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## Impact of SDG3 in the Prevention of Physical and Mental Effects of Infertility Observed in Nigerian Women: A Scoping Review

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### ABSTRACT

Infertility significantly impacts both the physical and emotional well-being of individuals and is particularly prevalent in low- and middle-income countries like Nigeria. Since many causes of infertility are avoidable, there is potential for public health initiatives and Sustainable Development Goal 3 (SDG3) to play a role in health education and prevention. This scoping review aimed to assess existing literature for a better understanding of the factors relevant to analyzing how SDG3 might influence Nigerian women's ability to mitigate the physical and mental effects of infertility. Exhaustive searches were conducted across electronic databases including Scopus, Web of Science, JSTOR, CINAHL, MEDLINE, and PubMed. The initial review commenced in October 2023, with the final search concluded in March 2024. Identified papers underwent screening using the PRISMA extension for scoping review flow diagrams. After removing duplicates and screening titles and abstracts, 1,340 papers were identified, with 169 reports evaluated for inclusion. Ultimately, 46 papers met the inclusion criteria for this scoping review. Data analysis revealed various factors contributing to the burden of infertility among Nigerian women, encompassing medical conditions, modifiable risk factors, environmental influences, physical and psychological stressors, and policy-related considerations. Socio-economic factors were also implicated in infertility within this population. However, significant gaps in knowledge persist, as no substantial findings were uncovered regarding the true causes across these categories. Therefore, addressing the burden of infertility among Nigerian women requires a multi-faceted approach including interventions aligned with SDG3, public awareness campaigns, health screening initiatives, utilization of assisted reproductive technologies, provision of physical and psychological wellness services, as well as counseling support.

### INTRODUCTION

The United Nations implemented Quality Health and Wellness as one of the 17 Sustainable Development Goals in 2015, intending to guarantee robust livelihoods and advocate wellness for all, regardless of age (United Nations, 2015). Sustainable Development Targets emphasize living a healthy lifestyle, with indicators tracking progress across countries (Ritchie, 2018). SDG3 comprises thirteen targets and twenty-eight indicators to monitor progress. These targets focus on reducing maternal and child mortality, combating diseases, enhancing psychological well-being, deterring substance misuse, diminishing road-related accidents, and granting widespread entry to medical care and birth control. SDG3 additionally strives to attain comprehensive health protection and impartial entry to medical care for all sexes, which endeavors to guarantee communal availability of family planning as well as sexual and reproductive health amenities (United Nations, 2017).

Several studies have explored the frequency of infertility in underdeveloped and developing countries, such as Nigeria, and its potential impacts on the physical and mental wellness of affected individuals. Gametes are ova and sperm cells that are haploid and have one copy of each type of chromosome i.e. 1–22 X or 1–22 Y (Ikwuka, 2023a). The World Health Organization (WHO) defines

clinical infertility “as the inability to give birth to a healthy baby after at least one year of regular, unprotected sexual activity” (WHO, 2020). Estimates vary, suggesting that globally, between 48.5 million and 186 million couples may be affected by primary or secondary infertility (Starrs, 2018), depending on the measurement method (Inhorn, 2015; Mascarenhas, 2012).

Primary infertility refers to the inability to conceive or start the development of a child. One significant factor contributing to secondary infertility is infections of the reproductive tract (Kaufman, 1999), which are more prevalent than primary infertility (Starrs, 2018) and describes the inability to become pregnant even after previous attempts (Bowa, 2012).

Autoimmune antibodies produced by the female partner against sperm cells from the male partner have been implicated as a cause of female infertility. Other immune reactions include antibodies to clotting factors, which result in both thrombosis and hemorrhage; and hemolytic reactions during transfusion of blood products (Ikwuka, 2023e). Oxidative stress has also been associated with infertility. Linked to the induction of oxidative stress are major free radicals. Among these major free radicals, superoxide anions, hydroxyl radicals, and hydroperoxyl radicals are of physiological significance. A non-radical of physiological significance is hydrogen peroxide (Ama,

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2023; Baysah, 2023; Ekechi, 2023a; Ikwuka, 2023b). The influence and effects of hormonal imbalance in females leading to infertility in such females have also been reported in different studies (Aliu-Ayo, 2023a; Aliu-Ayo, 2023b).

Parenthood is often socially and culturally expected in many societies, and infertility's physical and psychological effects on individuals' well-being and health have been extensively researched in underdeveloped and developing countries (Nahar, 2022). Many forms of stigmatization are experienced by those who do not fulfil the societal norm which demands having offspring. This can result in stress, unstable marriages, verbal abuse, violence against partners, separation, and exclusion.

A thorough definition of fertility awareness considers behaviorally influencing variables at every stage of life, such as cognitive, social, environmental, and developmental aspects (McCurdy, 2015). It is widely acknowledged that a lack of knowledge about fertility hurts views and actions concerning sexual and reproductive health (SRH) throughout the course of one's life. These behaviors include not using family planning (FP) methods, delaying the application of FP methods after giving birth or after an abortion, stopping the use of FP methods, using ineffective FP methods, getting pregnant unintentionally, and having false beliefs about being infertile (Dyer, 2002). Diabetes mellitus and arterial hypertension remain two of the most common diseases in the world. Today, diabetes mellitus (DM) ranks third in the overall structure of morbidity and mortality after cardiovascular diseases and oncological diseases (Virstyuk, 2021a). In addition, the interplay, role and effects of metabolic syndrome diseases on male fertility are still being investigated by different researchers. Metabolic disorders, e.g. Hypertension, Adiposity, Diabetes mellitus and Dyslipidemia, collectively known as Metabolic Syndrome Diseases (MSDs) are diseases related to one another (Ikwuka, 2015; Ikwuka, 2017a; Ikwuka, 2017c; Ikwuka, 2023c; Ikwuka, 2023f; Ikwuka, 2024; Virstyuk, 2016). Different studies have shown that MSDs are associated with asymptomatic hyperuricemia, systemic immune inflammatory processes, and fibrogenesis all of which can lead to nephropathy (Ikwuka, 2017d; Ikwuka, 2017e; Ikwuka, 2018c; Ikwuka, 2018d; Ikwuka, 2019a; Ikwuka, 2019c; Ikwuka, 2022; Ikwuka, 2023d; Virstyuk, 2017a; Virstyuk, 2018a; Virstyuk, 2019; Virstyuk, 2021a; Virstyuk, 2021b).

Governments and sexual reproductive health right (SRHR) organizations still overlook infertility despite several other delicate SRHR issues being addressed, including abortion, teenage SRHR, and comprehensive sexuality education (Ombelet, 2011). Inaccurate prevalence numbers on infertility contribute to its invisibility and undermine justifications for action, including offering complete reproductive care, preventing and de-stigmatizing infertility-related disorders (Ombelet, 2011). Furthermore, little is known about current initiatives to address infertility in nations with low and moderate incomes, such as Nigeria (Kroes, 2019).

Men's involvement in infertility management and counseling is encouraged by the availability of assisted reproductive technologies (ARTs), which also improve gender relations and raises awareness of female infertility (Inhorn, 2015). However, the greatest obstacle to expanding access to ARTs in nations like Nigeria will continue to be the high cost of these treatments (Starrs, 2018). Many couples wait until they need treatment. As a result, additional initiatives are required to lessen the stigma associated with infertility and the detrimental consequences it has on the lives of those who are struggling with it. Since avoidable factors account for a large share of infertility; public health, and sustainable development can contribute to reduce the burden (Van der Poel, 2012).

With over 220 million inhabitants, Nigeria is the most populous country in Africa. There has yet to be evidence that the nation's 2.5% annual population growth is causing its financial and socio-economic needs, particularly in healthcare, to rise quickly (World Bank, 2023). From a per capita and state government's perspective on budget share, the country's health financing is relatively low. Nigeria's health sector governance needs to be improved, with institutional channels for advocacy and involvement that need to be improved, contributing to the low coverage of most preventive and curative health treatments.

The majority of Nigerians, like those in most developing nations, are pronatalists who favor early marriage and large number of children. As a result, the idea of deliberate childlessness is foreign, and trying to conceal infertility will only make it more stigmatized (Orji, 2008). The perception of a social norm breach may cause the responses to infertility from the extended family or the community. Children are valued greatly in the society, and generally speaking, a woman's value is based on her capacity for reproduction (Okonofua, 2002). When comparing underdeveloped countries to industrialized countries, the cultural realities of different locations cause unique issues related to infertility.

Family planning initiatives are supposed to target over-fertility rather than infertility according to an established argument, given the overpopulation of most developing nations (Runstein, 2004). The high population rise in most emerging countries has led to an expansion of family planning services and population policies. Nevertheless, it appears that supporting infertile females, which is a component of this service, has been overlooked. Infertility is a critical reproductive health concern that can have dramatic repercussions, including suicide, even with the high rate of population expansion (Daar, 2002). Due to inadequate guidelines and insufficient treatment options, infertility is frequently poorly managed medically (Ola, 2008).

The organized efforts of society to safeguard, advance, and improve people's health are referred to as public health. This is a blend of science, abilities, and values aimed at preserving and enhancing everyone's health through collaborative or social acts. Since families are

the foundation of society and are affected by infertility, the effects are not limited to women. Most developing countries have experienced substantial population decrease with services for contraception and population controls expanded. Infertility has been linked to physical, emotional, and psychological side effects e.g. anxiety, sadness, marital problems, and social stigma, therefore infertility is not just a medical issue (Daar, 2002).

Since infertility impacts the entirety of one's life experience both qualitatively and quantitatively, public health and Sustainable Development Goal 3 have recently emphasized the necessity for an intimate social link between an individual and the environment. It is a societal problem that affects individuals as well as 10% of the people who are of reproductive age experiencing infertility in one way or the other (Evens, 2004). Stress has a depressing influence on various hormones that act in fertility, and infertility can amplify the pain and emotions experienced by those impacted. This may set off a vicious cycle in which stress results in infertility, which in turn causes more stress, which further reduces fertility (Greil, 1997).

Due to the perception that infertility is solely a medical condition and the assurances given to patients by medical professionals regarding the minimal impact of stress on ovulation, the psychological and physiological aspects of the condition have been neglected. There are several psychological or mental health effects, including societal ramifications and personal pain, which can hurt infertility. When treatment is accessible, technological developments in assisted reproduction can give many couples hope. Nonetheless, there are obstacles related to pricing and medical coverage.

According to (Cousineau, 2007), by medicalizing infertility, women's emotional reactions, including pain, a loss of control, shame, and a change of course for their adult lives — have unintentionally led to contempt for these feelings. The psychological impact of infertility can be awful. Partners who are more anxious to become pregnant may have worsening sexual difficulties. Couples who are infertile frequently experience marital disagreement, particularly when they are pressured to make medical choices. Similar to those with cancer or heart illness, women who are attempting to conceive frequently experience clinical depression (Domar, 1993). Metabolic syndrome diseases (MSDs) are interrelated diseases with very high economic costs, morbidity, and mortality rates, thus requiring the search for new and effective treatment options (Ikwuka, 2024). Treatment optimization in MSD patients using a combination of HMG-CoA and SGLT-2 inhibitors, and A2RB (AT1) has resultant clinical effectiveness as indicated by marked improvements in metabolic functions of the heart, liver, pancreas, and kidney (Ikwuka, 2017b; Ikwuka, 2018a; Ikwuka, 2018b; Ikwuka, 2021; Virstyuk, 2017b; Virstyuk, 2018b; Virstyuk, 2018c; Ikwuka, 2024). In addition, Glucagon-like Peptide 1 Receptor Agonists (GLP-1 RAs) e.g. Liraglutide have been found to improve the efficacy of

treatment and clinical course of type 2 diabetes mellitus and hypertension in patients with such comorbidities (Ikwuka, 2019b). It has also been reported that coconut water has hepatorenal protective functions against alloxan-induced type 1 diabetes mellitus (Ekechi, 2023b).

Stress levels are high even for couples using infertility treatments (Beutel, 1999). Infertility can lead to a range of emotional challenges for individuals, including the loss of envisioned life plans and the disappointment of not experiencing motherhood or parenthood as anticipated. It may also trigger feelings of uncertainty about one's identity, a sense of losing control over life's circumstances, and strain on relationships, sometimes leading to their breakdown. Additionally, for many individuals, infertility can result in the loss of support from religious communities, which previously provided strength and solace. Couples where the male partner is identified as the source of infertility often face heightened emotional strain and encounter difficulties within their marital relationship.

There are 186 million infertile individuals in the globe, with 30 to 40 per cent of them residing in Africa. Based on multiple cultures in Nigeria, a married couple should have a kid during the first few years of their union. When a couple begins to battle with infertility, the question "When do you plan on having children?" may seem lighthearted in the first year of marriage, but it may also be a severe insult (Sharma, 2009). The experiences of childless women in Africa are currently not well documented in a comprehensive qualitative way. These could affect how well infertility is managed with the addition of appropriate medications. Extensive, evidence-based data about the experiences of African and Nigerian infertile women is absent, as previous assessments have concentrated on the clinical or biological models.

In a region with such high fecundity, assembling research data on the variety of medical and psychological issues related to infertility requires a rigorous evaluation of the available information. While certain academic studies and medical publications have discussed different facets of infertility in Nigeria (Orji, 2002), further work is required. The primary goal of this literature evaluation is to study and thoroughly record the medical and psychological components of fertility problems among Nigerian women while evaluating its effect concerning the afflicted individuals and their societal context, as well as the role of healthcare professionals' attitudes in patients' acceptance of their diagnosis. This study aims to pinpoint areas of deficiency in existing literature concerning the initial research endeavors, healthcare policies, and comprehensive evaluations on this topic as in other related studies (Koster-Oyekan, 1999; Umezulike, 2003). There needs to be more systematic data regarding the psychological, physical, and socio-cultural effects of infertility on the well-being of Nigerian women. This is true, even if primary research studies are expected (Tanywe, 2018). This justifies the requirement for a thorough scoping evaluation of the infertile literature.

This scoping review aims to comprehensively assess the literature and identify key variables relevant to understanding how Sustainable Development Goal 3 could play a role in alleviating the physical, and psychological challenges associated with infertility among Nigerian women. This review will locate, synthesize, and summarize existing research to investigate the elements influencing Nigerian women suffering from both primary and secondary fertility issues regarding their physical and emotional health. By giving a more excellent knowledge of the relationship between the physical and mental repercussions of infertility among women in Nigeria, this study will enable health professionals and society to develop effective measures for the prevention and management of infertility.

## MATERIALS AND METHODS

### Study Design

This research is a scoping review. Due to the variety of research that has been done on the topic, (Munn, 2018) adopted this design as opposed to doing a systematic review. A scoping assessment was conducted on current interventions aimed at reducing the stigma associated with infertility as well as its psychological and physical repercussions. A description and conceptualization of the impact of sustainable development goals on the physical and psychological repercussions of infertility was carried out before outlining the steps and conclusions of this scoping review (Cook, 2014).

### Methods

Scoping reviews are a valuable instrument in the expanding toolbox of evidence synthesis techniques. Scoping reviews are preferred by researchers over systematic reviews when the latter's goals include establishing a body of literature, explaining concepts, examining research methodologies, or detecting knowledge gaps. To produce reliable results, it must be carried out with strict and open

procedures, even though their goals differ from those of systematic reviews.

The methodological approach outlined by (Arksey, 2005) was followed. The intricacies of metrics and the broad spectrum of research form methodologies used in existing studies made it clear that a scoping examination was the optimal method to investigate the extensive literature on infertility indicators and fertility care. A review method was developed following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Extension for Scoping Reviews (PRISMA-ScR) to ensure a thorough and organized analysis.

Below are the steps undertaken to conduct this review.

### Stage 1: Developing a Rationale and Identifying the Research Question

These inquiries directed the scoping review. Which metrics show how SDG 3 is affecting Nigerian women's ability to avert the psychological and physical consequences of infertility? What kinds of indicators are there, and what sizes are they? How are these indicators measured according to the reports? Which country map, by the info, has that is currently available? In this nation, which organizations are in charge of gathering data?

### Stage 2: Identifying Relevant Studies

In the first phase, one bibliographic database was used to perform a preliminary limited search. Text terms found in the abstract were then examined, the title of the documents, and the index words used to characterize the articles. The search method was developed in the second phase after determination of the words found in texts and index phrases. There was additional refinement of this. Table 1 gives the search engine methods for the different databases. A systematic electronic search was conducted using PubMed, MEDLINE, Web of Science, CINAHL, and Scopus.

**Table 1:** Search strategy keywords

Bibliographic Database	Search query
PubMed	"Women" [Mesh] AND ("Infertility" [Mesh] OR "assisted reproduction*" [tw] OR "infertility" [tw] OR "subfertility" [tw]) AND ("Patient Care/standards" [Mesh] OR "Health Care Quality Indicators" [Mesh] OR "indicator*" [tw])
MEDLINE	Women/ AND (Infertility/ OR assisted reproduction*.mp. OR infertility.mp. OR subfertility.mp.) AND (Patient Care/standards/ OR Quality Indicators, Health Care/ OR indicator*.mp.)
Web of Science	Women AND (Infertility OR "assisted reproductive*" OR infertility OR subfertility) AND ("Patient Care/standards" OR "Quality Indicators, Health Care" OR indicator*)
CINAHL	(MH "Women+") AND ((MH "Infertility+") OR "assisted reproduct* OR infertility OR subfertility) AND ((MH "Patient Care/standards+") OR (MH "Quality Indicators, Health Care+") OR indicator*)
Scopus	INDEX TERMS ("Women") AND (INDEX TERMS("Infertility") OR TITLE-ABS-KEY ("assisted reproductive*") OR TITLE-ABS-KEY("infertility") OR TITLE-ABS-KEY("subfertility")) AND (INDEX TERMS ("Individual Well-being/ protocols.") OR INDEX TERMS ("Performance Measures", Health Care)) OR TITLE-ABS-KEY("indicator*"))

Additionally, online resources such as the World Health Organization: The International Committee for Monitoring Assisted Reproduction Technologies (ICMART), The Nigerian Demographic Health Survey Organization, the International Federation of Gynecology and Obstetrics (FIGO), the United Nations Population Fund (UNFPA), and the American Academy of Pediatrics (AAP) were combined with the electronic search.

Conference proceedings and reports from other related organizations were also searched. Some of these national ART surveillance system societies are affiliated with the Centers for Disease Control and Prevention (CDC, 2018), the African Network and Registry for Assisted Reproductive Technology (ANARA), and the International Federation of Fertility Society Surveillance 2019 (IFFS, 2019). In the end, the list of pertinent article references and citations made by relevant article logs that were not date-restricted was manually checked.

### Stage 3: Study Selection

#### Inclusion Criteria

Credible publications (which included every type of study, which involves both initial and subsequent research), demographic accounts (which included females seeking

mental and physical care from infertility), and concept reports (which included indicators of infertility and conception prevention and treatment through the impact of SDG3) were included in this study. The search was limited to research that was accessible in the English language.

#### Exclusion Criteria

Literatures which did not undergo peer review due to concerns about the source's reliability was excluded from this scoping review. Bias may be introduced by including data from unpublished studies and thus unpublished studies were excluded. Literatures that would be difficult to translate due to linguistic quirks can also add bias to this scoping review and were excluded.

#### Stage 4: Charting the Data

To identify important information and determine whether it supports the aims and objectives of this scoping review, the data must be summarized as part of the analysis process. Data charting is the procedure used to create this summary. Table 2 below shows some articles examined during this scoping review. It summarizes African, low- and middle-income countries (LMICs), and Nigerian literature by region.

**Table 2:** Data charting

Region	Country	Author(s)/Date	Study Type	Aim
West Africa	Cameroon	Egbe <i>et al.</i> , 2020	Quantitative	To determine the prevalence and associated factors of infertility in Douala, Cameroon
	The Gambia	Dierickx, <i>et al.</i> , 2019	Qualitative	Long-term ethnographic study
	The Gambia	Dierickx, <i>et al.</i> , 2021	Qualitative	Long-term ethnographic study
	The Gambia	Dierickx, <i>et al.</i> , 2022	Qualitative	Long-term ethnographic study
	Ghana	Adofo, 2021	Qualitative	To explore factors that influence family planning uptake after the first delivery, including fear of infertility.
	Ghana	Alhassan <i>et al.</i> , 2014	Qualitative	To examine prevalence and severity of depression in relation to age, type of infertility and duration of infertility in Ghanaian infertile women.
	Ghana	Anokye, <i>et al.</i> , 2017	Qualitative	To determine the psychosocial effects of infertility among couples
	Ghana	Anaman-Torgbor <i>et al.</i> , 2021)	Qualitative	To explore the experiences of women undergoing ART treatment
	Ghana	Fledderjohann, JJ., 2012	Qualitative	To explores the implications of infertility for women in Ghana
	Ghana	Osofu & Hanninen, 2020	Qualitative	To document lived experiences of infertile women and on how they can be helped to improve their own condition
	Ghana	Naab <i>et al.</i> , 2013	Qualitative	To describe infertile women's psychosocial health problems and their infertility-related beliefs
	Ghana	Tabong & Adongo, 2013	Qualitative	Exploratory study on causes of infertility

	Mali	Hess, <i>et al.</i> , 2018	Mixed Methods	To examine infertility-induced psychological distress and coping strategies among women in Mali
	Niger	Samandari <i>et al.</i> , 2019	Qualitative	individual and structural factors influencing married girls' early first birth
	Nigeria	Abarikwu, 2013	Literature review and secondary data analysis	Review to identify risk factors for male-factor infertility in Nigeria
	Nigeria	Adegbola & Akindele, 2013	Quantitative	To examine the pattern of infertility cases amongst infertile couples seeking care
	Nigeria	Aduloju, 2018	Quantitative	To examine the quality of life in women of reproductive age and compare the quality-of-life scores among fertile and infertile women
	Nigeria	Bello <i>et al.</i> , 2021	Mixed methods Implementation Research Protocol	To assess psychoeducational evaluate its effectiveness for reducing symptoms of anxiety and depression in infertile populations
	Nigeria	Dimka & Dein, 2013	Qualitative	Ethnographic study documenting impact of infertility on women's lives
	Nigeria	Ibisomi & Mudege, 2013	Qualitative	To explore societal perception and acceptance of childlessness in Nigeria
	Nigeria	Ikimalo & Babatunde, 2012	Qualitative	To investigate perceptions of infertility among urban residents of Port Harcourt, Nigeria
	Nigeria	Ilyasu <i>et al.</i> , 2013	Qualitative	To determine the public perception of infertility, its causes and factors associated with acceptability of ART
	Nigeria	Larsen <i>et al.</i> , 2010	Mixed methods	To examine the experiences of women with infertility in Nigeria
	Nigeria	Okafor <i>et al.</i> , 2017	Qualitative	To explore the perceptions of infertility and IVF and how to enhance the use of IVF treatment among married couples
	Nigeria	Omoaregba <i>et al.</i> , 2011	Qualitative	To determine the prevalence of psychological distress as well as its associated socio-cultural characteristics among women attending infertility clinics
	Nigeria	Ndubuisi <i>et al.</i> , 2021	Qualitative	To assess the impact of infertility on the sexual life of women with infertility seeking care
	Nigeria	Whitehouse & Hollos, 2014	Qualitative	To explore experiences of infertility by types of infertility (low, childless)
Central Africa	Rwanda	Dhont <i>et al.</i> , 2011	Mixed methods	To understand the socio-cultural consequences of infertility
	Rwanda	Dhont, 2011	Quantitative	To examine predictors for infertility and treatment-seeking behavior
East Africa	Ethiopia	Akalewold, <i>et al.</i> 2022	Quantitative	Hospital-level survey on factors driving infertility
	Kenya	Ochako <i>et al.</i> , 2015	Qualitative	To explore reasons for contraceptive hesitancy, for which fear of infertility was a major factor
	Kenya	Njogu <i>et al.</i> , 2022	Qualitative	To describe women's fertility treatment and experiences

Kenya	Sedlander <i>et al.</i> , 2018	Qualitative	To understand how beliefs that modern contraceptives cause infertility shapes behavior? Unclear
Kenya	Sedlander <i>et al.</i> , 2021	Quantitative	To conduct sociocentric network analysis to explore if beliefs that contraceptives effect infertility result in low use
Kenya, Tanzania	WHO (Bulletin)	Key Informant Interview	Interview with healthcare providers on Maasai experiences of infertility
Malawi	Bornstein, <i>et al.</i> , 2020	Qualitative	To understand the production and impact of infertility-related stigma
Malawi	Chipeta <i>et al.</i> , 2010	Qualitative	To explore factors that affect the intentions of men and women to use family planning methods
Malawi	Parrot, 2014	Qualitative	Ethnographic research on how men's reproductive bodies are problematized and biomedically defined diagnoses contribute to the visibility of male infertility

**Stage 5: Compiling, Analyzing, and Presenting the Findings**

147 unique indicators were identified. These indicators were categorized conceptually into classes (including structural, process, and outcome), and characteristics (dimensions) such as safe, effective, patient-centered, timely, efficient, and equitable) using pre-established analytical frameworks (Davies, 2004; Runstein, 2004).

Two analytical frameworks were applied to arrange the whole set of mapped indicators. The Donabedian framework (Donabedian, 1988) outlined the various classes of indicators (see Table 3), while the Institute of Medicine (IOM) structure outlined the characteristics (dimensions) of indicators, such as promptness, productivity, equality, safety, and efficacy (see Table 4).

**Table 3:** Classes of Indicators

Classes	Explanation
Structural	Foundational markers, which include staffing levels, funding, beds, supplies, and physical facilities, are used by health systems and organizations to provide services and programs. These indicators characterize the quantity and kind of resources.
Process	Process indicators make use of the generally recognized guidelines for clinical practice. Healthcare professionals' actions and their quality are assessed by process indicators, which are collections of related actions performed to achieve certain goals.
Outcome	The impact of medical services on patients' health conditions is demonstrated by outcome indicators.

**Table 4:** Characteristics (Dimensions) of Indicators

Dimensions	Explanation
Safe	By providing care for individuals that is meant to be beneficial, thereby preventing harm to them.
Effective	By avoiding serving those who are unlikely to benefit, or underusing or misusing services based on scientific information, sustainable development target 3 aims to serve everyone who might benefit.
Patient-centered	Making sure that all clinical decisions are based on the values of the patient and providing care that is sensitive to and cognizant of each patient's individual needs, preferences, and values.
Timely	Reducing waiting times and possibly hazardous delays for care providers and recipients.
Efficient	Making sure everyone is healthy and happy while avoiding destruction, such as discarding of tools, supplies, concepts, and energy resources.
Equitable	It offers attention and empathy whose quality is constant regardless of the patient's socioeconomic status, location, gender, or race.

**RESULTS AND DISCUSSION**

1,340 reports came from the electronic search, and 91 more reports were found through other means. Following removal of duplicates, 169 entire text

publications were assessed for inclusion by screening the titles and abstracts. Finally, 46 reports were included in this scoping review using the PRISMA Flowchart as illustrated in Figure 1.



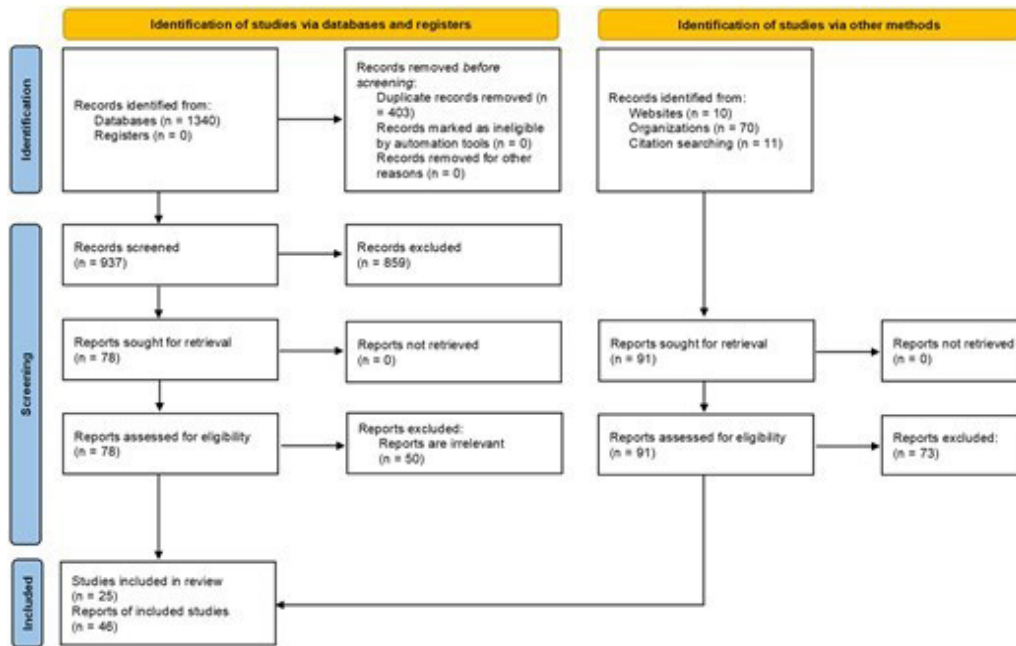


Figure 1: PRISMA Flowchart illustrating the screening and reporting process for the scoping literature review

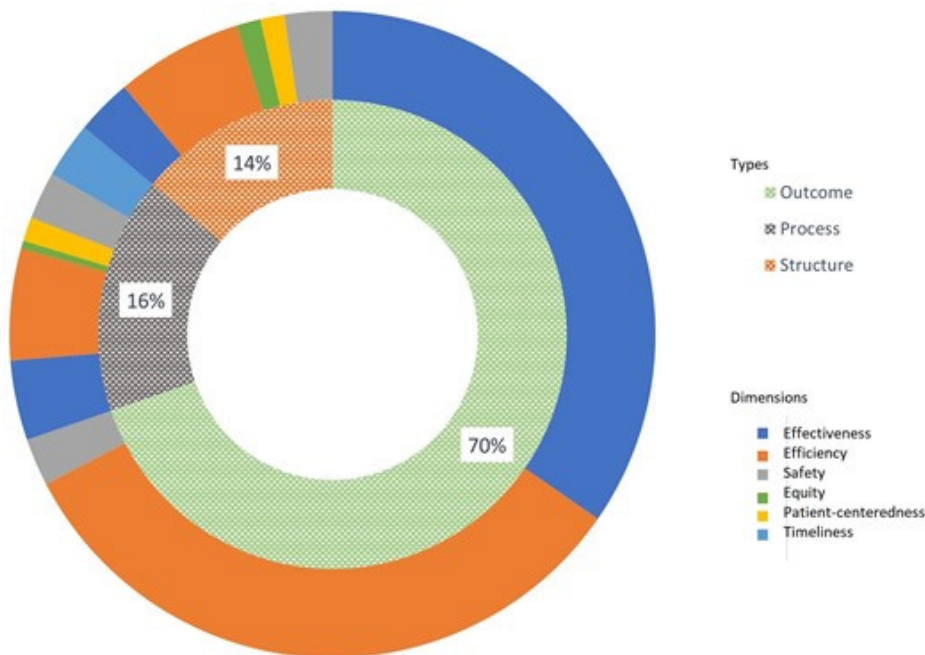


Figure 2: Range of parameters and categories of infertility indicators reported

The types (classes) of indicators (outcome, process, and structure) are represented by the inner doughnut and the characteristics of indicators (effectiveness, efficiency, equity, patient-centeredness, safety, and timeliness) are represented by the outer doughnut, indicating the relative abundance of published work (see Fig. 2 above). Except for a small number of process indicators

(16.34%) and structure indicators (13.94%), the majority of the indicators (69.72%) were outcome indicators (see Table 5). Equity, patient-centeredness, safety, and timeliness indicators were less prevalent in dimension, with effectiveness (41.43%) and efficiency (44.62%) accounting for most indicators (see Table 5).

**Table 5:** Types and dimensions of indicators showing their percentage levels

Types	Dimensions						
	Effectiveness	Efficiency	Equity	Patient-centeredness	Safety	Timeliness	
Outcome	87	82	0	0	6	0	175 (69.72%)
Process	10	14	1	3	6	7	41 (16.34%)
Structure	7	16	3	3	6	0	35 (13.94%)
	104 (41.43%)	112 (44.62%)	4 (1.59%)	6 (2.39%)	18 (7.17%)	7 (2.80%)	

The frequency of infertility in developing nations is covered in comparatively few publications. Less developed countries have rates between 6.9 and 9.3%, according to (Boivin, 2020). The incidence varies significantly by region, and these variations can be primarily attributed to various environmental, cultural, physical, psychological, and social factors. This ignorance of fertility and infertility in Nigeria may result in a delayed or insufficient diagnosis or course of treatment, which could have a detrimental effect on a person's or a couple's health. Moreover, it might reinforce societal stigmas, negative physical and mental health impacts like aggression and despair, problems related to infertility, and prevent more help-seeking behaviors.

Lack of fertility awareness in Nigeria restricts women from controlling their fertility (McCurdy, 2015; Iyanda, 2020). An essential comprehension of conception and the cycle of menses is known as fertility awareness (Iyanda, 2020), which was reported on the most recent estimates of DHS (Demographic Health Survey) information gathered among women in 29 African nations and revealed that women had the most inaccurate information regarding ovulation and fertility. The lack of awareness and comprehension regarding fertility and infertility in Nigeria may cause women's health to suffer and result in a delayed or insufficient diagnosis or course of therapy for infertility. Moreover, it could reinforce societal stigmas related to infertility and dissuade people from getting help. To improve infertility understanding and reduce the stigma associated with infertility, expanding Sexual and Reproductive Health therapy and other programs promoting fertility awareness could be an excellent place to start. There is variation in the definition and nomenclature of the phrase "fertility awareness".

DHS data frequently uses simple questions to gauge a woman's level of fertility awareness, such as when her period is most likely to end (McCurdy, 2015). While many studies in the more extensive literature aim to comprehend "various facets of conception and knowledge of fertility across the lifespan and in various contexts, as well as certain related attitudes and actions," many of them do not have a precise definition of fertility awareness (Kudesia, 2018). Instead, they focus on understanding these various aspects of knowledge and beliefs. When defining fertility awareness broadly, cognitive, social, environmental, and developmental effects that impact behavior across the life

course are included (McCurdy, 2015).

In certain instances, the concept of fertility awareness has broadened to encompass details about the onset of fertility and physical changes that accompany puberty in both girls and boys, the return to fertility following childbirth or an abortion, the chance of pregnancy for women who are nursing or not, the fluctuating nature of fertility and the risk of fertility during the period of menstruation, discernible changes throughout the monthly cycle, such as indicators of a woman's fertility, male fertility, how methods of contraception influence the probability of conception, possible adverse effects of family planning techniques, and situations related to ageing and infertility/subfertility. Most people agree that SRH attitudes and actions are negatively impacted throughout life by low fertility awareness. These behaviors include not using family planning, using delayed methods after giving birth or an abortion, quitting a technique, using ineffective methods, getting pregnant unintentionally, and having false beliefs about being infertile. Despite the challenge of estimating the effects of fertility awareness in programs, several studies and SDG3 indicate that doing so adds substantial value to individual and community-level interventions, increasing knowledge and positively influencing social norms surrounding fertility and infertility (Dyer, 2002).

Both nationally and globally, infertility has received more attention due to a growing understanding of the severity and effects of the condition and ongoing developments in accessible treatment choices (Ombelet, 2014; Hammarberg, 2013). Human rights reports, national health plans, and SDG advancement are all starting to incorporate infertility treatments and initiatives (Davis, 2020). The SDGs research suggests that addressing the needs and priorities of public health inside nations requires a more integrated national, regional, and global approach, as well as the current and emerging health needs related to infertility, rather than keeping the same priorities set thirty years ago. For this reason, the 2030 agenda includes these goals.

The primary objective of Sustainable Development Goals is to "enhance the methods of implementation and rejuvenate the worldwide partnership for sustainable development" (Batram, 2018). This addresses associated stigma, creates information networks to track and identify infertility, its causes, and its effects, and expedites

programs to address infertility, outstanding reproductive care, prevent, and treat infertility, as well as improve programs for physical, research, infrastructure for public health, mental and psychological support, and regulations. The influence of SDG3 on infertility prevention together with the physical and mental effects of infertility in Nigerian women, were examined in this scoping review of studies published in English language. The strengths of this scoping review include the fact that works from grey literatures were excluded. This scoping review concentrated on natural causes of female infertility instead of the narrative-based ones often seen in the literature.

The primary limitation of this scoping review is the small number of publications which addressed the specific research topic, according to an initial analysis. Since many studies that tried to determine the causes of female infertility made varying attempts, it required some time to find papers that precisely tackled the topic of the research to provide a comprehensive review. For example, many studies concentrated on prevalence rather than causes and risk factors. Since publications in other languages were not included, this scoping review's focus was restricted to studies published in English language.

## CONCLUSION

Nigeria's infertility problem demands sufficient attention and needs to be addressed by all relevant stakeholders. Based on published studies, infertility among Nigerian women has both physical and mental effects which are poorly understood, with genuine causes not fully understood. Knowledge gaps still exist that must be filled in order to comprehend fully the true causes of female infertility. A thorough comprehension of the physical and mental effects of infertility among Nigerian women may potentially result in the recognition of more efficient initial prevention and intervention strategies for female infertility.

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