A high level description of the Natural Cycles fertility algorithm

Abstract

This document describes in broad strokes the Natural Cycles° algorithm, which identifies ovulation and returns a daily fertility status for both NC° Birth Control and NC° Plan Pregnancy. Using inputs such as basal body temperature and menstruation, the algorithm learns over time to provide a customized solution for each individual user and cycle. The algorithm's performance and the product's contraceptive effectiveness has been repeatedly studied and validated with large quantities of data - a process that is also described in this document together with its results.

Introduction

As for many other companies, where algorithms are the core in their innovation and valuation, the details of the algorithm are kept secret to protect its most valuable asset. However, based on the feedback from healthcare professionals that we work together with and from you, Cyclers, we thought that it's time to present a description of the algorithm with a little more detail than we've previously revealed.

Firstly it is important to note that the Natural Cycles° fertility algorithm is based on complex statistical analysis developed by physicists and therefore not straightforward to explain in a simple matter for everyone to understand. It uses advanced statistical methods to learn from patterns from historical data for the individual user and covers many edge cases and scenarios, such as coming off hormonal contraception or having a miscarriage. It has been optimized with more and more data using for instance machine learning techniques over the last 8 years. Therefore the description you will read here is a much simplified description of the actual algorithm, to give you a digestible overview of how it works.

In one sentence, Natural Cycles° algorithm rapidly learns from previously recorded cycles from the same user, to provide a tailor-made solution for each individual cycle in order to detect and predict ovulation, and thus to identify fertility. Natural Cycles also suggests when to test for the occurrence of the Luteinizing Hormone (LH) to pinpoint an individual's most fertile days. This optional, but powerful feature of Natural Cycles, boosts the accuracy of the ovulation detection and the fertility prediction even further.

The algorithm serves two products - NC° Birth Control and NC° Plan Pregnancy. Figure 1 shows how the app may look like for a specific user for the two different products. The core of accurately detecting ovulation is the same for both products, but there are differences in the risk profile - for NC° Birth Control the algorithm is optimized to have a very low risk of wrongly attributing a green (safe) day in the fertile window, while for NC° Plan Pregnancy it is optimized to better isolate the fertile window and the most fertile days. While using NC° Birth Control the user gets either green (non-fertile) and red (use protection) days. On the other hand, NC° Plan Pregnancy users get a fertility scale ranging from green (not fertile) to the darkest shade of red (peak fertility). This description focuses on the core of the algorithm - ovulation detection and prediction (common to both products) and NC° Birth Control features and validation. Additionally, features specific to NC° Plan Pregnancy are included.

Figure 1: Today and Month page example views for a user using NC° Birth Control (left) and NC° Plan Pregnancy (right).

The basics of the menstrual cycle

Let's start with the basics. The menstrual cycle consists of three phases: the pre-ovulatory phase, the ovulatory phase and the post-ovulatory phase. The cycle begins with the first day of menstrual bleeding and lasts on average 29.3 ± 5.2 (one standard deviation) days [2]. The individual cycle length can however vary greatly from woman to woman. The pre-ovulatory (follicular) phase is estrogen-rich and cooler than the post-ovulatory (luteal) phase, where progesterone dominates and warms the body, which is illustrated in Figure 2. These two phases are separated by ovulation, which is when a temperature rise of 0.25-0.45 °C (0.4-0.8 °F) occurs in the body. The fertile window ends with ovulation day and begins 5 days before, as sperm can survive up to 5 days in the body under the right conditions [3]. Only during these six days (also called the fertile window) is it possible for a woman to get pregnant through unprotected sexual intercourse.

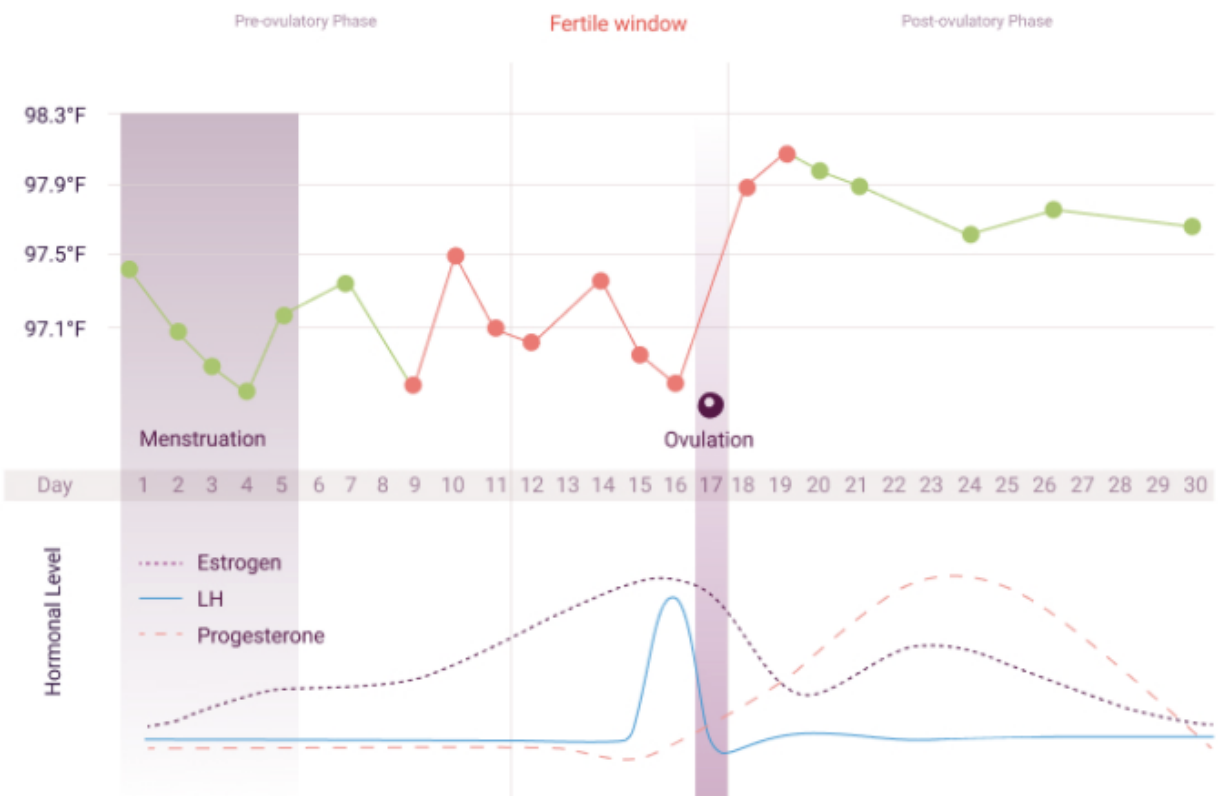


Figure 2: Temperature evolution during one example cycle, indicating the algorithms output in terms of red and green fertility status, overlaid on top of a graph showing the hormonal evolution throughout the female menstrual cycle.

Prior to ovulation, a surge in Luteinizing Hormone arises and is triggered by the increased level of estrogen. The LH surge lasts for around 48 hours [4] with the ovulation commencing 10 ± 5 hours after the LH peak [5]. The presence of LH is thus a good indicator of the most fertile days of the cycle as sperm should ideally already be present in the fallopian tubes at the start of ovulation for fertilization to occur. Without fertilization, the released ovum only survives 12-36 hours in the female body.

The luteal phase (time between ovulation and the following cycle) is on average 13 ± 1.4 (one standard deviation) days [11]. A normal luteal phase is considered to be between 10 and 16 days, but can vary between 6 and 18 days. Although the luteal phase length varies from woman to woman, it usually remains fairly constant from cycle to cycle for the same woman. This implies that the variation in cycle length usually reflects the variation in the length of the follicular phase and hence the ovulation day.

It is important to note that each woman has her own individual menstrual cycle pattern which can vary significantly from the norm [2,6]. The cycle length, the length of the follicular phase, the length of the luteal phase, the amplitude of the rise in temperature, the base temperature in the

pre- and post-ovulatory phases and also the overall shape of the temperature evolution throughout the cycle are all parameters that vary from woman to woman.

Irregularities in the menstrual cycle can occur due to a number of factors related to health and lifestyle, such as illness/medication, recent use of hormonal contraception [8] , recent pregnancy, stress, travel, extensive use of alcohol/drugs [9] and more. These events might delay ovulation and it is thus important to actually detect ovulation rather than assume that it happens when it usually occurs. These factors can also affect a user's temperatures and it is therefore important to use statistical methods to be able to distinguish a temperature rise due to ovulation from a rise due to a change in lifestyle. The NC° algorithm takes these cycle and temperature irregularities into account and does not give green (safe) days unless certain.

Fertility indicators used as algorithm inputs

As a result of the different hormones that are discharged during the menstrual cycle (see Figure 2 above), these are the fertility indicators used as algorithm inputs:

- The **basal body temperature BBT** is an indirect measurement of the amount of progesterone in the body and a rise in temperature is thus a reassurance that ovulation has occurred and that the woman is currently in the luteal phase, which is a non-fertile phase of the cycle. Since the temperature stays elevated (compared to the follicular phase) from ovulation until the end of the cycle, it is a constant and certain indicator that the woman is not currently fertile, even if she did not measure any temperature points around the time of ovulation. However, catching when the temperature rise happened is still important in order to learn more about when the user is ovulating and using that information to improve the prediction of her upcoming cycles and ovulation.

  BBT is measured in the morning on a daily basis, and Natural Cycles active users measure on average about 70% of the days. The more often a user measures the better the fertile window will be isolated and the more green days the user will get.

  Abnormal temperature entries can arise from for example a typo or a fever value that the user did not mark to be excluded in the app. Every entry that has a temperature measurement is scrutinized and evaluated whether it is considered to be abnormal based on where the user is in her cycle and what her normal temperature and temperature variations are. If the temperature is considered to be abnormal, it is marked by the algorithm as excluded and not taken into account in the calculations. The user is informed in the app that the algorithm is considering the temperature value as excluded.

- **LH tests**, also known as Ovulation Prediction Kits (OPKs) or ovulation tests, directly measure the amount of luteinizing hormone in the urine. The LH surge occurs one or two

days prior to ovulation and lasts for 48 hours [16]. If the LH peak is found, it is thus a very powerful indicator of when ovulation is taking place. As the surge only lasts for a brief two day period, and doesn't always trigger ovulation within the following few days, the detected LH peak thus needs to be followed by elevated temperatures to be certain that ovulation did take place.

Measuring LH is optional and used by about 25% of the users. It boosts the accuracy of the ovulation detection and the fertility prediction, resulting in more green days. It does not significantly affect the effectiveness of the product. The algorithm calculates which days to measure LH personalized to the individual user's cycle, which is displayed in the app. This part of the algorithm is optimized to minimize the number of tests needed without missing the LH peak.

- **The start and end of the cycle** i.e. the first day of menstruation. The relationship between the ovulation and the start and end of a cycle gives information about the length and variability of the different phases of the cycle for that particular person, which is used to predict upcoming ovulation and menstruation.

We believe that it is important to not require any deeper knowledge in the human body. This avoids error due to subjective analysis, which have proven to be one of the most difficult factors when using natural family planning for preventing pregnancies. Learning how to for instance read the cervix or the cervical mucus requires quite some training with subjective results that are difficult to validate with an algorithm. We do however provide more symptom tracking options in the app, such as cervical mucus, but it is not taken into account into the algorithm to avoid human error.

Anticipating the onset of the fertile window

For the follicular phase of the cycle (before ovulation), the user gets days marked as green (non-fertile) until the algorithm can no longer be certain that the user is not approaching her fertile window. It is not possible with BBT or LH to anticipate the onset of the fertile window, meaning that in this part of the algorithm, the past ovulation pattern for a particular user is what is used combined with statistical analysis. The NC° algorithm will thus give a buffer of red days before the predicted ovulation. How large this buffer needs to be depends on several factors - it takes into account sperm survival probabilities, the user's personal ovulation pattern and how regular or irregular that is, how much data we have on that specific user (how well we know her ovulation pattern and can anticipate her future earliest ovulation). For the first cycles, when the algorithm doesn't have much information on when the user usually ovulates and how that varies, the buffer of red days in the beginning of the cycle is enlarged.

For NC° Plan Pregnancy users, the risk of missing the onset of the fertile window is lower than for NC° Birth Control users, as the probability of conception in the first couple of days of the fertile window is low. The buffer of red days is thus smaller for NC° Plan Pregnancy users, as it is more important to better isolate the fertile window when using NC° for trying to get pregnant.

Determining if ovulation has happened

The body temperature rises after ovulation due to the increase in progesterone and stays elevated until the next cycle. At a certain point in the cycle (exact timing depends on past ovulation data for that user), the NC° algorithm starts checking for whether the user has ovulated in the current cycle. Only if and when ovulation has been confirmed by a clear enough temperature rise will the algorithm start giving green (safe) days again.

Not assuming anything about a user's individual temperature curve beforehand, we get to know what her temperature baseline looks like in both the follicular phase and luteal phase. When we then eventually see if she has ovulated, we check that her recent temperatures are 1) statistically compatible with the luteal phase and 2) statistically different from the follicular phase. How significant these statistical tests must be for the algorithm to confirm ovulation, depends on different factors such as:

- the number of recent temperature values that are used in the statistical test (at least 3, except if a recent positive LH test is present then at least 2 is enough).
- the number of previous cycles with detected ovulation (how well we know when this particular user usually ovulates)
- where the user is in her cycle compared to when the user usually ovulates and how much that varies cycle to cycle
- LH test results and their timing
- whether and when the user has recently been using hormonal contraception or been pregnant
- whether the user is using NC° Birth Control or NC° Plan Pregnancy (where the latter has a lower risk and hence needs a less significant result)

The higher the required statistical significance, the more distinct and consistent the temperature rise must be to confirm that the user has ovulated. In layman terms, the requirement on the significance increases if the algorithm is sceptical based on the available data. The requirement will be higher on days prior to the expected ovulation day, while it will be lower later in the cycle when the user usually has already ovulated.

If the NC° algorithm concludes that the user must have ovulated in the current cycle, it returns to giving green days again and starts looking for the most likely ovulation day.

Determining the ovulation day

The ovulation day is first estimated when the algorithm has confirmed that ovulation has happened already this cycle (as was described in the previous section), which means that the placement of ovulation day does not affect the red and green days in the current cycle. The part of the NC° algorithm that determines the most likely ovulation day is one of the most complex parts, since the data is often fluctuating or partly missing, but it is an important part of the algorithm since it leads to more accurate ovulation prediction for upcoming cycles.

In the default method of determining the ovulation day, the temperature curve in the entire cycle is used (taking also the information from the previous cycles into account). The temperature value of the ovulation day itself is less important since a single data point can fluctuate due to many reasons and should not be given as much importance. Many factors, weights and parameters are used in this analysis, which have been optimized through comparing LH and ultrasound ovulation data. By now, Natural Cycles has millions of cycles with confirmed ovulation and temperature curves that the algorithm has learned from when perfecting finding the most likely ovulation day.

If no or very little temperature data is present around the time of ovulation, a more simplified way of estimating the ovulation day is used. It is based on the little temperature data that is present (if any), previous ovulation patterns and cycle length information. If this secondary method is used to estimate ovulation in a cycle, we take into account its larger uncertainty when performing future predictions.

Additional features in the NC° algorithm

In this section some additional features of the algorithm are described. There are events in life that can affect the menstrual cycle or the data. Here a few such edge cases are described and how the algorithm takes them into account. In general though, if a user's cycle changes over time, for instance due to recently coming off hormonal birth control or starting to enter perimenopause, the algorithm will also adapt over time with the cycle.

Ovulation window and changing past data

For the cases when there isn't good enough temperature data around ovulation to be certain exactly when it has occurred, the algorithm provides a window of several days, which within ovulation most likely happened. Since a user's luteal phase usually remains rather stable from cycle to cycle (although the length varies from woman to woman), the data on the entire luteal phase gives more information concerning when ovulation did happen. This means that the algorithm can both come to move the confirmed ovulation day as well as narrow down the ovulation window (if there is one) when it gets more data from the luteal phase.

It's important to note that in the case when the algorithm is less certain exactly when ovulation happened, it also means that it will be less accurate in predicting the upcoming menstruation. Failing to accurately predict the exact ovulation day or menstruation during a cycle does however not indicate that the green days are less trustworthy. As was described in the section above - it is more straightforward to confirm that ovulation has occurred (meaning that the user is in a non-fertile phase of the cycle) than knowing exactly when it occurred.

It is also important to note that the algorithm never changes green and red days in the past for users on NC° Birth Control, even if the estimated ovulation day changes when considering the data from the luteal phase as described above. The only case when the algorithm does recalculate the past fertility status is when the user gives it a reason to do so by changing the fertility data in the past - for instance by changing past temperature or menstruation data.

No data for some time

As a safety measure, the temperatures are cross checked also after ovulation has been detected, in the rare case that the temperature rise was not due to ovulation. This implies that the temperatures have to stay elevated for the algorithm to consistently return green days in the luteal phase.

Emergency contraception

Users who decide to take emergency contraception such as the emergency pill or to insert a copper IUD, can input this information into the app. Since the emergency pill contains hormones it has an impact on the BBT and should be taken into account accordingly. Cycles, where the pill was taken, are affected by the presence of the additional hormones. Changes to the cycle characteristics due to the emergency pill (such as changes to the ovulation day, luteal phase length and cycle length) are taken into account when the algorithm is making future predictions.

Detecting a potential pregnancy

When a person becomes pregnant, the fertilized egg implants into the uterus on average around 9 days after ovulation. This is also when the body first becomes aware that it is pregnant and starts producing the hCG hormone, which is what a pregnancy test can detect. What also happens is that the progesterone starts increasing instead of decreasing as it would in a normal cycle when menstruation is approaching. This means that the temperature increases instead of decreases around the time when menstruation is expected and when one can first get a positive pregnancy test. The algorithm can therefore flag to the user that she might potentially be pregnant and should confirm with a pregnancy test. This is a great benefit since it is important to find out about a pregnancy as early as possible, whether the user is using NC° Plan Pregnancy or if the pregnancy was unintended.

When a pregnancy ends, the algorithm will take it into account and give time for the temperature and cycle to return to normal before it again starts to identify patterns when checking for ovulation.

Prediction for future days and cycle

Predicting of upcoming days and cycles is also a feature of the algorithm. It updates each day with new data at hand. For instance, it initially predicts the following cycle to start (period prediction) based on previous cycle lengths, but updates after ovulation has been detected in the current cycle to give more accurate period predictions using the ovulation date in the current cycle and the user's personal luteal phase length.

Birth control effectiveness

Pearl Index and effectiveness

The effectiveness of preventing pregnancy of a certain birth control method is usually performed by calculating a so-called "Pearl Index". The Pearl Index is a number from 0-100, indicating how many women out of 100 experienced an unintended pregnancy using the birth control method for a year. The effectiveness is then calculated by converting the Pearl Index into a percentage and subtracting it from 100%, e.g. a Pearl Index of 10 implies an effectiveness of 90%. The effectiveness (or the Pearl Index) is usually measured with both **typical use** (counting all pregnancies) and **perfect use** (counting pregnancies despite the user following the instructions). In the case of Natural Cycles, perfect use is reached when a user uses protection or abstains when the app gives a red day.

Maximizing the algorithm's effectiveness

Overall the NC° algorithm has about 100 parameters (factors and weights, etc), which have been tweaked and optimized with data from millions of ovulations and cycles. When we developed the algorithm, we especially looked at the following:

1. The accuracy of the estimated **ovulation day** using temperature data and comparing with LH data in cycles where there isn't a false positive LH test result.
2. Fraction of **green (safe) days**
3. **Probability of conception** due to the algorithm falsely giving green days within the fertile window. It is calculated as a theoretical perfect use effectiveness assuming unprotected sex on the most fertile green day per cycle (if any) and no sex on red days, and taking into account the different probability of conception in the different days in the fertile window.

We always strive to improve the ovulation accuracy (1) since being able to detect ovulation as accurately as possible is crucial and all other metrics follow from this. Then we try to maximize the number of green (safe) days (2) that can be given while reducing the probability of conception

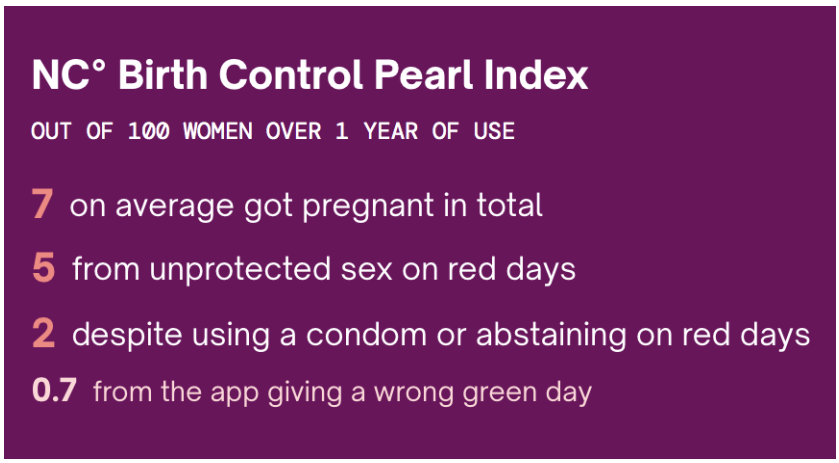
(3). We have seen that if we can give more green days and better isolate the fertile window, it has a positive impact on the overall typical use effectiveness of Natural Cycles, since users are then more likely to use protection on the red (unsafe) days. The most common reason for pregnancy using Natural Cycles is unprotected sex on a red day, so this is important to take into account.

We also look at several factors that are important to keep the pregnancy risk at the same level throughout their variation, e.g. number of past cycles for a user, cycle regularity, previous use of hormonal contraception, different parts of the cycle. **This means that the pregnancy risk is similar before and after the algorithm detects ovulation, even though BBT only confirms ovulation after the fact.**

Validation of the algorithm and resulting effectiveness

Following up on a regular basis on real data from real users on the effectiveness of the product as well as the performance of the algorithm is part of the post-market surveillance we need to do as a manufacturer of a medical device for contraception. Every month we look at the effectiveness, unintended pregnancies and the reasons behind the pregnancies. We divide them into typical and perfect use pregnancy cases and method failure (pregnancy due to the app giving a wrong green day). This analysis is performed in the same way as the clinical studies that have been published in [19], [20], [21] and [22]. We consistently follow up with an impressive 98% of users on the contraceptive effectiveness and we constantly monitor these numbers very closely. This is a great benefit of being a digital contraception that monitors the cycle - that we can more easily follow up with pregnancies (in an anonymized way in the data). We therefore have a very good understanding of what leads to pregnancies and what cohort of users are better suited for this product than others, performance per country, age group, over time and much more. This is probably the most sophisticated post-market surveillance ever performed on any birth control method to date.

Being able to closely follow up on the product's effectiveness in almost real time enables us to act quickly if we would see any deviation. Thankfully this has so far never been the case and the results related to the algorithm performance have always been stable over time within the expected statistical fluctuations. The typical use effectiveness can vary somewhat depending on the type of user, their culture and behaviour, and how many users in what country, etc, since it highly depends on the willingness to use protection on red days. Overall the resulting effectiveness of Natural Cycles is **93% with typical use (Pearl Index of 7)** and **98% with perfect use (Pearl Index of 2)**. Only counting pregnancies due to the algorithm giving a wrong green day leads to an effectiveness of > 99% (**method failure rate of 0.7%**). These numbers are further explained in the table below.



In addition to effectiveness metrics, we follow up every month with new data coming in from the users on the probability of conception, assuming sex on the most fertile green day per cycle cycle (if any). The results are best summarized in the chart below, showing the probability of a red day with regards to ovulation (confirmed with LH test data) and the probability of conception in the different days in the fertile window. Taking into account these two metrics is what makes up the total probability of conception from the algorithm attributing false green days within the fertile window, which is also what is used when developing the algorithm as was described in the previous section.

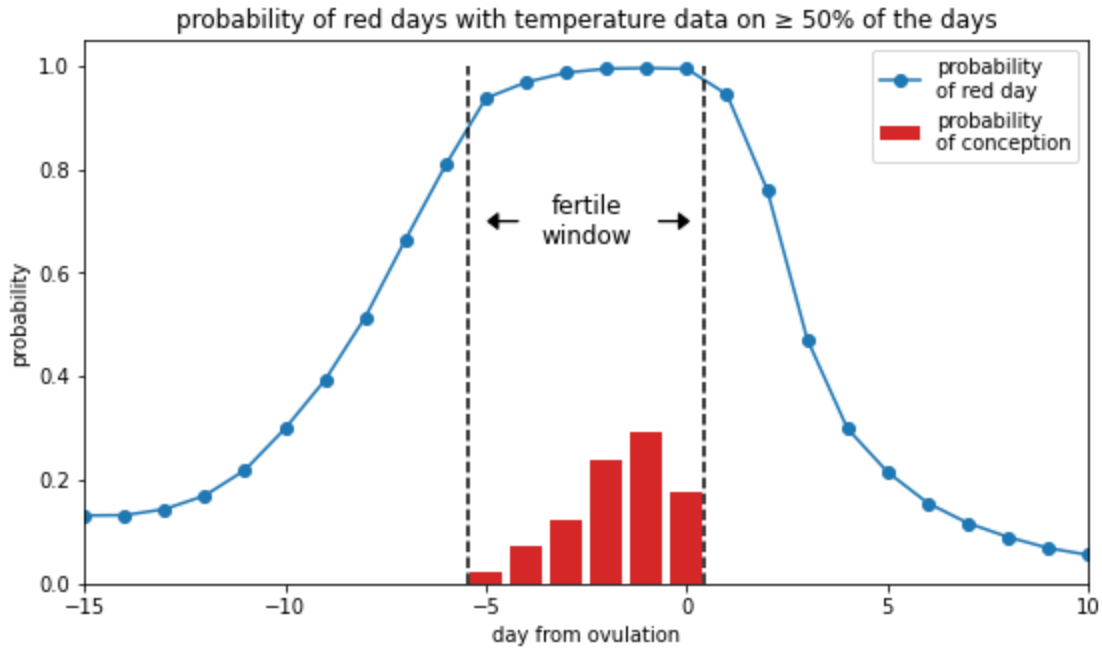


Figure 3: The probability of a red day and the probability of conception per day in the cycle normalized to the ovulation day. Cycles with a temperature measurement on at least 50% of days are included. The probability of receiving a green day on the three most fertile days (ovulation day and the two days before) is very low and proportionally less likely than the probability of receiving a green day in the beginning of the fertile window when the probability of conception is lower. The net resulting pregnancy risk is thus at the same level for the green days given in the beginning of the cycle and after the algorithm confirms ovulation.

In conclusion, the importance of a personalized algorithm, which takes the individual users' cycle and ovulation patterns into account, is clear since a woman's cycle is truly unique. A clinical study with results published in [23] compared Natural Cycles algorithm with two types of calendar-based methods (the standard days method and the rhythm method) in cycles where ovulation was known and the resulting probability of conception and number of days marked as safe are vastly different, showing the importance of ovulation detection in the method. With a personalized and highly performing algorithm like Natural Cycles, it becomes evident that the overall typical use effectiveness as a birth control does not depend on how or how often the user measures her temperature or her cycle regularity, but rather how compliant she is at using protection on the red (fertile) days.

References

[1] S. Green, *Curious History of Contraception.* St. Martin's Press, New York, 1972.

[2] Bull, J. et al. Real-world menstrual cycle characteristics of more than 600,000 menstrual cycles. NPJ Digit Med. 2019 Aug 27;2:83. doi: 10.1038/s41746-019-0152-7.

[3] A. J. Wilcox, C. R. Weinberg, and D. D. Baird, *Timing of sexual intercourse in relation to ovulation*, The New England Journal of Medicine **333** (1995) no. 23, .

[4] J. D. Hoff, *Hormonal dynamics at midcycle; a reevaluation*, Journal of clinical endocrinology and metabolism **57** (1983) no. 4, 377380.

[5] J. E. Garica, J. S. Jones, and J. L. Wright, *Prediction of the time of ovulation*, The american fertility society **36** (1981) no. 3, .

[6] A. E. Treloar et al., *Variation of the human menstrual cycle through reproductive life*, International journal of fertility **12** (1967) no. 1, .

[7] D. Schwarz and M. J. Mayaux, *Female fecundity as a function of age*, The New England Journal of Medicine **306** (1982) no. 7, .

[8] M. P. Vessey et al., *Fertility after stopping different methods of contraception*, British medical journal **1** (1978) 265–267.

[9] G. Howe et al., *Effects of age, cigarette smoking and other factors on fertility; findings of a large prospective study,* British medical journal **290** (1985) .

[10] J. W. Rich-Edwards et al., P*hysical Activity, Body Mass Index, and Ovulatory Disorder Infertility*, EPIDEMIOLOGY **13** (2002) no. 2, .

[11] E. A. Lenton, B. M. Landgren, and L. Sexton, *Normal variation in the length of the luteal phase of the menstrual cycle: identification of the short luteal phase.,* British journal of obstetrics and gynaecology **91** (1984) no. 7, .

[12] M. N. M. et al., *Temporal relationship between basal body temperature nadir and luteinizing hormone surge in normal women*, The american fertility society **27** (1976) no. 7, .

[13] M. L. Barron and R. Fehrings, *Basal Body Temperature Assessment: Is It Useful to Couples Seeking Pregnancy?* , American Journal of Maternal Child Nursing **30** (2005) no. 5, .

[14] R. P. and A. Ferreira, *A New Approach to Modeling Daily Probabilities of Conception*, Biometrics **55** (1995) 1005–1013.

[15] J. C. Prior et al., *Determination of luteal phase length by quantitative basal temperature methods: validation against the midcycle LH peak* , Clinical and investigative medicine **13** (1990) no. 3, 123–131.

[16] H. M. Behre et al., *Prediction of ovulation by urinary hormone measurements with the home use ClearPlan Fertility Monitor: comparison with transvaginal ultrasound scans and serum hormone measurements*, Human reproduction **15** (2000) no. 12, .

[17] C. L. BUXTON and W. B. ATKINSON, *Hormonal factors involved in the regulation of basal body temperature during the menstrual cycle and pregnancy*, Journal of clinical endocrinology and metabolism **8** (1948) no. 7, 544–549.

[18] E. Scherwitzl Berglund, A. Linden Hirschberg, and R. Scherwitzl, Identification and prediction of the fertile window using NaturalCycles, The European Journal of Contraception and Reproductive Health Care 20 (2015) no. 1, .

[19] E. Scherwitzl Berglund, K. Gemzell Danielsson, J. Sellberg, R. Scherwitzl, Fertility awareness-based mobile application for contraception. The European Journal of Contraception & Reproductive Health Care. 2016;21(3):234-241.

[20] E. Scherwitzl Berglund, O. Lundberg, H. Kopp Kallner, K. Gemzell Danielsson, J. Trussell, R. Scherwitzl, Perfect-use and typical-use Pearl Index of a contraceptive mobile app. Contraception. 2017;96(6):420–425.

[21] Pearson, J. et al, Natural Cycles app: contraceptive outcomes and demographic analysis of UK users. The European Journal of Contraception & Reproductive Health Care. 2021 Apr;26(2):105-110.

[22] Pearson, J. et al, Contraceptive Effectiveness of an FDA-Cleared Birth Control App: Results from the Natural Cycles U.S. Cohort, J Womens Health. 2021, doi: 10.1089/jwh.2020.8547

[23] Kleinschmidt, T. et al. Advantages of determining the fertile window with the individualised Natural Cycles algorithm over calendar-based methods. Eur J Contracept Reprod Health Care. 2019 Dec;24(6):457-463. doi: 10.1080/13625187.2019.1682544