollution or toxins (e.g., lead, pesticides) can affect a child's respiratory health and overall development.
  - **Exposure to infectious diseases**: Children in environments with inadequate immunization, poor healthcare access, or prevalent infectious diseases (like malaria, measles, or tuberculosis) face higher health risks.

- **Socio-Economic Determinants:**
  - **Income and poverty:** Children from low-

- income families are at higher risk of malnutrition, limited access to healthcare, and education gaps, all of which negatively impact health.
- **Education of caregivers:** Parental or caregiver education levels influence child health. Educated caregivers are more likely to seek timely medical care, practice good hygiene, and ensure proper nutrition.
- **Access to healthcare services:** The availability and affordability of healthcare services are vital. Limited access to healthcare leads to untreated illnesses, delayed diagnosis, and higher mortality rates.

GLOBAL AND REGIONAL CHILD HEALTH STATISTICS

Globally, child health has seen significant improvements over the past few decades due to advancements in healthcare, sanitation, and immunization. However, disparities remain, particularly in low- and middle-income countries. Key global statistics include:

- According to the World Health Organization (WHO), 5 million children under the age of 5 died in 2021, with most deaths occurring in sub-Saharan Africa and South Asia. The leading causes of death were preterm birth complications, pneumonia, diarrhea, and malaria.
- Malnutrition remains a significant problem, contributing to approximately 45% of child deaths worldwide. Stunting (impaired growth and development) affects an estimated 22% of children under five globally.
- Immunization coverage has improved, with vaccines preventing 2-3 million deaths each year, but millions of children still do not receive essential vaccinations.

In Nigeria, child health remains a significant public health challenge despite some progress. Nigeria accounts for a substantial share of global child mortality, primarily due to preventable or treatable causes.

According to UNICEF, Nigeria has the highest number of child deaths in sub-Saharan Africa, with over 850,000 children under five dying each year (as of 2021). The leading causes of death include malaria, pneumonia, diarrhea, and malnutrition.

Immunization rates in Nigeria have improved but remain suboptimal. In 2020, only about 57% of children were fully immunized against common childhood diseases, leaving a large proportion at risk for preventable illnesses like measles and polio.

In Nigeria, socio-economic disparities, political instability, poor infrastructure, and a weak healthcare system exacerbates the challenges in achieving optimal child health outcomes. Efforts to improve healthcare access, enhance nutrition programs, increase immunization coverage, and reduce the disease burden are critical to improving child health in Nigeria and globally.

GROWTH AND DEVELOPMENT

Growth and development are essential aspects of child health. Growth refers to increased physical size, while development encompasses acquiring skills and functional capacities such as motor, cognitive, language, and social-emotional abilities. Understanding these processes helps identify normal patterns and detect deviations that may indicate health problems.

Normal Growth Patterns

- **Infancy (0-12 months):**
  - Physical growth is most rapid during infancy. A newborn typically doubles their birth weight by 4–6 months and triples it by 12 months.
  - Height increases by about 25 cm (10 inches) during the first year.
  - Head circumference grows rapidly, reflecting brain development.
  - Adequate nutrition, including breastfeeding or formula feeding, plays a critical role in ensuring proper growth.
- **Childhood (1-10 years):**
  - Growth slows after infancy but remains steady.
  - Children typically gain around 2-3 kg (4-7 lbs) and grow 5-8 cm (2-3 inches) per year.
  - During early childhood, physical changes include the development of muscle mass, coordination, and balance, while body fat gradually decreases.
- **Adolescence (10-19 years):**
  - Growth accelerates again during puberty, with boys experiencing a growth spurt around ages 12-16 and girls between 10-14 years.
  - Boys tend to gain more height and muscle mass compared to girls, who typically see increases in fat distribution as they develop secondary sexual characteristics.
  - By the end of adolescence, adult height is usually achieved.

Developmental Milestones

Children follow predictable developmental stages across four key domains: motor, cognitive, language, and social-emotional. However, the pace of development can vary among individuals.

- **Motor Development:**
  - Gross motor skills involve large muscle activities such as crawling, walking, and jumping.

        - By 6 months, babies typically roll over.
        - By 12 months, they begin to walk.
        - By 2-3 years, children can run, climb, and start to pedal tricycles.
    - Fine motor skills involve smaller movements, such as grasping and manipulating objects.
        - By 9 months, babies develop a pincer grasp to pick up small items.
        - By 18 months, they can scribble and use utensils.
- **Cognitive Development:**
    - Refers to thinking, reasoning, and problem-solving skills.
    - Infants begin exploring the world through their senses and by 9-12 months, develop object permanence (understanding that objects continue to exist even when out of sight).
    - By 3-4 years, they engage in pretend play and ask questions, demonstrating curiosity and imagination.
    - By 7 years, children can solve more complex problems and develop logical thinking.
- **Language Development:**
    - Language skills include the ability to understand and use words.
    - By 12 months, most babies say their first words.
    - By 2 years, they can speak in short sentences.
    - By 3-4 years, vocabulary rapidly expands, and they can form more complex sentences.
    - By 6 years, most children are fluent in their native language, with a vocabulary of several thousand words.

- **Social-Emotional Development:**
    - Includes the ability to interact with others, manage emotions, and develop self-awareness.
    - By 6-8 months, infants show attachment to caregivers, often exhibiting separation anxiety.
    - By 18-24 months, they begin to show empathy and can engage in simple cooperative play with peers.
    - By 3-5 years, children develop a sense of self and identity, learning to manage emotions and social interactions.

Monitoring Growth

Monitoring growth helps assess whether a child is growing appropriately compared to standardized norms.

- Growth Charts:
    - Growth charts are essential tools that track a child's physical development over time. These charts compare a child's growth in weight, height, and body mass index (BMI) to age- and sex-specific percentiles.
    - World Health Organization (WHO) and Centres for Disease Control and Prevention (CDC) growth charts are commonly used globally.
    - Ideally, children should stay within the same percentile range as they grow. Deviations may indicate undernutrition, overnutrition, or other medical concerns.

- **Anthropometric Measures:**
    - Height and weight are standard measures, plotted on growth charts.
    - Head circumference is measured in infants and young children to monitor brain growth.
    - BMI (body mass index) is calculated from height and weight and provides a measure of body fat. A BMI-for-age percentile is used to screen for underweight, overweight, or obesity in children.

Assessing Developmental Delays

Developmental delays occur when a child does not achieve developmental milestones at the expected time. These delays can occur in one or more domains (motor, cognitive, language, social-emotional).

- Signs of Developmental Delay:
    - Not rolling over by 6 months or not walking by 18 months (gross motor delay).
    - Lack of babbling by 12 months or absence of speech by 2 years (language delay).
    - Difficulty interacting with others or avoiding eye contact may indicate social-emotional delay.
- Screening Tools for Developmental Delays:
    - Healthcare providers use standardized developmental screening tools during regular health check-ups to identify potential delays early. Examples include the Ages and Stages Questionnaire (ASQ) and the Denver Developmental Screening Test.
    - Children identified with delays may be referred for further evaluation and early intervention services, which are critical for improving long-term outcomes.

NUTRITION IN CHILDHOOD

Proper nutrition is essential for the growth, development, and overall well-being of children. Nutritional needs vary across different age groups, and an understanding of these needs helps ensure children receive adequate nutrition to support optimal growth. Additionally, addressing malnutrition and micronutrient deficiencies is vital for promoting child health and preventing long-term health issues.

Nutritional Needs Across Different Age Groups

- Infants (0-12 months):
  - Exclusive breastfeeding is recommended for the first six months of life, providing all the necessary nutrients, including proteins, fats, carbohydrates, vitamins, and minerals.
  - Breast milk contains immune-protective components such as antibodies, helping to protect against infections.
  - After six months, complementary foods are introduced to meet increasing nutritional needs while continuing breastfeeding.
  - Key nutrients include:
    - Protein: Supports rapid growth and tissue development.
    - Fats: Provide concentrated energy and support brain development.
    - Iron: Important for brain development and to prevent anaemia, especially since infants' iron stores from birth are depleted around 6 months of age.
- Toddlers (1-3 years):
  - Nutritional needs remain high as toddlers experience continued growth and brain development. They require a balanced diet with fruits, vegetables, whole grains, dairy, and protein sources. Toddlers should have a varied diet to develop healthy eating habits.
  - Nutrient focus:
    - Calcium and Vitamin D: For bone health.
    - Iron: To support cognitive development and prevent anaemia.
    - Healthy fats: To support brain development.
- School-aged children (4-12 years):
  - Growth slows but continues steadily during this period, and nutrient needs are still high to support growth and activity levels. Children need a balanced diet with a focus on whole grains, lean proteins, dairy products, and a variety of fruits and vegetables.
  - Key nutrients:
    - Protein: Supports growth and repair of tissues.
    - Calcium and Vitamin D: Continue to be important for bone development.
    - Fiber: Promotes healthy digestion and prevents constipation.

Breastfeeding and Complementary Feeding Guidelines

- **Breastfeeding**: The World Health Organization (WHO) and UNICEF recommend exclusive breastfeeding for the first six months of life, with continued breastfeeding along with appropriate complementary foods up to two years of age or beyond. Breast milk is considered the optimal food for infants due to its ideal nutrient composition and immune-protective properties.
- **Complementary Feeding:** Complementary foods should be introduced at 6 months of age to meet the growing nutritional needs of the infant. These foods should be nutrient-dense, soft, easy to chew, and rich in key nutrients like iron, zinc, and vitamin A. Foods should include pureed vegetables, fruits, grains, and proteins such as eggs, fish, or meat. Gradually, the texture of foods is increased as the baby develops the ability to chew.

Malnutrition: Under-nutrition and Over-nutrition (Obesity), Micronutrient Deficiencies

- **Under-nutrition:** Under-nutrition occurs when a child does not receive enough nutrients or energy, resulting in impaired growth and development. Stunting (low height for age), wasting (low weight for height), and underweight (low weight for age) are common signs of under-nutrition. Under-nutrition increases the risk of infections and long-term developmental delays.
- **Over-nutrition (Obesity):** Childhood obesity is a form of over-nutrition where a child consumes more energy than they expend, leading to excess body fat. Childhood obesity is linked to an increased risk of developing chronic diseases such as type 2 diabetes, cardiovascular diseases, and metabolic disorders later in life. Poor dietary habits (high intake of processed foods, sugary beverages, and a sedentary lifestyle) contribute to obesity.
- **Micronutrient Deficiencies:**
  - Iron deficiency: This leads to anaemia, which can cause fatigue, poor cognitive development, and increased risk of infections.
  - Vitamin A deficiency: Affects vision and immune function. In severe cases, it can cause blindness.
  - Iodine deficiency: This leads to thyroid dysfunction and can result in cognitive impairments and developmental delays.

Strategies for Improving Child Nutrition

- **Promoting Exclusive Breastfeeding:** Educating mothers on the benefits of exclusive breastfeeding for the first six months and providing support through healthcare systems and community programs.
- **Implementing Complementary Feeding Programs:** Initiating education programs to teach caregivers about the importance of introducing a variety of nutrient-rich foods at six months. Emphasizing the importance

of locally available and affordable foods that can meet nutritional requirements.

- **Food Fortification:** Fortifying staple foods such as salt (iodine), flour (iron and folic acid), and cooking oil (vitamin A) can help prevent micronutrient deficiencies in populations where deficiencies are prevalent. Food fortification is an effective public health strategy in regions with widespread nutrient deficiencies.
- **School-Based Nutrition Programs:** Implementing school feeding programs to ensure children have access to nutritious meals. These programs can reduce malnutrition and promote healthy eating habits from a young age. Incorporating nutrition education into the curriculum to teach children about healthy food choices and portion control.
- **Public Health Campaigns:** Launching campaigns to raise awareness of the dangers of over-nutrition (obesity) and under-nutrition, promoting healthy dietary habits, and encouraging physical activity. Educating families on the dangers of excessive consumption of processed foods and sugary drinks, and promoting balanced diets rich in fruits, vegetables, and whole grains.
- **Micronutrient Supplementation:** Providing vitamin, A supplements in high-risk populations, particularly in low-income countries, to reduce the incidence of deficiency-related diseases. Distributing iron and folic acid supplements to address widespread anaemia among children and women of childbearing age.

COMMON CHILDHOOD DISEASES

Childhood diseases encompass a wide range of health issues that affect children globally, with both infectious and non-communicable diseases posing significant health challenges. Understanding these diseases, their impact, and management strategies is crucial for promoting child health and well-being.

INFECTIOUS DISEASES

1. **Vaccine-Preventable Diseases:**

- **Measles**: a highly contagious viral disease characterized by fever, cough, conjunctivitis, and a distinctive rash. Measles can lead to severe complications such as pneumonia, encephalitis, and death. Vaccination with the MMR (measles, mumps, rubella) vaccine is essential to prevent outbreaks.
- **Polio**: caused by the poliovirus, polio primarily affects children and can lead to paralysis and death. The oral polio vaccine (OPV) has been pivotal in reducing polio incidence globally. Continued vaccination efforts are necessary for the disease's eradication.
- Diphtheria: This bacterial infection, caused by Corynebacterium diphtheriae, presents with a sore throat, fever, and a thick coating in the throat that can obstruct breathing. The DTP (diphtheria, tetanus, pertussis) vaccine has significantly reduced diphtheria cases.

2. Respiratory Infections:

- **Pneumonia**: a leading cause of morbidity and mortality in children, pneumonia can be caused by bacteria (e.g., Streptococcus pneumoniae), viruses, or fungi. Symptoms include fever, cough, and difficulty breathing. Vaccination (e.g., pneumococcal vaccine) and prompt antibiotic treatment are crucial for management.
- **Bronchiolitis**: typically caused by respiratory syncytial virus (RSV), bronchiolitis affects infants and leads to inflammation of the small airways, causing wheezing and difficulty breathing. Supportive care, including oxygen therapy and hydration, is essential for treatment.

3. Gastrointestinal Infections:

- **Diarrhea**: a significant cause of morbidity in children, diarrhea can be caused by viral (e.g., rotavirus), bacterial (e.g., Escherichia coli, Shigella), or parasitic infections. Oral rehydration therapy (ORT) is critical for management, along with zinc supplementation to prevent complications.
- **Cholera**: Caused by Vibrio cholerae, cholera leads to severe watery diarrhea and dehydration. Prevention through improved sanitation, clean water access, and vaccination in endemic areas is essential.

4. Parasitic Infections:

- **Malaria**: caused by Plasmodium species and transmitted by Anopheles mosquitoes, malaria is a leading cause of childhood morbidity and mortality in sub-Saharan Africa. Symptoms include fever, chills, anaemia, and organ dysfunction. Treatment typically involves artemisinin-based combination therapies (ACTs), with preventive measures including insecticide-treated nets and prophylactic medications.
- **Helminths**: Intestinal worms like roundworms, hookworms, and whipworms can cause malnutrition, anaemia, and developmental delays in children. Regular deworming with albendazole or mebendazole is effective in managing these infections.

NON-COMMUNICABLE DISEASES

1. **Allergies**:

- **Asthma**: A chronic respiratory condition characterized by recurrent episodes of wheezing, shortness of breath, and chest tightness. Common triggers include allergens, respiratory infections, and environmental pollutants. Management

includes inhaled corticosteroids, bronchodilators, and avoiding triggers.

- **Food Allergies:** Allergic reactions to specific foods (e.g., peanuts, shellfish) can range from mild to life-threatening anaphylaxis. Management involves strict avoidance of allergens and immediate treatment with epinephrine in case of severe reactions.

2. Congenital Conditions

- **Down Syndrome**: A genetic disorder caused by the presence of an extra chromosome 21, leading to intellectual disability and characteristic physical features. Early intervention, educational support, and health management can improve outcomes.
- **Congenital Heart Defects (CHDs):** Structural heart abnormalities present at birth can lead to complications and require surgical intervention or long-term medical management. Early diagnosis through prenatal screening or postnatal examination is crucial for effective management.

3. Paediatric Cancers:

Common cancers in children include leukemia (especially acute lymphoblastic leukemia), brain tumours, and neuroblastoma. Treatment typically involves chemotherapy, radiation therapy, and sometimes surgery. Early detection and specialized paediatric oncology care are essential for better outcomes.

IMMUNIZATION AND PREVENTIVE CARE

Preventive care in childhood is a cornerstone of public health, aiming to reduce the incidence of infectious diseases and ensure healthy development. Immunization, health education, and routine screenings are essential components of this strategy, protecting children from both immediate and long-term health risks.

Importance of Vaccination in Preventing Infectious Diseases

1. **Prevention of Life-Threatening Diseases**: Vaccines protect against serious infectious diseases like measles, polio, diphtheria, pertussis (whooping cough), and tetanus, which can lead to complications, long-term disability, or death.
2. **Herd Immunity:** When a large portion of a population is vaccinated, it provides indirect protection to those who are not vaccinated, such as newborns, people with compromised immune systems, or those who cannot receive vaccines due to allergies. This concept, known as herd immunity, helps prevent outbreaks.
3. **Reduction in Healthcare Costs:** Vaccination reduces the burden on healthcare systems by preventing costly treatments and hospitalizations for diseases that could have been avoided.
4. **Eradication of Diseases:** Vaccination has led to the near eradication of diseases like smallpox and has significantly reduced the global burden of polio and measles. Continued immunization efforts are vital for achieving the global eradication of other infectious diseases.

EXPANDED PROGRAM ON IMMUNIZATION (EPI) SCHEDULE

The Expanded Program on Immunization (EPI) was established by the World Health Organization (WHO) in 1974 to ensure that all children receive vaccines against common infectious diseases. The EPI schedule is adapted by countries to meet their local needs, but the core vaccines and schedule generally include the following:

(*see fig on the next page)*

HEALTH EDUCATION AND HYGIENE PROMOTION

Beyond vaccination, health education and the promotion of good hygiene practices are essential for preventing infectious diseases, especially in low-income settings. Key areas of focus include:

1. Hand Hygiene: Regular handwashing with soap is one of the simplest and most effective ways to prevent the spread of infections, including diarrhea and respiratory illnesses.
2. Sanitation and Safe Water: Access to clean drinking water and adequate sanitation facilities reduces the spread of waterborne diseases such as cholera and typhoid.
3. Safe Food Practices: Educating families on proper food handling and storage helps reduce the risk of foodborne illnesses, which are common causes of childhood diarrhea and malnutrition.
4. Health Education Campaigns: Public health campaigns focused on immunization, breastfeeding, and proper hygiene can help parents and caregivers understand the importance of these preventive measures in promoting child health.

ROUTINE SCREENING (ANAEMIA, VISION, HEARING)

Routine screening plays a vital role in early detection of health issues in children, enabling timely interventions to prevent complications and improve outcomes.

1. **Anaemia Screening:** Iron-deficiency anaemia is common in children, particularly in low-income regions. Routine screening can detect low haemoglobin levels, allowing for nutritional interventions like iron supplementation and fortified foods to prevent developmental delays and cognitive impairments.
2. **Vision Screening:** Early detection of vision problems, such as refractive errors (e.g., near-sightedness, farsightedness), can prevent long-term visual impairments.

Corrective measures such as glasses can significantly improve a child's educational and developmental progress.

3. **Hearing Screening:** Hearing loss can affect speech and language development in children. Newborn hearing screenings are essential to detect congenital hearing loss early. For older children, routine hearing tests can identify any issues that may affect communication and learning.

INTEGRATED MANAGEMENT OF CHILDHOOD ILLNESS (IMCI)

IMCI is an integrated approach that focuses on the health and well-being of the child. IMCI aims to reduce preventable mortality, minimize illness and disability, and promote healthy growth and development of children under five years of age. IMCI includes both preventive and curative elements that can be implemented by families, communities, and health facilities.

The strategy includes three main components:

- Improving case management skills of healthcare providers.
- Improving health systems to provide quality care.
- Improving family and community health practices for health, growth, and development.

Key Components:

1. Clinical Guidelines: IMCI provides standardized guidelines for assessing and treating common conditions such as pneumonia, diarrhea, malaria, malnutrition, measles, and ear infections.
2. Preventive Measures: The strategy emphasizes vaccination, nutrition (including breastfeeding), and health education to promote hygiene and sanitation.
3. Training Health Workers: Health workers are trained to effectively use IMCI guidelines, improving their clinical and communication skills for better patient interaction.
4. Community Involvement: Community health workers engage in health promotion, support families in recognizing illness, and monitor child health.
5. Health System Strengthening: IMCI aims to enhance healthcare infrastructure, data management, and intersectoral collaboration to improve child health services.

In health facilities, the IMCI strategy promotes the accurate identification of childhood illnesses in outpatient settings, ensures appropriate combined treatment of all major conditions that affect a young child, strengthens the counseling of caretakers, and speeds up the referral of severely ill newborns and children. In the home setting, it promotes appropriate care-seeking behaviours, improved nutrition, and support for early childhood development, prevention of illness, and correct implementation and adherence to treatment.

COMMON MENTAL HEALTH DISORDERS IN CHILDREN

The more common disorders in children include Attention Deficit Hyperactive Disorder (ADHD), anxiety disorders, and ASDs; these disorders have significant implications for the child's emotional, cognitive, and social development.

- **ADHD**: Some 5-10% of children from all over the world have ADHD. Symptoms commonly associated with ADHD include inattention, hyperactivity, and impulsivity. Most children with ADHD go through serious problems both at academics and socially; early diagnosis has been considered vital to improving outcomes.
- **Anxiety disorders:** include one of the most common psychiatric disorders of children, with prevalence rates as high as 7% among all paediatric populations. Anxiety disorders include generalized anxiety disorder, separation anxiety, and social anxiety. These disorders may result in prominent changes in behaviour, including avoidance of school and sleep disturbance.
- **Autism Spectrum Disorder:** About 1 in 54 children have ASD; the symptoms of this disorder range from difficulty with verbal or non-verbal communication and social interaction, laced with restricted and repetitive patterns of behaviour. Programs of early intervention comprise speech therapy, behavioural interventions, and support for parents, which are integral to enhancing the quality of life in children with ASD.

IMPORTANCE OF EARLY RECOGNITION AND INTERVENTION

Early recognition of mental health disorders is important. Intervention, which encompasses behavioural therapies such as CBT, can greatly reduce long-term effects. Early treatment for ADHD and anxiety, including family involvement, along with the child, helps develop social interaction, the ability to regulate behaviours, and academic performance. Early programs that target areas of need, such as social skills, cognitive development, and behaviour, provide many positive benefits for children with ASD.

ROLE OF FAMILY AND SCHOOL

Family and school environments are associated with the management of mental disorders among children. Parental involvement in a therapeutic approach minimizes disruptive behaviour attributes and enhances emotional

functioning. Schools can also offer psychological, counselling, and special education services and may work in collaboration with the family to support the child holistically.

STRESS MANAGEMENT AND BEHAVIOURAL PROBLEMS

Behavioural and stress management strategies among children may include the following:

1. Mindfulness and relaxation techniques can help to reduce anxiety.
2. Physical Activity: It has been proven that regular physical exercises reduce symptoms of depression and anxiety.
3. Behavioural Techniques: Behavioural treatments, like behavioural parent training and techniques for managing classrooms, have been found as efficacious interventions that improve outcomes in ADHD.

ENVIRONMENTAL AND SOCIAL DETERMINANTS OF CHILD HEALTH

Some of the factors associated with child health include poverty, education, housing conditions, and access to healthcare services.

1. Poverty and Effects of Education, Housing, and Access to Healthcare:

- **Poverty**: Children from poor families have a high risk of malnutrition, developmental problems, and chronic diseases. As a result, there is less utilization of health care services translates into higher rates of preventable diseases and medical treatments than necessary.
- **Education**: Parental education and child health show a positive correlation. Greater parental education, better the use of health services, or preventive practices that may prevent communicable diseases in children.
- **Bad housing conditions**, like overcrowding and lack of clean water, make people susceptible to infectious diseases such as respiratory infections and diarrheal disease.
- **Safe Drinking Water and Sanitation:** Access to clean drinking water and adequate sanitation reduces the spread of diseases like diarrheal disease and cholera, two leading causes of mortality for children in developing countries. Improved sanitation indeed goes along with a better current health status of the child, particularly concerning infections.

2. Accident and Injury Prevention in Children:
Among the common causes of morbidity and mortality due to injury in childhood are drowning, burns, and falls. The key to prevention is the implementation of specific home safety practices, childproofing, and parental education in preventing accidents.

3. Child Abuse and Neglect:
This will prevent long-term emotional and psychological damage by early identification and intervention. In this regard, paediatricians, educators, and social workers are regarded as front-line personnel in making such identifications when symptoms of abuse, such as unexplained injuries or changes in behaviour, indicate the need for intervention action to make sure that proper intervention strategies are implemented accordingly.

CHILD HEALTH IN EMERGENCIES

Children who suffer from everything related to war zones, natural disaster aftermath, and all other humanitarian catastrophes are at higher risk for diseases from malnutrition and psychological trauma.

- **You might consider the impact of conflict and natural disasters on children:** Children who face conflict and natural disasters are more exposed to malnutrition, diseases, and psychological trauma. Displacement of families usually disrupts access to education and healthcare services, those very things that cause long-term damage to children's health.
- **Child Refugees and Displaced Persons**: Among the graver consequences refugee children face are malnutrition, mental health disorders, and losses to interrupted education. While such negative effects are somewhat mitigated at international levels regarding efforts on mental health support, vaccinations, and schooling, substantial gaps often remain in access to healthcare.

HEALTHCARE SYSTEMS AND POLICIES FOR THE HEALTH OF CHILDREN

Primary healthcare systems make a very important contribution to child health mainly through preventative care, vaccinations, and treatment of illnesses.

- **Primary Health in Promoting Child Health:** Primary health care is the first point of contact for families and children, particularly in disadvantaged communities. Primary health care provides growth monitoring, vaccinations, and infections such as diarrhea, pneumonia, and other common illnesses.
- **National Child Health Programs and Initiatives:** Many countries have initiated various national schemes directed at the health of children. For instance, the Integrated Child Development Services functioning in India aims at the reduction of malnutrition and improvement of early childhood education. Such programs emphasize preventive care, vaccination, and nutrition Education.

- **Access to Care Disparities:** The socioeconomic inequalities in health access badly affect the chances of children, especially from deprived sections of society and rural areas. Most policies that target these inequities concern increasing the availability and affordability of care to underserved populations.

FUTURE CHALLENGES AND INNOVATIONS IN CHILD HEALTH

Thus, foreshadowing what is to come relative to the future of child health, is the emerging infectious diseases, advances in pediatric care, and digital health innovations.

Emerging Infectious Diseases: Recent outbreaks, such as that of Zika and COVID-19, have had a disproportionate effect on children. Congenital Zika virus has been linked to birth defects in newborns, while COVID-19 has disrupted education and routine healthcare services for children around the world. The fact that the climate is changing at an unprecedented rate will make it increasingly evident that new diseases affecting child health will continue to emerge.

- **Advances in Paediatric Care:** Gene therapy and personalized medicine are emerging technologies currently revolutionizing the treatment of paediatric disorders. Gene therapy could potentially cure genetic disorders, and personalized medicine can provide treatment care that is tailored to the specific genetic profile and disease condition affecting an individual child.
- **Digital Health Interventions:** Telemedicine and mobile health applications are increasingly imperative in the field of paediatric healthcare, especially for underserved populations: consultations in real-time, monitoring the condition of a patient remotely, and better compliance with prescribed treatments. Climate Change and Child Health: Climate change is emerging as an increasingly important factor in child health. Environmental changes expose children to the risks of emerging infectious diseases, respiratory disease, and malnutrition.

CONCLUSION

Child health is a fundamental component of global health, shaping the future of societies and ensuring the well-being of generations to come. As we have explored, addressing the myriad factors influencing child health—ranging from infectious diseases and nutrition to access to healthcare and preventive measures—is essential for reducing childhood morbidity and mortality. Effective strategies, such as Integrated Management of Childhood Illnesses (IMCI), emphasize the importance of a holistic approach that integrates preventive and curative care, engages communities, and strengthens health systems.

Investing in child health is not merely a health issue; it is a social and economic imperative. By prioritizing the health and well-being of our children, we are laying the foundation for healthier, more prosperous communities in the future. As former United Nations Secretary-General Kofi Annan once said, "Children are our greatest treasure. They are our future." This underscores the responsibility we all share in safeguarding their health and ensuring they have the opportunity to thrive.

In our collective efforts to improve child health outcomes, we must remain steadfast in our commitment to empowering families, communities, and health systems. Together, we can create a world where every child has the chance to lead a healthy and fulfilling life.

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CHILD SURVIVAL STRATEGY

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Definition

Child survival strategies are the various steps taken on behalf of children aged 0-5 by individuals and communities to reduce the risks and severity of adverse health outcomes that these children are prone to (USAID,2002). They are strategies that have been put in place by the United Nations Children's Education Fund (UNICEF) to help combat the issue of child morbidity and mortality among under-5 children (UNICEF, 2006).

They are simple, practicable, culturally acceptable and low-cost methods of improving child survival.

Child survival is a major public health concern in most countries in Africa. The past 20 years have witnessed improvements in child survival due to the effective public health interventions and better economic and social performance worldwide. Nevertheless, about 10.6 million children die yearly, 4.6 million of these in the African Region. About one quarter of these deaths occur in the first month of life, over two thirds in the first seven days. The majority of under-five deaths are due to a small number of common, preventable and treatable conditions.

The objective of the strategy is to accelerate the reduction of neonatal and child mortality in line with the Millennium Development Goals by achieving high coverage of a defined set of effective interventions. They aim to prevent childhood killer diseases, save children from death due to rapid dehydration as a result of diarrhoea, assess the nutritional status of children and give prompt attention to those having or developing malnutrition, to monitor the growth pattern of children especially those under-five and to encourage breastfeeding.

Multiple constraints in health systems hamper the effective scaling up of interventions. Insufficient human, financial, and material resources coupled with limited managerial capability, out-of-pocket payments and inadequate mechanisms for families to access health care are just some of the factors that lead to poor service delivery and low coverage of interventions. Insufficient availability of essential drugs and supplies, and inadequate supervision of health-care providers are among the persistent problems of the health system in many countries.

The strategies are eleven in number and are represented with the acronym, "**GOBIFFFETH**"; meaning:

- Growth monitoring
- Oral rehydration therapy
- Breastfeeding
- Immunization
- Female education
- Family planning
- Food fortification and supplementation
- Environmental protection and sanitation
- Essential drugs program
- Treatment of common ailments
- Health education

Growth monitoring:

Growth monitoring has been defined as the regular measurement, recording and interpretation of a child's growth change in order to counsel, act and follow up results (Vee and Zerfas, 1987).

This involves the routine measurements (weight, height, mid-upper arm circumference, head and chest circumference) of a child to help detect abnormal growth. It is the process of following the growth rate of a child in comparison to the standard, in order to detect faltering early on and address it accordingly (Griffiths and Rosso, 2007). It is also used as a screening tool to diagnose nutritional, chronic systemic and endocrine disease at an early stage (Khadilkar et al., 2007).

Oral rehydration therapy:
Diarrhoea has been observed to be the second leading cause of death and malnutrition in children under age 5, as it accounts for more than 500,000 deaths globally (GBD, 2017) and most also result from dehydration. Nigeria had the highest number of deaths due to diarrhoea in 2016.

Oral rehydration involves the administration of oral rehydration solution (ORS) to replace lost ions and electrolytes in the body system to prevent dehydration (WHO, 2009).

Before administering an oral rehydration solution, it is important to assess the level of dehydration. This involves:

- Asking the mother or caregiver about the number of stools passed, frequency of vomiting, level of thirst and urine flow and appearance.
- Observing the mental condition of the child, the appearance of the eyes, the state of the mouth and mucous membranes and the rate of breathing.
- Feeling the condition of the skin, the rate and volume of pulse and for infants, observing and feeling the anterior fontanelle.

The oral rehydration solution is prepared by dissolving one sachet in 1 litre of clean water. It should be administered using a cup and spoon.
If an Oral rehydration solution is not available, a salt sugar solution (SSS) can be administered. Mothers must be taught on how to prepare for maximum cooperation and effectiveness.

It involves the use of 5 cubes of sugar or 10 teaspoons of granulated sugar, 1 level teaspoon of salt and 600mls of clean water.

It should also be noted that hands must be washed thoroughly with soap and water before preparation.

Mother or care giver should also be educated on danger signs and the importance of taking prompt actions. These danger signs include:

- Persistent, frequent, large amount of watery stool, persistent vomiting, persistent feeling thirst, dark urine, sunken eyes, unusual weakness, irritability or drowsiness, depressed anterior fontanelle, etc.

Breastfeeding:
Undernutrition in under-5 children causes an estimated 2.7 million child deaths annually, which is about 45% of all child deaths. Exclusive breastfeeding, which is feeding an infant with only breast milk without adding any other fluid, including water, from 0-6 months of life, has been observed to save the lives of over 820,000 under-5 children yearly (WHO, 2018). After 6 months of life, complementary feeding with locally available foods should be combined with breastfeeding until 2 years of life to boost the nutrition of the child and further save lives.

Breastfeeding is recognized as the gold standard of infant feeding. Breastfeeding is fundamental to the growth, development, and health of children.

Breastfeed should be given during the day and night allowing a long time, at least 15 minutes, on each breast. The baby should always be put to the breast on demand and allowed to suck until satisfied.

Steps to successful breastfeeding for maternity services (WHO/UNICEF)

Every facility providing maternity services and care for newborn infants should:

- Have a written breastfeeding policy that is routinely communicated to all healthcare staff.
- Train all healthcare staff in skills necessary to implement this policy.
- Inform all pregnant women about the benefits and management of breastfeeding.
- Help mothers initiate breastfeeding with 30 minutes of birth.
- Show mothers how to breastfeed and how to maintain lactation even if they should be separated from their infants.
- Don't give newborn food or drink other than breast milk unless medically indicated.
- Practice rooming i.e. allow mother and infant to remain together 24 hours a day.
- Encourage feeding on demand.
- Give no artificial teats or pacifiers.
- Foster the establishment of breastfeeding support groups.

Immunization:
This is the method of administering protective measures against infectious diseases in children (Tadesse et al., 2009). It is a core child survival strategy which is targeted at averting about 1.2 million child deaths every year (Malande et al., 2019). It is also a key strategy toward achieving the Sustainable Development Goal (SDG) number 3 (WHO, 2010). Almost one third of

deaths among children under 5 are preventable by vaccines. The vaccine-preventable diseases include pertussis, childhood tuberculosis, tetanus, polio, measles, diphtheria, measles, influenza, mumps, rubella, Haemophilus influenza type b, hepatitis B, rotavirus, varicella, pneumococcal pneumonia, meningococcal meningitis.

Female education:
Female education can be described as a gateway towards diversified aspects of modern life that significantly affect child survival in the following ways:

- It makes a woman conscious about the well-being of herself and her family.
- · It gives the basic ideas about the path to well-being and also equips and encourages them to increase their knowledge of healthy living.
- · It helps to form the attitudes that promote a healthy life.
- · It facilitates health-seeking behaviors and makes mothers willing to use healthcare services when necessary as well as prepares them for overcoming the barriers in doing so.
- · Education allows greater exposure to the mass media, which can keep mothers better informed about health issues.
- · It teaches and encourages mothers to practice good hygiene.
- · It equally empowers mothers to make and implement proper and timely decisions regarding their children's health.

A proverb says, "If you educate a man, you educate an individual, but if you educate a woman, you educate a nation".

Family planning:
This is a deliberate action that entails controlling the timing and number of pregnancies in women (UNICEF, 1998). It has been observed that several morbidities and mortalities are associated when there is no adequate spacing in childbirth. Child survival is influenced by three aspects of fertility behaviors- the mother's age at the time of birth, the number of births, and the time interval between births.

Infants face less competition for resources such as food and medical care when the birth interval is long.

Where two babies are not spaced, the older one is likely to suffer a sudden reduction in care and premature withdrawal from breastfeeding which may adversely affect the immunologic defense system, thus predisposing the child to childhood infections, malnutrition or death.

Food fortification and supplementation:
Food fortification involves enriching commonly eaten staple foods with micronutrients. Food supplementation is taking foodstuff or capsules that are specifically made to increase the micronutrient status of the person taking it. It is cost-effective and improves nutritional outcomes.

Vitamin A and zinc supplementation have benefits in reducing death due to diarrhoea in children. Iodine fortification by salt iodization has caused moderate reductions in the incidence of goitre, cretinism and low cognitive function. It has improved mental development and physical growth in young children under 3.

Iron supplementation and fortification have improved haemoglobin levels and have reduced iron deficiency anaemia in children.

Vitamin A fortification in sugar and oil has reduced the risk of blindness in children.

Folic acid supplementation prevents neural tube defects. Mothers are advised to take folic acid during the antenatal period.

Environmental protection and sanitation:
Many of the diseases that lead to increased morbidity and mortality in children are largely related to the unavailability of safe water, poor hygiene behaviour and poor sanitary facilities. Inadequate drainage and accumulated waste water encourage the breeding of mosquitoes with high malaria attacks being a significant cause of deaths in children. Improved household water, sanitation and promotion of hygiene are essential for child survival.

Essential drugs program:
Essential medicines, as defined by the World Health Organization, are medicines that satisfy the priority healthcare needs of the population. These are medications to which people should have access at all times in sufficient amounts and their prices should be at generally affordable levels.

Health education:
Health education plays a crucial role in childhood survival by promoting awareness about proper nutrition, hygiene and preventive healthcare measures. It empowers parents and caregivers to make informed decisions, reducing the risk of diseases and improving overall child well-being. (organization w. h.)

Social determinants of child health

Socioeconomic factors like lack of health insurance, low minimum wages of parents and care givers, expensive health care services adversely affect child survival.

Poor access to healthcare services and not receiving timely care of arrival increases

childhood morbidity and mortality

Highly unstable politics, internal crisis like banditry and terrorism, natural disasters like flooding negatively influence health outcomes in children.

POLICY AND GOVERNMENTAL ROLE

The government plays a pivotal role in child survival. Governments and their partners should work together to foster strong primary health care systems so that all children have access to essential health, nutrition, and social services.

Specifically, governments and partners can jointly:

- Prioritize child health by including it as a top agenda item and allocating sufficient resources to support comprehensive child health and nutrition programs.
- Develop and implement policies and costed plans for child health and nutrition that support nurturing care and include targeted activities to reach the most vulnerable children.
- Coordinate and harmonize implementation strategies across projects and initiatives so that child health and nutrition services are delivered as a holistic package. This includes greater support for the uptake of IMNCI/ICCM, treatment programs for acute malnutrition, and follow-up services for children at elevated risk.
- Strengthen community delivery strategies and community health care worker programs to increase service availability where children live and to improve caregiver knowledge and support.
- Invest in referral networks so that care is available for emergencies and for children with complex conditions.
- Build effective partnerships for multi-sectorial action across government sectors and local actors to tackle determinants of child health such as water and sanitation, air pollution, food security, and gender equity. (Requejo, 2024)

NATIONAL CHILD HEALTH POLICIES

Integrated Management of Childhood Illness (IMCI) and Integrated Community Case Management (ICCM) are the key child survival thrusts being used by the Nigerian Government to address the unacceptably high under-5 morbidity and mortality indices.

The Federal Ministry of Health, in 1997, adopted the implementation of the Integrated Management of childhood illness (IMCI) strategy as the main thrust of her child survival effort. Implementation has however remained at a lower scale.

Integrated Management of Childhood Illness (IMCI): is an integrated approach that focuses on the health and well-being of the child. IMCI aims to reduce preventable mortality, minimize illness and disability, and promote healthy growth and development of children under five years of age. IMCI includes both preventive and curative elements that can be implemented by families, in communities, and in health facilities.

The strategy includes three main components:

- Improving case management skills of healthcare providers;
- Improving health systems to provide quality care;
- Improving family and community health practices for health, growth and development.

In health facilities, the IMCI strategy promotes the accurate identification of childhood illnesses in outpatient settings, ensures appropriate combined treatment of all major conditions that affect a young child, strengthens the counseling of caretakers, and speeds up the referral of severely ill newborns and children. In the home setting, it promotes appropriate care-seeking behaviors, improved nutrition, and support for early childhood development, prevention of illness, and correct implementation and adherence to treatment.

Integrated Management of Childhood Illness, 2024

In addition, Integrated Community Case Management (ICCM) was introduced in Nigeria in 2013 to address the three major childhood illnesses (Pneumonia, diarrhea, and malaria) in rural communities to improve access to curative care at the community level

Objectives

- To provide optimum nutrition for infants and young children
- To increase the exclusive breastfeeding rate from 17% to 50% by 2030
- To reduce by half, the 2013 prevalence rate of 29% of underweight by 2030.
- To significantly reduce morbidity and mortality from ARI (Pneumonia), diarrhea, malaria, and vaccine-preventable diseases.
- To reduce morbidity and mortality attributable to HIV/AIDS in children.
- To reduce the disease burden arising from vaccine-preventable diseases in all communities in Nigeria, while using immunization as an entry point to strengthen the overall Primary Health Care delivery system.

Policy Thrusts:

- The government shall implement global strategies for child survival through sustained advocacy to ensure optimal growth and development of all newborns and children.

- Supporting and enhancing an enabling environment without any form of discrimination for working mothers through the provision of crèches in workplaces.
- Ensure that health workers and other care providers have the skills and information to support optimal infant and young child feeding.
- Prevention of mother-to-child transmission of HIV and ensure optimal infant and young child feeding in the context of HIV.
- Revitalize Baby Friendly Initiative in the community and health facilities.
- Government shall work with relevant agencies towards the implementation of the current International Labour Organization (ILO) on Maternity Protection at Work.
- Provide Vitamin A and other micronutrients (iron, folic acid, iodine, zinc) including supplementation for post-partum mothers and children aged 6-59 months.
- Provide the delivery of evidence-based, cost-effective, and integrated interventions (IMCI, ICCM, Immunization, etc.).
- Increase access and promote the use of long-lasting insecticidal nets for pregnant women and under-five children through health facilities and community outlets.
- To ensure optimal care, support, and treatment of HIV-infected and affected children.
- To provide access to early diagnostic services and prophylaxis (antiretroviral and Cotrimoxazole) to exposed infants
- To ensure availability and access to diagnostic tools such as Rapid Diagnostic Test kits and essential childhood medicines like Artemisinin-based combination therapy, Amoxicillin, Oral Rehydration Solution, Zinc, etc.

Other policies include:

- School and adolescent health promotion
- Pre-adolescent health
- Injury prevention and protection of children
- Care for children living under special circumstances

(Federal ministry of health, 2018)

IMPORTANCE OF FUNDING AND RESOURCES

The importance of adequate funding in the implementation of comprehensive child survival strategies cannot be over-emphasized.
Investing in children improves health outcomes, incomes, and economies. Inadequate costing can lead to a shortage of critical medicines, vaccines, and other essential supplies.
Unavailability of health insurance to the average family restricts health seeking ability, preventing early diagnosis and management of conditions.

COMMUNITY BASED APPROACH

The promotion of household and community health practices through community health workers (CHWs) is among the key strategies to improve child health.

The Role Of Health Care Workers

Community health care workers are the frontline workers who support healthcare programmes and as such, have a role to play in ensuring child survival strategies in the community and world at large. Their roles include the following:

1. Identifying pregnant women and diagnosing existing and pregnancy-related conditions, promoting health through education, hence giving antenatal care (NPHCDA, 2011);
2. Teaching women on health promotion through healthy lifestyles in pregnancy and also during postnatal period, and distributing commodities such as mosquito nets (NPHCDA, 2013).
3. Facilitating birth and emergency preparedness for unexpected adverse events/complications that may occur in pregnancy or post-natal (FMoH, 2014);
4. Ensuring they are well equipped for vaccination, dispensing micronutrient supplements and oral medications during postnatal periods (NPHCDA, 2011);
5. Carrying out growth monitoring in children to observe their growth matrix and to detect anomalies as soon as possible (NPHCDA, 2013);
6. Promoting breastfeeding and family planning programs amongst mothers by informing them of the importance and the benefits attached (CHPN, 2006). (child survival strategies: addressing under 5 mortality in Nigeria, 2021)

MODELS OF SUCCESSFUL COMMUNITY INTERVENTIONS

The Community Engagement Continuum consists of a stepwise scale of engagement starting with community outreach activities and culminating in shared leadership. The five steps or categories of increasing community involvement, impact, trust, and communication in the framework include:

- Outreach
- Consult
- Involve
- Collaborate
- Shared Leadership
- The Outreach category applies to programs that provide information and services within the community (e.g., a trained health worker provides information to individuals and families at the household level). The Consult category applies to programs that share information with the community and solicit feedback. The Involve category applies to programs where

communities and service providers cooperate with each other (e.g., involvement consists only of some role in the selection of the local community health workers/ village health workers and/or the involvement of community members in some intervention activities. The Collaborate category applies to programs that form a partnership with the community on several aspects of the intervention including planning and management of the program. The highest step in the community engagement continuum is Shared Leadership, where final decision-making authority for the program is held by the community itself. (Commun, 2014)

MONITORING AND EVALUATION

INDICATORS OF CHILD HEALTH AND SURVIVAL

Indicators for assessing infant and young child health survival include 8 core indicators, are population-based and can be derived from household survey data.

Impact indicators on the health status of women's and children's health.

1. Maternal mortality ratio (deaths per 100 000 live births);
2. Under five child mortality, with the proportion of new born deaths (deaths per 1000 live births);
3. Children under five who are stunted (percentage of children under five years of age whose height-for-age is below minus two standard deviations from the median of the WHO Child Growth Standards).

Coverage indicators on key interventions on women's and children's health.

- Met need for contraception (proportion of women aged 15-49 years who are married or in union and who have met their need for family planning, i.e. who do not want any more children or want to wait at least two years before having a baby, and are using contraception);
- Antenatal care coverage (percentage of women aged 15–49 with a live birth who received antenatal care by a skilled health provider at least four times during pregnancy);
- Antiretroviral prophylaxis among HIV-positive pregnant women to prevent vertical transmission of HIV, and antiretroviral therapy for women who are treatment-eligible;
- Skilled attendant at birth (percentage of live births attended by skilled health personnel);
- Postnatal care for mothers and babies (percentage of mothers and babies who received postnatal care visit within two days of childbirth);
- Exclusive breastfeeding for six months (percentage of infants aged 0–5 months who are exclusively breastfed);
- Three doses of the combined diphtheria, pertussis and tetanus vaccine (percentage of infants aged 12–23 months who received three doses of diphtheria/pertussis/tetanus vaccine);
- Antibiotic treatment for pneumonia 1. (percentage of children aged 0–59 months with suspected pneumonia receiving antibiotics). (organization W. h., 2014)

IMPORTANCE OF DATA COLLECTION AND ANALYSIS

Data collection and analysis can yield essential information to guide child welfare decision-making and practice improvements. Data and statistics provide a foundation for agencies to respond to Federal and State reporting requirements, and requests from agency leadership, policymakers, and funders, which can support sustainability. They also may support agencies' continuous quality improvement efforts.

Data can help child welfare professionals, policymakers, and others better recognize the extent of ethnic, and other disproportionality and disparity in their systems and across the country. (child welfare information gateway, n.d.)

CHALLENGES AND BARRIERS

The barriers to accessing adequate healthcare include:

- Long distance to healthcare facilities
- Uneven distribution of healthcare facilities
- Dearth of healthcare personnel due to scarcity of healthcare funds
- Cultural practices such as wife seclusion in northern Nigeria
- High illiteracy rates
- Financial constraints (Adedini, 2014)

CONCLUSION

In conclusion, effective child survival strategies are essential for reducing mortality rates and ensuring the well-being of children worldwide. By focusing on key interventions such as improving maternal health, enhancing nutrition, providing access to clean water and sanitation, and ensuring timely vaccinations, we can significantly impact child survival. Collaborative efforts among governments, organizations, and communities are vital to implement these strategies effectively. Additionally, addressing socio-economic factors and promoting education can create an environment where children thrive. Ultimately, investing in the health and survival of children is not only a moral imperative but also a foundational step toward sustainable development and a brighter future for all.

Supervisor's Note:

Child survival strategies, if adequately implemented, can reduce our high morbidity and mortality rates. The need for health professionals and administrators to understand these strategies can therefore not be overemphasized.

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BREASTFEEDING

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INTRODUCTION

The act of feeding a baby with milk from the breast. Breastfeeding or nursing is the process by which human breast milk is fed to an infant directly or indirectly.

Babies can be fed directly from the mother's breast, or breast milk can be extracted/expressed and then fed to the baby using alternate feeding methods. Breast milk contains calories, vitamins, minerals, and other important nutrients that help an infant grow and develop.

Breastmilk is the ideal food for infants. It is safe, clean and contains antibodies which help protect against many common childhood illnesses. Breastmilk provides all the energy and nutrients that the infant needs for the first months of life, and it continues to provide up to half or more of a child's nutritional needs during the second half of the first year, and up to one third during the second year of life.

Breastfed children perform better on intelligence tests, are less likely to be overweight or obese and less prone to diabetes later in life. Women who breastfeed also have a reduced risk of breast and ovarian cancers.

According to WHO, exclusive breast feeding is the practice of whereby an infant receives only breast milk from the mother or a wet nurse or expressed breast milk. Commencing within the first 1 hour of birth to first 6 months of life.

BREAST FEEDING POSITIONS

There are several breast feeding positions used by different mothers in different situations, but the most popular position is the cradle hold position. The emphasis here is that mother should be comfortably seated with proper support to ensure a relaxed position. As much as possible, nipple and areola should be inserted into baby's mouth.

Cradle hold

The cradle hold is the most common position and helps provide an enjoyable feeding and bonding experience for both of you.

- Sit somewhere with support to keep your arm at the right height, like an armed chair or couch. If needed, you can use pillows to support your arm.
- Position your little one in your lap with their head in the crook of your arm.
- Keep your baby's chest against yours so they do not have to turn their head toward your breast. If necessary, use pillows to support your baby's head.

Cross-cradle hold

This position is useful when first learning to breastfeed and is a great option for small babies. It allows you to have good control of your baby's head while helping your little one to latch on.

Think of this as the reverse of the cradle hold. To perform the cross-cradle hold, position your baby in the opposite direction of the cradle hold with their head in your hand, rather than the crook of your arm.

Under-arm hold, Football hold or Rugby hold

If you are dealing with engorged breasts or sore nipples, this is a great position to try. This hold helps to prevent plugged ducts by positioning your baby to empty the bottom ducts – it's a win for both of you!

- While turned on your side, hold your baby like a football or rugby ball along your forearm, with your baby's body on your arm and face toward your breast.
- Position your baby's legs under your arm.
- Use your other hand to support your breast.

The football or rugby hold is also helpful if you have undergone a Cesarean section and can't place your baby on your stomach while nursing.

Side lying position

If you and your baby are more comfortable lying down, this is a great position to try.

- Lay on your side and place your baby on their side, facing you, with their head at your breast.
- Support your back with pillows and make sure that your baby's nose isn't obstructed.

Reclining position

If your little one has difficulty latching or is restless and crying, this is a calming position to try. In fact, this position is sometimes called "biological nurturing."

Support yourself with pillows and lean far enough back for your baby to be fully supported on your reclined body – not completely flat.

Lay your baby prone on your chest. To engage in skin-to-skin contact, lay your naked baby on your bare chest and enjoy bonding with your little one.

https://www.belliesabroad.com/wp-content/uploads/2018/04/BF.WHO-poster-A2.jpg

NUTRITIONAL BENEFITS FOR THE BABY

- Breast milk as the optimal source of nutrition for infants
  - Balanced nutrients (fats, proteins, vitamins, minerals)
  - Aids easy digestion
- Immunological benefits
  - Transfer of antibodies
  - Reduced risk of infections (respiratory, gastrointestinal)
  - Reduced risk of contamiation
  - Antimicrobial -Lactoferrin
  - Anti-inflammatory - Lysosomes, NK cells, macrophages and pro-inflammatory cytokines (IL-1, IL-6, IL-8, and TNF-α),
  - Immunomodulating -immunoglobulin production, and a suppressive effect on T cells
- Long-term health advantages
  - Lower risk of obesity, type 2 diabetes, and certain allergies
  - Development of the baby's brain and nervous system
- Provide laxative effect
  - Clears out Early passage of Meconium and bilirubin
- Beneficial for Preterm Infants
  - Decreased necrotizing enterocolitis
  - Decreased infection rates
  - Better able to tolerate feedings

BENEFITS TO THE MOTHER

- Less postpartum bleeding
- More rapid uterine involution
- Weight loss
- Decreased premenopausal breast cancer rates
- Decreased ovarian cancer rates
- Saves time
- Lactational amenorrhea can be a FP method but not reliable
- Should still use progesterone-only contraceptives
- Combined contraceptives dry up milk

EMOTIONAL AND PSYCHOLOGICAL BENEFITS

- Bonding between mother and baby
  - Physical closeness, warmth, and comfort
  - Promotes secure attachment
- Release of oxytocin and its effects on maternal health
  - Reduces stress and anxiety
  - Enhances maternal instincts and bonding

ECONOMICS, SOCIETAL AND ENVIRONMENTAL BENEFITS

- Economic savings for families
  - Formula costs vs. breast milk
- Reduction of healthcare costs
  - Fewer infant illnesses mean lower healthcare expenses

- Environmental impact
  - Less waste from packaging, bottles, and formula production.
  - Reduces littering and defacing of the environment.

PROBLEMS WITH BREASTFEEDING

- Anatomical problems (amastia, amazia)
- Poor latching
- Appetite spurt
- Breast engorgement
- Breast abscess
- Sore and cracked nipples
- Plugged ducts
- Physiological problems
- Psychological problems
- Poor knowledge
- Poor skill
- Poor social support
- Hospital practices
- Traditional beliefs

BREAST MILK SUBSTITUTE

Although breast milk is the gold standard for infant nutrition, especially within ages 0-6 months, some conditions warrant the use of infant substitutes.

BMS is the milk of other mammals. It is a specially formulated infant milk formula that is now available. They comprise reconstituted skimmed cow milk mixed with electrolyte-depleted cow's milk whey or casein proteins. The fats added are usually from vegetable, palm, coconut, or corn oils. Human milk fortifiers are used to increase the caloric value, especially for premature infants.

GLOBAL PERSPECTIVE ON BREASTFEEDING

WHO and UNICEF recommend that children initiate breastfeeding within the first hour of birth and be exclusively breastfed for the first 6 months of life – meaning no other foods or liquids are provided, including water.
Infants should be breastfed on demand – that is as often as the child wants, day and night. No bottles, teats or pacifiers should be used.
From the age of 6 months, children should begin eating safe and adequate complementary foods while continuing to breastfeed until they are two years old or older.

BABY FRIENDLY INITIATIVE

This was launched in 1991 by WHO and UNICEF to encourage and promote, protect, and support the act of breastfeeding. It is a global movement for mankind and is directed principally at health workers and health facilities. It is aimed at re-orienting them towards adopting policies and practices that promote and encourage breastfeeding.

This is achieved by observing the 10 steps to successful breastfeeding.

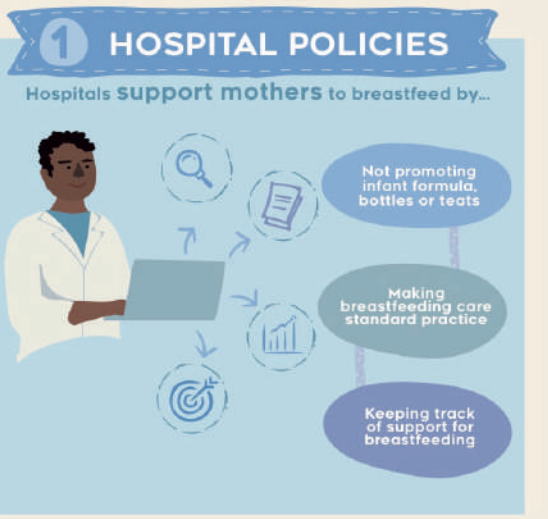
Critical management procedures:

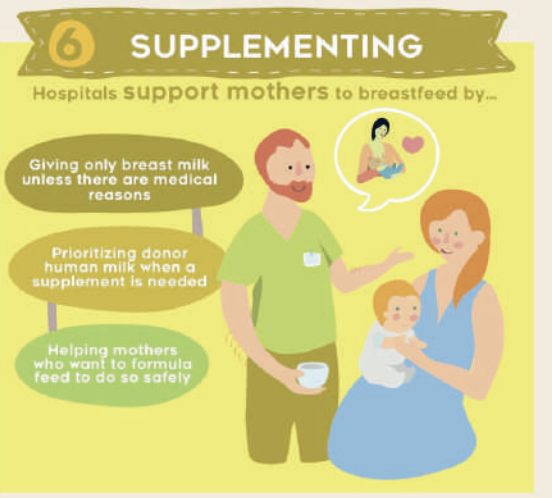
1. This first part comprises of:
   a. Comply fully with the *International Code of Marketing of Breast-milk Substitutes* and relevant World Health Assembly resolutions.
   b. Have a written infant feeding policy that is routinely communicated to staff and parents.
   c. Establish ongoing monitoring and data-management systems.
2. Ensure that staff have sufficient knowledge, competence, and skills to support breastfeeding.

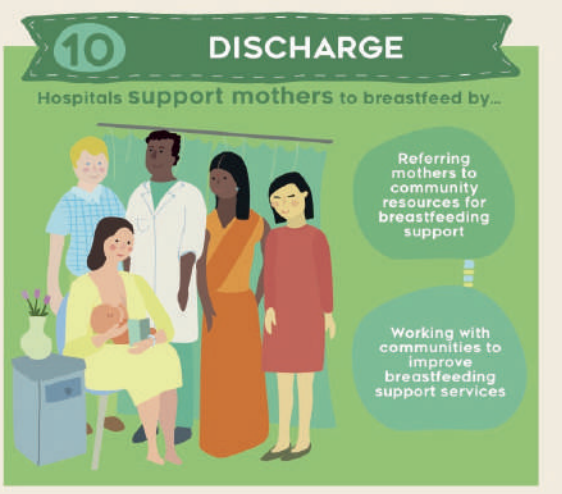
Key clinical practices:

1. Discuss the importance and management of breastfeeding with pregnant women and their families.
2. Facilitate immediate and uninterrupted skin-to-skin contact and support mothers to initiate breastfeeding as soon as possible after birth.
3. Support mothers to initiate and maintain breastfeeding and manage common difficulties.
4. Do not provide breastfed newborns any food or fluids other than breast milk, unless medically indicated.
5. Enable mothers and their infants to remain together and to practice rooming in 24 hours a day.
6. Support mothers to recognize and respond to their infants' cues for feeding.
7. Counsel mothers on the use and risks of feeding bottles, teats, and pacifiers.
8. Coordinate discharge so that parents and their infants have timely access to ongoing support and care.

The TEN STEPS to Successful Breastfeeding







World Health Organization

unicef

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CONCLUSION

In conclusion, breastfeeding is a very important part of childhood life whose importance cannot be overemphasized due to its numerous benefits to both mother and child. Breastmilk provides essential nutrients, promotes emotional bonding, and supports long-term health. Breastfeeding is not only natural but it provides a cost-effective, way to nourish infants and also contributes to the well-being of families and communities. Challenges to effective Breastfeeding may arise, but with proper support, education, and societal orientation, Exclusive breastfeeding can become a more acceptable and normalized practice. Skilled counseling and support should be provided prenatally and post-partum to all mothers to prevent poor lactation and avert the introduction of pre-lacteal feeds, commercial milk formula (CMF), or other breastmilk substitutes which are major risk factors for the premature termination of exclusive breastfeeding and any breastfeeding. Mothers, families, and communities must be provided with appropriate educational support and skill development, to understand and handle unsettled baby behaviors as an expected phase of human development. Society encouraging a breastfeeding-friendly environment benefits everyone, ensuring that mothers can provide the best start for their babies.

Health workers should be given the required knowledge and skills to promote, protect, and support breastfeeding, and ensure that they comply with the national/ international code on marketing of breast milk substitute.

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MATERNAL HEALTH

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INTRODUCTION

Maternal health is the health of women during pregnancy, childbirth, and the postpartum period. It encompasses the healthcare dimensions of family planning, preconception, prenatal, and postnatal care. World Health Organization has indicated that even though motherhood has been considered a fulfilling natural experience that is emotional to the mother, a high percentage of women develop health problems and sometimes even die.

Maternal health is very important because over 300 million women worldwide suffer from either short- or long-term complications arising from pregnancy or childbirth. Most of these deaths and disabilities are preventable. Maternal morbidity and mortality can be reduced through preventive and promotive activities and by addressing avoidable factors that cause death, which include safe motherhood initiatives.

Given the importance of maternal health for our families, communities, and nation, addressing the unacceptable rates of maternal mortality and severe maternal morbidity calls for a comprehensive approach that addresses health from well before to well after pregnancy. The achievement of this goal depends on improving maternal health literacy. It was noted that high maternal health literacy can achieve better maternal and child health behaviours and outcomes, such as actively acquiring health information, taking correct contraception during the puerperium, adherence to breastfeeding, and lowering health care expenditures.

World Health Organization estimates that about 295,000 maternal deaths occurred in 2017. According to UNICEF Nigeria is the 2nd country with the largest number of maternal death in 2020 [82,000 deaths].

Safe motherhood is a concept to ensure that women receive high-quality care to achieve the optimum level of health for mother and infant.

The six pillars of safe motherhood include

- family planning
- antenatal care
- obstetric care
- postnatal care
- post abortion care and
- control of STI/HIV/AIDS.

FACTORS AFFECTING MATERNAL HEALTH

Socioeconomic factors:

Maternal education, woman's age, employment and income, socio-economic status, residence (i.e. rural/urban), parity, distance to health facilities, and exposure to the media.

Poverty and unemployment prevent many women from getting proper and adequate medical attention due to their inability to afford good antenatal care.

Lower levels of maternal education are associated with higher maternal mortality even amongst women able to access facilities providing intrapartum care. Literate women tend to marry later and are more likely to use family planning methods. Mothers with primary education tend to take better care of their

children and are more likely to seek medical care, such as immunization, than those who lack schooling.

Poor access to maternal health services, bad roads, and transport challenges, is one of the major contributing factors to maternal deaths in low-resource settings, and understanding access barriers to maternal services is an important step for targeting interventions aimed at promoting institutional delivery and improving maternal health.

Cultural and social influences:

Early marriage, patriarchy, and exposure to intimate partner violence have a significant negative relationship with maternal health.
Low status of women, poverty, poor nutrition [in childhood, adolescence, and adulthood], ignorance/illiteracy, religious beliefs [that act as barriers to utilization of available health services], and harmful traditional practices are some of the cultural barriers faced that negatively influence maternal health.

Health service factors:

Lack of access to essential obstetric care, lack of access to family planning counseling and service, lack of drugs, blood, equipment, essential materials, instruments, consumables, etc in the hospital, non-availability of health workers on essential duties, the attitude of health workers and deficient communication and utility (power, water, etc) facilities in the hospitals.

MAJOR CHALLENGES IN MATERNAL HEALTH

Maternal health remains a complex challenge, with many women facing significant barriers that prevent them from receiving optimal care during pregnancy, childbirth, and the postpartum period. From maternal mortality to the rise in chronic conditions, addressing these challenges requires comprehensive strategies and multi-faceted interventions.

A. Maternal Mortality

Maternal mortality remains one of the most urgent challenges in maternal health. Globally, over 287,000 women die each year due to pregnancy and childbirth complications, the majority of which are preventable. According to UNICEF, the latest MMR of Nigeria is 576 (per 100,000 live births). The lifetime risk of a Nigerian woman dying during pregnancy, childbirth, postpartum, or post-abortion is 1 in 22, in contrast to the lifetime risk in developed countries estimated at 1 in 4900. Global targets for MMR by 2030 is to reduce it to less than 70 per 100,000 live births [SGD 3.1].

The leading causes of maternal death include:

- Haemorrhage
- Infections (puerperal sepsis
- Hypertensive disorders:
- Unsafe abortions:
- Obstructed labour:

B. **Chronic Conditions and Complications**

The increasing prevalence of chronic conditions poses new challenges to maternal health.

- **Hypertensive Disorders:** Hypertensive disorders, such as preeclampsia and eclampsia, are a leading cause of maternal and neonatal mortality. Preeclampsia, characterized by high blood pressure and damage to organ systems, can escalate into eclampsia, leading to seizures and other life-threatening complications. Early detection through regular prenatal check-ups is essential in managing these conditions.

- **Diabetes and Other Chronic Health Issues** Gestational diabetes and pre-existing chronic conditions, such as heart disease and obesity, significantly increase the risk of pregnancy complications. Managing these conditions requires specialized care during pregnancy and postpartum.

C. Mental Health Issues

Maternal mental health is often overlooked, but it plays a critical role in the well-being of both mother and child.

- **Postpartum Depression and Anxiety**: Postpartum depression affects about 10-15% of new mothers, while anxiety disorders may affect even more. Left untreated, these mental health conditions can impair a mother's ability to care for her newborn, leading to long-term consequences for the child's development and well-being.
- **Importance of Mental Health Support**: Integrating mental health services into maternal healthcare is essential. Screening for postpartum depression and providing access to counselling, support groups, and psychiatric care can significantly improve outcomes for mothers.

IMPROVING MATERNAL HEALTH IN NIGERIA

Improving maternal health in Nigeria is crucial to reducing the high maternal mortality rate, which remains one of the highest in the world. To address this, several key strategies need to be implemented at national, state, and community levels, focusing on improving access to quality healthcare, addressing socio-economic and cultural barriers, and strengthening the healthcare system.

1. Improve Access to Quality Healthcare

- **Skilled Birth Attendants:** Increase the availability of skilled healthcare providers, such as midwives and doctors, at delivery. Ensuring that every pregnant woman has access to skilled care during childbirth is essential to preventing complications such as hemorrhage and obstructed labor.
- **Emergency Obstetric Care:** Strengthen referral systems and equip healthcare facilities with emergency obstetric care (EmOC) capabilities, including blood transfusion services, cesarean section facilities, and medicines such as oxytocin and magnesium sulfate.
- **Antenatal and Postnatal Care:** Expand access to comprehensive antenatal care (ANC) services to monitor maternal health, detect complications early, and provide essential health education. Postnatal care is also critical to manage complications such as infections and postpartum hemorrhage.

2. Strengthen the Health System

- **Healthcare Infrastructure:** Improve infrastructure, particularly in rural areas, by building and equipping more health facilities, ensuring they are stocked with essential supplies and medications.
- **Health Worker Training and Retention:** Provide ongoing training and professional development for healthcare workers, particularly in rural and underserved areas. This should include updated training on the management of obstetric emergencies and respectful maternity care. Additionally, incentives for healthcare workers to stay in remote areas through better salaries, career development, and working conditions.
- **Universal Health Coverage (UHC):** Implement policies to provide affordable, quality healthcare for all, including financial protection for women and families. This will reduce out-of-pocket expenses and increase access to maternal health services.

3. **Address Socio-Economic and Cultural Barriers**

- **Poverty and Education:** Address poverty, a significant determinant of maternal health, by improving socio-economic conditions and access to education for women. Educated women are more likely to seek timely antenatal care, deliver in health facilities, and follow up on postnatal visits.
- **Cultural Beliefs and Practices:** Engage with communities to address harmful cultural practices and beliefs surrounding pregnancy and childbirth, such as reluctance to deliver in healthcare facilities or reliance on traditional birth attendants. Community health education programs can raise awareness about the importance of skilled birth attendance and emergency care.
- **Transportation**: Improve transportation infrastructure and establish community-based emergency transport systems to ensure women can access healthcare facilities quickly during emergencies, particularly in rural and hard-to-reach areas.

4. **Improve Family Planning and Reproductive Health Services**

- **Contraceptive Access:** Expand access to family planning services, including modern contraceptives, to allow women to space their pregnancies and avoid high-risk pregnancies. Unplanned and closely spaced pregnancies are major contributors to maternal deaths.
- **Education on Reproductive Health:** Provide reproductive health education in communities and schools to increase awareness of the importance of family planning and safe pregnancy practices.

5. Strengthen Data Collection and Monitoring

- Maternal Death Surveillance and Response (MPDSR): Continue and expand the use of MPDSR to monitor and review maternal deaths, identify the causes, and implement responses to prevent future deaths. This will help health authorities develop targeted interventions and track progress.
- Health Information Systems: Strengthen health data collection systems to ensure that accurate, timely information on maternal health is available for policy-making and resource allocation.

6. Promote Policy and Advocacy Efforts

- **Government Commitment:** Strong political commitment is required to implement effective maternal health policies. Advocacy efforts should aim at ensuring that maternal health remains a priority in Nigeria's national and state health agendas.
- **Collaboration with International Partners:** Leverage international partnerships and funding from global health organizations such as the WHO, UNFPA, and UNICEF to support maternal health programs.

7. Empower Women and Communities

- **Women's Empowerment:** Promote gender equality and empower women to make decisions regarding their health. Empowered women are more likely to seek antenatal care, deliver in health facilities, and use family planning services.
- **Community Involvement:** Involve community leaders and members in maternal health initiatives to create local ownership and sustainability. Community health programs and home visits by community health workers can play a

significant role in improving maternal health outcomes.

Maternal and Perinatal Death Surveillance and Response

Maternal and Perinatal Death Surveillance and Response (MPDSR) (2) is an essential quality of care (QOC) intervention that aims to improve maternal and newborn health outcomes.

The MPDSR continuous action cycle relies on teams to collect information on when, where, and why women and babies die, and outline the necessary actions to prevent similar deaths.

In 2021, Nigeria passed the National Maternal and Perinatal Death Review and Response Bill as "an act to provide the surveillance, review and prevention of maternal and perinatal deaths and related matters." MPDSR is implemented through facility-level reviews, community surveillance, health worker training, and national data management. The Ministry of Health, in collaboration with WHO and UNICEF, leads this effort.

Key Objectives

- Identifying Deaths
- Understanding Causes
- Actionable Recommendations
- Response Implementation
- Monitoring

Challenges

Challenges include underreporting of deaths, resource constraints, health worker fatigue, and cultural barriers. Additionally, gaps in data collection limit the effectiveness of the program. Despite these challenges, MPDSR has improved emergency obstetric care, training, and referrals in some regions. Strengthening resources, improving data collection, and engaging communities will be crucial for further success.

CONCLUSION

Improving maternal health outcomes globally requires addressing the significant disparities in care, reducing maternal mortality through strategic interventions, and managing chronic conditions that complicate pregnancies. By focusing on education, strengthening healthcare systems, implementing effective policies, and involving communities, we can reduce the global maternal health burden and ensure safer pregnancies and childbirth for all women.

"We are speaking of…an initiative; the beginning of a renewed emphasis & more intense effort to make pregnancy & childbirth as safe for all women in the future, as it is for a minority today. It could be done; it ought to be done, and in the name of social justice and human solidarity, it must be done." DG, WHO (1987).

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MATERNAL SURVIVAL STRATEGIES

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INTRODUCTION

Maternal mortality refers to the death of a woman during pregnancy, childbirth, or within 42 days of delivery due to complications related to pregnancy or childbirth, excluding accidental or incidental causes (WHO,1992). Maternal morbidity is a plethora of disabilities and illnesses resulting from complications of pregnancy, labour, delivery, and postpartum; most commonly those resulting from major causes of maternal deaths

In 2020, the maternal mortality ratio in the African Region was estimated at 531 deaths per 100,000 live births. Countries with extremely high maternal mortality rates are South Sudan with 1223 deaths, followed by Chad with 1063 deaths, and Nigeria with 1047 deaths per 100,000 live births. In 2017, Nigeria's maternal mortality rate was estimated at 917 per 100,000 live births; it increased by nearly 14% in 2020 to reach 1047 deaths.

Globally, approximately 287,000 women died in 2020 due to pregnancy or childbirth-related causes.

Maternal Mortality is a critical indicator of the quality of healthcare systems, particularly maternal and reproductive health services. Maternal survival strategies are crucial in reducing preventable maternal deaths, as most maternal deaths are avoidable with proper interventions. These strategies focus on improving access to quality care, addressing the underlying causes of maternal mortality, and strengthening health systems. Maternal Survival Strategies are crucial because they reduce maternal mortality by focusing on prevention, timely interventions, and addressing systemic health and social inequities.

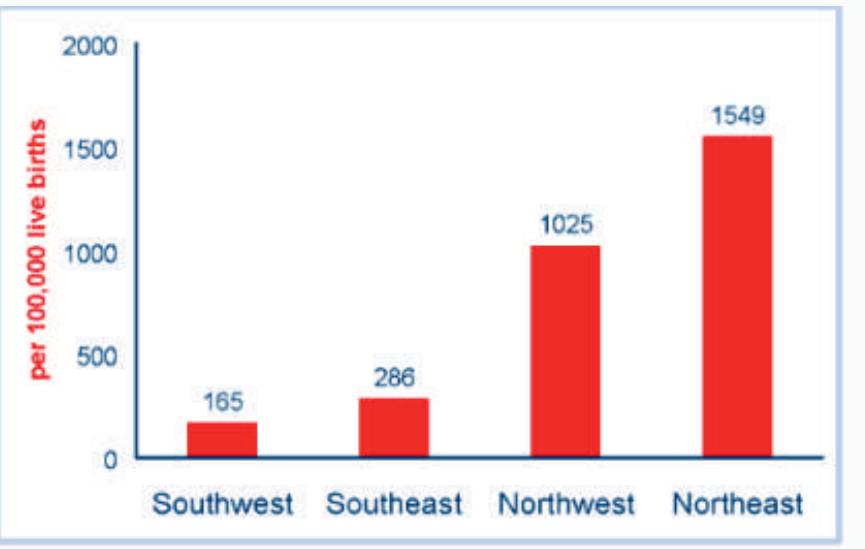
This article highlights effective strategies and their implementations. By investing in maternal health, countries can significantly reduce the global burden of preventable maternal deaths and improve the well-being of women, children, and families worldwide.

GLOBAL LANDSCAPE OF MATERNAL MORTALITY

600,000 women die of pregnancy-related causes worldwide. The majority of these deaths i.e. 95%, occur in developing countries in Latin America, the Caribbean, Africa, and Asia. 34% of global maternal deaths occur in Nigeria and India alone. According to WHO 2019, Nigeria occupies 1.7% of the total world population, yet contributes 20% of global maternal mortality. Globally, a maternal death occurred almost every two minutes in 2020. 145 Nigerian women die in childbirth every day i.e. one dies every 10 minutes. For every woman who loses her life, approximately 20 more will suffer short and long term disabilities, such as Chronic anaemia, Chronic Kidney Disease, Stroke, vesico-vaginal or Recto-vaginal fistulae, Stress Incontinence, Chronic pelvic pain, PID, Infertility, Ectopic Pregnancy, Depression etc.

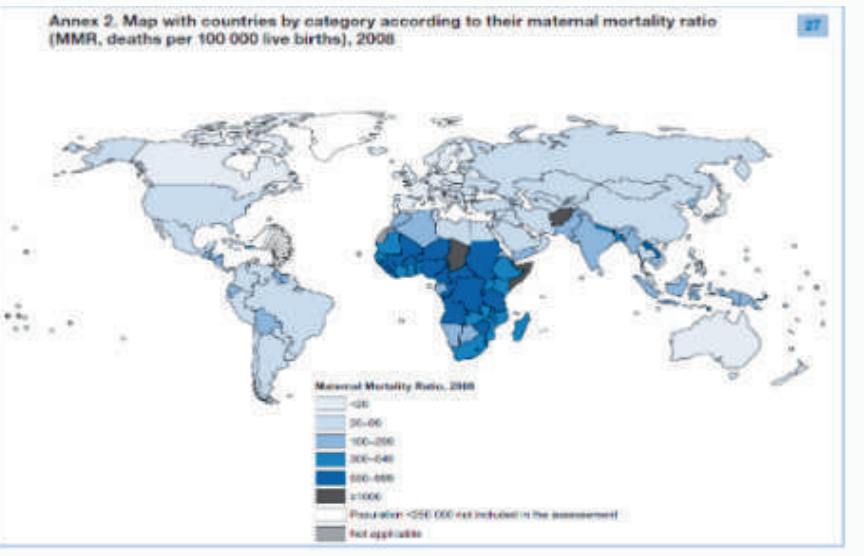
Maternal Mortality is a global health issue, therefore it requires a global solution. Maternal survival strategies refer to the various methods, interventions, and practices aimed at ensuring

the health and well-being of mothers during pregnancy, childbirth, and the postpartum period. These strategies are designed to reduce maternal mortality and morbidity by addressing common risks and complications that women face before, during, and after pregnancy. These strategies are part of broader efforts by governments, healthcare systems, and international organizations to improve maternal health outcomes and meet global health goals, such as the Sustainable Development Goals (SDGs) and Millenium Development Goals (MDGs).



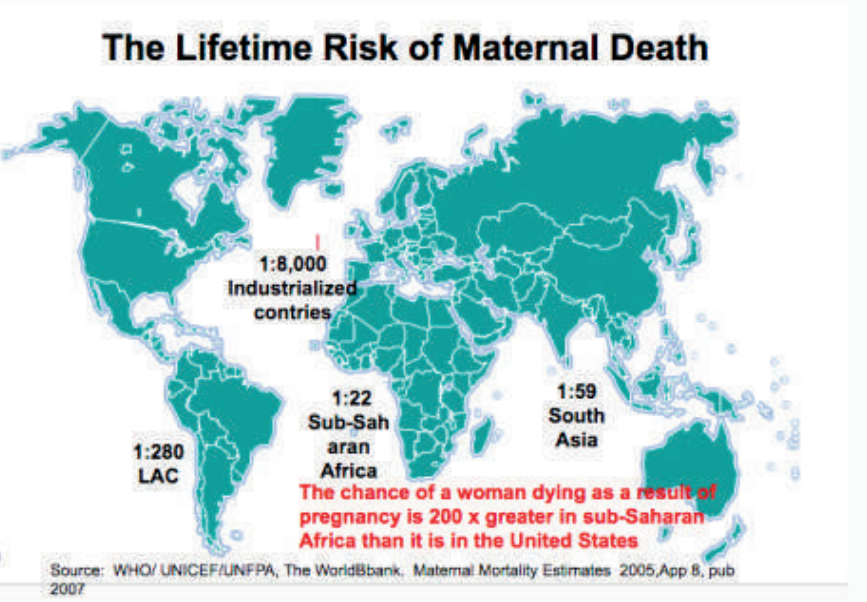
Maternal Mortality Ratio by Zone

In 1990, the global maternal mortality rate was 400 deaths per 100,000 live births, however, in 2020, the global maternal mortality rate was 223 deaths per 100,000 live births. However, this rate is still far from the Sustainable Development Goal (SDG) target of less than 70 maternal deaths per 100,000 live births by 2030.



GLOBAL MATERNAL MORTALITY RATIO

WHO recommends at least four antenatal care visits during pregnancy to monitor maternal and fetal health. About 85% of pregnant women receive at least one antenatal visit, but only 58% receive the recommended four visits. In 2020, about 77% of married or in-union women of reproductive age were using some form of contraception. However, there are still approximately 218 million women in low- and middle-income countries with unmet needs for modern contraception, leading to unintended pregnancies and higher maternal health risks. These statistics show that while significant progress has been made in improving maternal survival through various strategies, large disparities still exist, particularly in low-resource settings.

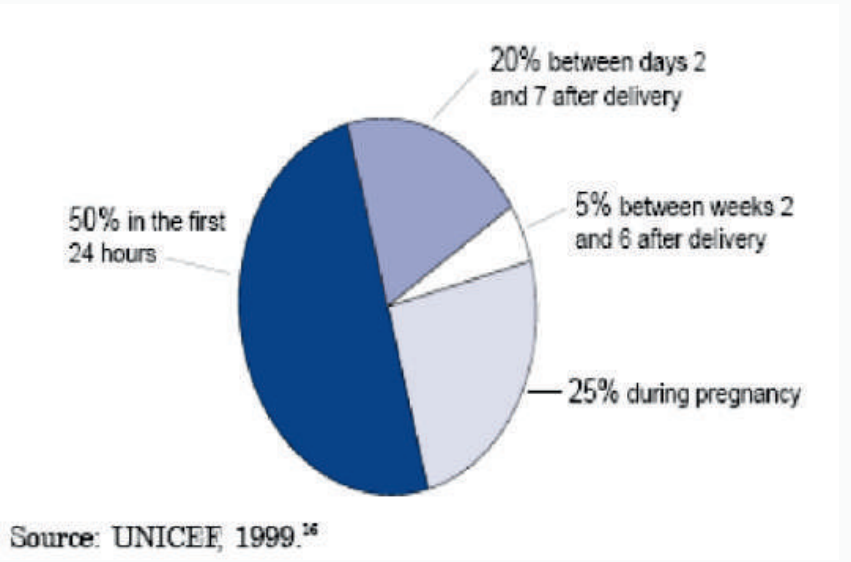


The Lifetime Risk of Maternal Death

There are great disparities between high-income and low-income regions concerning maternal mortality and the implementation of maternal survival strategies. Sub-Saharan Africa remains the region with the highest maternal mortality rate, with around 533 deaths per 100,000 live births in 2020, accounting for roughly two-thirds of global maternal deaths. South Asia has the second-highest maternal mortality rate, at about 163 deaths per 100,000 live births. However, between 2000 and 2017, Southern Asia achieved the greatest overall reduction in MMR: a decline of nearly 60% (from an MMR of 384 down to 157). Globally, about 81% of births were attended by skilled health personnel in 2020. In low-income countries, only around 65% of births are attended by skilled health personnel. In contrast, nearly 100% of births in high-income countries are attended by skilled professionals.

CAUSES OF MATERNAL DEATH

Maternal Death can be classified according to timing and cause. The timing of maternal death is subdivided into: Ante-natal, Intra-natal and Post-natal. Post-natal death accounts for about 61% of maternal deaths, with most of them occurring within 24 hours after delivery.



Timing of Maternal Deaths

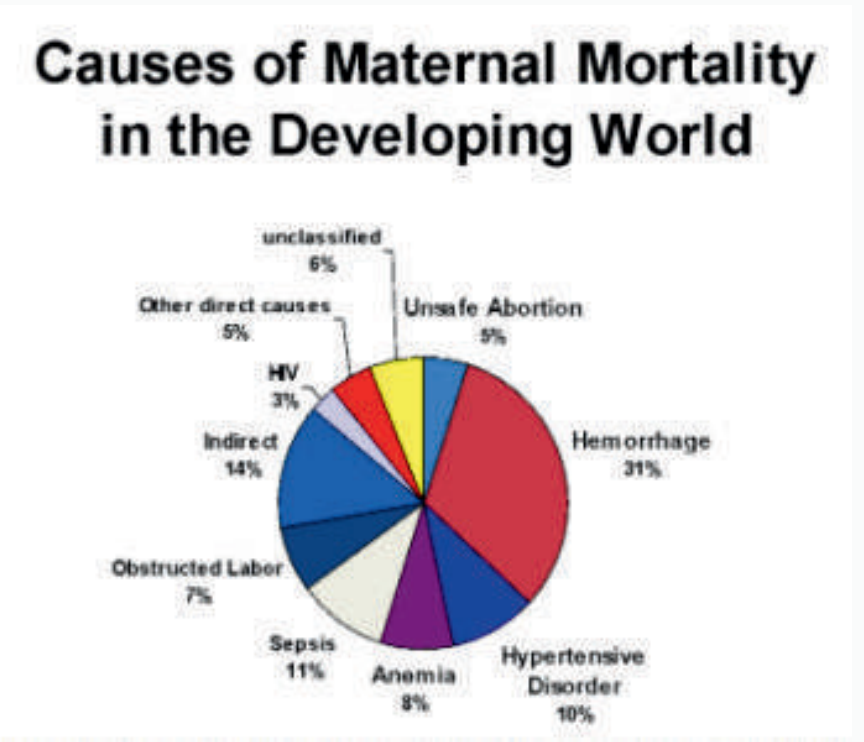
The causes of maternal death can be direct or indirect. Direct causes include hemorrhage, eclampsia, sepsis, unsafe abortion, and obstructed labour. Indirect causes include anemia, malaria, tuberculosis infection, HIV/AIDs, Sickle Cell Disease, and cardiovascular diseases in pregnancy.

The leading causes of maternal deaths globally are:

- Hemorrhage (27%),
- Hypertensive disorders (14%),
- Sepsis (11%),
- Complications from unsafe abortions (9%).

However, in Nigeria, 70 percent of maternal deaths in Nigeria are due to one of five complications:

- Obstetric Haemorrhage
- Sepsis
- Unsafe abortion
- Hypertensive diseases of pregnancy (eclampsia)
- Obstructed labour



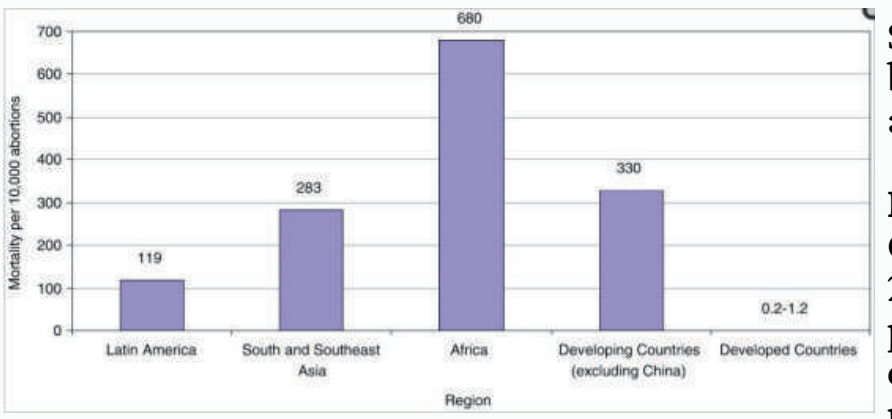
Other direct causes include embolism, ectopic pregnancy, anesthesia-related. Indirect causes include: malaria, heart disease

Causes of Maternal Mortality. Source: Adapted from " WHO Analysis of causes of maternal deaths: A systematic review." The Lancet, vol 367, April 1, 2006.

Obstetric Hemorrhage as a Cause of Maternal Death: Obstetric hemorrhage is a leading cause of maternal death, frequently exacerbated by factors such as late arrival to medical facilities in a moribund state with cardiovascular collapse. In such cases, resuscitation efforts in the emergency room or labor ward are often not aggressive enough, and the situation is further complicated by a severe lack of blood and blood products, which are essential for effective management of the condition.

Obstructed labour as a cause of maternal death: Obstructed labor can often be anticipated, as it is caused by mechanical factors. Women whose growth has been stunted by malnutrition or untreated infection or who bear children before pelvic growth is complete are at greatest risk for cephalopelvic disproportion, the disproportion between the size of the infant's head and the bony birth canal, which is the main cause of obstructed labor; fetal malpresentation is another, less common cause. Obstructed labor is a critical cause of maternal death that often arises from attempts at home birth with an untrained traditional birth attendant in remote areas characterized by poor or nonexistent road access, resulting in prolonged labor and significant delays in obtaining essential medical care. These delays can lead to life-threatening complications such as ruptured uterus, severe infection, and internal bleeding; prolonged obstructed labor may also cause injuries to multiple organ systems, including the development of vesico-vaginal or recto-vaginal fistulae, while significantly increasing the risks of sepsis and hemorrhage, ultimately jeopardizing the health and survival of the mother.

Unsafe abortion as a cause of maternal death: The World Health Organization estimated that approximately one-quarter of all pregnancies, totaling around 50 million each year, end in abortion; of these, an estimated 20 million are performed using unsafe methods by untrained providers or by the women themselves. This issue is particularly prevalent in Nigeria and the West African sub-region, where unsafe interference often results in death from infection, blood loss, and organ damage, and where spontaneous miscarriage—occurring in one in four pregnancies—can also lead to severe complications and death.



Global estimates of maternal mortality due to unsafe abortion. SOURCE: Wulf, 1999.

Sepsis as a cause of maternal death: It occurs when an infection during pregnancy, childbirth, or postpartum triggers a severe immune response, leading to organ failure. In low-resource settings, poor sanitation, delayed care, and limited access to antibiotics increase the risk of sepsis.

Hypertensive Diseases as a cause of maternal death: Hypertensive diseases, such as preeclampsia and eclampsia, account for about 14% of maternal deaths. These conditions cause dangerously high blood pressure during pregnancy, which can lead to severe complications like seizures, organ failure, and stroke. Without timely intervention, both the mother and baby are at risk.

FACTORS CONTRIBUTING TO MATERNAL MORTALITY

Largely preventable and broadly divided into 4 groups:

1. 1Medical factors; Direct or indirect causes, as has been discussed above.
2. Socio-cultural factors
3. Health service factors
4. Reproductive factors

Socio-cultural factors: The low status of women, coupled with poverty and poor nutrition throughout childhood, adolescence, and adulthood, significantly undermines maternal health outcomes. Additionally, ignorance or illiteracy, religious beliefs that deter the use of available health services, and harmful traditional practices further compound these challenges, limiting access to proper care and support for women.

In developing countries, women with complicated labors face many barriers to receiving timely and appropriate medical care. These obstacles can be summarized as the following the three delays described by Thaddeus and Maine (1994) and Maine (1997):

- Delay in deciding to seek care
- Delay in reaching a health facility because of a lack of transportation or resources
- Delay in receiving appropriate care at the facility.

Significant reductions in maternal mortality can be achieved if complications are anticipated and addressed promptly.

Health service factors: An article from The Guardian Newspaper in Nigeria reported that in 2020, about 82,000 Nigerian women died due to pregnancy-related complications and that doctors and activists said high maternal mortality rates reflect a lack of trust in a broken public healthcare system and little political will to fix it.

The World Health Organization recommends one doctor per 600 people for a functional healthcare system, but in Nigeria, the ratio is one doctor for every 4,000 to 5,000 patients. While the federal healthcare budget for 2024 is at a record high of 5%, it still falls short of the 15% recommended by the UN. Many Nigerians live in areas without adequately equipped medical facilities or face the need to pay upfront for treatment. During pregnancy, women often skip prenatal check-ups, turn to traditional healers, and delay seeking professional medical care until it's too late.

Factors related to healthcare services that affect maternal mortality include a lack of access to essential obstetric care and family planning counseling, inadequate availability of drugs, blood, equipment, and essential materials in hospitals, the non-availability of health workers on essential duties, and deficiencies in transportation, communication, and utility facilities such as power and water.

Reproductive Factors: A number of studies have shown that certain groups of women are at increased risk of maternal mortality. Maternal health risks are significantly heightened in women who are too young (under 18 years), too old (over 35 years), have too many deliveries (five or more), have deliveries spaced less than two years apart, or are too sick (with pregnancies that are contraindicated or pose a very high risk to life); notably, young adolescents aged 10 to 14 face a higher risk of complications and deaths related to pregnancy, with adolescent girls under 15 years experiencing the highest risk for pregnancy complications.

CORE MATERNAL SURVIVAL STRATEGIES

Core maternal survival strategies are essential interventions designed to improve maternal health and reduce maternal mortality. These strategies focus on providing comprehensive antenatal and postpartum care, ensuring access to skilled healthcare, facilitating emergency obstetric services, and promoting family planning. Additionally, they emphasize education, community engagement, and the

improvement of healthcare systems to address the social determinants of health. By implementing these strategies, countries can significantly enhance maternal health outcomes, particularly in resource-limited settings.

Antenatal Care: Antenatal care (ANC) can be defined as the care provided by skilled health-care professionals to pregnant women and adolescent girls to ensure the best health conditions for both mother and baby during pregnancy. Focused Antenatal Care (FANC) aims to give holistic individualized care to each woman to help maintain the normal progress of her pregnancy through timely guidance and advice.

The components of ANC include:

- Risk identification
- Prevention and management of pregnancy-related or concurrent diseases
- Health Education

The goals of Antenatal Care include:

- Health Promotion
- Prevention of complications of pregnancy and childbirth
- Early Detection and prompt management of problems
- Birth and Emergency Planning

Antenatal care plays a crucial role in improving maternal and newborn health by increasing the likelihood of skilled attendance at birth and providing essential health promotion, prevention, screening, and diagnosis of diseases. It also offers opportunities to prevent and manage concurrent conditions through integrated services, enhances the woman's experience of pregnancy, and ensures that babies have the best possible start in life while aligning with Sustainable Development Goals and promoting a human rights-based approach to care.

Research has shown that Nigerian women are more likely to receive ANC if they have secondary or higher education as well as if they are economically advantaged. Urban women are 3 times as likely to receive ANC as rural women (46% v 15%).

It is widely accepted that screening pregnant women to identify those at risk for obstetric complications is not a replacement for skilled care during labor and delivery. More maternal deaths occur in the much larger group of low-risk women.

however, certain antenatal interventions appear to be effective in reducing adverse maternal outcomes. These include the recognition and treatment of hypertensive disease of pregnancy, detection and treatment of asymptomatic bacteriuria, and external cephalic version at term, nutritional supplementation and encouraging birth preparedness.

Skilled Birth Attendance and Access to Skilled Care:

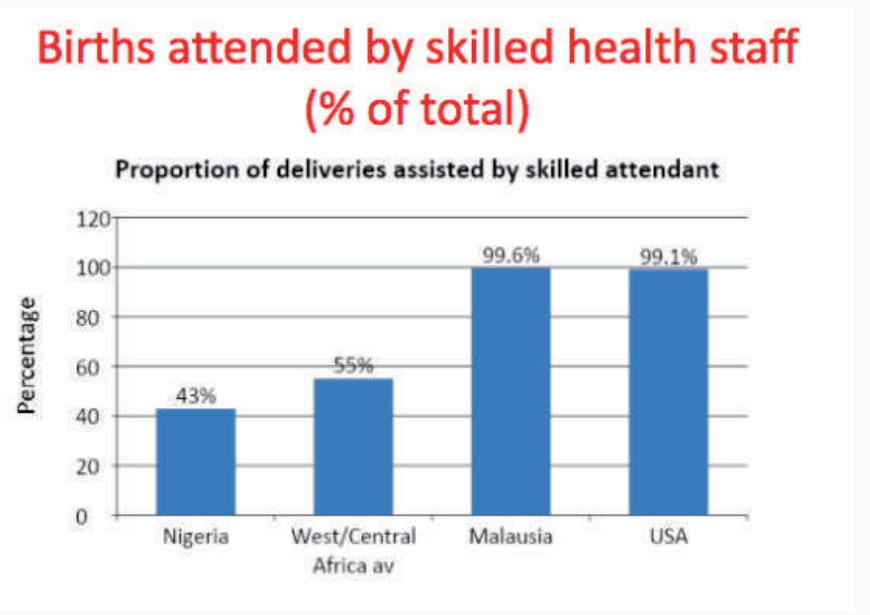
One in four babies worldwide is delivered without skilled care. Out of the total deaths, 75% can be prevented by access to a Skilled Birth Attendant, & Emergency Obstetric Care

An accredited health professional – an accredited health professional such as a doctor, midwife, nurse, or community health worker (CHO and CHEW) who has the knowledge and skills needed to:

- Manage normal (uncomplicated) pregnancies and childbirth
- Manage the immediate postnatal period
- Identify, manage, and refer complications in women and newborns

Ensuring that all women have access to skilled healthcare providers during pregnancy, childbirth, and the postpartum period. There are major differences worldwide and among developing countries in the proportion of deliveries with skilled attendance, the quality of that attendance, the proportion of deliveries that take place in health facilities, and the quality of services in these facilities.

In developing-country urban areas, childbirth may also take place in the home with or without medically trained attendants or in a health clinic with a nurse or physician. In rural areas of the developing world, most childbirth takes place at home, generally without skilled birth attendance, and often with poor access to medical care.



Births attended by a skilled health provider.

In most settings, traditional birth attendants (TBAs) are guided by traditional, often untested practices, rather than medical experience. Therefore, they should be trained in advising and referring when necessary during pregnancy & delivery; and provided with training and basic

supplies such as sterile razor blades and washable plastic sheets.

Birth Preparedness and Emergency Obstetric Care: Every pregnant woman should have a plan put in place prior to birth or any emergency related to pregnancy. all women are at risk of complications and often time these may not be predictable.

Evidence shows that 15% of pregnancies will result in life-threatening complications as a result of pregnancy that may lead to morbidity and mortality for the mother and/ or the baby. However, in Africa, especially West Africa, most people do not appreciate the potential risks of pregnancy.

Components of Birth and Emergency Preparedness include:

- Expected Date of Delivery
- Where the woman plans to deliver
- Who will attend delivery (Birth Attendant)
- Who will support the woman in labour
- Transport arrangements especially when labour starts at odd hours
- Source of funds for hospital bills
- Who will donate "compatible" blood, if it becomes necessary
- Who will care for other children at home

There should be established facilities equipped to manage obstetric emergencies such as severe hemorrhage, preeclampsia, and obstructed labour, ensuring timely access to necessary interventions, including cesarean sections, blood transfusions, and instrumental obstetric procedures.

Post-natal Care: The period up to six weeks after delivery is crucial for the health of both newborns and mothers, with two-thirds of all maternal deaths occurring within this timeframe, particularly during the first 24 hours following childbirth. Key concerns during this critical period include ensuring adequate recovery from childbirth, providing proper newborn care, promoting nutrition and breastfeeding, and facilitating family planning, all of which are essential for the well-being of both mother and baby. Active management of the third stage of labor is a major step in reducing the incidence of postpartum hemorrhage (PPH).

Key components of active management of the third stage of labour include the immediate administration of a uterotonic agent, with oxytocin being the preferred drug to prevent PPH following the delivery of the baby. Delayed cord clamping is recommended, allowing for a delay of at least 1 to 3 minutes to reduce the rates of infant anemia, with cord clamping time (CCT) performed if necessary. Postpartum vigilance is essential, requiring healthcare providers to assess uterine tone every 15 minutes for the first two hours; if uterine atony is detected, fundal massage should be performed and monitoring should occur more frequently. Furthermore, ensuring a continuous supply of high-quality oxytocin is critical; it is important to maintain the cool chain for oxytocin storage, as its potency can be diminished if exposed to heat for extended periods.

Family Planning and Post-Abortion Care: Family planning was presented as one of the key strategies for maternal mortality reduction in developing countries. It helps prevent unwanted pregnancy, prevent illegal abortions, redistributes births from high to low-risk categories, and reduces the total number of births. To avoid maternal deaths, it is also vital to prevent unwanted pregnancies and help those with incomplete abortion. Post abortion care (PAC) is directed at women with incomplete abortion; emergency management of complications related to abortions; offer counselling on the patients' needs and family planning; provision of modern contraception; linkage to other reproductive health care services such as screening for STIs and gynecological cancers; and facilitate the woman's social reinsertion and prevent future unsafe abortion cases via provider-community partnership.

ADDRESSING BARRIERS TO MATERNAL HEALTH

Women and their families don't recognize dangerous complications: This causes delay in seeking care. Education of the female child and raising awareness about signs of life-threatening complications is very important. Education of women and men about when and where to seek care is equally helpful. Removing cultural barriers that promote home delivery as well as debunking cultural myths and misconceptions can help tackle this barrier. In addition, women who didn't attend ANC are more likely to lack knowledge of serious obstetric complications and where/how to get help. Community health workers (CHWs) in collaboration with community leaders should be mobilized to do home visits for behavioral changes, positive health-seeking attitudes among pregnant women, they should be encouraged for early booking and attend ANC.

Delay in seeking Care: This is usually due to a combination of socioeconomic and geographic barriers. In Nigeria, there is a scarcity of equipped quality hospital that can appropriately handle obstetric emergencies. This means that patient have to travel longer distances to get

better care. Cost of transportation, and cost of services might also make women who are low-income reluctant to seek professional care. Some women may also be reluctant to seek care due to previous negative experiences or poor quality of care at healthcare facilities. To improve maternal outcomes, it is essential to develop action plans for obstetric emergencies that ensure timely and effective responses. Raising the status of women plays a critical role in empowering them to make informed health decisions, while educating community members about the importance of seeking care swiftly during emergencies helps to reduce delays in accessing life-saving treatment. Additionally, creating insurance programs for emergency care can improve affordability and access to critical medical services when they are most needed.

Delay in receiving appropriate care at the facility: Poor quality of care is a significant barrier and one of the reasons for poor maternal and newborn outcomes in Nigeria. Improving maternal health requires the development of comprehensive emergency transportation plans to ensure that women can quickly access healthcare facilities during obstetric emergencies. Upgrading the transportation system is key to facilitating swift movement, particularly in rural areas, while enhancing referral systems will allow for smoother transitions between lower-level healthcare centers and more specialized facilities. Establishing maternity waiting homes near health centers can further reduce delays by providing a safe space for expectant mothers to stay close to medical care as they near labor. Together, these measures are critical for improving access to timely and effective maternal healthcare.

Tackling Maternal Mortality Problems in Nigeria: A human rights-based approach to maternal health is essential for abolishing healthcare and nutritional inequalities, bridging socio-cultural gaps, and restoring the confidence of the girl-child. This involves ensuring that all deliveries are attended by skilled birth attendants, such as doctors, nurses, and midwives, while restructuring the healthcare system to meet the demands of safe motherhood. Expanding Emergency Obstetrics and Newborn Care services, both basic and comprehensive, and closely supervising the implementation of the National Reproductive Health Policy are critical steps in improving maternal outcomes.
Legislative reforms are needed to provide free antenatal, delivery, and family planning services for every woman, alongside compulsory basic education that includes reproductive health education. Laws should also be enacted to eliminate harmful socio-cultural practices, such as early marriage and female genital mutilation, while domestication of international conventions relevant to safe motherhood is crucial. Further, the development of a human rights code of ethics for professionals, empowering women through education and skills acquisition, and engaging NGOs, traditional rulers, and religious leaders in maternal health advocacy, are all vital, including the reform of abortion laws in Nigeria.

INNOVATIONS IN MATERNAL SURVIVAL STRATEGIES

MCSP was built on work started under USAID's predecessor, the Maternal and Child Health Integrated Program (MCHIP), to continue supporting the expansion of the evidence base for innovative approaches and facilitating locally owned and context-sensitive adaptation of these life-saving innovations.

The Program focused on the implementation of six priority innovations:

Product Innovations

- **Uterine Balloon Tamponade**: In settings without timely access to high-quality comprehensive emergency obstetric and newborn care, the uterine balloon tamponade can be lifesaving when other interventions fail to stop postpartum hemorrhage (PPH).
- **Bubble Continuous Positive Airway Pressure**: This strategy provides low-income countries with a simple, low-cost method of reducing the 20-38% percent of neonatal deaths due to respiratory failure.

Process Innovation

- **Reaching Every Community / Quality Improvement**: Addressing equity gaps among communities is essential to improving national coverage of routine immunization. Building on the globally accepted Reaching Every District strategy, Reaching Every Community / Quality Improvement focuses on equitable coverage via quality improvement processes, data-driven strategies, and ownership at the local level.
- **Possible Serious Bacterial Infections Guidelines**: Making antibiotic treatment simpler, easier to access, and more acceptable to families in resource-limited settings would dramatically reduce the nearly 420,000 annual newborn deaths due to infections every year. These guidelines provide community health workers with evidence-based recommendations to identify serious diseases and to use simple, safe, and effective antibiotics rather than solely resorting to referral of hospital treatment.

- **First Time/Young Parents:** Programs that neglect young parents and adolescent reproductive health can integrate the MCSP First Time/Young Parent Model into health systems, improving the quality of health services necessary to prevent the 16 million unintended pregnancies among girls 15-19 years of age each year. For part of the Model, MCSP adapted Save the Children's My First Baby Guide to improve maternal and neonatal outcomes of married, pregnant, and parenting adolescents. One of the most significant adaptations was approaching first-time parenting with a gender-focused lens to increase male involvement and couples communication and address gender norms.
- **Gestational Age Estimation:** Precise estimation of gestational age and estimated date of delivery—regardless of resource level—facilitate appropriate birth planning and complication readiness. They also improve the capacity to provide appropriate, time-sensitive interventions for improving maternal and newborn outcomes in the context of both antenatal and intrapartum care. (1)

OTHERS INCLUDE:

- **INJECTABLE CONTRACEPTIVES:**

A new formulation that combines a widely used long-acting contraceptive in an easy-to-use injection is already improving access to this life-changing intervention by allowing community health workers to bring the drug directly to women. Several countries are even studying the potential for women to self-inject, further empowering women and their choices.

Modeling showed that this innovation, making long-acting contraception more accessible, could save more than 3 million lives – including women, newborns, and children – by helping women healthily space their pregnancies.

- **BETTER PNEUMONIA TREATMENT:**

Accurately diagnosing pneumonia in young children is very difficult. New tools to diagnose and treat the condition, including better respiratory rate monitors and portable pulse oximeters, can save many more lives from this disease, which is the leading infectious killer of children under five.

- **KANGAROO MOTHER CARE(KMC)**

There is so much we can do now to give newborns a better chance at a healthy life. Studies have shown that kangaroo mother care, or skin-to-skin contact between the newborn and mother immediately after birth, improves breastfeeding and thermal regulation of newborns, both critical for survival in low-resource settings.

- **SINGLE DOSE ANTI-MALARIAL DRUGS:**

Despite the widespread distribution of mosquito nets, malaria is still one of the world's biggest killers. Better drugs to protect against diseases like malaria are in the works, including a potent single-dose anti-malarial drug

USE OF TELEMEDICINE TO CONNECT REMOTE AREAS WITH SPECIALIZED CARE

According to the third Sustainable Development Goal (SDG), by the year 2030, the MMR should be estimated at less than 70 cases per 100,000 live births, and no country should have an MMR that exceeds the world average. In 2017 an MMR of 211 per 100,000 LB was reported globally and it was estimated that between 50 and 100 women experienced near-miss mortality (NMM) for each maternal death. Nevertheless, the novel coronavirus pandemic has had a global impact on maternal and perinatal health via an increase in the MMR, perinatal mortality rate, near-miss mortality, and neonatal morbidity, mainly affecting low and middle-income countries (LMIC).

Most of these deaths in LMIC are preventable and are directly related to the human development index and quality access to obstetric health services.

The preceding demonstrates a critical and urgent need to implement innovative and affordable initiatives to improve maternal and perinatal health indicators.

Digital health or eHealth is defined as information and communication technology (ICT) in health services, and the surveillance of diseases of public health interest. The implementation of eHealth has technological, cultural, and financial barriers associated with transmitting video, audio, and images in LMIC. The Resolution of the World Health Assembly on Digital Health, recognized the value of digital technologies in contributing to the achievement of the SDGs, establishing the use of telemedicine between trained and certified providers (hospitals) as one of the strategies with the most significant impact. Access to a low number of qualified health workers, geographic inaccessibility, and unequal distribution of workers contribute to limitations in the adequate coverage of human resources for health barriers intended to be overcome by telemedicine. (3)

THE SUSTAINABLE DEVELOPMENTAL GOALS AND MATERNAL MORTALITY:

In the context of the Sustainable Development Goals (SDG), countries have united behind the target to accelerate the decline of maternal mortality by 2030. SDG 3 includes an ambitious target: "reducing the global MMR to less than 70 per 100 000 births, with no country having a maternal mortality rate of more than twice the global average".

The global MMR in 2020 was 223 per 100,000 live births; achieving a global MMR below 70 by the year 2030 will require an annual rate of reduction of 11.6%, a rate that has rarely been achieved at the national level. However, scientific and medical knowledge is available to prevent most maternal deaths. With 10 years of SDGs remaining, now is the time to intensify coordinated efforts, and to mobilize and reinvigorate global, regional, national, and community-level commitments to end preventable maternal mortality.

WHO RESPONSE

Improving maternal health is one of WHO's key priorities. WHO works to contribute to the reduction of maternal mortality by increasing research evidence, providing evidence-based clinical and programmatic guidance, setting global standards, and providing technical support to Member States in developing and implementing effective policies and programs.

As defined in the Strategies Toward Ending Preventable Maternal Mortality (EPMM) and Ending Preventable Maternal Mortality: A Renewed Focus for Improving Maternal and Newborn Health and Well-being, WHO is working with partners in supporting countries towards:

- Addressing inequalities in access to and quality of reproductive, maternal, and newborn health care services;
- Ensuring universal health coverage for comprehensive reproductive, maternal, and newborn health care;
- Addressing all causes of maternal mortality, reproductive and maternal morbidities, and related disabilities;
- Strengthening health systems to collect high-quality data to respond to the needs and priorities of women and girls; and
- Ensuring accountability to improve quality of care and equity.(4)

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REVIEW OF MATERNAL AND CHILD HEALTH IN NIGERIA.

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INTRODUCTION

To understand the current state and progression of maternal and child health (MCH) in Nigeria, we need to first understand what it means and its implications for the overall effectiveness of the existing health systems.

What is MCH? Maternal and child health is the promotive, preventive, curative, and rehabilitative health care for mothers and children. The sub-areas of MCH include; Maternal health, Child health, Family planning, School health, Handicapped Children, Adolescent health, and Health aspects of care of children in special settings such as daycare. [1]The main objective is to reduce maternal, perinatal, infant, and childhood mortality and promote reproductive and overall health for children and adolescents within the family.[1]

Why maternal and child health combined? In developing countries, women and children comprise a significant portion of the population, they are often considered vulnerable, and many of the illnesses that affect them are preventable.

Despite the World Health Organisation (WHO) ranking of Nigeria's health systems as 187th out of 191 member states in the year 2000, there was some improvement with regards to MCH outcomes in the following decade. The national maternal mortality ratio reportedly reduced from 800/100,000 in 2005 to 576/100,000 in 2013. [2] Further, the under-five mortality rate in Nigeria reduced from 201 per 1000 live births in 2003 to 117 per 1000 live births in 2013. [2] Even though Nigeria has made significant progress in initiating and advancing healthcare programs for this specific group, such as Emergency obstetric and newborn care and integrated management of childhood illnesses, there is still a considerable distance to cover.

Nigeria was ranked third in the world for maternal mortality rate in 2020, according to WHO reports, following Sudan and Chad whilst reports from UNICEF in 2019 indicate high levels of child mortality. The primary objective of this article is to emphasize the present condition of maternal and child health in Nigeria when compared with developed nations, the obstacles hindering its progress, and potential suggestions to address these obstacles.

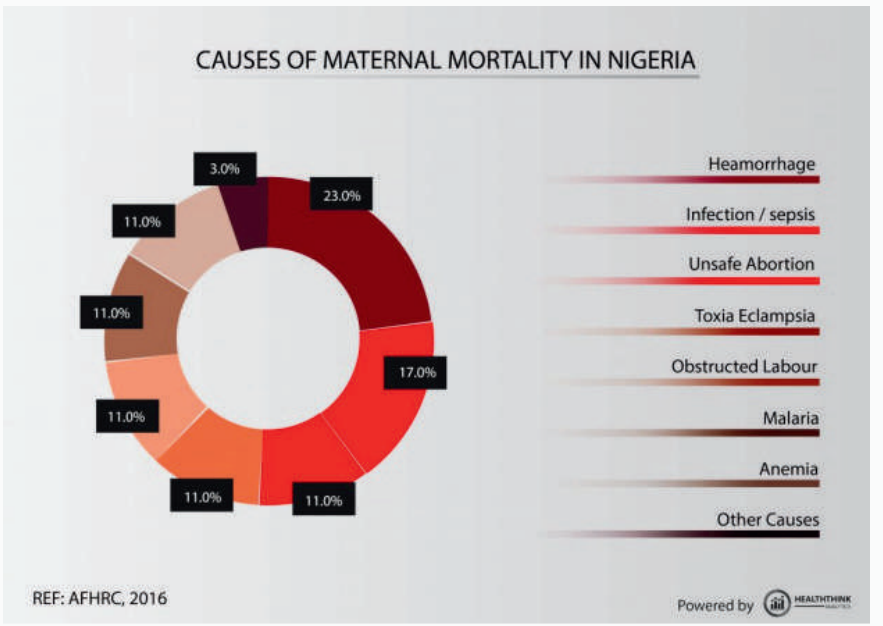
CURRENT STATE OF MATERNAL AND CHILD HEALTH IN NIGERIA

Maternal death refers to the death of a woman during pregnancy or within 42 days after abortion, irrespective of the duration and place of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or unintentional causes (WHO). [3]

In 2017, Nigeria's maternal mortality rate was estimated at 917 per 100,000 live births; it increased by nearly 14% in 2020 to reach 1047 deaths categorized alongside two other countries in Sub-Saharan Africa as having "extremely high" maternal mortality rate. According to the WHO, the current maternal mortality ratio in Nigeria is 814 per 100,000 live births, which shows significant improvement from 2020. [3]

About 70% of maternal deaths in Nigeria are due to one of five complications: Obstetric Hemorrhage, Sepsis, Unsafe abortion, Hypertensive diseases of pregnancy (eclampsia), and obstructed labor. [3]

Some other drivers of maternal mortality in Sub-Saharan Africa include; Poor health-seeking behavior, long distances to health facilities, and lack of transport to tertiary facilities. Delays in reaching health facilities due to poor infrastructure such as roads, communication, and transport, delayed decision to seek maternal care, delays in receiving appropriate care due to inadequately skilled health workforce, and inadequate medical equipment.[3]



Causes of maternal mortality in Nigeria. (Source: African Population Health and Research Center) [4]

As previously mentioned, according to the latest reports from UNICEF, Nigeria's infant and under-5 mortality rates are estimated to be 74 and 117 per 1000 live births, respectively. Approximately 262,000 babies die at birth each year, making it the second-highest national total in the world..[5,6] More than half of the under-five deaths result from malaria, pneumonia, or diarrhea, other leading causes include preterm birth complications, birth trauma, and congenital anomalies.[7]

Key challenges facing Maternal and Child Health in Nigeria

Despite efforts targeted at addressing maternal and child deaths across national and sub-national levels, health indicators still suggest some challenges are peculiar to Nigeria and other African countries and are responsible for the stunting of the progress of these efforts in comparison to countries of the developed world.

Some of these challenges have been found to include;

1. **Socioeconomic barriers:** In Nigeria, more than two-thirds of the population live below the international poverty line of $1.25 per day. Such poverty limits the opportunities for most mothers to access appropriate healthcare services for themselves and their children. [8]
2. **Limited access to healthcare facilities, poor transport services, lack of a safe water supply, and inadequate basic sanitation facilities** hinder rural dwellers from receiving adequate healthcare and social and economic services. These conditions adversely affect child survival. [8]
3. **Maternal illiteracy:** The illiteracy rate in Nigeria stands at approximately 40%, with the majority of illiterate individuals being women. Research indicates that mothers with access to education are more inclined to possess a better understanding of and access to maternal and child health services, including immunization and better feeding practices, which can ultimately enhance child survival rates.[9]
4. **Inadequate infrastructure:** Studies have shown that rural areas with limited healthcare facilities had greater maternal mortality rates. This highlights the need for fair distribution of healthcare facilities to guarantee that women in all areas have access to crucial maternal and child health services.[10]
5. **Poor policy implementation:** Evidence-based policy-making ensures that resources are better planned and used more efficiently. It is important that while the government implements programs to enhance the health of its citizens and put in place health interventions, policies and programs need to be influenced by appropriate evidence to ensure that resources are allocated to the different areas of health to improve health indices.[11]

PROGRESS MADE IN MATERNAL AND CHILD HEALTH

The alarming statistics of maternal and child mortality set in motion a resolution at the World Health Assembly (2024), by its member states , to carry out specific actions toward the improvement of maternal and child health (MCH). The 2024 resolution is dedicated to addressing the major causes of maternal and child death while improving access to comprehensive health services through stronger primary health care, expanding Emergency Obstetrics and Newborn Care (EmONC), delivery of quality, safe, and effective care through adequate facilities and well-trained personnel. [12]

This reflects the commitment of our global leaders to address urgent health needs and highlights the necessity of allocating sufficient resources to maternal and child survival as it continues to remain a global health challenge.

USAID's Maternal and Child Health and Nutrition has played a vital role, over the past 10 years, in reducing maternal and child mortality by delivering essential and lifesaving care to women and children worldwide. [13] The 2024 Annual Report to Congress shows that there's been a 42% decrease in maternal mortality and a 55% decrease in child death among the under-5 population globally, since 2000. [14]

It also reports substantial progress in African

countries especially in sub-Saharan Africa. The overall goal is to reduce under-5 mortality to fewer than 20 deaths per 1,000 live births, and maternal mortality to fewer than 50 deaths per 100,000 live births by 2035. In many of these countries, child mortality rates have decreased at or above the target reduction of 3% annually. For example, between 2020 and 2022, priority countries saw an average reduction of 3.11% annually. [14]

In Nigeria, newborn mortality has decreased by 25%, child mortality by 39%, and maternal mortality ratio has dropped by 9% in the last 20 years, but remains high

Hence, the adoption of the 2024 resolution in the World Health Assembly (WHA) is particularly significant to African countries like Nigeria where despite the progress made, about 35% of all deaths in Nigeria are still preventable child and maternal deaths keeping maternal and child mortality as one of the top pressing issues within the country. [14]

The Government, with the aid of the Global Financing Facility for Women, Children and Adolescents (GFF) established the Basic Health Care Provision Fund to channel more resources to Primary Health Care nationwide, strengthening about 900 primary health facilities with critical infrastructures like maternity wards, skilled health workers and medicines. [15]

The Nigeria State Health Investment Project was expanded into the Northeastern region of Nigeria with the support of GFF and the World Bank, resulting in a jump from 28% safe deliveries to 68% between 2014 and 2022 and tripling the number of children immunized each year. Adolescent girls in places like Kaduna state now have access to better information and counseling on family planning, increasing the use of modern contraceptives [15] while reducing the complications associated with unplanned pregnancies and grand multiparity. Through the Accelerating Nutrition Results project GFF and World Bank have provided nutrition services to nearly 5 million pregnant women and over 7 million children under five in over 12 states, and supported the treatment of children from amongst the 2.6 million affected by severe malnutrition nationally.[15]

Based on previous projects, the Nigerian government created the Nigeria Health Sector Renewal Investment Initiative to significantly decrease maternal and child mortality. This initiative aims to coordinate with partners on national health priorities using the Sector Wide Approach (SWAp), which is essential in environments with limited resources. [15]

THE ROLE OF NGO'S AND THE PRIVATE SECTOR IN IMPROVING MATERNAL AND CHILD HEALTH

The involvement of private sectors and non-governmental organizations is crucial for capacity building, designing, implementing, monitoring, and reviewing projects and policies to facilitate the achievement of the Sustainable Development Goals. [16] These Goals also include targets related to maternal mortality, and neonatal and child mortality (SDG Target 3.1 and 3.2 respectively). Their contribution to improving maternal and child health involves collaborating with non-profit organizations, private organizations, and the government. They work in partnership with the Ministry of Health to manage joint projects and programs that will improve health system function. They provide innovative approaches to make health service delivery faster and more effective, develop human resources, strengthen infrastructure and information systems, and advocate for policies that aid the public sector and hiring practices that ensure long-term health system sustainability. [16,18]

NGO facilitation of government programs has shown to be a feasible strategy for ensuring equity of maternal and child health programs. [17] With government-initiated programs, there is likely to be improved equity of program coverage and home-based care through the NGO's training of community-based workers, planning outreaches to educate and reach poor homes, supervising, monitoring, and designing tools to reinforce various aspects of the program. [17]

Private sectors and NGOs have long aided in bridging gaps within healthcare delivery, research, and advocacy. Their positive outcome is attributed to flexibility in planning and ability to design health education, promotion, social marketing, and community-based projects tailored to the needs of the population. [18] About 60% of maternal, newborn, and child health (MNCH) services in Nigeria are provided by the private health sector (eg, institutional delivery, antenatal care, routine immunization, contraceptives) serving both rural populations and the urban poor.[19]

RECOMMENDATIONS FOR THE FUTURE

Although the private sector is perceived to provide more services with higher quality in comparison to the public sector, there is still a knowledge gap about the advantages of private sector care. The involvement of private sector in quality of care agenda for maternal and child health is complicated by limited capacity of the government to balanced mixed health systems

as well as missed opportunities in terms of cross-sector knowledge transfer and learning. [19]

The engagement between the private and public sectors is viewed as a means of addressing issues related to the equity and quality of healthcare services, as well as improving access and responsiveness within the system. Therefore, it is essential to establish a comprehensive framework that encourages greater collaboration between the private and public sectors, with clearly defined roles and mechanisms that prioritize transparency and accountability.[18]

Further recommended actions based on the 2021 multi-stakeholder dialogue convened by the Federal Ministry of Health in Abuja include:
Engaging the private sector stakeholders in the development of health policies and strategies by having private sector representatives in national working groups on issues concerning maternal and child health.

There should be regulatory mechanisms to monitor funding and resource use. These regulatory mechanisms are to be properly funded and implemented and must involve members of the private sector associations.

Financial mechanisms and incentives aimed at private healthcare providers should be developed to enable them to deliver quality healthcare at minimum cost. Capitation fees paid by NHIS should be increased to incentivize private health care providers and medical equipment should be distributed at a subsidized rate. [19]

The poorest segments of the population are usually disadvantaged with regard to the utilization of facility-based services since issues related to accessibility and cost are involved. In this regard, programs need to identify and address barriers to care utilization in the poorest segments of the population and should consider providing safety nets for the poor. [17]

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THE ROLE OF NGO'S AND THE PRIVATE SECTOR IN IMPROVING MATERNAL AND CHILD HEALTH

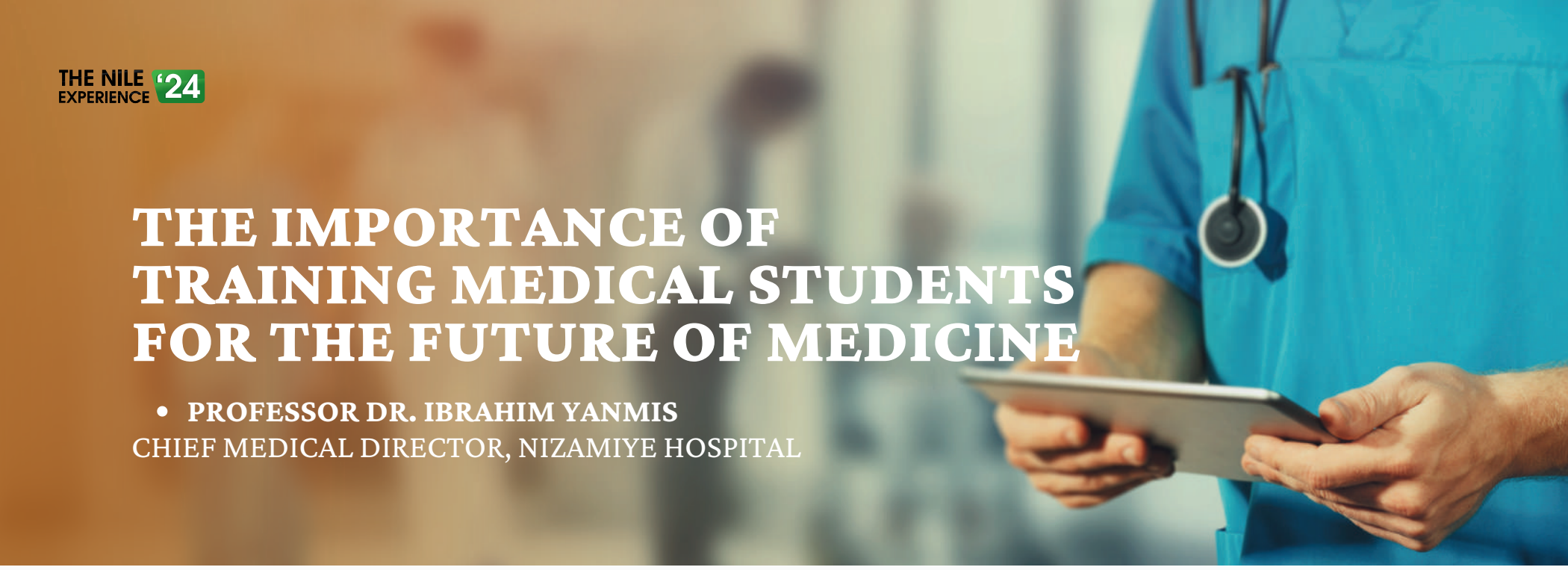
The involvement of private sectors and non-governmental organizations is crucial for capacity building, designing, implementing, monitoring, and reviewing projects and policies to facilitate the achievement of the Sustainable Development Goals. [16] These Goals also include targets related to maternal mortality, and neonatal and child mortality (SDG Target 3.1 and 3.2 respectively). Their contribution to improving maternal and child health involves collaborating with non-profit organizations, private organizations, and the government. They work in partnership with the Ministry of Health to manage joint projects and programs that will improve health system function. They provide innovative approaches to make health service delivery faster and more effective, develop human resources, strengthen infrastructure and information systems, and advocate for policies that aid the public sector and hiring practices that ensure long-term health system sustainability. [16,18]

NGO facilitation of government programs has shown to be a feasible strategy for ensuring equity of maternal and child health programs. [17] With government-initiated programs, there is likely to be improved equity of program coverage and home-based care through the NGO's training of community-based workers, planning outreaches to educate and reach poor homes, supervising, monitoring, and designing tools to reinforce various aspects of the program. [17]

Private sectors and NGOs have long aided in bridging gaps within healthcare delivery, research, and advocacy. Their positive outcome is attributed to flexibility in planning and ability to design health education, promotion, social marketing, and community-based projects tailored to the needs of the population. [18] About 60% of maternal, newborn, and child health (MNCH) services in Nigeria are provided by the private health sector (eg, institutional delivery, antenatal care, routine immunization, contraceptives) serving both rural populations and the urban poor.[19]

RECOMMENDATIONS FOR THE FUTURE

Although the private sector is perceived to provide more services with higher quality in comparison to the public sector, there is still a knowledge gap about the advantages of private sector care. The involvement of private sector in quality of care agenda for maternal and child health is complicated by limited capacity of the government to balanced mixed health systems



THE IMPORTANCE OF TRAINING MEDICAL STUDENTS FOR THE FUTURE OF MEDICINE

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As science and technology continue to offer faster and more effective solutions to health challenges, medical education must evolve to meet the needs of the future. Revolutionary developments such as genetic engineering, artificial intelligence, robotic surgery, personalized medicine, and telehealth will redefine medical practice. To thrive in this transformation, the healthcare system will require professionals who not only possess knowledge but can also adapt to new technologies, think critically, and uphold ethical principles.

Information Access and Evaluation Skills

Traditional medical education focuses heavily on memorization, but modern training emphasizes the ability to access and critically evaluate information. Future doctors must stay up-to-date with rapidly changing scientific literature and make evidence-based decisions. While AI-powered diagnostic tools will support physicians in their analyses, human insight will remain essential, especially in complex clinical situations.

Adaptation to AI and Digital Health Systems

AI and machine learning will play a vital role in early diagnosis, patient monitoring, and treatment planning. Medical students must gain proficiency in using digital healthcare technologies during their education. By integrating AI, data analytics, and digital health into medical curricula, students will be better prepared to adapt to technological innovations and use them effectively in practice.

Personalized and Holistic Care Approaches

- Future healthcare will offer personalized treatments tailored to each patient's genetic, environmental, and lifestyle factors. Medical education must therefore encourage students to evaluate individuals as a whole, rather than focusing solely on diseases. A multidisciplinary approach that incorporates genetics, psychology, and social work will be crucial in providing comprehensive care.

Development of Communication and Empathy Skills

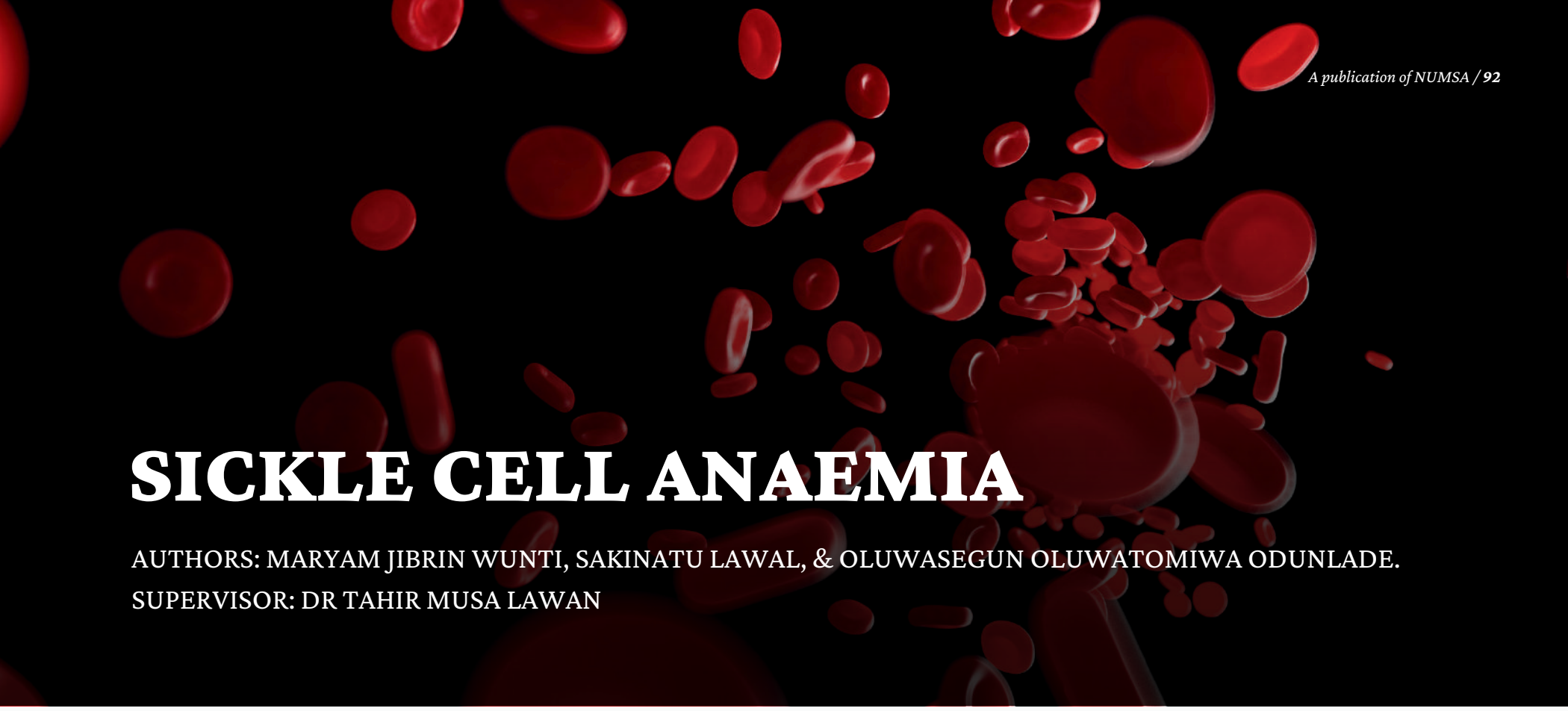
While technology will become central to healthcare, human-centered care will remain essential. Medical education must equip students not only with technical skills but also with empathy, communication, and ethical values. Future physicians will need to nurture strong patient-doctor relationships and ensure that technology enhances, rather than diminishes, the patient experience.

Lifelong Learning and Continuous Education

With medical knowledge and technologies evolving rapidly, lifelong learning will be essential for doctors. Teaching students the importance of continuous self-improvement will help them adapt to new developments throughout their careers. Medical education should foster a mindset of "learning how to learn" to ensure adaptability in an ever-changing healthcare landscape.

Conclusion

Success in future medicine will depend not only on access to advanced technologies but also on healthcare professionals who can use these tools effectively and ethically. Medical education must strike a balance between scientific knowledge, technology, empathy, and ethics. If today's medical students are prepared to meet the demands of tomorrow's healthcare system, society will benefit from more effective healthcare solutions, building a healthier future for all.



SICKLE CELL ANAEMIA

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INTRODUCTION

Sickle-cell disease (also known as sickle-cell disorder) is a common genetic condition due to a haemoglobin disorder – inheritance of mutant haemoglobin genes from both parents. Such haemoglobinopathies, thalassaemia and sickle-cell anaemia, are globally widespread. (University, 2024)

Sickle cell anemia is a genetic disease that affects the shape and function of red blood cells. It is an autosomal recessive genetic disorder caused by a mutation in the β-globin gene, which codes for β globin chain. An amino acid Glutamine (hydrophilic) is replaced by Valine (hydrophobic) at position 6 of the β globin chain of the Hb. When a person has 2 copies of S gene (homozygous SS), he/she has sickle cell anemia.

Sickle cell trait is an inherited blood disorder that affects approximately 8 percent of African Americans. Unlike sickle cell disease, in which patients have two genes that cause the production of abnormal haemoglobin, individuals with sickle cell trait carry only one defective gene and typically live normal lives without health problems related to sickle cell. A person with AS – Sickle cell trait usually has no symptoms but can pass it to his offspring. . (hematology, 2024)

HISTORICAL BACKGROUND

Sickle cell disease (SCD) is one of the most studied genetic disorders, with a rich historical background tracing back to early clinical descriptions and genetic discoveries.

The earliest documented case of sickle cell disease was by Dr. James B. Herrick, an American physician, who described the case of a 20-year-old Grenadian student with peculiar sickle-shaped red blood cells. Herrick's description of the patient's "peculiar elongated and sickle-shaped" red blood cells in 1910 marks the first recognition of the disease in medical literature.

In the 1920s, Dr. Vernon Mason coined the term sickle cell anaemia after observing the distinct sickle-shaped cells in patients.

Further advancements in understanding SCD came with Dr. Linus Pauling's discovery in 1949 that the disease was caused by an abnormal form of haemoglobin, known as haemoglobin S (HbS). Pauling's work led to the realization that SCD was a molecular disease, the first genetic disorder attributed to a protein abnormality

A pivotal development in understanding the epidemiology of SCD came with the discovery of the relationship between sickle cell trait (heterozygous HbAS) and resistance to malaria. In 1949, British biologist Anthony Allison demonstrated that individuals with the sickle cell trait had a survival advantage in regions where malaria was endemic. This explains the high prevalence of the sickle cell gene in populations of African descent, where malaria is historically widespread.

EPIDEMIOLOGY

Sickle cell anaemia (SCA), a major form of sickle cell disease (SCD), is a global health challenge with varying prevalence across regions and populations.

Global Epidemiology:

Sickle cell anaemia affects individuals of African, Mediterranean, Middle Eastern, and Indian descent. Globally, approximately 300,000 children are born annually with SCD, with the highest incidence in sub-Saharan Africa. The disease has also spread to other regions due to migration, notably the Americas, Europe, and the Caribbean.

Epidemiology of Sickle Cell Anaemia in Nigeria:
Nigeria bears the highest burden of sickle cell anaemia worldwide, accounting for 50% of SCD cases globally. An estimated 2-3% of Nigerian newborns are affected by SCA, equating to approximately 150,000 children born annually with the condition. Furthermore, about 20-30% of the Nigerian population carries the sickle cell trait (HbAS). In Nigeria, the infant mortality rate due to SCA is high, with up to 100,000 children dying from complications related to the disease each year.

Epidemiology of Sickle Cell Anaemia Among Ethnic Groups in Nigeria:

The prevalence of SCA varies among different ethnic groups in Nigeria, reflecting genetic factors and regional malaria burden.

The Yoruba ethnic group, one of Nigeria's largest ethnic groups, has a high prevalence of the sickle cell trait (HbAS), with about 20-25% of individuals carrying the trait.

In the Igbo population, the sickle cell trait is carried by 15-20% of the population. SCA affects about 2% of births. In northern Nigeria, particularly among the Hausa and Fulani, the prevalence of the sickle cell trait is notably higher, with 25-30% of the population being carriers (HbAS). This is partly because the region has historically been highly endemic for malaria.

PATHOPHYSIOLOGY

Sickle cell anaemia is caused by a point mutation in the B-globin gene, leading to the production of haemoglobin S (HbS) instead of normal haemoglobin A (HbA). In the deoxygenated state, HbS polymerizes, causing red blood cells (RBCs) to deform into a rigid, sickle shape. This sickling process is reversible initially but becomes irreversible with repeated cycles of deoxygenation and reoxygenation. The sickle-shaped RBCs are prone to haemolysis and have a shorter lifespan (10-20 days, compared to the normal 120 days). They also obstruct small blood vessels, leading to vaso-occlusion, tissue ischemia, and pain.
The constant haemolysis contributes to anaemia, while the vaso-occlusion is responsible for many acute and chronic complications. (Rees, Williams, & Gladwin, 2010) (Piel, Steinberg, & Rees, 2017)

Impacts on Blood Circulation and Oxygen Transport
The sickling of red blood cells has profound effects on blood circulation and oxygen transport. Normal red blood cells are flexible and pass easily through the smallest capillaries, ensuring efficient oxygen delivery.

However, the rigid and deformed sickle cells cause occlusions in the small blood vessels, leading to restricted blood flow (vaso-occlusion) and inadequate oxygen delivery to tissues (hypoxia).

Additionally, the lifespan of sickled red blood cells is significantly shortened, from the normal 120 days to about 10-20 days, leading to chronic haemolytic anaemia. This causes a compensatory increase in erythropoiesis but is often insufficient, leaving the body in a state of chronic oxygen deficiency. (NIH, 2023) (Serjeant, 1997)

ACUTE SYMPTOMS

The acute manifestations of sickle cell disease arise primarily from vaso-occlusion and haemolysis. Key acute symptoms include:

- **Vaso-occlusive Crisis (Painful Crisis):** This is the most common presentation, characterized by sudden, severe pain due to blockages in small blood vessels. Pain often occurs in the bones, chest, abdomen, or joints.
  - **Acute Chest Syndrome:** A serious complication characterized by chest pain, fever, cough, hypoxemia, and pulmonary infiltrates. It is caused by sickling within the pulmonary vasculature, infection, or fat embolism.
  - **Splenic Sequestration Crisis:** Sudden enlargement of the spleen due to trapping of sickled RBCs, leading to a rapid decline in haemoglobin and hypovolemic shock, particularly in young children.
  - **Aplastic Crisis:** Temporary cessation of erythropoiesis due to parvovirus B19 infection, leading to a sudden worsening of anaemia with symptoms like fatigue, pallor, and shortness of breath.
  - **Infections:** Patients with sickle cell anaemia are prone to infections, particularly from encapsulated organisms like Streptococcus pneumonia and Haemophilus influenza, due to functional asplenia. (Platt, Brambilla, Rosse, & et al, 1994) (Rees, Williams, & Gladwin, 2010)

CHRONIC COMPLICATIONS

Chronic complications of sickle cell disease are largely due to ongoing haemolysis, repeated vaso-occlusion, and the resultant organ damage. These include:

- **Chronic Pain:** Patients often suffer from chronic pain, especially in the bones and joints, due to ongoing tissue ischemia and damage.

- **Stroke**: Sickle cell disease increases the risk of ischemic or hemorrhagic stroke due to vessel occlusion in the brain. Children are especially vulnerable, with stroke being one of the most serious complications.
- **Pulmonary Hypertension**: Chronic hemolysis can lead to elevated pressure in the pulmonary arteries, resulting in dyspnoea, fatigue, and heart failure.
- **Kidney Damage**: Repeated vaso-occlusion in the renal medulla causes chronic kidney disease, leading to proteinuria, haematuria, and eventual kidney failure.
- **Osteonecrosis**: Bone infarctions from repeated vaso-occlusion can lead to avascular necrosis, particularly in the femoral and humeral heads.
- **Retinopathy**: Microvascular occlusion in the eyes can cause proliferative sickle retinopathy, increasing the risk of vision loss.
- **Gallstones**: Chronic haemolysis increases bilirubin production, which can lead to the formation of gallstones.
- **Delayed Growth and Puberty**: Children with sickle cell disease often experience delayed physical development and puberty due to chronic anaemia and nutrient deficiencies. (Piel, Steinberg, & Rees, 2017) (Serjeant, 1997)

Life Expectancy and Prognosis

With advances in medical care, particularly the introduction of newborn screening, prophylactic antibiotics, and hydroxyurea therapy, the life expectancy of individuals with sickle cell disease has improved significantly. However, it remains reduced compared to the general population. The median life expectancy is around 40-60 years, though this varies depending on the availability of healthcare and early interventions. Acute chest syndrome, stroke, and infections are the leading causes of death in sickle cell disease, and early detection and management of these complications are critical to improving prognosis. (Platt, Brambilla, Rosse, & et al, 1994) (NIH, 2023)

HISTORY TAKING

A thorough history is essential in managing patients with sickle cell disease. Key points to inquire about include:

- Pain Episodes: Frequency, location, duration, and triggers of pain crises should be explored.
- Past Medical History: History of complications such as acute chest syndrome, stroke, splenic sequestration, or infections.
- Family History: Family history of sickle cell disease or other hemoglobinopathies.
- Growth and Development: In children, ask about any history of growth delays or developmental concerns.
- Previous Hospitalizations and
- Treatments: Record any previous hospitalizations, transfusions, or treatments with hydroxyurea or other medications.
- Vaccination History: It is crucial to assess the vaccination status, especially for pneumococcal and meningococcal vaccines, due to the increased infection risk.
- Current Medications: Ask about the use of medications such as hydroxyurea, folic acid, and pain management strategies. (Rees, Williams, & Gladwin, 2010) (Serjeant, 1997)

INVESTIGATION AND FINDINGS

Several laboratory and imaging studies are used to diagnose and monitor sickle cell disease and its complications:

- Complete Blood Count (CBC): Patients typically have normocytic anaemia with reticulocytosis (elevated reticulocyte count) due to chronic haemolysis.
- Peripheral Blood Smear: Shows characteristic sickle-shaped red blood cells and other abnormal cell forms, such as target cells.
- Haemoglobin Electrophoresis: This test confirms the diagnosis by identifying the presence of haemoglobin S and determining the relative proportions of HbS, HbA, and other haemoglobins.
- Liver and Kidney Function Tests: Used to monitor for organ damage.
- Transcranial Doppler Ultrasound: This non-invasive test is used to screen children for increased risk of stroke by assessing cerebral blood flow velocity.
- Chest X-ray: In cases of acute chest syndrome, the chest X-ray may show infiltrates consistent with pneumonia or pulmonary infarction.
- Urinalysis: Used to check for haematuria, proteinuria, or signs of renal impairment. (Piel, Steinberg, & Rees, 2017) (NIH, 2023)

CASE STUDIES

CASE 1

Atypical Presentation of Sickle Cell Disease in Early Infancy

History - This case report discusses an atypical presentation of sickle cell disease (SCD) in a 10-week-old male infant who presented with severe anaemia requiring hospitalization. The infant, who was HIV exposed but tested negative for the virus, arrived at Chawama First Level Hospital with a 2-week history of coughing, sneezing, refusal to breastfeed, intermittent fevers, and irritability. He had been exclusively breastfed, received all appropriate vaccinations, and had no family history of SCD. (Muzazu, Chirwa , Khatanga-Chihana, & Simuyandi, 2022)

- **Investigations** - Upon examination, the infant was ill-looking, irritable, and febrile (temperature 38.8°C). Blood investigations revealed bicytopenia (haemoglobin 3.7 g/dL), red cell anomalies, and raised liver function tests. Haemoglobin electrophoresis indicated a HbS percentage of 90.5% and HbF percentage of 2.9%, confirming a diagnosis of sickle cell disease. The child was also diagnosed with pneumonia and sepsis, with blood cultures showing Staphylococcus haemolyticus and Streptococcus pneumoniae. (Muzazu, Chirwa , Khatanga-Chihana, & Simuyandi, 2022)

Management - Management included two blood transfusions, intravenous crystalloid fluids, broad-spectrum antibiotics (cefotaxime and ciprofloxacin), and analgesics. The child improved, with haemoglobin levels rising to 8.8 g/dL before being discharged after 13 days on folic acid and malaria prophylaxis. (Muzazu, Chirwa , Khatanga-Chihana, & Simuyandi, 2022)

However, two months later, the child was readmitted with fever and irritability, exhibiting signs of oral thrush and severe pallor. Laboratory tests indicated severe anaemia (HB 2.8 g/dL) and leucocytosis (WCC 56.2 x 10^9/L). During this admission, he was treated for Vaso-occlusive crisis and oral candidiasis, again receiving blood transfusions and supportive care. (Muzazu, Chirwa , Khatanga-Chihana, & Simuyandi, 2022) The child returned to the hospital two weeks later with weakness and respiratory distress. Laboratory results showed positive malaria (P. falciparum), severe anaemia (HB 2.2 g/dL), and leucocytosis. He was treated with blood transfusions and artemether-lumefantrine for malaria, with a satisfactory recovery and haemoglobin of 12.5 g/dL at discharge. (Muzazu, Chirwa , Khatanga-Chihana, & Simuyandi, 2022)

Summary - This case emphasizes the importance of early recognition and management of SCD, even in infants as young as 10 weeks. The atypical early presentation of SCD necessitates heightened clinical suspicion in children presenting with severe anaemia, regardless of age. Moreover, it underscores the need for comprehensive new-born screening programs in developing countries to facilitate early diagnosis and proactive management, which could significantly improve clinical outcomes and reduce complications associated with sickle cell disease. (Muzazu, Chirwa , Khatanga-Chihana, & Simuyandi, 2022)

CASE 2

18-Year-Old Female with Severe Sickle Cell Crisis

History – An 18-year-old female of African origin came to A&E with severe pains in her right leg, left hip, chest, and back. She was well known to many of the staff as she had attended on many occasions with painful sickle crises. She had been out all night at a club. Examination should initially be brief until adequate pain control has been achieved (Parveen & Michael, 2013)

Investigations - Full blood count (FBC) with reticulocytes, urea, and electrolytes (U&Es), and liver biochemistry to compare with her normal baseline values. (Parveen & Michael, 2013)
Blood cultures and midstream urine (MSU) to rule out infection, a common precipitating factor in sickle crises. (Parveen & Michael, 2013)
Oxygen saturation and grouping and saving for potential transfusions. (Parveen & Michael, 2013)

Management - Immediate pain relief with IV morphine administered at 0.1 mg/kg every 20 minutes until pain control was achieved, followed by patient-controlled analgesia (PCA) using diamorphine. Monitoring included pain scores, respiratory rate, and oxygen saturation. Adjuvant oral analgesia with paracetamol and ibuprofen to complement morphine. Supportive care included keeping the patient warm, ensuring hydration (aiming for 3 litres per day), and maintaining oxygen saturation above 95%. Oxygen therapy was initiated as needed. (Parveen & Michael, 2013)

Complications - The patient's crisis escalated, leading to the development of acute chest syndrome, a severe complication in sickle cell patients. This syndrome is characterized by rib and thoracic pain, bilateral chest signs, tachypnoea, and deteriorating oxygenation. Her haemoglobin levels dropped, and a chest X-ray revealed new infiltrates. (Parveen & Michael, 2013)

Acute Chest Syndrome Management - Exchange blood transfusions were performed to reduce HbS levels to under 20%. Aggressive oxygen therapy, including CPAP, was used to maintain oxygenation. Broad-spectrum intravenous antibiotics were initiated due to concerns of pulmonary infection. (Parveen & Michael, 2013)

Progress – This patient's current crisis was more severe than her previous ones and she went on to develop the acute chest syndrome from which she died (Parveen & Michael, 2013)

DIAGNOSIS OF SICKLE CELL ANEMIA

How is sickle cell anaemia diagnosed?

Healthcare providers diagnose sickle cell anaemia by doing a physical examination that may include feeling your spleen or liver. They'll ask about your symptoms, particularly pain in your arms, legs or belly. They may ask about your medical history, including infections. They may order the following tests: (Cleaveland Clinic, 2024)

- Complete blood count (CBC): CBCs include specific tests to check on your red blood cells. (Cleaveland Clinic, 2024)
- Haemoglobin electrophoresis: Also known as high-performance liquid chromatography, this test analyses your haemoglobin to find and measure the abnormal haemoglobin that causes sickle cell anaemia. (Cleaveland Clinic, 2024)
- Genetic tests: Your provider may order tests to see if you have the genetic changes (mutations) that cause sickle cell anaemia. (Cleaveland Clinic, 2024)

Prenatal and New-born screening of sickle cell disease

Prenatal Screening

Prenatal screening for sickle cell disease can be performed as early as 8 to 10 weeks into pregnancy using a sample of amniotic fluid or placenta tissue. These tests identify the presence of the sickle haemoglobin gene but cannot predict the severity of the disease. Early detection allows parents to make informed decisions about their child's care and future health needs. (NHLBI, 2024)

Newborn Screening

Newborn screening involves collecting a blood sample from the baby's heel, which is tested for abnormal haemoglobin using methods like high-performance liquid chromatography (HPLC). If sickle cell disease is detected, follow-up testing and genetic counselling are recommended. Screening can also identify carriers of the sickle cell trait, enabling families to understand the genetic risks for future children. (NHLBI, 2024)

MANAGEMENT OF SICKLE CELL ANEMIA

Management of sickle cell anaemia is usually aimed at avoiding pain episodes, relieving symptoms and preventing complications. Treatments might include medicines and blood transfusions. For some children and teenagers, a stem cell transplant might cure the disease. Gene therapies also are being developed that may offer cures for people with sickle cell disease.

ACUTE MANAGEMENT

Acute painful crises in sickle cell disease require supportive therapy, including intravenous fluids and strong analgesia. Morphine is the drug of choice, administered at 0.1 mg/kg intravenously or subcutaneously every 20 minutes until pain is controlled, followed by 0.05–0.1 mg/kg every 2–4 hours. For patient-controlled analgesia (PCA) in adults, a continuous infusion of 0–10 mg/h is typical, with a PCA bolus dose of 2–10 mg and a lockout time of 20–30 minutes. Milder pain may be managed with paracetamol (1 g every 6 hours), ibuprofen (400 mg every 8 hours), or diclofenac (50 mg every 8 hours), but caution is advised with NSAIDs in patients with renal impairment. Preventative measures include daily penicillin (500 mg) and vaccinations for pneumococcal and Haemophilus influenzae type b. Folic acid is recommended for all patients to support hemolysis. Blood transfusions are reserved for severe cases such as heart failure, stroke, acute chest syndrome, splenic sequestration, and aplastic crises. (Parveen & Michael, Kumar & Clark's Clinical Medicine 8th Edition, 2012)

In managing complications, adjunctive therapies include laxatives like lactulose (10 mL twice daily), senna (2–4 tablets daily), and sodium docusate (100 mg twice daily), along with anti-pruritic like hydroxyzine (25 mg twice daily as needed), antiemetics such as prochlorperazine (5–10 mg three times daily) or cyclizine (50 mg three times daily), and anxiolytics like haloperidol (1–3 mg orally or intramuscularly twice daily as required). (Parveen & Michael, Kumar & Clark's Clinical Medicine 8th Edition, 2012)

A newer approach to treating painful crises is the use of inhaled nitric oxide, which is based on the hyper-hemolytic paradigm. However, this therapy is still under investigation and is not yet established through randomized controlled trials. (Parveen & Michael, Kumar & Clark's Clinical Medicine 8th Edition, 2012)

LONG TERM TREATMENTS

Long term treatment for sickle cell anaemia depends on your symptoms and your overall health. For example, if you have severe complications like acute chest syndrome, frequent acute pain crises or stroke, your provider may recommend an allogeneic stem cell transplant. This procedure is the only cure for sickle cell anaemia. (Cleaveland Clinic, 2024)
Other sickle cell anaemia treatments are blood transfusions, antibiotics to treat infections and medications that ease specific symptoms. Those medications include: (Cleaveland Clinic, 2024)

- Hydroxyurea (Droxia®, Hydrea®, Siklos®, Mylocel®): Hydroxyurea is an anticancer drug. It's treatment for infants aged 6 to 9 months, children and adults. It may reduce how often you have serious complications and ease anemia symptoms. (Cleaveland Clinic, 2024)

- Voxelotor (Obryta®): Voxelotor keeps red blood cells from becoming sickled cells. It's treatment for children age 4 and older. (Cleaveland Clinic, 2024)
- L-glutamine therapy (Endari®): This medication, which is a treatment for children age 5 and older and adults, keeps sickled cells from becoming even more abnormal. (Cleaveland Clinic, 2024)
- Crizanlizumab-tmca (Adakveo®): This reduces how often you may have VOC/acute pain crisis. It's treatment for people age 16 and older. (Cleaveland Clinic, 2024)

NEW ADVANCEMENTS

The FDA approved two gene therapies, Casgevy and Lyfgenia, for treating sickle cell disease in patients aged 12 and older. (FDA, 2023)
Approval Date: These therapies were approved on December 08, 2023 (FDA, 2023)

- Casgevy: Utilizes CRISPR/Cas9 genome editing technology to modify patients' blood stem cells, increasing foetal haemoglobin (HbF) production to prevent red blood cell sickling. (FDA, 2023)
- Lyfgenia: Uses a lentiviral vector to modify blood stem cells to produce HbA T87Q, reducing the risk of red blood cell sickling and occlusion. (FDA, 2023)

LIVING WITH SICKLE CELL ANEMIA: PREVENTATIVE CARE AND LIFESTYLE MODIFICATIONS

As a patient with sickle cell Anaemia, there are several things you can do, and precautions you can take, to stay as healthy as possible: (NHS, 2022)

- **MANAGING SICKLE CELL PAIN**

You can reduce your risk of painful episodes (sickle cell crises) by avoiding things that can trigger them. Try to: (NHS, 2022)

  - Drink plenty of fluids, particularly during hot weather – dehydration increases the risk of a sickle cell crisis (NHS, 2022)
  - Avoid extreme temperatures – you should dress appropriately for the weather and avoid sudden temperature changes, such as swimming in cold water (NHS, 2022)
  - Be careful at high altitudes – the lack of oxygen at high altitudes may trigger a crisis (travelling by plane should not be a problem because planes are pressurised to maintain a steady oxygen level) (NHS, 2022)
  - Avoid very strenuous exercise – people with sickle cell disease should be active, but intense activities that cause you to become seriously out of breath are best avoided (NHS, 2022)
  - Avoid alcohol and smoking – alcohol can cause you to become dehydrated and smoking can trigger a serious lung condition called acute chest syndrome. (NHS, 2022)
  - Relax – stress can trigger a sickle cell crisis, so it may help to learn relaxation techniques, such as breathing exercises (NHS, 2022)

It's also a good idea to be prepared for treating painful episodes at home. Keep a ready supply of painkillers (paracetamol or ibuprofen) and consider buying some heated pads to soothe the pain. (NHS, 2022)

- **AVOIDING INFECTIONS**

You'll usually be given antibiotics and advised to have vaccinations to help prevent most serious infections, but there are also things you can do to reduce your risk. For example, you should make sure you follow good food hygiene measures to prevent food poisoning. (NHS, 2022)

Make sure you speak to your GP or healthcare team if you're planning to travel abroad, as this may mean you need extra medication or vaccinations. For example, if you're travelling to an area where malaria is found, it's important to take antimalarial medication. (NHS, 2022)

You may also need to take extra food and water precautions abroad. (NHS, 2022)

- **PREGNANCY AND CONTRACEPTION**

Women with sickle cell disease can have a healthy pregnancy, but it's a good idea to speak to your healthcare team for advice first. It may be useful to find out if your partner is a carrier of sickle cell and discuss the implications of this with a genetic counsellor. (NHS, 2022)

Some sickle cell disease medicines, such as hydroxycarbamide, can harm an unborn baby. You may need to stop taking them before trying to get pregnant. (NHS, 2022)

There's an increased risk of problems, such as anaemia, sickle cell pain, miscarriage and pre-eclampsia, during pregnancy. You may need extra monitoring and treatment during pregnancy to help prevent problems. If you're not planning a pregnancy, use a reliable form of contraception. (NHS, 2022)

- **SURGERY PRECAUTIONS IF YOU HAVE SICKLE CELL DISEASE**

It's important to let your healthcare team know if you need to have an operation under general anaesthetic at any point. Tell your surgeon that you have sickle cell disease. This is because general anaesthetic can cause problems for people with sickle cell disease, including an increased risk of experiencing a sickle cell crisis. (NHS, 2022)

You may need close monitoring during surgery to make sure you're getting enough fluids and oxygen and are kept warm. Sometimes you may need a blood transfusion beforehand to reduce the risk of complications. (NHS, 2022)

WHEN TO GET MEDICAL ADVICE

Make sure you know when to get medical advice and where to go, as sickle cell disease can cause a number of serious problems that can appear suddenly. Problems to look out for include: (NHS, 2022)

- A high temperature over 38C (or any increased temperature in a child) (NHS, 2022)
- Severe pain that's not responding to treatment at home (NHS, 2022)
- Severe vomiting or diarrhea (NHS, 2022)
- A severe headache, dizziness, or a stiff neck (NHS, 2022)
- Breathing difficulties (NHS, 2022)
- Very pale skin or lips (NHS, 2022)
- Sudden swelling in the tummy (NHS, 2022)
- A painful erection (priapism) lasting more than 2 hours (NHS, 2022)
- Confusion, drowsiness, or slurred speech (NHS, 2022)
- Fits (seizures) (NHS, 2022)
- Weakness on 1 or both sides of the body (NHS, 2022)
- Changes in vision or sudden vision loss (NHS, 2022)

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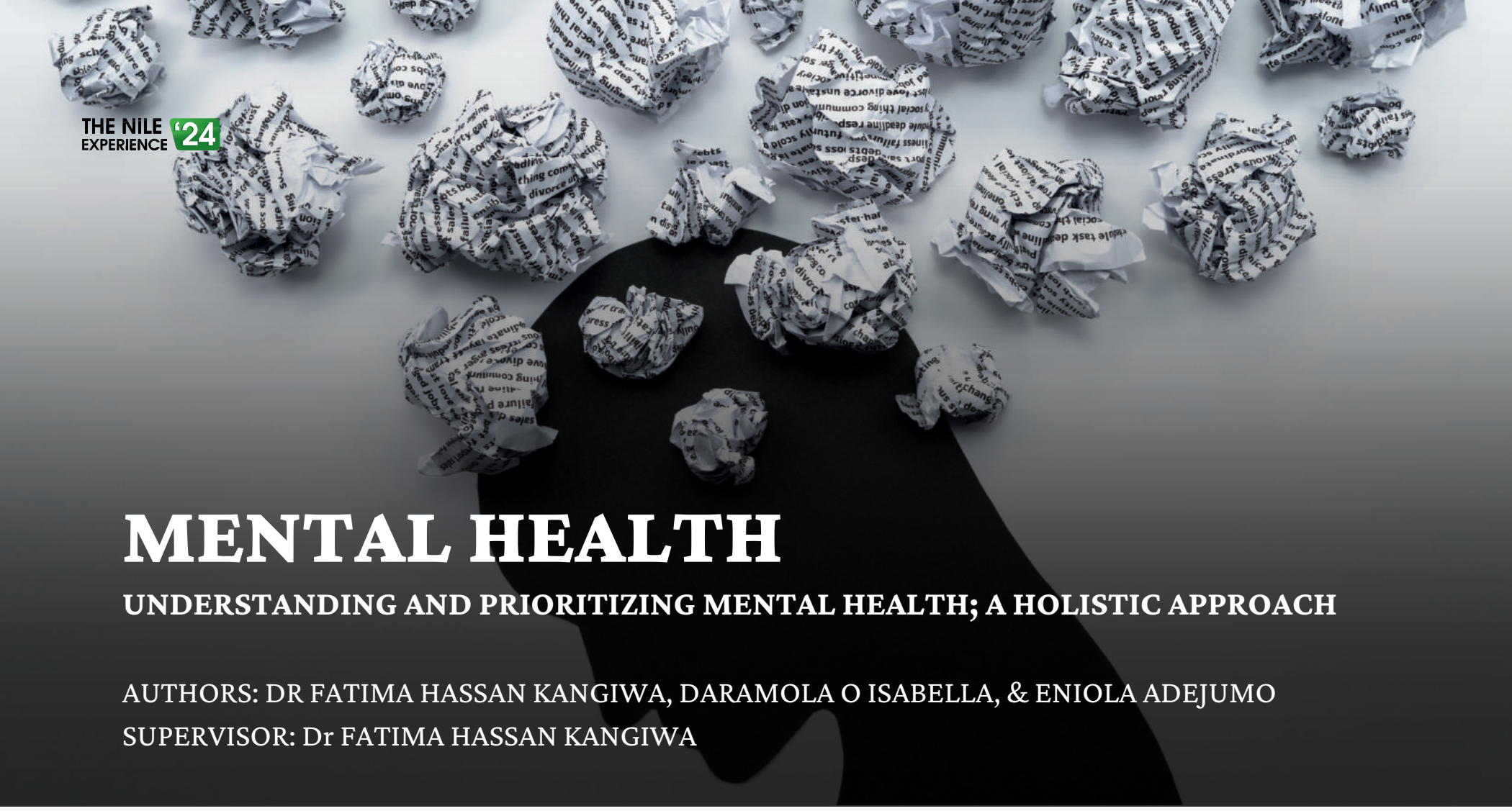

MENTAL HEALTH

UNDERSTANDING AND PRIORITIZING MENTAL HEALTH; A HOLISTIC APPROACH

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Mental health, often overshadowed by its physical counterpart, is an intricate and essential aspect of human existence. It envelops our emotions, psychological state, and social well- being, shaping our thoughts, behaviors, and interactions. With the complexities of modern life—constant connectivity, societal pressures, personal expectations, and the frenzied pace of technological advancements—mental well-being has become increasingly paramount.

INTRODUCTION

Mental health has been hidden behind a curtain of stigma and discrimination for too long. It is time to bring it out into the open. The magnitude, suffering and burden in terms of disability and costs for individuals, families and societies are staggering. In the last few years, the world has become more aware of this enormous burden and the potential for mental health gains. We can make a difference using existing knowledge ready to be applied.

For all individuals, mental, physical and social health are vital and interwoven strands of life. As our understanding of this relationship grows, it becomes ever more apparent that mental health is crucial to the overall well-being of individuals, societies and countries. Indeed, mental health can be defined as a state of well-being enabling individuals to realize their abilities, cope with the normal stresses of life, work productively and fruitfully, and make a contribution to their communities. Unfortunately, in most parts of the world, mental health and mental disorders are not accorded anywhere near the same degree of importance as physical health. Rather, they have been largely ignored or neglected. This publication aims to guide you in the discovery of mental health, in the magnitude and burdens of mental disorders, and in understanding what can be done to promote mental health in the world and to alleviate the burdens and avoid deaths due to mental disorders. Effective treatments and interventions that are also cost-effective are now readily available. It is therefore time to overcome barriers and work together in a joint effort to narrow the gap between what needs to be done and what is actually being done, between the burden of mental disorders and the resources being used to address this problem. Closing the gap is a clear obligation not only for the World Health Organization, but also for governments, aid and development agencies, foundations, research institutions and the business community.

The magnitude and burdens of the problem [1] As many as 450 million people suffer from a mental or behavioural disorder. Nearly 1 million people commit suicide every year. Four of the six leading causes of years lived with disability are due to neuropsychiatric disorders (depression, alcohol-use disorders, schizophrenia and bipolar disorder). One in four families has at least one member with a mental disorder. Family members are often the primary caregivers of people with mental disorders. The extent of the burden of mental disorders on family members is difficult to assess and quantify and is consequently often ignored. However, it does have a significant impact on the family's quality of life. In addition to the health and social costs, those suffering from mental illnesses are also victims of human rights violations, stigma and discrimination, both inside and outside psychiatric institutions

WHAT IS MENTAL HEALTH?

Mental health is a state of mind characterized by emotional well-being, good behavioural adjustment, relative freedom from anxiety and disabling symptoms, and a ability to establish constructive relationships and cope with the ordinary demands and stresses of life[2]. Mental health is more than the mere lack of mental disorders. The positive dimension of mental health is stressed in WHO's definition of health as contained in its constitution: "Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." Concepts of mental health include subjective well-being, perceived self efficacy, autonomy, competence, intergenerational dependence and recognition of the ability to realize one's intellectual and emotional potential. It has also been defined as a state of well-being whereby individuals recognize their abilities, can cope with the normal stresses of life, work productively and fruitfully, and contribute to their communities. Mental health is about enhancing competencies of individuals and communities and enabling them to achieve their self-determined goals. Mental health should be a concern for all of us, rather than only for those who suffer from a mental disorder. Mental health problems affect society, and not just a small, isolated segment. They are therefore a major challenge to global development. No group is immune to mental disorders, but the risk is higher among the poor, homeless, the unemployed, persons with low education, victims of violence, migrants and refugees, indigenous populations, children and adolescents, abused women and the neglected elderly. For all individuals, mental, physical and social health are closely interwoven, vital strands of life. As our understanding of this interdependent relationship grows, it becomes ever more clear that mental health is crucial to the overall well- being of individuals, ,societies and countries

Unfortunately, in most parts of the world, mental health, and mental disorders are not given anywhere the same importance as physical health. Rather, they have been ignored or neglected.

Importance of mental health in overall well-being

Your mental health is an important part of your well-being. This aspect of your welfare decides how you're re able to operate psychologically, emotionally, and socially among others. Considering how much of a role your mental health plays in each aspect of your life, it's important to guard and improve psychological . wellness using appropriate measures. It has been conceptualized as a positive emotion that leads to a feeling of happiness. The personality traits of people with positive mental health includes psychological resources of self-esteem, mastery, and resilience, which is the ability to cope with adversity and avoid a breakdown when confronted by stressors. Such people have the ability to master their environments, and they can identify,, confront, and solve problems. Mental health is clearly influenced by cultural, socioeconomic, and political situations [3].

Growing awareness and conversations surrounding mental health in modern society.

Mental health awareness is the ongoing effort to reduce the stigma around mental illness and mental health conditions by sharing our subjective experiences. Often, because of misconceptions about mental health and mental fitness, people often suffer in silence and their conditions go untreated. Mental health awareness is an important social movement to both improve understanding and increase access to healthcare.[4] In recent years, there has been a significant risein awareness and conversations surrounding mental health in modern society. People are increasingly recognizing the importance of mental well-being, breaking down stigmas and encouraging open dialogue. This shift has been supported by greater access to resources, advocacy by public figures, and a growing understanding of the impact mental health has on overall quality of life. As a result, mental health is becoming an integral part of discussions in healthcare, workplaces, and communities worldwide. The growing awareness and conversation surrounding mental health in modern society reflect a significant shift in attitudes.

Over the past decade, public understanding and acceptance of mental health issues has increased dramatically. Studies show that about 90% of people believe mental health has gained a higher public profile, with a large majority feeling that's s now more socially acceptable to discuss these issues openly. This cultural shift has been crucial in reducing the stigma that historically surrounded mental health, which often deterred people from seeking help.[5]

Despite this progress, challengeremain.. Mental health stigma, which can manifest in various forms public, self, and structural still leads to social isolation, discrimination, and even economic disadvantages for those affected. However, as awareness continues to rise, there are increasing calls for more accessible and equitable mental health care.

The Components of Mental Health

1. **Emotional well-being:** Recognizing and managing emotions. Positive emotional well-being helps people manage their thoughts and feelings. People with positive emotional well-being have a sense of meaning and purpose, they have the skills to adapt to and deal with life challenges. They Identify, process, and express emotions in healthy ways.[6]
Without positive emotional well-being people may have difficulty connecting socially.

11. **Psychological well-being:** Coping with stress, trauma, and life challenges. Psychological well-being refers to an individual's overall mental health and emotional state, encompassing aspects like life satisfaction, self-esteem, and the ability to manage stress. It is more than just the absence of mental illness; it involves positive functioning, such as maintaining fulfilling relationships, a sense of purpose, and the ability to handle lifeâ€™s challenges. Key elements of psychological well-being include autonomy, the ability to make independent decisions; positive relationships, which foster support and connection, environmental mastery, or the capability to manage life's demands; and personal growth, which refers to continuous self improvement and adaptation. A sense of control, emotional resilience, and mindfulness also contributes significantly to well-being. [7] Maintaining psychological well-being is essential for both personal happiness and overall health, as poor mental health can have a profound impact on physical well-being and quality of life.

111. **Social well-being; maintaining healthy relationships and community connections**. Studies show that strong social connections are linked to an increased chance of longevity, a better immune system, less inflammation, and faster recoveries from disease. When you feel more connected to others, you are less vulnerable to anxiety and depression and have higher self-esteem, empathy, and trust toward others. In other words, meaningful relationships generate a positive social, emotional, and physical well-being spiral. Unfortunately, the opposite is also true, and those who lack social connectedness are more prone to suffer a decline in physical and psychological health and are susceptible to becoming further isolated.[8]

1V. **Cognitive well-being:** Focus, memory, and clarity of thought. Cognitive health is the ability to think, learn, and remember clearly. It is needed to carry out many everyday activities effectively. Cognitive health is just one aspect of overall brain health. When in a state of mental clarity, the brain can think quickly and creatively, solve problems effectively, and maintain focus on a task without distraction. Not only does itincrease efficiency, but it also boosts confidence and overall happiness.

Common Mental health challenges

1. **Anxiety Disorders:** Many of us worry from time to time. We fret over finances, feel anxious about job interviews, or get nervous about social gatherings. These feelings can be normal or even helpful. They may give us a boost of energy or help us focus. But for people with anxiety disorders, they can be overwhelming. Anxiety disorders affect nearly 1in 5 American adults each year. People with these disorders have feelings of fear and uncertainty that interfere with everyday activities and last for 6 months or more. Anxiety disorders can also raise your risk for other medical problems such as heart disease, diabetes, substance abuse, and depression. The good news is that most anxiety disorders get better with therapy. The course of treatment depends on the type of anxiety disorder. Medications, psychotherapy, or a combination of both can usually relieve troubling symptoms. Anxiety disorders are one of the most treatable mental health problems we see, says Dr. Daniel Pine, an NIH neuroscientist and psychiatrist. Still, for reasons we do not fully understand, most people who have these problems do not get the treatments that could help them. One of the most common types of anxiety disorder is social anxiety disorder or social phobia. It affects both women and men equal a total of about 15 million U.S. adults. [9]Without treatment, social phobia can last for years or even a lifetime. People with social phobia may worry for days or weeks before a social event. They're re often embarrassed, self-conscious, and afraid of being judged. They find it hard to talk to others. They may blush, sweat, tremble, or feel sick to their stomach when around other people.

11. **Depression and mood disorders:** Depression is a mood disorder that causes persistent feelings of sadness, emptiness, and loss of joy. It is different from the mood fluctuations that people regularly experience as a part of life. Major life events, such as bereavement or the loss of a job, can trigger depression.But depression is distinct from the negative feelings a person may temporarily have in response to a difficult life event. Depression often persists in spite of a change of circumstances and causes feelings that are intense, chronic, and not proportional to a personal circumstances. It is an ongoing problem, not apassing one. While there are different types of depression, the most common one is major depressive disorder. It consists of episodes during which the symptoms last for at least two weeks, can last for several weeks, months, or years. For many people, it is a chronic illness that gets better and then relapses. [10]

Depression is a mental health condition that causes a chronic feeling of emptiness, sadness, or inability to feel pleasure that may appear to happen for no apparent reason.

Depression is the leading cause of disability

worldwide, according to the World Health Organization (WHO). It can undermine a personâ€™s relationships, make working and maintaining good health very difficult, and in severe cases, may lead to suicide. In fact, depression contributes to nearly 40,000 suicides in the United States each year.

111. **Stress and burnout:** Burnout and stress are at all-time highs across professions, and among already strained health care workers, they are exacerbated by the politicization of mask-wearing and other unrelenting stressors. According to the World Health Organization, burnout is a syndrome resulting from workplace stress that has not been successfully managed. It Is characterized by three dimensions: feelings of energy depletion or exhaustion, increased mental distance from one's job or feelings of negativism or cynicism related to one's s job and reduced professional efficacy.

1V. **PTSD and trauma-related issues;** posttraumatic stress disorder (PTSD) is a prevalent and complex psychiatric condition that arises in response to exposure to traumatic events, significantly impacting an individual's mental well-being. Characterized by a diverse array of symptoms, PTSD can affect cognition, mood, somatic experiences, and behavior, leading to chronic impairments and an elevated risk of comorbid psychiatric illnesses, including an increased susceptibility to suicide. This activity describes the evaluation and management of PTSD and highlights the role of the interprofessional team in improving care for affected patients. Clinicians participating inÂ this activity can expect to gain comprehensive insights intoÂ the complexity of managing PTSD, acknowledging the individualized nature of trauma cases and the variability in symptom manifestation. Participants can expect learning about both psychological interventions and pharmacotherapy for prevention and treatment. Clinicians are provided a holistic approach to addressing the multifaceted challenges posed by this challenging psychiatric disorder.

V. **Eating Disorder and body image issues:** Body image distress is often seen as a symptom of an eating disorder. However, not every person with an eating disorder has a problematic body image, and many people who do not have eating disorders have poor body image. Body image is the subjective image people have of their own body, which is distinct from how their body actually appears. It is a complex construct and is made up of beliefs, thoughts, perceptions, feelings, and behaviors. The way we see ourselves and our bodies have an impact on our health, our mental health, and our relationships. A healthybody image involves an objective belief of one's appearance and the ability to separate one's value as a person from how one looks.

Negative body image is often characterized by dissatisfaction with appearance and engaging in behaviors such as dieting, checking, and/or avoidance, in an attempt to ameliorate the dissatisfaction. Negative body image often emerges during childhood.[11]

V1. **Substance abuse and addiction:** Many people do not understand why or how other people become addicted to drugs. They may mistakenly think that those who use drugs lack moral principles or willpower and that they could stop their drug use simply by choosing to. In reality, drug addiction is a complex disease, and quitting usually takes more than good intentions or a strong will. Drugs change the brain in ways that make quitting hard, even for those who want to. Fortunately, researchers know more than ever about how drugs affect the brain and have found treatments that can help people recover from drug addiction and lead productive lives. Addiction is a chronic disease characterized by drug seeking and use that is compulsive, or difficult to control, despite harmful consequences. The initial decision to take drugs is voluntary for most people. Still, repeated drug use can lead to brain changes that challenge an addicted person's self-control and interfere with their ability to resist intense urges to take drugs. These brain changes can be persistent, which is why drug addiction is considered a "relapsing" disease people in recovery from drug use disorders are at increased risk for returning to drug use even after years of not taking the drug. It's common for a person to relapse, but relapse does not mean that treatment doesn't work. As with other chronic health conditions, treatment should be ongoing and should be adjusted based on how the patient responds. Treatment plans need to be reviewed often and modified to fit the patient's changing needs.

Risk factors and causes

Poor mental health can arise from a wide range of factors that influence an individual's well-being, these are often grouped into biological, environmental, and psychosocial Biological Factors

- **Neurochemistry:** Some research suggests that poor mental health may be linked to levels of certain neurotransmitters such as dopamine, serotonin, and norepinephrine. Imbalances in these hormones may affect mood regulation and contribute to conditions such as depression/anxiety. Serotonin affects sleep, mood, memory, and behaviour. Low levels of serotonin and GABA can be seen in depression and anxiety.

- **Family history and genetics-some mental health issues run in the family and genetic factors can contribute to the development of mental health issues.** Condition such as autism, schizophrenia, bipolar disorder, major depression, and attention deficit hyperactivity disorder (ADHD), may be transmitted to the offspring of a patient of the condition. Even though a mental disorder may be inheritable in a family, there may be considerable differences in the severity of symptoms among family members. Genetic factors that can contribute to the development of mental disorders include genetic polymorphism, epigenetic regulations, and single gene changes.
- **Hormonal Imbalance:** Hormonal imbalance can affect the level of production, release, and activities of neurotransmitters in the brain ultimately impacting, behaviours, mental health, and emotions. Disruption in cortisol, thyroid hormones, estrogen, and progesterone hormones can alter the balance of dopamine, serotonin, norepinephrine, and GABA. Anxiety, irritability, and depression are usually the results.
- **Chronic illnesses:** having a chronic illness or any illnesses in general can be stressful and affect mental health causing depression, and anxiety. Any illness that causes pain, self-isolation, and disability will lead to depression.
- **Neurological disorders:** Traumatic brain injuries or conditions such as dementia and epilepsy can impair cognitive function and lead to poor mental health.
- **Environmental factors:** Low socioeconomic status due to poverty, financial instability, unemployment, and noise pollution. Poor living conditions, overcrowding, absence of privacy, and unsafe neighborhoods contribute to stress thereby causing depression and negatively impacting mental health.
- **Exposure to violence, war, and trauma can lead to Post-traumatic stress disorder (PTSD):** causing Bullying, discrimination, stigma, racism, sexism, and religious intolerance also affect mental health. School /workplace and high-pressure environments can lead to burnout, anxiety, and depression.
- **Psychological factors:** such as; Sexual assault, heartbreak, trauma, neglect, and all forms of abuse can cause PTSD, and anxiety and negatively impact mental health. Low self-esteem, perfectionism, high sensitivity, grief loss, divorce, life milestones such as new parenthood, starting a new job, and marriage can lead to stress and depression. Relocating, changing school /job and retirement can bring a sense of loss, loneliness, and homesickness.
- **Lifestyle factors**: Physical inactivity, chronic sleep deprivation, and nutritional deficiencies such as low levels of omega-3, fatty acids, and vitamin b12 affect mood and brain function, excessive screentime and negative social media influence can increase feelings of isolation and anxiety. Drugs and substance abuse also negatively affect brain development and function.

The Stigma around mental health

Stigma refers to the misconceptions, negative beliefs, and attitudes that a society has towards mental health issues. This can lead to discrimination, shame, and isolation to individuals affected.

- **Mental health: Misunderstanding and ignorance** - Most people do not understand or have no knowledge of mental health issues,they often equate it as a weakness or assume that mental health issues are choice and patients can make the conscious decision to be cured, It is also a misconception that mental health patients are crazy, violent, and dangerous.
- **Discrimination and social exclusion:** Mental health patients often face discrimination in the employment sector and educational sector, most are seen as unreliable or less capable of handling tasks as such most are often rejected by employers and students areusually exempted from carrying out activities and they end up missing out on academic opportunities.
- **Media and representation:** Movies and television show often portray mental illness in a very exaggerated, overemphasized and dramatic manner, this can distort the public's understanding of mental health issues and the reality of those living with the condition.
- **Societal and cultural beliefs**: Mental health is a topic that is not often spoken so there is a lot of secrecy and shame attached to it; most victims are ashamed to openly talk about their conditions for fear of being looked down on and castigated, patients are usually embarrassed to see health care.
- **Internalized stigma**: Mental health prejudice often becomes engrained and internalized into patients leading to feelings of shame, low self-esteem, and hopelessness, they often isolate themselves and withdraw from social interactions, they believe that they are less valued because of their mental 1llness

Consequences of stigma

- **Social isolation** - for fear of being discriminated and stigmatized, mental health patients often isolate themselves and shy away from social

- circles, this can lead to immense loneliness and exacerbation of symptoms.
- **Delay in seeking help**- patients often refuse to seek treatment for fear of being judged and ridiculed by members of society, thus early diagnosis is often prevented. Psychiatric symptoms may also progressively worsen.
- **Poor treatment adherence** - patients may **stop therapy and medications before completion due to fear of being stigmatized.**

Addressing the stigma

1. Education
2. Tolerance and acceptance should be taught in schools and communities.
3. Awareness should be spread about mental health disorders in communities, this will help to reduce the various misconceptions about mental health and end the stigma surrounding it.
4. Advocacy and protest- the media should stop the wrong representation of mental illness. Campaigns should be put in place to withdraw stigmatizing images and videos that portray mental illness in a degrading manner. laws should be made to protect individuals with mental health from discrimination in workplaces and communities.
5. Media responsibility - the media should portray correct depictions of mental illness, it should show that a disorder doesn't make them any less human or less capable of surviving in society. This would help to encourage open dialogue about mental illness and help normalize it.
6. Promoting early health care and treatment - mental health care should be made readily available, affordable, and accessible to patients, counseling, and therapy should be encouraged so the barriers surrounding seeking treatment will be broken.
7. Changing our language - people should learn to refrain from addressing mental health patients in derogatory terms such as "Crazy, mad, insane".

Prevention

- Maintaining a healthy lifestyle-physical activity can lead to the release of endorphins that improve mood and reduce anxiety, stress, and depression. Eating a healthy balanced diet, with foods rich in vitamin b12 and omega 3 fatty acids supports brain health.
- Adequate sleep and stress management - Proper sleep helps to reduce stress, relaxes the body and brain functions. Adults should try to achieve 7-9 hours of quality sleep every night, Stress management techniques such as meditation, deep breathing, yoga, and progressive muscle relaxation can be done to decrease stress and anxiety levels
- Seeking professional help early early diagnosis of any disorder is key for quick assessment and initiation of treatment. Regular mental health checks and counseling sessions should be done in all individuals.
- Building strong social connections- family, friends, and loved ones all serve as social support systems. Strong relationships should be built as it reduces the feelings of loneliness and homelessness. Social connections bring a sense of belonging to people.
- V. Creating a work-life balance- people should make time for relaxation and take breaks during work hours to prevent burnout and stress. Boundaries should be set between the private life and work life.
- VI. Practicing gratitude- a grateful attitude should be cultivated in the lives of individuals. Small wins should be celebrated and practicing gratitude for things no matter how little can shift the perspective form a negative to a positive one. Self-compassion should be developed, avoid negative self-talk and harsh self-criticism.
- V11. Journalling and breaks from social media writing down thoughts, feelings and emotions can serve to reduce stress and identify patterns, social media breaks should be carried out occasionally to reduce exposure to too much overwhelming news and content

SEEKING PROFESSIONAL HELP WHEN SELF CARE ISN'T ENOUGH

Self-care refers to activities carried out to aid in managing stress, lowering the risk of illness, and increasing energy. These acts depend on the individual and could include: regular exercise, eating regular, healthy meals and staying hydrated, making sleep a priority, and exploring relaxation or wellness activities. However, it is important to seek professional help when experiencing severe or distressing symptoms which have lasted 2 weeks or more, such as: Difficulty sleeping, Drastic changes in appetite or unplanned weight changes, Mood changes, affecting desire to get out of bed, Difficulty concentrating, Loss of interest in things previously found enjoyable, Inability to complete usual tasks and activities, Feeling of irritability, frustration, or restlessness, Severe mood swings affecting relationships, Hearing voices or believing things that are not true, Having unexplained aches or pains, Suicidal ideations (Health, 2024)

TYPES OF MENTAL HEALTH PROFESSIONALS

In the course of seeking help in the management of mental health issues, it is easy to confuse the roles of the professionals available, the clinical psychiatrist, psychologist, and counselors.

Initially, when mental health disorders are identified, the first line of care to seek should be a primary care physician. The primary care physician then evaluates symptoms and decides the type of mental health professional and therapy that best suits the symptoms.

Referral to any of the following mental health professionals may then occur.

- **Psychiatrist**: this is a medical doctor who specializes in the prevention, diagnosis, and treatment of mental health illnesses. They are specifically trained to differentiate mental health disorders from other underlying medical conditions that could present with psychiatric symptoms. They also monitor the effects of mental illnesses on other systemic diseases such as cardiovascular diseases, and the effects of medications prescribed on the body (weight, blood glucose, blood pressure, sleep, kidney, and liver functioning). As medical doctors, they are trained to write prescriptions for appropriate medication, as well as combine medication with appropriate psychotherapy if necessary.
- **A psychologist:** is a mental health professional with a doctoral degree (PhD, PsyD, or EdD) in psychology. that provides their clients with mental and emotional support, services, and information. Their methods may include talk therapy and diagnostic tests, which can help them adequately evaluate and assist their clients. Psychologists typically approach mental health from a behavioural perspective, assessing how their clients' underlying thoughts, emotions and concerns impact their overall emotional well-being. Their primary responsibilities include identifying and diagnosing mental health conditions and creating strategies to help their clients with these results. Psychologists may conduct clinical research and focus their study on various areas, including psychological theories, behavioural therapy, or personality traits and development. They do not typically prescribe medication or perform medical procedures. They often work in association with a psychiatrist or another medical doctor who provides the medical treatment for the illness
- **Counsellor:** A counsellor is a professional who offers coaching and advice to their clients. Counsellors can help people identfy their goals and aspirations and may also provide solutions or resources to address

While counsellors, psychologists, and psychiatrists all work with clients and patients to evaluate and improve their mental and emotional health, these careers are distinct from one another. Some distinctions between these three professions include:

- **Behavioural observation:** Psychologists may use therapeutic methods that are unique to their field and may base their diagnosis on behavioural patterns and observations, whereas psychiatrists and counsellors may focus on other methods of evaluation.
- **Ability to diagnose:** Psychologists and psychiatrists can diagnose their patients' mental health conditions, while counsellors provide resources and create plans without an official diagnosis. Psychiatrists use these diagnoses to determine which medication may yield the most positive results, and psychologists are unable to prescribe medication.
- **Talk therapy:** Counsellors and psychologists may focus a lot of their time spent with clients on talk therapy and discussion. This may be one of their primary methods of treatment and support, whereas psychiatrists can utilize talk therapy, but as medical doctors, their primary concern is typically their client’s brain chemistry and physical and mental well-being.
- **Assess chemical imbalances:** While counsellors and psychologists both provide support for their client’s overall mental health and well-being, psychiatrists are unique in that they are interested in evaluating and assessing their patients’ chemical imbalances and using this information to inform their diagnoses. (team, 2024)

THERAPY OPTIONS

Types of Psychotherapy

There are many approaches to psychotherapy, also called talk therapy, from which mental health professionals draw their treatment practices. Different types of psychotherapies are often better suited to specific types of problems. For example, some psychotherapies are designed mainly to treat disorders like depression or anxiety, while others focus more on helping people overcome problems with relationships or obstacles to greater life satisfaction. Some forms of psychotherapy are one-on-one with a therapist, while others are group-based or family-based. According to the American Psychological Association, those approaches fall into five broad categories.

- **Psychoanalytic or psychodynamic therapies:** The idea behind this kind of therapy is that people's lives are affected by unconscious issues and conflicts. The goal of the therapist is to help the person bring those issues to a conscious level where they can be understood and dealt with. This may involve analyzing dreams or exploring a person's personal history.
- **Behavioural therapy:** This approach to therapy focuses on learning and behaviour to change unhealthy behavioural patterns. Some therapists try to help patients learn new associations by using a system of reward and punishment to bring about certain behavioural changes. Another approach might involve a controlled series of exposures to a phobia trigger to desensitize a person to an unreasonable fear.
- **Cognitive therapy:** The emphasis in cognitive therapy is on a person's thoughts. The idea is that dysfunctional thinking is what leads to dysfunctional emotions or behaviours. The goal is to help the person recognize unhealthy thinking patterns and to recognize and change inaccurate beliefs. Group therapy. One or more behavioural providers lead a group of 5-15 patients a few hours per week. Groups are typically designed to help each other deal with a particular issue, including obesity, social anxiety, grief, chronic pain, or substance abuse.
- **Humanistic therapy:** This approach to therapy is based on the idea that people are capable of making rational choices and developing their maximum potential. This approach to therapy is often client-centred, with the client being seen as the authority on what is going on inside. Integrative or holistic therapy. This approach relies on integrating multiple approaches to therapy based on the client's individual needs. For instance, cognitive behavioural therapy is a combination of the two individual therapies and focuses on both thought and behaviour. (Saling, 2021)

IMPORTANCE OF EARLY DETECTION

Early detection in mental health involves identifying the initial signs and symptoms of mental health disorders before they escalate into severe conditions. This proactive approach is vital as it allows for prompt intervention, which can significantly alter the course of the disorder. According to the National Institute of Mental Health, approximately 50% of lifetime cases of mental illnesses begin by age 14, and 75% by age 24. This highlights the importance of early identification and intervention in mitigating the long-term impact of mental health issues. Early detection is not only about recognizing symptoms but also understanding the risk factors that contribute to mental health disorders. These factors can include genetic predisposition, environmental stressors, and individual behavioral patterns. By identifying these early indicators, healthcare professionals can devise personalized intervention strategies that address the unique needs of each individual.

The Benefits of Early Detection

The benefits of early detection in mental health are manifold:

- **Timely Intervention:** Early detection allows for prompt treatment, which can prevent the progression of mental health disorders. Early intervention strategies can include therapy, medication, lifestyle changes, and support systems that are tailored to the individual's needs.
- **Reduced Stigma:** Identifying mental health issues early can help in reducing the stigma associated with these conditions. When symptoms are recognized and treated early, it normalizes the conversation around mental health, encouraging more individuals to seek help without fear of judgment.
- **Improved Prognosis:** Early treatment of mental health disorders often results in a better prognosis. Individuals are more likely to respond positively to treatment when their symptoms are in the early stages, leading to improved long-term outcomes.
- **Cost-Effective:** Early detection and treatment can be more cost-effective than dealing with advanced stages of mental health disorders. Preventive measures and early interventions can reduce the need for more extensive and expensive treatments later on. (reporting, 2024)

ROLE OF SUPPORT SYSTEMS

A support system encompasses the network of family, friends, healthcare professionals, and community resources that provide emotional, informational, and practical help. Beyond just offering a listening ear, support systems facilitate access to care, advocate for the individual's needs, and provide a sense of belonging and acceptance. In the context of mental health, such networks are invaluable, offering a buffer against the isolation often imposed by mental illness.

The Multifaceted Benefits of Support Systems

- **Emotional Support:** Encouragement and understanding from loved ones can significantly alleviate the feelings of

- Informational Support: Access to accurate information about mental health conditions, treatment options, and coping strategies can empower individuals to make informed decisions about their care.
- Practical Assistance: Help with day-to-day tasks, accompanying someone to appointments, or financial support can lessen the burden of mental health challenges, allowing individuals to focus on recovery.

WHO RESPONSE

All WHO Member States are committed to implementing the Comprehensive Mental Health Action Plan 2013 to 2030", which aims to improve mental health by strengthening effective leadership and governance, providing comprehensive, integrated, and responsive community-based care, implementing promotion and prevention strategies, and strengthening information systems, evidence and research. In 2020, WHO's Mental Health Atlas 2020 analysis of the country's performance against the action plan showed insufficient advances against the targets of the agreed action plan. WHO's World Mental Health Report: Transforming Mental Health for All calls on all countries to accelerate the implementation of the action plan. It argues that all countries can achieve meaningful progress towards better mental health for their populations by focusing on three paths to transformation deepening the value given to mental health by individuals, communities, and governments; and matching that value with commitment, engagement, and investment by all stakeholders, across all sectors; reshape the physical, social and economic characteristics of environments, homes, schools, workplaces, and the wider community to better protect mental health and prevent mental health conditions; and strengthen mental health care so that the full spectrum of mental health needs is met through a community-based network of accessible, affordable, and quality services and supports.

CONCLUSION

As highlighted earlier, the relationship between mental, physical, and social health is vital and interwoven. Mental health problems are largely overlooked, which poses a major problem to the society at large.

Understanding common mental health challenges, knowing when to seek professional help, early intervention and establishment of support systems are integral parts of mental health care, therefore they should be integrated into general healthcare, and non-health settings such as community services, and the educational sector.

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NOMA:

A MULTIFACTORIAL DISEASE AT THE CROSSROADS OF NEGLECT, PUBLIC HEALTH, AND HUMAN RIGHTS

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OVERVIEW

Noma (cancrum oris) is a devastating disease that predominantly affects malnourished children in impoverished regions, particularly in sub-Saharan Africa. Characterized by its rapid progression from minor oral lesions to severe facial gangrene, Noma has a high mortality rate of up to 90% when left untreated. Despite being preventable, it remains prevalent due to factors such as malnutrition, poor hygiene, and limited access to healthcare. This article provides a comprehensive overview of Noma, examining its historical context, epidemiology, and the multifactorial etiology involving bacterial infections and co-factors like immune suppression and malnutrition. It also addresses the socio-economic determinants that increase susceptibility to the disease.

This article discusses Noma as a neglected disease and a human rights violation, emphasizing the disproportionate burden it places on vulnerable populations lacking access to basic healthcare, nutrition, and sanitation. Effective prevention strategies—including improving nutrition, access to healthcare, and early detection—are vital for mitigating the disease's impact. The article concludes by advocating for global attention, multidisciplinary efforts, and a holistic approach to addressing the socio-economic conditions that perpetuate the cycle of Noma, emphasizing the urgent need for better public health infrastructure and coordinated international action.

INTRODUCTION

Noma (cancrum oris) is a preventable disease that has been largely neglected and remains poorly understood. It predominantly affects disenfranchised populations, often leading to severe and fatal outcomes. The condition necessitates urgent medical and surgical care, which is challenging to obtain in the resource-limited settings where most cases are reported (Farley et al., 2021).

GLOBAL HISTORY AND EPIDEMIOLOGY OF NOMA

Noma derives its name from the Greek word "nomein," meaning "to devour," reflecting its rapid and destructive nature. Historically, the disease was not confined to tropical or African countries; it was first noted by Hippocrates in the fifth century BC as a severe ulceronecrotic condition affecting the mouth, face, and respiratory tract. The disease predominantly occurs in regions of extreme poverty with low measles vaccination coverage.

The earliest clinical description dates back to 1595 by Dutch surgeon Carolus Battus. In 1828, German physician Richter highlighted its persistent presence across Europe, associating it with malnutrition and childhood infections like measles. By the late 19th and early 20th centuries, improved hygiene and nutrition led to a marked decline of noma in Western Europe and other developed nations. However, during World War II, cases re-emerged in Nazi concentration camps, underscoring the link between severe malnutrition and the disease.

Noma continues to be described as the “true face of poverty,” thriving in conditions of extreme deprivation. Risk factors have escalated due to economic crises, rising food prices, malnutrition, climatic changes, and ongoing health disparities, all of which are compounded by neglect at national and international levels.The World Health Organization (WHO) recognized noma as a global health priority in 1994 following concerning reports from humanitarian organizations across Africa.

According to WHO estimates from 1998, the worldwide annual incidence of noma was about 140,000, with a prevalence of 770,000. However, updated studies suggest the actual incidence may be around 30,000–40,000 annually, affecting approximately 700,000 children under six years old, including around 100,000 in Africa. The disease has a case fatality rate of 85%, reflecting the dire consequences of delayed or absent treatment. In sub-Saharan Africa, data indicate noma’s contribution to child mortality ranges from less than 0.5% to over 3%, while it accounts for around 0.5% of global child mortality.

Accurately determining the global burden of noma remains challenging. The lack of standardized reporting until 1992, combined with social stigma, nomadic populations, and the remote locations of affected communities, hinders data collection. These obstacles have been compounded by inadequate healthcare infrastructure and poor record-keeping.

NOMA IN AFRICA

Noma continues to ravage the most marginalized communities across Africa, where it predominantly affects children living in extreme poverty. The disease is particularly prevalent in sub-Saharan nations, including Nigeria, Niger, Burkina Faso, and Senegal, where economic crises exacerbate existing vulnerabilities. Malnutrition, poor oral hygiene, and infectious diseases such as HIV and measles are significant risk factors that weaken the immune system, creating conditions conducive to the development of noma. Despite its severity, prevention and treatment of noma remain low priorities in these regions.

According to Fieger et al. (2003), the annual incidence of noma in northwestern Nigeria was estimated at 640 cases per 100,000 from 1996 to 2001, extrapolating to about 25,600 cases annually across sub-Saharan Africa. Regional studies report annual incidence rates between 1.64 and 13.4 per 100,000 children in eastern Ethiopia, while data from Senegal, Niger, and Gambia indicate rates ranging from 0.28 to 1.9 per 1,000 children. In Nigeria, the prevalence was approximated at 1 case per 1,250 children aged two to six years in 1997. Yet, these figures may underrepresent the true burden, as less than 10% of affected children receive medical care during the acute stages.

A 2007 WHO survey identified Burkina Faso, Ethiopia, Mali, Niger, Nigeria, and Senegal as the countries with the highest number of reported noma cases, earning the designation of the “noma belt.” More recent studies, including one from Nigeria between 2010–2018, estimated an incidence of 8.3 per 100,000 in the North Central Zone. Another 2018 study found a community-based point prevalence of 3,300 per 100,000 children in the North West. Variability in estimates is largely attributed to differing study designs and diagnostic criteria.

Despite these alarming statistics, noma remains underdiagnosed and poorly understood. Its endemic presence among impoverished populations highlights the pressing need for integrated public health strategies and sustained efforts to address the socio-economic determinants driving this devastating disease.

UNDERSTANDING THE RISK FACTORS FOR NOMA

Noma, a severe and often fatal disease affecting the face and mouth, primarily strikes young children in low-resource settings. Despite its seriousness, there’s limited primary research on what specifically causes noma. However, various studies have identified several potential risk factors that might contribute to the development of the disease.

1. Nutritional Deficiency and Comorbidities
Malnutrition is one of the most significant risk factors for noma. Children who are chronically undernourished are more vulnerable to infections, including noma. Other common health issues, like respiratory illnesses, diarrhea, HIV, and malaria, have also been linked to the onset of noma. These conditions can weaken the immune system, making it easier for infections to take hold. In particular, diseases that could be prevented with vaccines, such as measles, are known to increase the risk of developing noma.

2. Age and Feeding Practices
Noma typically affects children between the ages of 2 and 5. This is often a period of weaning from breastfeeding to solid foods, which can be less nutritious and potentially contaminated, especially in environments with poor sanitation. The teething stage around this age might also make the gums more vulnerable to infection. A study from Zambia suggested that children may be at risk because the food they eat during this time is less sterile than breast milk, increasing their exposure to harmful pathogens. Additionally, children who were not breastfed are considered to be at a higher risk.

3. **Social and Environmental Factors**
Several social and environmental factors play a role in the development of noma. Poor access to basic healthcare, including a lack of routine childhood vaccinations, can leave children susceptible to infections. Low socioeconomic status, lack of dietary variety, and poor oral hygiene, which can lead to gum disease, have also been cited as risk factors. Interestingly, in some studies, children from households without chickens were more likely to develop noma, possibly because chickens might help control pests that could transmit diseases.

4. **Sanitation and Living Conditions**
Children living in environments where livestock are kept close to living areas or where there is poor sanitation are at a higher risk of developing noma. These conditions can lead to contamination of food and water, creating a breeding ground for infections that could trigger the onset of the disease.

Challenges in Research and Understanding
One of the main challenges in studying noma is the lack of standardized data collection across different regions. Many studies rely on retrospective chart reviews, which can limit the quality of information collected. Additionally, because there is no standardized approach to defining the stages of noma, it's difficult to draw clear conclusions about what causes the disease. In some studies, the lack of a proper control group or robust statistical analysis made it hard to establish clear associations between risk factors and the development of noma.

THEORIES ON DISEASE DEVELOPMENT

There are many theories about why children between 2 and 5 years old are more likely to develop noma. One hypothesis is that during the teething stage, reduced blood flow to the gums makes the mouth more susceptible to infections. Others suggest that weaning practices may play a role, as solid foods might be prepared under unhygienic conditions, leading to the spread of pathogens. This could contribute to higher rates of diarrhea, a condition often seen in children who develop noma.

ETIOLOGICAL CONSIDERATIONS

Noma has a multifactorial etiology, with malnutrition as a key factor often associated with extreme poverty. Other contributors include concomitant diseases and poor oral hygiene, which can lead to gingivitis. Malnutrition weakens immune function, potentially resulting in a nutritionally acquired immune deficiency syndrome, common among preterm and low-birth-weight infants, who represent up to 25% of births in certain African regions. The onset of noma typically coincides with a vulnerable nutritional phase during weaning, where underweight infants are at heightened risk. This period also aligns with the emergence of immunosuppressive diseases such as malaria and measles.

Social determinants play a critical role in noma, particularly in large families where maternal grand multiparity and poor nutritional status are common. Maternal malnutrition during pregnancy may increase the risk of prematurity or low birth weight, leading to a cycle of recurrent infections and chronic malnutrition, further predisposing children to noma. Measles and malaria are frequently reported antecedent illnesses, occurring during the weaning period and exerting serious immunosuppressive effects. Other diseases associated with noma include typhus, chickenpox, tuberculosis, and HIV.

Insufficient oral hygiene can contribute to necrotizing gingivitis, characterized by periodontal pathogens, which may subsequently lead to noma.

ETIOPATHOGENESIS

Noma (cancrum oris) is a necrotizing infection primarily involving a mix of bacteria. However, bacterial presence alone does not cause the disease. Key co-factors, such as malnutrition and HIV/AIDS, interact in complex ways to trigger noma.

- **Role of Bacteria:**

Bacteria, particularly anaerobic species like Prevotella, Spirochaetes, and Peptostreptococcus, are central to noma's progression. Early stages of the disease, marked by a distinct odor, respond well to antibiotics. However, no single bacteria can be definitively identified as the primary cause, indicating a complex bacterial environment.

- **Malnutrition:**

Malnutrition makes children more vulnerable to infection and disease progression, especially in impoverished areas of Central Africa, where it weakens the immune system. Though malnutrition predisposes individuals to noma, not all malnourished children develop it, suggesting other factors are involved. Malnutrition can also result from the stress of the disease's acute phase, further weakening the immune system.

- **HIV/AIDS:**

The role of HIV varies by region. In Central Africa, most children with noma are HIV-negative, while in Southern Africa, many cases are linked to HIV-positive individuals. Immunosuppression from HIV creates a favorable environment for bacterial growth, leading to necrotizing conditions that may progress to noma. Antiretroviral therapy can help manage the condition by improving immune function.

In summary, noma results from a complex interplay of bacterial infection and host factors like malnutrition and HIV, which compromise immune defenses and lead to severe tissue destruction. Addressing these co-factors is crucial for prevention and management.

Clinical Progression of Noma

The World Health Organization has classified noma into five stages for better case detection:

- **Stage 0:** Simple gingivitis, characterized by inflammation of the gums.
- **Stage 1:** Acute necrotizing gingivitis, where the inflammation escalates, causing significant pain and bleeding.
- **Stage 2:** Oedema, marked by swelling of the affected tissues.
- **Stage 3:** Gangrene, where tissue death occurs, leading to necrosis and extensive damage.
- **Stage 4:** Scarring, indicating permanent damage to the affected areas.
- **Stage 5:** Sequelae, which involves long-term complications that arise after the acute phase has resolved.

In their publication "Overview of a Neglected Disease and Human Rights Violation," Farley et al. (2021) present a comprehensive analysis of the stages of noma disease.

1. **Initial Clinical Signs:** Noma typically begins with mild oral lesions, which may manifest as small intraoral ulcers or acute necrotizing gingivitis (ANG). ANG is characterized by spontaneous bleeding, ulceration of the gingival papillae, pain, and sometimes the presence of grayish pseudomembranes. In regions of high poverty in Africa, ANG prevalence in children can range from 15% to 60%. Lack of dental hygiene and malnutrition are significant contributors to ANG, and while the condition may improve with enhanced oral care, undernourished children may require antibiotics. If untreated, ANG can progress to necrotizing stomatitis, damaging the gingival and oral mucosa and underlying bone.

2. **Edema and Halitosis:** The onset of noma is defined by facial edema and intraoral necrotizing stomatitis, often accompanied by a distinct halitosis. This stage is acute, lasting only a few days.

3. **Necrosis:** Following the emergence of necrotizing stomatitis and facial edema, a necrotizing infection can rapidly spread to involve the intraoral mucosa, facial muscles, skin, maxilla, and mandible within a few days. The skin may show bluish discoloration indicative of underlying necrosis. Interestingly, this gangrenous process can exhibit self-limiting characteristics, often resulting in well-demarcated necrosis. Some children may experience only small lesions without treatment, while others may suffer extensive facial destruction, potentially due to differences in immune system integrity.

4. **Sloughs and Healing:** Once necrosis is demarcated, the necrotic tissue begins to slough. At this juncture, many patients succumb to sepsis. Those who survive will see signs of healing as granulation tissue forms and the mucosa and epithelium grow over the wound margins. Depending on the severity of the tissue defect and the patient's overall health, this healing process can take weeks or months. Complications may include intraoral constricting bands, resulting in trismus, which can further impair the nutrition of already undernourished children.

5. **Sequelae:** Approximately 15% of children survive acute noma, and most present with significant facial deformities and functional impairments such as trismus or ankylosis of the mandible. These issues lead to difficulties in eating, and speech, and increased social isolation. Over time, contractures can cause growth disturbances, leading to further facial disfigurement and functional limitations. The psychological impact of surviving noma is profound, although it has been inadequately studied.

TREATMENT OF NOMA

Acute Phase Treatment (Stages 0 to 4)

Historically, management of noma cases at medical institutions in the 1800s and early 1900s focused on nutritional support, including high-protein foods such as fruits, eggs, milk, and meat, alongside alcohol (e.g., wine and brandy) and wound cleaning with bicarbonate of soda, leeches, and nitric acid. While the effectiveness of these treatments is unclear due to reliance on case series and reports, they underscore an early recognition of the roles of poor nutrition and hygiene in the disease's progression.

In more recent decades, a shift in treatment has occurred, with timely administration of broad-spectrum antibiotics, wound cleaning and debridement, and nutritional support proving effective in reducing the severity and complications of noma. Commonly used antibiotics include amoxicillin, metronidazole, lincomycin, and cefotaxime, although no studies have compared their relative efficacies.

According to current WHO guidelines, management of the acute stages of noma involves several key interventions, including oral

hygiene (using chlorhexidine mouthwash), antibiotic therapy (amoxicillin and metronidazole), nutritional support (high-protein diets), and wound cleaning with hydrogen peroxide . Honey is also recommended for local dressing due to its antibacterial properties and ability to promote regeneration .

Sequelae Treatment (Stage 5)

For survivors of the acute phase, extensive reconstructive surgery and intensive physiotherapy are often necessary to address the structural and functional defects resulting from noma . The timeframe between acute illness and surgical intervention can sometimes span decades, with the specific surgical approaches varying according to the unique clinical presentation of each case . Surgical techniques include pedicled supraclavicular flaps for large facial defects, myocutaneous flaps, and procedures to treat trismus, such as bone distraction or coronoidectomy . Additionally, a range of techniques exists for reconstructing defects in the lips and cheeks, including the use of temporo-parietal fascia and radial forearm flaps .

Physiotherapy plays a crucial role in the management of noma, particularly in preventing or minimizing trismus, thereby facilitating improved eating, chewing, and speaking .

Noma often leads to social stigma and isolation for patients and their families, underscoring the importance of integrating social and psychological support into treatment plans . Although evaluating the outcomes of noma treatment can be challenging due to inconsistent follow-up, studies suggest that surgical interventions significantly enhance survivors' quality of life, even if functional improvements are modest . The severity of the initial disease presentation, the effectiveness of antibiotic treatment, and the extent of facial involvement all contribute to the long-term sequelae and their impact on quality of life . Implementing a standardized outcome measurement tool for assessing the impact of surgical treatment in noma patients is recommended to improve outcome reporting .

TRADITIONAL TREATMENTS

In regions such as Mali and Nigeria, traditional healers' understanding of noma is limited. Nevertheless, some traditional treatments reported in Nigeria include the use of ground herbs, plants, ointments, and procedures like cheek piercing during the edema phase . Traditional healers in Nigeria have expressed interest in referring patients to hospitals for advanced care and participating in training related to the disease .

PREVENTIVE MEASURES

Primary prevention of noma is closely linked to broader economic development, but this development must ensure that parents have the means to adequately feed their children. While food security programs might not always be preferred, they are effective in reducing the incidence of malnutrition-related conditions, including noma. However, implementing such preventive measures often involves navigating complex political and public health challenges. Medical prevention focuses on strategies like vaccination programs (e.g., measles vaccines) and the prevention and treatment of related illnesses such as HIV and malaria.

Secondary prevention—early detection and treatment before the onset of visible symptoms —poses challenges due to the need for robust surveillance in regions already grappling with issues of famine and poverty, where healthcare resources are limited and often prioritized for other pressing needs.

Tertiary prevention involves reducing the impact of symptomatic noma through appropriate treatment and rehabilitation, aiming to minimize disability and prevent fatalities.

Though noma is not widespread, it often occurs alongside other neglected diseases and malnutrition. Therefore, rather than addressing it in isolation, like vertical programs targeting the eradication of specific health conditions (such as guinea worm), noma prevention should be integrated into broader initiatives focusing on neglected tropical diseases, poverty, malnutrition, and health education.

MORTALITY OF NOMA

Noma is a severe gangrenous disease primarily affecting young children, and its associated mortality rates are alarmingly high. The World Health Organization (WHO) estimates that untreated noma has a mortality rate of approximately 90% within weeks of onset . However, the precise rate of mortality varies and is poorly documented due to several factors, including the variability in individual cases and the lack of standardized reporting in studies.

The speed at which noma can lead to death remains a topic of debate. Some sources suggest that death can occur as quickly as two weeks after the initial symptoms appear, although it is unclear which symptoms specifically correlate with this timeline. More consistent reports indicate that death typically follows the onset of facial edema, with fatalities potentially occurring within days of this manifestation. This highlights the critical importance of timely diagnosis and intervention; when noma is recognized and

treated promptly, the risk of mortality significantly decreases .

NOMA: A NEGLECTED DISEASE AND HUMAN RIGHTS VIOLATION

Noma continues to be a neglected disease within the realms of tropical medicine, local health policies, and neglected tropical disease programs. Despite numerous institutional reports, including those from the World Health Organization (WHO), noma has not been included in assessments of the global disease burden. However, a recent preliminary estimate suggests that the disease accounts for between 1 and 10 million disability-adjusted life years (DALYs), warranting its classification as a neglected tropical disease. The persistence of noma underscores the harsh reality that the most vulnerable children are denied their fundamental right to adequate nutrition. In 2012, the United Nations Human Rights Council Advisory Committee highlighted noma-affected children as a stark illustration of the consequences of severe malnutrition and childhood diseases, stating, “Noma, the face of poverty, represents the worst violations of the rights of the child.”

Evidence regarding mortality rates reveals stark contrasts based on treatment received. Studies indicate that mortality rates for untreated noma can range from 49% to 94%, whereas those who receive antibiotic therapy demonstrate significantly lower rates, ranging from 0% to 38%. It is crucial to acknowledge that these estimates stem from various case series and retrospective analyses, which often lack uniformity in their reporting of noma stages and follow-up durations. Therefore, the reported mortality rates should be interpreted cautiously, as study design limitations may lead to over- or underestimation of the true mortality associated with noma, particularly at the community level.

PUBLIC HEALTH

Noma is a perplexing disease with limited global data available regarding its incidence, mortality rate, and other epidemiological factors. This scarcity extends to understanding the reasons behind the significant variations in incidence and prevalence among similar impoverished populations in different underdeveloped countries.

The relationship between HIV/AIDS and noma remains unclear, as do the host-related and environmental factors that might either provide protection against noma or promote its development. It is particularly puzzling why only a small fraction of cases involving necrotizing gingivitis, necrotizing periodontitis, and necrotizing stomatitis progress to noma. Gathering adequate information on these topics could be invaluable for formulating and implementing effective public health policies and programs aimed at preventing, detecting, and treating this devastating disease.

Individuals at risk of noma predominantly reside in impoverished rural areas, where they often lack education, financial resources, and access to healthcare services. Cultural beliefs and practices, such as the preference for consulting traditional healers over conventional medical practitioners, frequently lead individuals with necrotizing gingivitis or periodontitis—often accompanied by their parents—to delay or entirely neglect seeking medical treatment. Consequently, by the time a diagnosis is made, the disease has typically advanced to necrotizing stomatitis or noma. Those who develop noma face the grim prospects of disfigurement, functional impairment, or death.

Survivors of acute noma with severe mid-facial destruction often require extensive, complex surgical reconstruction and functional rehabilitation, the results of which are frequently suboptimal. In underdeveloped countries where advanced surgical expertise is scarce, many individuals suffering from facial mutilation have little hope of returning to normalcy. They often experience social discrimination fueled by superstitions and the stigma associated with pronounced facial defects, leading to isolation and shunning by their communities. The social consequences and psychological impacts can be profound.

When developing public health policies addressing noma, it is crucial to recognize that necrotizing gingivitis and necrotizing periodontitis are precursors to necrotizing stomatitis and noma. Since the primary cause is a polybacterial, predominantly anaerobic infection, preventing noma could be as straightforward as treating these precursor conditions through education on dental hygiene and the use of antibiotics. Unfortunately, implementing even these basic preventive measures in remote, impoverished, and poorly educated populations presents substantial logistical challenges. What may appear to be simple interventions in developed nations may be unfeasible due to financial constraints and a lack of political will in many underdeveloped countries. Therefore, adequate funding from developed nations and private philanthropic organizations is essential for conducting research on all aspects of noma and for providing experienced surgeons to treat those affected.

Healthcare practitioners encountering cases of necrotizing stomatitis and noma should report these instances to the relevant health authorities. Although many cases will likely remain undiagnosed and untreated for the reasons previously mentioned,

documenting known cases can significantly contribute to the existing national and international databases on noma.

Ultimately, without addressing poverty, sanitation, education, and personal dental hygiene, as well as fostering the political will to allocate the necessary financial resources, the chances of reducing the incidence of noma and the number of individuals affected remain slim.

In this context, at the turn of the 20th century, the World Health Organization launched an initiative to curb the incidence of this disease. The steps outlined in the WHO's oral health program aimed at reducing noma included training healthcare practitioners to recognize early diagnosis and treatment, raising awareness among at-risk populations, promoting epidemiological and etiological research, and establishing regional treatment centers. Although little is known about the progress of this initiative, noma remains an unresolved global concern.

Recently, on December 15, 2023, the WHO officially recognized noma as a neglected tropical disease (NTD) after a concerted effort by 32 nations, including Nigeria and 14 others in Africa. This classification is expected to increase public awareness, encourage funding for research and treatment, and strengthen collaborative approaches to combat the disease. By designating noma as an NTD, there is a renewed opportunity to mobilize political support and integrate efforts across sectors to improve health outcomes for affected communities.

CONCLUSION AND FUTURE DIRECTIONS

Noma is a devastating disease characterized by mutilation and unclear etiopathogenesis, primarily affecting children, particularly in sub-Saharan Africa. Those impacted by noma endure significant challenges, including disfigurement, functional impairment, social stigma, and even mortality.

To address this pressing issue, further research is essential to identify the risk factors contributing to the pathogenesis of noma and to understand the reasons behind the marked differences in incidence and prevalence among similar impoverished populations in different regions. There is a need for more information regarding the molecular virulence factors of the putative pathogenic bacteria that enhance their fitness and increase the likelihood of causing noma. Identifying virulence genes responsible for bacterial attachment, invasion, immune evasion, and toxin biosynthesis that leads to tissue damage will be crucial in elucidating the disease's pathogenesis.

The rapid progression of noma highlights the dysregulation of the immune system in affected individuals. Identifying the specific immune elements impaired in patients with precursor lesions or early noma is crucial. This includes examining cytokine profiles, the functional activity of systemic or local immuno-inflammatory cells—such as neutrophils, macrophages, or lymphocytes—and the nature of antibody-mediated humoral responses. Collectively, this information will provide valuable insights into the pathogenesis of noma and inform the development and implementation of effective public health policies and prevention programs, as well as novel treatment modalities.

In the interim, it is essential to secure funding from developed nations and private philanthropic organizations to support the training of experienced surgeons to treat those affected by noma. Efforts should also focus on promoting education about personal and oral hygiene while ensuring that basic healthcare services are accessible to impoverished and poorly educated populations.

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A CALL TO ACTION

To effectively combat noma, a multi-faceted approach is essential. Firstly, raising awareness and enhancing education are critical. Health professionals in affected regions must be trained to identify early signs of noma and deliver prompt treatment. Public health campaigns focusing on improving hygiene, nutrition, and vaccination coverage are also vital in preventing the disease.

Secondly, there is an urgent need for more research and data collection on noma. Accurate epidemiological data is crucial for understanding the true burden of the disease and developing effective interventions. Additionally, research into affordable, accessible treatments and reconstructive surgical techniques is desperately needed.

Thirdly, collaboration is key. International organizations, governments, and non-governmental organizations (NGOs) must work together to integrate noma prevention and treatment into broader public health initiatives. Addressing the underlying determinants of health, such as poverty and malnutrition, and improving access to healthcare, can significantly reduce the incidence of noma and improve outcomes for those affected.

As medical students, we play a crucial role in connecting these efforts and ensuring they reach those in need. This commitment was highlighted on April 23rd, 2024, when the Technical Office on Neglected Tropical Diseases, NiMSA, and the Executive members of Nile University Medical Students' Association, visited the NOMA Centre, established by the NOMA Aid Nigeria Initiative (NANI) in collaboration with the Ministry of Health. During our visit, we met Dr. Charles Ononiwu, the maxillofacial surgeon leading the centre, and agreed to leverage our student network to refer NOMA patients from rural areas across Nigeria to the centre. I'd like to encourage all readers to join this effort by sharing the contact information for the NOMA Centre and supporting NANI's mission to eradicate NOMA in Nigeria. The centre offers comprehensive treatment and support to patients at no cost.
If you or someone you know has been affected by NOMA and needs assistance, please contact the NOMA Centre at 08000-666-2243 or via email at info@nani.ng.

GYRONICS TEAM

Gyronics aims at creating innovative, and accessible technology that revolutionizes how we interact with the technological world around us all. Gyronics creates wearable gesture recognition technology aimed at enabling users to control hardware systems, and also software applications through movements and gestures. Gyronics is currently focusing on tailoring such technologies to people with disabilities that prevent or make it difficult to control traditional interfaces such as mice, keyboards, controllers, and touch devices. Through this Gyronics believes significant social impact can be made in assissting people with such disabilites to truly gain digital autonomy.

Gyronics wearable device works simply by positioning and strapping the device onto the arm of the user, after which running the supported application of choice, or turning on the hardware system of interest and pairing with the device through Bluetooth, enables the user to begin using the wearable as a medium to control applications of hardware devices.

At the moment Gyronics is further developing its capabilties by further advancing its core offerings through its wearable device technology, its gesture-recognition Artificial Intelligence models, and its cross-platform Application Programmable Interface (API) creating a platform that enables developers to utilize Gyronics' wearable device in their own applications. Further support on distributed sensors for controlling hardware devices such as drones, rovers, and robotic arms are also under further development. Gyronics' wearable device works on all major computer platforms (MacOs, Windows, Linux) with further mobile platforms such as Android and iOS coming in the future. Excited at the future prospects of the technology, Gyronics is heavily invested in creating a world of intuitive, and accessible technology.


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