Preventing Unintended Pregnancies (the Natural Way) among Women with Hard Cases

Richard J. Fehring

ABSTRACT: The purpose of this paper is to illustrate and discuss three case scenarios of women (and their spouses) who are experiencing difficult life situations in which they might choose to have an abortion if they would have an unintended pregnancy. For these situations the current medical profession often recommends sterilization, for either the woman or her spouse, so as to prevent an unintended pregnancy. The three cases involve: (1) a woman with breast cancer and on a medication that would result in a deformed child, (2) a woman with five children under the age of five who is currently breastfeeding an infant, and (3) a peri-menopausal woman who has a health problem and who has a significant risk for having a child with Down's syndrome. The use of modern natural family planning (NFP) methods and special protocols developed by researchers at Marquette University to manage these special problems will be presented. An argument will also be made that the use of NFP is more healthy and beneficial for the woman, her potential child, her spouse, and family. Conversely, use of hormonal contraception is either medically contra-indicated in these situations or unnecessary.

THIS PAPER WILL PRESENT three short case presentations in which pregnancy would be considered deleterious for a woman, her baby, or both. The first case involves a woman who is on a medicine for breast cancer and who should not get pregnant, given the effect of the drug on a developing baby and the medical inadvisability of pregnancy while she is being treated for cancer. The second case involves a woman who is breastfeeding her infant and currently has four other children under the age of five. Use of hormonal contraception would be contradictory to successful breastfeeding because it would work to suppress natural breast milk production. Pregnancy is not recommended for 18-24 months after the birth of a child, so as to optimize the health of the mother and future children. The final case involves an older peri-menopausal woman who has certain health

problems, has six children, and is fearful of another pregnancy. Hormonal contraception for older women (and replacement hormone therapy) increases the risk for breast cancer. All three of these women and their spouses wish to use natural family planning (NFP), but they realize that these methods have not been very successful in these situations. They all sought out the Marquette University Natural Family Planning (NFP) Institute for help.

In these three case situations, physicians and other health care providers (e.g., nurse practitioners) would be reluctant (or refuse) to recommend use of fertility awareness based methods of NFP to avoid pregnancy. The reluctance by health professionals to recommend or support use of NFP is that in these cases the woman might end up with an unintended pregnancy, the pregnancy might be detrimental to her health, and/or she might have a child who is deformed in some physical or mental manner. In general, health professionals would not trust the effectiveness of NFP in these difficult situations. There is also a great fear of medical malpractice law suits. The choice of hormonal contraception is also ruled out for these cases because of the deleterious effects on the woman's health, e.g., the hormones might well stimulate cancerous growth. Sterilization is often the recommendation solution for these cases, and if an unintended pregnancy occurs, abortion.²

Case Study One

Heather White (not her real name) is a 35-year-old Catholic woman

¹ R. J. Fehring. "Physician and Nurse's Knowledge and Use of Natural Family Planning," *The Linacre Quarterly* 63 (1995): 22-28. J. B. Stanford, P.B Thurman, & J.C. Lemaire. "Physicians' Knowledge and Practices regarding Natural Family Planning," *Obstetrics & Gynecology* 94 (1999): 672-78. R. Fehring, L. Hanson, & J. Stanford. "Nurse-Midwives' Knowledge and Promotion of Lactational Amenorrhea and Other Natural Family Planning Methods for Childspacing," *Journal of Nurse Midwifery and Women's Health* 46 (2001): 68-73.

² R.E. Lawrence, K.A. Rasinski, J.D. Yoon and F.A. Curlin, "Factors Influencing Physicians' Advice about Female Sterilization in USA: A National Survey, *Human Reproduction* 26 (2011): 106-11; M.K. Whiteman, S. Cox, N.K. Tepper et al., "Postpartum Intrauterine Device Insertion and Postpartum Tubal Sterilization in the United States," *American Journal of Obstetrics and Gynecology* (2011): online ahead of print, also in *Contemporary OB/GYN*.

who was diagnosed and treated for breast cancer. She is married and has two small children, a girl who is five and a boy who is three years of age. She had surgery to remove her right breast with follow-up chemotherapy. Her oncologist placed her on the drug tamoxifen for five years to prevent the re-occurrence of cancer. She was told not to get pregnant because of the deleterious effect that the drug might have on a developing baby. Tamoxifen is used to prevent the recurrence of breast cancer and is an anti-estrogenic type of drug. She discussed birth control with her obstetrician gynecologist, and he recommended that either she (or preferably her husband) should seek sterilization. She refused her physician's recommendation for two reasons. First of all, she and her husband are Catholic and follow their religion in regards to methods of family planning. Second, she still wished to have another child.

She and her husband previously used what is called the symptomthermal method of NFP (i.e., a combination of basal body temperature plus cervical mucus observations), but she was not comfortable with that method. She had small children who routinely interrupted her sleep patterns and interfered with her temperature readings. The disruption of sleep made it difficult for her to establish a waking temperature baseline necessary for that method of NFP. She heard (from a friend) of a new method of NFP that utilized electronic hormonal monitoring and sought out that method at the Marquette University Institute for Natural Family Planning.

As a Catholic couple, she and her husband wanted to follow their faith and not use methods contrary to the Church's teaching. The Ethical and Religious Directives (ERDs) for Catholic health care institutions are very clear on this matter. ERD §54 states: "direct sterilization of either men or women, whether permanent or temporary, is not permitted in a Catholic health care institution. Procedures that induce sterility are permitted when their direct effect is the cure or alleviation of a present and serious pathology and a simpler treatment is not available." Furthermore, No contraceptive may be used or recommended, the ERDs states, for "the Church cannot approve contraceptive interventions that

³ U.S. Conference of Catholic Bishops (USCCB), *Ethical and Religious Directives for Catholic Health Care Services*, 5th ed. (Washington, D.C.: USCCB, 2009).

either in anticipation of the marital act, or in its accomplishment, or in the development of its natural consequences, have the purpose, whether as an end or a means, to render procreation impossible." Such interventions violate "the inseparable connection, willed by God...between the two meanings of the conjugal act: the unitive and procreative meaning." The basic principle is that one may not use an immoral act to achieve some good effect. This is not the same as the principle of double effect, whereby one might regretfully tolerate the loss of the life of a child in the womb if there were no other way to deal with a cancerous uterus other than by a hysterectomy. The treatment of the cancer is the direct and intended effect and the loss of the child is foreseen but unintended. But, providing sterilization or condoms in the case of the woman on Tamoxifen would be an act directly intended for the purpose of contraception (not a foreseen but unintended result of treating a valid medical problem) and therefore would be prohibited like any other choice made for the sake of contraception.

Tamoxifen interferes with some of the natural markers of fertility (in particular, the production of cervical mucus). Because of this interference it makes the practice of NFP very difficult for anyone while on this drug. Some speculate that the use of tamoxifen would prevent ovulation, but this has not been documented. In fact, as an anti-estrogen type drug, it actually will stimulate ovulation. There are, however, markers of fertility that still can be used to track fertility with confidence. Basal body temperature and the LH surge are not affected by tamoxifen use. The couple could use the "heroic" approach and practice abstinence from intercourse for five years, but this would not be good for the intimacy of the marriage and would not be necessary.

The patient described in this case came to the Marquette University NFP Institute for help. She stated that she and her husband are of the Catholic faith and that they did not want to resort to sterilization (as recommended by her oncologist). She had two young children already, but she also indicated that they might want to try to have more children after the five-year course of tamoxifen. She came to Marquette NFP Institute because she heard that the Institute used an electronic hormonal fertility monitor with the method of NFP that they provided. In

⁴ Ethical & Religious Directives for Catholic Health Care Services, §52.

discussing this case with the couple, it was decided that she should use three indicators for estimating her fertility: temperature, cervical mucus, and an electronic hormonal fertility monitor. She had a follow-up at the Institute after every menstrual cycle to assess her progress and to assess the effects that the cancer drug had on her natural fertility indicators and her ability to discern the fertile phase of her menstrual cycle.

As expected, during the first three menstrual cycles the mucus ratings and patterns were not discernible because of a continuous mucus pattern and mucus ratings that indicated high fertility for most of the menstrual cycle. There were, however, clear temperature shifts and the monitor displayed a clear fertile window by detecting the baseline rise of estrogen and the LH surge in the urine. After the third menstrual cycle, the woman indicated that she has small children and so it was difficult for her to always obtain a temperature reading before rising in the morning. She said that she was comfortable using just the objective readings from the monitor along with the Marquette fertility algorithm.

Figure 1 shows the first six menstrual cycles of use by the patient with the hormonal fertility monitor. The figure represents the data that was downloaded from her monitor to our computers in the Institute and recreated into the Marquette Method menstrual cycle charting system. The data chart shows the length of each menstrual cycle, the day of the E3G rise from baseline (as indicated by an "H," which means high fertility), and the estimated day of ovulation, i.e., the threshold of LH that is indicated as peak with a "P" recording on our chart. As can been seen in Figure 1, the menstrual cycles vary in range from 27 to 40 days, and the estimated day of ovulation (i.e., the second peak day of the monitor and recorded on the chart) occurs between day 13 and day 28. The monitor was able to identify the fertile phase and the variability of the fertile phase from cycle to cycle. The couple was able to successfully avoid pregnancy with this approach for the five years of therapy. A recommendation for cases like this, where there is a severe reason for avoiding pregnancy, is to use two indicators for the beginning and the end of the fertile phase, and to be more conservative by only using the post-ovulatory phase for intercourse. A second test (in the evening) with the newer hormonal monitor (i.e., the Clearblue Advanced Ovulation Test kit) that measures the rise in urinary estrogen and LH would also be recommended.

Case Study Two

The breastfeeding transition (i.e., the transition from amenorrhea through the first six menstrual cycles post-partum) can be one of the most difficult transitions for users of NFP. It is during the postpartum breastfeeding transition that NFP often fails to help couples to avoid pregnancy. Unintended pregnancy and confusing natural signs of fertility encountered during this transition are reasons why couples often discontinue the use of NFP.

The second case involves a Catholic married couple. Both are college graduates, serious about their faith, and participate frequently in the sacraments. They have five small children, the last two not intended (but wanted) and conceived during the breastfeeding transition. The woman is 32-years-old, the man 33. He is a primary grade school teacher. She is a stay-at-home mom, but very active in parish life, providing catechesis for grade school children and serving as a cantor for mass.

They presented themselves to the NFP teacher as having the problem of trying to be faithful to Church teaching but as frustrated that NFP was not working for them. They were using a method of NFP based only on mucus. There was, however, no mucus pattern that would help them to discern a fertile phase during the breastfeeding transition. They tried the traditional methods of distinguishing what is called a basic infertile pattern (of cervical mucus) but could not differentiate an infertile pattern from a fertile pattern. When she visited her obstetrician, her cervix was determined to be normal and healthy. He found no inversion of cervical tissue that might be causing a continuous mucus pattern. They were desperate and sought help from the professional nursing NFP staff at Marquette University.

From the standpoint of Catholic morality as well as from the physiological standpoint, it does not make sense to put her on hormonal contraception, i.e., the progestin only pill. First of all, morally speaking, a physician or health professional should not use something that is morally evil to produce a good. Admittedly, the use of hormonal contraception might have helped the woman (and the couple) to have some psychological peace in regards to avoiding pregnancy, but it would certainly not bring them spiritual peace as Catholics wanting to be faithful to the teachings of the Church. The intent for using a hormonal

therapy would be contraceptive, that is, to avoid conception, and would try to achieve this by separating fertility from their intercourse. From a medical standpoint, being on the hormonal contraception would not be helpful in discerning when her menstrual cycles would resume.

Use of hormonal contraception was proposed by Catholic physicians in the early 1960s as an aid to women who had irregular menstrual cycles in an effort to help regularize their menstrual cycles, so that they could then use NFP with greater ease.⁵ If the hormonal pill somehow helped to regularize the menstrual cycle, then this might have been a moral use of the pill, especially if given in a post-ovulatory phase; but it could not be morally acceptable if it were given to suppress ovulation. There are moral protocols available for helping women "normalize" the menstrual cycle, especially for those women with polycystic ovarian syndrome or with short luteal phases. But use of the hormonal pill to suppress ovulation and normal menses does nothing to help a woman find out what is wrong with her menstrual cycle or to discover the probable underlying cause of the irregularity (e.g., low thyroid levels). Furthermore, if the hormonal pill is provided to suppress ovulation, especially with the progestin only pill, there is the even more serious problem that the pill might act as an abortifacient.

The more difficult questions from the standpoint of using NFP are what method of NFP can they use and which method is the most secure and effective. The woman in this case should be encouraged to continue to breastfeed at least for one year, as recommended by the American Pediatric Association. Breast-feeding is healthy for both the mother and the infant for numerous health reasons — even for intellectual development of the infant. The Catholic Church also promotes the use of breastfeeding. The woman can be assured that if she is within the first six months of the birth of her child, is totally breastfeeding, and has not experienced menses, she has less than a 2% chance of conceiving another child. This is known as the lactational ammenorrehea method or LAM, which has been extensively researched for its efficacy among a

⁵ J.J. Lynch, "The Oral Contraceptives: A Review of Moral Appraisement," *The Linacre Quarterly* 29 (1962): 168-75.

variety of populations.6

Once the woman is out of the situation described by the LAM criteria, however, she should no longer use this method. So, what method or signs of fertility might she use? As stated, the cervical mucus sign was not useful for her since she could not discern any infertile patterns with the cervical mucus. Studies have indicated that the mucus sign and other signs of fertility, such as the BBT shift in temperature, are not very helpful, and in fact they might even increase the possibility of having an unintended pregnancy.⁷

Researchers at the Marquette University Institute for NFP have developed a breastfeeding protocol that uses an electronic hormonal fertility monitor to track the potential days of fertility in the postpartum transition to fertility. This protocol involves creating "artificial" 21-day menstrual cycles and using the monitor to track fertility by testing for the estrogen rise and the first luteinizing hormone (LH) surge before ovulation. This is done by re-triggering and fast-forwarding the monitor every twenty days. The monitor will test for twenty days in a row if it does not sense an LH surge. The efficacy of this protocol has been tested with 198 postpartum breastfeeding women. With correct use there have been no pregnancies. The imperfect use pregnancy rate is .06 per 100 women over 12 months of use. This study has been published in the *Journal of the American Board of Family Medicine*.⁸

The woman in this case study was one of the first to use a precursor of this protocol. Her fertility monitor charts are shown in Figure 2. This

⁶ M.H. Labbok et al. "Multicenter Study of the Lactational Amenorrhea Method (LAM): I. Efficacy, Duration, and Implications for Clinical Applications," *Contraception* 55 (1999): 327-36; V. Valdes et al., "The Efficacy of the Lactational Amenorrhea Method (LAM) among Working Women," *Contraception* 62 (2000): 217-19; World Health Organization Task Force, "The World Health Organization Multinational Study of Breast-Feeding and Lactational Amenorrhea. III. Pregnancy During Breast-Feeding," *Fertility and Sterility* 72 (1999): 431-39.

⁷ G.A. Tomaselli, M. Guida, and S. Palomba et al., "Using Complete Breast-Feeding and Lactational Amenorrhoea as Birth Spacing Methods," *Contraception* 61 (2000): 253-57.

⁸ T. Bouchard, M. Schneider, and R. Fehring, "Efficacy of a New Postpartum Transition Protocol for Avoiding Pregnancy," *Journal of the American Board of Family Medicine* 26 (2013): 35-44.

Figure shows that the woman had five artificial cycles by using the monitor and that in the fifth cycle there was a urinary LH surge with presumed subsequent ovulation and a short luteal phase (typical for a breastfeeding woman). The first thee "cycles" were 28 days in length since she did not re-trigger the monitor after the twenty days of testing. That left four days in which she did not test her fertility status. That is the reason that the current protocol was modified to have 21 day cycles.

The Marquette researchers are also working on modifications to the protocol during the first six menstrual cycles after ovulation resumes post-partum. Canadian physicians have also proposed some modifications to this protocol. The current protocol has a default beginning of fertility on day six of the menstrual cycle. The first few menstrual cycles, however, typically have a pattern of delayed ovulation. Therefore, a tentative protocol will have the beginning of fertility on day ten and then one day earlier for each of the next five menstrual cycles. Further research is needed to help women more confidently progress through the breastfeeding transition.

Morally there would be no problem with abstaining from sexual intercourse until completing the transition to normal menstrual cycle lengths. Sadly, some couples feel that this is the only recourse to follow. There is a need for more research in this area of reproductive transition, along with the transition through peri-menopause. Physicians, nurses, and scientists need to see this as a significant problem to solve and help couples live with their gift of fertility.

Case Study Three

This case involves a married couple who are Roman Catholics and who have used the Marquette Model of NFP since December 2012 to avoid pregnancy. She is 47 and he is 46. Both are college graduates. In the past she has been pregnant three times. She has no history of hormonal contraceptive use. She has had two Cesarean sections. They want to use NFP to prevent pregnancy and to thus to deal with various health concerns. The man has high blood pressure; the woman has a

⁹ S.J. Genius and T.P. Bouchard, "High-tech Family Planning: Reproductive Regulation through Computerized Fertility Monitoring," *European Journal of Obstetrics and Gynecology* (2010), in press.

seizure disorder and suffers from migraines, and she takes medications for both of these conditions daily. The woman is extremely fearful of an unintended pregnancy and refuses to have any sexual intercourse. Previously the couple was using complete abstinence as their method of choice for family planning. The husband is very patient and sought help to determine a secure method of NFP.

The peri-menopausal transition

The peri-menopausal time period is a much longer transition than the breastfeeding transition. Furthermore, "older" women (i.e., those over 42 years of age) who have completed their families, who have resumed their careers, and who have concerns about having a baby with defects can be fearful about another pregnancy and may want to have secure methods of family planning. There is not a lot of research on the use of NFP during peri-menopause. We do know from research that the menstrual cycle length shortens somewhat as women progress through peri-menopause, but it can remain very regular in length. 10 But once the difference in menstrual cycle length varies by more than seven days, the woman is then considered to be in an early peri-menopausal stage. It is generally thought that women at the age of 45 have a very low chance of pregnancy, similar to that of a 21-year-old woman on oral hormonal contraception. This fact, however, is not always comforting to the woman NFP user. Women and couples who use the post-ovulatory period as identified by cervical mucus peak, the BBT, and/or the urinary LH surge are generally able to use NFP effectively.

The stages and the biological markers for the peri-menopausal transition have been delineated according to the "stages of reproductive aging workshop" or STRAW model.¹¹ Research also shows that when the differences in the menstrual cycle length go beyond seven days, the follicle stimulating hormone (FSH) is high and fertility is not likely. According to the stages of reproductive aging model, once the menstrual cycle lengths vary by seven days, then the woman should be considered

¹⁰ A.E. Treolar et al. "Variation of the Human Menstrual Cycle Through Reproductive Life," *International Journal of Fertility* 12 (1967): 77-126.

¹¹ M.R. Soules et al. "Executive Summary: Stages of Reproductive Aging Workshop (STRAW)," *Fertility and Sterility* 76 (2001): 874-78.

in peri-menopause. Furthermore, when there is a difference in the running lengths of the menstrual cycle of more than 42 days, menopause most likely will take place within a two-year time period.¹² More research is needed before integrating this knowledge into the use of NFP.

Use of family planning and NFP during peri-menopause

Health care professionals have recommended the use of just about every type of contraceptive method for the peri-menopausal women. In general it is felt that it is prudent for healthy women without other risk factors to use a combination (estrogen/progesterone) type of birth control pills until the age of fifty. Some recommend that the levels of estrogen should be reduced, the use of progestin only pills, the use of a progestin type IUD, and/or non-hormonal contraception as women approach the early fifties. Others, however, believe that as long as women are healthy and have no cardiovascular risk, hormonal contraception is safe. There is also the recommendation that contraception be used for at least one full year after menopause.

In reviewing the literature, however, there does not seem to be any studies on the efficacy of the use of NFP among older perimenopausal women. In fact, the recommendation from a World Health Organization (WHO) report is that due to the irregular menses and amenorrhea with peri-menopause that the use of NFP would be impractical.¹³ There was one study conducted with 36 users of the symptom-thermal method of NFP between the ages of 45 and 53 in which the researchers found that 33% of the women were potentially fertile and that 61% of the 177 menstrual cycles charted were potentially fertile.¹⁴ The authors

¹² J. Taffe and L. Dennerstein, "Time to the Final Menstrual Period," *Fertility and Sterility* 78 (2002): 397-403.

¹³ World Health Organization (WHO), "Scientific Study Groups on Research on the Menopause in the 1990s" in *Research on the Menopause: Report of a WHO Scientific Group* (Geneva, Switzerland: World Health Organization, 1994).

¹⁴ A.M. Flynn, "Symptothermal and Hormonal Markers of Potential Fertility in Climacteric Women," *American Journal of Obstetrics and Gynecology* 165 (1991): 1987-89; M.G. Metcalf, "Incidence of Ovulatory Cycles in Women Approaching the Menopause," *Journal of Biosocial Science* 11 (1979): 39-48.

mentioned that a defined fertile phase was able to be determined. They did not determine the efficacy of the method to avoid pregnancy.

Researchers at Marquette University used data to determine pregnancy rates among older reproductive age women by abstracting from data about online and in-person teaching of NFP by the Marquette method. The NFP method here involved use of a hormonal fertility monitor or cervical mucus monitoring, either alone or in combination. We were able to collect data (i.e., menstrual cycle charting) from 150 participants who used NFP and who were 40 years or older. This data set was used to determine the total unintended pregnancy rate based on 100 women over 12 months of use of the Kaplan-Meier survival analysis statistic. The total unintended pregnancy rate among the 150 participants was 3 per 100 users over 12 months with typical use. The results of this report indicate that the use of NFP among older women (i.e., aged 40-54) can be as effective as with younger women. The unintended pregnancy rate that we found among older reproductive age women is lower than the unintended pregnancy rate or 9-20 per 100 younger women who use NFP methods. Our unintended pregnancy rate of 3 per 100 older reproductive age women was also lower than the typical unintended pregnancy rate of 8-9 per 100 users of women on hormonal birth control.

The effectiveness of NFP in this study could come from the decrease in fertility among peri-menopausal women. We had a limited number of participants and would like to have at least 200 or more. The study was also limited due to the homogeneity of the participants in that they were mostly middle-class white Catholic couples. For future research we would like to develop an algorithm for determining when a woman is no longer fertile. This might be based on FSH levels and the variability of the length of the menstrual cycle or of the follicular and luteal phases. We also need to build a data set with at least 200 women over 45 and with more diverse participants.

Based on our limited study on the efficacy of NFP among older women, the medical recommendation of hormonal contraception for one year past menopause might not be wise. This recommendation could constitute excessive and unnecessary use of hormones that increase the risk for future breast cancer. Furthermore, use of NFP during the perimenopausal transition might help decrease the use of sterilization, a

burden that falls primarily on women in the U.S. and does so in particular among minority and poor women. We concluded that NFP use among older women can be very effective. The high efficacy could be a reflection of diminished fertility among older women and a reflection of higher motivation to avoid pregnancy.

The woman in this case study successfully used NFP until she was fifty years old, at which time her cycles gradually became extremely variable, i.e., showing a difference of greater than 45 days in total length. She was also able to monitor her medical problem of migraine headaches, and she realized that they were triggered through menses. By monitoring her menstrual cycle and day of ovulation through a hormonal fertility monitor, she was able to anticipate menses and pre-medicate to avoid the debilitating effect of the migraine, which eventually diminished as she progressed through the peri-menopause transition.

Discussion and Conclusion

Women and couples are often confronted with medical or developmental situations in which an unintended pregnancy would be detrimental to the mother, to the developing baby, or both. Common difficult situations occur when women of reproductive age are being treated for cancer, when they are going through the postpartum breastfeeding transition, and when older women approach menopause. Healthcare professionals normally offer sterilization or a hormonal method of family planning. If these methods fail, abortion is often assumed. The use of hormonal contraception, however, is often contraindicated in these situations and may make the medical problem worse. In particular, there is an over-use of hormonal contraception and an unnecessary use of sterilization during peri-menopause when fertility is greatly diminished. Use of NFP can help women and couples appreciate their shared fertility and be open to new life, and it can also be a very secure method of family planning for these difficult situations. The use of modern methods of NFP, access to NFP teachers who are health professionals, and the use of modern hormonal monitoring is recommended for these situations. Researchers at Marquette University, in particular, have addressed these difficult situations and have provided evidenced-based protocols as solutions.

Fig. 1: Electronic Hormonal Fertility Monitoring Chart

Computerized Data Chart from electronic hormonal fertility monitor, showing length of menstrual cycle, the length of the estimated fertile phase (dark blue) and the estimated day of ovulation (two dark blue bars with ripe follicle/egg icon).

Fig. 2: Fertility Monitoring Chart: Marquette Breastfeeding protocol Example of a woman who is using the Marquette Breastfeeding protocol and creating artificial cycles of use.