FACULTY OF FAMILY PLANNING AND REPRODUCTIVE HEALTH CARE
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REVIEW

This review is intended as an educational exercise and reports the personal views of the authors

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Fertility awareness methods of family planning: The physiological background, methodology and effectiveness of fertility awareness methods

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Key words
fertility, fertility awareness, fertility awareness methods, FAM, natural family planning, NFP, cervical secretions, cervical mucus, basal body temperature, lactational amenorrhoea method, LAM, personal hormone monitoring

Introduction

Fertility awareness methods (FAM) include all family planning methods based on the identification of the fertile time.[1] The effectiveness of these methods depends on two key variables - the accurate identification of the fertile days of a woman's menstrual cycle (the fertile time) and the modification of sexual behaviour.

This depends on the ability of couples either to abstain from intercourse (natural family planning), or to use a barrier method correctly during the fertile time (fertility awareness combined method). This first FACT about fertility awareness methods of family planning will focus on the accurate identification of the fertile time. A second FACT will focus on the modification of sexual behaviour.

Physiological background

Fertility awareness methods are based on an understanding of reproductive physiology. Figure 1 summarises the physiological changes that occur during the menstrual cycle and the observed indicators of fertility. The length of a

Figure 1 *Physiological changes during the menstrual cycle and observed indicators of fertility*

Pituitary hormones FSH and LH have no observable signs and symptoms.

Ovarian hormones oestrogen and progesterone form the clinical basis of fertility awareness methods.

The main target organs are the endometrium, cervix and secretions.

Growth and maturation of the follicles takes a variable time. Surge in LH causes rupture of the follicle at ovulation. The corpus luteum has a constant lifespan of 12-16 days.

Period – shedding of endometrium.

Pre-ovulation under the influence of oestrogen, secretions change - increase in fluid volume, salts, sugars and amino-acids. These secretions nourish sperm and aid penetration through the loose network.

Post-ovulation, with the effect of progesterone, the secretions form a dense fibrillar plug blocking sperm penetration.

The cervix changes from low firm and closed during the infertile time to high soft and open when a woman is fertile. After ovulation, the cervix reverts to low, firm and closed within 24 hours.

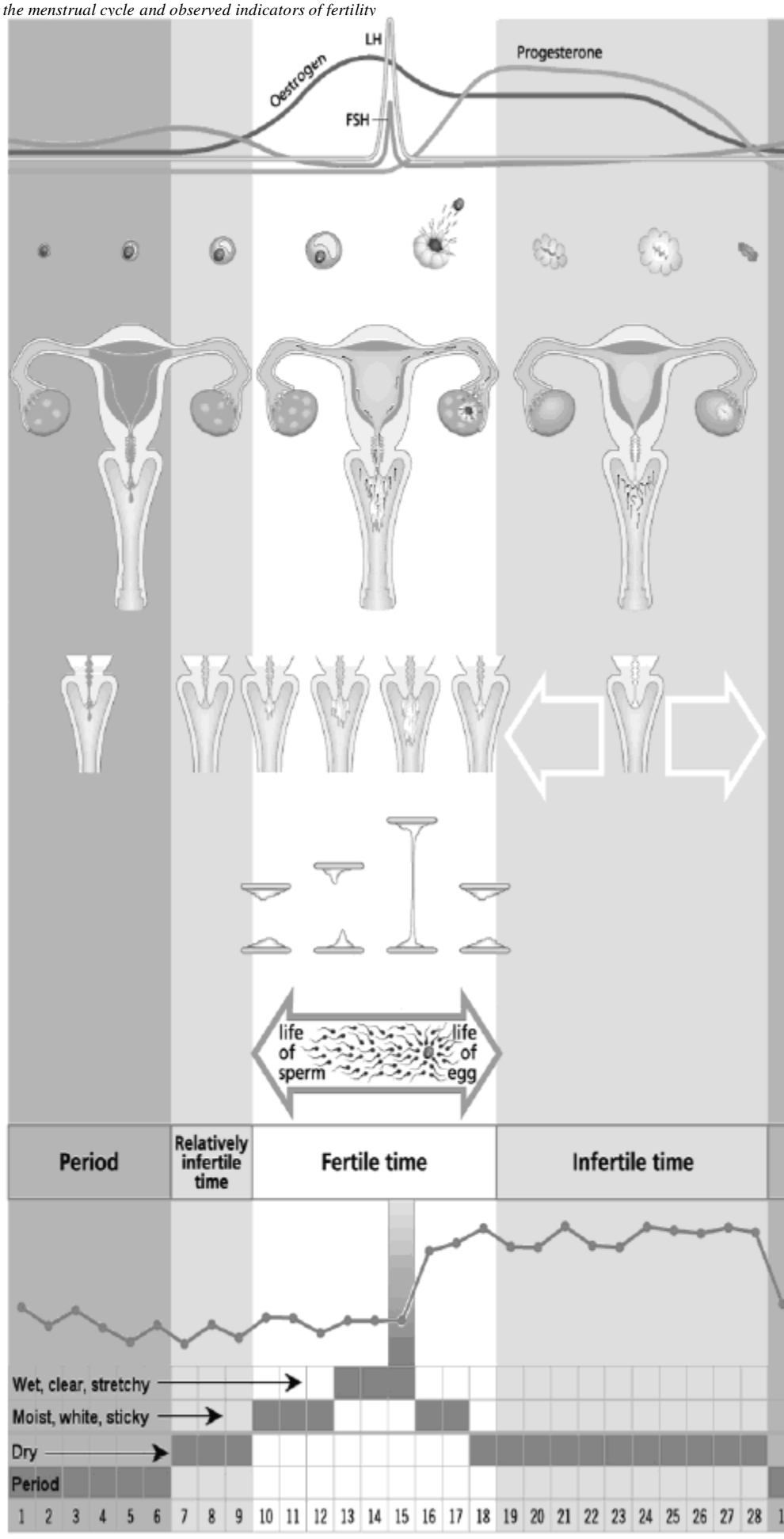
At first secretions feel moist and look white or cloudy. Then they become clearer, wetter, slippery and stretchy. This is the most fertile time. After ovulation the secretions change back to sticky, then dry.

Sperm can fertilise a woman's egg for up to 6 days after sex, when secretions are present. Allowing for the lifespan of the egg, the fertile time lasts for an average of 8-9 days.

The days before the fertile time are only relatively infertile. Days after the fertile time ends are infertile, and the most effective in avoiding pregnancy.

The basal body temperature rises by approx 0.2° C after ovulation – the progesterone effect. It stays at the higher level until the next period.

The secretions are recorded in the appropriate boxes on the chart.



Using combined indicators

The fertile time starts at the first sign of secretions and ends after the third high temperature is recorded provided all high temperatures occur after peak day. (Peak day is the last day of wetness or slippery secretions).

menstrual cycle is measured from the first day of menstruation, (the first day of fresh red bleeding) up to, but not including, the first day of the next menstruation. The position of the fertile time will vary according to the length of the cycle. The time from ovulation to the next menstruation is likely to be constant (around 12-14 days) whereas the time before ovulation is more variable.

The length of the fertile time

The World Health Organisation (WHO) defines the days of potential fertility for a couple during each menstrual cycle as the time from the first act of intercourse which may lead to pregnancy, to the demise of the ovum.[2] To identify the fertile time during each menstrual cycle, it is essential to know the life-span of the sperm in the female genital tract before ovulation, the timing of ovulation and the length of time during which the ovum can be fertilised after ovulation.

The life-span of the sperm is up to 7 days. In the female genital tract the survival of the sperm depends on the presence of alkaline cervical secretions (mucus), produced from the secreting cells lining the cervix. In the absence of cervical secretions, the acidic vaginal environment will rapidly destroy sperm.[3,4] In the presence of fertile secretions, sperm will live an average of 3 days, with a 99% probability that the survival time is less than 7 days.[5,6] The average life span of the ovum is about 17 hours.[6] Fertilisation must take place during those few hours following ovulation if pregnancy is to occur.

Detection of ovulation and correlation with the indicators of fertility

Ultrasound gives the most accurate information on the time of ovulation. Ultrasound studies have shown that the basal body temperature rise and cervical secretion changes are accurate in indicating the time of ovulation.[7] Ovulation can also be detected by hormone assays in plasma or urine.[8] Weinberg and Wilcox researched the chances of conception on each day of the menstrual cycle.[9] They identified the limits of the fertile window from 6 days prior to 1 day after ovulation.

Observed indicators

The following observed indicators of fertility (sometimes referred to as 'clinical indicators') alter in response to the changing levels of oestrogen and progesterone during the menstrual cycle. These indicators may be used alone to identify the fertile time, but are more commonly combined to improve effectiveness.

Observing the cervical secretions

The hormones oestrogen and progesterone influence the quantity and the quality of cervical secretions. The different types of secretions either impede or encourage sperm motility and this determines the state of fertility: [3,10]

- When the oestrogen levels are low, there may be minimal, thick, white and sticky secretions present at the cervix. The sperm are rapidly destroyed in the acidic environment of the vagina.
- The rising levels of oestrogen alter the cervical secretions from being thick and sticky to becoming gradually more transparent, wetter and more stretchy. The secretions become more fluid due to increased water content. The sperm move easily in these fertile secretions. Some of the sperm rest in small pockets (crypts) in the mucosal lining of the cervix before swimming up through the uterus. The last day of the transparent slippery secretions is known as the peak day. This day coincides closely with ovulation.[11]
- Immediately after ovulation, under the influence of progesterone: the cervical secretions thicken to form a sticky plug, which is antagonistic to sperm penetration.[3, 10]

The WHO multicentre study reported that 94% of women (from a variety of backgrounds) could detect the changes in cervical secretions indicating the start of the fertile time. Most women need to observe the secretions for about three cycles before recognising the changes with confidence.[12] Changes in secretions can be masked by seminal fluid, spermicide or vaginal infections. The Ovulation Method, Billings Method[13] or Creighton Model are methods which use cervical secretions only.

Cervical secretions

- The fertile time starts when a woman is first aware of any cervical secretions.
- The fertile time ends on the fourth morning after peak day.*

** Peak day is only recognised on the day following peak, because the cervical secretions have become cloudy / sticky*

The effectiveness of using the cervical secretions as a single indicator. A WHO multicentre study,[14] involving 725 participants, showed that if couples are given good natural family planning (NFP) teaching and follow the instructions correctly, the cervical secretion indicator has a failure rate of around 3%. Such a low rate only occurs with perfect use. However, with imperfect use the study showed an overall failure rate of nearly 20%. In 1990, Trussell critically appraised the overall design of the WHO study.[15]

Recording the basal body temperature

Progesterone causes a rise in the basal body temperature - the temperature before rising and after resting for at least 3 hours. After menstruation the temperature stays at the lower level. Immediately after ovulation progesterone increases the temperature by at least 0.2°C (0.4°F). The higher temperature is maintained until the level of progesterone falls at menstruation. Digital thermometers or special mercury fertility thermometers can be prescribed on an FP10. These help to ensure accurate recordings. Simplified fertility awareness charts can be downloaded from the Fertility UK web site: www.fertilityuk.org. Couples using the temperature as a single indicator method have to abstain from intercourse from the beginning of menstruation until they have recorded three temperatures at least 0.2°C higher than the preceding six.[16]

Basal body temperature

- The temperature chart will not identify the start of the fertile time.*
- The fertile time ends after three high temperatures are recorded (at least 0.2°C higher) than the preceding six.

**The temperature method used alone requires abstinence for an average of about 16 days per cycle.*

Barrett and Marshall carried out research on the chances of conception on each day of the menstrual cycle.[17] They used the rise of basal body temperature to estimate the time of ovulation. They found that the chances of conception approximated to zero 6 days before the day of the temperature rise and 2 days after the day of the temperature rise.

The effectiveness of using the temperature as a single indicator. In a study of 351 participants, using temperature as a single indicator of fertility, the overall failure rate was 5.4% compared with a method failure rate of 1%. This illustrates that the temperature method is only effective if used by highly motivated couples who are able to tolerate a lengthy time of abstinence.[16]

Observing changes in the cervix

Oestrogen and progesterone cause subtle changes in the muscle and connective tissue of the cervix.[18] Women can learn to recognise these changes by gently palpating the cervix at about the same time each day. A woman may notice whether the cervix is: high or low in the vagina; firm or soft to touch, closed or slightly open. It takes several months to be confident in using cervical signs. Palpating the cervix is rarely used alone as a single indicator, but the cervix changes are of particular value to women with long cycles, during breastfeeding, and during the pre-menopausal years.

Changes in the cervix

- The fertile time starts at the first sign of the cervix becoming high, soft or open.
- The fertile time ends after the cervix has been low, firm and closed for 3 days.

The effectiveness of using the cervix as a single indicator. There are no effectiveness studies using the cervix indicator alone. However, a Canadian study[19] has confirmed that the cervix changes correlate with the cervical secretion and temperature indicators in identifying the fertile time.

Other less reliable indicators of fertility

Oestrogen and progesterone may cause other recognisable changes. These may include: abdominal pain, abdominal heaviness, breast changes, inter-menstrual bleeding, back pain, skin changes and changes in libido and mood. Although in individual women the changes may be consistent, they should not be relied on to indicate the fertile time.[11] Women must not automatically assume that these changes are physiological, when they could be pathological.

Simple rule-based methods

Calculation based on previous cycle lengths

The calendar calculation takes into account the life of the sperm and ovum. It is based on the length of a woman's previous 6-12 menstrual cycles. The lengths of the shortest and longest cycle are used to identify the likely fertile time. The fertile time includes the whole of the first and the last fertile day. If a woman's longest or shortest menstrual cycle length changes, she recalculates her fertile time.

Calculation based on previous 6-12 menstrual cycle lengths

- Shortest cycle minus 20 = First fertile day.
- Longest cycle minus 10 = Last fertile day.

The effectiveness of using the calendar calculation alone. Kambic and Lamprecht reviewed the effectiveness of calendar methods.[20] The overall failure rates averaged around 20%, ranging from 5% to 47%. Although present research indicates that the calendar method is not sufficiently reliable to be recommended as a single indicator, the information gained by recording cycle lengths is useful when combining indicators.

Standard days (8-19) rule

A large existing data set from a WHO study[14] was used to estimate the theoretical probability of pregnancy on different days of the menstrual cycle. The results identified that for women with cycle lengths between 26-32 days, the fertile time is likely to occur within days 8-19 of the menstrual cycle. This provides the basis of a simple rule,[21] which may be useful information for couples without access to other methods of family planning.[22,23]

Standard days rule

- Applies if cycle lengths are 26-32 days.
- The first fertile day is day 8.
- The last fertile day is day 19.

The effectiveness of using the standard days rule. Further studies are needed to determine the effectiveness of the standard days rule in avoiding pregnancy and to assess its acceptability to users and providers. However, the potentially higher failure rate should be compared with around 80-90% possibility of pregnancy in 1 year for young couples who use no family planning method.[24]

In a US study of women trying to achieve a pregnancy, Wilcox suggests the identification of a short, fixed, fertile window (between days 10-17) was highly unpredictable.[25] However, this study population of women had cycle lengths that varied between 19-60 days. This would inevitably result in a far more unpredictable fertile time compared with women with cycle lengths of 26-32 days where the standard days rule may be appropriate for couples without access to other methods of family planning.

Lactational amenorrhoea method

Women who are fully breastfeeding have reduced fertility.[26,27] In the first 6 months post-partum, breast-feeding may be used as a family spacing method using the guidelines of the lactational amenorrhoea method (LAM).

Lactational amenorrhoea method

A woman is 98% protected against pregnancy if she is:

- Less than 6 months post-partum
- Amenorrhoeic after the first 56 days
- Fully breastfeeding day and night.

When the mother gives her baby other foods or liquids regularly, when her periods return, or at 6 months post-

partum, she needs to consider using another family planning method. If she chooses a fertility awareness method, she will require the support of an experienced FAM teacher.

The effectiveness of using the lactational amenorrhoea method. The findings from a recent WHO multicentre study[28] reported that in the first 6 months after childbirth the cumulative pregnancy rate ranged from 0.9%-1.2% during full breastfeeding. This provides further evidence to support previous research findings that the lactational amenorrhoea method offers at least 98% protection against pregnancy. In spite of these recent findings, health professionals still lack confidence in discussing this method post-natally with breast-feeding women.[29]

Fertility monitoring devices

Personal hormone monitoring systems

Persona consists of a small hand-held electronic monitor and simple, disposable urine test sticks. The sticks collect information about the levels of hormones and the monitor reads and interprets this information. The monitor measures two hormones - oestrone-3-glucuronide (EG), a urinary metabolite of oestrogen, and luteinising hormone (LH). The fertile time is indicated by red light days and the infertile time is indicated by green light days. An independent European prospective study of 710 women with regular menstrual cycles (23-35 days) using Persona alone showed a method failure rate of 6.2%.[30]

Computerised thermometers

Several devices combine an electronic thermometer with a small computer. The computer combines information about the temperature with a calculation based on cycle length. The display indicates the fertile and infertile times. Examples include Bioself,[31] Ladycomp/Babycomp[32] and Cyclotest.[33] More rigorous research is needed to evaluate the effectiveness of these devices.

Saliva testing devices

The ferning effect of oestrogenised cervical secretions has been well-documented for many years in laboratory conditions.[34] Saliva testing devices such as the *PG53* and '*MaybeBaby*' are widely available as home kits via the Internet. The devices use a small microscope to detect a ferning pattern. They have not been subject to rigorous research and cannot be recommended for contraceptive purposes.

Combining the indicators of fertility

Many women decide to combine two or more indicators of fertility. The most common combination is cervical secretions and temperature. This is sometimes called the sympto-thermal method. Cross-checking indicators increases the effectiveness of the method by more accurately identifying the fertile time.

Figure 2 illustrates a completed chart from a woman combining the observed fertility indicators with Persona. Her shortest cycle in the previous year was 28 days. In any given cycle different indicators may identify the *start* of the fertile time. To identify the *end* of the fertile time at least two indicators must correlate. In this example, day 8 is the start of the fertile time (the calculation is the earliest indicator). Day 19 is the end of the fertile time (third high temperature after peak day). There is no need to wait for the cervix to remain closed for 3 days, or to do a longest cycle calculation, provided temperature and secretions are correlated. In addition, this chart shows close correlation between observed indicators and Persona.

Women are encouraged to record factors which may affect the menstrual cycle or the fertility indicators. These may include alcohol, disturbed nights, holidays, time zone changes, shift work, stress, illness or medication.[35]

Fertility awareness combined with barrier methods

Many couples choose to combine fertility awareness knowledge with barrier methods during the fertile time. It is important that couples understand the correct use of their chosen barrier method. In practice, the use of barrier methods (particularly if used with additional spermicide) can make the recognition of cervical secretions difficult. Combining the temperature and changes in the cervix can help to avoid this problem.

A large prospective study[36] of 758 new users analysed the relation between unintended pregnancy rates and sexual behaviour with special reference to barrier method use during the fertile time. Fifty-four percent of the participants used NFP only (or predominantly) and 46% combined fertility awareness with barriers (perfect use pregnancy rate: 0.63%; overall pregnancy rate: 2.2%). The study shows that couples who use barrier methods during the fertile time still take risks and have unprotected intercourse during the fertile time. The researchers conclude that fertility awareness methods are most unforgiving of imperfect use, but are extremely effective when either abstinence or protected intercourse is used during the fertile time.

The effectiveness of fertility awareness methods using a combination of indicators

Table 1 shows five separate studies using a combination of indicators. The failure rate when combining indicators is less than that observed in most of the studies, which use a single indicator. If couples are to use fertility awareness methods successfully, they require a high degree of motivation. The most recent prospective study using a combination of indicators reported an overall failure of 2.6.

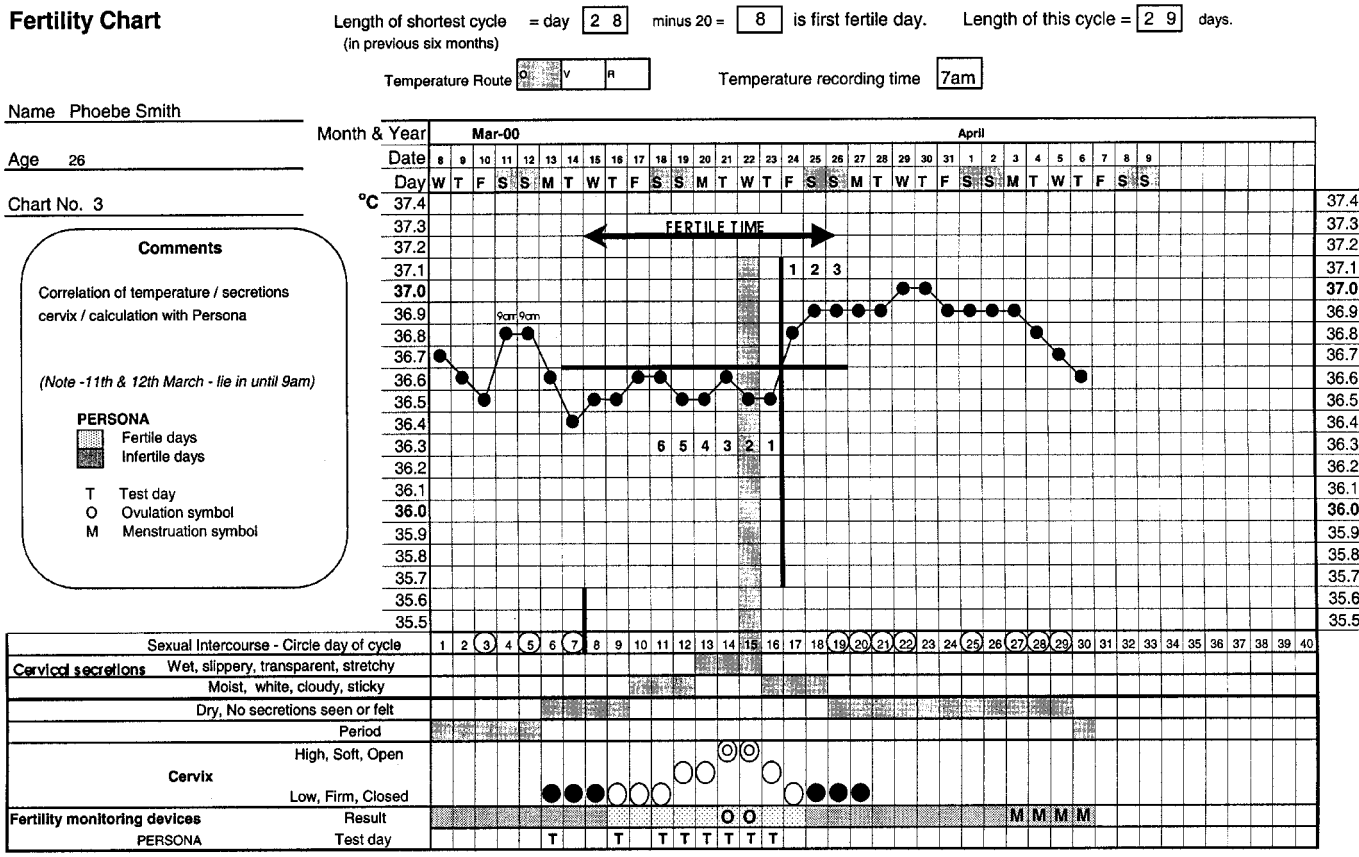
In the Rice study, the Canadian centre involving 168 participants clearly demonstrated how family spacers (those who plan more children at a later date; n = 67) are less effective in preventing pregnancy (overall failure 14.9). They are prepared to take risks, whereas family limiters (those who have completed their family; n = 101), are more conscientious users (overall failure 1.1).

Effectiveness studies and probability of conception studies have confirmed that once correctly identified, the late

Table 1 *Comparison of effectiveness studies using a combination of indicators*

The Study	Description	Participants (n)	Method failure	Overall failure
Rice et al, multicentre, 1981[37]	New users	1022	0.9	7.5
Marshall, UK, 1985[38]	Experienced users	118	0.3	3.9
Barbato, Italy, 1988[39]	New users	460	0.4	3.6
Clubb, et al, UK, 1988[40]	New users	72	1.3	2.7
Freundl, European multicentre, 1999[41]	New users	1328	0.5	2.6

Figure 2 *A completed chart combining fertility indicators*



infertile time is the safest time to have unprotected intercourse and avoid a pregnancy. Advances in teaching techniques and use of combined indicator methods have considerably reduced the unintended pregnancy rate among fertility awareness method users. Lamprecht and Trussell carried out an evaluation of well-designed effectiveness studies.[42] They discuss the many factors influencing the effectiveness of fertility awareness methods, propose a framework for evaluating published reports on effectiveness and provide guidance for the design of future studies.

Cost-effectiveness of fertility awareness methods

A UK study evaluated the cost-effectiveness of teaching fertility awareness methods in Primary Care in the UK.[40] The study confirmed that audio-visual materials reduce teaching time and that group teaching is feasible for some couples. The time/cost compared favourably with other methods. Although the cost in the first few months was higher (nurses time), once a couple understood the method they no longer needed to attend the clinic on a regular basis, and the ongoing cost of charts and thermometers was minimal. With increasing numbers of UK households having access to the Internet, the comprehensive teaching site www.fertilityuk.org can be used as a distance learning resource for clients.

Table 2 shows the advantages and disadvantages of fertility awareness methods.

Conclusion

It is well recognised that there is no ideal method of family planning. Increasing the range of choice will help to meet the needs of more couples. If couples are satisfied with their method of family planning, they are more likely to use it consistently. The most effective fertility awareness methods combine two or more indicators to identify the fertile time, but the contraceptive effectiveness of the method relies on the ability of the couple either to abstain or to use a barrier method consistently during the fertile time. Research clearly demonstrates that motivated couples can use fertility awareness methods of family planning successfully, provided they are taught and supported by experienced FAM teachers/health professionals. Many primary health-care or family planning clinics in UK now integrate fertility awareness knowledge into comprehensive family planning services.[43] A fertility awareness consultation sheet produced in collaboration with FPA can help to improve consultations and support health professionals discussing fertility awareness and family planning choice.[44]

Table 2 *Advantages and disadvantages of fertility awareness methods of family planning*

Advantages	Disadvantages
• No chemical agents or physical devices • No side effects • Efficient - when well-taught and motivated • Low cost for methods based on observation [40] • Not dependent on medical personnel after initial instruction • Promotes education/fertility awareness • Encourages shared responsibility/ increased communication • Ethically acceptable • Can be used to plan pregnancy	• Takes time to learn: 3 - 6 cycles • Some women find charting difficult • Some couples find abstinence difficult • Requires commitment of both partners • More difficult at times of stress or hormonal change • No protection against STIs • Cannot be used without co-operation of partner • Fertility monitoring devices are expensive

Training and support services

Successful use of fertility awareness methods depends on adequate teaching and support from a trained FAM Teacher. Fertility UK runs university-accredited multidisciplinary courses for health professionals in addition to an information and referral service. Contact www.fertilityuk.org. Email: admin@fertilityuk.org, Tel +44 (0)20 7371 1341.

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Discussion points

1. 'Trust me I'm the doctor' or 'Trust me I'm the patient'

'The ultimate power of society is in the people themselves, and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them but to inform their discretion by education." (Thomas Jefferson, US President, 1820)

Fertility awareness methods involve an educational process. Motivation of the woman/couple is the most significant factor for effective learning and use. How much can we trust those we teach FAM to be responsible for their own family planning? Discuss.

2. Provision of a comprehensive family planning service

'Family planning is far more than just the mechanisms of contraception. It is part of, and includes, reproductive health. Family planning aims to enable people to choose whether and when to have children. This includes birth control and infertility advice and help. Family planning embraces emotional well-being and affects the individual's enjoyment of his or her own sexuality.' (Model for District Health Authorities, 1990).

Basic information about fertility awareness helps to fulfil the broader definition of the services many family planning clinics offer. How much is this information offered as a routine part of the service? Any examples of good practice? Do you have trained fertility awareness/NFP Teachers within the service? Have you considered sponsoring a nurse to do the training/set up a clinic? How can we work towards the provision of a high quality comprehensive service?

3. How can we best explain the effectiveness of a behavioural method?

Following the launch of Persona in 1996, one of the factors which emerged was the lack of public understanding about contraceptive effectiveness. The method failure of Persona has been quoted as 94% effective. This implies that six women in 100 will get pregnant within 1 year, even if they are using the device correctly. How can we ensure that patients understand the concepts of method failure and user failure, which are particularly relevant with the highly user-dependent fertility awareness methods? (Godwin K. Consumers' understanding of contraceptive efficacy. *British Journal of Family Planning* 1997; **23**: 45-46)

4. Health professional attitudes to lactational amenorrhoea method

The lactational amenorrhoea method is still seen as a *new* method, in spite of more than a decade passing since the first Consensus Meeting (Bellagio 1988). This is an area in which many health professionals still lack confidence, despite extensive research demonstrating it to be a very effective method. Discuss.