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INTRODUCTION

- Natural Cycles is a digital fertility awareness-based method (FABM) of contraception cleared by the FDA and certified in the EU.
- Fertility awareness apps and the associated databases of physiological data provide a unique opportunity to examine a large number of menstrual cycles in order to improve understanding.
- With more than 1,000,000 registered users globally in August 2018, the Natural Cycles database is one of the largest collections of menstrual cycle data ever compiled.

AIM

The aim of this study is to describe menstrual cycle characteristics observed from a large database of cycles and investigate the association of menstrual cycle characteristics with cycle length, age and BMI.

METHODS

- How the app works: The Natural Cycles mobile app uses menstruation data, BBT, and optionally LH tests as inputs to an automated statistical algorithm that retrospectively detects the rise in BBT following ovulation and makes personalised predictions of the upcoming fertile window (Figure 1).

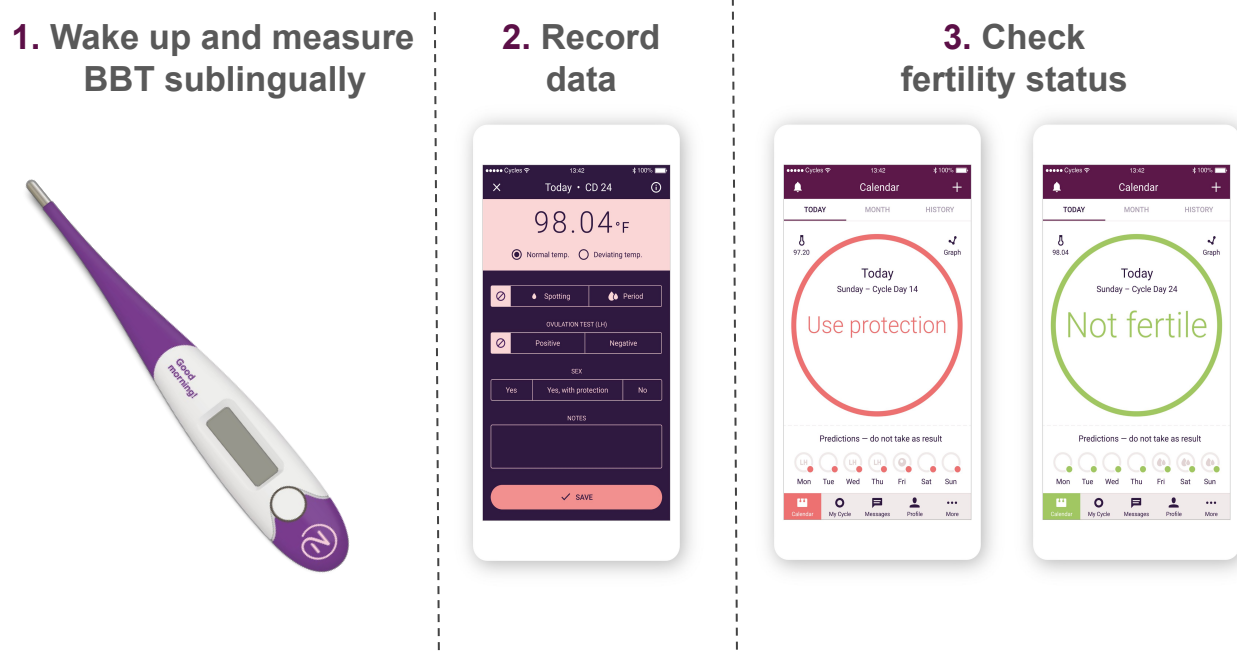


Figure 1: How Natural Cycles is used.

- Analysis of anonymised data collected prospectively from users of the Natural Cycles app between August 2014 and December 2018.
- Users were aged 18 to 45, had BMI ranging from 15 to 40, had not recently used hormonal contraception and were not pregnant.
- Users had to have logged at least 30 entries in the app. Cycles between 10 and 90 days with a detected ovulation were included.
- Menstruation, basal body temperature (BBT) and luteinising hormone (LH) tests were recorded anonymously by users of the Natural Cycles app.
- Ovulation day was calculated by a proprietary algorithm using BBT measurements and optionally LH tests.
- Mean cycle and bleed lengths were calculated in cohorts of ovulatory cycles by cycle length, age and BMI. Mean follicular phase luteal phase lengths were calculated in a subsample of ovulatory cycles with LH tests meeting strict data quality criteria.

Limitations

- The sample was drawn from the Natural Cycles user base which is not fully representative of the general population.
- Ovulation detection by the algorithm may have more variability than ultrasound detection.
- Women with high BMI were underrepresented in the sample compared to the general population.

RESULTS

- We analysed 612,613 ovulatory cycles of length 15 to 50 days with a mean length of 29.3 days from 124,648 users.
- The mean follicular phase length was 16.9 days (95% CI: 10-30) and mean luteal phase length was 12.4 days (95% CI: 7-17).
- Mean cycle length decreased by 0.18 days (95% CI: 0.17-0.18, $R^2 = 0.99$) and mean follicular phase length decreased by 0.19 days (95% CI: 0.19-0.20, $R^2 = 0.99$) per year of age from 25 to 45 years.
- Mean variation of cycle length per woman was 0.4 days or 14% higher in women with a BMI of over 35 relative to women with a BMI of 18.5-25.

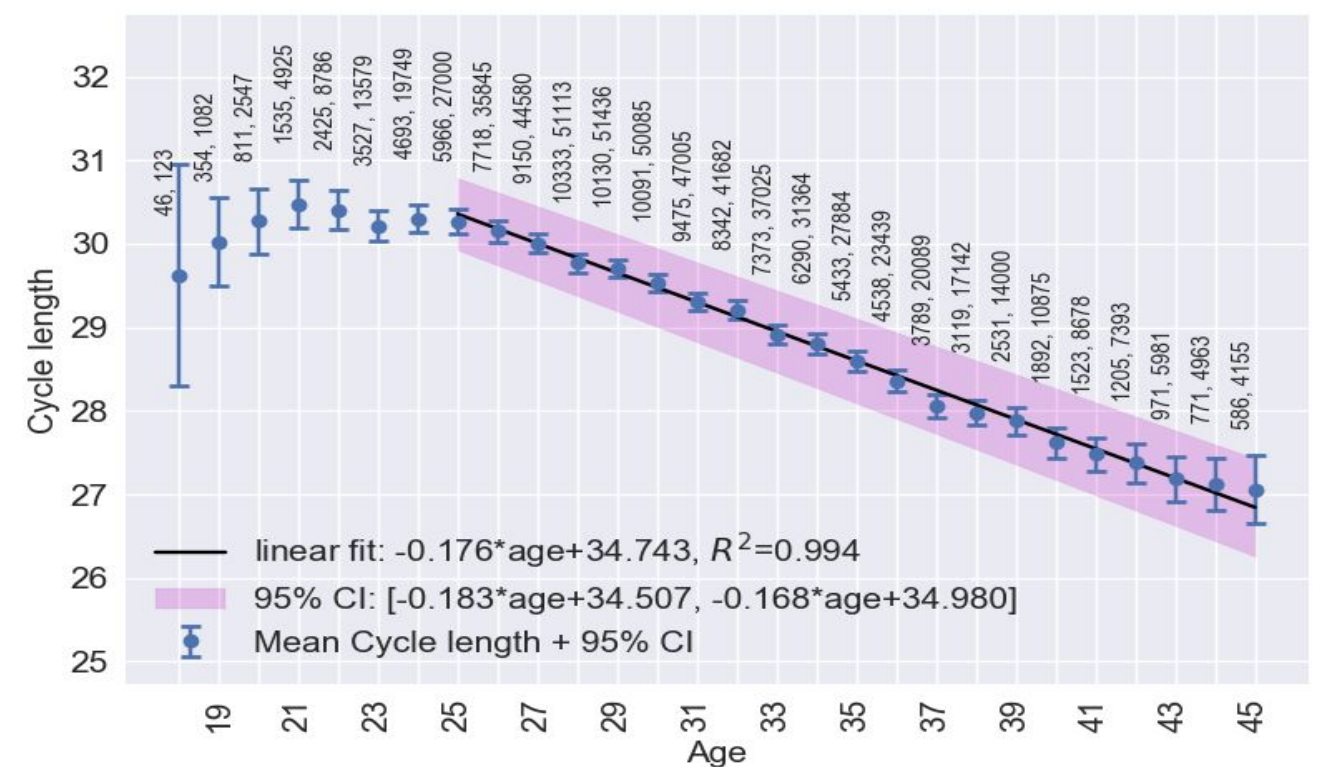


Figure 2: Cycle length and age.

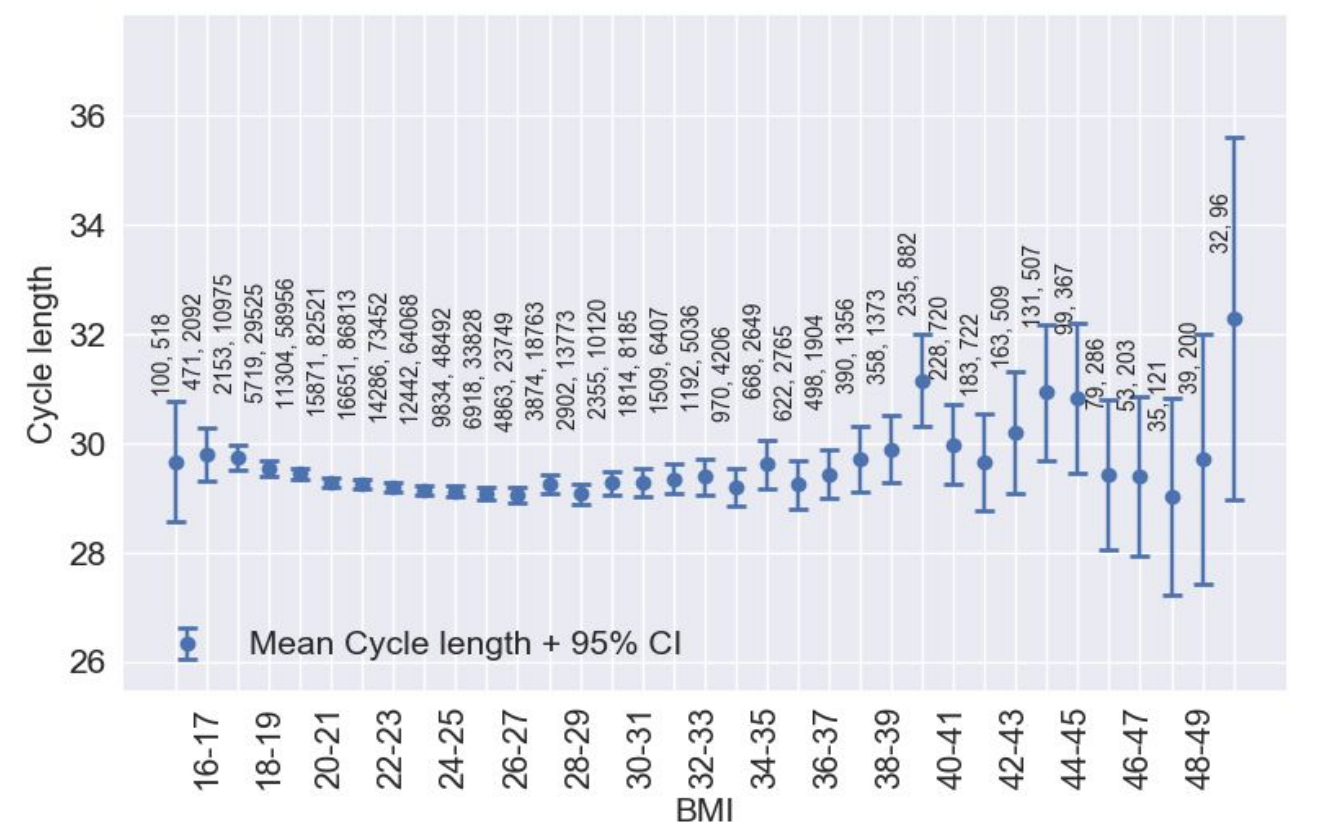


Figure 3: Cycle length BMI.

CONCLUSIONS

This is the largest study of real world menstrual cycle characteristics to date. Cycle, follicular phase and luteal phase lengths were significantly different to the traditional 14+14 day model. Large scale real-world data collection from mobile applications is a valuable tool in women's health research.