

# SymRec - Web Tool for Planned Parenthood and Hormonal Therapy

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**Abstract** — The Symptothermal method is based on monitoring, recording and evaluation of fertility-related symptoms. The mentioned method can help prevent unintended conception, assist achieve conception, help identify various gynecological diseases and timing of hormonal treatment. The Symptothermal method is the preferred method for planned parenthood to hormonal contraception because it has no adverse side effects. Regular paper tables used in gynecology wards require significant user knowledge. However, the digitized data tables require only simple data entry from the user. The developed web interface allows for automatic analysis, evaluation and data archiving. Table records in electronic form significantly save user time, simplify the workflow and include long-term data pertaining to patient health status, thus playing an important role in the early diagnosis of diseases and successful treatment.

**Keywords** - Basal temperature; cervical mucus; diagnosis of gynecological diseases; hormonal therapy; cervix; planned parenthood; symptothermal method.

## I. INTRODUCTION

The transition from traditional paper-based health records to their electronic counterparts is currently a top priority in many countries. Electronic health records offer a simplified and rapid access to patient data under various circumstances (e.g., health risk, early diagnosis) The reproducibility and transferability of patient data allows remote consultation with medical staff (telemedicine, home care) [1][2]. This paper deals with implementation of our web tool for users in Slovak Republic.

Symptothermal records used in planned parenthood are also considered to be health records since they offer additional information when diagnosing various gynecologic diseases, including newly detected or long-term health states and may also be used in case of infertility-related treatments [3]. The use of the mentioned records can help unnecessary medical therapy in cases where incorrectly timed sexual intercourse is the cause of infertility. They can also be used for setting-up hormonal therapy and advanced treatment monitoring [4]. Longer records (several years) can help diagnose even minimal menstrual cycle deviations pertaining associated with possible health risks and thus allow for the early diagnosis (cervix cancer) and complete patient recovery.

This paper consists of several parts. Section 2 of the paper describes symptothermal method in general. All rules, which

are used by the symptothermal method in our web tool, are described in Section 3. Sections 4 and 5 describe the structure of SymRec web tool. These sections deal with user interface, parts of SymRec web tool window and security of stored data. Section 6 describes the future work.

## II. SYMPTOTHERMAL METHOD

The symptothermal method is a universal approach consisting of monitoring, recording and evaluation of fertility symptoms to either prevent or facilitate conception. The mentioned method is natural (without medication) and has no adverse side effects. The process includes the monitoring of basal temperature changes, cervix and quality of cervical mucus. Basal body temperature is the lowest temperature attained by the body during rest (usually during sleep). Lowest values are attained early morning and then continue to slowly increase each half an hour by approximately 0.05°C. Monitored symptoms are recorded in the record table. In Figure 1, it is shown one record table, which is used to store menstrual cycle data (42 day limit) and offers overview of fertile days and cycle changes.

The cycle is divided into four phases:

1. Menstruation,
2. 1<sup>st</sup> phase – pre-ovulation infertility,
3. 2<sup>nd</sup> phase – fertile days,
4. 3<sup>rd</sup> phase – post-ovulation infertility.

The mentioned phases are not identical with physiological changes of the endometrium (proliferative phase, ovulation, secretive phase) except for menstruation, because they include the mutual pair fertility (life time of sperm) [5][6].

## III. EVALUATION OF THE 3<sup>RD</sup> PHASE OF POST-OVULATION INFERTILITY

Post-ovulation infertility commences after the egg reaches its lifetime and begins to degrade within 48 hours post-ovulation. This phase can also be described as completely non-fertile because progesterone generated by the yellow body suppresses any possible ovulation. Monitoring of fertility symptoms does not allow the precise determination of ovulation, however it does allow precise post-ovulation infertility phase. Numerous rules are used to

The form is titled 'Denný záznam číslo: ..... mesiac/rok: .....'. It includes a section for 'Vek' (Age) and 'predchádzajúce cykly' (previous cycles) with fields for 'Najskorší 1. deň zvýšených teplôt nad DH' and 'Najmenší počet dní výskytu hlienu do vrcholu'. The main grid has columns for days 1-42 and rows for 'deň cyklu krvácanie (X, /) styk (✓)', 'deň mesiaca', 'nepravidelnosti (X)', 'zvyčajná doba merania teploty', 'Hodnota DH aktuálneho cyklu', 'deň cyklu Vrcholný deň hlienu', 'vonkajšie pozorovanie hlienu', 'vnútorné pozorovanie hlienu', and 'zmeny krčka maternice'. On the right, there are ovals for 'Vyhodnotenie aktuálneho cyklu' (cycle evaluation) with fields for 'koniec I. fázy cyklu', 'počet hlienových dní do vrcholu', '1. deň teplotného vzostupu', 'začiatok III. fázy cyklu podľa pravidla', 'dĺžka cyklu', and 'dĺžka luteálnej fázy'. At the bottom, it provides contact info for 'Poradenská služba Ligy pár páru: lpp@lpp.sk; gynekolog@lpp.sk' and website 'www.lpp.sk'.

Figure 1. Regular (paper) record in Slovak language.

determine this phase, combining various temperature curves and mucus changes. The mentioned rules are based on various observed situations in monitored cycles.

The following rules are currently used:

1. R, based on works published by Dr. Jozef Rötzer,
2. B, based on works published by Dr. John Billings,
3. K, based on works published by Konald Prem and John Kippely.

All mentioned rules are based on the assumption that the greater the temperature increase, the fewer the number of days of mucus drying necessary for accurate prediction of non-fertile phase. Higher accuracy can be obtained by adding one day to the 3<sup>rd</sup> cycle phase determined by these rules.

**A. R rule**

The phase of post-ovulation infertility begins in the evening of the 3<sup>rd</sup> day of temperature rise after maximum mucus day, if the mentioned day is also the 3<sup>rd</sup> day of mucus drying. The following conditions must be fulfilled for the temperature rise – all temperatures are valid, follow after each other, the first or second temperature is at least 0,1°C

higher than lower boundary and third temperature has reached or surpassed the upper boundary. Valid temperatures within one cycle are measured each morning, within the same time range (± 30 minutes) and the same place (e.g., vagina, mouth or rectum), during complete body rest and healthy state.

**B. B rule**

The phase of post-ovulation infertility begins in the evening of the 3<sup>rd</sup> day of temperature rise after maximum mucus day, if the mentioned day is also the 4<sup>th</sup> day of mucus drying. The following conditions must be fulfilled for the temperature rise – all temperatures are valid, they are at least 0.05°C higher than the lower boundary, no temperature decrease has occurred and one temperature has reached or surpassed the upper boundary. The temperatures are measured analogous to R rule, during complete body rest and healthy state. The temperatures in the temperature rise may follow after each other and one temperature can be missing between them [7].

**C. K rule**

The phase of post-ovulation infertility begins in the evening of the 3<sup>rd</sup> day of full temperature rise if the

mentioned day is also at least the 2<sup>nd</sup> day of mucus drying. A full temperature rise comprises three temperatures after each other (without interruption), all of which must be at the upper boundary or beyond.

In case only one fertility symptom is available for a certain non-standard situation, we can use rules based on monitoring only one fertility symptom. Insufficient control with additional symptom(s) is compensated by adding an additional day. However, these rules are unable to resolve certain abnormal manifestations of menstrual cycle during the female fertile period and thus are less effective than previous rules. The mentioned rules include the 4T rule (four temperatures), 5T rule (five temperatures) and Marshall Rule [3].

IV. RULE IMPLEMENTATION WITHIN THE WEB INTERFACE

Based on obtained information and rules we created a record table integrated into a web interface. The mentioned application may be used for controlling or supporting female fertility. Another possible use is the early diagnosis of gynecological diseases and proper timing of hormonal therapy. Conventional paper records require significant user knowledge of the underlying evaluation rules. By digitizing the mentioned data we facilitate this process by automatic computer analysis, evaluation and archiving of entered data and automatic prediction of 3rd phase of post-ovulation infertility. The area is defined based on the determined local minima and maxima [8]. The developed interface evaluates a single symptom – basal body temperature.

V. WEB INTERFACE OF SYMREC WEBTOOL

The electronic record table is used for daily data entry and evaluation. Data must be entered periodically each day and thus rely either on new user registration or existing user data. Data are saved in a database. We used MySQL open source database which is running on our server. The data are secured by name and password. Cryptographic hash function SHA1 is used.

Upon providing valid credentials the user is presented with a record table. Figure 2a shows that the first application screen contains information about the user account including the user name, record history, help, printing and user log-out.

In Figure 2, it is shown the page which consists of (ordered from top to bottom):

- a) user account information,
- b) header,
- c) menstrual bleeding records,
- d) basal temperature array,
- e) notes,
- f) evaluation box,
- g) Evaluate and Reset buttons

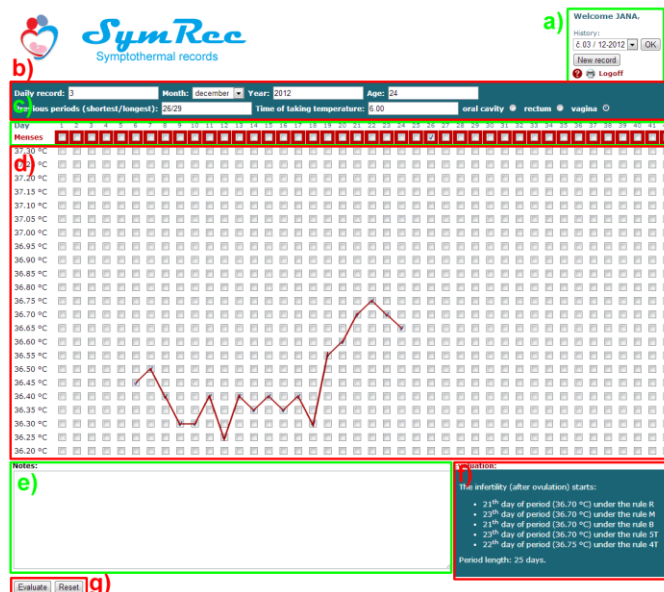


Figure 2. Webinterface of SymRec webtool.

The header contains record information for single cycle, including record number, month, year, age and the length of shortest and longest previous cycle, time and location of measurement.

The first day of menstrual bleeding must be recorded for the current cycle and also on the first day of the successive cycle. This will determine the cycle length calculated by the program and shown in the “Evaluation” box (Figure 2f, bottom right).

The temperature array consists of rows and columns. Rows represent the basal temperature from 36.2°C to 37.3°C and columns represent cycle days. The basal temperature during one cycle must be evaluated under identical conditions and only valid values must be entered into the table. The temperature is measured each morning, same timeframe within one cycle and same place. Measurement must be performed using a thermometer with two decimal precision for more exact evaluation of fertile days. No physical activity has to be performed 1 hour prior to measurement. Temperature measured during illness is not considered valid and thus not recorded that day.

Notes or cycle irregularities may be noted in the “Notes, irregularities” box.

Figure 2g shows that the table header (daily record, month and year), basal temperatures and menstrual bleeding are confirmed using the “Evaluate” button. Entered data are stored in the database, analyzed and results are written to the “Evaluation” box. In Figure 3, it is shown the evaluation box. In evaluation box, it is written when the infertility starts by different rules and how long the period takes.

**Evaluation:**

The infertility (after ovulation) starts:

- 21<sup>th</sup> day of period (36.70 °C) under the rule R
- 23<sup>th</sup> day of period (36.70 °C) under the rule M
- 21<sup>th</sup> day of period (36.70 °C) under the rule B
- 23<sup>th</sup> day of period (36.70 °C) under the rule 5T
- 22<sup>th</sup> day of period (36.75 °C) under the rule 4T

Period length: 25 days.

Figure 3. Detail of "Evaluation" box.

Evaluation of older records allows monitoring of minimum cycle deviations. The application is thus appropriate not only for fertility management but also for early diagnosis of gynecologic diseases and hormonal treatment timing. The web application also includes extensible help detailing all application controls. In Figure 4, it is shown the sample of extensible help. There is written about registration, correct measurement of the temperature and correct notation of the symptoms. User can also find information about records history and evaluation there.

## VI. CONCLUSION AND FUTURE WORK

The developed web interface fulfills the requirements of the symptothermal method and additionally allows storing, analysis, evaluation and archiving of entered data. Evaluation calculates the third phase of post-ovulation infertility and predicts the cycle length. The interface may be used for controlling or promoting female fertility. Moreover, early diagnosis of gynecological diseases and hormonal treatment timing is also possible. Future development will add other evaluation criteria (calculation of the first phase of pre-ovulation infertility, mucus quality and cervix state) in order to obtain more precise calculation of the third phase of post-ovulation infertility. This time is the web tool available

only in Slovak language however internationalization work is underway to include English.

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## NÁPOVEDA NA POUŽÍVANIE STRÁNKY Symptotermálne záznamy

Nachádzate sa na stránke Symptotermálne záznamy. Stránka slúži ako alternatíva k tlačenej verzii záznamových tabuliek využívajúcich pravidlá Symptotermálnej metódy. Umožňuje zaznamenávanie dní krvácania, bazálnych teplôt, času a miesta merania, čísla záznamu, poznámok, informácií o predchádzajúcich cykloch, mesiaci a roku záznamu. Možnosť prezerania starších záznamov poskytuje náhľad do histórie záznamov a tým možnosť porovnať predchádzajúce záznamy s aktuálnym.

Návod na používanie stránky Symptotermálne záznamy:

1. Pred prvou návštevou stránky je potrebné sa **zaregistrovať**. Registračné údaje slúžia výlučne na uloženie, spracovanie a vyhodnotenie zadaných údajov/symptómov. Bližšie informácie o registrácii nájdete **tu**.
2. Pri každom ďalšom používaní stránky je potrebné sa prihlásiť. Bez prihlásenia nie je možné so záznamami pracovať.
3. Dbajte na to, aby ste správne vyplnili hlavičku tabuľky, najmä číslo denného záznamu (nezadávať dva záznamy s rovnakým číslom), mesiac a rok.
4. V riadku "Krvácanie" zaznačte prvý deň krvácania aktuálneho cyklu aj prvý deň krvácania nasledujúceho cyklu.
5. V poli bazálnych teplôt zaznačte len **platné bazálne teploty**. Teploty zaokrúhľujte vždy rovnakým spôsobom.
6. V poli "Poznámky" môžete zapísať prípadné nepravidelosti či iné poznámky.
7. Po vyplnení potrebných údajov kliknite na tlačidlo "Vyhodnotiť". Vaše údaje sa uložia a vyhodnotia. Na základe symptotermálnych pravidiel sa zistí teplotný vzostup, ohraničí sa III. fázu poovulačnej neplodnosti a vypíše dĺžku cyklu. Meniť je možné len najnovší záznam (teda aj novo vytvorený).
8. Staršie záznamy je možné prezeráť cez funkciu "História záznamov". Záznamy v histórii sú zoradené od najnovšieho po najstarší záznam. Výber je nutné potvrdiť tlačidlom "OK". Staršie záznamy nie je možné meniť.
9. Viac informácií o používaní Symptotermálnej metódy nájdete na stránke organizácie **Liga pár páru**. Kompletné informácie o metóde a príklady hodnotenia záznamov ponúka **Príručka symptotermálnej metódy PPR**.

V prípade problémov nás kontaktujte na: [stm.podpora@gmail.com](mailto:stm.podpora@gmail.com).

Figure 4. Help for users (This time is the help available only in Slovak).