
INFERTILITY AS A PUBLIC HEALTH CONCERN: A NARRATIVE REVIEW

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Abstract

Introduction

Infertility is a significant global public health issue affecting millions of individuals and couples during their reproductive years. According to the World Health Organization, approximately one in six adults experiences infertility during their lifetime. Beyond its clinical implications, infertility has profound psychological, social, economic, and demographic consequences. Delayed diagnosis, unhealthy lifestyles, environmental exposures, and unequal access to fertility care continue to increase the global burden of infertility.

Objective: This narrative review aims to summarize the current evidence on the epidemiology, risk factors, diagnosis, management, prevention strategies, psychosocial impact, and public health implications of infertility, while highlighting the role of healthcare professionals and policy initiatives in improving reproductive health outcomes.

Methods: A narrative review was conducted using electronic databases including PubMed, Scopus, Web of Science, Google Scholar, and the Cochrane Library. Peer-reviewed articles, systematic reviews, clinical guidelines, and reports published between 2015 and 2026 were reviewed. Relevant publications from the World Health Organization, national health agencies, and professional organizations were also included.

Key Findings: The literature indicates that infertility is influenced by multiple biological, environmental, lifestyle, and socioeconomic factors affecting both men and women. Common causes include ovulatory disorders, tubal disease, endometriosis, male factor infertility, hormonal abnormalities, and unexplained infertility. Infertility is associated with significant psychological distress, social stigma, reduced quality of life, and financial burden. Advances in assisted reproductive technologies have improved treatment outcomes; however, disparities in accessibility, affordability, and public awareness remain major challenges.

Conclusion: Infertility should be recognized as an important public health priority requiring coordinated efforts from healthcare professionals, researchers, policymakers, and communities. Integrating infertility prevention, early diagnosis, evidence-based treatment, psychosocial support, and public awareness into reproductive health programmes can improve fertility outcomes and enhance the quality of life of affected individuals and couples.

Keywords: Infertility; Reproductive Health; Public Health; Assisted Reproductive Technology; Risk Factors; Prevention; Women's Health; Men's Health.

Introduction

Infertility is a disease of the male or female reproductive system characterized by the inability to achieve pregnancy after 12 months or more of regular unprotected sexual intercourse. It affects both men and women and results from a combination of biological, genetic, environmental, lifestyle, and medical factors ^[1]. Infertility is classified as primary infertility, in which a couple has never achieved pregnancy, and secondary infertility, where pregnancy has occurred previously but cannot be achieved again. This classification is important for diagnosis, treatment planning, and epidemiological assessment ^[2].

Infertility is a growing global reproductive health challenge, affecting approximately one in six adults during their lifetime ^[3]. Although its prevalence is similar across different regions, access to infertility diagnosis and treatment varies considerably, particularly in low- and middle-income countries. Delayed childbearing, lifestyle changes, environmental exposures, and chronic diseases have further contributed to the increasing burden of infertility worldwide ^[1,4].

Beyond its medical implications, infertility is recognized as an important public health issue because of its psychological, social, and economic consequences. Individuals and couples experiencing infertility often face anxiety, depression, marital stress, social stigma, and financial hardship due to the high cost of fertility treatment. Despite significant advances in reproductive medicine, infertility remains underrecognized in many public health programmes. Therefore, this narrative review summarizes the current evidence on the epidemiology, risk factors, prevention, diagnosis, management, and public health implications of infertility, highlighting the need to integrate infertility care into comprehensive reproductive health services ^[1-3].

Objectives

- To describe the epidemiology and global burden of infertility.
- To review the major causes and modifiable risk factors associated with infertility.
- To examine the psychosocial, economic, and public health consequences of infertility.
- To summarize current approaches to infertility diagnosis and management.

- To discuss evidence-based prevention strategies and the role of healthcare professionals.
- To identify future directions for strengthening infertility care within public health systems.

Methods

Design

This study was conducted as a narrative review to provide a comprehensive overview of infertility as a public health concern. A narrative review methodology was selected because it allows the integration and synthesis of evidence from diverse study designs, including original research articles, systematic reviews, meta-analyses, and international guidelines.

Literature Search

A comprehensive literature search was undertaken to identify relevant publications related to infertility and public health. Electronic databases searched included PubMed, Scopus, Web of Science, Google Scholar, and the Cochrane Library. In addition, reports and publications from international organizations, including the World Health Organization (WHO), as well as national reproductive health guidelines and policy documents, were reviewed to obtain current evidence and recommendations.

The literature search covered publications from January 2015 to March 2026. Search terms and Medical Subject Headings (MeSH) included combinations of the following keywords: infertility, reproductive health, public health, infertility management, assisted reproductive technology, epidemiology, risk factors, prevention, male infertility, and female infertility. Boolean operators ("AND" and "OR") were used to refine the search and retrieve relevant articles. Reference lists of selected articles were also screened to identify additional pertinent studies.

Inclusion Criteria

Studies were included in this narrative review if they met the following criteria:

- Published in the English language.
- Published between 2015 and 2026.
- Original research articles, observational studies, randomized controlled trials, systematic reviews, meta-analyses, and evidence-based clinical practice guidelines.
- Studies addressing the epidemiology, risk factors, diagnosis, management, prevention, psychosocial aspects, or public health implications of infertility.
- Publications from recognized international organizations and government agencies related to reproductive health.

Exclusion Criteria

The following publications were excluded from the review:

- Editorials, commentaries, opinion articles, and letters to the editor.
- Conference abstracts without full-text publications.
- Non-English language publications.
- Duplicate articles identified across databases.
- Studies with insufficient methodological details or those not directly related to infertility as a public health issue.

Epidemiology of Infertility

Infertility is a major global reproductive health problem affecting approximately one in six adults during their reproductive years ^[5]. The prevalence is similar across high-, middle-, and low-income countries, although regional differences exist due to variations in healthcare access, socioeconomic conditions, lifestyle factors, environmental exposures, and reproductive tract infections ^[1,2]. In low- and middle-income countries, limited access to fertility services, financial constraints, and social stigma contribute to a higher disease burden and delayed treatment. In contrast, delayed childbearing, obesity, and lifestyle-related disorders are increasingly common causes in high-income countries. These findings highlight infertility as a universal public health concern requiring improved awareness, timely diagnosis, and equitable access to reproductive healthcare services ^[1-3].

Causes and Risk Factors of Infertility

Infertility is a multifactorial condition resulting from abnormalities in the male or female reproductive system or a combination of both. Female factors account for nearly one-third of infertility cases, male factors contribute another one-third, while the remaining cases are due to combined or unexplained causes ^[6].

Female Factors

Female infertility commonly results from ovulatory disorders, tubal disease, endometriosis, uterine abnormalities, and advanced maternal age. Conditions such as polycystic ovary syndrome (PCOS), pelvic inflammatory disease, uterine fibroids, and congenital uterine anomalies can impair ovulation, fertilization, or embryo implantation. Fertility also declines significantly after 35 years because of reduced ovarian reserve and poor oocyte quality ^[7].

Male Factors

Male infertility contributes to approximately 40–50% of infertility cases and is commonly associated with low sperm count, poor sperm motility, abnormal sperm morphology, varicocele, hormonal disorders, and genetic abnormalities. Lifestyle factors such as smoking, obesity, alcohol consumption, environmental toxin exposure, and excessive heat further compromise male reproductive function ^[8].

Combined and Unexplained Infertility

Some couples experience infertility due to factors affecting both partners simultaneously. In addition, 10–20% of infertility cases remain unexplained despite normal clinical investigations. These couples often require individualized evaluation and management, including lifestyle modification or assisted reproductive technologies ^[1,4].

5. Lifestyle and Environmental Determinants

Several modifiable lifestyle and environmental factors influence fertility. Obesity, malnutrition, smoking, alcohol consumption, drug abuse, chronic stress, and physical inactivity negatively affect hormonal balance, ovulation, and sperm quality. Exposure to environmental pollutants, pesticides, heavy metals, radiation, and occupational chemicals has also been linked to impaired reproductive function. Furthermore, delayed childbearing, particularly after 35 years of age, significantly reduces fertility due to declining ovarian reserve. Promoting healthy lifestyles and

minimizing harmful environmental exposures are important strategies for infertility prevention [1,2,4].

6. Psychosocial Impact

Infertility has profound psychological, social, and economic consequences. Individuals and couples frequently experience anxiety, depression, low self-esteem, and marital stress, while social stigma and gender discrimination may further worsen emotional well-being. The high cost of infertility investigations and assisted reproductive technologies also places a considerable financial burden on many families. Therefore, comprehensive infertility care should include psychological counseling, social support, and patient-centered care to improve quality of life and treatment outcomes [9].

Diagnosis and Evaluation

A comprehensive and systematic evaluation is essential for identifying the underlying causes of infertility and developing an appropriate treatment plan. International guidelines recommend that both partners should be evaluated simultaneously after 12 months of regular unprotected sexual intercourse without conception, or earlier in the presence of risk factors such as advanced maternal age, irregular menstrual cycles, previous pelvic inflammatory disease, or known male reproductive disorders [1,2].

Laboratory investigations are undertaken to assess ovarian reserve, ovulation, thyroid function, prolactin levels, and other endocrine disorders. Hormonal evaluation commonly includes follicle-stimulating hormone (FSH), luteinizing hormone (LH), estradiol, progesterone, anti-Müllerian hormone (AMH), thyroid-stimulating hormone (TSH), prolactin, and testosterone where indicated. These investigations help identify endocrine abnormalities that may contribute to infertility [10].

Imaging studies are important for evaluating reproductive anatomy. Transvaginal ultrasonography is routinely used to assess ovarian follicles, uterine abnormalities, and endometrial thickness. Hysterosalpingography (HSG), saline infusion sonography, hysteroscopy, and laparoscopy may be performed to evaluate tubal patency, intrauterine pathology, and pelvic conditions such as endometriosis [11].

For male partners, semen analysis remains the cornerstone of infertility evaluation. The assessment includes semen volume, sperm concentration, motility, morphology, and vitality according to the standardized procedures outlined in the WHO Laboratory Manual for the Examination and Processing of Human Semen (6th Edition) [12]. Abnormal findings generally require repeat testing and further specialist evaluation.

When clinically indicated, genetic testing is recommended, particularly in cases of severe male infertility, recurrent pregnancy loss, premature ovarian insufficiency, or congenital reproductive abnormalities. Advances in molecular diagnostics have improved the identification of chromosomal abnormalities and single-gene disorders, enabling individualized counseling and management [13].

Current Management Strategies

The management of infertility depends on the underlying cause, duration of infertility, age of the partners, associated medical conditions, and individual reproductive goals. Current treatment approaches include medical therapy, surgical interventions, assisted reproductive technologies (ART), and lifestyle modifications. Management should be individualized and based on evidence-based clinical guidelines to optimize reproductive outcomes ^[14].

Medical treatment is the first-line approach for many infertility conditions, particularly those related to ovulatory and hormonal disorders. Ovulation induction using medications such as letrozole, clomiphene citrate, or gonadotropins is commonly used to stimulate ovulation in women with anovulation or oligo-ovulation ^[13]. Hormonal therapy helps correct endocrine disorders, including thyroid dysfunction and hyperprolactinemia, thereby improving fertility outcomes ^[15]. Antibiotics are prescribed to treat reproductive tract infections that may contribute to infertility ^[20]. Additionally, lifestyle modifications such as maintaining a healthy weight, quitting smoking, limiting alcohol intake, engaging in regular physical activity, reducing stress, and adopting a balanced diet play an important role in enhancing natural fertility and improving the success of infertility treatment ^[21].

Surgical Management

Surgical management is indicated when structural abnormalities of the reproductive organs contribute to infertility. Procedures such as laparoscopy are used to diagnose and treat conditions including endometriosis, pelvic adhesions, and tubal disorders, while hysteroscopy helps correct intrauterine abnormalities such as polyps, fibroids, uterine septa, and adhesions that may impair implantation ^[1,3]. In men, varicocelectomy can improve semen quality and enhance the chances of natural conception in selected patients with clinically significant varicocele ^[22].

Assisted Reproductive Technologies (ART)

Assisted reproductive technologies (ART) provide effective treatment options for couples who fail to conceive through conventional methods. Intrauterine insemination (IUI) is commonly used for mild male factor and unexplained infertility, while in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI) offer higher success rates, particularly in severe male infertility and previous fertilization failure ^[23]. Fertility preservation through cryopreservation of oocytes, sperm, embryos, or ovarian tissue is increasingly utilized for individuals undergoing cancer treatment or delaying parenthood ^[24].

Infertility as a Public Health Issue

Infertility is increasingly recognized as a significant public health issue because of its widespread prevalence, multifactorial etiology, and profound effects on individuals, families, and society. Although infertility is not a life-threatening condition, it substantially affects physical, psychological, social, and economic well-being. The World Health Organization (WHO) recognizes infertility as a disease of the reproductive system and emphasizes the need for equitable access to prevention, diagnosis, treatment, and supportive care as part of comprehensive reproductive health services ^[25].

Disease Burden

Infertility affects approximately one in six adults worldwide, making it one of the most common reproductive health conditions globally [7]. Both male and female factors contribute almost equally to infertility, while combined and unexplained causes account for a significant proportion of cases. As fertility rates decline in many countries, infertility has become an important demographic and public health concern requiring coordinated national and international responses [13].

Disability and Quality of Life

Although infertility does not directly cause physical disability, its emotional and psychosocial consequences can be substantial. Individuals experiencing infertility often report anxiety, depression, low self-esteem, social isolation, and reduced life satisfaction. Repeated treatment failures and prolonged uncertainty may further impair mental health and interpersonal relationships. Studies have consistently demonstrated that infertility significantly reduces health-related quality of life, particularly among women in societies where parenthood is strongly associated with social identity and family expectations [2,3].

Economic Implications

Infertility imposes a considerable financial burden on affected individuals, families, and healthcare systems. The costs associated with diagnostic investigations, medications, surgical procedures, and assisted reproductive technologies (ART) are often substantial, particularly in countries where fertility treatments are not covered by public or private health insurance. Many couples experience financial hardship due to

Prevention Strategies

Preventing infertility requires a comprehensive public health approach that addresses modifiable risk factors, promotes reproductive health awareness, and ensures timely access to preventive healthcare services. Many causes of infertility are preventable through health education, infection control, healthy lifestyle practices, and early medical intervention. Public health policies should focus on increasing awareness, reducing risk factors, and improving access to quality reproductive healthcare services [1,2].

Reproductive Health Education

Reproductive health education is one of the most effective strategies for preventing infertility. Comprehensive education should include information on reproductive anatomy and physiology, fertility awareness, menstrual health, family planning, the impact of delayed childbearing, and the importance of seeking timely medical care for reproductive health problems. Community-based education programs and school health initiatives can improve awareness and encourage healthy reproductive behaviors. [9].

Prevention of Sexually Transmitted Infections

Sexually transmitted infections (STIs), particularly **Chlamydia trachomatis** and **Neisseria gonorrhoeae**, are important preventable causes of infertility.

Vaccination

Vaccination helps prevent infections that can affect fertility. Immunization against human papillomavirus (HPV), rubella, and hepatitis B protects reproductive health by reducing the risk of infections and related complications that may contribute to infertility ^[1,2].

Healthy Lifestyle Promotion

Adopting a healthy lifestyle significantly improves reproductive health and fertility outcomes. Maintaining a healthy body weight, consuming a balanced diet, engaging in regular physical activity, avoiding tobacco use, limiting alcohol consumption, managing stress, and obtaining adequate sleep help optimize hormonal balance and reproductive function in both men and women. Public health campaigns should encourage these behaviors to reduce preventable infertility ^[1,4].

Early Diagnosis and Treatment

Timely identification and management of reproductive disorders can prevent permanent infertility. Early diagnosis and treatment of endocrine disorders, reproductive tract infections, endometriosis, varicocele, and other medical conditions improve fertility outcomes and reduce long-term complications.

Occupational and Environmental Protection

Reducing exposure to occupational and environmental hazards is another important preventive strategy. Contact with pesticides, heavy metals, industrial chemicals, radiation, excessive heat, and endocrine-disrupting chemicals has been associated with impaired reproductive function.

Preconception Care

Preconception care aims to optimize the health of individuals before conception and improve pregnancy outcomes. It includes medical assessment, screening for chronic diseases, nutritional counseling, folic acid supplementation, review of medications, immunization status, lifestyle counseling, and management of pre-existing medical conditions. Integrating preconception care into primary healthcare services supports fertility preservation and promotes healthy pregnancies ^[1,2].

Role of Healthcare Professionals

Healthcare professionals play a pivotal role in the prevention, early detection, diagnosis, treatment, and long-term management of infertility. Effective infertility care requires a patient-centered and multidisciplinary approach involving physicians, nurses, reproductive endocrinologists, embryologists, psychologists, counselors, laboratory specialists, and public health professionals.

Counseling

Counseling enables individuals and couples to understand the causes, diagnostic procedures, treatment options, expected outcomes, and potential risks associated with infertility. Counseling should be individualized, culturally sensitive, and provided throughout the treatment process to support informed decision-making. Preconception counseling, genetic counseling, and fertility preservation counseling are important components of comprehensive infertility care.

Early Screening

Healthcare professionals play an important role in identifying individuals at risk of infertility through routine reproductive health assessments and early screening. Timely evaluation of menstrual irregularities, reproductive tract infections, endocrine disorders, varicocele, and other fertility-related conditions facilitates early intervention and improves treatment outcomes.

Referral

Appropriate and timely referral to fertility specialists is essential when primary care management is insufficient or specialized investigations and treatments are required. Healthcare providers should refer couples with prolonged infertility, recurrent pregnancy loss, severe male factor infertility, suspected tubal disease, endometriosis, or complex endocrine disorders to specialized reproductive medicine centres for advanced evaluation and management.

Psychological Support

Infertility often causes significant emotional distress, anxiety, depression, and marital challenges. Healthcare professionals should provide empathetic communication, emotional support, and psychological counseling throughout the fertility journey. Early identification of mental health concerns and referral to psychologists or mental health specialists can improve coping strategies, treatment adherence, and overall well-being.

Community Awareness

Healthcare professionals contribute to community awareness by organizing reproductive health education programs, awareness campaigns, workshops, and outreach activities. These initiatives help reduce stigma, dispel myths, encourage timely medical consultation, and promote equitable access to infertility services. Community engagement is particularly important in regions where infertility is associated with cultural misconceptions and discrimination.

Follow-up Care

Regular follow-up is necessary to monitor treatment response, manage complications, provide ongoing counseling, and modify treatment plans as needed. Follow-up care also ensures continuity of care, enhances patient satisfaction, and supports long-term reproductive and psychological health. Healthcare professionals should encourage adherence to treatment recommendations and maintain open communication with patients throughout the care continuum.

Multidisciplinary Approach

Effective infertility management requires collaboration among obstetricians and gynaecologists, urologists, reproductive endocrinologists, fertility nurses, embryologists, psychologists, genetic counsellors, nutritionists, and primary care providers. A multidisciplinary approach facilitates comprehensive assessment, individualized treatment planning, psychosocial support, and coordinated care, ultimately improving fertility outcomes and patient-centered reproductive healthcare.

Government Policies and International Guidelines

Government policies and international guidelines play a crucial role in strengthening infertility prevention, diagnosis, treatment, and access to reproductive healthcare services. Comprehensive

policies help ensure equitable access to fertility care, improve the quality of reproductive health services, reduce disparities, and promote awareness regarding infertility as a significant public health issue. International organizations and national governments continue to advocate for the integration of infertility services within universal reproductive healthcare systems.

World Health Organization Recommendations

WHO recommends improving access to infertility prevention, early diagnosis, evidence-based treatment, and psychosocial support while addressing modifiable risk factors such as sexually transmitted infections, obesity, tobacco use, and delayed childbearing. The organization also advocates for universal access to quality fertility services, strengthened health systems, increased research, and public awareness to reduce the global burden of infertility.

National Reproductive Health Programmes

Many countries have incorporated infertility prevention and reproductive health services into their national reproductive health programmes. In India, reproductive health initiatives under the National Health Mission (NHM) and the Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH+A) strategy focus primarily on maternal and reproductive health services, although access to comprehensive infertility care remains limited in many public healthcare settings ^[3,5].

Fertility Care Policies

Several countries have developed national fertility care policies that establish clinical standards for infertility diagnosis, assisted reproductive technologies (ART), laboratory practices, and ethical conduct. Professional organizations such as the American Society for Reproductive Medicine (ASRM) and the European Society of Human Reproduction and Embryology (ESHRE) regularly publish clinical practice guidelines to support standardized infertility management ^[4,6].

Insurance Coverage

The high cost of infertility investigations and assisted reproductive technologies remains a major barrier to accessing fertility care. Expanding insurance coverage and incorporating infertility services into universal health coverage can improve affordability, reduce financial hardship, and increase equitable access to evidence-based fertility treatments.

Public Awareness Initiatives

Public awareness initiatives are essential for improving knowledge about infertility, reducing stigma, promoting healthy reproductive behaviors, and encouraging timely healthcare seeking. Governments, healthcare organizations, professional societies, and non-governmental organizations conduct awareness campaigns through mass media, educational institutions, community outreach programmes, and digital platforms.

Overall, strengthening government policies, implementing international recommendations, expanding insurance coverage, and enhancing public awareness are fundamental to improving infertility prevention and ensuring equitable access to quality reproductive healthcare. Coordinated efforts by governments, healthcare providers, professional organizations, and policymakers are essential to address infertility as a public health priority.

Recent Advances in Infertility Care

Recent advances in reproductive medicine have significantly improved the diagnosis, treatment, and success rates of infertility management. Technological innovations, molecular diagnostics, and digital health solutions have enhanced the precision of fertility assessment while enabling more personalized and patient-centered care.

Artificial Intelligence in Reproductive Medicine

Artificial intelligence (AI) has emerged as a promising tool in reproductive medicine. Machine learning algorithms are increasingly used to analyse clinical data, predict ovarian response, assess embryo quality, estimate implantation potential, and optimize individualized treatment protocols. AI-assisted embryo selection has demonstrated improved accuracy and consistency compared with conventional morphological assessment, potentially increasing the success rates of assisted reproductive technologies while reducing human subjectivity.

Genetic Testing

Advances in molecular genetics have enhanced the identification of genetic causes of infertility and improved reproductive outcomes. **Preimplantation Genetic Testing (PGT)** enables next-generation sequencing technologies also facilitate early identification of hereditary reproductive disorders, allowing individualized genetic counselling and informed reproductive decision-making.

Time-Lapse Embryo Monitoring

Time-lapse embryo monitoring systems continuously observe embryo development without removing embryos from the incubator. Time-lapse imaging supports more objective embryo selection and may contribute to improved clinical pregnancy and live birth outcomes in selected patient populations.

Cryopreservation

Cryopreservation has become an integral component of modern fertility care. Fertility preservation is particularly beneficial for individuals undergoing cancer treatment, women delaying childbearing for personal or medical reasons, and patients at risk of premature ovarian insufficiency. Cryopreservation provides greater reproductive flexibility and enhances long-term fertility options.

Personalized Fertility Treatment

Individualized ovarian stimulation protocols, personalized embryo transfer strategies, and precision medicine approaches have improved treatment effectiveness while minimizing complications such as ovarian hyperstimulation syndrome (OHSS). Personalized care also enhances patient satisfaction and optimizes reproductive outcomes.

Telemedicine

Telemedicine has transformed infertility care by improving access to reproductive health services, particularly for individuals living in remote and underserved areas. Virtual consultations facilitate fertility counseling, follow-up appointments, interpretation of laboratory reports, medication monitoring, psychological support, and patient education while reducing travel costs and improving continuity of care. The widespread adoption of telemedicine following the

COVID-19 pandemic has demonstrated its value as an effective complement to conventional fertility services.

Challenges and Future Directions

Despite advances in reproductive medicine, infertility remains a significant public health challenge due to barriers in access, affordability, and awareness. The high cost of infertility treatment and inadequate insurance coverage often prevent couples from seeking or completing treatment. Social stigma, especially toward women, continues to affect psychological well-being and delays healthcare seeking. Rural populations also face greater challenges than urban populations because of limited healthcare infrastructure and specialist services.

Conclusion

Infertility is a significant public health concern that affects the physical, psychological, social, and economic well-being of individuals and couples worldwide. Early diagnosis, evidence-based treatment, healthy lifestyle practices, and equitable access to fertility care are essential for improving reproductive outcomes. Continued research and supportive health policies are needed to ensure accessible, affordable, and high-quality infertility care for all.

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