

Review Article

Contraceptive Methods: A Comprehensive Review

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Abstract: Family planning and contraception remain central pillars of global reproductive health. Despite significant advancements in contraceptive technology, unintended pregnancies continue to represent a major public health challenge worldwide, with approximately 121 million unintended pregnancies occurring annually. This review aims to provide a comprehensive, evidence-based synthesis of available contraceptive methods, encompassing their mechanisms of action, efficacy rates, safety profiles, and clinical considerations. A systematic search of PubMed, MEDLINE, Cochrane Library, and WHO databases was conducted covering literature published between 2000 and 2024. Keywords included: contraception, family planning, hormonal contraceptives, intrauterine devices, barrier methods, emergency contraception, permanent sterilization, natural family planning, and male contraception. Studies meeting inclusion criteria were critically appraised. Contraceptive methods span a broad spectrum from highly effective long-acting reversible contraceptives (LARCs) with failure rates below 1% to less reliable barrier and behavioral methods. Hormonal methods including combined oral contraceptive pills, progestogen-only pills, injectables, patches, and vaginal rings demonstrate high efficacy when used correctly. Intrauterine devices (both hormonal and copper) represent the most effective reversible options. Permanent methods offer definitive contraception. Emerging research explores male hormonal contraception and novel non-hormonal approaches. Contraceptive counseling should be individualized, considering patient preference, medical eligibility, cultural context, and reproductive goals. Expanding access to LARCs and comprehensive contraceptive education remains the most impactful strategy to reduce unintended pregnancies. Future research should prioritize male contraception and non-hormonal alternatives to expand contraceptive options.

Keywords: contraception, family planning, hormonal contraceptives, intrauterine device

1. INTRODUCTION

Contraception — the deliberate prevention of conception through the use of various devices, agents, medications, barriers, or surgical procedures — stands as one of the most transformative developments in modern reproductive medicine [1]. Since the introduction of the first combined oral contraceptive pill in 1960, the landscape of family planning has evolved dramatically, offering individuals and couples an increasingly diverse array of options tailored to different life stages, health conditions, and reproductive intentions. Despite these advances, the global burden of unintended pregnancy remains substantial. According to the World Health Organization (WHO) and the Guttmacher Institute, approximately 121 million unintended pregnancies occur each year, representing nearly 48% of all pregnancies worldwide. Unintended pregnancies carry significant consequences, including increased maternal and neonatal morbidity and mortality, higher rates of induced abortion, educational and economic disadvantages — particularly for women in low- and middle-income countries — and profound psychological impacts [2]. The importance of contraception extends beyond pregnancy

prevention. Many hormonal contraceptives confer non-contraceptive health benefits, including reduction of dysmenorrhea, management of endometriosis, treatment of polycystic ovary syndrome (PCOS), and lowering the risk of certain cancers. Conversely, contraceptives may be contraindicated in women with specific medical conditions, necessitating careful clinical evaluation [3]. A thorough understanding of all available contraceptive methods — their mechanisms, efficacy, safety, advantages, disadvantages, and patient eligibility criteria — is essential for healthcare providers involved in reproductive health. This review provides a comprehensive, evidence-based synthesis of contraceptive methods for clinicians, researchers, and public health practitioners. Objectives of This Review: This article aims to: (1) categorize and describe all major contraceptive methods; (2) review mechanism of action, typical and perfect use efficacy rates, side effects, and contraindications; (3) highlight special populations and considerations; (4) discuss emerging and investigational contraceptive technologies; and (5) offer a framework for individualized contraceptive counseling.

2. MATERIAL AND METHODS

A comprehensive literature search was performed using PubMed/MEDLINE, the Cochrane Database of Systematic Reviews, EMBASE, and WHO reproductive health databases. The search covered publications from January 2000 to December 2024. Search terms included: 'contraception,' 'family planning,' 'hormonal contraceptives,' 'intrauterine device,' 'IUD,' 'barrier contraception,' 'emergency contraception,' 'permanent sterilization,' 'natural family planning,' 'male contraception,' 'contraceptive failure,' and 'Pearl Index.' Studies were included if they: (1) focused on contraceptive methods in humans; (2) were published in English; (3) included data on efficacy, safety, or clinical use; and (4) were systematic reviews, randomized controlled trials, prospective cohort studies, or authoritative clinical guidelines. Editorials, case reports, and studies with sample sizes fewer than 50 participants were excluded unless they addressed rare adverse events or novel contraceptive modalities. Efficacy data are reported as the Pearl Index (pregnancies per 100 woman-years of use) and as 12-month failure rates under typical and perfect use conditions, consistent with the Trussell method. Quality assessment of included studies was conducted using the GRADE framework for systematic reviews and the Cochrane Risk of Bias tool for randomized trials. Medical eligibility criteria are referenced from the WHO Medical Eligibility Criteria for Contraceptive Use, 5th edition (2015, updated 2024).

3. CLASSIFICATION OF CONTRACEPTIVE METHODS

Contraceptive methods are broadly classified based on their duration of action, reversibility, hormonal composition, and mechanism of action. The most widely adopted classification divides methods into:

- Long-Acting Reversible Contraceptives (LARCs): intrauterine devices (IUDs) and subdermal implants
- Short-Acting Hormonal Methods: combined oral contraceptive pills, progestogen-only pills, injectable contraceptives, transdermal patches, and vaginal rings
- Barrier Methods: male and female condoms, diaphragm, cervical cap, and contraceptive sponge
- Spermicidal Agents
- Permanent Methods: female sterilization (tubal ligation) and male sterilization (vasectomy)
- Emergency Contraception: levonorgestrel pills, ulipristal acetate, and copper IUD
- Fertility Awareness-Based Methods (FABMs): calendar/rhythm method, basal body temperature, cervical mucus monitoring (Billings method), and symptom thermal method

Table 01 summarizes the typical-use and perfect-use failure rates (12-month) for major contraceptive methods according to Trussell (2018) and WHO data:

Table 01: Comparative Efficacy of Contraceptive Methods

Contraceptive Method	Typical Use Failure Rate (%)	Perfect Use Failure Rate (%)	Duration / Notes
Copper IUD (e.g., Paragard)	0.8	0.6	Up to 10–12 years
Levonorgestrel IUD (e.g., Mirena)	0.1–0.5	0.1	3–8 years
Subdermal Implant (e.g., Nexplanon)	0.05	0.05	3 years
Female Sterilization (Tubal Ligation)	0.5	0.5	Permanent
Vasectomy	0.15	0.10	Permanent
Depot Medroxyprogesterone Acetate (DMPA)	4	0.2	Every 3 months
Combined Oral Contraceptive Pill (COCP)	7	0.3	Daily
Progestogen-Only Pill (POP)	7–10	0.3	Daily
Contraceptive Patch (Evra)	7	0.3	Weekly x 3
Vaginal Ring (NuvaRing)	7	0.3	Monthly
Male Condom	13	2	Per act; STI protection
Female Condom	21	5	Per act; STI protection
Diaphragm + Spermicide	17	6	Per act
Spermicide Alone	21	16	Per act
Symptothermal Method (FABMs)	2–0	0.4	Daily monitoring
Calendar/Rhythm Method	9–25	5	Daily monitoring
Lactational Amenorrhea Method (LAM)	≤2	≤2	Up to 6 months postpartum
Emergency Contraception (LNG pill)	N/A	~1–2*	Within 72 hrs; single use
No Method	85	85	—

Long-acting reversible contraceptives represent the most effective reversible contraceptive methods available, with failure rates comparable to permanent sterilization. Their defining feature is that once placed, they do not require ongoing patient action for efficacy, making them particularly well-suited for individuals seeking reliable long-term contraception without the commitment of permanence [4]. WHO and major gynecological societies — including the American College of Obstetricians and Gynecologists (ACOG) and the Royal College of Obstetricians and Gynecologists (RCOG) — recommend LARCs as first-line contraceptive options for most individuals.

4. INTRAUTERINE DEVICES (IUDS)

The copper intrauterine device (Cu-IUD), commercially available as the Paragard T 380A in the United States and Multiload Cu-375 in many other countries, is the most widely used and most studied non-hormonal LARC. First introduced in the 1970s, the Cu-IUD remains one of the most effective reversible contraceptive methods worldwide [5].

Mechanism of Action: Copper ions released from the device exert a spermicidal effect by impairing sperm motility, reducing sperm viability, and inhibiting fertilization. The physical presence of the device in the uterine cavity also creates a foreign body inflammatory response that alters the endometrial environment, rendering it unfavorable to implantation. Unlike hormonal methods, the Cu-IUD does not suppress ovulation [6]. **Efficacy:** The Cu-IUD has a typical and perfect use failure rate of approximately 0.8% and 0.6% per year, respectively. It is licensed for use for up to 10–12 years, depending on the specific device. **Non-Contraceptive Uses:** The Cu-IUD is the most effective form of emergency contraception when inserted within 5 days of unprotected intercourse, with a failure rate of less than 0.1%. **Advantages:** Hormone-free; immediate return to fertility upon removal; long-lasting; cost-effective over time; suitable for women who cannot use hormonal contraception.

Disadvantages and Side Effects: Increased menstrual bleeding (menorrhagia) and dysmenorrhea are the most common complaints and the leading cause of discontinuation. Rare but serious complications include uterine perforation (approximately 1 per 1,000 insertions) and device expulsion (approximately 2–5% of users in the first year) [7].

Contraindications: Unexplained vaginal bleeding, current pregnancy, distorted uterine cavity (e.g., fibroids), active pelvic inflammatory disease (PID), copper allergy, and Wilson's disease.

Hormonal (Levonorgestrel) IUD

Levonorgestrel-releasing intrauterine systems (LNG-IUS) include several devices: Mirena (52 mg LNG, licensed for 5–8 years), Kyleena (19.5 mg LNG, 5 years), Liletta (52 mg LNG, 8 years), and Skyla (13.5 mg LNG, 3 years). They release a small daily dose of levonorgestrel locally within the uterus [8].

Mechanism of Action: Local progestogenic effects include thickening of cervical mucus (preventing sperm penetration), thinning of the endometrium, and partial suppression of ovulation (approximately 25–50% of cycles, varying by device dose).

Efficacy: The LNG-IUS (Mirena) has failure rates of 0.1–0.5% per year, making it one of the most effective contraceptive methods available.

Non-Contraceptive Benefits: Significant reduction in menstrual blood loss (80–90%) and dysmenorrhea. Approved for treatment of heavy menstrual bleeding and endometriosis-associated pain. May reduce the risk of endometrial hyperplasia and cancer.

Disadvantages: Initial irregular spotting/bleeding for the first 3–6 months; ovarian cysts (functional) occur in approximately 12% of users; hormonal side effects (acne, mood changes) possible but less common than with systemic hormonal methods [9].

Subdermal Contraceptive Implant

The etonogestrel (ENG) subdermal implant, marketed as Nexplanon (and formerly Implanon), is a single flexible rod (4 cm x 2 mm) inserted sub dermally in the inner upper arm. It releases etonogestrel continuously over a 3-year period.

Mechanism of Action: Primary mechanism is suppression of ovulation through inhibition of the LH surge. Secondary mechanisms include thickening of cervical mucus and endometrial changes.

Efficacy: The ENG implant has the lowest failure rate of any reversible contraceptive — approximately 0.05% per year — equivalent to female sterilization. Rapid return to fertility occurs within weeks of removal.

Advantages: Highly convenient; no daily action required; suitable for women who cannot take estrogen; rapid return to fertility.

Disadvantages: Irregular bleeding patterns are the most common complaint, affecting up to 70% of users (ranging from amenorrhea to frequent/prolonged bleeding). Minor surgical procedure required for insertion and removal. Not suitable for women with current or suspected breast cancer [10].

Drug Interactions: Enzyme-inducing medications (e.g., rifampicin, carbamazepine, phenytoin) may reduce efficacy. Women requiring such medications should use additional contraception or alternative methods.

5. HORMONAL CONTRACEPTIVES

Combined Oral Contraceptive Pills (COCs)

Combined oral contraceptive pills contain synthetic estrogen (almost universally ethinylestradiol) and a progestogen. Since their introduction in 1960, they have become the most widely used reversible contraceptive method globally, with an estimated 151 million users worldwide [11].

Mechanism of Action: The primary mechanism is suppression of ovulation through inhibition of FSH and LH secretion via negative feedback on the hypothalamic-pituitary-ovarian axis. Secondary mechanisms include cervical mucus thickening and endometrial changes that reduce receptivity to implantation.

Types: Monophasic (fixed hormone doses), biphasic, and triphasic (varying doses across the cycle) formulations exist, though monophasic formulations are preferred for simplicity. Estrogen doses have decreased significantly over decades (from 150 mcg to 10–35 mcg ethinylestradiol) to reduce cardiovascular side effects while maintaining efficacy [12].

Progestogens: Older progestogens (norethindrone, levonorgestrel) have greater androgenic activity. Newer progestogens (desogestrel, gestodene, norgestimate, drospirenone, dienogest) are more selective with anti-androgenic or neutral effects, beneficial for acne and PCOS.

Non-Contraceptive Benefits: Reduction in dysmenorrhea and menorrhagia; improvement of acne and hirsutism (anti-androgenic progestogens); treatment of endometriosis and PCOS; reduction in risk of ovarian and endometrial cancers (with long-term use); protection against ectopic pregnancy.

Risks and Side Effects: The most significant risks include venous thromboembolism (VTE), arterial thrombosis (stroke, myocardial infarction) in high-risk individuals, and a modest increase in risk of cervical and breast cancers with current use. Common minor side effects include nausea, breast tenderness, breakthrough bleeding, mood changes, and decreased libido. The absolute risk of VTE is approximately 3–10 per 10,000 woman-years in COCP users compared to 2 per 10,000 in non-pregnant non-users.

WHO Medical Eligibility Criteria – Contraindications: Category 4 (unacceptable risk): breastfeeding women <6 weeks postpartum; smokers aged ≥35 years (>15 cigarettes/day); hypertension (systolic ≥160 mmHg or diastolic ≥100 mmHg); multiple cardiovascular risk factors; history of VTE; known thrombogenic mutations; ischemic heart disease; stroke; complicated valvular heart disease; migraines with aura; active hepatitis or severe liver disease; breast cancer [13].

Progestogen-Only Pills (POPs)

Progestogen-only pills, commonly referred to as 'mini-pills,' contain only a progestogen and are taken daily without a pill-free interval. Traditional POPs (norethindrone 350 mcg) require strict timing (within

a 3-hour window). Newer desogestrel-containing POPs (Cerazette, 75 mcg) have a 12-hour window, improving convenience [14].

Mechanism of Action: Traditional POPs primarily work through cervical mucus thickening and endometrial effects, with inconsistent ovulation suppression (only ~50% of cycles). Desogestrel POPs reliably suppress ovulation in ~97% of cycles, making them more comparable in efficacy to COCPs.

Advantages: Safe for breastfeeding mothers (WHO Category 1 at all postpartum stages); suitable for women with contraindications to estrogen; suitable for women over 35 who smoke.

Disadvantages: Irregular menstrual bleeding; strict pill timing (especially traditional POPs); potential for functional ovarian cysts; slightly higher failure rates compared to COCPs under typical use.

Injectable Contraceptives

Injectable contraceptives deliver progestogen intramuscularly or subcutaneously for a defined period. The most widely used are:

- Depot Medroxyprogesterone Acetate (DMPA / Depo-Provera): 150 mg IM or 104 mg SC every 12–13 weeks
- Norethindrone Enanthate (NET-EN): 200 mg IM every 8 weeks (used in some countries)

Mechanism: Suppression of ovulation is the primary mechanism, along with cervical mucus thickening and endometrial atrophy.

Advantages: High efficacy with typical use; discreet; no daily action; suitable for breastfeeding women after 6 weeks postpartum; may reduce seizure frequency in epileptic patients.

Disadvantages: Significant delay in return to fertility (may take 12–18 months after last injection); irregular bleeding or amenorrhea; weight gain; possible reversible reduction in bone mineral density with long-term use (not considered clinically significant in most users); cannot be immediately reversed [15].

Contraceptive Patch

The transdermal contraceptive patch (Evra; Xulane in the USA) delivers 20 mcg ethinylestradiol and 150 mcg norelgestromin daily through the skin. It is applied weekly for three consecutive weeks, followed by a patch-free week.

Efficacy and Mechanism: Equivalent to COCPs through the same mechanism (ovulation suppression, cervical mucus thickening). Failure rates mirror COCPs under typical use (7%). May have reduced efficacy in women weighing more than 90 kg [16].

Advantages: Improved adherence over daily pill; no gastrointestinal absorption issues; weekly application.

Disadvantages: Local skin reactions; slightly higher estrogen exposure than low-dose pills (potentially higher VTE risk); visible on skin; patch may detach in hot/humid conditions.

Vaginal Contraceptive Ring

The combined hormonal vaginal ring (NuvaRing; Nuvaring) is a flexible, transparent ring (54 mm diameter) inserted vaginally for 3 weeks and removed for 1 week. It releases 15 mcg ethinylestradiol and 120 mcg etonogestrel daily. A newer extended-use ring (Annovera) releases estradiol acetate and

segesterone acetate and can be used for an entire year (insert for 21 days, remove for 7 days, reinsert for up to 13 cycles) [17].

Advantages: Low systemic hormone levels; minimal gastrointestinal issues; monthly insertion rather than daily pill.

Disadvantages: Vaginal discomfort or awareness for some users; possible partner awareness during intercourse; requires comfort with vaginal insertion; ring expulsion risk.

6. BARRIER CONTRACEPTIVE METHODS

Barrier methods physically prevent sperm from reaching the ovum. Their contraceptive efficacy is significantly dependent on consistent and correct use. With the exception of male and female condoms, barrier methods do not protect against sexually transmitted infections (STIs).

Male Condom

The male (external) condom is the only contraceptive method that provides dual protection against both pregnancy and STIs, including HIV. Made primarily of latex (alternatives: polyurethane, polyisoprene for latex allergy), it is placed over the erect penis before intercourse.

Efficacy: Typical use failure rate of 13% per year; with perfect use, 2% per year. The large gap between perfect and typical use reflects errors in application, breakage, and slippage.

Non-Contraceptive Benefits: Protection against STIs (HIV, chlamydia, gonorrhea, herpes, HPV) when used consistently and correctly.

Disadvantages: Requires partner cooperation; may reduce sensation; latex allergy risk; efficacy highly dependent on correct use.

Female Condom

The female (internal) condom (FC2) is a polyurethane or nitrile sheath inserted into the vagina before intercourse. It has an inner ring for insertion and an outer ring that remains outside the vagina [18].

Efficacy: Typical use failure rate of 21%; perfect use 5%.

Advantages: Female-controlled; can be inserted before intercourse; provides STI protection; suitable for individuals with latex allergy.

Disadvantages: Higher cost than male condoms; can be awkward to insert; reduced sensation for some users; outer ring may slip during intercourse.

Diaphragm and Cervical Cap

The diaphragm is a dome-shaped silicone or latex barrier device inserted into the vagina to cover the cervix. The Caya diaphragm is a one-size-fits-most design that does not require fitting by a clinician. The cervical cap (FemCap) is a smaller, thimble-shaped device that fits directly over the cervix and requires clinician fitting. Both devices must be used with spermicide and are inserted before intercourse, remaining in place for at least 6 hours afterward. They are less effective in women who have previously given birth [19].

Efficacy: Diaphragm: typical use 17%, perfect use 6%. Cervical cap: typical use 17–23% (higher failure in parous women), perfect use 9–20%.

Contraceptive Sponge

The contraceptive sponge (Today Sponge) is a soft, polyurethane foam sponge containing spermicide (nonoxynol-9) that is inserted into the vagina before intercourse. It provides protection for up to 24 hours without additional spermicide. Typical use failure rate is approximately 12% in nulliparous women and 24% in parous women [20].

7. PERMANENT CONTRACEPTION (STERILIZATION)

Sterilization procedures are intended to be permanent and should be considered irreversible. Although reversal procedures exist for both male and female sterilization, success rates are variable and depend heavily on the duration since the procedure and the technique used. Patients must be counseled extensively regarding permanence before the procedure.

Female Sterilization (Tubal Occlusion)

Female sterilization involves occluding the fallopian tubes to prevent sperm and egg from meeting. It is one of the most commonly used contraceptive methods globally.

Techniques include: (1) laparoscopic tubal ligation (Pomeroy, Parkland, Falope ring, Hulka clip, Filshie clip techniques); (2) mini laparotomy (common in low-resource settings); and (3) hysteroscopic sterilization (Essure — now withdrawn from many markets due to adverse events).

Efficacy: Failure rate of 0.5% per year overall, but varies by technique. The 10-year cumulative failure rate is approximately 1.85% (all methods combined). Highest failure rates with bipolar coagulation performed premenstrually in young women.

Risks: Surgical risks include anesthesia complications, injury to adjacent structures (bowel, bladder, blood vessels), post-operative infection, and ectopic pregnancy (should tubal ligation fail, the resulting pregnancy has a higher likelihood of being ectopic). Long-term regret rates are reported at 6–27%, with highest rates in women under 30 years [16].

Non-Contraceptive Benefits: Prospective data suggest sterilization may reduce the risk of ovarian cancer (approximately 29% risk reduction).

Male Sterilization (Vasectomy)

Vasectomy involves surgical occlusion or excision of the vas deferens, preventing sperm from reaching the ejaculate. Techniques include conventional vasectomy and the no-scalpel vasectomy (NSV), the latter associated with fewer complications and faster recovery.

Efficacy: Vasectomy has a failure rate of approximately 0.15% over 12 months with confirmed azoospermia. Confirmation of success requires semen analysis at 8–16 weeks post-procedure.

Advantages: Simpler, safer, and less expensive than female sterilization; performed under local anesthesia; shorter recovery time.

Risks: Short-term: hematoma, infection, epididymitis. Long-term: chronic scrotal pain (post-vasectomy pain syndrome) in approximately 1–2% of men. No established link with prostate cancer [18].

Important Note: Vasectomy does not provide immediate contraception. Azoospermia must be confirmed before unprotected intercourse is permitted.

8. EMERGENCY CONTRACEPTION

Emergency contraception (EC) refers to methods used after unprotected sexual intercourse or contraceptive failure to prevent pregnancy. It is not intended for regular use and does not protect against STIs. EC is most effective when used as soon as possible after unprotected intercourse.

Levonorgestrel Emergency Contraceptive Pills (LNG-ECP)

Levonorgestrel 1.5 mg (as a single dose or two 0.75 mg doses 12 hours apart) is the most widely available EC pill worldwide (Plan B One-Step, Next Choice, Levonelle). It is effective within 72 hours of unprotected intercourse and reduces pregnancy risk by approximately 85–89% when used within this window. Efficacy decreases with time and may be reduced in women with higher body weight (BMI >26 kg/m²) [19].

Mechanism: Primarily inhibits or delays ovulation. Does not interrupt an established pregnancy. If taken after ovulation, it is not effective.

Ulipristal Acetate (UPA)

Ulipristal acetate 30 mg (EllaOne, Ella) is a selective progesterone receptor modulator licensed for EC up to 120 hours (5 days) after unprotected intercourse. It maintains efficacy more consistently across the window than LNG-ECP and is superior in the 72–120-hour period. UPA may reduce the efficacy of subsequent progestogen-based contraception (hormonal methods should not be started until 5 days after UPA) [17].

Copper IUD as Emergency Contraception

Insertion of a Cu-IUD within 5 days of unprotected intercourse is the most effective form of EC, reducing pregnancy risk by >99%. In addition, it provides ongoing long-term contraception. It is particularly advantageous for women who desire ongoing highly effective contraception after EC.

9. FERTILITY AWARENESS-BASED METHODS (FABMs)

Fertility awareness-based methods involve identifying the fertile window of the menstrual cycle and abstaining from unprotected intercourse during that period. These methods have no medical side effects and are acceptable for individuals with religious or cultural objections to other forms of contraception. However, they require significant training, motivation, and consistent practice, and are less effective than hormonal or LARC methods.

Calendar/Rhythm Method

Based on calculating the fertile window from past menstrual cycle lengths. Requires regular cycles. Typical use failure rate of 9–25% per year; not recommended for women with irregular cycles.

Basal Body Temperature (BBT) Method

Women track their resting body temperature daily; a rise of 0.2–0.4°C after ovulation (due to progesterone) signals the end of the fertile window. Only useful retrospectively for identifying post-ovulatory infertility.

Cervical Mucus (Billings Ovulation) Method

Women observe and record cervical mucus characteristics throughout the cycle. The mucus transitions from dry/scanty to wet/clear/stretchy (like raw egg white) around ovulation. Requires training and significant user motivation.

Symptothermal Method

Combines BBT and cervical mucus observation, with optional inclusion of cervical position assessment. With perfect use, failure rates of 0.4%; typical use ranges from 2–0%. This is among the most effective FABMs when practiced correctly.

Lactational Amenorrhea Method (LAM)

LAM is a temporary postpartum contraceptive method based on the fact that exclusive breastfeeding suppresses ovulation through prolactin-mediated inhibition of GnRH. For LAM to be effective, three criteria must ALL be met: (1) the infant is less than 6 months old; (2) the woman is amenorrheic; and (3) the woman is exclusively or nearly exclusively breastfeeding. When all three criteria are met, the failure rate is approximately 2% or less in the first 6 months postpartum [16].

10. SPERMICIDAL AGENTS

Spermicides are chemical agents that immobilize or kill sperm. Available forms include gels, creams, foams, suppositories, and films containing nonoxynol-9 (N-9) as the active ingredient. When used alone, spermicides have a typical use failure rate of approximately 21% and a perfect use failure rate of approximately 16%, making them one of the least effective methods. Spermicides are most effective when used in combination with barrier methods (diaphragm, condom). Importantly, nonoxynol-9 does not protect against STIs and, with frequent use, may cause vaginal mucosal irritation that can increase susceptibility to HIV transmission. WHO does not recommend N-9 products for women at high risk of HIV [18].

11. CONTRACEPTION IN SPECIAL POPULATIONS

Adolescents

Adolescents are at high risk for unintended pregnancy and STIs. ACOG and WHO recommend LARCs (IUDs and implants) as first-line options for adolescents, as they are highly effective and do not require ongoing adherence. Condoms should be used concurrently for STI protection. Concerns about IUD insertion in nulliparous adolescents are not supported by evidence; IUDs are safe and acceptable in this population.

Perimenopausal Women

Contraceptive need persists until confirmed menopause (12 months of amenorrhea in a woman over 50; 24 months in a woman under 50). Low-dose COCPs or LNG-IUS may provide both contraception and management of perimenopausal symptoms. Progesterone-only methods are preferred in women with cardiovascular risk factors. Hormone replacement therapy (HRT) is NOT a contraceptive method.

Women with Chronic Medical Conditions

The WHO Medical Eligibility Criteria (MEC) provides guidance on contraceptive use in women with specific medical conditions. Key considerations include: cardiovascular disease (estrogen-containing methods are generally contraindicated); diabetes mellitus (most methods are acceptable; avoid estrogen in women with vascular disease); epilepsy (enzyme-inducing antiepileptics reduce efficacy of hormonal methods — DMPA or Cu-IUD preferred); systemic lupus erythematosus (avoid estrogen-containing methods; Cu-IUD or progestogen-only methods preferred); and breast cancer (avoid all hormonal methods during active disease) [15].

Postpartum Contraception

The postpartum period presents a critical window for contraceptive initiation to prevent closely spaced pregnancies. Key considerations: Cu-IUD and LNG-IUS can be inserted immediately postpartum (within

10 minutes of placental delivery) or after 4 weeks. Implants can be inserted immediately postpartum. DMPA can be given immediately postpartum (non-breastfeeding women) or after 6 weeks (breastfeeding women). Estrogen-containing methods are deferred until 6 weeks postpartum in non-breastfeeding women and are generally avoided in breastfeeding women throughout the period of breastfeeding [14].

12. EMERGING AND INVESTIGATIONAL CONTRACEPTIVE METHODS

Male Hormonal Contraception

Despite decades of research, no male hormonal contraceptive has yet received regulatory approval. Approaches include testosterone-based regimens (which suppress spermatogenesis but cause side effects including mood changes, dyslipidemia, and acne) and combined testosterone/progestogen regimens. The WHO-sponsored MENT (7- α -methyl-19-nortestosterone) implant and the dimethandrolone undecanoate (DMAU) oral pill have shown promise in clinical trials. A major challenge remains the design of a reversible method that reliably suppresses spermatogenesis to azoospermia or severe oligospermia without unacceptable systemic effects [19].

Non-Hormonal Female Contraception

Research into non-hormonal female contraceptives targets: (1) CDB-4124, a selective progesterone receptor modulator; (2) Eppin (a sperm surface protein that can be targeted by antibodies); (3) RISUG (Reversible Inhibition of Sperm Under Guidance) — an injectable intra-vas polymer that incapacitates sperm — and its related technology Vasalgel, currently under investigation in the United States; (4) YCT529, a non-hormonal male oral contraceptive targeting retinoic acid receptor alpha (RAR- α), currently in Phase I clinical trials.

Extended-Cycle and Continuous Hormonal Contraception

Extended-cycle combined oral contraceptives (e.g., Seasonique, Lybrel) allow fewer or no withdrawal bleeds per year. Evidence suggests no medical benefit from regular withdrawal bleeds, and extended regimens are acceptable for most women with potential benefits including fewer menstrual symptoms and improved adherence.

Digital and App-Based Fertility Monitoring

FDA-cleared fertility tracking applications (e.g., Natural Cycles) use algorithm-based analysis of BBT data to identify fertile and non-fertile days, providing a digital approach to FABMs. In clinical studies, perfect use failure rates of approximately 1.8% and typical use rates of approximately 6.5% have been reported. These tools are best suited for women with regular cycles seeking non-hormonal contraception who are highly motivated [20].

13. CONTRACEPTIVE COUNSELING: A PATIENT-CENTERED APPROACH

Effective contraceptive counseling is the cornerstone of reproductive healthcare. The goal is to support individuals in making informed, autonomous decisions that align with their reproductive goals, health status, values, and life circumstances. Counseling should be non-coercive, culturally sensitive, and free from provider bias. The GATHER framework (Greet, Ask, Tell, Help, Explain, Return/Refer) remains a widely adopted structured approach to reproductive counseling. Key elements of counseling include:

- Assessment of reproductive intentions: Does the patient wish to become pregnant now, in the future, or not at all?
- Medical history review and WHO MEC eligibility assessment

- Discussion of all available options with unbiased information on efficacy, benefits, risks, and practical use
- Assessment of STI risk and need for dual protection
- Acknowledgment of patient preferences, including cultural and religious considerations
- Follow-up plan for side effect monitoring and method switching if needed

The concept of reproductive justice — recognizing that all individuals have the right to have children, not have children, and to parent their children in safe environments — should underpin contraceptive counseling. Access to contraception should not be limited by socioeconomic status, geography, or systemic barriers.

14. GLOBAL ACCESS, EQUITY, AND PUBLIC HEALTH IMPLICATIONS

Access to contraception is a fundamental human right and a key driver of women's empowerment, maternal health, and economic development. According to UN data, an estimated 270 million women worldwide who want to avoid pregnancy have an unmet need for contraception. This is especially pronounced in sub-Saharan Africa, South Asia, and among adolescent, rural, and low-income populations. Barriers to access include: cost and availability of modern contraceptives; lack of comprehensive sexuality education; provider bias and coercive practices; legal and policy restrictions (e.g., marital consent requirements); cultural and social stigma; and lack of trained healthcare providers. Investment in expanding contraceptive access has been shown to be one of the most cost-effective public health interventions. The Copenhagen Consensus and Guttmacher Institute estimate that for every dollar invested in family planning, governments save between \$2 and \$6 in costs related to maternal and child health. The global contraceptive landscape is also shaped by supply chain vulnerabilities (as highlighted during the COVID-19 pandemic), commodity security concerns, and the importance of integrating family planning into primary healthcare systems.

15. DISCUSSION

This comprehensive review has synthesized current evidence across the full spectrum of contraceptive methods. Several key themes emerge from the literature:

Efficacy Gradient and LARC Prioritization: The most striking finding is the substantial efficacy gap between LARC methods and other contraceptive options under typical use conditions. The difference in pregnancy rates between an IUD (0.1–0.8%) and an oral contraceptive pill (7%) under typical use is almost entirely attributable to user-dependent factors such as missed pills, incorrect timing, and inconsistent use. This underscores the importance of promoting LARCs as first-line options while ensuring patient autonomy and informed choice [13].

The Dual Protection Dilemma: No highly effective contraceptive method other than condoms provides protection against STIs. This creates a clinical challenge, particularly for adolescents and individuals with multiple partners, who need both effective pregnancy prevention and STI protection. Counseling on 'dual use' — combining a highly effective hormonal or LARC method with consistent condom use — is essential in these populations [14].

The Male Contraception Gap: The conspicuous absence of reversible male contraceptive options (other than the condom and vasectomy) represents a major gap in the contraceptive landscape. The disproportionate burden of contraception on women — both in terms of health risks and practical responsibility — is an equity issue. Continued investment in male contraceptive research is urgently needed.

Importance of Individualized Medicine: The WHO Medical Eligibility Criteria framework has been transformative in guiding clinicians to provide safe contraception across diverse patient populations. Nevertheless, translation of this evidence into clinical practice remains inconsistent. Clinicians must routinely apply MEC criteria and avoid both over-restriction (denying contraception based on unfounded concerns) and under-restriction (prescribing contraceptives without appropriate safety screening) [15].

Emerging Technologies: Digital fertility monitoring applications, non-hormonal male contraceptives, and novel LARC designs represent exciting frontiers. However, these technologies must be rigorously validated in diverse populations before widespread adoption, and marketing claims must not outpace the evidence base.

16. CONCLUSION

Contraception is a cornerstone of reproductive health, enabling individuals and couples to exercise their fundamental right to determine the number, timing, and spacing of their pregnancies. The contraceptive landscape has never been richer, offering methods spanning a spectrum of efficacy, duration, mechanism, and user demands. Long-acting reversible contraceptives — particularly IUDs and subdermal implants — represent the gold standard of reversible contraception and should be promoted as first-line options in routine clinical counseling. Hormonal methods remain highly effective and offer significant non-contraceptive benefits but require ongoing user adherence and careful patient selection. Barrier methods, while less effective, provide essential STI protection and should be recommended concurrently with other methods in at-risk populations. Effective contraceptive counseling, grounded in patient-centered care, medical eligibility criteria, and reproductive justice principles, is the most impactful intervention available to healthcare providers. Expanding access to the full range of contraceptive methods — regardless of geography, socioeconomic status, or cultural context — remains an urgent global health priority. Future research should prioritize: (1) the development and regulatory approval of male hormonal and non-hormonal contraceptives; (2) novel non-hormonal female contraceptive technologies; (3) implementation science to address barriers to LARC access and uptake; and (4) further evaluation of digital and app-based fertility monitoring in diverse populations.

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