The problem

Goals
- Empirical evidence
- The data
- The development of a simple and effective method for ovulation prediction would... of the menstrual cycle and of its phases is a problem of greatest... cast are more appropriate than point predictions (Marsu... women have to take into account that there is variability both... casts ranging from 0 to 6 cycles were provided by the Catholic Marriage Advisory Council of England and Wales, leading to a total of 36641 each providing a sequence of at least 6 consecutive cycles, leading to a total of 36641 cycles.

Modelling intra-woman variability
- We adopt a state-space formulation

3. A negative one-lag autocorrelation on first differences is present for many women. (Women may misunderstand the signals for the end of a cycle, anticipating it, thus will add one to the cycle day the signs belong to the previous one.)

4. Some observations are very different from the others and can be considered as outliers. (Some cycles can have a peculiar biological explanation, such as early detectable fertility.)

5. After allowing for the above effects the process remains noisy.

Results for an individual woman

Woman I
- We show results obtained by fitting the model to the longest observed sequence of consecutive cycle lengths from an individual woman (195 observations).

Woman II
- We also show inference results for a sequence of consecutive cycle lengths from a second woman (172 observations).

A model for all women
- Most women have relatively short sequences of cycle lengths, which makes the possibility of individual estimation difficult.
- A possible solution is a hierarchical model which allows a transfer of information across women and the estimation of population parameters for prediction on women not included in the survey.

Model estimation and applications
- Estimation of the hierarchical model from the total cycle lengths
- Estimation of the hierarchical model from the pre- and post-ovulatory phase lengths
- Applications to prediction of probability of conception given intercourse behavior.

Model extension
- Selection of covariates (woman’s age, temperature, stress, etc.)

Inference extensions
- Parameter estimation using Monte Carlo Sequential procedures, in order to develop a dynamic algorithm for prediction.

References