Contraception allows parents to choose the number and spacing of children. Each year, family planning programmes prevent an estimated 187 million unintended pregnancies, including 60 million unplanned births and 105 million abortions, and avert an estimated 2.7 million infant deaths and 215,000 pregnancy related deaths.1

The prevalence of contraceptive use differs across the world owing to differences in desired number of children, awareness, funding, and service delivery, with an overall prevalence of use worldwide of 63%. Female sterilisation and intrauterine devices account for nearly 40% in less developed regions, and pills, intrauterine devices, and condoms for the same proportion in more developed regions.2

This article reviews evidence based information on contraceptive methods currently available for women.

The family planning consultation

Counselling

Counselling is thought to enable clients to make contraceptive choices that best fit their values and needs; it should lead to greater satisfaction and more correct and longer use of contraception, particularly when partners are involved. However, a Cochrane review of randomised controlled trials that acknowledged heterogeneity between studies found no conclusive evidence that counselling improves adherence to, and continuation of, the use of contraceptives.3

The World Health Organization identifies four types of clients according to their counselling needs: returning clients with no problems, returning clients with problems, new clients with a method in mind, and new clients with no method in mind.4 Family planning providers must therefore be both knowledgeable and skilled in communicating information. Ideally, family planning counselling is holistic and encompasses sexual and reproductive health, but prevention of sexually transmitted infections is outside the scope of this review.

Clinical aspects

According to WHO international guidelines, the minimum requirements before starting contraception with a combined oestrogen-progestogen product consists of asking for a personal and family history of deep vein thrombosis and measuring blood pressure at baseline and follow-up.5 Combined agents are best avoided by women over 35 years who smoke.6 Progestogens only can be started in healthy non-pregnant women without screening procedures.5

When used correctly, the lactational amenorrhoea method prevents conception in more than 98% of women during the first six months after childbirth.7

Levonorgestrel-only emergency contraceptive pills and copper bearing intrauterine devices are valuable methods of emergency contraception.8

SUMMARY POINTS

Combined oestrogen and progestogen contraceptives inhibit ovulation. Their biological effects and safety profiles are similar regardless of route of administration

Progestogen-only methods act by various mechanisms and can be used by women in whom oestrogens are contraindicated

Copper bearing intrauterine devices combine the highest efficacy with the lowest cost. The levonorgestrel releasing intrauterine system reduces menstrual blood loss

When used correctly, the lactational amenorrhoea method prevents conception in more than 98% of women during the first six months after childbirth

Levonorgestrel-only emergency contraceptive pills and copper bearing intrauterine devices are valuable methods of emergency contraception

Emergency contraceptive pills prevent pregnancy; they should be taken as soon as possible, and not later than 72 hours after unprotected intercourse

Box 1 | Drugs that interact with hormonal contraceptives

Liver enzyme inducing drugs that reduce the efficacy of hormonal contraceptives

Barbiturates
Carbamazepine
Oxcarbazepine
Phenytoin
Primidone
Topiramate
Modafinil
Rifampicin
Griseofulvin
Certain antiretrovirals (such as ritonavir and nevirapine)

Other drugs
Non-liver enzyme inducing antibiotics (various interactions)
Lamotrigine (concentrations lowered by the contraceptive)
Ciclosporin (concentrations raised by the contraceptive)
Potassium sparing diuretics (risk of hyperkalaemia with pills containing drospirenone)
How do hormonal contraceptives work?

Combined oestrogen-progestogen products

Table 1 lists the currently available combined oestrogen-progestogen contraceptives. These products release an oestrogen (mostly ethinylestradiol) and a progestogen, which act systemically to inhibit ovulation. All, except the sequential pill, also increase the viscosity of cervical mucus—which inhibits migration of sperm to the uterine cavity—and suppress endometrial growth. Combined oral contraceptives, patches, and combined vaginal rings may be used cyclically, according to an extended regimen (with a medication-free interval), or continuously. According to WHO guidelines, return to fertility on discontinuation of treatment is immediate, with the exception of monthly injectable preparations, which require five months on average after the last injection for fertility to return.

Progestogen-only products

Progestogen-only preparations (table 2) may be given to women in whom oestrogens are contraindicated. Progestogen-only pills are taken each day at the same time, with no pill-free interval. Progestogen-only pills and implants that release levonorgestrel act primarily by thickening the cervical mucus; ovulation is not always prevented. In addition to their effect on cervical mucus, desogestrel pills, depot medroxyprogesterone acetate, and etonogestrel releasing implants inhibit ovulation in most cycles. Fertility returns as soon as pills are discontinued, whereas it takes an average of 10 and six months to return after the last injection of depot medroxyprogesterone acetate and norethisterone enantate, respectively.

How effective are hormonal contraceptives?

Effectiveness is related to the acceptability of the contraceptive method and to compliance. “Typical use” is considerably less effective than “perfect use” (correct and consistent use). A recent Cochrane review found that combined oral contraceptive pills, transdermal patches, and vaginal rings were equally efficacious; they have a failure rate of 0.3 per 100 women per year with perfect use and 8 with typical use.

Maintaining a regular schedule is more important for progestogen-only pills than for combined oral contraceptives—more than a three hour delay in taking the progestogen-only pill can cause failure of contraception. Implants, injectable preparations, and intrauterine contraceptives do not depend on daily compliance and have lower failure rates. Implants (failure rate of 0.05 per 100 women per year with typical use) and injectable preparations (3) are among the most effective reversible contraceptives. According to recently updated WHO recommendations, depot medroxyprogesterone acetate may be given up to four weeks late without pregnancy needing first to be ruled out.

How is the effectiveness of hormonal contraceptives affected by drug interaction?

The efficacy of hormonal contraceptives may be reduced when liver enzyme inducing drugs are taken simultaneously. Box 1 lists several drugs that interact

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Box 1 Listed several drugs that interact

Box 2 | Contraindications to combined hormonal contraceptives

**Absolute contraindications (class 4 in the WHO classification)**
- Pregnancy
- Undiagnosed genital bleeding
- Breast cancer
- Past or present circulatory disease (for example, arterial or venous thrombosis, ischaemic heart disease, and cerebral haemorrhage)
- Thrombophilia
- Pill induced hypertension
- Migraine with aura
- Active liver disease, cholestatic jaundice, Dubin-Johnson syndrome, acute porphyria
- Systemic lupus erythematosus
- Haemolytic-uraemic syndrome
- Thrombotic thrombocytopenic purpura

**Relative contraindications (class 2 or 3 in the WHO classification)**
- Smoker aged over 35 years
- Hypertension (blood pressure above 140/90 mm Hg)
- Diabetes
- Hyperprolactinaemia
- Gall bladder disease
- Migraine without aura
- Otosclerosis
- Sickle cell disease

Box 3 | Contraception for special groups

**Adolescents**
When accessible, adolescents mostly use pills (less often patches or rings) or male condoms. Dual protection with a condom and another contraceptive should be encouraged. Easy access to emergency contraception is a priority. Long acting reversible contraceptives protect more effectively against unwanted pregnancy; injectable preparations and implants are preferable to copper bearing intrauterine devices in this age group.

**Post partum**
Because of the higher risk of thrombosis during the first weeks after childbirth, combined oestrogen-progestogen preparations should not be used until 21 days after delivery. Progestogen-only pills may be started at once. Progestogen-only injectable preparations may cause heavy metrorrhagia if given before six weeks post partum. Intrauterine contraceptives may be inserted immediately after delivery or any time from six weeks post partum onwards (to lessen the risk of perforation). Diaphragms and cervical caps should not be fitted until six to 12 weeks post partum.

**Lactating mothers**
Breast feeding is a contraindication for the use of all hormonal methods except for progestogen-only pills, which have no known adverse effect on the infant or lactation.

**Older (perimenopausal) women**
Contraceptives (including 20 µg pills) that are well tolerated, effective, and not contraindicated should not be discontinued until menopause is confirmed or the age of 51. The levonorgestrel intrauterine system is particularly useful for premenopausal women with menorrhagia. Because of diminishing fertility, less effective methods (such as diaphragms and cervical caps) may provide sufficient protection in this age group.
with hormonal contraceptives. Certain antibiotics without liver enzyme inducing activity alter the enterohepatic recirculation of sex steroids and thereby reduce the efficacy of combined oral contraceptives. Additional contraceptive protection, such as a barrier method, should be used concurrently and for four weeks after discontinuing such drugs. Interactions of antiretrovirals with hormonal contraceptives are specific to the type of antiretroviral and hormonal contraceptive being used. HIV positive women should use a dual method of hormonal and barrier contraception.9

**What are the non-contraceptive benefits of combined contraceptive pills?**

Analysis of data from 45 observational studies from 21 countries showed that the overall relative risk of ovarian cancer decreased by 20% for each five years of use.10 In women who had used combined oral contraceptives for 15 years the risk was halved. A protective effect with regard to both endometrial and ovarian malignancy can be detected in ex-users of contraceptives for up to 15 years.

Hormonal contraceptives may be used to treat dysfunctional uterine bleeding, dysmenorrhea, and menorrhagia; their use is associated with a lower incidence of functional ovarian cysts, benign breast disease, and colorectal cancer.11 Their effect on bone mineral density depends on the dose of oestrogen and the age of the woman.

**What are the adverse effects and complications of hormonal contraceptives?**

The side effects and complications of combined oral contraceptives have been well investigated. A nationwide prospective study carried out in the United States showed that after six months of using an oral contraceptive 16% (switchers) to 32% (starters) of women had stopped taking their pill. Nearly half (46%) of the women who discontinued did so because of side effects, such as breakthrough bleeding and headache.11

Case-control studies have shown an increased relative risk of deep venous thrombosis and pulmonary embolism, ranging from 2.1 to 4.4.12 This risk is related to the dose of oestrogen and the type of progestogen. Pills containing desogestrel or gestodene are associated with a twofold greater risk than those containing levonorgestrel or norethisterone; those containing cyproterone acetate have a four times greater risk.12 The data are insufficient to make conclusions about combined oral contraceptives containing other progestogens.12 Women with thrombophilia are particularly at risk of thromboembolic events. A systematic review and meta-analysis of seven studies of women taking combined oral contraceptives found significant associations of the risk of thromboembolism with deficiencies of antithrombin, protein C, or protein S; raised concentrations of factor VIIIc; and the presence of factor V Leiden and prothrombin G20210A.13

Use of combined oral contraceptives is associated with an increased risk of myocardial infarction, stroke, gallbladder disease, hypertension, glycometabolic imbalance in people with diabetes, carcinoma of the cervix, hepatocellular carcinoma, and—to a lesser degree—breast cancer in current users. These risks are not modified when ethinylestradiol is given parenterally, or by the use of new progestogens not derived from 19-nortestosterone.1 A Cochrane review found that transdermal patches cause more, and the vaginal ring causes fewer (except for vaginal discharge and vaginitis), side effects than combined oral contraceptives.7 A cohort study found a more than twofold increase in deep venous thrombosis and pulmonary embolism in users of transdermal contraceptives compared with women taking a combined oral contraceptive containing 35 µg ethinylestradiol and norgestrel.14 Box 2 lists contraindications to the use of combined hormonal contraceptives.

The use of a progestogen only is commonly associated with altered bleeding patterns.12 15 Use of depot medroxyprogesterone acetate decreases bone mineral density, but this returns to baseline values after discontinuation of treatment.14

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**Table 1** Combined oestrogen-progestogen preparations

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined oral contraceptives</td>
<td>Tablets that are taken daily, either cyclically, according to an extended regimen, or continuously</td>
</tr>
<tr>
<td>Monthly injectable preparations</td>
<td>Oily suspension of an oestrogen and a progestogen given monthly by deep intramuscular injection</td>
</tr>
<tr>
<td>Transdermal combined patch</td>
<td>Adhesive patch worn on the body that releases steroids via the skin into the bloodstream. The patch is changed weekly</td>
</tr>
<tr>
<td>Combined vaginal ring</td>
<td>Flexible ring placed in the vagina that releases steroids via the vaginal wall into the bloodstream. The ring is kept in place for 3 weeks, after which the ring is not worn for 1 week</td>
</tr>
</tbody>
</table>

**Table 2** Progestogen-only preparations

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progestogen-only pills</td>
<td>Most contain a very low dose of progestogen. They are taken continuously and every day at the same time</td>
</tr>
<tr>
<td>Progestogen-only injectable preparations</td>
<td>Oily suspension of a progestogen given every 2 or 3 months by deep intramuscular injection</td>
</tr>
<tr>
<td>Implants</td>
<td>Small plastic rods which are surgically implanted under the skin medially in the upper arm. They are effective for either 3 or 5 years</td>
</tr>
<tr>
<td>Levonorgestrel intrauterine system</td>
<td>Intrauterine contraceptive which releases small quantities of levonorgestrel in the uterine cavity</td>
</tr>
</tbody>
</table>

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How do intrauterine contraceptives work?
Copper bearing intrauterine devices act by immobilising sperm in the uterine cavity and preventing fertilisation. Of all contraceptive methods, these devices combine the highest efficacy with the lowest cost. The TCu-380A is approved for 10 years but could be effective for 12.

The levonorgestrel releasing intrauterine system causes marked (but reversible) atrophy of the endometrium. A Cochrane review of contraception trials found this system to be as effective as the TCu-380A. It is approved for five years of use and is successful in treating menorrhagia and dysmenorrhoea. A systematic review of nine studies showed that menstrual bleeding over time is reduced by 74-97%. A systematic overview of observational studies found limited evidence that this system benefits women with endometriosis, adenomyosis, fibroids, endometrial hyperplasia, and early stage endometrial cancer (in women unfit for surgery). WHO guidelines state that fertility returns immediately after removal of all intrauterine contraceptives.

What are the adverse effects and complications of intrauterine contraceptives?
Insertion of intrauterine devices can be painful. Rarely, uterine perforation occurs. Immediate postpartum or postabortal insertion has the advantages of high motivation, assurance that the woman is not pregnant, and convenience, but it is associated (particularly postpartum and after a second trimester abortion) with a higher expulsion rate than after interval insertion (box 3). Copper bearing intrauterine devices increase menstrual flow by 30% on average and may aggravate dysmenorrhoea. According to a recent Cochrane review, non-steroidal anti-inflammatory drugs reduce bleeding and pain associated with the use of intrauterine devices; tranexamic acid is a second line treatment for excessive bleeding. A case-control study found that intrauterine devices do not raise the risk of tubal occlusion in nulligravid women, and a meta-analysis of case-control studies showed that ectopic pregnancy is not more common in women who conceive with an intrauterine device in place. According to observational evidence, intrauterine devices do not increase the risk of pelvic inflammatory disease unless inserted in women with pre-existing gonorrhoea or Chlamydia infection.

Women using a levonorgestrel releasing intrauterine system may have spotting and bleeding during the first months, acne (if already prone to it), mastalgia, or mood changes and they may develop functional ovarian cysts. The recurrence or persistence of side effects may require the removal of the device. Amenorrhoea occurs in about 20% of women one year after insertion of the levonorgestrel releasing intrauterine system. Women may consider it a reason for discontinuation if they were not counselled about the beneficial effect this may have on their health.

How useful are barrier methods?
All barrier methods offer the convenience of contraception “when needed,” but their success rate depends on correct and consistent use. Typical use is associated with high failure rates (from 1.5 for the male condom to 32 per 100 women per year for the cervical cap used by multiparous women), and all may cause allergy.

The female condom is a single-use polyurethane sheath, which is placed into the vagina. To insert the condom into the vagina, the movable and flexible inner ring at its closed end is compressed and introduced much like a diaphragm. The larger, fixed outer ring remains outside the vagina to cover part of the introitus. The penis should be manually placed (by either partner) into the sheath to prevent it from becoming wrongly positioned between the condom and the vaginal wall. The condom is removed immediately after intercourse.

The diaphragm is particularly suited for women over the age of 35, whose fertility is progressively decreasing and who show greater compliance. It should be inserted less than three hours before intercourse and left in situ for at least six hours afterwards. Its use increases the risk of urinary tract infections.

The cervical cap may be inserted up to 48 hours before coitus. Both the diaphragm and the cap must be coated with spermicide before insertion. Neither should be fitted within six to 12 weeks after childbirth or second trimester abortion, and neither protects against HIV. Women with a history of toxic shock syndrome should not use a diaphragm or a cap.

How useful are spermicides, used alone?
Spermicides are usually used with barrier devices, and they are not reliable if used alone, except in women whose natural fertility is reduced, particularly with increasing age. Their use many times a day (for example, by professional sex workers) may cause damage of the vaginal wall and facilitate HIV transmission.
ADDIITIONAL EDUCATIONAL RESOURCES

Resources for healthcare professionals
WHO (www.who.int/reproductive-health/)—Medical eligibility criteria for contraceptive use, 3rd ed. Geneva: Reproductive Health and Research, 2004 (type title into the search box)
Faculty of Sexual and Reproductive Healthcare (www.fsrhc.org.uk)—Provides method specific guidance (first click on “Good medical practice”)
International Planned Parenthood Federation. Medical and service delivery guidelines. (www.ippf.org/en/Resources/Guides-toolkits/)—These guidelines offer up to date evidence based guidance on various issues, including family planning
Royal College of Obstetricians and Gynaecologists (www.rcog.org.uk/index.asp?PageID=703)—Patient information leaflet on sterilisation for women
Emergency Contraception Website (www.not-2-late.com)—Provides information on emergency contraception for “the morning after”
Contraceptive.org.uk (www.contraceptive.org.uk/)—Refers to other sources of information
Family Planning Council (www.familyplanning.org/)—Information on birth control methods
Contraceptive.org.uk (www.contraceptive.org.uk/)—Refers to other sources of information
Resources for patients
Association of Reproductive Health Professionals (www.arhp.org/patienteducation/index.cfm)—Series of booklets on various reproductive health matters, including contraception
Family Planning Council (www.familyplanning.org/)—Information on birth control methods
Contraceptive.org.uk (www.contraceptive.org.uk/)—Refers to other sources of information
Emergency Contraception Website (www.not-2-late.com)—Provides information on emergency contraception for “the morning after”
Royal College of Obstetricians and Gynaecologists (www.rcog.org.uk/index.asp?PageID=703)—Patient information leaflet on sterilisation for women
Society of Obstetricians and Gynaecologists of Canada (www.sexualityandu.ca)—Information adapted to different target groups, such as teenagers, adults, parents, teachers, and healthcare professionals

Does evidence support the use of natural contraceptive methods?
Methods based on fertility awareness involve identifying “fertile days” of the cycle by observing changes in the basal body temperature or cervical secretions, or by monitoring cycle days, and abstaining from coitus or using a barrier contraceptive on those days. A Cochrane review, in which the authors searched five computerised databases for randomised controlled trials of these methods, concluded that—because of poor methodology and reporting—pregnancy rates could not be determined. Although these methods may be the only ones deemed acceptable for personal or religious reasons, or the only ones available in resource poor settings, they are difficult to apply; couples who use them should be informed about the lack of evidence regarding their effectiveness and, where possible, counselled about other options they might consider.

Is the “lactational amenorrhoea method” reliable?
The lactational amenorrhoea method is an efficient physiological tool for spacing births. Suckling an infant reduces the release of gonadotrophins, which suppresses ovulation and causes amenorrhoea. Reduced suckling leads to the return of ovulation.

For this method to be successful three conditions must be met: the baby must be exclusively or nearly exclusively breast fed on demand, day and night; the mother must be amenorrhoeic; and the method must not be relied on for more than six months. Another contraceptive method must be used as soon as these criteria are no longer fulfilled.

A Cochrane review established that the lactational amenorrhoea method, when correctly applied, is 98% effective. The beneficial effects of exclusive breast feeding on the infant are important additional advantages.

When and how to use emergency contraception
Emergency contraception includes all methods that act after intercourse but before implantation. For maximal efficacy it should be used as soon as possible. Combined oral contraceptives, progesterogen-only pills, mifepristone, and copper bearing intrauterine devices may be used. Hormonal emergency contraceptives can be offered at any time during the menstrual cycle, and even twice in a given cycle, if necessary.

Currently, the levonorgestrel-only emergency contraceptive is the most widely used. A recent Cochrane review found it to be more effective and better tolerated than the combined oral contraceptive, with no adverse effect on pregnancy. A single 1500 µg dose regimen is simpler than 750 µg taken twice, 12 hours apart. When dedicated emergency contraceptive pills are not available, the Yuzpe method may be used: two tablets of a combined oral contraceptive, each containing 50 µg ethinylestradiol and 250 µg levonorgestrel, are taken twice at a 12 hour interval. The selective progesterone receptor modulator mifepristone (10 mg taken within five days of unprotected coitus) is also effective, but it may cause the next menstruation to be delayed, which may increase anxiety.

A WHO multicentre randomised trial found that a single low dose of mifepristone and both the single and the two dose regimens of levonorgestrel are equally efficacious. A Cochrane review using information from eight randomised controlled trials found that advance provision of hormonal emergency contraceptives had no negative effect on sexual and reproductive health behaviours and outcomes. Another systematic review showed that increased access to emergency contraceptive pills enhances use but does not reduce rates of unintended pregnancy.
Postcoital (up to five days) insertion of a copper intrauterine device prevents implantation. The method is effective, even after multiple coital exposures during a short interval, and it has the advantage of providing ongoing contraception.

What are the drawbacks of sterilisation?

According to the guidelines of the International Planned Parenthood Federation, voluntary sterilisation should be available to all people who do not request it under duress, who are certain that they want no more children, and who understand the nature of the procedure after counselling. Verbal counselling must be backed by printed information to be read by the patient before the operation.\(^9\)

Female sterilisation is more risky than vasectomy. A large prospective multicentre cohort study showed that the cumulative probability of regret within 14 years after tubal sterilisation was considerably higher (20% v. 6%) for women sterilised at the age of 30 or less than for those over 30.\(^{28}\) Regret is more common after sterilisation immediately post partum or after an abortion than at a less emotional time. Unpredicted life events, like a change in marital status or the death of a child, are also sources of regret. Counselors must mention that tubal occlusion is permanent and irreversible, and that it carries a low failure rate.

At what age can a woman stop using contraception?

Women who smoke and those with other cardiac risk factors should discontinue use of combined oral contraceptives at age 35 and switch to another method. In healthy non-smokers, any method that is well tolerated, including low dose (20 µg ethinylestradiol) combined oral contraceptives, can be used up to age 51, after which the risk of conceiving is negligible. Women who prefer to stop using hormonal or intrauterine contraceptives at an earlier age can use a barrier method until menopause is confirmed.

Contributors: J-JA wrote the first draft of the article and both authors helped review the evidence on which the paper is based. Both authors are guarantors.

Competing interests: JJA has been paid by Bayer Schering Pharma and by Organon, part of Schering-Plough, for organising education. Competing interests: guarantors.

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