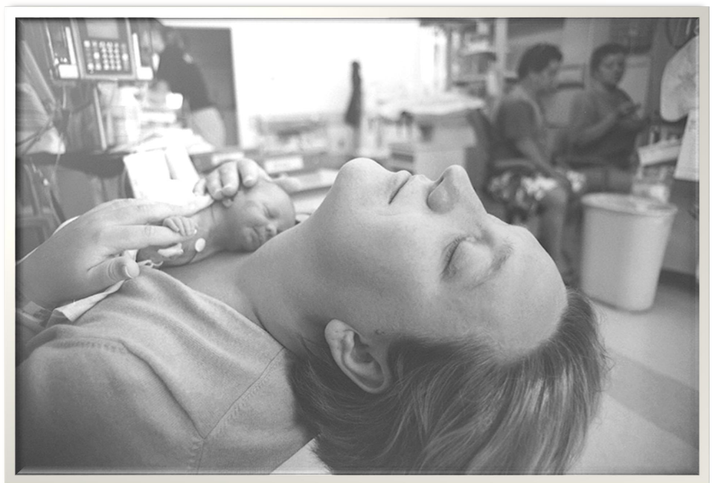
Heart Rate Variability Changes During Kangaroo Care

D. Kommers [1,2], R. Joshi [2,3], C. van Pul [3], L. Atallah [4], L. Feijs [2], G. Oei [5,6], P. Andriessen [1,7], S. Bambang Oetomo [1,2]

(1) Department of Neonatology, Máxima Medical Center; (2) Department of Industrial Design, Eindhoven University of Technology; (3) Department of Clinical Physics, Máxima Medical Center; (4) Patient Care & Measurements Department, Philips Research, Eindhoven, (5) Department of Gynacology, Máxima Medical Center; (6) Department of Electrical Engineering, Eindhoven University of Technology; (7) Faculty of Health, Medicine and Life Science, Maastricht University.

BACKGROUND

- Kangaroo care (KC) is a period of direct skin-to-skin contact where infants are placed prone on a naked parental chest. It is a positive stimulus that improves physiological regulation and is associated with improved long-term outcomes in preterm infants.
- No studies have visualized the dynamic regulatory changes that occur in response to KC.

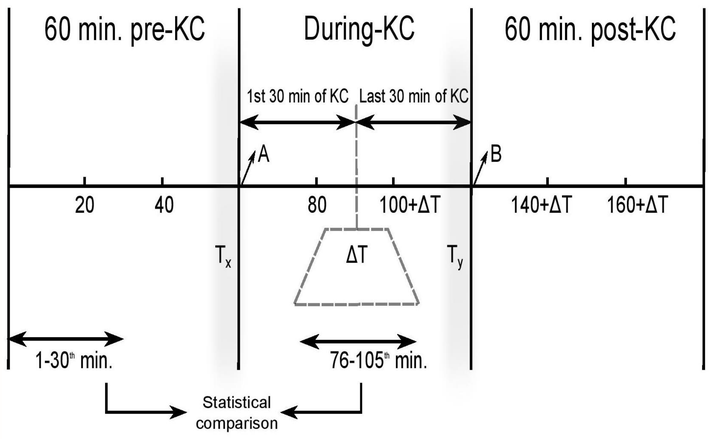


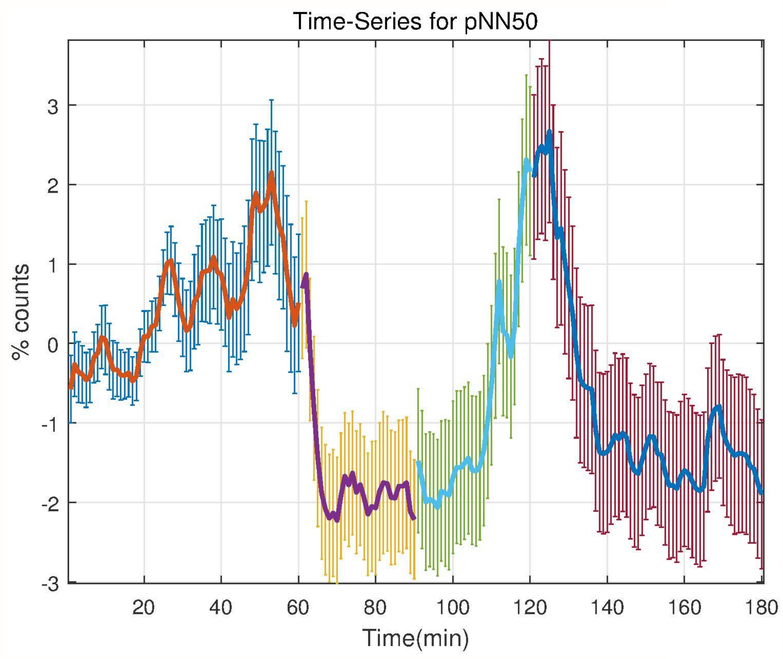
OBJECTIVE

- To determine whether heart rate variability (HRV) can serve as a surrogate measure to track regulatory changes during KC, a period of parental coregulation distinct from regulation within the incubator.

METHODOLOGY

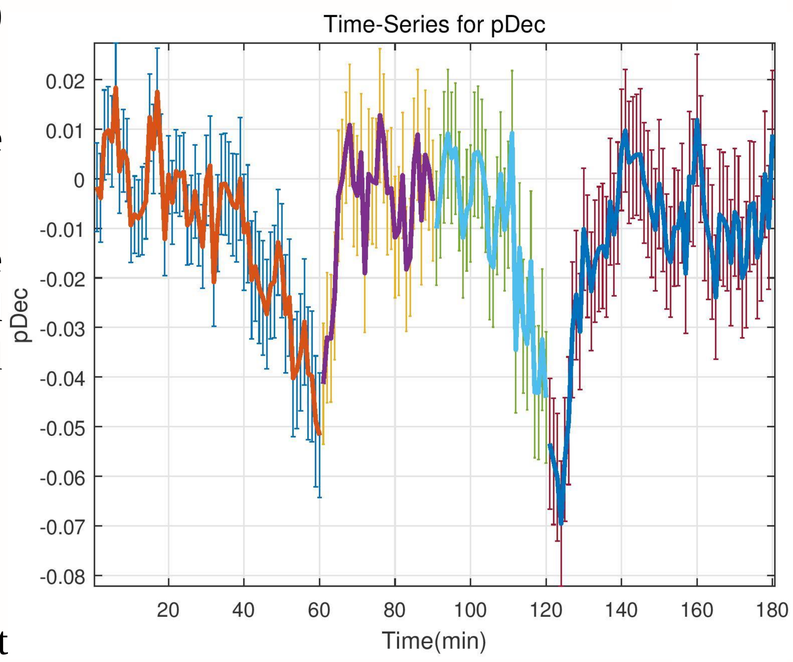
- A total of 191 accurately annotated KC-sessions with a duration of at least one hour were investigated in 11 preterm infants. 8 HRV features were analyzed using the ECG-data of the pre-KC, during KC and post-KC periods.
- Since the duration of KC varied (ΔT), the first 30 and last 30 minutes were visualized (mean ± SEM, calculated every minute using a moving-average window of 5 minutes), in addition to the hour long pre-KC and post-KC periods. Tx and Ty represent the time for transferring the baby from the incubator to parental chest and vice versa.
- Two new features, the percentage deceleration (pDec) and the standard deviation of decelerations (SDDec) were developed to explicitly extract the effect of transient decelerations on HRV.
- Statistical analyses were carried out on the mean value of the HRV-features corresponding to the stable epochs of the pre-KC period (1-30th min) and the during KC periods (76-105th min) using the 2-sided paired Wilcoxon rank-sum test.





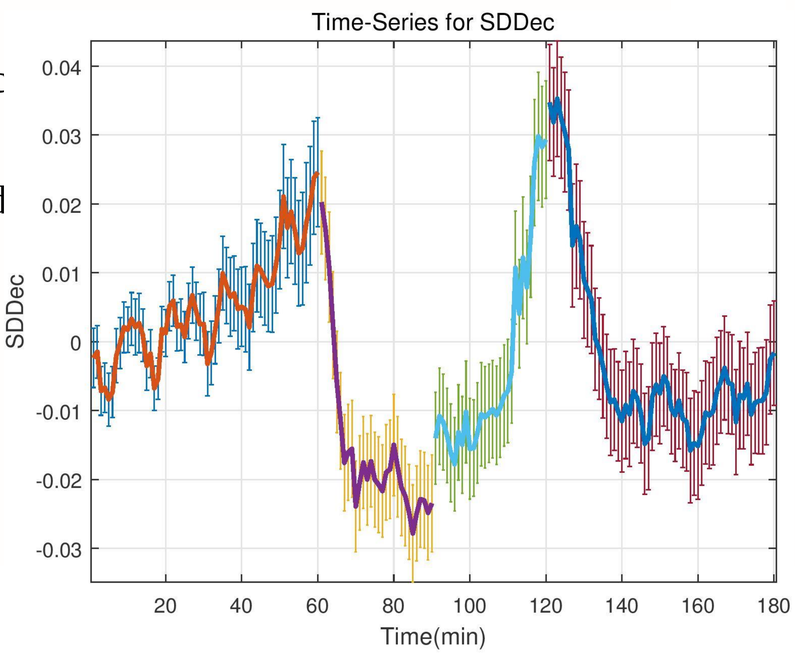
RESULTS

- All HRV features responded prominently to transitions, while classical HRV-features like the pNN50 decreased during KC ($P < 0.01$).
- This surprising decrease in HRV during a period of comfort is becasue of a decrease ($P < 0.01$) in the extent of undesirable transient decelerations (SDDec) while pDec remained at levels similar to pre-KC.
- We speculate that the immediate change in HRV features during KC may be caused by a switch in the neural mechanisms responsible for regulation- i.e., a rapid transition from the dominant unmyelinated PSNS and the SNS to the more stable regulation offered by the myelinated vagus (Porges polyvagal theory) in response to parental coregulation.
- There appears to be a lasting impact of KC on HRV in the post-KC period (see pNN50).



CONCLUSIONS

- In preterm infants, HRV reduces in response to KC. This is due to a decrease in the extent of transient decelerations that commonly occur in neonates and are reflective of physiological instability.
- In preterm infants, HRV may be clinically useful for capturing the dynamic changes in autonomic regulation in response to kangaroo care and other changes in environment and state.
- The visualization of a physiological response as a result of KC allows nurses to promote KC and increase the involvement of family.



perinatal IMPULS

máxima medisch centrum | TU/e Technische Universiteit Eindhoven University of Technology | PHILIPS