Building Intrapartum Research Through Health – an interdisciplinary whole system approach to understanding and contextualising physiological labour and birth (BIRTH) (COST Action IS1405)

Report of the Short Term Scientific Mission (STSM)

“Methods of physiological measurement and comparative description of women’s wellbeing in different settings of maternity care”

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University of Crete - Faculty of Medicine, Greece

Date of STSM: Sunday 6th - Sunday 13th of March 2016

Host Site: Lucerne University of Applied Sciences and Arts, Switzerland

Host Person in Charge: Dr Claudia Meier Magistretti
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Introduction – Statement of problem

Thermography (infrared thermal imaging) is a non-invasive method with the ability of real-time monitoring and imaging, which has been used in medicine since the early 1960’s. It uses no radiation and no contact, is free from any limitations or contra-indications, easy to use and objective. Already, the method has been introduced in the clinical research area for diagnosis and prevention of various diseases [1-6].

Psychology has long been considered by many to be a social science – much of the theory and diagnosis of conditions has been based on a consultation process of working with a therapist through a series of questions, exercises and techniques. When we consider, for example, social anxiety – a fear of social situations and an avoidance of normal social interactions – a therapist traditionally talks through the issues with the patient and relies purely on the descriptions of the patient’s feelings and emotions connected to these events. When working through a treatment program the therapist would need to rely on the patient reporting improvements in their approach to triggers based on their changing emotional response to the situations that caused them anxiety. The physiological response is a change in the equilibrium in the body which can be felt as an increase in heart rate, blood pressure, breathing rate and changes in GI tract motility. This state of arousal does not quickly fade; in fact it can take between 20 to 60 minutes for the body to return to its pre-arousal levels. Where there is an ongoing stressor and stress has become chronic, the body can remain in this level of arousal for significant periods of time [7-10].

Also, researchers that want to study neurovascular elements of human social interaction are often confronted with the limitations of commonly used methods in neuroscience. They often involve the application of electrodes or other contact measurement instruments on the skin of the test subjects, which interferes with spontaneous behavior. Non-contact methods, such as functional magnetic resonance imaging, involve subjecting test subjects to active radiation and require the test subjects to remain still for extended periods of time [9-10]. One solution to this problem is the use of thermal imaging technology. It is passive, so thermal imaging cameras record infrared radiation emitted by the subject without submitting them to radiation of any kind. Moreover, this technology allows the researcher to gather information in real time, allowing the test subjects to move naturally. Thermal imaging records the thermal radiation that is emitted spontaneously by the human body. The body and mental responses are therefore purely ecologic [11].

Some recent studies have now demonstrated that the applications of thermal imaging could be even further reaching with effective use in the field of psychophysiology [12]. In a fascinating new study [13], the potential for using thermal infrared imaging to determine
psychophysiological states has been identified and discussed. It has long been determined that certain physiological activity within the body will emit natural thermal signatures – changes in the nervous system due to this described activity of the “fight or flight response” and cutaneous temperature can vary significantly dependent upon the level and type of arousal. These distinct thermal patterns can be seen clearly using thermal infrared imaging camera in a non-invasive procedure. For example certain areas of the body show temperature variations during different emotions (Figure 1).

<table>
<thead>
<tr>
<th>Regions</th>
<th>Stress</th>
<th>Fear</th>
<th>Startle</th>
<th>Sexual arousal</th>
<th>Anxiety</th>
<th>Joy</th>
<th>Pain</th>
<th>Guilt</th>
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<td>Nose</td>
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<td>Cheek</td>
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<td>Supraorbital</td>
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<td>Forehead</td>
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<td>Maxillary</td>
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<td>Neck-earloid</td>
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<td>Tail</td>
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<tr>
<td>Fingern/palm</td>
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<tr>
<td>Lips/mouth</td>
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**Figure 1.** Overview of the direction of temperature variation in the considered regions of interest across emotions [13].

Furthermore, another study which explored the temperature variations of the nasal tip and maxillary area averaged for a group of children and for a group of mothers, found a strong correlation in thermal variations between children and their mothers which were shown during the emotional phases of the experiment. During experiment, children were invited by the experimenter to play with a toy. The toy was designed to break during play, giving the impression that the child had accidentally broken it. Mothers were invited to observe their children in interaction with the experimenter through a one-way mirror from a separated room. Results showed that during the experiment the emotional distress caused by the 'breaking' of the toy lead to thermal variations in the specified facial region of interest (RI) of the child. The facial thermal modulations observed in the mothers were surprisingly similar to those observed in the child. Second, facial thermal modulations of the mothers clearly correlated with corresponding modulations of their children. Thus, mother-child dyads showed a significant and situation-specific synchronicity between the autonomic reactions individually exhibited by each partner [11].

In addition, most scientists describe thermography as an emerging method for making measurements and assessments in cases of anxiety and stress [14]. Regarding the accuracy of the thermal imaging method Yoshitom et al [15] made a study with the goal to present thermal imaging computer vision enabling detection of human feeling. For this aim thermal image processing and Neural Network were used for recognizing facial expressions. The results of this study showed that neural, happy, surprise and sad expressions were recognized with 90% accuracy.
It is demonstrated that a variety of affective states, such as aggression [16] and emotional arousal [17-20], have been shown to elicit thermal responses in the face suggesting that skin temperature may be indicative of affective/emotional states. For example, fear has been shown to cause a rapid (300 ms post-stimulus) increase in temperature in the periorbital region, with simultaneous cheek temperature decreases [21,22]. Stress in infants, caused by maternal separation, results in decreased forehead temperature [23,24]; while stress in adults (e.g. lying, performing difficult mental tasks) causes increases in skin temperature in the forehead [25] and periorbital regions [26], and temperature decreases in the jaw area [27]. Merla & Romani [27] tested facial thermal responses to stress, pain and sexual arousal/excitement in a male cohort. Pain and stress caused a decrease in facial temperature (particularly in the perioral region) while sexual arousal caused a temperature increase owing to increased facial blood perfusion rates, particularly in the forehead, mouth and lip regions. Thermographic measures in all conditions were correlated with other physiological measures of arousal (galvanic skin response, penile turgidity). These results suggest that specific thermal signatures may exist in relation to specific types of emotional arousal. One more aimed to explore whether temperature changes occur during interpersonal social contact in the absence of any direct emotional manipulation and found that skin temperature changes are a sensitive index of arousal during interpersonal interactions [28].

Finally, a literature review regarding the theoretical perspectives provided by sociological and nursing research relating to the management of emotion at work and critical consideration of their application to an analysis of midwifery work, concludes that “It is essential that midwives develop their understanding of emotion at work in order to improve their own working lives, and to meet the needs of childbearing women and their families. More research is needed in this field to develop a body of knowledge to inform midwifery education and practice” [29].

Objectives - Aim of the study

Salutogenic care with women in pre- peri and post-natal care has been recently described in an international qualitative study [30] showing specific characteristics of pre-peri and postnatal salutogenic maternity care. Knowing what salutogenic maternity care may consist of we still lack knowledge about the effect of salutogenic practice on pregnant women and on midwives themselves. Known methods of measurement direct effects are of limited value for their equation of concern: retrospective interviewing would provide some, but not the needed solid evidence of how salutogenic care affects pregnant women, since they could be biased by a range of interpretations. Psychometric measurements may provide valid information about processes and short term effects of salutogenic care. The use of this method was tested in this STSM study with parallel image capture with the use of a thermal camera. Results were compared to participants’ narratives in order to validate subjective and technical evidence. At the same time, efforts were made for the recording of specific thermal signatures. More specifically two fields were investigated:
a) How midwives’ consulting session affects their psychology and body responses and
b) For the first time the quantify definition of salutogenic practice was attempted.

Materials and Methods

Participants: The method and its correlation with existing techniques were tested in midwives. In total four participants (n=4) were evaluated and classified based on their salutogenic orientation.

All participants were provided with a participant’s information sheet, informing in detail about the purpose and the protocol of the study two weeks before the evaluations. Suitable participants were required to provide written consent.

All participants were healthy woman aged 18-65 who worked in the birth house “Geburtshaus luna” in Biel, Switzerland. Exclusion criteria and participants’ protocol are presented in Table 1.

<table>
<thead>
<tr>
<th>Exclusion Criteria</th>
<th>Participants’ protocol</th>
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<tbody>
<tr>
<td>Any medication affecting the cardiovascular system</td>
<td>No ointments or cosmetics on the RI on the day of exam</td>
</tr>
<tr>
<td>Pain medication at the day of exam</td>
<td>No alcohol intake or smoking 24 hours before the exam</td>
</tr>
<tr>
<td>Solarium or sunbathing 5 days before exam</td>
<td>Not allowed tight fitting clothing and shaving of the RI 4 hours prior the exam</td>
</tr>
<tr>
<td>Any pathology or inflammations in the region of interest (RI)</td>
<td>No physical therapy and exercise 24 hours before exam</td>
</tr>
<tr>
<td>Medical implants in the body in the RI</td>
<td>No hot or cold packs application 24 hours before the exam</td>
</tr>
<tr>
<td>Women during menstruation</td>
<td>Bathing or shower no closer than 1 hour before exam</td>
</tr>
</tbody>
</table>

Table 1. Exclusion criteria and participants’ protocol

Technique and measurement procedure: All measurements were conducted in the same environment at a constant temperature of 20°C (±1°C) and 50% (±2%) of humidity [30,31]. Only the researcher, the participant midwife and the pregnant woman were in the room of the measurements, ensuring a consistent number of people in the room, to avoid the influence of human body at room temperature. Pregnant women were also informed in detailed about the procedure and their agreement was required. The room of measurement has only the necessary furniture and equipments.
On the arrival, midwives were instructed to remove all their jewelry and any other material only from the area of measurement (face/neck/hands). Hair should have to be tied up or behind the ears, without covering the RI. Then they were stood for 15 minutes with the RI exposed to achieve skin temperature equilibration with the temperature of the room \[32,33\]. After acclimatization and before the beginning of consultation the first set of images were taken (0 minutes). The next measurement was at 10 minutes, then at 20 minutes and then at 30 minutes (end of consultation). In total four measurements for each midwife was performing. Time was counted with a digital timer. Timing began after the first measurements.

The image processing equipment and other devices were located away from the participants’ area, to avoid heat disturbance \[34\]. For the measurement procedure one thermal imaging camera (FLIR C2) and its corresponding software were used. The distance between the camera and the midwife in every measurement were 1 m (±0,1m). The lens of the camera was parallel to the area of measurement. Human skin emissivity was set at 0.98 \[34\].

In addition, the consultation was recorded with a digital voice recorder (Olympus VN-741PC). A psychologist specialized in salutogenesis heard all the recordings to assess the salutogenic orientation of all the midwives. After each consultation the same psychologist was assessing the emotional status of each human based on her personal perspective using narrative as well as standardized methods of assessment.

The types of measurements: Participants were standing upright in anatomical position. In this position three images were recorded: Face and neck frontal view (FNF) and Palmar (HP) and Dorsal (HD) aspects of both hands (with fingers not in contact) (Figure 2). After the face image participants were slightly raise the arms out in front of the body and other two images were recorded.

![Figure 2. Head and neck frontal view. Dorsal and palmar aspects of hands.](image)

All data were saved with a serial number, and no personal identifiers were used. Personal data of participants (such as emails, age etc.) and the consent forms were
stored in different files from those which were include the data of the measurements. Only the research team has access to these files. No other obvious identifiers were saved or recorded. All data were stored in an encrypted laptop.

References


Day 1: March 6\textsuperscript{th}

Arrival at Zurich airport at 18:15. Arrival at Luzern at 21:00

Day 2: March 7\textsuperscript{th}

The first day began with a meeting with Dr Claudia Meier Magistretti, during which the following issues were discussed and resolved (8:00 am):

- What thermal imaging is and what features this method provide to us. How exactly it will be used in our pilot study.
- Design of the program and general obligations during the stay.
- Resolve outstanding issues.

Then (9:00 am), together with Dr Claudia Meier Magistretti, we had a meeting with the Director and the Scientific team of the Department of Social Pedagogy and Education, during which:

- Anastasia Topalidou made a short presentation about the cross-disciplinary collaboration and the aims of the current STSM.
- Dr Claudia Meier Magistretti organized some further meetings with participants who were interested in our project and in thermal imaging in general.

Finally (10:00 am – 13:00 pm), Anastasia Topalidou and Claudia Meier Magistretti had a meeting to finalize all the details. More specifically:

- The whole methodology was analyzed step by step and necessary corrections and additions were made.
- All the variables were categorized. We made a flow diagram with them based on the pregnancy and consultation conditions.
- Then we made a checklist for the procedure for every participant. In this checklist we included the Andonovski’s salutogenic triangle and Claudia’s salutogenic triangle for midwifery.
- We checked the possible need to make two sub-studies in place of one big, for statistical and analysis reasons.
- Finally we confirmed all our appointments via emails or phone.
- Claudia Meier Magistretti translated the questionnaire, the interview protocol and all the documents in German. The consent form, the information sheet for participants, the exclusion criteria and the participants’ protocol were translated by Claudia Meier Magistretti and sent to all the participants one month before the conduction of this study.
Day 3: March 8th

At 6:30 am departure from Luzern. At 8:08 am arrival in Biel where is the Birth House from which midwives were enrolled in our study.

8:30-9:30 am: Interview and measurements with the first midwife.

10:00 am–13:00 pm: Evaluation of the interview with the midwife and qualitative assessment. Evaluation of salutogenic approach by Claudia Meier Magistretti.

13:00-14:00 pm: Lunch Break and travel to Bern

14:00-17:00 pm: University of Bern: Processing of the first images (isotherm analysis and temperature signatures). Exportation of the first data from the images. Creation of the cumulative charts. Correlation of all the data with the depended variables. Evaluation of midwives’ salutogenic level. Planning the next day. At the end of this session we dealt with the methodology procedure and conducted the draft of methodology for our paper and the report.

17:00-18:00 pm: Travel to Nottwil. We visited the Europe's leading centre for paraplegia, spinal cord injuries and diseases – the Swiss Paraplegic Center (SPC).

18:00-21:00: We had a discussion and searched the possibilities of a potential cooperation with Susanne Bertschy, who is researcher at SPC and new member of the current COST Action. The main field was the pregnancy and the labor procedure of paraplegic women. Possible collaboration in the future.

21:00 pm: From Nottwil we took the train back to Luzern.

Day 4: March 9th

At 8:54 am departure from Luzern. At 10:10 am arrival in Biel where is the Birth House from which midwives were enrolled in our study.

10:30-11:30 am: Interview and measurements with the second midwife.

11:30 am–13:00 pm: Evaluation of the interview with the midwife and qualitative assessment. Evaluation of salutogenic approach by Claudia Meier Magistretti.

13:00-14:00 pm: Lunch Break and travel to Luzern

14:00-17:00 pm: University of Luzern: Processing of the second images (isotherm analysis and temperature signatures). Exportation of the data from the images. Creation of the evolutionary graphs. Correlation of all the data with the depended variables. Evaluation of midwives’ salutogenic level. Planning the next day. At the end of this session we dealt with the papers we will write as a result of the present STSM and started to look for funding to support our collaborations.
17:00-18:00 pm: Meeting with Prof. Dr Franziska Meinecke Head of the Bachelor’s Program in Medical Engineering and Lecturer of Medical Engineering if Luzern University of Applied Arts and Sciences. We discussed a number of issues regarding the contribution of engineering in several fields. We also started the implementation of a common interdisciplinary project between the Department of Medical Engineering and the Department of Social Pedagogy and Education. We also found a fund for which we are planning to apply. For this reason we scheduled a Skype meeting in 23rd of March.

Claudia Meier Magistretti informed her director and found the all the details we need for the application.

18:00-21:00: Train to Emmenbrucke to meet a pregnant woman at the last stage of gestation who accepted to help us to have some thermal images of the abdomen from different angles. This action is linked to two projects of WG2.

21:00 pm: Bus back to Luzern.

22:00 pm: Dinner with Claudia Meier Magistretti to make the summary of the day and to prepare our schedule and obligations for the next day.

Day 5: March 10th

At 8:00 am departure from Luzern. At 09:38 am arrival in Biel where is the Birth House from which midwifes were enrolled in our study.

10:30-11:30 am: Interview and measurements with the third midwife.

11:30 am–13:00 pm: Evaluation of the interview with the midwife and qualitative assessment. Evaluation of salutogenic approach by Claudia Meier Magistretti.

13:00-14:00 pm: Interview and measurements with the forth midwife.

14:00 pm–15:00 pm: Evaluation of the interview with the midwife and qualitative assessment. Evaluation of salutogenic approach by Claudia Meier Magistretti.

15:00-15:30 pm: Train to Olten,

14:00-17:00 pm: Olten: Processing of the images (isotherm analysis and temperature signatures). Exportation of the data from the images. Creation of the evolutionary graphs. Correlation of all the data with the depended variables. Evaluation of midwifes’ salutogenic level. Planning the next day.
Day 6: March 11th

9:00 am - 13:00am: Classification of all quality data (pictures, values, charts). Correlation of results a) one by one and b) by category. Creating integrated combinatorial graphs. Then I made the first categorized data analysis exported and studied the data and images.

13:00 – 14:00 pm: Lunch break.

14:00 – 17:00: Writing the STSM report.

17:00 – 19:00: Creating all necessary excel files and data bases.

Day 7: March 12th

8:00 – 11:00 am: Finishing the STSM report.

11:00 am – 13:00 pm: Searching for the literature we need to write our papers (as results from this STSM).

13:00 – 14:00 pm: Lunch break.

14:00 – 18:00 pm: Continuation of searching for all the available literature we need. Making files and data sheet with all the categorized of the found articles.

18:00 – 20:00 pm: Conduction a schedule with all the obligations and collaborations that arises from this STSM. Making the timeline for the next month regarding the next meetings and fund proposals.

Day 8: March 13th

Flight to Norway (Bergen) for the COST meeting.
This program gave us the opportunity to explore a new way of imaging, which is non-invasive, with a view to apply it in the future in several fields (psychology, sociology etc). Thermal imaging is a method which moved from industrial use to medical practice. The ability this method gives, for imaging without radiation, makes it ideal for many applications. However, the direct application of the method primarily remains in a research level. Particularly, in midwifes it is the first attempt that made.

From the findings and the results of this STSM research two articles will be conducted:

a) How midwives’ consulting session affects their emotions and body response and
b) Salutogenic versus not salutogenic thermal signatures: First quantitative approach

We aim to submit both articles for publication the latest up to July.

Also, we are planning to submit some results from this STSM to the upcoming in Trondheim, Norway (September 2016), “Health Promotion Research - An International Forum”, as an oral presentation.

Further Collaboration:

- With Prof. Dr Franziska Meinecke Head of the Bachelor’s Program in Medical Engineering and Lecturer of Medical Engineering if Luzern University of Applied Arts and Sciences: We are planning to submit the next month for a funding of 20.000 for interdisciplinary collaboration between the departments of Lucerne University. Claudia Meier Magistretti will be the PI of the study. The proposal will be based on the finding of this STSM.
- Possible collaboration with Susanne Bertschy for Swiss Paraplegic Center in order to receive a small fund to work with thermal imaging in paraplegic women.
- Possible small fund with Claudia Meier Magistretti, if the first one will be accepted, to work further and with more participants in the field of salutogenic thermal signatures.
- Possible cooperation with Prof. Catherine Walter-Laager form University of Graz Austria, in the field of thermal imaging in infants.
- Pursuing research at all stages until the final investigation in midwives based on all the variables.
Conclusion

In conclusion, the STSM program gives the opportunity to early stage researchers to work at Universities in other countries, learn from their expertise and from leading academics and researchers. Personally for me it was a unique opportunity to attend a top University in Europe and to work with academics and other researchers. The way a University of another country and the people who compose it works and the exchange of knowledge is a great asset for any early stage researcher. In simple words the experience, the knowledge and what a STSM program offers cannot be described.
I hereby confirm that the activities and outputs described above took place. Anastasia was a very dedicated, innovative and creative addition to our team while she was at Luzern University of Applied Sciences and Arts. She was interested in all the opportunities available to her, fully engaged, and a very active contributor to debate, to present and to working out the issues and problems in the work she undertook. It was a pleasure to have her with us for the week, and we look forward to working with her in the future.

Dr Claudia Meier Magistretti
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A thermal and an optic image: (from the left) Anastasia Topalidou, the director of the Birth House and Claudia Meier Magistretti

Thermal images of a midwife with salutogenic orientation