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Mobile Health Service is Promising to Detect the Blood Pressure and HRV Fluctuations across the Menstrual and the Lunar Cycle

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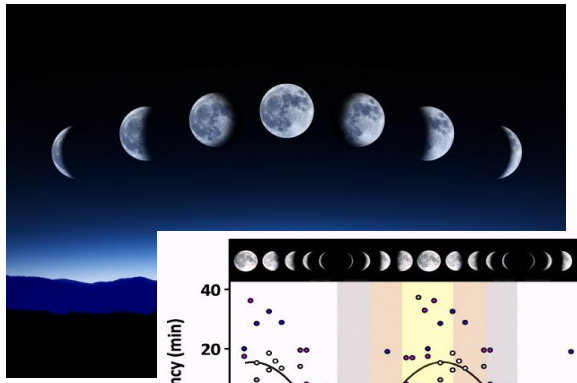
Mind the gap and build the bridge

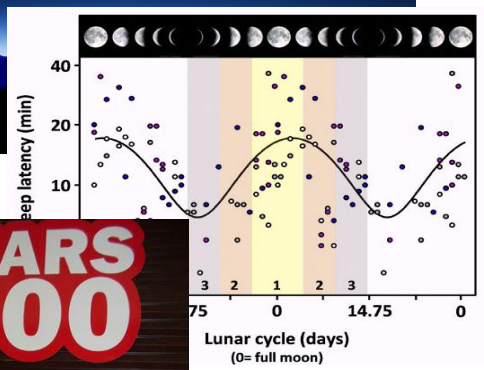
between physiology and mobile medicine services

- In physiology, there is strong market pain for reliable experimental tools to monitor tiny (minimal) fluctuations of bio-signals in big scale groups in comfortable non-lab conditions
- Classic experimental designs has reached the limit of their research value. Mobile medicine promises progress.
- Existing mobile medicine services need to expand its applicability

Why to search for the Lunar influence on human physiology?

- There is strong *belief* that the Lunar cycle exerts effect on human physiology and psychics (sleep, suicide, depression, anxiety, emotions etc.)
- There is a long story of attempts to document enigmatic influence of the Lunar cycle on the man, and not only. Still, *no decisive evidence* was obtained.
- Manned spaceships are affected by Moon location. This area is emerging and evolving.





In great part, the problem of uncertainty of the Lunar impact on the man is methodological

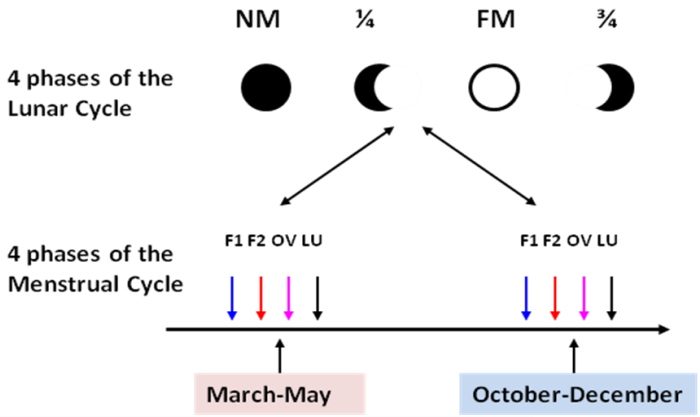
- Most of “lunar” studies are cross-sectional (plenty of subjects are usually tested only at one phase of the Moon)
- Most of studies are retrospective, that means lack of basic working hypothesis behind. Data collected from some data bases (hospitals, outpatient clinics, police, etc)
- Adequate physiological parameter must be used to elucidate the Lunar cycle
- Ignorance of the menstrual cycle that is similar by duration and probably evolutionally linked to moon phase

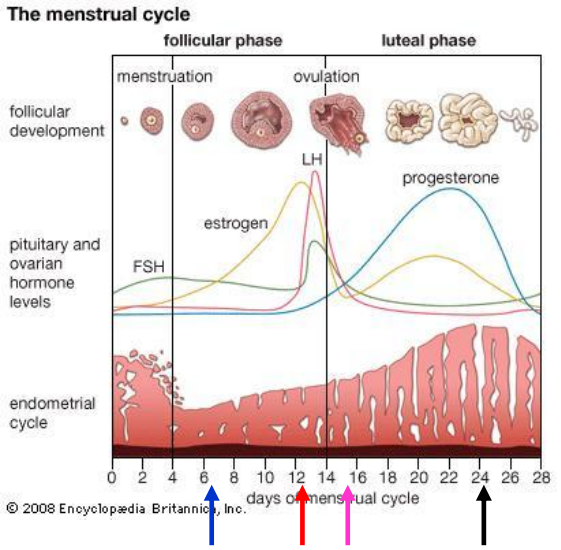
Our current approach to document the Lunar impact on humans

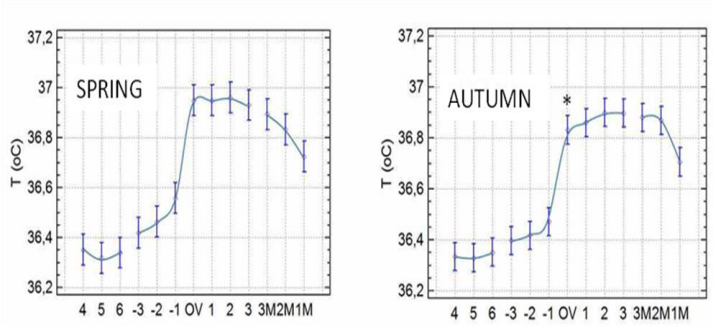
- A partially longitudinal design. Several points of data collection were assigned along the year in one test person (at least 8 points).
- Linking of a physiological parameter to moon phase (using calendar).
- Heart rate variability (heart rhythm) as a physiological parameter
- with respect to the menstrual cycle (28-29 days).
- Still, the study was retrospective (our own registered data base on HRV)

The design

"Münchner Astro Archive"
http://www.maa.mhn.de/StarDate/moonphases.htm.







23 young females
143 ECG samples

F1 – early follicular (7th)
F2 – late follicular (13th)
OV – ovulation (16th)
LU – luteal (24thday)

State Data Base Record #2014620775 of 28.05.2014, "Variability of heart rate", Federal service on intellectual property of Russia

Biosignal: Heart Rate Variability, Blood Pressure

Heart Rate Variability

Time-domain / statistical

RRNN – mean inter RR

RMSSD – root mean square of SD

SDNN – standard deviation

pNN50 – portion of neighbor RR which differ by more that 50 ms

Frequency-domain / spectral

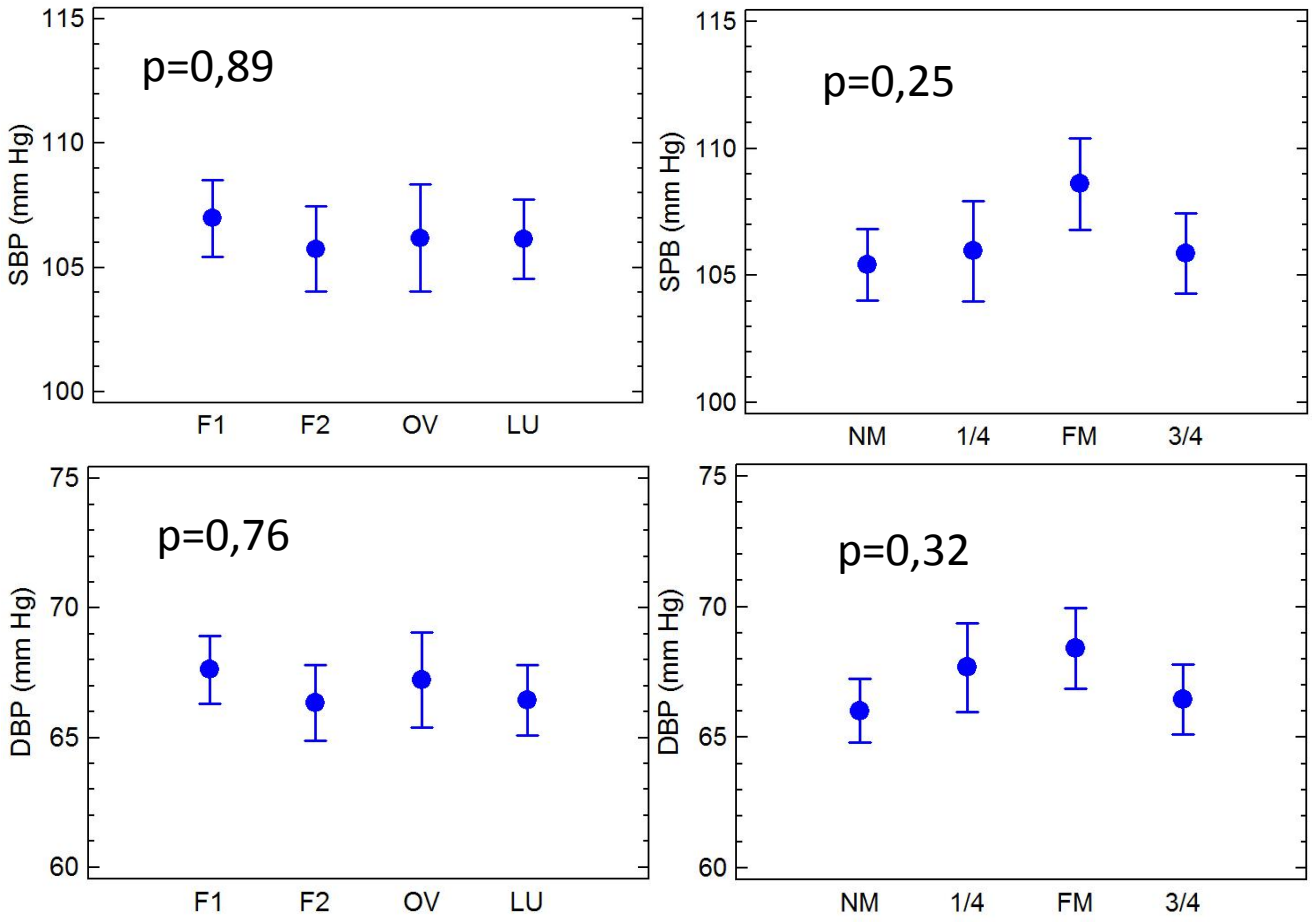
TP, HF, LF, VLF, - total power, high , low and very low frequency power

HF%, LF%, VLF% - per cent of frequency bands

The hypothesis

- The partially longitudinal design would have helped tracing the effect of moon phase on human physiological parameters
- The full moon phase may have exerted the most prominent effect on heart rate variability and blood pressure

Results: Hemodynamics: No effect

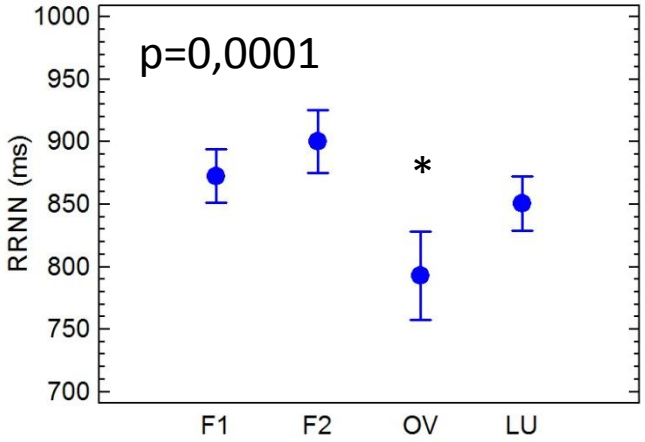


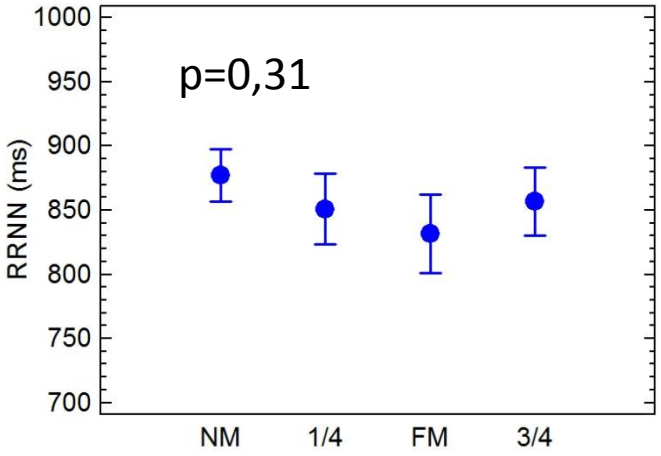
Moon phase
NM: new
¼: waxing
FM: full
¾: waning

Menstrual cycle
F1: early follicular
F2: late follicular
OV: ovulation
LU: luteal

SBP:is for the systolic, **DBP**: the diastolic blood pressure

The time-domain characteristics of HRV: Heart Rate and Period





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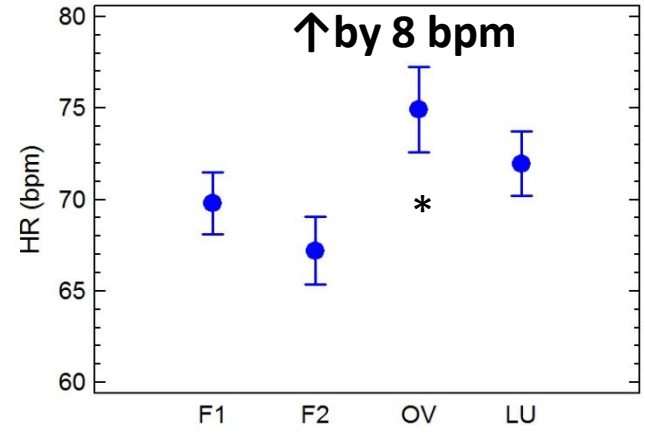
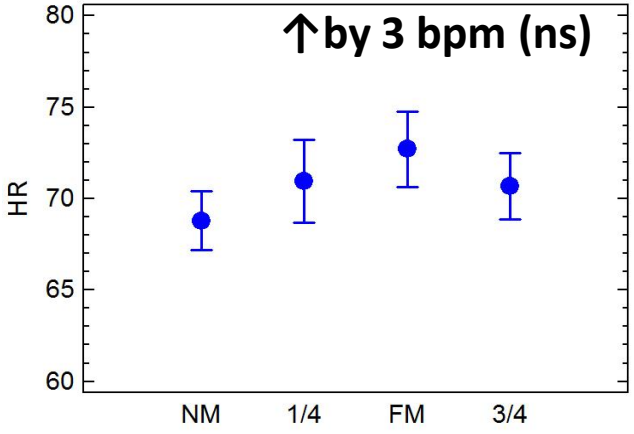
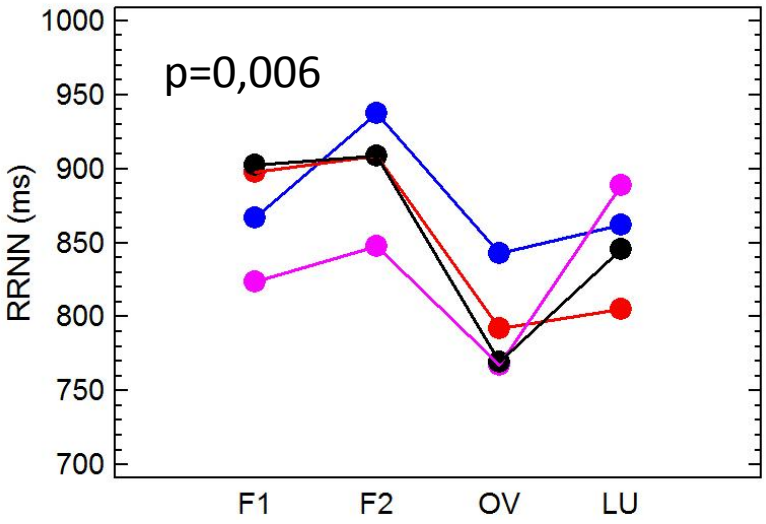




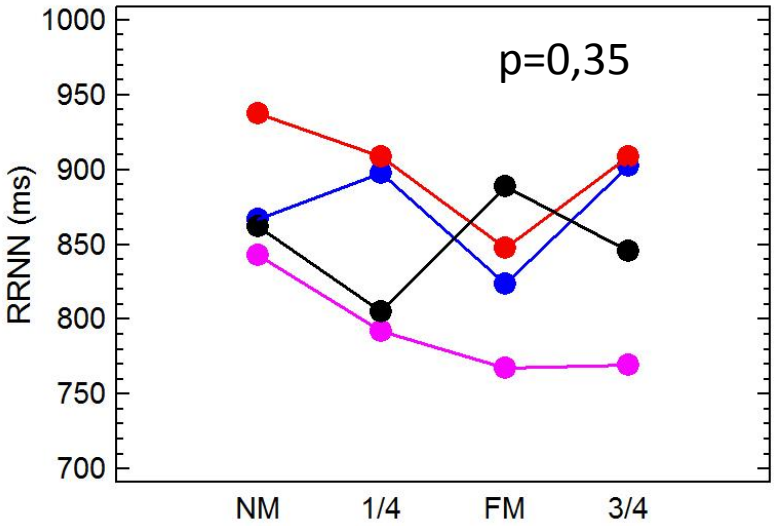
Menstrual cycle
F1: early follicular
F2: late follicular
OV: ovulation
LU: luteal

Interaction of the Lunar and the menstrual cycle



Moon phase:

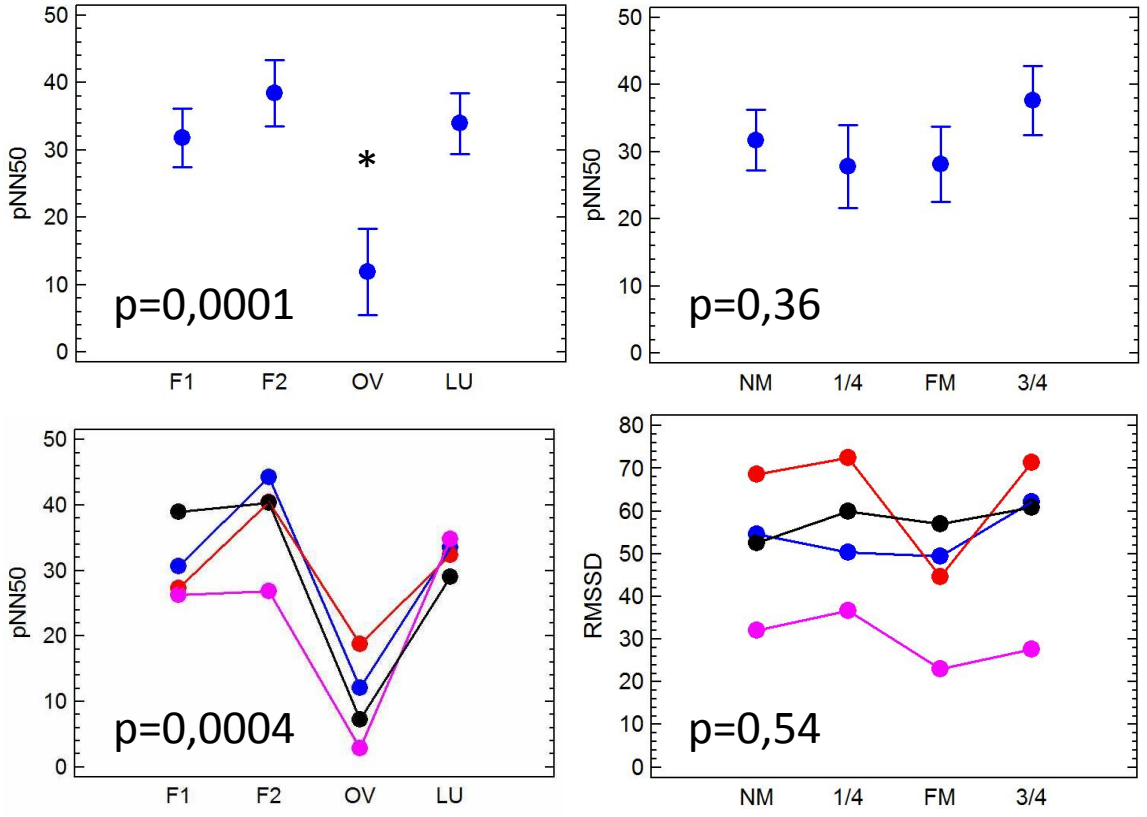
NM ¼ FM ¾



Phase of menstrual cycle:

F1 F2 OV LU

Percent of neighboring RR intervals which differ by more than 50 ms



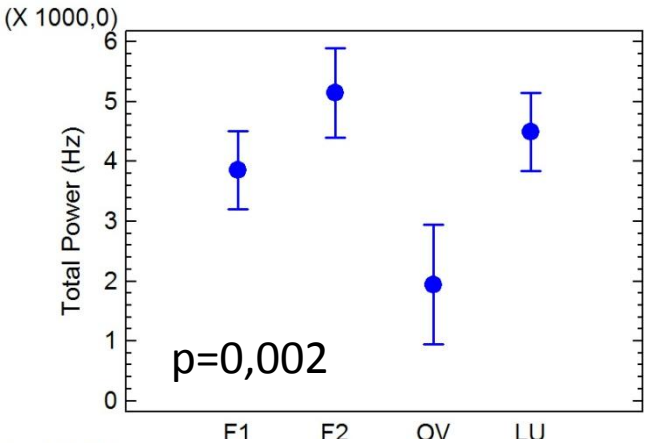
Moon phase:

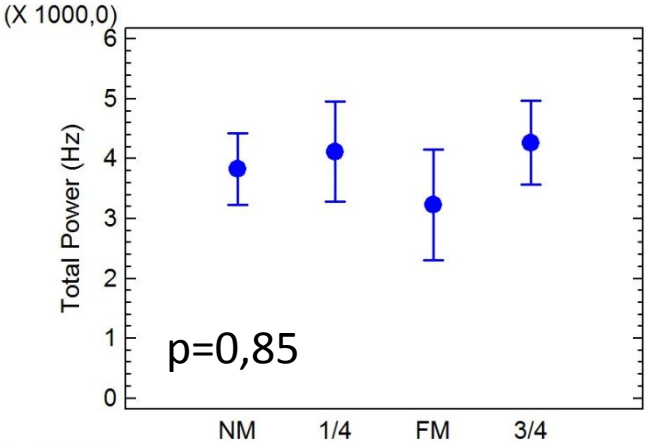
NM ¼ FM ¾

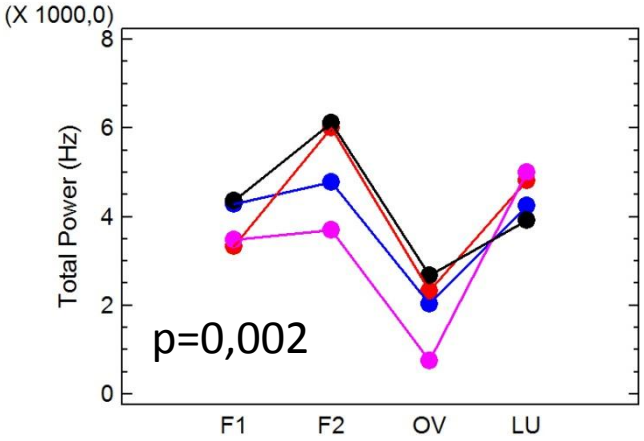
Phase of menstrual cycle:

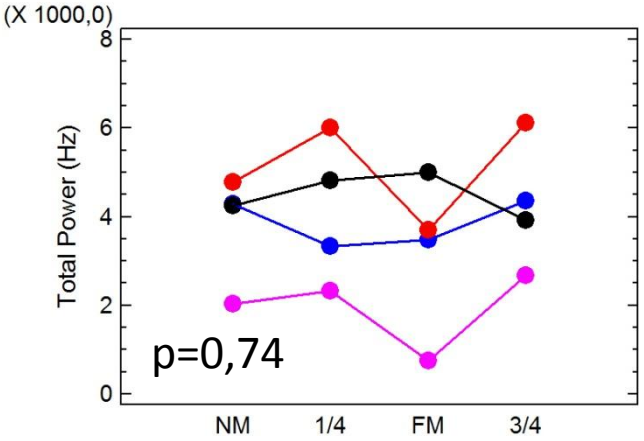
F1 F2 OV LU

Total frequency power









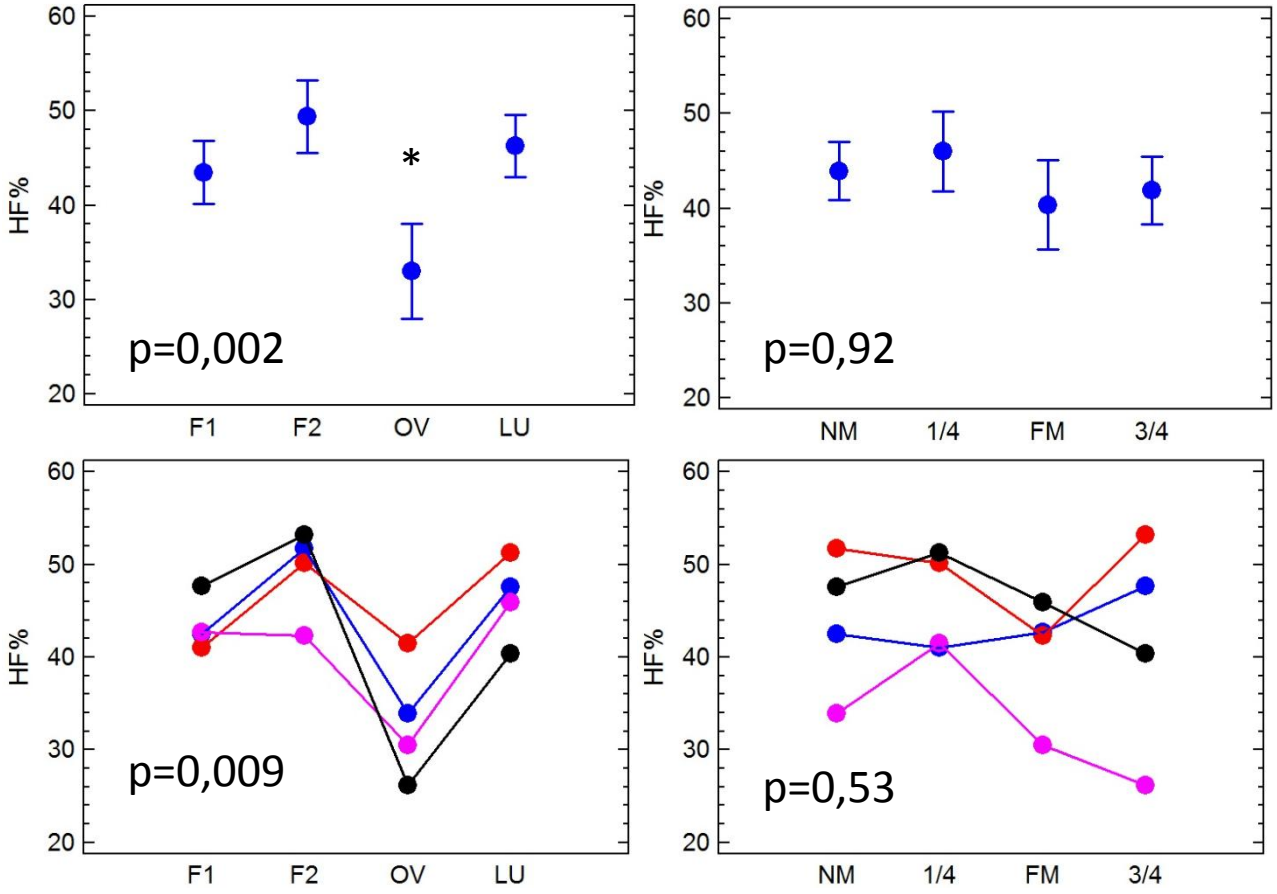
Moon phase:

NM ¼ FM ¾

Phase of menstrual cycle:

F1 F2 OV LU

High frequency power: a measure of the parasympatheic nervous activity



Moon phase:
NM ¼ FM ¾

Phase of menstrual cycle:
F1 F2 OV LU

General conclusion from the experiment:

we failed to demonstrate interference of HRV with moon phase

Why?

- If at all exists, the lunar effect on human autonomic functions most likely is tiny. Contribution of the menstrual cycle to total variance of HRV parameters was 7 to 14%, while that of the lunar cycle was less than 1%.

Still…

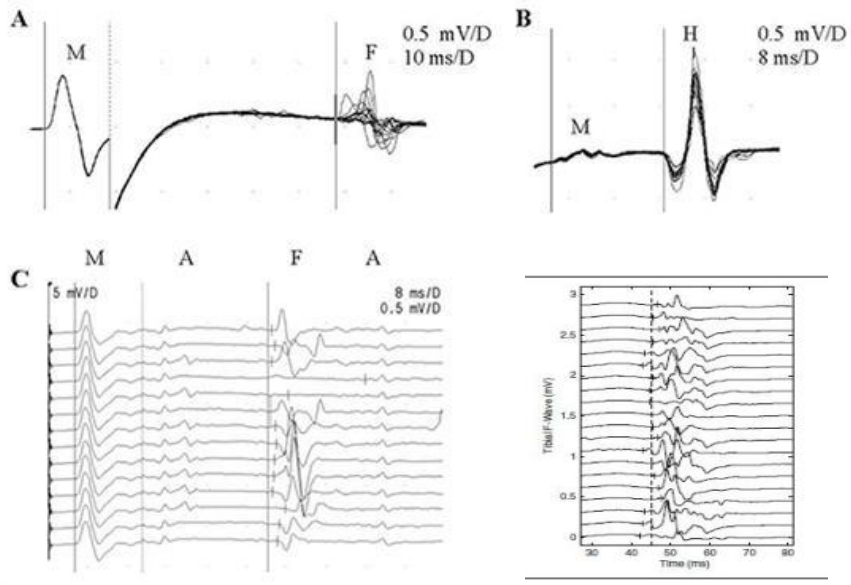
- A clear, though far insignificant, tendency to interaction between the Lunar and menstrual cycle was still notable. In the full moon phase, HRV parameters changed in the same direction as in the ovulation phase.

How to proceed?

- We must adopt an ultimately longitudinal design with day-to-day collection of HRV parameters from few subjects within one year (365 samples instead of 8).
- Males also can/must participate as there is the hypothesis that men may also have been influenced by the Moon. In males the effect of the Moon is not shadowed by the menstrual cycle.

Why longitudinal?

- From neurophysiology it is known that tiny effects/events, which are indistinguishable from noise, can be made visible by multiply repetitions (stimulations) on one nerve or neuron.



Noise stochastic fluctuations of a signal are annihilated and smoothed over repetitions, while a steadily persistent event-related spike is accumulated and becomes visible after 100-200 stimuli

Repetitions of the lunar phases in one and the same subject may have accumulated and become similarly visible (at least 12 repetitions of the Moon cycle)

Why mobile Medicine service?

- Collection of HRV data in a day-to-day mode can be performed only with a personal bio-signal logger, activated at a scheduled time by a subject.
- The mobile application to the CardiaCare project seems to be a reliable solution to extract RR-intervals for further analysis
- We believe that only a mobile medicine approach would have allowed to capture the Lunar cycle effect on humans. And other effects.

Proposed design

- 10-12 subjects (both females and males) could have passed electrocardiography (5 min long samples, each time at the same time – 7 AM, after waking, before meals, at basic metabolism, every day, for one year) with help of CardiaCare

- At least, 12 moon cycles can be accumulated and synchronized by phase to visualize a tiny effect of moon phase on heart functioning

- Besides moon phase, HRV parameters can be again linked to menstrual cycle phases, body temperature, outdoor temperature, solar illumination, magnetic field, seasons and whatsoever (sleep duration, anxiety, blood pressure). Interactions.

Mobile Medicine applications

- Predicting ovulation (and other phases) by HRV (personal awareness) using cell phone
- Reminding about full moon phase (if it really affects)
- Predicting stressful combinations (full moon plus ovulation)

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