

Addressing the Inequities in Access to Assisted Reproductive Technology (ART) Treatments in High-Income Countries- A Scoping Review

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Acknowledgements

First, I would like to express my gratitude to my academic supervisor, Prof Sue Dopson, for her insights, guidance, patience, and words of encouragement every time. It meant a lot to feel that I was on the right path and doing something worthwhile that could make a difference in fertility healthcare delivery.

I am also grateful to Prof Kamal Mahtani for his guidance, encouragement, and support throughout the course. The MGHL Dissertation drop-in sessions were very helpful, and I would like to express my gratitude to all the faculty members supporting those sessions, including Prof Mahtani, David Nunan, Stephany Tierney, and Lindsay Baines. Especially for their patience in answering innumerable questions and many iterations of the same questions.

I am grateful to all the faculty members who have taught me on this incredible course, both from Said Business School and the Nuffield Department of Primary Care Health Sciences. A special thanks to Matt Bryon for his constant support and for being there for everything and all matters.

I am grateful to all the cohort colleagues and classmates. A group of experts in the field of healthcare leadership, pleasant personalities and ever so helpful. Thanks for learning we did together.

Finally, I want to express my heartfelt gratitude to my family—my wife, daughters, and parents—for bearing with me and always encouraging me.

Conflict of Interest

There are no conflicts of interest related to my dissertation research. I have no financial, personal, or professional relationships that could influence the outcomes of this study. This is my own original research, and I am committed to conducting it with integrity and objectivity.

Addressing the Inequities in Access to Assisted Reproductive Technology (ART) Treatments in High-Income Countries- A Scoping Review

Abstract

Background: Subfertility is defined as the inability to conceive after twelve months or more of regular unprotected sexual intercourse. The World Health Organisation estimates that about 17.5% of adults worldwide seek help to conceive (WHO, 2023). A proportion of patients will need Assisted Reproductive Technology Treatment (ART) as their last resort. ART treatments are expensive and often involve out-of-pocket expenses, including in High-Income Countries (HICs) (Dyer, 2017, Chambers and Sullivan, 2009).
Subfertile individuals experience significant psychosocial morbidity (Boivin and Lancastle, 2010, Volgsten and Ekselius, 2008, Volgsten and Ekselius, 2010).

Objective: This scoping review aims to identify the causes of inequities in accessing ART treatments in HICs and how to address them.

Methods: The Joanna Briggs Institute Manual of Evidence Synthesis Methodology for Scoping Reviews (Aromataris and Lockwood, 2024) and Open Science Framework (OSF) methodologies (Lely, 2023) are followed. The evidence is mapped using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).

Inclusion Criteria: The PCC framework for Scoping Reviews—participants, Concept, and Context—is applied.

Exclusion Criteria: To best align with the objective, ART treatments for fertility preservation and cross-border access are excluded.

Outcomes: After a full-text study and data extraction from 58 studies, seven distinct themes emerged representing the barriers to access: Access Screening, Affordability, Ethnic and

Racial inequity, high BMI, HIV-positive status, Geography, Same-Sex couples, and Single women.

Conclusions:

Six evidence-based interventions are identified and proposed in this review to address the inequity. The updated Consolidated Framework for Implementation Research (Damschroder et al., 2022), along with a systems leadership and bottom-up change management process, are suggested for delivering the objective by educating, engaging, and empowering patients and practice staff, organisational leadership, funders, and policymakers, backed up with comprehensive data collection and insights.

Protocol (See Appendix 1) -

https://osf.io/t2k3a/?view_only=cc46f24b1258432bb75b5a06511f433d

Lay Summary

Title

A Scoping Review for Understanding and Resolving the Barriers in Accessing Assisted Reproductive Technology (ART) Treatments in High-Income Countries (HICs).

Background

Subfertility or unwilling childlessness can be distressful, including the risk of mental health problems and compromised social abilities. One in six individuals, on average, is unwillingly childless worldwide. A proportion will need advanced medical treatments called Assisted Reproductive Technology (ART), such as Invitro Fertilisation, which are expensive. Research suggests that those living in HICs may also find these unaffordable. Other access barriers may include distance to the clinic, ethnicity, education level, relationship status, etc.

Objective

To identify and minimise the barriers to accessing ART treatments for the unwillingly childless living in HICs.

Methods of Research

A well-planned search methodology with set search criteria is used. To gather a reliable and representative body of evidence, 58 studies in the English language between 2004 and 2024 were included from nine countries and regions, with various study designs, policies, professional guidance, and legislation.

Findings

Seven themes are identified representing barriers to access-

1. Access Screening - criteria used by clinics to offer treatment.
2. Affordability.
3. Ethnic and Racial bias.
4. High Body Mass Index or overweight.

5. HIV-positive status

6. Geographic distance from the clinic.

7. Bias against Same-sex couples and Single women.

Six intervention areas are identified to mitigate the challenge -

1. Data & Research for better insights.

2. Education and awareness are needed to improve communication between providers and patients and prevent disease.

3. Law and Regulation for promoting equitable, safe care.

4. Inclusive recruitment - Representation of minority groups amongst staff.

5. Inclusive Ethics and Policy Committees - Representation of minority groups amongst policymakers.

6. Innovation - developing novel medical interventions to reduce cost and time to baby.

Policy Implications

Raising awareness and educating policymakers to recognise subfertility as a medical condition for funding adequately to improve access. Access criteria should be backed by evidence and set in policy. Using robust evidence, adequate protocols and equipment and liberalising regulation to include those who are overweight, HIV-positive, Same-sex couples and Single women.

Practice Implications

Educating practice staff on the importance of better communication with minority groups, including ethnicity, gender identity, and relationship status, is required. Patients must also be educated on preventive health, safe treatment options for HIV-positive patients, and setting up clinics in rural areas. Comprehensive data collection is also required to monitor progress and help sustain equitable care.

Research Gaps

Several important areas of further research are identified for improving access, the top being -

- A deeper understanding of the role of Social Class.
- The potential of Artificial Intelligence to improve access

Conclusion

Barriers to accessing ART treatments are prevalent in HICs. An effective implementation plan involves educating and closely working with practice teams, leadership, and policymakers. This complex adaptive systems challenge needs a bottom-up approach to change management and effective systems leadership. This review will be suitable as a policy map and further research will enhance the clarity.

Background

Subfertility:

The World Health Organisation (WHO) defines Subfertility as a disease of the reproductive system characterised by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse (World_Health_Organisation, 2023a). It is estimated that one in six to one in ten individuals of reproductive age worldwide experience subfertility in their lifetime (Boivin et al., 2007, World_Health_Organisation, 2023b). The prevalence is higher in some parts of the world, e.g., sub-Saharan Africa, where it may be up to around one in three individuals (Leke and Oduma, 1993). An estimate was given by a prospective study from the Netherlands from a specific region, quoting the incidence of subfertility to be 10%, and about 15% of couples seeking medical help to conceive (Beurskens et al., 1995). A similar study from the Avonshire region of England quoted a similar figure of one in six couples seeking help to conceive. The WHO recognises subfertility as a medical condition and estimates that 48.5 million to 186 million individuals may be Subfertile globally (World_Health_Organisation, 2023b). Depending upon the cause for subfertility and the context, a variable but significant proportion of people will need ART treatment. The first

ever successful IVF treatment resulted in the birth of Louise Brown at Oldham General Hospital in the United Kingdom in 1978, under the care of Gynaecologist Dr Patrick Steptoe and the Nobel prize-winning Scientist Dr Robert Edwards (Dow, 2019). An estimated ten million children have since been born globally with the help of ART (ESHRE, 2022).

Assisted Reproductive Technology (ART) Treatments

The main ART treatments are Invitro Fertilisation (IVF) and Intracytoplasmic Sperm Injection (ICSI) (Rowell, 2003).

Invitro Fertilisation (IVF)—Eggs are retrieved from ovaries by a transvaginal "Ovum pick-up" procedure. This is generally after the ovaries have been supra-physiologically stimulated, but it can be done in a natural menstrual cycle, too. The eggs and a sperm sample of suitable quality are incubated together in a suitable medium to allow fertilisation to occur. The fertilised eggs are monitored while growing into embryos over the next few days, followed by embryo transfer into the womb (Gianaroli, 2000), hoping for a live birth.

Intracytoplasmic Sperm Injection (ICSI)—In male factor subfertility, where the sperm is of suboptimal quality, there is a risk that the sperm may not fertilise the egg on its own. In such cases, a single sperm, if injected directly into a suitable egg, can aid fertilisation. Once fertilised, the embryo transfer procedure is performed the same way as with IVF (HFEA_UK, 2024). There are a variety of other uses of the above techniques such as for fertility preservation, surrogacy and pre-implantation genetic testing. This scoping review will focus only on IVF and ICSI techniques as ART treatments

Why do The Scoping Review

The Inequity of Access

Despite ART treatments having been around for more than four decades, the treatments remain inaccessible and unavailable to a significant proportion of the global population, with

affordability being the biggest challenge (Lunenfeld, 2004, Domar et al., 2021, Lass and Lass, 2023, Lass and Lass, 2021). Apart from impacting access to treatments, low socioeconomic status is also a predictor of poorer reproductive health outcomes, including in the developed world (Berga, 2016). One ART cycle costs are prohibitively high and unaffordable in Lower- and Middle-Income Countries (LMICs) (Njagi, 2023). This is true for a significant proportion of the population in High-Income Countries (HICs), where ART treatments for some people involve taking partial or full out-of-pocket expenses (Dyer, 2013, Chambers and Sullivan, 2009). The cost of one standard ART cycle in 2008-9 was 50% of an annual disposable family income in the United States, while it was 20% of annual disposable family income in Scandinavia and the United Kingdom, the latter with state funding support (Chambers and Hoang, 2014). According to a recent report by the Human Fertilisation and Embryology Authority United Kingdom (HFEA UK), 63% of IVF treatments in 2021 in women under 35 years were privately funded (HFEA_UK, 2023c). It is known that better state or insurance funding for ART treatments increases utilisation when comparing countries with similar gross domestic product (GDP) (Lass and Lass, 2023). There is evidence from the United Kingdom (UK) and the United States of America (USA) suggesting disparity in access and clinical outcomes for ethnic and racial minorities compared with non-Hispanic white women (Ekechi, 2021). The unfavourable geographic location of services, unfavourable policy, relationship status, cultural and religious beliefs, and educational status of people seeking ART treatment may be other factors impacting access.

Psychosocial morbidity

Suffering from Subfertility is known to be psychosocially demanding, at times with devastating consequences, including experience of loss and stigma (Boivin and Lancastle, 2010). A high risk of anxiety and depression is noted during the two weeks after embryo transfer when patients are waiting for the outcomes (Boivin and Lancastle, 2010). The

average chance of having a live birth from an Invitro Fertilisation Treatment in the developed world is about one in four cycles, and subfertile individuals or couples will need more than one treatment for success (Harrison et al., 2022). There is a risk of desperate patients making catastrophic financial decisions, leading them to what can be described as “a fertility poverty trap”. In extreme situations, especially in Lower and Middle-income countries (LMICs) where there is no financial support, state or insurance, women generally dependent on their male partners end up in severe economic difficulties, even abandonment, divorce, poor health, and starvation (Dyer, 2013, Ombelet, 2019, Inhorn, 2023). Approximately one-third of women and one-tenth of men with unresolved infertility get a psychiatric diagnosis (Volgsten and Ekselius, 2008, Volgsten and Ekselius, 2010, Wang, 2022), more so in cultures where having an heir guards inheritance and property rights, including making a marriage secure, particularly for women (Wang, 2022). A systematic review and meta-analysis showed that one in two infertile women in LMICs suffered from intimate partner violence over their lifetime, with psychological violence being most common, followed by physical violence, sexual violence and economic coercion (Wang and Fu, 2022). Infertility is, therefore, not only an issue of reproductive health but also psychological, social and financial health, more so where childbearing is regarded as central to womanhood (Wang, 2022). About two-thirds of all treated patients do not meet their parenthood goals and are known to have an increased risk of living with lower self-esteem (Wischmann T, 2012, HFEA_UK, 2023b).

The Case for ART Treatments

Fertility outcomes are directly related to female age. The “egg reserve”, or the estimated number of eggs remaining in the pair of ovaries at any given age, declines with age, reaching almost a negligible number at menopause (Faddy, 1992), as shown in figure 1 below. The number of eggs retrieved during an IVF or ICSI treatment and, in turn, the chance of success depends on the egg reserve at the time of the treatment (Mcavey et al., 2011).

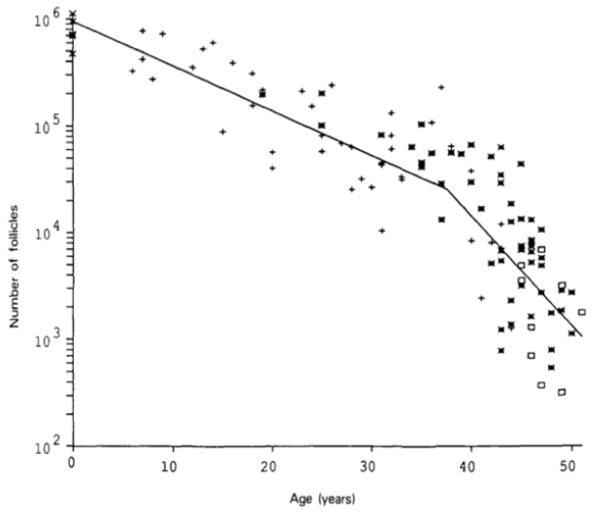


Figure 1: Bi-exponential model of declining follicle numbers (eggs) in human ovaries from birth to 51 years of age. Adapted from Faddy MJ et al. 1992, Human Reproduction

Based on a review of 400,135 treatments, the chance of live birth in ART treatments depends on the number of eggs retrieved, up to about 20 eggs (Sunkara et al., 2011).

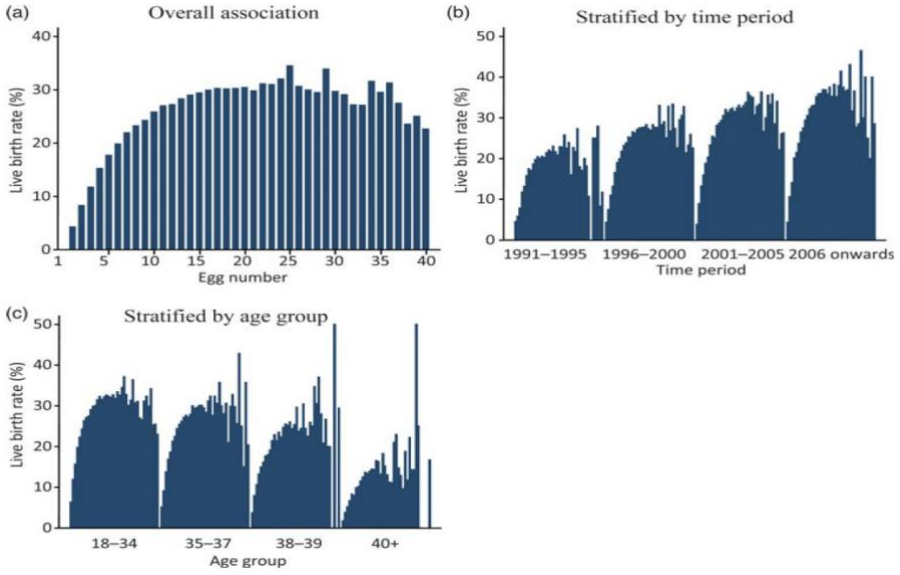


Figure 2: The Live birth rate (LBR) following IVF or ICSI treatment increases with an increasing number of eggs retrieved, up to about 20 eggs. The LBR for the number of eggs has improved over time but decreases with advancing age. Adapted from Sunkara S et al. 2011, Human Reproduction

Evidence suggests that fertility preservation by ART treatments is on the rise as it improves the quality of life for young cancer treatment survivors and for those diagnosed with gender incongruence undergoing gender transition or those exposed to other medical conditions leading to loss of fertility potential.

The 1948 UN Charter endorsed that everyone has the right to marry and start a family, regardless of race, nationality, or religion. It also recognised that the family is the fundamental unit of society, entitled to protection by society and the state, as outlined in Article 16 of the Universal Declaration of Human Rights. This affirmed the central role of the family unit in human existence and dignity (Humphrey, 1948). The Warnock Report of the Committee of Inquiry into Human Fertilisation and Embryology in the UK acknowledged the emotional strain experienced by individuals who are unable to have children, whether by choice or circumstance (Warnock, 1984). There is evidence linking an increased relative risk of all-cause mortality for those experiencing subfertility (Murugappan, 2020). The European Society of Human Reproduction and Embryology (ESHRE) and the American Society of Reproductive Medicine (ASRM), rightly so, consider subfertility a severe handicap that has a significant psychosocial impact on those desiring a child, substantially improving their well-being when successful.

The Economic Argument

Delayed childbearing, obesity, the ubiquity of endocrine disruptors such as environmental pollutants, an increase in sexually transmitted diseases, the need for fertility preservation, increasing awareness about ART treatments, etc., are all leading to an increase in demand for ART treatments (Jensen et al., 2008, Adashi et al., 2000). The view that subfertility is a lifestyle problem and not a serious medical condition continues to influence policymakers' views. The historical paradigm of controlling the population growth and competing healthcare needs has kept ART treatments a low funding priority (Pennings et al., 2008, Hamilton, 2018). The total fertility rate in most of the developed world is declining, leading to a decreasing number of young working-age people and taxpayers around over time (Connolly et al., 2010).

Robert Solow's Nobel Prize-winning theory for defining economic growth includes an adequate supply of working-age individuals (labour supply) as one of the determinants of growth (Solow, 1956). To better understand the contribution of ART treatments to economic growth, it is vital to consider the contribution of ART treatments to the population. Connolly et al. 2009 calculated that a child born of IVF in the UK, at an average expense of £12,931, is worth 8.5 times this amount to the UK Treasury in discounted future tax revenue (Connolly, 2009). Faddy et al. 2018, showed in their projection that at the rate of about 400,000 children born of ART treatments annually, there will be 157 million or 1.4% of the population globally, by the end of the century. If the number increases by a modest 30,000 births annually, it will lead to 394 million people or a significant 3.5% of the population globally, owing their lives to ART treatments (Faddy et al., 2018) and subsequently contributing to economic growth.

Objective

The choice and support to procreate is equated with basic personal respect and dignity (Robertson, 1994). Access to ART treatments is understood to be a challenge for a significant number of people globally, including many in the developed world. There seems to be a paucity of research on factors leading to inequity of access to ART treatments in HICs. This scoping review aims to explore the breadth of published and unpublished literature to identify the factors leading to inequity of access in HICs, as graded by the World Bank (Worldbank_data_1962-2022, 2024). The emerging themes will be explored to identify evidence-based strategies for improving access to ART treatments and understand their implications in the context of HICs.

Methodology

This scoping review follows the methodology of the Joanna Briggs Institute Manual of Evidence Synthesis (Aromataris and Lockwood, 2024), with guidance also taken from the Open Science Framework methodology (Lely and Morris, 2023). Furthermore, the knowledge synthesis in this Scoping review will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews' (PRISMA-ScR) methodology (Tricco et al., 2018).

Research Question

The Primary research question is-

What are the Inequities in accessing Assisted Reproductive Technology treatments in High-Income countries (HICs)?

The following question will be a Secondary Objective -

How to mitigate the risk of Inequity of Access to ART Treatments in HICs?

Together, the primary and the secondary objectives form a robust basis for the Title of this Scoping Review-

Addressing the Inequities in Access to Assisted Reproductive Technology (ART) Treatments in High-Income Countries- A Scoping Review.

Eligibility Criteria - Inclusion Criteria

Table 1: Inclusion Criteria

Participants	Concept	Context
Individuals needing Assisted Reproductive Technology Treatment	Identify the Inequities of Access to Assisted Reproductive Treatments and propose strategies to improve Access	High – Income Countries as defined by the World Bank criteria

Participants

Individuals needing help with ART treatment to conceive, including women and men, single and couples, both heterosexual and same-sex relationships.

Concept

This scoping review's concept of interest is identifying the inequities in accessing ART treatments and identifying research on strategies to improve access.

Context

The scoping review will focus on developed countries, which the World Bank classifies as High-Income Countries (Worldbank_data_1962-2022, 2024).

Defining the Context: The World Bank's classification of the world's economies is based on gross national income (GNI) per capita estimates, using purchasing power parity rates. The most current World Bank Income classifications is as follows (Worldbank_data_1962-2022, 2024):

- Low income: $1,025 or less
- Lower middle income: $1,026 to $4,035
- Upper middle income: $4,036 to $12,475
- High income: $12,476 or more

Exclusion Criteria

The following types of studies will be excluded for lacking relevance to the objective of the research -

- ART treatments for Fertility Preservation - social, for oncology or gender dysphoria.
- Studies on cross-border access to ART treatments.
- Studies on Challenges to Access from Covid19.
- Studies focusing on animals and in other than English language.
- Literature published before 2004.

Information Sources

The study search strategy has been designed to be as comprehensive as possible in identifying reviews and primary studies, as well as published and unpublished grey literature works that are suitable for answering the central research question. –

1) Electronic databases -
    a) PubMed Medline
    b) Epistemonikos - a collaborative, multilingual database of health evidence.
    c) Scopus - a comprehensive database of scientific research that includes journals, conference proceedings and books.
    d) The Cochrane Database of Systematic Reviews, part of the Cochrane Collaboration.
2) Reference lists of relevant publications.
3) Hand-searching of the key journals.
4) Existing networks and conferences.
5) Professional organisations such as the European Society for Human Reproduction and Embryology (ESHRE), British Fertility Society (BFS) and American Society of Reproductive Medicine (ASRM).
6) Legislation

Search Strategy

The search criteria attempted to achieve a systematic and comprehensive coverage of the evidence purposefully aligned with the study questions mentioned above. The search string Keywords, using MeSH terms and Text Words, are shared for all searches. The key terms used are truncated with an asterisk for a comprehensive inclusion opportunity (See search string and details for each database below in **Appendix D).**

PubMed Medline

Humans only - English language only - 2004-2024 only - 1049 studies

Included after full-text screening and deduplication- 44 studies

Scopus

Human only and English language - 74 studies.

Included after full-text screening and deduplication - 7 studies.

Epistemonikos

Human only and English language - 2 studies

Included after full-text screening and deduplication - 1 study.

Cochrane Database of Systematic Reviews

Included none

Policy and Position Statements

1. ESHRE Task Force on Ethics and Law 14 (2008): Equity of access to assisted reproductive technology (Pennings et al., 2008).
2. ESHRE Taskforce on Ethics and Law (2010): Lifestyle-related factors and access to medically assisted reproduction. Human reproduction (Oxford) (Dondorp et al., 2010).
3. Centre for Disease Control and Prevention National Public Health Action Plan for the Detection, Prevention, and Management of Infertility, Atlanta, Georgia: Centre for Disease Control and Prevention; June 2014.
4. Klipstein, S. et al. (2021) Disparities in access to effective treatment for infertility in the United States: An American Society of Reproductive Medicine (ASRM) Ethics Committee opinion. Fertility and sterility (Klipstein, 2021). [Online] 116 (1), 54–63.
5. Human Fertilisation and Embryology Authority UK (2023). Report on Ethnic Diversity in Fertility Treatment 2021.London, United Kingdom. HFEA UK.

Policy or Position statements included - 5 Reports.

Legislation

Human Fertilisation & Embryology Act 2008 Amendment to include same-sex couples and single women. (Human Fertilisation and Embryology Act Amendment 2008 (c. 22) Part 1 – Amendments of the Human Fertilisation and Embryology Act 1990)

The Legislation Amendment included - 1

Data Charting

Modifying the standard data extraction template from the JBI (Aromataris and Lockwood, 2024), two distinct data charts are created, tabulating all relevant information in a systematic way into predetermined fields as listed below -

1. **Study Characteristics Table -** charts following information - (Appendix B - Data Chart 1) -

a. ID Number - a running numeric ID

b. Author(s) and Year of Publication

c. Publishing Journal

d. Study Context

e. Study Participants and Sample Size, if relevant and available

f. Methodology or Study Design

g. Citation

2. **Study Findings Table –** charts following information – (Appendix C - Data Chart 2)

a. Author(s) & Reference

b. Aim/ Objective of the study

c. Findings in the study

d. Improvement strategies proposed in the study

The following sections will describe the seven inequities identified and the evidence from the extracted data.

See Appendices 2 & 3 for the Data Charts with Study Characteristics & Study findings.

Synthesising Data

The data evidence extracted after full-text, focused reading and charted in two separate tables

1. Study Characteristics Table (Appendix B)
2. Study Findings Table (Appendix C)

Two tables are used to avoid missing relevant details, making the data extraction more thorough since a wide range of countries, regions, and types of studies are covered. Further, the descriptive review in the Results Section provides a descriptive narrative of identified factors causing inequity of access, along with identified solutions to address the different inequities and the evidence.

Thematic Synthesis

Common outcome categories are identified, and the findings are summarised under the respective thematic labels, followed by the strategies to improve access presented respectively as a subheading under each label in the Results section –

Table 2: The identified seven themes causing Inequity of Access to ART in HICs

1	Access Screening
2	Affordability
3	Ethnic & Racial Inequity
4	High Body Mass Index
5	HIV-Positive Status
6	Geographic Access
7	Same-Sex Couples and Single Women

Results

General Characteristics of Search and Studies

Following a systematic search, a total of 1162 contender publications were identified -

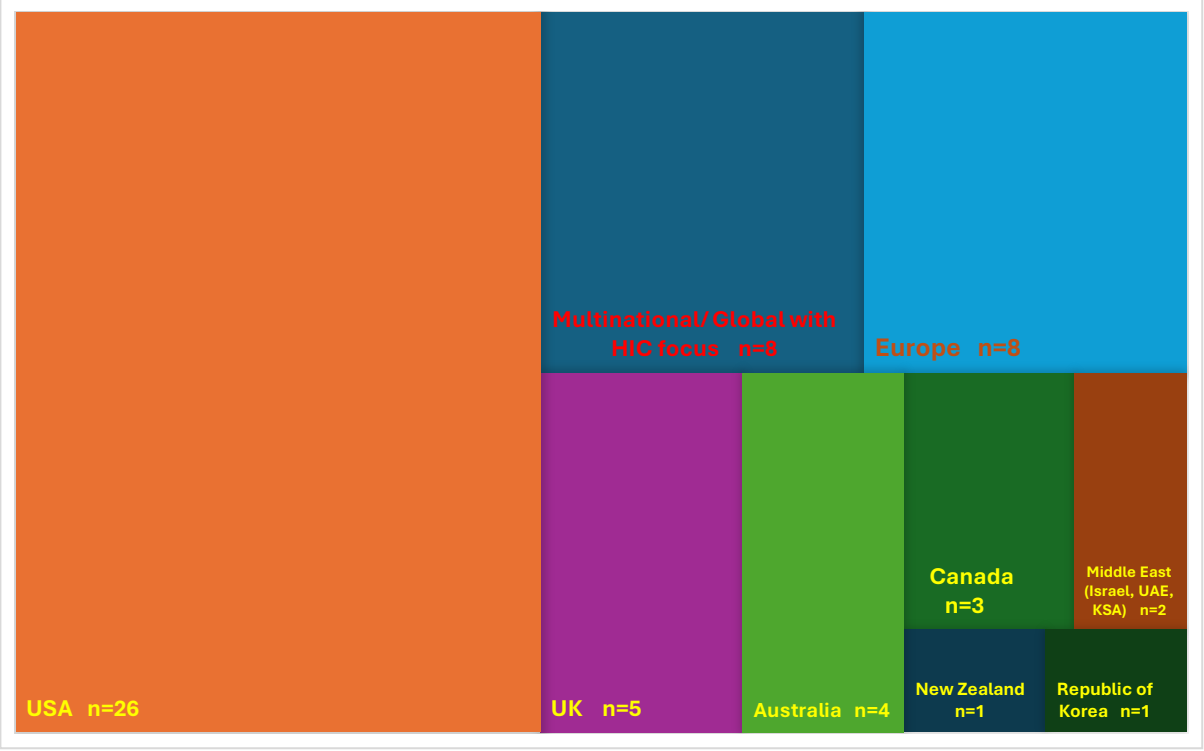
Table 3: Distribution of Studies and Databases

Database	Studies
PubMed Medline	1049
Scopus	74
Epistemonikos	2
Cochrane Database	31
Policy	5
Legislation	1
Total	1162

After title and abstract screening and deduplication, 204 studies were long listed. Full-text screening of the 204 studies, excluding studies that are not relevant to the objective, are not from the right context of HICs, are not in the date range 2004-2024, and nor are in the English language, 146 studies were excluded. This leaves a final number of 58 studies included.

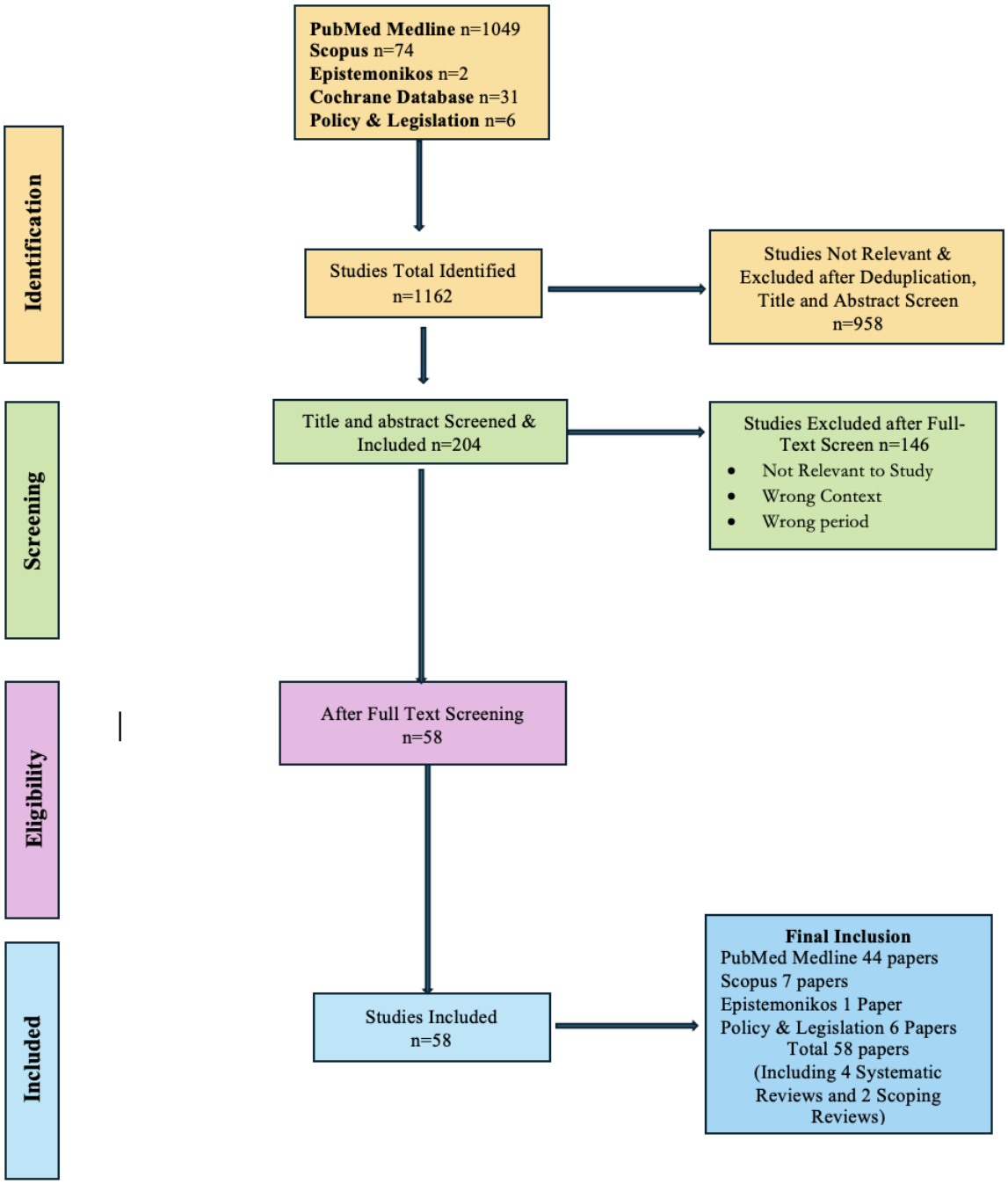
The number of included studies from each country is visualised below in the Treemap graph.

Figure 3: The Treemap visualising the representation of Countries with the number of Included studies



The search results are systematically presented below with a PRISMA flowchart showing the stages of the review decision process and study inclusion, with complete transparency.

Figure 4: PRISMA Flow Chart



Descriptive Narrative and Addressing the Identified Inequities

Access screening

Peterson MM examined the social, medical, legal and ethical aspects of the inequity of access to ART treatments in Australia (Peterson, 2005a), questioning the access screening and the paternalistic "gatekeeping" role of private clinics. The reasoning of "going against nature" and "absence of medical subfertility" has been used to deny access to lesbian and single women in Australia, the UK and the USA (Peterson, 2005a, Krajewska, 2015, Beckman and Harvey, 2005). Vandervort et al., in Canada, find access screening as a form of social dominance that violates Human Rights law and is against the principles of self-determination (Vandervort, 2006).

Addressing the Challenge of Access Screening

For fair access, any screening should be set into a regulatory framework, enforced by law, and backed by robust science and ethics (Peterson, 2005a, Vandervort, 2006).

Affordability

Affordability is the most quoted deterrent to accessing ART treatments in HICs, covered by 30 publications in this review. Access to ART in HICs depends on the availability of state or insurance-based financial support (Chambers et al., 2014; Chambers and Sullivan, 2009). The International Consortium for Monitoring of ART (ICMART) has noted an independent association between affordability and utilisation (Dyer et al., 2020). Lass et al. found that countries with higher Gross Domestic Product (GDP) have higher utilisation and that disparities in ART utilisation increase with decreasing affordability.

Publicly funded healthcare systems, such as in Europe, have better coverage than insurance-funded systems, such as in the USA, which have significant variation and lesser coverage (Adamson, 2009a, Domar et al., 2021). In the USA, the states that have mandated insurance coverage for fertility, the dropout rate, after initial investigations, is quoted as >50% (Davis

and Sokol, 2016). A strong negative correlation also exists between the Gender Inequality Index (GII) and ART treatment utilisation (Lass and Lass, 2023). In HICs, ART treatment cost represents a high economic burden. In Europe, one IVF/ICSI cycle could cost 10-20% of annual household income (after state funding support), and in the USA, out-of-pocket costs could be up to 25-50%, as quoted respectively in 2004 and 2009(Lunenfeld, 2004, Chambers and Sullivan, 2009).

Subfertility, when not considered a medical condition, is not covered by public funding or private health insurance (Davis and Sokol, 2016). Although cost-effectiveness studies have shown economic value in ART treatments (Connolly et al., 2010), it is not enough to justify public funding (Lunenfeld, 2004). Applying Weiner's AAA (Attribution-Affect-Action) framework, Williamson et al. questioned 554 Canadians about their views on 4 vignettes on reproductively challenged women differentiated by the cause of their need for ART. Participants were less likely to support funding for career-driven women who delay conceiving while being more sympathetic to those who were not deemed responsible, e.g. women with cancer. There was overall low support for public funding for ART treatments (Williamson and Lawson, 2021).

In the USA, ART utilisation improves with mandated insurance coverage (Correia and Kraschel, 2023, Korkidakis and DeSantis, 2024). However, only a small proportion of states have mandated coverage, and out of those, even fewer have comprehensive coverage (Davis and Sokol, 2016). With often minimal or no cover for those of low socioeconomic status (Hammoud et al., 2009). The self-insured employers are exempt from providing comprehensive coverage even in states with insurance mandates (Adashi and Dean, 2016), leaving many vulnerable with a lack of access. Brodeur et al. suggest that most specialist clinics establish their services preferably in urban areas with high median income and insurance mandates (Brodeur et al., 2022), adding to the problem.

Quebec, Canada, became the first North American demographic to introduce public funding for ART treatments in 2010, conditional on single embryo transfer. Subsequent years noted a significant increase in ART utilisation and an increase in the provincial birth rate. The single embryo transfer policy led to a significant reduction in multiple pregnancies, reducing perinatal morbidity and mortality for the mother and child (Shaulov et al., 2015). The same has been noted in some states in the USA, where comprehensive insurance coverage is conditional to a single embryo transfer policy, leading to safer clinical outcomes (Kissin et al., 2016).

Messaoud et al. from France reported that even in the presence of free access, two out of three women at 24 months after diagnosis and four out of five women from socio-economically disadvantaged backgrounds did not access ART treatments. Younger (18-24 years of age) and older women (40-43 years of age) were at a higher risk of low utilisation. More research was recommended to identify the cause (Messaoud et al., 2023).

In 2010, after Australia introduced EMSN (Extended Medical Safety Nets) Caps to control the increasing Medicare (state health insurance) expenses, a 16% reduction in utilisation was noted. The impact was most pronounced on women over 40 years of age (Chambers et al., 2012). Furthermore, after the introduction of EMSN caps, as access to ART treatments decreased, a negative correlation was noted with the number of embryos transferred, increasing the risk of high-risk multiple pregnancies (Chambers et al., 2014).

Addressing the Challenge of Affordability

Funding

Funding will improve ART treatment access (Adamson, 2009a, Domar et al., 2021, Lass and Lass, 2023, Pennings et al., 2008). Some propose more comprehensive, countrywide and fair insurance mandates to improve access (Farley and Webb, 2007, Correia and Kraschel, 2023, Hammoud et al., 2009). Beckman et al. proposed that an improved funding provision should

be set in statute (Beckman and Harvey, 2005). Brodeur et al. suggest improving funding by expanding insurance mandates will encourage specialist services to set up clinics in rural and underserved areas (Brodeur et al., 2022). Economic calculations have established that the return on investment for an IVF-born individual is quite healthy (Connolly, 2009). Funding of fertility services must be a moral obligation as an abiding strategic goal supported by regulation and legislation (Adashi and Dean, 2016).

Innovation

By using innovative technology like Telehealth, rural doctors can communicate with specialists and get expert input to help patients locally (Brodeur et al., 2022). Novel stimulation protocols, such as natural or mild stimulation and invitro maturation, can reduce cost and increase access (Davis and Sokol, 2016).

Education and Awareness

To reduce the need, the role of education and awareness amongst patients and provider teams around preventive lifestyle-related factors is widely recommended (Butts, 2023, Beckman and Harvey, 2005, Peterson, 2005a, Mcgarity et al., 2022, Komorowski and Jain, 2022, Domar et al., 2021). The availability of easily understandable information will empower women to make optimal decisions (Beckman and Harvey, 2005).

Data Collection

Setting up registries and collecting high-quality data about affordability gives robust insights into access challenges, which can be used to inform regulation and policy (Lunenfeld, 2004).

Ethnic and Racial Inequity

This review includes 20 studies that examined Ethnic and Racial disparities in HICS. Non-Hispanic (NH) White and Non-Hispanic Asian women are reported to have a higher access to and utilisation of ART treatments than Black African American and Hispanic women (Dongarwar et al., 2022, Humphries, 2016, Klipstein, 2021). Ethnic and racial inequities are

reported to be impacting clinical outcomes as well (Butts, 2023, Davis and Sokol, 2016, Dongarwar et al., 2022). The clinical outcomes, including live birth rate per egg retrieval, were highest in Non-Hispanic White women in both mandated and non-mandated states (Correia and Kraschel, 2023). Society of Assisted Reproductive Technology, USA (SART USA) data also suggests less favourable treatment outcomes for non-white patients undergoing ART, both in fresh and frozen IVF cycles (Butts, 2023). Comprehensive insurance mandates, while improved, do not eliminate ethnic and racial inequities (Korkidakis and DeSantis, 2024, Correia and Kraschel, 2023). With enhanced no-cost access to ART programs for active-duty service members in military settings, while fourfold increased access was seen in African American women, a decreased access was seen in Hispanic women (McCarthy-Keith et al., 2010). The Increased access to ART treatments, however, did not improve the clinical outcomes in either group (McCarthy-Keith et al., 2010).

A study about subfertile Arab American men residing in an ethnically segregated community primarily inhabited by recent immigrants and war refugees highlighted substantial barriers to effective care. Economic constraints, linguistic and cultural obstacles, and social marginalisation are identified as the main issues (Inhorn and Fakih, 2006).

The report “Ethnic Diversity in Fertility Treatment 2021” by HFEA UK highlights a range of inequities in access to and clinical outcomes from ART treatments for minority ethnic patients (HFEA_UK, 2023a). Amongst others, a lower IVF birth rate is reported for Black African women. The average age of starting fertility treatment among heterosexual Black African patients is higher than the national average. While there has been a significant decline in multiple birth rates nationally, Black African women continued to have the highest rates at 9%, compared to 7% for White women in 2017-21.

For married heterosexual subfertile couples, ART treatments have been a largely acceptable mode of procreation in the Middle East since the 1980 Fatwa endorsement of IVF by the Grand Shaykh of Egypt's famous religious university, Al Azhar (Inhorn and Gürtin, 2017). While the national healthcare policy in HICs such as Israel, the UAE and the KSA wholly or partially funds the ART treatments, it is only for the natives; there is no state funding for expats and immigrants, leading to an explicit inequity of access (Inhorn and Gürtin, 2017, Gürtin et al., 2015).

There is systematic review-level evidence that access to ART treatments in the USA is generally more challenging for patients of colour compared with non-Hispanic white patients (Humphries, 2016, Jackson-Bey, 2021, Merkison et al., 2023, Wellons et al., 2012). Awareness of insurance coverage amongst Black African and Hispanic women is low, and they often work for self-insured employers exempt from providing mandated insurance coverage (Butts, 2023).

The poorer clinical outcomes, such as lower clinical pregnancy and live birth rate and higher miscarriage rate in minority ethnic women, may be driven by relatively lower socio-economic status, lifestyle, education level, and higher prevalence of comorbidities (Komorowski and Jain, 2022). A significantly greater proportion of African American and Hispanic women had fibroids or tubal factor infertility, less than a 4-year college degree and household incomes below $100,000 compared to white women (Jain, 2006). The disparity in socio-economic status is known to be associated with health disparities, even in the same demographics and healthcare settings (Moor et al., 2017). The secondary data analysis of a Randomised controlled trial – Assessment of multiple intrauterine gestations from ovarian stimulation (AMIGOS) trial: baseline characteristics (Diamond et al., 2015) – showed that income is a strong predictor of clinical outcomes in fertility treatment, including live birth and miscarriage rate (Hansen et al., 2015, Berga, 2016).

Addressing the Challenge of Ethnic and Racial Disparity

Quality of Data and Research

The biggest impediment to getting robust evidence of ethnic disparities is the missing data. The SART USA Clinical Outcomes Reporting System (SART-CORS) database has missing data on race and ethnicity, up to approximately 35%, limiting the validity of disparities research (Humphries, 2016, Merkison et al., 2023, Komorowski and Jain, 2022, Wellons et al., 2012). Policy-mandated patient-level ethnicity and race data reporting can improve the insights and influence funding and public health interventions (Komorowski and Jain, 2022, Butts, 2023).

Qualitative studies and inclusive interventional research to reduce the disparity of access and outcomes based on race and ethnicity are essential and urgent next steps (Korkidakis and DeSantis, 2024).

Education and Awareness

Cultural familiarity education of medical and allied health professionals and understanding the impact of religious and cultural narratives surrounding feelings of isolation, shame, and, ultimately, invisibility is likely to help minimise ethnic and racial inequities (Korkidakis and DeSantis, 2024, Humphries, 2016, Ekechi, 2021).

Inclusive Recruitment

Rectifying the under-representation of women from Black, Hispanic and Asian populations within the subfertility treatment provider space is likely to help (Ekechi, 2021)

Body Mass Index (BMI)

More than 50% of adults are estimated to be overweight or obese across HICs (CDC_USA, 2023, NHS_Digital, 2022, WHO, 2022). The National Institute of Clinical Excellence and Care (NICE), UK, recommends that the ideal range of BMI for optimal outcomes after ART treatment is 19-30. At the same time, the British Fertility Society (BFS) recommends a BMI

cutoff of 35. A systematic review by Maheshwari et al. found an association between a BMI above 25 and a reduced chance of pregnancy and an increased risk of miscarriage. The quality of evidence, though, is poor; there is no reduction in the live birth rate, and therefore, the recommendation is not to decline ART treatment (Maheshwari et al., 2007). Pandey et al. claim that with variation in professional guidance and the evidence on the impact of BMI on ART treatments weak, the case for restricting treatments may not be justified (Pandey et al., 2010).

Dondorp et al., in ESHRE Task Force for Ethics and Law 2010, are concerned about the risk of perinatal morbidity and mortality to both the mother and the child. An 80% relative risk increase of congenital Neural Tube defects and a 30% relative risk increase in congenital Cardiac abnormalities are also quoted in children of obese women. Obese men are also at increased risk of lower testosterone and higher risk of erectile dysfunction (Dondorp et al., 2010). Shah et al. found in the USA that 60.7% of adults 18-75 years support the use of ART treatments in obese women. The expression of support was directly related to the respondent's BMI and inversely related to the respondent's age and education level (Shah et al., 2013). Vahratian et al. found that in the absence of clear national professional guidance and lack of data collection, decisions to offer treatment were down to the clinics (Vahratian and Smith, 2009a). Those against treatment cite a lack of funding and the risk of perinatal complications. At the same time, those in favour believe that the restriction unfairly stigmatises women and delays timely access to effective treatment. The evidence directly related to ART seems poor (Vahratian and Smith, 2009a).

Addressing the Challenge for high BMI Individuals

Data collection and ongoing monitoring

Aggregated data used in meta-analyses linking obesity to ART outcomes are not adjusted for key confounders such as age (Pandey et al., 2010). Better data collection with ongoing

monitoring of adverse outcomes will provide insights into this important health policy issue (Vahratian and Smith, 2009a).

Education

A focus on education and health promotion for this group is required to ensure short—and long-term success in pregnancy outcomes (Vahratian and Smith, 2009a). The ESHRE Taskforce on Ethics and Law recommends education on weight loss because evidence suggests a positive reproductive effect (Dondorp et al., 2010).

Weight loss

Fertility physicians should insist to the patients that a serious effort is made to lose weight (Dondorp et al., 2010, Shah et al., 2013). This should not, however, be expected from women reaching the end of their fertility (Dondorp et al., 2010).

Autonomy and Ethics

It is important to give due consideration so that individuals' fundamental rights are not violated (Vahratian and Smith, 2009a). Restricting treatment may lead to the risk of stigmatisation when infertility is already a psychosocially demanding situation for most (Pandey et al., 2010).

HIV Positive Status

ART treatments, apart from being a solution to subfertility, can be an effective risk reduction strategy to minimise transmission between serodiscordant partners as well as between the mother and the child (Bell et al., 2020a). European and UK law requires special handling and separate storage facilities for gametes and embryos from HIV seropositive individuals (Gigstad et al., 2023). While there is mostly no legal prohibition to treat, there are considerable challenges at the clinic and staff level. In Sweden, the law permits treatment if it is "unlikely" to endanger a mother's or child's life. Since the risk is never zero, most clinics decline treatment as they do not want to take a chance (Gigstad et al., 2023). Pitts et al.

determined that safe treatments are available for HIV-positive individuals and couples in most clinics in Australia. There is a, however, difference in results, with poorer outcomes for HIV-positive women compared to men. The numbers treated also vary between states (Pitts and Shields, 2004).

A thematic analysis done by Bell et al. around Europe identifies the following challenges (Bell et al., 2020a) -

a. Technical access - There are no protocols and equipment to provide safe treatment.

b. Legislation and Policy Access—Individual clinics limit access and do not meet requirements set in policy and professional guidance.

a. Social Dimensions - HIV-positive individuals face discrimination and stigma and choose to avoid access.

Addressing the Challenge for HIV-positive Individuals

The following interventions are suggested to minimise the risk of inequity -

Comprehensive data collection - To understand and rectify the risk of poorer outcomes in HIV-positive women in Australia (Pitts and Shields, 2004). Due to the paucity of scientific publications, more research focus is also recommended on both HIV-positive partners (Pitts and Shields, 2004).

Sharing best practices between regions and countries for those without accessible guidance (Gigstad et al., 2023).

Educating patients by providing accurate information on reproductive options (Bell et al., 2020a).

Providers should be aware and educated to create an environment free of stigma and judgement (Bell et al., 2020a).

Geographic Access

More ART clinics in the USA are in areas with high population density (Nangia et al., 2010). About 90% of women of reproductive age living in states with insurance mandates are served by a clinic nearby, compared to 71% in states with no insurance mandate (Nangia et al., 2010). McGarity et al. in the USA found that 85% of satellite clinics were located near other services' main clinics to compete for their patients (McGarity et al., 2022). About 78% of the satellite clinics were in areas with high median income for gaining business (McGarity et al., 2022). Brodeur et al. studied the geographically underserved populations in the USA and found a correlation between poor affordability and poor access. They also found a correlation with poorer clinical outcomes (Brodeur et al., 2022). In Nordic countries, the ART services are also concentrated in urban areas, leading to higher indirect travel and lodging costs for those in rural areas. Furthermore, harsh weather conditions in the northern region can lead to limited or no treatment access for certain periods of the year (Olafsdottir et al., 2009a).

Addressing the Challenge due to Geographic Access

Improved Insurance Mandate

Comprehensive insurance coverage and a mandate extended to more states will encourage specialists to set up clinics in underserved and rural areas (Brodeur et al., 2022).

Targeted Research

Research to identify areas of unmet need or Geographic inequity burden; use the information to educate health policy experts to identify potential support funding for underserved areas and improve access (Nangia et al., 2010, McGarity et al., 2022).

Perception of Equity of Access

Uniformity of policy and cost across all Nordic countries will improve the perception of equity of access in the Nordic countries' otherwise quite uniform healthcare systems (Olafsdottir et al., 2009a).

Single Women and Same-sex couples

France only started including single women and same-sex couples in funded ART treatments in 2021, and Ireland in 2022 (Fincham et al., 2022). Same-sex couples and Single women have been denied ART treatment in the past (Peterson, 2005b), but the Australian ART legislation has opened up in the last 15-20 years, including Single Women and Same-Sex Couples, more since the legalisation of same-sex marriages in 2017 (Newman et al., 2021). Although legal, stigmatisation and discrimination against single women and same-sex couples in the USA are recognised (Beckman and Harvey, 2005). Based on the European Atlas for Fertility Treatment Policies, the following countries restrict access for Single women and Same-Sex couples by legislation, leading to persistent inequity of access (Fincham et al., 2022, Brigham et al., 2013).

Table 4: European Countries restricting ART treatments for Same-sex couples and Single Women

Austria	No ART treatments for single women and donor egg treatment only for heterosexual or same-sex female couples.
Italy	No ART treatments for single women or same sex couples - female or male.
Germany	No ART treatments permitted for same sex couples - female or male

The HFEA UK Act 2008 amendment replaced the sentence “need for a father” with “need for supportive parenting” from policy to bring the legislation in line with the modern family (HFEA_UK, 2008).

Addressing the Inequity facing Single Women and Same-sex couples

Research

Further research to investigate the following areas is recommended for influencing policy and legislation (Krajewska, 2015)-

- The societal and legal standings of single women
- Understanding the local practice of ART clinics and their decision-making processes.

Inclusive Policymaking

Peterson et al. recommend that single women and same-sex couples be represented on ethics committees that advise policymakers (Peterson, 2005a).

Liberalisation of Regulation

A liberalisation of regulation related to personal characteristics such as sexual orientation and partnership status is likely to increase access (Brigham et al., 2013).

Discussion

Summary of Findings

A summary of the results is presented below under the thematic labels, along with brief suggestions on how to address the challenges.

a. **Access screening** is widely used by funders and treatment providers alike and is prone to exacerbating the inequity of access when clinics set their own criteria. Peterson MM describes it as a paternalistic "gatekeeping" role (Peterson, 2005b). The recommendation for a fair practice of access screening is to set the criteria in a regulatory framework backed by robust evidence and legislation (Vandervort, 2006).

b. The role of **Affordability** in accessing ART treatments is a significant challenge in HICs too (Adamson, 2009a, Klipstein, 2021, Pennings et al., 2008). In Europe, state funding has provided better coverage than the Insurance-based funding systems such as in the USA (Domar et al., 2021, Adamson, 2009b). Overall, fewer than 25% of individuals in the USA have access to resources required to meet their subfertility management needs (Butts, 2023). The introduction of funding support, conditional on the Single Embryo Transfer (SET) policy, improved access and reduced the risk of multiple pregnancies and perinatal complications and Neonatal intensive care admissions in Canada, the USA, and Australia (Shaulov et al., 2015, Kissin et al., 2016, Chambers et al., 2014).

Improved funding set in the statute is recommended (Adashi and Dean, 2016, Beckman and Harvey, 2005). Innovation by creating less expensive but equally effective protocols (Davis and Sokol, 2016) and empowering patients through preventive education will increase capacity (Domar et al., 2021, Beckman and Harvey, 2005). Educating clinic staff to improve communication and be supportive providers will help access (CDC_USA, 2014b). Setting up registries for better and more comprehensive data collection will aid meaningful research for much-needed insights (Lunenfeld, 2004).

c. There is systematic review level evidence that **Ethnic and Racial inequity** is a key challenge to access to and outcomes of ART treatments (Humphries, 2016, Merkison et al., 2023, Butts, 2023). Improved funding, even no-cost treatments, failed to eliminate the inequity of access and outcomes in this group across HICs (Korkidakis and DeSantis, 2024, Mccarthy-Keith et al., 2010, HFEA_UK, 2023a). There is a correlation between minority ethnic status and lower socioeconomic status and poorer reproductive health, including lower median income, lower education level and higher prevalence of comorbidities such as fibroids and blocked fallopian tubes as compared with Caucasian white women. Credible research into the matter is hindered by a lack of quality data collection (Komorowski and Jain, 2022, Wellons et al., 2012).

Comprehensive data collection, data registries and representation of minority ethnic groups in the clinic staff teams and Ethics and Policy Advisory committees will help mitigate the risks of inequity and improve access (Ekechi, 2021).

d. Women with **high BMI** are often excluded from treatment, citing high risks to reproductive health, potentially exposing some to inequity of access. There is evidence suggesting perinatal risks to the mother and the child, but there is no good evidence of a decrease in the live birth rate after ART treatment for overweight women (Maheshwari et al., 2007). Without clear professional guidance and a lack of credible research based on robust

data, the case for restricting treatments is not justified (Pandey et al., 2010). High-quality data collection for ongoing monitoring is imperative (Vahratian and Smith, 2009a). There is, however, a strong case for fertility clinicians to insist on weight loss by patients before providing treatments (Dondorp et al., 2010, Shah et al., 2013).

e. Those with **HIV-positive status** experience stigmatisation, isolation and disparity of access to ART treatments (Gigstad et al., 2023, Bell et al., 2020b). There is no legislation or scientific evidence against treatment in a well-managed patient. The problem primarily is a lack of adequate equipment, protocols and experience and having confidence in treating HIV-positive patients at the clinical level (Bell et al., 2020b). Clear national protocols for clinics and sharing best practices will improve confidence and access (Bell et al., 2020b).

f. ART services often choose to be in urban areas with a higher socioeconomic status demographic. This maximises business but leads to **inequity of Geographic access** for those with no or low coverage by ART services (McGarity et al., 2022, Nangia et al., 2010). In addition, in Nordic countries, harsh weather can restrict access for individuals in the northern region for part of the year (Olafsdottir et al., 2009a).

g. While the majority of the HICs now are open to treating **Single women and Same-sex couples**, there remain some HICs that restrict treatment by legislation - Italy, Austria, Germany, UAE and KSA (Inhorn and Gürtin, 2017, Brigham et al., 2013, Fincham et al., 2022). A degree of stigmatisation and discrimination continues to add to the inequity (Beckman and Harvey, 2005).

Interpretation and Comparison to Current Research

This scoping review included 58 studies from 2004-2024 across HICs. The objective was to identify the causes of inequity in access to ART treatments and how to address the challenges. A thematic synthesis of the data has shown that seven distinct themes emerged as the causes of inequity in HICS, as shown in Table 2, suggesting a pervasive presence of disparity of

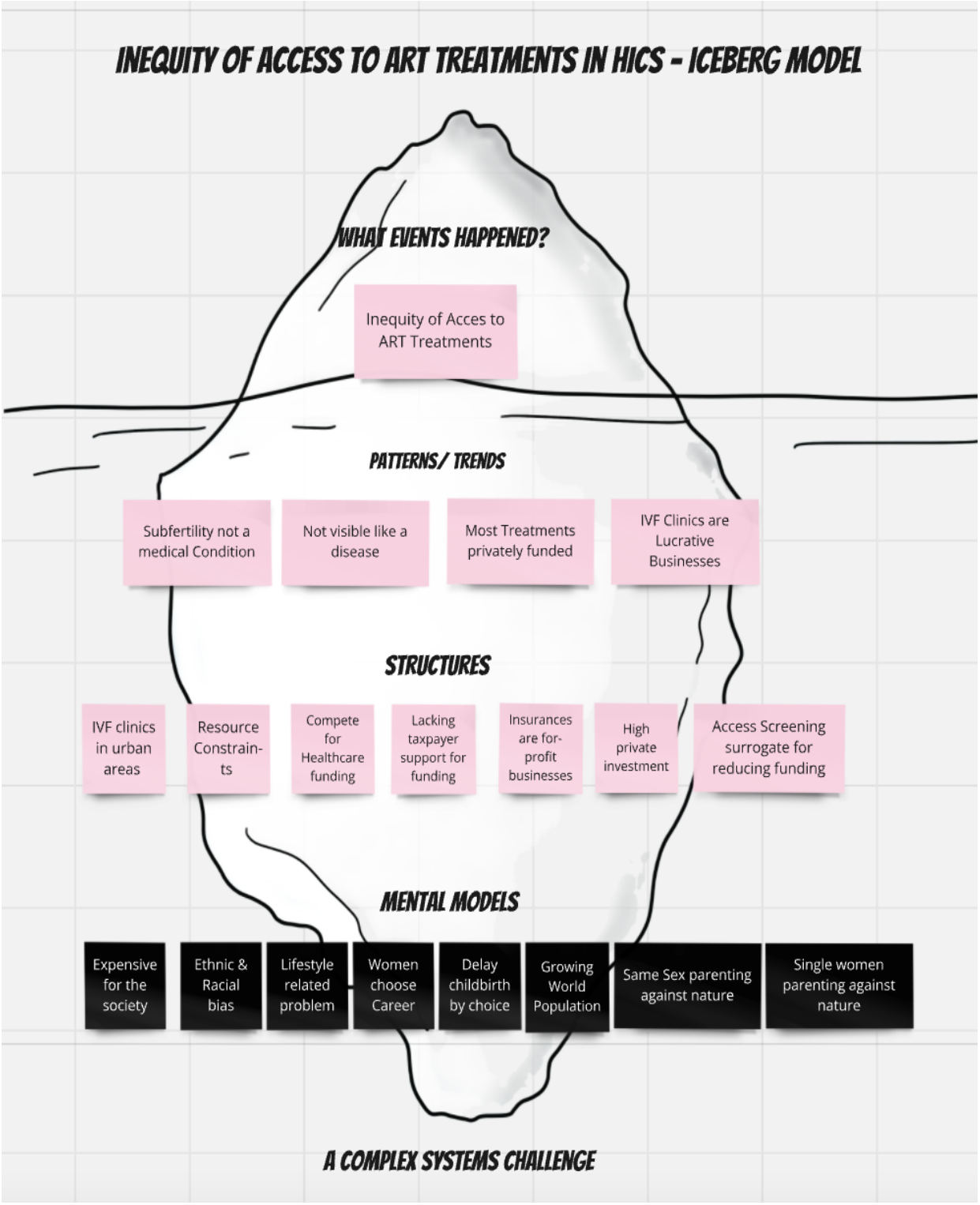
access (Davis and Sokol, 2016, Beckman and Harvey, 2005, Berga, 2016). A scoping review by Huddleston et al. from the USA found similar themes (Huddleston et al., 2023), apart from the disparity caused by "Access Screening" and the challenges faced by "HIV-positive" and "High BMI" individuals, which are unique to this review. Another scoping review by Mackay et al. (Mackay et al., 2023) aimed at global populations found "geographic access" as the most mentioned challenge and no mention of access screening, same-sex or single women, HIV-positive or High BMI individuals. The disparity for minority ethnic populations comes out strong in both.

Out of the identified seven themes, inequity due to lack of affordability and Ethnic and Racial inequity is the most quoted in this review. ART treatments are expensive, and more than one cycle is often needed. Past literature has shown Affordability as a dominant challenge in LMICs (Ombelet, 2019, Njagi, 2023) and HICS (Dyer, 2013, Chambers and Sullivan, 2009). It is not a surprise that affordability is a key challenge identified in this review, too. Ethnic & racial bias has emerged strongly in this review, with Systematic review grade evidence (Humphries, 2016, Wellons et al., 2012). Access to as well as outcomes of ART treatments is impacted negatively in women of colour (Davis and Sokol, 2016, Dongarwar et al., 2022) compared to Non-Hispanic White women. The inequity persists even when fully funded treatments are available (Mccarthy-Keith et al., 2010, Correia and Kraschel, 2023).

The interpretation of the themes is context-dependent, mutually interdependent and constitutes a complex adaptive systems challenge (Meadows, 2001, Scharmer and Kaufer, 2013). Despite the evidence of high psychosocial morbidity (Boivin and Lancastle, 2010, Wischmann T, 2012) and increased all-cause mortality amongst subfertile individuals (Murugappan, 2020), deeply embedded, antiquated mental models continue to lead to prevalent structures and trends that fail to recognise subfertility as a medical condition, further leading to inequity as shown in the Iceberg model in Figure 5 below. A sustainable

solution while working on the evidence-based interventions identified in this review and a robust implementation plan must include an effort to implement a paradigm change (Meadows, 1991).

Figure 3: The Iceberg Model - Illustrating the manifest events and the underlying driving trends, structures and mental models



Practice & Policy Implications and the Interventions

In line with the objective and based on the evidence extracted from the included studies in this scoping review, Table 5 below presents the Practice and Policy implications of addressing the inequity of access to ART treatments in HICs. In addition, six common interventions have emerged from the evidence in the scoping review, shown here with targeted solutions for enhancing equity, alongside the practice and policy implications as a source of further details of implications. Interventions 1,2 & 3 are common for all identified causes, while 4,5 & 6 contribute to some inequities. Together, these interventions are key vehicles for the equitable delivery of ART treatments-

1. Data & Research
2. Education and Awareness
3. Law and Regulation
4. Inclusive recruitment
5. Inclusive Ethics and Policy Committees
6. Innovation

Table 5: Policy & Practice Implications with specific Interventions to enhance equity

	Implications		**Interventions for addressing the inequities**					
Source of Inequity ↓	**Practice**	**Policy**	**Data & Research**	**Education & Awareness**	**Law & Regulation**	**Inclusive Recruitment**	**Inclusive Ethics & Policy Committees**	**Innovation**
Access screening →	Fair & equitable screening criteria Regular review of criteria backed by robust evidence and law	Only to use published Access criteria set in policy and regulation	High Quality access Data collection for regular monitoring	Easily understood Information for patients	Set up Access Criteria in Policy & Regulatory framework	NA	NA	NA
Affordability →	Payment plans Selling whole treatment not cycles – A Value Based Health Care model	State funding set in Statute Universally Mandated Comprehensive Insurance coverage	High Quality Data collection on Family Income for regular monitoring	Increase Policymakers' Awareness on Subfertility being a Medical Condition Patient education about Lifestyle & risk factors for prevention	Equitable funding (state or insurance) set in law Funding to be conditional to Single Embryo Transfer if clinically justified	NA	NA	Innovative low-cost treatment protocols Telemedicine for rural areas
Ethnic & Racial bias →	Information for patients in different languages and formats Cultural familiarity training for practice staff	Policy-mandated comprehensive patient level ethnicity and race data collection	High Quality Ethnicity and Race data collection for regular monitoring Inclusive Qualitative research	Diversity, Equality and Inclusion training to practice staff	Policy mandate for reducing Ethnic & Racial inequity	Inclusive recruitment in Practice teams	Minorities' representation in Ethics and Policy Advisory Committees	Innovative low-cost treatment protocols

	Implications		Interventions for Addressing the Inequities					
Source of Inequity ↓	**Practice**	**Policy**	**Data & Research**	**Education & Awareness**	**Law & Regulation**	**Inclusive Recruitment**	**Inclusive Ethics & Policy Committees**	**Innovation**
High BMI →	Weight loss and lifestyle Education & Awareness programmes	Uniform science backed BMI cutoff, set in Regulation and Policy	High Quality BMI and associated outcomes data collection for regular monitoring	Patient education on Lifestyle, Nutrition & Dietetics for prevention and healthier outcomes	Review policy to minimise risk of unfair exclusion Include evidence-based BMI cut off in Policy	NA	NA	NA
HIV-Positive →	Safe protocols and equipment Sharing best practices and guidelines between countries and regions	Policy on safe treatment of HIV-positive individuals	High Quality outcomes data collection for HIV-positive individuals for regular monitoring	Educating practice staff to mitigate concerns and Improve acceptance for treatment Information on options for patients	Inclusive policy and regulation with safe practice guidance	Inclusive recruitment in Practice teams	Representation of HIV-positive patients in Ethics & Policy advisory Committees	Telemedicine for minimising in person contact
Geographic Access →	Practices to set up Satellite clinics in rural areas Telemedicine	Universal Funding & Insurance mandate will encourage clinics to set up in rural areas	Research to identify geographic areas of unmet need	Educating policy makers on geographic inequity burden	Policy to include support for travel costs where applicable	NA	NA	Telemedicine for rural areas for access to specialist opinion
Same-Sex or Single women →	Understanding and influencing local decision making in practices	Inclusive Policy Liberalisation of regulation	Research on societal and legal standing of Single women and Same-Sex pairs	Educating practice staff on inclusive practice Awareness of available options	Policy against discriminatory practices	Inclusive recruitment in practice teams	Representation of Same-sex couples and Single women in Ethics & Policy advisory Committees	NA

Implementation

A vital next step proposed for delivering the objective of this research, "Addressing the Inequity of Access to ART Treatments in HICs," is to develop an implementation framework for the contribution to practice based on the Consolidated Framework for Implementation Research (CFIR 2022). This framework will provide a suitable tool to help address the seven sources of inequity using the six interventions identified. A robust implementation and sustainability plan is essential for these interventions to be successful. This framework will also need to be tested and validated in real-world practice.

The five domains of the updated Consolidated Framework for Implementation Research (CFIR 2022) (Damschroder et al., 2022) are comprehensive and suitable, given the highly contextual nature of this complex adaptive systems challenge at hand (Senge and Kania, 2019, Lisa Dreier, 2019).

The five Domains of CFIR -

Domain 1 - The Intervention or Implementation that is planned - The six key interventions identified in this scoping review for enhancing equity.

Domain 2 - The Outer Setting is the external context, including the Country, Population mix, Cultural and Social Factors, Funding, Policy and Professional Guidance.

Domain 3 - The Inner setting is the organisational context, including the Physical Infrastructure of Practices and Networks of practices, Knowledge management systems, Communication and Organisational Culture.

Domain 4 - The individual domain includes the Leadership team, Policymakers, and implementation team in the Practices—all their beliefs and preferences, culture, incentives and motivations for managing subfertility and providing ART treatments and the motivation to support a successful implementation.

Domain 5 - The Implementation Domain, where the key elements are

- Stakeholder engagement
- Change management
- Innovation delivery
- Sustainability planning, Data collection
- Ongoing monitoring and Evaluation

Sustainability

Trisha Greenhalgh's NASSS framework (Nonadoption, Abandonment, Scale-up, Spread and Sustainability) will be used (Greenhalgh et al., 2017) to ensure the sustainability and successful embedding of the six Interventions and Innovative treatment protocols related to enhancing the equity of access to ART treatments.

Leadership and Change Management

An overarching systems leadership and change management plan are required to solve this complex adaptive systems problem. A deep understanding of multiple contexts, with a mix of other suitable leadership styles, as suggested by Goleman in "Leadership that Gets Results (Goleman, 2000) -

- Affiliative leadership style for developing emotional bonds and relationships with those involved (Hillier, 2013). Convening the conversations for understanding their incentives.
- A Democratic Leadership style where team members feel valued and empowered to deliver the objective (Follett, 1926).
- An Adaptive Leadership style for when inevitable uncertainties arise, utilising the team's collective intelligence to find solutions and get engagement for prompt action (Heifetz et al., 2009).

- An Authoritative Leadership that shares the vision of equitable service delivery to Subfertile women already facing high psychosocial morbidity (Goleman, 2000, Yukl, 1990). And having the power to persuade (Cialdini, 2002).

Overall, this contributes to fostering engagement and empowerment at the clinical staff level to align with the objective of reducing inequity by raising Awareness and Education, supported by comprehensive Data collection. Taking a bottom-up approach to change management involving practice staff, organisational leadership at the local and national levels, as well as funders and policymakers.

Strengths and Weaknesses

The strengths and weaknesses of this Scoping Review are important to note.

Strengths

The review included 58 studies from various contexts (see the Treemap in Figure 4) and a diverse range of study types (see Appendix 2). With the extensive exploration of the landscape and comprehensive inclusion of literature, a set of distinct themes emerged, suggesting the causes of inequity with high confidence. A diversity of perspectives included sharing multiple viewpoints, giving the Scoping Review a more robust standing. The comprehensive exploration also allows this Scoping Review a higher potential to identify more gaps for suggesting future research and use more funding opportunities. This Review's comprehensive study makes it useful for policymakers, potentially becoming an influential source of policy information.

Weaknesses

While this Scoping review covers a wide range of literature, it is limited in its deep exploration and lacks a more nuanced understanding of a topic. It provides a surface overview of the inequity of access to ART treatments in HICs, which is less reliable evidence than systematic reviews or interventional research in specific areas. The quality appraisal is

not included, which may reduce the credibility of the evidence charted and make it less influential. The risk of bias is higher in this Scoping Review because the author may have inadvertently been selective about included studies, leading to a bias in fair representation of causes of inequities.

Gaps in Research

The evidence synthesis in this scoping review has given clear insights into the common challenges leading to inequity of ART treatment access. Clear gaps in research are also identified that need to be addressed -

1. Current research on the impact of Social Class on the inequity of access is limited (Tierney, 2022). Recognising a need for a nuanced understanding of how the disparities are caused by factors such as sociodemographic, ethnic and racial status, high BMI, and possibly also HIV-positive status, the role of Social Class is a research gap and could be explored more.
2. AI is showing potential in facilitating the outcomes of ART treatments (Salih et al., 2023). AI Tools have shown promise by identifying good embryos non-invasively, with a high chance of successful pregnancy (Meseguer Escriva et al., 2022, Paya and Meseguer, 2023). There is a potential to bring success closer, reduce time to baby and, therefore, cost to baby, enhancing equity of access to ART treatments. More research is required to make this technology universally accessible and affordable.
3. Why does there remain an inequity of access to ART treatments in ethnic and racial minorities, even in the presence of the availability of treatments with no out-of-pocket cost (Messaoud et al., 2023)?
4. Access screening has emerged as contributing to the inequity of access to ART treatments in HICs (Peterson, 2005a, Vandervort, 2006). More research is needed to understand how access screening causes the inequity and deal with it comprehensively.

5. More research is required to identify an evidence-based cutoff for BMI at which it starts impacting reproductive outcomes. Current evidence for this is weak (Pandey et al., 2010), leading to variation in practice and inequity of access to ART treatments (Maheshwari et al., 2007).

Personal Reflections & Conclusion

Reflecting on my journey through this scoping review on the inequity of access to ART treatments in HICs, I have gained extensive awareness of the intricate complexities around this issue. Working as a fertility specialist over the last twenty years, I increasingly feel the heavy burden of psychological distress my patients face being subfertile. The emotional toll these inequities impose on many of these individuals is in addition to the financial strains experienced in their pursuit of parenthood. I reflect on the impact of an outdated paradigm of viewing subfertility as an outcome of personal choice and lifestyle rather than a serious medical condition, causing significant harm by justifying the lack of attention from policymakers and funders.

This review has strengthened my appreciation of the pervasive nature of the underlying health disparities in accessing ART treatments and the fact that these complex adaptive systems challenges exist in HICs, too. I gained insights into the critical role context plays and how socio-economic factors, cultural beliefs, and healthcare policies come together to create a landscape where access to ART remains a privilege rather than a right. The impact on the marginalised communities stands out to me: those who are minority ethnic, HIV-positive, or those in same-sex relationships and single women. The use of Access screening to exclude patients without basis in robust scientific evidence or legislation is not justifiable. An example is the lack of evidence around the cut-off for BMI, where reproductive outcomes are poorer. However, when the risk of complications in pregnancy in overweight women is high,

with risk of causing harm to the mother and baby, prior weight loss must remain a justifiable pre-condition before ART treatment.

I have realised the crucial role my learning from the eight modules of my Masters in Global Healthcare Leadership will play in delivering this objective. As proposed in the relevant sections above, understanding the systems change process, having a robust implementation plan for the identified interventions, effective leadership, role of innovation, and a bottom-up change management plan will be the critical success factors. I recognise the need for interdisciplinary collaboration between healthcare professionals, patient advocacy groups, regulators, and policymakers to introduce effective and sustainable solutions.

Through this journey, my personal dedication to this cause has become stronger. The insights I have gained have driven my commitment to advocating a systemic change for health equity in access to ART treatments. To sum up, this scoping review has not only enhanced my academic knowledge and given me practical solutions for implementation, but it also emphasises my significant role as a future leader in global healthcare, underscoring the need for advocacy and active involvement in shaping policies that guarantee equitable access to ART treatments for all individuals, regardless of their background.

Appendix A - Study Protocol

Title: Addressing the Inequities in Access to Assisted Reproductive Technology (ART) Treatments in High-Income Countries- A Scoping Review.

Abstract

Objective: The scoping review's objective is to explore the existing literature, systematically identifying the factors leading to inequity in access to Assisted Reproductive Technology (ART) treatments in High-Income Countries (HICs) and propose strategies for improving access.

Introduction: Subfertility is defined as a disease of the reproductive system when an individual fails to conceive after twelve months or more of regular unprotected sexual intercourse. One in six individuals, on average globally, is likely to seek help to conceive. ART treatments are known to be unaffordable by a large proportion of the population in Lower-Income and Lower and Middle-Income Countries (LMICs). There is some evidence suggesting that the same may be true in HICs. While lack of affordability is the main cause of difficulty in access to ART treatments in LMICs, it is not expected to be as big a problem in HICs because of the availability of some degree of state funding or insurance. The inequities existing in HICs may be different, such as geographical access, ethnicity and race, educational achievement, deprivation, gender identity, etc. Subfertile individuals, while waiting, are known to suffer from significant psychosocial morbidity, which becomes a long-lasting problem if they remain unsuccessful.

Methods: The scoping review will be conducted following the Joanna Briggs Institute Manual of Evidence Synthesis, with guidance also taken from the Open Science Framework (OSF) methodology. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews' (PRISMA-ScR) will be used for mapping and synthesising the evidence.

Inclusion Criteria: The PCC framework—Participants, Context, and Concept—will be applied. Publications, policy or position statements, professional guidance, and grey literature that explores inequities in access to ART treatments, focusing on HICs, as defined by the World Bank criteria, will be included. A breadth of relevant literature published on humans over the last twenty years, 2004-2024, in the English language will be included for robustness.

Exclusion Criteria: The studies involving fertility preservation, cross-border access, and difficult access due to Covid19 will be excluded.

The Protocol of the review will be published in the Open Science Framework (osf.io), a priori.

Introduction:

Subfertility - Definition and prevalence: The World Health Organisation (WHO) defines Subfertility as a disease of the male or female reproductive system characterised by the failure to achieve a pregnancy after twelve months or more of regular unprotected sexual intercourse. Evidence suggests that, on average, one in every six couples of reproductive age worldwide experience subfertility in their lifetime. The prevalence is higher in sub-Saharan Africa, up to around one in three individuals (WHO, 2023). The WHO estimates that 48.5 million to 186 million individuals may be subfertile globally(WHO, 2023). Since the first successful IVF treatment in the UK in 1978, an estimated ten to twelve million children have been born globally with the help of assisted reproductive technology (ART)(ESHRE, 2022).

Assisted Reproductive Technology (ART)

ART treatments are advanced fertility treatments where egg and/or sperm are handled outside the body in an embryology laboratory to assist conception. Common ART treatments (Rowell, 2003) are–

In vitro fertilisation (IVF) —Fertilisation is aided by mixing eggs and sperm in a suitable medium in the laboratory, followed by embryo transfer into the womb a few days later.

Intracytoplasmic sperm injection (ICSI) —An advanced technique where a single sperm is injected directly into each available egg to aid fertilisation, used mainly in cases of male factor subfertility.

Background: “Control over reproduction is central to personal identity, to dignity, and to the meaning of one's life," as quoted by Robertson JR in the essay, The Invisible Woman (Robertson, 1994). About one in six individuals in the world will likely need help conceiving (WHO, 2023). A proportion of these will need Assisted Reproductive Technology (ART) treatments, such as Invitro Fertilisation (IVF) or Intracytoplasmic Sperm Injection (ICSI), as a last resort. Despite ART treatments having been around for more than four decades, the treatments remain inaccessible to a significant proportion of the global population for various reasons (Dyer, 2013), with affordability being the biggest challenge. The cost for one ART cycle is relatively high and unaffordable in LMICs (Njagi, 2023) but may also be a problem in HICs (Chambers and Sullivan, 2009). The cost of one standard ART cycle in 2008-9 was 50% of an annual disposable income in the United States and 20% in Scandinavia and the United Kingdom, the latter with state funding support, depending on out-of-pocket expense (Chambers and Hoang, 2014). According to a recent Human Fertilisation and Embryology Authority (HFEA) report, 63% of IVF treatments in the UK in 2021 in women under 35 years were privately funded (HFEA_UK, 2023c). The disadvantage is compounded by the scientific and biological fact that infertile women will need more than one and often many ART cycles for success. There is a risk of desperate patients making catastrophic financial decisions, leading them to what can be described as “a fertility poverty trap”. In extreme situations, women generally end up in severe economic difficulties, even abandonment, divorce, poor health, and starvation (Dyer, 2013, Ombelet, 2019, Inhorn,

2023). While suffering from subfertility, approximately one-third of women and one-tenth of men get a psychiatric diagnosis (Volgsten and Ekselius, 2008, Volgsten and Ekselius, 2010). About two-thirds of all treated patients do not meet their parenthood goals and are known to have an increased risk of living with lower self-esteem (Wischmann T, 2012, HFEA_UK, 2023b). And for those remaining unwillingly childless, a large proportion suffer from lifelong loss and psychosocial morbidity.

Objective: Access to ART treatments is a challenge for a significant number of people globally, including those in HICs. This scoping review explores the breadth of published and unpublished literature to identify and address the inequities in access to ART treatments in High-Income Countries as defined by the World Bank.

Methods: This scoping review will follow the Joanna Briggs Institute Manual of Evidence synthesis (Aromataris and Lockwood, 2024) methodology, with guidance also taken from the Open Science Framework methodology (Lely, 2023). Furthermore, the knowledge synthesis in this Scoping review will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews' (PRISMA-ScR) systematic methodology for mapping and presenting the evidence (Tricco et al., 2018).

Research Questions: It is widely recognised that there are challenges in access to ART treatments globally. While affordability, policy, and geographic access are known to be major factors in Low-Income and Low-Middle-Income Countries. The Upper-Middle-Income and High-Income Countries may not be immune to the challenges. There is a paucity of research in this area for high-income countries. To cover a wide range of factors that potentially can influence access to ART treatments, the following research question will be the primary study question -

What are the Inequities in accessing Assisted Reproductive Technology treatments in High-Income countries (HICs)?

The following question will be a Secondary Objective -

How can we mitigate the risk of Inequity of Access to ART Treatments in HICs?

Together, the primary and the secondary objectives form a robust basis for the title of this Scoping Review-

Addressing the Inequities in Access to Assisted Reproductive Technology (ART) Treatments in High-Income Countries- A Scoping Review.

Inclusion criteria: The inclusion criteria for the studies will be based on the PCC framework — Participants, Context, and Concept—which is most suitable for a scoping review exploring the landscape (Munn, 2022, Aromataris and Lockwood, 2024) of inequities in access to ART treatments.

Participants - Individuals needing help with ART treatment to conceive, including women and men, single and couples both heterosexual and same-sex.

Exclusion Criteria: The following types of studies will be excluded -

- ART treatments for Fertility Preservation for oncology or gender identity disorders
- ART treatments for social Fertility Preservation
- Studies on cross-border access to ART treatments
- Studies on Challenges to Access from Covid19
- Studies focusing on animals
- Literature published before 2004

Context—The Scoping review will focus on High-Income Countries as defined by The World Bank Classification, based on Gross National Income, which is gross national income converted to international dollars using purchasing power parity rates(Worldbank_data_1962-2022, 2024).

Defining the Context: The World Bank's classification of the world's economies is based on gross national income (GNI) per capita estimates. The GNI is gross national income

converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. The most current World Bank Income classifications by GNI per capita (updated July 1 of every year) are as follows:

- Low income: $1,025 or less
- Lower middle income: $1,026 to $4,035
- Upper middle income: $4,036 to $12,475
- High income: $12,476 or more

Concept - The concept of interest for this scoping review is identifying the Inequities in Access to ART treatments and identifying research on strategies to improve access.

Study Selection: The study search strategy will be designed to be as comprehensive as possible in identifying reviews and primary studies, published and unpublished, that are suitable for answering the Research Questions. Studies in the English language between 2000 and 2024 will be included. The range of the years included is large and will compensate for including only English language studies. A strategy that will search for evidence via a variety of appropriate sources will be adopted, such as:

Electronic databases -

a) PubMed Medline

b) Epistemonikos is a collaborative, multilingual database of health evidence supported by The Epistemonikos Foundation.

c) The Cochrane Database of Systematic Reviews, a part of Cochrane Collaboration, is an international body supported in the UK by the UK Cochrane Centre, which is based in Oxford.

d) Scopus, an abstract and citation database for biomedical electronic research, that has a wide journal reach covering rather recent literature, starting 1995.

8) Reference lists of relevant publications.

9) Hand-searching of the key journals.

10) Existing networks and conferences.

11) Professional organisations such as the European Society for Human Reproduction and Embryology (ESHRE), British Fertility Society (BFS) and American Society of Reproductive Medicine (ASRM).

Study Search Criteria: The search criteria will attempt to achieve a systematic and comprehensive coverage of the evidence purposefully aligned with the study questions. The search string MeSH terms and Keywords will be shared for all searches.

Keywords: Assisted Reproductive Technology, Invitro Fertilisation, IVF, Access, Inequity of Access, Disparity of Access, High-Income Countries.

Search results: The search results will be systematically presented according to JBI methodology (Aromataris and Lockwood, 2024), quoting the number of relevant studies identified and selected. The reasons will be given to justify inclusion or exclusion decisions. A PRISMA flowchart will also be included, sharing the stages of the review decision process to identify the most appropriate, relevant literature aligned with the systematic methodology adopted (Tricco, 2018), the search criteria, and the study questions to ensure the inclusion of a breadth of literature.

Data extraction and Analysis: A modification of the standard data extraction form from the JBI data extraction template (Aromataris and Lockwood, 2024) will be produced to have two separate data charts -

1. **Study Characteristics table,** which extracts and charts the following information -

h. ID Number - a running numeric ID

i. Author(s) and Year of Publication

j. Publishing Journal

k. Study Context

l. Study Participants and Sample size, if relevant and available

m. Methodology or Study Design

n. Citation

2. **Study Findings table**, which extracts and charts the following information -

e. Author(s) & Reference

f. Aim/ Objective of the study

g. Findings in the study

h. Improvement strategies proposed in the study

Results and Conclusion: A descriptive narrative synthesised from the relevant conclusions based on the extracted data will be written, aligned with the primary and secondary study questions, systematically mapping the landscape to identify the inequities in access to ART treatments and propose strategies to improve access. This systematic landscape research may further lead to more relevant research, such as Systematic reviews, to give more certain answers or may be used by stakeholders, such as policymakers considering a policy review.

Recommendation

The impact of the increasing global population and climate change has been central to the geopolitical agenda of global health. Family planning has been a policy priority for reproductive health globally, while the subfertility aspect of reproductive health has been sidelined (Wang, 2022, Connolly, 2009). Clear evidence suggests a rapid fall in the Total Fertility Rate across most countries. For example, in England and Wales, the total fertility rate is 1.48 children born to each woman during her fertile life, while the replacement rate for

the population at the current levels is 2.1 children (Ermisch, 2023, Ermisch, 2021). A policy imperative may start developing, facilitating change in the paradigm of population control towards supporting redistribution of healthcare funding towards increased funding of ART treatments.

Appendix B - Study Characteristics Table

Number	Author(s)	Journal	Study Context	Population and sample size	Methodology	Citation details
Global/ Multinational						
1	**Adamson, G.D.** (Adamson, 2009)	Women's Health	Global	Individuals seeking ART treatments globally	Special Report- Expert Opinion	Adamson, G. D. (2009) Global cultural and socioeconomic factors that influence access to assisted reproductive technologies. *Women's health (London, England)*. [Online] 5 (4), 351–358.
2	**Domar A et al.** (Domar et al., 2021)	RBMO	9 countries - USA, Canada, UK, France, Germany, Italy, Spain, Australia and China	Patients experiencing subfertility, 1944 Respondents of the questionnaire (1037 patients and 907 partners)	Cross Sectional Quantitative Research Study	Domar, A. et al. (2021) Barriers and factors associated with significant delays to initial consultation and treatment for infertile patients and partners of infertile patients. Reproductive biomedicine online. [Online] 43 (6), 1126–1136.
3	**Dyer S et al.** (Dyer et al., 2020)	RBMO	Global	Subfertile population	ICMART Commentary (International Consortium for Monitoring ART)	Dyer, S. et al. (2020) ART utilization: an indicator of access to infertility care. Reproductive biomedicine online. [Online] 41 (1), 6–9.
4	**Lass A et al.** (Lass and Lass, 2023)	Human Fertility	G20 countries	Individuals seeking ART treatments	Article Commentary	Lass, A. & Lass, G. (2023) Inequalities in assisted reproduction technology utilisation between the G20 countries. Human fertility (Cambridge, England). [Online] ahead-of-print (ahead-of-print), 1–6.
5	**Lass A et al.** (Lass et al., 2019)	Journal of Medical Economics	Global	Individuals seeking ART treatments	Retrospective Cohort Study Using ICMART Data	Lass, A. et al. (2019) Correlation between gross domestic product, utilization of in vitro fertilization, and pregnancy success rate across the world. Journal of medical economics. [Online] 22 (9), 878–882.
6	**Peterson MM et al.** (Peterson, 2005)	Journal of Medical Ethics	High-Income Countries	Individuals seeking Fertility treatments -	Opinion Study - Ethics and Legal Perspectives on Access and Equity	Peterson, M. M. (2005) Assisted reproductive technologies and equity of access issues. Journal of medical ethics. [Online] 31 (5), 280–285.
7	**Lunenfeld B et al.** (Lunenfeld, 2004)	Human Reproduction Update	Global with focus on HICs and mainly Europe	Those seeking fertility care, mainly ART treatments.	Report	Lunenfeld, B. & Van Steirteghem, A. (2004) Infertility in the third millennium: implications for the individual, family and society: Condensed Meeting Report from the Bertarelli Foundation's Second Global Conference. Human reproduction update. [Online] 10 (4), 317–326.
USA						

8	**Adashi E.Y. et al.** (Adashi and Dean, 2016)	Fertility & Sterility	USA	Individuals seeking ART treatments	Invited Narrative Review	Adashi, E. Y. & Dean, L. A. (2016) Access to and use of infertility services in the United States: framing the challenges. Fertility and sterility. [Online] 105 (5), 1113–1118.
Number	**Author(s) (Reference)**	**Journal**	**Study Context**	**Population and sample size**	**Methodology**	**Citation details**
9	**Beckman L.J. et al.** (Beckman and Harvey, 2005)	Journal of Social Issues	USA	Individuals seeking ART treatments in the USA	Narrative Review	Beckman, L. J. & Harvey, S. M. (2005) Current Reproductive Technologies: Increased Access and Choice? Journal of social issues. [Online] 61 (1), 1–20
10	**Brodeur T.Y. et al** (Brodeur et al., 2022)	Reproductive Sciences	USA	Populations geographically underserved for ART services	Narrative Review	Brodeur, T. Y. et al. (2022) Access to Fertility Care in Geographically Underserved Populations, a Second Look. Reproductive sciences (Thousand Oaks, Calif.). [Online] 29 (7), 1983–1987.
11	**Davis O.K. et al.** (Davis and Sokol, 2016)	Fertility & sterility	USA	Subfertile population	Conference Brief	Davis, O. K. & Sokol, R. Z. (2016) Introduction Access to fertility care. Fertility and sterility. [Online] 105 (5), 1111–1112.
12	**Dongarwar et al.** (Dongarwar et al., 2022)	Systems Biology in Reproductive Medicine	USA	Subfertile population	Retrospective Cohort Study	Dongarwar, D. et al. (2022) Racial/ethnic disparities in infertility treatment utilization in the US, 2011-2019. Systems biology in reproductive medicine. [Online] 68 (3), 180–189.
13	**Farley OS et al.** (Farley Ordovensky Staniec and Webb, 2007)	Health Services Research	USA	1210 Subfertile women	National Survey of Family Growth USA (NSFG USA)	Farley Ordovensky Staniec, J. & Webb, N. J. (2007) Utilization of Infertility Services: How Much Does Money Matter? Health services research. [Online] 42 (3p1), 971–989.
14	**Hammoud AO et al.** (Hammoud et al., 2009)	Fertility & Sterility	USA All states	Patients undergoing ART treatment	Demographic analysis of public data	Hammoud, A. O. et al. (2009) In vitro fertilization availability and utilization in the United States: a study of demographic, social, and economic factors. Fertility and sterility. [Online] 91 (5), 1630–1635.
15	**Correia KFB et al.** (Correia and Kraschel, 2023)	American Journal of Obstetrics and Gynecology	USA	Women seeking ART treatments	Retrospective Cohort Study using Society of Assisted Reproductive Technology USA data.	Correia, K. F. B. et al. (2023) State insurance mandates for in vitro fertilization are not associated with improving racial and ethnic disparities in utilization and treatment outcomes. American journal of obstetrics and gynecology. [Online] 228 (3), 313.e1-313.e8.
16	**Kissin D et al.** (Kissin et al., 2016)	Obstetrics Gynecology	USA	Women seeking ART treatments	Review Article	Kissin, D. M. et al. (2016) Fertility Treatments in the United States: Improving Access and Outcomes. Obstetrics and gynecology (New York. 1953). [Online] 128 (2), 387–390.
17	**Komorowski AS et al.** (Komorowski and Jain, 2022)	Reproductive Biology & Endocrinology	USA	Women seeking subfertility care	Narrative Review	Komorowski, A. S. & Jain, T. (2022) A review of disparities in access to infertility care and treatment outcomes among Hispanic women. Reproductive biology and endocrinology. [Online] 20 (1), 1–1.
18	**Korkidakis A et al.** (Korkidakis and DeSantis, 2024)	Fertility & Sterility	USA	Women seeking ART treatments	Cross-Sectional Study	Korkidakis, A. et al. (2024) State Insurance Mandates and Racial and Ethnic Inequities in Assisted Reproductive Technology Utilization. Fertility and sterility. [Online] 121 (1), 54–62.
19	**McCarthy-Keith DM et al.** (Mccarthy-Keith et al., 2010)	Fertility & Sterility	USA	2050 women undergoing first cycle,fresh, nondonor ART from 2000 to 2005	Retrospective Cohort study	McCarthy-Keith, D. M. et al. (2010) Will decreasing assisted reproduction technology costs improve utilization and outcomes among minority women? Fertility and sterility. [Online] 94 (7), 2587–2589.

Number	Author(s) (Reference)	Journal	Study Context	Population and sample size	Methodology	Citation details
20	**McGarity MZ et al.** (Mcgarity et al., 2022)	BMC Health Services Research	USA	Women seeking ART treatments	Cross-sectional study	McGarity, M. Z. et al. (2022) Impact of satellite clinics on geographic access to assisted reproductive technology services in the United States. BMC health services research. [Online] 22 (1), 1–928.
21	**Nangia AK et al.** (Nangia et al., 2010)	Fertility & Sterility	USA	Women and Men of reproductive age Women 20-44 years Men 20-49 years	Cross-sectional Study	Nangia, A. K. et al. (2010) Access to assisted reproductive technology centers in the United States. Fertility and sterility. [Online] 93 (3), 745–761.
22	**Shah DK et al.** (Shah et al., 2013)	Journal of Women's Health	USA	Adults aged 18-75 years old in the USA, Men and Women	Quantitative Survey	Shah, D. K. et al. (2013) Public opinion regarding utilization of assisted reproductive technology (ART) in obese women. Journal of women's health (Larchmont, N.Y. 2002). [Online] 22 (11), 978–982.
23	**Vahratian A et al.** (Vahratian and Smith, 2009)	Human Reproduction	USA	Overweight women seeking fertility treatment	Cross Sectional Descriptive Study	Vahratian, A. & Smith, Y. R. (2009) Should access to fertility-related services be conditional on body mass index? Human reproduction (Oxford). [Online] 24 (7), 1532–1537.
24	**Butts S et al.** (Butts, 2023)	Fertility & Sterility	USA	Minority Ethnic patients seeking access to ART treatments	Narrative Review study	Butts, S. & Dokras, A. (2023) Recognizing racial and ethnic disparities in women's reproductive health is not enough. Fertility and sterility. [Online] 119 (3), 339–340.
25	**Jain T et al.** (Jain, 2006)	Fertility & Sterility	USA	Minority ethnic patients seeking ART treatment in a state with mandated insurance cover	Cross sectional Survey	Jain, T. (2006) Socioeconomic and racial disparities among infertility patients seeking care. Fertility and sterility. [Online] 85 (4), 876–881.
26	**Inhorn MC et al.** (Inhorn and Fakih, 2006)	Fertility & Sterility	USA	Arab American men presenting for infertility	Qualitative Study	Inhorn, M. C. & Fakih, M. H. (2006) Arab Americans, African Americans, and infertility: barriers to reproduction and medical care. Fertility and sterility. [Online] 85 (4), 844–852.
CANADA						
27	**Vandervort L et al.** (Vandervort, 2006)	Human Rights Quarterly	Canada	Patients seeking ART treatments	A Critical Opinion Study	Vandervort, L. (2006) Reproductive Choice: Screening Policy and Access to the Means of Reproduction. Human rights quarterly. [Online] 28 (2), 438–464.
28	**Shaulov T et al.** (Shaulov et al., 2015)	Journal of Assisted Reproduction and Genetics	Canada	Retrospective data on IVF cycles performed in Public & Private ART clinics in Quebec	Retrospective Cohort Study	Shaulov, T. et al. (2015) Public health implications of a North American publicly funded in vitro fertilization program; lessons to learn. Journal of assisted reproduction and genetics. [Online] 32 (9), 1385–1393.
29	**Williamson LE et al.** (Williamson and Lawson, 2021)	Journal of Obstetrics and Gynaecology Canada	Canada	Canadian men and women 18 years and above asked to respond with their views to support access to ART for one of 4 women in different situations (vignettes).	RCT Participants randomly assigned to receive one of four	Linzi E. Williamson, Karen L. Lawson, Canadian Support for IVF Access and Use, Journal of Obstetrics and Gynaecology Canada,

					vignettes describing a reproductively challenged woman and asked to complete an online questionnaire regarding offering ART or not.	Volume 43, Issue 2,2021.
Number	**Author(s) (Reference)**	**Journal**	**Study Context**	**Population and sample size**	**Methodology**	**Citation details**
EUROPE						
30	**Brigham K.B. et al.** (Berg Brigham et al., 2013)	Human Reproduction	Europe (Thirteen EU countries)	Women seeking ART treatments in thirteen EU countries with Regulatory framework for ART treatments and public funding for ART treatments.	A Descriptive & Comparative Analysis	Berg Brigham, K. et al. (2013) The diversity of regulation and public financing of IVF in Europe and its impact on utilization. Human reproduction (Oxford). [Online] 28 (3), 666–675.
31	**Lass A et al.** (Lass and Lass, 2021)	Journal of Medical Economics	Europe	ART cycles in 40 countries in Europe including those in transition, in 2016	Retrospective Cohort Study Using European IVF Monitoring Consortium data.	Lass, A. & Lass, G. (2021) Is there a correlation between total fertility rate, utilization of assisted reproduction technology, and national wealth in Europe? Journal of medical economics. [Online] 24 (1), 536–539.
32	**Olafsdottir HS et al.** (Olafsdottir et al., 2009)	Acta Obstetricia et Gynecologica	Nordics - Norway, Sweden Denmark, Finland, Iceland	ART treatments in Nordic countries in 2004	Cross Sectional descriptive study	Olafsdottir, H. S. et al. (2009) Access to artificial reproduction technology in the Nordic countries in 2004. Acta obstetricia et gynecologica Scandinavica. [Online] 88 (3), 301–307.
33	**Bell M et al.** (Bell et al., 2020)	AIDS Care	Europe	HIV positive patients or their partners seeking ART treatments.	Thematic Literature Review	Bell, M. et al. (2020) Accessibility and availability of assisted reproductive technology for people living with HIV in Europe: a thematic literature review. AIDS care. [Online] 32 (8), 949–953.
34	**Gigstad K et al.** (Gigstad et al., 2023)	Sexual & Reproductive Healthcare	Europe	Access to ART treatments for HIV positive patients	Survey for policy and regulation mapping	Gigstad, K. et al. (2023) HIV and access to fertility treatment in the European and Swedish contexts. Sexual & reproductive healthcare. [Online] 35100812–100812.
35	**Messaoud KB et al.** (Messaoud et al., 2023)	BMC Women's Health	France	Women seeking IVF treatment in a cost-free IVF system.	Retrospective Cohort study	Messaoud, K. B. et al. (2023) Strong social disparities in access to IVF/ICSI despite free cost of treatment: a French population-based nationwide cohort study. BMC women's health. [Online] 23 (1), 621–621.
UNITED KINGDOM						
36	**Krajewska A et al.** (Krajewska, 2015)	Medical Law Review	United Kingdom	Single women seeking fertility treatment	Narrative Review	Krajewska, A. (2015) Access of single women to fertility treatment: A case of incidental discrimination? Medical law review. [Online] 23 (4), 620–645.

Number	Author(s) (Reference)	Journal	Study Context	Population and sample size	Methodology	Citation details
37	**Pandey S et al.** (Pandey et al., 2010)	Human Reproduction	United Kingdom	Overweight and Obese women seeking ART treatments	Opinion study and critical appraisal of evidence	Pandey, S. et al. (2010) Should access to fertility treatment be determined by female body mass index? Human reproduction (Oxford). [Online] 25 (4), 815–820.
38	**Ekechi C** (Ekechi, 2021)	The Lancet	United Kingdom	Inequity in access to ART treatments for ethnic minorities in the UK	Opinion	Ekechi, C. (2021) Addressing inequality in fertility treatment. The Lancet (British edition). [Online] 398 (10301), 645–646.
AUSTRALIA						
39	**Chambers G.M. et al. (Chambers et al., 2012)**	BMC Health Services Research	Australia	Women undergoing ART treatments	A Cross-Sectional Study with Econometric Analysis	Chambers, G. M. et al. (2012) A reduction in public funding for fertility treatment - An econometric analysis of access to treatment and savings to government. BMC health services research. [Online] 12 (1), 142–142.
40	**Chambers G.M. et al.** (Chambers et al., 2013)	Human Reproduction	Australia	Women undergoing ART treatments	A Time Series Analysis of Utilisation of ART	Chambers, G. M. et al. (2013) Socioeconomic disparities in access to ART treatment and the differential impact of a policy that increased consumer costs. *Human reproduction (Oxford)*. [Online] 28 (11), 3111–3117.
41	**Chambers G.M. et al.** (Chambers and Hoang, 2014)	Fertility & Sterility	High-Income Countries and Low and Middle-Income Countries	Women undergoing ART treatments	A Health Economic Evaluation of the type of Cost Consequence Analysis	Chambers, G. M. et al. (2014) The impact of consumer affordability on access to assisted reproductive technologies and embryo transfer practices: an international analysis. Fertility and sterility. [Online] 101 (1), 191-198.e4.
42	**Pitts M et al.** (Pitts and Shields, 2004)	Australian and New Zealand journal of public health	Australia	People infected with HIV seeking Investigations and ART treatment.	A Quantitative Survey	Pitts, M. & Shields, P. (2004) Access to infertility investigations and treatment for HIV+ people: a survey of Australian infertility clinics. Australian and New Zealand journal of public health. [Online] 28 (4), 360–362.
Middle East - United Arab Emirates (UAE), Israel and Kingdom of Saudi Arabia (KSA)						
43	**Inhorn, MC et al** (Inhorn and Gurtin, 2017)	Reproductive Biomedicine Society Online	Middle East	People seeking ART treatments in the Middle Eastern countries	A review of Cultural and Religious Beliefs, Policy and Acceptance related ART Treatments	Inhorn, M. C. et al. (2017) Assisted reproduction and Middle East kinship: a regional and religious comparison. Reproductive biomedicine & society online. [Online] 441–51.
44	**Gurtin ZB et al 2015** (Gürtin et al., 2015)	Book Chapter 165 from - The Changing World Religion Map	Middle East	People seeking ART treatments in the Middle Eastern countries	A book Chapter reviewing influence of Islam on access to ART treatments in the middle east	Gurtin, ZB et al. (2015), Islam and Assisted Reproduction in the Middle East: Comparing the Sunni Arab World, Shia Iran and Secular Turkey, S.D. Brunn (ed.), The Changing World Religion Map, Springer Netherlands, 3137-3153.

Number	Author(s) (Reference)	Journal	Study Context	Population and sample size	Methodology	Citation details
NEW ZEALAND						
45	**Farquhar CM et al.** (Farquhar et al., 2011)	Human Reproduction	New Zealand	246 couples with unexplained subfertility	Retrospective Cohort Study	Farquhar, C. M. et al. (2011) Accessing fertility treatment in New Zealand: a comparison of the clinical priority access criteria with a prediction model for couples with unexplained subfertility. Human reproduction (Oxford). [Online] 26 (11), 3037–3044.
REPUBLIC OF KOREA						
46	**Lee HS et al. (Lee et al., 2023)**	Plos One	Korea	Individuals seeking fertility care	Cross-Sectional Study	Lee, H. S. et al. (2023) Comparative analysis of infertility healthcare utilization before and after insurance coverage of assisted reproductive technology: A cross-sectional study using National Patient Sample data. PloS one. [Online] 18 (11), e0294903–e0294903.
LEGISLATION, POLICY, PROFESSIONAL GUIDANCE OR POSITION STATEMENTS						
47	**Centre For Disease Control & Prevention (CDC) USA - US Department of Health and Human Services** (CDC_USA, 2014)	CDC Report	USA	Subfertile Individuals across the USA	National Public Health Guideline	Centres for Disease Control and Prevention. National Public Health Action Plan for the Detection, Prevention, and Management of Infertility, Atlanta, Georgia: Centres for Disease Control and Prevention; June 2014.
48	**ESHRE Taskforce on Ethics and Law Dondorp W et al. (Dondorp et al., 2010)**	ESHRE	Europe	Individuals seeking conception naturally or with ART	Professional Guidance	Dondorp, W. et al. (2010) Lifestyle-related factors and access to medically assisted reproduction. Human reproduction (Oxford). [Online] 25 (3), 578–583.
49	**Human Fertilisation and Embryology Act 2008** (HFEA_UK, 2019)	Human Fertilisation and Embryology Authority UK	UK	All ART treatments regulated by HFE Act UK	Legislation	Human Fertilisation and Embryology Act 2008 (c. 22) Part 1 – Amendments of the Human Fertilisation and Embryology Act 1990 Document Generated: 2024-05-12
50	**ESHRE Taskforce on Ethics and Law 14: Equity of access to assisted reproductive technology Pennings G et al.** (Pennings et al., 2008)	Human Fertilisation and Embryology Authority UK	Europe	People suffering from infertility in Europe.	Professional Guidance	Pennings, G. et al. (2008) ESHRE Task Force on Ethics and Law 14: Equity of access to assisted reproductive technology. Human reproduction (Oxford). [Online] 23 (4), 772–774.
51	**American Society of Reproductive Medicine Ethics Committee Opinion Klipstein et al.** (Klipstein, 2021)	Fertility	USA	People seeking fertility treatments.	Ethics Committee Opinion	Klipstein, S. et al. (2021) Disparities in access to effective treatment for infertility in the United States: an Ethics Committee opinion. Fertility and sterility. [Online] 116 (1), 54–63.
52	**Ethnic Diversity in Fertility Treatment 2021 HFEA UK 2023 (HFEA_UK, 2023)**	HFEA UK Website	UK	A report on ethnic diversity in ART treatments utilisation in the UK	HFEA UK Publication	Human Fertilisation and Embryology Authority UK (2023). Ethnic Diversity in Fertility Treatment 2021.London, United Kingdom. HFEA UK.
SYSTEMATIC OR SCOPING REVIEW						
53	**Jackson-Bey T et al.** (Jackson-Bey, 2021)	Fertility & Sterility	USA	Individuals seeking Fertility treatments	Systematic review	Jackson-Bey, T. et al. (2021) Systematic review of racial and ethnic disparities in reproductive endocrinology and infertility: where do we stand today? F&S reviews. [Online] 2 (3), 169–188.

Number	**Author(s) (Reference)**	**Journal**	**Study Context**	**Population and sample size**	**Methodology**	**Citation details**
54	**Mackay A et al.** (Mackay et al., 2023)	Pharmacy	17 out of 19 studies from HICs, one each from Ghana and Indonesia	Inequity of access to ART treatments	Scoping Review	Mackay, A. et al. (2023) Inequity of Access: Scoping the Barriers to Assisted Reproductive Technologies. Pharmacy. [Online] 11 (1), 17-.
55	**Humphries IA et al.** (Humphries, 2016)	American Journal Of Obstetrics and Gynecology	USA	Individuals seeking ART treatments in the USA with focus on ethnic minorities	Systematic Review	Humphries, L. A. et al. (2016) Influence of race and ethnicity on in vitro fertilization outcomes: systematic review. American journal of Obstetrics and Gynecology [Online] 214 (2), 212.e1-212.e17.
56	**Huddleston, A et al.** (Huddleston et al., 2023)	Reproductive Sciences	USA	Individuals seeking ART treatments in the USA.	Scoping Review	Huddleston, A. et al. (2023) Inequities in Medically Assisted Reproduction: a Scoping Review. Reproductive sciences (Thousand Oaks, Calif.). [Online] 30 (8), 2373–2396.
57	**Merkison JM et al.** (Merkison et al., 2023)	Fertility & Sterility	USA	Racial and Ethnic minorities seeking ART treatments in the USA	Systematic Review	Merkison, J. M. et al. (2023) Racial and ethnic disparities in assisted reproductive technology: a systematic review. Fertility and sterility. [Online] 119 (3), 341–347.
58	**Wellons MF et al** **(Wellons et al., 2012)**	Fertility & Sterility	USA	Racial and Ethnic Minorities seeking ART in the USA	Systematic Review	Wellons, M. F. et al. (2012) Race matters: a systematic review of racial/ethnic disparity in Society for Assisted Reproductive Technology reported outcomes. Fertility and sterility. [Online] 98 (2), 406–409.

Appendix C - Study Findings Table

Author(s) & Reference	Aims/ Objective	Findings in the study	Improvement strategies proposed
Global - Multinational			
Adamson, G.D. (Adamson, 2009)	Discussing the impact of the following on access to ART treatments 1. Religious, cultural and Political characteristics 2. Economics and Relative Cost of Treatment 3. Nature of Healthcare system 4. Insurance coverage 5. Professional Regulation	1. Acceptability - Moral & Legal status of the Embryo 2. Better access in HICs due to some state support or Insurance coverage 3. Public funded systems have better coverage e.g. Europe. Insurance funded systems have large variation and less coverage, USA 4. No regulation or Professional guidance - Least successful model. Strict regulation also reduces access. Best model is pone supported by patients, professionals and public	1. Better funding improves access 2. Lower costs 3. Patient friendly and professionally supported regulation 4. Technological advancements will bring the cost down. 5. Slow harmonisation of regulation and guidelines will occur but religious, cultural and socio-economic factors will continue to have influence.
Domar A et al. (Domar et al., 2021)	Identify the key drivers and barriers for infertile patients and their partners to see an infertility specialist and initiate treatment.	1. Significant delays in receiving medical infertility diagnosis, an average 38.6 months. 2. Motivational coherence within couples in the desire for a child was a key facilitator 3. Perceived supportive Healthcare team were important determinants of treatment journey continuation 4. Financial concerns were an important barrier to accessing treatment.	1. The need for better education surrounding treatment and the lower chances of success with longer delays and resultant older age. 2. HCP teams should maintain an open communication with patients and partners.
Dyer S et al. (Dyer et al., 2020)	The importance of utilizing assisted reproductive technology (ART) as an indicator of access to infertility care	1. ICMART calculates ART utilisation by total number of initiated ART cycles over one year per million people. 2. There is independent association between affordability and utilisation 3. Sociocultural factors such as religious norms, reproductive health literacy and societal acceptance of ART, impact utilisation. 4. Utilisation of ART treatments has an impact on clinical practice - countries with high ART utilisation have high Elective, Single Embyro transfer rate and vice versa.	Formal recognition of ART Utilisation as a marker of access, consensus of its definition and interpretation, and its wider use to produce the kind of evidence that is required to generate sound public policies aimed at reducing inequities in access to infertility care.
Lass A et al. (Lass and Lass, 2023)	A review of inequalities in utilisation of ART treatments in G20 countries	1. Countries with higher GDP have higher utilisation 2. State and insurance funding increases utilisation in countries with similar GDP. 3. Disparities in ART utilisation increases with decreasing consumer affordability and the state funding. 4. A strong negative correlation exists between Gender Inequality Index (GII) and ART utilisation. 5. ART utilisation is influenced by socio-cultural factors such as pro-natalist policy, education and religious acceptability of the treatment	1. More affordable ART Treatments providing generous state funding or insurance coverage. 2. Pronatalist policy prioritising fertility treatments. 3. More critical is the need for education to promote change in attitudes and behaviours to enable to close the gender inequality gap
Lass A et al. (Lass et al., 2019)	To assess whether utilization is related to the gross domestic product (GDP), and if the GDP has any effect on suc§cess in IVF treatment.	1. Strong positive correlation exists between the GDP of a country and the utilisation of ART treatments. 2. Unexpected Strong negative correlation between GDP and the outcomes Clinical Pregnancy rate (CPR) and Delivery rate (DR). 3. Unexpected Strong negative correlation between utilisation of ART treatments and the outcomes Clinical Pregnancy rate (CPR) and Delivery rate (DR).	Need further research the understand the unexpected negative correlation between the GDP and Utilisation with Clinical Pregnancy and Delivery rates.

Author(s) & Reference	Aims/ Objective	Findings in the study	Improvement strategies proposed
Peterson MM et al. (Peterson, 2005)	Narrative review exploring the social, medical, legal, and ethical reasoning that has traditionally promoted lack of equity in access to ART treatments in Australia and whether the criteria used for client deselection are ethically appropriate, are explored by this review. In addition, the issues of distribution and just "gatekeeping" practices associated with these sensitive medical services are examined.	1. Certain groups of women have been denied access to ARTs in Australia - single heterosexual women, lesbians, poor women, and those women with certain disabilities or who are older 2. Based on fears and assumptions that the physical and/or psychosocial development of children born because of these technologies would be impaired, including fear of aberrant parental bonding. Vast majority of evidence has though refuted these fears. 3. Most IVF treatments being privately funded, allows for paternalistic decision making by providers to set their own screening criteria, more so in the USA. 4. A disparity in utilisation exists in Australia, where white, middle-class women, have a higher utilisation of IVF treatments compared to Black African and Hispanic women. 5. The claim of non-qualification due to absence of medical infertility is routinely used as a reason to deny ART services to lesbian women.	To ensure equity of access to reproductive services and just distribution of medical resources, it is imperative that ART clinics should provide valid, defensible policies that encourage deliberation of ethically contentious cases with consistency and fairness. Such policies must be determined, with reference to law, by ethics committees, which include members who represent the underserved and minority groups whose needs otherwise remain unrecognised.
Lunenfeld B et al. (Lunenfeld, 2004)	This meeting report summarizes the Bertarelli Foundation's Second Global Conference, in Prague on November 16–17, 2002. Over 150 participants from 30 countries attended, discussing the management, demographic trends, economic implications, access and policy issues. Focusing on HICs and further on Europe.	1. Barriers to infertility treatment can be classified into three main categories: accessibility, economic cost, and cultural/societal factors. 2. In many developed countries, infertility is not considered a disease and thus not covered by public or private health insurance. ART has been criticized for lack quality control of the service, including the high rate of multiple births. 3. In HICs, IVF/ICSI costs represent a considerable economic burden. In Europe one IVF/ICSI cycle can cost up to 10% of annual family income on one IVF cycle (in countries where it is not fully covered by private or public insurance). In America it is 25% of annual family income. The number of countries where full reimbursement is available for multiple cycles is limited. 4. In the developed world, societal factors have resulted in a significant delay in childbearing and seeking access to infertility treatment. 5. While cost effectiveness studies of ART treatments have shown economic value to the society, it is not enough to justify public funding. Ultimately, society—in deciding which health care procedures should be publicly funded—sets priorities based on criteria other than cost-effectiveness.	1. Technical excellence, setting up of Regulators and Registries for monitoring quality, patient safety and the numbers, upholding ethical practice and good medical practice guidelines are all important elements for improving utilisation. 2. The most important factor limiting access in developed countries is economic challenges i.e. out of pocket cost. 3. The role of culture and social barriers to infertility treatment should not be underestimated. Catholic religious authorities, for example, forbid the use of certain ART procedures. In many countries, infertility is still taboo. 4. National ART Guidelines, Regulation, National Registries offer considerable promise in curbing excesses and offer better success rates and safe treatments.

Author(s) & Reference	Aims/ Objective	Findings in the study	Improvement strategies proposed
USA			
Adashi E.Y. et al. (Adashi and Dean, 2016)	A review of the impact of the following on the access to ART treatments 1. Economic barriers, Insurance coverage and State funding 2. Socio-cultural barriers 3. Infrastructural barriers 4. Geographic distribution of clinics	1. High under-insurance or no uninsurance rate. Self-insuring employers a majority, with no or low coverage. 2. High out of pocket expense. Ever use of ART higher in states with high median income and high insurance mandate. 3. Language, communication, preconceptions of healthcare, stigmas, provider bias. 4. Clinics favours locating in high insurance mandated, high median income, urban states.	Improving underwriting of ART services must be a moral imperative and as an abiding strategic goal supported by regulation and legislation. .
Beckman L.J. et al. (Beckman and Harvey, 2005)	Social, Cultural, Political, Relational and Economic factors influencing access to ART for women (focussing on women's reproductive health)	Explored - 1. Situational context - Social, Cultural, Political, legal environment. 2. Relationship context - Characteristics of partnership, gender roles, partner support and sexual behaviour. 3. User Characteristics - Economic situation, Motivation for family, Education, Insurance coverage/ state funding Understanding, Stigma, ethnicity, sexual orientation. 4. General acceptability - Difficulty of use, Time lost from work or childcare responsibilities, Effectiveness/success rate.	1. Improve public funding and insurance coverage by statute 2. Easily understood information for optimal decision making. 3. Empowering women to make decisions independently. 4. Destigmatise infertility, especially in same sex couples, single women and HIV positive individuals.
Brodeur T.Y. et al (Brodeur et al., 2022)	Individuals or couples living in geographically underserved areas, seeking fertility and ART treatments and their reproductive health outcomes.	Underserved populations seeking fertility and ART treatments have poorer access, higher indirect costs, lower affordability, lower chance of live birth, and higher risk multiple pregnancies.	1. Improved insurance coverage will improve access More Subspecialists will set up practice in rural areas with insurance coverage. 2. Innovation including Telehealth, remote monitoring of treatments and better communication between local Gynaecologists and Subspecialists will improve access and outcomes.
Davis O.K. et al. (Davis and Sokol, 2016)	A Summary brief of the presentations at the conference, identifying key issues highlighted and strategies proposed to address the disparities in access to ART treatments.	1. Infertility is not seen as a disease, Under-insurance rates and high out-of-pocket expenditures. Further complicated by Age, Discrimination and Bias towards Sexual orientation 2. Economic, Sociological, Cultural and Religious barriers exist. 3. Disparity in Geographic Location of ART services, generally in Urban areas with high affordability and insurance coverage. 4. Ethnicity bias - Hispanic, Black and Asian women have poorer ART outcomes. 5. High dropout rate, of up to 50% even in insured patients.	1. Consistent reporting of Race and Ethnicity. 2. Reduce cost by using novel stimulation protocols e.g. Invitro Maturation of oocytes, mild stimulation, modified natural cycles. 3. Policy focus on insurance coverage.
Dongarwar et al. **(Dongarwar et al., 2022)**	To examine the relationship between race and ethnicity with the utilization of infertility treatments over the previous decade 2011-2019	Over the studied period in the USA - 1. A 63.7% increase in all fertility treatments (134% increase for fertility enhancing drugs and IUI and 40% increase in ART treatments) 2. Significant racial and ethnic disparity in utilisation of ART treatments exists - i. Non-Hispanic (NH) Asian women have highest rate of fertility treatments	1. Sharing and expanding knowledge that racial and ethnic inequities continue to impact marginalized groups, 2. Addressing these inequities requires critical focus on informing actionable ways by influencing - i. Advocacy, ii. Policy change. iii. Patient education. iv. Provider training.

		i. Hispanic women have the lowest rate of fertility treatments ii. NH White women have the highest likelihood of receiving treatment. iii. NH Black and Hispanic women have the lowest likelihood of receiving treatment	
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
Farley OS et al. (Farley Ordovensky Staniec and Webb, 2007)	To estimate the effects of financial access and other individual characteristics on the Utilisation of fertility treatment and the choice of treatment type.	1. Access to ART treatments is highly influenced by Income 2. Merely having insurance does not seem to influence the decision to access ART treatments. 3. Neither Income nor Insurance have any impact on decision to access consultation or diagnostic testing. 4. Well insured ethnic minorities continued to have reduced access to ART treatments as compared to white women.	Recommend further research on the following - i. Explore whether having insurance coverage for infertility treatments significantly increases utilization. ii. Whether the benefits of increased coverage exceed the costs? iii. Whether insurance coverage leads to lower multiple births by increasing Elective Single Embryo Transfers.
Hammoud AO et al. (Hammoud et al., 2009)	To characterize the demographic correlates of IVF availability and utilization, defined by - 1. The number of physicians performing IVF 2. The number of cycles per 100,000 reproductive age women	1. The study suggests low IVF utilization in the United States is correlated with low availability, low level of education, and less urbanization in the state. 2. Low availability is associated with the absence of mandated IVF coverage and lower median income	1. Economic barriers remain a major obstacle for US couples considering IVF treatment. 2. Mandated IVF coverage has been proposed as a method to reduce both the disparity in IVF utilization as well as the incidence of multifetal pregnancies resulting from IVF treatment
Correia KFB et al. (Correia and Kraschel, 2023)	This study aimed to determine how state insurance mandates are associated with racial and ethnic disparities in in vitro fertilization utilization and clinical outcomes.	1. ART treatments utilisation was higher in insurance mandated states compared to non-mandated states for all ethnicities. 2. In insurance mandated states the utilisation was higher in Non-Hispanic White women as compared to Non-Hispanic Black and African women and Hispanic women. 3. The clinical outcomes including live birth rate per index egg retrieval were highest in Non-Hispanic White women in both mandated and non-mandated states.	1. Insurance mandates do not mitigate ethnic disparities. 2. The biggest impediment in getting robust evidence of ethnic disparities in the USA is the missing data. Better and mandatory data reporting can be evidence of disparities with high confidence. 3. Evidence of ethnic racial disparities can inform and influence policy and public health interventions with high confidence.
Kissin D et al. (Kissin et al., 2016)	Review of the recently released National Public Health Action Plan for the Detection, Prevention, and Management of Infertility.	1. National Public Health Action Plan for detection, prevention and management of infertility calls for i. Prevention and early detection of subfertility ii. Reducing disparities in access to high quality fertility treatments iii. Improving safety of fertility treatments 2. In the USA, Non-ART treatments contribute more to multiple pregnancies than ART treatments. 3. Improved insurance coverage of ART treatments reduces multiple pregnancies by increasing elective single embryo transfers, increasing patient safety	1. Economic analyses are needed to show whether insurance coverage for ART, coupled with safer ART practices, can improve health equity and reduce health care costs associated with iatrogenic multiple births. 2. Educate couples affected by subfertility about the risks of multiple births and the benefits of single embryo transfer. 3. A well-designed US based study to assess reproductive outcomes among women covered by health insurance plans that link reimbursement with limitations on the number of embryos transferred would provide important information on the acceptability and feasibility of such an approach in this country.

Author(s) & Reference	Aims/ Objective	Findings in the study	Improvement strategies proposed
Komorowski AS et al. (Komorowski and Jain, 2022)	To review the disparities in access to subfertility care and treatment outcomes among Hispanic women	Compared to Non-Hispanic White women - 1. Hispanic women are less likely to seek treatment for subfertility 2. May have lower live birth rate 3. May have higher risk of premature delivery and low birth weight babies 4. Are more likely to have ART treatment cycle cancelled 5. Are more likely to be obese with higher prevalence of sexually transmitted infections. 6. Ethnicity rand Race reporting into SART CORS (Society of Assisted Reproductive Technology Clinical Outcomes Reporting Service) is not mandatory and is grossly underreported, 35% data is missing.	1. Improved and generous insurance coverage including ART treatments. 2. Early treatment of Obesity and Sexually transmitted disease to prevent subfertility. 3. Improved and Mandatory ethnicity and race data reporting to SART CORS. 4. Good quality research based on high quality data to get reliable insights into causes of disparities 5. Educating Patients and providers for better understanding
Korkidakis A et al. (Korkidakis and DeSantis, 2024)	To examine whether the scope of state-mandated insurance coverage for ART treatments and proportion of the population eligible for this coverage are associated with reductions in racial/ethnic inequities in ART utilization.	1. An updated analysis with focus on both the scope and population eligibility of state-mandated coverage for infertility services. 2. Including imputation of missing race/ ethnicity data makes the analysis more robust 3. Comprehensive mandates for state insurance are associated with higher ART utilization across all racial and ethnic groups. 4. Comprehensive Mandates do not eliminate racial and ethnic inequities in access to ART.	1. Increasing population reach of comprehensive insurance mandates for ART treatments is likely to minimise but not eliminate ethnic and racial disparities. 2. Understanding how ethnic and racial differences in knowledge, awareness, cultural factors, and geographic barriers contribute to the inequities in ART utilisation can inform strategies to improve access. 3. Qualitative studies identifying racial/ethnic-specific differences would assist in targeting interventions around increasing reproductive health knowledge and awareness in a culturally relevant manner.
McCarthy-Keith DM et al. (Mccarthy-Keith et al., 2010)	To evaluate assisted reproduction technology (ART) usage and outcomes in minority women seeking care at enhanced access, military ART programs	Given enhanced and low-cost ART treatment access for active-duty service members in military setting - 1. A fourfold increased access was seen in African American Women. 2. A decreased access was seen in Hispanic women. 3. Increased access to ART treatments did not improve the outcomes (Clinical pregnancy or live birth) in either group, compared to Caucasian women.	1. While there is a drive to mandate insurance coverage of fertility treatments in the USA, it is important to recognise that decreasing out of pocket cost increases utilisation for some minority groups 2. It is also important to note that affordability is not the only deterrent to utilisation of ART treatments for some minority women.
McGarity MZ et al. **(Mcgarity et al., 2022)**	To determine the extent to which satellite clinics impact geographic access to ART and estimate the percentage of reproductive-age women who have geographic access to ART services.	1. 85% of satellite clinics placed close to other practices main clinics and 78% of satellite clinics placed in areas with $11k higher median income - suggesting that the main objective of satellite clinics is to gain business and market share rather than improve geographical access. 2. In line with Hotelling's law in economics. 8% of US reproductive age women live in areas with only satellite clinics and no main clinic, suggesting improved access for these.	1. Less than a quarter of all satellite clinics contribute to improving access. 2. The objective and the strategy of setting up satellite clinics follows "Hotelling's law of economics" - to grow market share and maximise profits. 3. The study identified many areas in the US where unmet need exists that could potentially support the presence of a new clinic and would help expand geographic access to care to large, underserved populations.

Author(s) & Reference	Aims/ Objective	Findings in the study	Improvement strategies proposed
Nangia AK et al. (Nangia et al., 2010)	To describe the disparity of assisted reproductive technology (ART) centers in the United States as they relate to residential locations of populations in their reproductive years and state-mandated coverage for infertility services.	The distribution of ART centres in the USA is inequitable - 1. The ART centers appear well distributed in areas of highest population density. 2. Percentage of female reproductive age population served by an ART center was higher in mandated (90%) than in nonmandated (71%) states (P<.01). 3. Three states have no ART centre at all.	Once there is clarity on the geographic burden of the infertility requiring ART treatments, defined as travel time from a patient's residence to the nearest ART facility. The findings of this study may help researchers and health policy experts to begin having educated discussions regarding allocation of new services.
Shah DK et al. (Shah et al., 2013)	To assess public opinion regarding provision of assisted reproductive technology (ART) to obese (BMI > 30 kg/m2) women in the United States.	1. 60.7% support use of ART treatments in Obese women. 2. Support for ART treatment to obese women directly related to respondent's BMI and inversely related to respondent's age. 3. Twice as many morbidly obese women 9BMI >40) support use of ART in obese women as compared to the ones with normal BMI. 4. BMI and Education are inversely related to setting up a BMI cut off for ART treatments. 5. No statistically significant association between respondent's gender, income, education, race, profession, state of residence, or self-reported history of infertility and support of IVF in obese women	1. The ESHRE Task Force on Ethics and Law recommends weight loss because evidence suggests a positive reproductive effects. 2. Fertility physicians should insist that a serious effort at achieving these results be made. 3. No such position statement in the USA.
Vahratian A et al. (Vahratian and Smith, 2009)	An analysis of utilisation of fertility services by a representative US population according to female body mass index.	1. In absence of national professional guidance, the decisions to treat or not are made at clinic/ service level. Therefore, high level of clinical variation and lack of data collection leading to limited opportunity for relevant insights. 2. Issues like limited funding for services, reduced likelihood of success with conception and the increased risk for pregnancy complications are cited for restricting treatments. 3. Those against restriction believe that this form of clinical decision-making unfairly stigmatizes women and limits their timely access to diagnostic tests and effective treatments.	1. It is important to consider the medical, social and ethical issues involved in allocating resources for fertility treatment. 2. To best serve this population, continued education and health promotion is required for this population to ensure both short- and long-term success in pregnancy outcomes. 3. Ongoing monitoring of the impact of obesity on utilisation of ART treatments and the adverse outcomes including delayed childbearing will provide further insight into thisclinical health policy issue.
Butts S et al. (Butts, 2023)	Summarizing the published literature describing racial and ethnic disparities in assisted reproductive technology.	1. In the USA, barriers exist in terms of race, ethnicity, geography, disability, LGBTQA and Socioeconomic status. 2. Health equity efforts, including research and advocacy, directed at dismantling such disparity have been the diligent work of many dedicated individuals and a strategic priority of the American Society for Reproductive Medicine. 3. Systematic review level evidence that Access to ART in the United States is generally more challenging for patients of colour compared with white patients 4. It is estimated that <25% of individuals with infertility in the United States access the resources required to have their treatment needs met. This is further worsened by racial and ethnic disparities. 5. Where state-mandated coverage of infertility assuages this to a degree.,	1. Need to further appraise the state of research, advocacy, and health care systems that have allowed these disparities to be so durable and lingering. 4. Must acknowledge some of the historical truths about health care delivery in the United States and other world regions 5. To better understand the nuances leading to the existing disparities, collect more patient-level data or include large-sized cohorts of people of colour. 6. Most sizable studies of ART and disparities are derived from the SART-CORS database; however, the high rate of missing data on race and ethnicity (approximately 35%) limits the validity of disparities research conducted utilizing this powerful platform. 7. A move towards interventional research to reduce the disparity of access and outcomes

		many women of colour are unaware that such a coverage exists, or work for employers exempt from the mandate. 6. SART data supports differential and often less favourable treatment outcomes for non-white patients undergoing ART both in fresh and frozen in vitro fertilization cycles.	based on races and ethnicities is an essential and urgent next step. 8. Strategic partnerships and resources are needed to increase research funding, develop policies aimed at improving patient access, and train broad populations of providers to better recognize and address this exigent problem
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
Jain T et al. **(Jain, 2006)**	To examine sociodemographic differences based on patient race/ethnicity among infertility patients seeking care in a state with mandated coverage of infertility treatment.	1. Significant disparities exist in the USA based on Race & Ethnicity, Household income, Education level and duration of infertility 2. African American women experienced a significantly longer duration of infertility before seeking care compared with Caucasian women 3. Significantly greater proportion of African American and Hispanic women had tubal factor infertility compared with Caucasian women 4. Significantly greater proportion of African American and Hispanic women had less than a 4-year college degree compared with Caucasian women 5. Significantly greater proportion of African American and Hispanic women had household incomes below $100,000 compared with Caucasian women	The pervasiveness and persistence of disparities are undeniable and disturbing. Research directed toward better understanding the reasons for such disparities will be the next step toward our common goal of providing equal access to quality care for all Americans.
Inhorn MC et al. **(Inhorn and Fakih, 2006)**	To compare barriers to infertility care among African Americans and Arab Americans.	1. Arab Americans and African Americans living in metropolitan Detroit are at increased risk of infertility and share similar histories of poverty, racism, and cultural barriers to medical treatment. 2. The study revealed significant barriers to effective infertility care, including economic constraints, linguistic and cultural barriers, and social marginalization in mainstream U.S. society, particularly after September 11, 2001	1. Understanding Arab American community is important and timely, given the repercussions of September 11th. 2. September 11th led to a spate of research on Arab Americans and American Muslims' culture. Most of this research has focused on Arab American identity politics, religiosity, and experiences of discrimination. Research on Arab American health has been sidetracked. 3. A critical need is identified for Arab Americans and the research community to take up the challenge of actively developing and funding research, education, and intervention programs to combat the high rates of disease, trauma and stress, and barriers to good health care in this population.
CANADA			
Vandervort L et al. (Vandervort, 2006)	A Critical Review of Access Screening for ART treatments and Human Rights. The human significance, societal implications, and legitimacy of access screening merit careful examination.	1. Access screening is inconsistent with the principles of self-determination and violates international human rights law. 2. Medically Assisted Reproduction is inaccessible to people for reasons as poverty, shortage of healthcare staff, resources constraints, lack of information, religious and cultural beliefs. 3. Non-profit organisations with patient advocacy mandate are often in a better position to educate people and help make informed choices. 4. Many patients never become aware of all legitimate treatment options apart from those shared by the clinician. 5. Access screening is a form of social control through which social dominance is expressed. As a result, there are gaps in the discourse and flaws in the logic of policy arguments dealing with access.	1. Access screening to be introduced in a regulatory framework, enforced by law, to prevent access decisions being influenced by sole clinicians or Service Policies. 2. A limited set of medical criteria, strictly defined in law and uniformly applied, may be used to avoid the unqualified use of healthcare resources. 3. It is morally unacceptable to screen people for access to fertility healthcare using social, economic, racial, ethnic and cultural criteria to determine who has the right to reproduce. 4. ART treatments should be fully accessible to those who are able to make an informed decision and are legally competent to consent to treatment and choose to get pregnant and give birth. In accordance with the principles of equality and self-determination. 5. The principle of Self Determination must triumph over the principle of access screening.
Shaulov T et al. (Shaulov et al., 2015)	To determine trends in practice and outcomes that occurred since the implementation	1. Publicly funded programme in Quebec, Canada increased access to ART treatments 2. When funded conditional to elective single embryo transfer, it led to significant reduction in multiple pregnancies, further reducing perinatal	1. The public funding of ART treatments increases access to ART treatments. 2. Publicly funded programme can lead to increase in provincial birth rate. 3. Public health benefits as reduction in multiple pregnancies and NICU admissions can be realised.

	of the publicly funded in vitro fertilization (IVF) and single embryo transfer (SET) program in Quebec, in August 2010.	morbidity and mortality for the mother and the child. 3. The percentage of Neonatal Intensive Care Unit (NICU) admissions decreased. 4. The program of publicly funded ART treatments led to significant increase in provincial birth rate. 5. The anticipated savings from NICU admissions did not materialise as the overall birth rate increased bot IVF and spontaneous.	
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
Williamson LE et al. **(Williamson and Lawson, 2021)**	Objective- Apply Weiner's attribution-affect-action (AAA) model to the context of societal support for access to assisted reproductive technology (ART).	1. Participants least likely to support access to IVF for women perceived to be more responsible for fertility - elicited lower levels of sympathy and higher levels of contempt (i.e., the career driven woman). 2. Women seen as less responsible for fertility issues elicited more sympathy and less contempt from participants, subsequently more willing to support access to IVF (i.e., the woman with cancer). 3. However, the means for these variables were below the scale midpoint for each vignette, indicating that participants did not overly blame any of the women in the vignettes for their circumstances. 4. Society does not hold overly prejudicial views of infertile women, regardless of the perceived cause - a comforting message for unwillingly childless. 5. Participants do not seem to view it as a life-threatening health condition that necessitates public financial support. 6. Low support for financial coverage of ART could result in treatments available only to the affluent or to individuals who are willing to incur financial debt.	1. Advocating for policy changes regarding financial coverage for ART to increase its overall accessibility may first require addressing the opinions of the public on this issue. 2. The participants in the study more highly educated and is not necessarily diverse. Beliefs about motherhood, fertility treatments, stigma of involuntary childlessness, and subsequent social sanctioning may differ among other subgroups. A study involving participants representing the population is recommended 3. Further research on this issue is warranted, including developing and testing interventions aimed at addressing beliefs around equitable and inclusive access to ART 4. Interventions may need to target beliefs regarding infertility, including the associated expenses and distress, and aim to increase empathy and compassion for afflicted individuals.
EUROPE			
Brigham K.B. et al. (Berg Brigham et al., 2013)	1. Regulation of ART treatments 2. Public funding of ART treatments	1. The utilisation of ART treatments is positively correlated with the breadth of regulation. Social characteristics such as relationship status and sexual orientation having maximum impact. 2. No clear evidence of public funding impacting uptake of ART treatments established (may be due to inability to match data across countries and over time). Tighter regulation (eligibility criteria) identified in countries with higher public funding.	1. A liberalisation of regulation related personal characteristics such as sexual orientation, partnership status and age is likely to increase utilisation and reduce cross border access. 2. Although, availability of Public Financing did not seem to be linked with utilization levels in Europe this study. Reduction in public funding to 50% in Germany in 2004 demonstrated a reduction in utilisation.
Lass A et al. (Lass and Lass, 2021)	To explore the relationships between total fertility rate (TFR), utilization of assisted reproduction technology (ART), and gross domestic product (GDP) per capita in Europe	1. There is correlation across Europe between GDP and ART treatments utilisation. This correlation is not seen in the most developed economies of European Economic Area. 2. No correlation was found between TFR and GDP or utilisation	1. Better data collection or imputation of missing data to improve quality of the analysis 2. Repeat the same analysis for other developed countries
Olafsdottir HS et al. (Olafsdottir et al., 2009)	To survey access to Artificial Reproduction Technology (ART) treatments in 2004 with regard to legislation, geographical location, financing and the kind of ART treatments provided in the Nordic countries.	1. All five Nordic countries have ART legislation (four at the time of study - 2004 - Finland implemented it in 2007). 2. Access to ART treatment s is generally good in the Nordic countries 3. All have a form of subsidy system covering some or the whole cost. 4. Denmark and Finland have the most generous subsidy system 5. The access to treatments is better in urban and densely populated areas.	1. Uniformity of access and funding criteria can minimise cross border treatments 2. Uniformity of cost and access will improve perception of equity of access across the Nordic countries.

		Leading to higher indirect costs in rural or sparsely populated areas. 6. Harsh weather in northern regions can limit access to ART treatments for a certain time of the year. 7. The legislation regarding gamete or embryo donation differs between countries 8. The legislation regarding access to same sex couples, Single women and surrogacy is variable.	
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
Bell M et al. (Bell et al., 2020)	Thematic literature review examines the state of research on access to and availability of assisted reproductive health technologies for people living with HIV in Europe, with the aim of identifying gaps for further research	For HIV discordant couples, HIV positive individuals and for healthcare providers 1. Information gaps persist in relation to effectiveness, safety and best practices regarding assisted reproductive technologies". 2. There are three types of challenges to access ART Treatments - Technical Access, Legislation & Policy and Social Dimensions. i. **Technical Access** - Limited number of clinics (Including UK & Europe) are set up to provide full range of ART treatments to HIV discordant couples or HIV Positive individuals safely. ii. **Legislation & Policy Access** - Reproductive clinics may limit their selection criteria to attempt to eliminate potential legal risks associated with treating HIV-discordant couples. iii. **Social Dimensions** - Even when assisted reproductive technologies are legally available, women seeking these treatments still face barriers of discrimination and stigma	**1. Technical Access** The use of sperm washing in combination with IUI, IVF and ICSI effectively reduces the risk of transmission below the transmission rate of 0.1% as expected in unprotected, heterosexual intercourse. **2. Legislation & Policy** To best meet the needs of individuals with HIV with the desire to achieve pregnancy, sexual and reproductive health and rights (SRHR) must be taken into consideration. **3. Social Dimensions** An environment free of stigma and judgment towards people living with HIV seeking ART treatments and accurate information on access to reproductive options, will improve access and safety.
Gigstad K et al. (Gigstad et al., 2023)	To present an updated mapping of regulations across Europe, with a focus on the Swedish context.	1. For HIV positive patients in Europe, the access to ART treatments is variable, complicated and often unclear. 2. European legislation requires separate lab facilities for handling gametes from people living with a chronic viral infection. 3. Some countries and clinics that lack suitable facilities refer patients abroad increasing the out-of-pocket expense and therefor increasing inequity of access 4. Some countries explicitly deny treatment to single women or same sex couples irrespective of HIV status - Ireland, Luxembourg, Poland, Slovakia and Sweden 5. In **Sweden** treatment is permitted but can only be carried out if it is unlikely to transmit infection to the child and that the treatment is not endangering life and health of woman and the child. In practice this is interpreted as a ban on treatment, despite of the legal framework and recommendations from both the 6. Public Health Agency and the National Board of Health and Welfare, people living with HIV remain largely unable to access treatment in Sweden.	1. Encourage countries with poor access to learn from those with more experience treating people living with HIV and with quick referral systems, such as Belgium, the Netherlands and Spain. 2. Clearly defined and readily available guidelines across Europe will help countries and clinics to have clarity. 3. A pan-European regulation may be a far-fetched idea.
Messaoud KB et al.	In a national context where in vitro	**In a system where ART was cost-free-**	Following factors need to study further to understand the inequity of access in places

(Messaoud et al., 2023)	fertilisation (IVF)/intracytoplasmic sperm Injection (ICSI) treatment is cost-free, how many women do not access IVF/ICSI and what are the factors associated with non-access?	1. Two out of three women did not access IVF/ICSI within 24 months of starting ovulation induction 2. Four out of Five older women (40-43) did not access IVF/ICSI 3. Four out of Five socially disadvantaged women from deprived areas did not access IVF/ICSI 4. Younger (18-24) and older women (40-43) were at higher risk of not accessing IVF/ICSI treatments 5. Distance to IVF clinic was not predictive of access.	where there is no or minimal cost to ART treatments - 1. Older age (>40) 2. Deprivation 3. Socially disadvantaged patients may be finding it difficult to interact with clinic staff. This may be due to experience of prejudice and bias.
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
UNITED KINGDOM			
Krajewska A et al. (Krajewska, 2015)	To evaluate the extent to which single women have access to publicly funded fertility treatment	1. HFE Act amendment 2008, The NHS Act 2006, Equality act 2010 and the NICE 2013 eligibility criteria have improved the rights of single women seeking ART treatments, there are gaps exposing them to prejudice and discrimination. 2. Negative attitudes towards single women persist amongst medical staff, potentially related to the welfare of the child (WOC) issue. 3. Equality legislation does not include. "Being single" as a protected characteristic. 4. A significant reason on inequity is that the right to publicly funded treatment is determined by NICE clinical guidelines and Clinical Commissioning Groups (CCGs) and Health Boards resource allocation policies. 5. Poor quality data collection - the number of single women seeking treatment remains unknown.	1. Further studies are required to investigate the legal and societal standings of single women in the context of fertility treatment. 2. Analyse the factors clinicians consider when the eligibility of patients for treatment is determined. 3. Further research to understand local practices of commissioning bodies and healthcare professionals, around the decision-making process.
Pandey S et al. (Pandey et al., 2010)	Is it justifiable to limit access to ART treatments based on BMI?	1. More than half of all women in reproductive years in the UK and USA are overweight or obese. 2. NICE UK proposes a preferred BMI of less than 29 for treatment while British Fertility Society proposes a BMI of less than 35. 3. The evidence remains weak and conflicted on impact BMI on ART treatment outcomes	1. Data linking obesity to poor reproductive outcomes tend to be from meta-analyses which are based on aggregated data, not adjusted for key **confounders such** as age and therefore not reliable. 2. Given the uncertainty of evidence and lack of consensus (NICE & BFS), not justifiable to set a cut off. 3. BMI restrictions on access to fertility care may be construed as being tantamount to infringing on an individual's fundamental rights 4. Restricting fertility care on grounds of weight may also cause stigmatization. Infertility is already a psychosocially demanding situation for most.
Ekechi C **(Ekechi, 2021)**	Opinion on inequity of access to ART treatments for ethnic minorities	1. Black women present later (older) and have poorer outcomes, fewer in-vitro fertilisation cycles performed, and limited options for ethnically matched egg and sperm donors. Minority ethnic populations in the UK face considerable challenges when seeking fertility treatment compared with their White counterparts. 2. US data show Black women seek fertility treatment less often than white women, despite being about twice as likely to experience infertility. 3. Understanding of racial disparities in access to, and outcomes of, fertility treatment in high income countries is	1. Improved collection of ethnicity data by UK clinics through the HFEA allows a better analysis of fertility treatment outcomes and a clearer understanding of who is benefiting from assisted reproductive technology. 2. Research on disparities in fertility outcomes must widen its approach beyond restricted access to also consider the structural and social factors that affect outcomes and individual risk factors. 3. Understanding of the under-representation of women from Black and Asian populations within the infertility space and of the impact of racist, religious, and cultural narratives surrounding feelings of isolation, shame, and, ultimately, invisibility, may help improve access. 4. Analyse disparities in fertility

		limited by inadequate data collection across many health-care settings.	outcomes through the lens of ethnicity and educating young women regarding fertility and gynaecological health, will improve early and inclusive access to fertility treatment.
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
AUSTRALIA			
Chambers G.M. et al. (Chambers et al., 2012)	Disparities in Access to ART Treatments due to reduced State funding	After the introduction of State Funding Cap - EMSNCaps (Extended Medicare Safety Net Caps) - 1. A 16% reduction in number of Fresh ART cycles. Impact on Frozen Cycles less pronounced. 2. Access to ART reduced, 13% fewer people undergoing Fresh ART cycles. 3. Most pronounced Impact for Women > 40years.	With increasing demand for ART treatment (later childbearing, growing obesity and sexually transmitted diseases), it is important to consider that changes to ART funding not only impact equitable access but also the clinical practice and the welfare of ART children and their families.
Chambers G.M. et al. (Chambers et al., 2013)	To assess the impact of Increased out of pocket costs on ART treatments for women from different socioeconomic status (SES) groups.	1. The higher SES groups have highest utilisation of ART treatments, irrespective of out-of-pocket cost, suggesting higher affordability and a higher need because of delayed childbearing leading to higher risk of subfertility. 2. Introduction of cap on state funding for ART treatments (EMSNCaps) with increased out-of-pocket cost leads to decreased utilisation of ART treatments in all SES groups. 3. The increased out-of-pocket cost differentially impacts different SES groups, with higher decrease in utilisation in highest SES group, in the first twelve months.	Public health policies additional to those that increase healthcare affordability are needed to reduce such disparities in equity of access.
Chambers G.M. et al. (Chambers and Hoang, 2014)	To assess independent impact of ART Treatment affordability, measured as out-of-pocket consumer cost relative to average disposable income, on ART utilization and embryo transfer practices	1. ART Treatment affordability measured as out-of-pocket consumer cost relative to average disposable income is positively correlated with ART Treatment Utilisation & Negatively correlated with the number of Embryos transferred. 2. Poorer Affordability for ART treatments can lead to unsafe clinical practices such as higher rate of high order pregnancies.	Policy to be informed by these findings to improve equity of access to ART Treatments and to promote safer clinical practices.
Pitts M et al. (Pitts and Shields, 2004)	To examine the availability in Australia of investigations and treatment of infertility for people infected with HIV.	1. Subfertility treatment for HIV positive people in Australia is available. 2. Most Clinics (80-88%) will offer treatments to HIV positive Men, HIV Positive Women and HIV positive couples. 3. Significant differences are noted between States and Territories in the numbers of HIV+ people reported seen at the clinics in the last 12 months.	The ART treatments in Australia provide a safe and highly effective means of fathering children for HIV positive men; but that results for HIV positive women are not as good. Better and comprehensive data collection is recommended. Almost no data are available for success rates where both partners are positive.
Middle East - Israel, United Arab Emirates (UAE) and Kingdom of Saudi Arabia (KSA)			
Inhorn, MC et al **(Inhorn and Gurtin, 2017)**	A review of Cultural and religious beliefs and acceptability in relation to ART treatments in the HICs in the Middle East	The ART treatments are an acceptable mode of procreation for those facing subfertility since the 1980 Fatwa endorsement of IVF for married couples by the Grand Shaykh of Egypt's famous religious university, Al Azhar. The total fertility rate is declining in all contexts There has been a strong build up towards a thriving ART sector since 1980s, starting with Israel being the first country.	There is explicit inequity of access to ART treatments, with state funding available only to the native populations. This is in line with rest of the healthcare inequity for expats.

		ART treatments are partially or completely funded - completely up to two live births in Israel, majority in the UAE and least in the KSA. The funding is only available for the natives. Expats have to pay out of pocket or through private insurance.	
Gurtin ZB et al 2015 **(Gürtin et al., 2015)**	A book chapter reviewing the influence of Islam on three different middle eastern Muslim contexts - Sunni Arab world, Shi'a Iran and secular Turkey	There is not a single monolithic "Islamic" response to ARTs. Rather, Islam has provided a multiplicity of responses to the practice and regulation of ART. The gamete and embryo donation is not permitted in the Sunni, is permitted in the Shia and in Secular Turkey it is determined by which faction people belong with some flexibility based on the need.	There is variation at regulatory, practice and attitudinal levels between the three Islamic factions - Similarities and differences between the Sunni Arab world, Shia Iran and secular Turkey demonstrate that while religion is an extremely important factor in generating personal and cultural responses to new technologies and their social applications, these responses are not over-determined by religion.
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
NEWZEALAND			
Farquhar CM et al. (Farquhar et al., 2011)	To compare the Clinical Priority Access Criteria (CPAC) score with the Hunault model, developed in the Netherlands, both being prediction models for chance of spontaneous conception, used to decide eligibility for access to ART treatments.	There was fair correlation between CPAC & Hunault model, not good. Hunault model performed better in calibration and would offer ART treatment to 26% more couples than CPAC.	1. CPAC would offer ART treatment to only 15% of the Subfertile couples while Hunault would offer to 41% women. 2. Policy changes to CPAC may be suggested and may improve access but will need additional funding.
REPUBLIC OF KOREA			
Lee HS et al. **(Lee et al., 2023)**	To analyse the types and cost of infertility care to understand the changes to utilisation of fertility care after the 2017 launch of assisted reproductive technology (ART) health insurance coverage in South Korea	Inclusion of Fertility management & ART treatments under national insurance scheme led to - 1. Increased utilisation of ART treatments by women 35 years and older 2. Increased utilisation of fertility services by men 3. The total cost of care for infertility increased substantially, and the use of medications related to ART increased markedly.	1. The findings from this study can be used when such change in policy is being considered or implemented elsewhere with view to be better informed. 2. Further studies to be done to understand the long-term implications of change in policy towards increasing utilisation by including ART treatments under national health insurance and reducing out-of-pocket expense for patients.
POLICY & POSITION STATEMENTS			
Centre For Disease Control & Prevention (CDC) USA - US Department of Health and Human Services (CDC_USA, 2014)	Economic, regional, and racial/ethnic disparities in access to and use of infertility services	Acknowledging and eliminating the Economic, Regional and Racial/Ethnic disparities	1. Improved communication with diverse populations 2. Behavioural and Psychological research 3. Use of Hospitalisation and Insurance data to monitor costs, out of pocket expense and days of hospitalisation
ESHRE Taskforce on Ethics and Law **Dondorp W et al.** **(Dondorp et al., 2010)**	Summary of the evidence about the impact of three lifestyle-related factors - Obesity, Tobacco smoking and Alcohol consumption on both natural and assisted reproduction (ART)	**Female obesity** leads to reduced chance of conception 1. Poorer outcomes with ART - 30% lower chance of success and 30% Higher risk of miscarriages. 2. Higher risk of peripartum complications - Gestational Diabetes, Hypertensive Disorders, Prematurity, Thromboembolic disease and Operative Delivery. 3. Increases risk congenital abnormalities - 80% increase in Neural Tube Defects and 30% increase in Cardiovascular defects.	1. Treating women with severe or morbid obesity would require special justification. 2. Fertility doctors should insist a serious effort at achieving weight loss and smoking cessation be made before treatment 3. This should, however, not be asked from women approaching the end their fertility. 4. Fertility doctors should refuse treatment if women are more than moderate drinking (6 units per day) who are not willing or able to minimize their alcohol consumption. 5. When making assisted reproduction conditional on lifestyle modification, fertility doctors should support their patients in achieving the intended results

		4. Positive association between high pre-gravid Maternal BMI and overweight in child. **Male obesity** leads to 1. Lower Testosterone 2. Higher scrotal temperature 3. Erectile dysfunction. **Smoking in female** 1. Infertility is twice as high in smokers, higher risk of early miscarriages and earlier menopause. 2. Higher risk of pregnancy complications like placental dysfunction, lower birth weight, still birth and neonatal death 3. Higher risk of sudden infant death syndrome and Respiratory illness. **Smoking in men** 1. Lower sperm count and motility 2. Higher risk of sperm DNA damage. **Alcohol consumption** Prenatal alcohol consumption by women leads to higher risk of congenital abnormalities, behavioural and cognitive disability in the offspring (Fetal Alcohol Spectrum Disorders)	
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
Human Fertilisation and Embryology Act 2008 (HFEA_UK, 2019)	Amendments to the HFE Act 1990	1. The "need for father" replaced with "need for supportive parenting" permitting same sex women to be legal parents. 2. The woman carrying the pregnancy in her womb is the legal mother. In case of surrogacy if the sperm of the commissioning male partner is being used, he will be regarded as the donor. It is the partner of the surrogate women who will be the legal second parent. 3. Permitted mitochondrial donation treatments. 4. Donor conceived individuals permitted to access more information about their genetic origins when 18 years old.	1. Amendment of HFE Act 2008 made access to ART treatments more equitable by including same sex women. 2. Facilitating wider use of donor gametes making access easier for single women and men. 3. Permitting Mitochondrial donation, opened access to those with risk of passing on mitochondrial disease. 4. More rights for donor conceived children to know of their genetic origins.
ESHRE Taskforce on Ethics and Law 14: Equity of access to assisted reproductive technology. **Pennings G et al.** **(Pennings et al., 2008)**	This study analyses the question of Justice & Access, not only for people suffering from infertility, but also for people who need assistance to prevent the birth of a child with a specific genetic disorder.	1. Critical for policy to decide whether desire to have a child is a fundamental need or a personal wish. 2. ESHRE argues that subfertility may be a serious handicap that prevents people from realising an important life goal. 3. In relatively affluent societies it is difficult to justify that no public funding at all will be provided. But funding cannot be unlimited as there are other competing healthcare and social needs. 4. Effectiveness of treatment is an important criterion in evaluating funding fertility treatments in a society with limited resources. Assessment of risk versus benefit is crucial. The response to treatment is also variable and depends on individual characteristics. 5. In limited resource society, people who already have a child may need to be low priority, however complexity of family relationships may need to be considered before they are excluded from funding. Such measure is not based on a normative conception of the family but on considerations of distributive justice.	In High-Income Countries - 1. ART treatments should be funded at least partially. 2. Funding for ART treatments should consider efficiency, safety and equity to avoid unjustified discrimination. 3. Funding cannot be unlimited. It is not unjust to collectively fund a fixed number of cycles for everyone 4. For real equity reimbursement of treatment should be accompanied by campaigns to raise public awareness of fertility affecting factors and the availability of treatment options and by improved education general. 5. Practitioners have a moral obligation towards their patients to reduce the cost of treatment as far as reasonably possible.
American Society of Reproductive	This opinion examines the factors that contribute to these disparities,	1. Building a family is a basic human right.	1. Further research is needed and encouraged to understand documented racial and ethnic disparities in treatment

Medicine Ethics Committee Opinion **Klipstein et al** (Klipstein, 2021)	proposes actions to address them, and replaces the document of the same name, last published in 2015	2. Infertility is recognized as a disease by the World Health Organization and the American Medical Association, among others. 3. In the United States, as in many other countries, economic, racial, ethnic, geographic, and other disparities affect both access to fertility treatments and treatment outcomes. 4. Economic factors are the chief contributors to disparities in access to effective treatment; however, social and cultural factors play a role as well, including individual or systemic discrimination that disadvantages certain people because of their race, ethnicity, sexual orientation, or gender identity.	success and to improve treatment methods to reduce those disparities. 2. Clinicians should engage in evidence-based efforts to develop simplified and lower-cost methods of treatment. 3. Multilingual staff and physicians as well as interpreters may help overcome some barriers. 4. It is the responsibility of all those providing reproductive and infertility care, including assisted reproductive technology, such as physicians, policy makers, and insurance providers, to actively and deliberately address and lessen the barriers to infertility care. 5. Efforts should include increasing insurance coverage, reducing the economic and noneconomic burdens of treatment, improving public and physician attention to treatment disparities, and reaching and education underserved populations and geographic areas.
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
Ethnic Diversity in Fertility Treatment 2021 **HFEA UK 2023** **(HFEA_UK, 2023)**	This report highlights disparities in use and outcomes of fertility treatment in the UK by ethnic group from 2017-2	1. Average in vitro fertilisation (IVF) birth rates increased across all ethnic groups, but Black patients had lower IVF birth rates. For 18-37 years olds it is 23% vs 32%, for year 2020-21. 2. Average age of starting fertility treatment among Black patients in heterosexual couples is at 36.0 years of age, compared to the national average of 35.0 in 2021. 3. Between years 2017-21, the average for same sex couples to start treatment was 32.7 years while it was 35.8 years for Asian same sex couples. 4. 92% of Donor Insemination treatments were utilised by white women and only 2% were utilised by black women.	**Development of Clinical Policies** Developing clinical policies should recognise that certain ethnic groups have a poorer outcome with fertility treatment. Whilst this is likely related to a number of different factors, ethnic variation in outcome should be a factor when deciding referral criteria and policies for investigating and treating subfertility. **Improve information and awareness among healthcare professionals** 1. Improved access to information for healthcare professionals to increase their awareness of the importance of early referral and investigations when patients from an ethnic minority group present with high risk factors. 2. Raise public awareness about factors that may affect fertility in ethnic minority patients so that people can make informed choices timely. **NHS Commissioning** When commissioning services, there should be consideration of how regional or local funding and eligibility criteria may have disproportional impacts on ethnic groups, limiting access to fertility treatment. Commissioners should ensure they undertake equality assessments of their existing policies. **Research** Publicly funded research to explore barriers Black, Asian and ethnic minority patients experience when accessing ART treatments. Research should also explore the relationship between gynaecological and other health conditions that can affect fertility, their prevalence in Black, Asian and ethnic minority patients, Higher rates of high-quality data entry about ethnicity should be sought from all clinics.
SYSTEMATIC OR SCOPING REVIEW			

Author(s) & Reference	Aims/ Objective	Findings in the study	Improvement strategies proposed
Jackson-Bey T et al. (Jackson-Bey, 2021)	To conduct a comprehensive review of racial and ethnic health disparities in infertility care and treatment.	1. Racial and Ethnic disparities remain, irrespective of the insurance mandate. 2. Racial and Ethnic disparities persist in Fertility treatment outcomes even after controlling for access. 3. Provider bias may be playing a role in perpetuating the ethnic and racial disparities in utilisation of fertility care and the treatment outcomes.	1. Mitigate provider bias. 2. Fund high quality health disparity research. 3. Improve access and affordability to treatment for all. 4. Improve patients' reproductive health knowledge.
Mackay A et al. (Mackay et al., 2023)	This scoping review aims to explore the barriers to accessing assisted reproductive technologies to highlight a potential role for the pharmacist in addressing these barriers.	1. USA is known to have a lower ART utilisation than Europe **2. Geographical Barrier** The most cited barrier to access identified in this scoping review was geographical location. Less populated locations had fewer or no services, leading to added cost of travel and accommodation. **3. Psychological Barrier** Existing depression, shame, stigma and embarrassment, often related to race, culture and belonging to rural counties/ low level of urbanisation was recognised as a barrier. **4. Minority Group Barriers** Race, culture, and ethnicity is indicated to act as a barrier, more amongst non-Caucasian people, attributed to cultural beliefs, communication, and a lack of culturally appropriate services. Lack of access due to sexual orientation (single women and same sex relationship) was a financial barrier as insurance coverage required a medical cause of infertility (USA). In Germany insurance funding was available for married couples not those co-habiting, who are 40% less likely to access ART. HIV infected individual had reduced access mainly due to limitations to permitted treatment around risks of transmission to the child and the other partner. **5. Financial Barrier** Having lower socioeconomic status, lower median income, and having no or little coverage by health insurance were all found to act as barriers. **6. Education level of the patient** A lower educational level of the patient is identified as a barrier (United States), including due to lack of knowledge around insurance mandate. **7. Age Barrier** Although least acknowledged, one study identified that for each 5 years rise in woman's age at initial consultation decreased access by 77%.	1. Increasing government support in terms of subsidies and services could act as an enabler to increasing the ability of patients to access ART 2. Cultural education of nurses, doctors, pharmacists, and allied health professionals is important to address stigma and shame, enabling the provision of care in a culturally sensitive and appropriate way. 3. To address geographical barriers are the introduction of satellite clinics and telehealth services utilising the accessibility of local health professionals, including pharmacists. 4. As medications are at the forefront of ART, the role of the pharmacist as a provider of medications can be seen to be an important aspect of this service.
Humphries IA et al. **(Humphries, 2016)**	A systematic review to evaluate the influence of race and ethnicity on clinical pregnancy and live birth outcomes after in vitro fertilization (IVF).	**Black African Women** There is lower clinical pregnancy rate and LBR among black women, the significant effect of race persisted after adjusting for treatment and patient factors as well as clinic-level variables. **Hispanic women** had lower LBR per pregnancy compared with white Women, in line with increased rates	1. More research is needed for better understanding of disparities in IVF outcomes. 2. For decades, clinical research in IVF has been performed in the context of white or Caucasian populations, and adjustments may be necessary to personalize protocols for expanding and including increasingly heterogeneous patient populations.

		of stillbirth and fetal loss. However, in some studies there was no significant difference when controlled for age, BMI, day-3 FSH, smoking status, and infertility diagnosis. **Asian/ Indian women** seem to have lower Clinical Pregnancy and Live Birth rate compared to white Caucasian women. It may be due to older age and higher prevalence of PCOS. When women of racial/ ethnic minorities do seek care, they may be older with greater risk of diminished ovarian reserve and worse prognosis. African American and Asian women express more concerns than do white women about the social stigma of infertility.	3. Evidence of disparities may motivate such innovation, and at the very least, it would improve patient counselling and inform accurate projections of IVF success.
Author(s) & Reference	**Aims/ Objective**	**Findings in the study**	**Improvement strategies proposed**
Huddleston, A et al. (Huddleston et al., 2023) **Race & ethnicity**	The aim of this scoping review was to identify gaps in research pertaining to inequities in MAR and propose suggestions for future research directions.	1. Most of the studies investigated MAR outcomes by race/ethnicity and found that historically marginalized populations had poorer outcomes. 2. LGBTQ + populations were less likely to use MAR or seek infertility care. 3. Most studies found positive correlations with MAR use with income and education. 4. The least commonly studied inequities in our sample were sex and/or gender and rural, under-resourced populations. 5. Findings showed that men and people from rural/under-resourced populations were less likely to access MAR.	1. Standardizing and diversifying race/ethnicity reporting regarding MAR. 2. The use of community-based participatory research to increase data for LGBTQ + patients 3. Increasing access to infertility care for men.
Merkison JM et al. **(Merkison et al., 2023)**	A Systematic Review to get a comprehensive overview of the disparities that exist, the factors that contribute to these disparities, and recommendations for how providers and health care systems may begin to resolve the gaps in equitable care.	1. Disparate live birth rates in non-White women have been observed across numerous studies. Although some studies have investigated the role of BMI and anatomic pathology as causes for these outcomes, none explain the disparate rates across different minority groups. 2. Although infertility coverage does appear to improve utilization rates among African American women, it does not appear to improve disparate treatment outcomes. 3. Hispanic-Latin women were less likely to be aware if their insurance offered coverage for infertility treatment. 4. African American women experience a longer duration of infertility before presentation to a fertility specialist and are less likely to be referred. 5. African American women are more likely to receive care at clinics with smaller IVF volumes and/or lower success rates. 6. Varied cultural and ethnic perceptions influence patients' views and decision making in regard to fertility care. 7. Rates of counselling for fertility preservation before cancer treatment were lower in African American, Asian American, Pacific Islander, and Hispanic patients.	**Patient Education** 1. Patient-centred education on the existence of fertility coverage is an essential component of improving access and utilization. **Improved Data Collection** 2. Additional data are needed to investigate the causative factors in the delayed referral of minority ethnic groups to fertility providers and the selection of fertility clinics. **Provider training** 3. Increasing provider diversity and cultural competency training will serve to strengthen the patient provider relationship and allow for patient autonomy in choosing a provider with whom they feel most comfortable.

		8. Compared with the US population, there is low representation of minority reproductive and infertility physicians across all ethnic minority groups.	
Wellons MF et al **(Wellons et al., 2012)**	To systematically review the reporting of race/ethnicity in Society for Assisted Reproductive Technology (SART) Clinic Outcome Reporting System (CORS) publications.	1. Significant racial/ethnic disparities in IVF outcomes. 2. Potential for selection bias limits confidence in these findings, given that fewer than 65% of SART reported cycles include race/eth-nicity.	Our understanding of how race/ethnicity influences ART outcome could be greatly im-proved if information on race/ethnicity was available for all reported cycles.

Appendix D – Search String

The search string Keywords, using MeSH terms and Text Words, are used for all searches. The key terms are truncated with an asterisk for a comprehensive inclusion opportunity-

PubMed Medline (Advanced search) -

1. For ART treatments - Assisted Reprod* OR Assistive Reprod* OR In Vitro Fertili* OR Invitro Fertili* OR IVF* - “Textword” search - limited to the period 2004-2024 - 46293 studies.

2. For Access - Access* OR Facilitat* OR Utili* OR Barrier* OR Hinder* OR Obstacle* “Textword” search - limited to period 2004-2024 - 2459629 studies.

3. For specific challenges to Access - polic* OR legislat* OR affordab* OR unaffordab* OR geography* OR race* OR gender* OR insurance* OR funding* OR cost* - “Textword” search - limited to period 2004-2024 - 1849971 studies

4. 1 AND 2 AND 3 -

(("assisted reprod*"[Text Word] OR "assistive reprod*"[Text Word] OR "in vitro fertil*"[Text Word] OR "invitro fertil*"[Text Word] OR "ivf"[Text Word]) AND ("access*"[Text Word] OR "barrier*"[Text Word] OR "utili*"[Text Word] OR "facilitat*"[Text Word] OR "hinder*"[Text Word] OR "obstacle*"[Text Word]) AND ("polic*"[Text Word] OR "legislat*"[Text Word] OR "affordab*"[Text Word] OR "unaffordab*"[Text Word] OR "geography*"[Text Word] OR "race*"[Text Word] OR "gender*"[Text Word] OR "insurance*"[Text Word] OR "funding*"[Text Word] OR "cost*"[Text Word])) AND ((humans[Filter]) AND (2004:2024[pdat]) AND (english[Filter]))

Scopus (Advanced Search)

Search String using MeSH terms.

((assisted AND reproduction OR assistive AND reproduction OR invitro AND fertilisation OR in AND vitro AND fertilisation OR ivf AND access OR inequity OR barrier AND policy OR affordability OR unaffordability OR insurance OR cost OR gender) AND PUBYEAR > 2003 AND PUBYEAR < 2024 AND (LIMIT-TO (EXACTKEYWORD , "Human") OR LIMIT-TO (EXACTKEYWORD , "Female") OR LIMIT-TO (EXACTKEYWORD , "Humans")) AND (LIMIT-TO (SUBJAREA , "MEDI")) AND (LIMIT-TO (LANGUAGE , "English"))

Epistemonikos (Advanced search)

Search String using MeSH terms -

(title:(Access OR Inequity OR Barrier AND Assisted Reproduction OR Assistive Reproduction OR Invitro Fertilisation OR In Vitro fertilisation OR IVF) OR abstract:(Access OR Inequity OR Barrier AND Assisted Reproduction OR Assistive Reproduction OR Invitro Fertilisation OR In Vitro fertilisation OR IVF))

Cochrane Database of Systematic Reviews

#1 “Title, Abstract and Keyword” search with MeSH terms for “Invitro Fertilisation”, “Invitro Fertilization” OR “IVF” gave 2926 studies - 60 Systematic Reviews and 2896 Trials

#2 “Title, Abstract and Keyword” search with MeSH terms for “Equity” OR “Inequity” OR “Access”, gave 31 studies - 2 Systematic Reviews and 29 Trials

#1 AND #2 - 0 studies.

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