International Committee of Occupational Health
Scientific Committee on Thermal Factors (SCTF)

5th Meeting Report

Time: Thursday, 16 December 2021, 1100H – 1230H GMT +8

Venue: Virtual Meeting on Zoom

Participants: Annex I

1. **Welcome and Introduction**

1.1 Jason Lee welcomed the attendees and provided updates to the committee:

1.1.1. Jason Lee emphasised on the importance of protecting vulnerable groups from heat stress and shared about his recent visit to FITI Testing & Research Institute in South Korea. FITI Testing & Research Institute was founded in 1965.

1.2 The meeting agenda was as follows:

1.2.1 Presentation by Hidenori Otani on "*Effects of Solar Radiation on Thermoregulation and Work Performance in the Heat"*.

1.2.2 Presentation by Marc Schenker on "*Heat Stress Risk Among California Agricultural Workers*".

1.2.3 Presentation by Bruno Lemke on "*Quantifying Heat Strain in Workers".*

2. **Hidenori Otani: "*Effects of Solar Radiation on Thermoregulation and Work Performance in the Heat".***

2.1 Link to paper 1 (Otani et al., 2016) and paper 2 (Otani et al., 2018)

2.2 Link to presenter's deck

2.3 Hidenori Otani shared two studies showing that increase in solar radiation decreases endurance exercise capacity in an indoor and outdoor setting.

2.4 Hidenori concluded that solar radiation can reduce work performance and affect several physiological parameters such as increased skin temperature, narrower core-to-skin temperature gradient, and increased perceived fatigue and thermal stress.

2.5 Discussions:

2.5.1 Bruno Lemke asked if there is any reason why a wind speed of 0.3 m/s was chosen rather than the actual wind speed at the different power levels?

2.5.1.1 Hidenori Otani replied that the wind speed of <0.3 m/s was selected in the first study, they only wanted to investigate the effects of solar radiation. Hidenori agreed that wind speed can affect skin temperature as due to its cooling effect. Hide continued by referencing another paper published in 2021, which investigated the combined effects of solar radiation and air velocity on thermoregulation.

2.5.1.2 Jason Lee agreed with Bruno and added that he presumed the findings from Hide's presented studies were not targeted at cyclists but rather a physiological study investigating the effects of solar radiation.

2.5.2 Tord Kjellstorm thanked Hidenori for the presentation and mentioned that heart rate can be used to as an indicator of heat stress impacts.

2.5.2.1 Jason Lee asked Hidenori if there were any differences in the heart rate responses and body core temperature with the various levels of solar radiation in his presented study.

2.5.2.2 Hidenori replied that there were no differences in heart rate responses and body core temperature between conditions and added that solar radiation has little effect on heart rate.

2.5.2.3 Jason introduced the idea that new parameters, for example blood pressure, can be investigated in future as current parameters, body core temperature and heart rate may be an outcome measure rather than the cause of exercise termination. Jason further asked if the trials in the

second study were conducted on the same day as solar radiation outdoors cannot be controlled.

2.5.2.4 Hidenori replied that the weather conditions near his university are very stable and all trials were conducted at the same time of the day between July to September.

2.5.3 Jason Glaser commented about the possibility of transferring or adapting the lab study design to a field setting.

2.5.4 Jason Lee commented that participants in the study were wearing sunglasses and asked if Hidenori was aware of any studies investigating the impact of wearing sunglasses on perceived comfort.

2.5.4.1 Hidenori was not aware of any studies.

3. Marc Schenker: *"Heat Stress Risk Among California Agricultural Workers"*

3.1 Link to presenter's deck

3.2 Marc Schenker shared about the California Heat Illness Prevention Study (CHIPS) which aimed to create improved heat illness prevention strategies for agricultural worker by quantifying heat strain risk and examining social-cultural perspective of heat-related illnesses.

3.3 Marc concluded that about 7% of California agricultural workers are still at risk of heat-related illness and knowledge related to heat-related illnesses often do not translate into actions.

3.4 Discussion:

3.4.1 Hsiao-Yu Yang commented that his team conducted a similar study on healthy workers and found no correlation between increase in body core

temperature and risk of acute kidney injury. He asked if Marc was aware of the mechanisms of heat stress-induced kidney injury.

3.4.1.1 Marc replied that the investigating kidney function was a supplementary part of his study and suggested that a study focusing on contributing factors of kidney injury could be done. Marc added that kidney function needs to be looked into further, especially chronic kidney injury.

3.4.2 Elspeth Oppermann asked if female participants in Marc's study were performing the same roles as male participants, how Marc would explain the difference in their behaviour if they were in the same role, and how understanding the female participants' behaviour can benefit male participants.

3.4.2.1 Marc replied that female participants worked at a lower workload than male participants despite performing the same role. Marc suggested that female participants might self-regulate their workload.

3.4.2.2 Elspeth added that it would be interesting to see if females have different discourses on managing workload than males.

3.4.2.3 Marc agreed with Elspeth.

3.4.3 Tord Kjellstrom asked if Marc measured work output or productivity directly.

3.4.3.1 Marc replied that due to different roles observed, it was difficult to measure productivity.

3.4.3.2 Tord replied that it would be possible to measure output per hour for those in a harvesting role.

3.4.3.3 Marc replied that measuring output per hour would be possible if the study looked at harvesters only. He added that productivity can be associated

with workload when workers are paid per piece, which can be a risk factor as workers will work harder and faster to produce more.

3.4.4 Matt Brearley commented that expressing workload as a percentage of maximal strength or endurance could normalise the data. Matt emphasised that understanding heat production due to work and environmental conditions at work are key causes of heat stress. Matt reminded that these two causes of heat stress should be focused on, while dehydration is merely an outcome of heat stress.

3.4.4.1 Marc agreed with Matt and reiterated that field studies can be limited but are practical.

3.4.4.2 Jason Lee reinforced Matt's comments that associations are not causation. Jason Lee also agreed with Marc that field studies can give real conditions but cannot answer many mechanistic questions.

3.4.5 Jason Glaser commented that dehydration is not related with kidney damage both short- and long-term. Jason Glaser also mentioned that the positive association between diabetics and risk of acute kidney illness was an interesting finding and it is worth exploring such populations with metabolic disorders as the temperature continues to rise.

4. Break

4.1 Jason Lee requested for non-members to introduce themselves.

5. Bruno Lemke: "*Quantifying Heat Strain in Workers".*

5.1 Link to presenter's deck

5.2 Bruno Lemke used actual and extrapolated data to quantify heat strain using work time lost and population affected.

5.3 Bruno compared actual and extrapolated data against National Institute of Occupational Safety and Health's recommended heat stress exposure limits.

5.4 Discussions:

5.4.1 Marc Schenker commented that heat acclimatisation has not be mentioned much during this meeting. Marc added that heat acclimisation is a major risk factor for fatalities in epidemiological data, which can cause shifts in the graphs presented by Bruno.

5.4.1.1 Bruno agreed with Marc, and explained that he tried to simplify the presentation by including only fully heat acclimatised people working at 300W in the shade and wearing standard work clothes. Bruno further elaborated that the graphs can be shifted for non-heat acclimatised individuals by using recommended heat stress alert limits.

5.4.1.2 Jason Lee added that he was pleased to see the inclusion of different graphs for different profiles of workers.

5.4.1.3 Bruno replied that he hopes that accounting for heat acclimatisation could help better understand the health effects of heat strain.

5.4.1.4 Jason finalised by emphasising the importance of looking at heat discomfort as they may indirectly lead to other problems such as poor decision making and unwillingness to work.

5.4.2 Hsiao-Yu Yang mentioned that it is difficult to measure WBGT in field studies if many workers are involved. Hsiao-Yu mentioned that Heat Index, which uses temperature and humidity as its parameters, has been critisied. He asked for comments on using Heat Index in epidemiological studies.

5.4.2.1 Bruno agreed that Heat Index has been criticised for its limitations as it does not include wind speed and solar radiation as a component. He shared that he measures WBGT by using two small temperature loggers, one with a globe attachment which incorporates wind speed and solar radiation, and the other just measuring temperature and humidity. He added that these modified temperature logger are also not costly.

5.4.3 Jason Glaser commented that the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) has a new rulemaking process to consider a heat-specific workplace standard for heat injury and illness prevention, and he felt that Bruno's work could be useful for them.

5.4.3.1 Marc Schenker reminded about the difference between experimental data collection and field conditions. Marc questioned the feasibility of using two temperature loggers for most monitoring of workers. He stated heart rate as a more feasible measurement while acknowledging its limitations.

5.4.3.2 Jason Glaser encouraged Bruno to submit his data onto the OSHA system and directed Bruno to the OSHA website.

6. AOB

6.1 Jason Glaser shared about the OSHA's new rulemaking for heat injury and illness prevention, and encourage members to take part in the rule making process.

6.2 Jason Glaser shared about his latest grant from the U.S. Department of Labour to improve occupational safety and health on agricultural workers with climate change as the focus, and suggested that members can discuss how they can contribute collectively towards that project in the next meeting. Jason Lee shared about other

sectors affected by heat stress. Jason Glaser agreed and mentioned that expansion of the project into other sectors such as construction are also being looked into.

6.3 Jason Glaser shared about the recent commentary "Dying for Sport" written in Occupational & Environmental Medicine. He invited members to come up with a statement about the shared sentiments on workers suffering illnesses or dying due to heat stress. Jason Lee suggested tapping on the media attention of FIFA World Cup 2022 Qatar to contribute to safeguarding the safety and well-being of workers. Jason Lee continued by sharing about Yuri Hosokawa's efforts in the Olympics to improve athletes and spectators' safety and well-being.

6.4 Jason Lee reminded existing members to renew their membership and new members to sign up to join the scientitic committee. Application can be done here and new applicants will have to submit an application with the ICOH Secretariat General with endorsement from any three incumbent members.

6.5 Jason Lee shared about the upcoming 33rd International Congress on Occupational Health held from 6 to 10 February 2022 and encouraged members to sign up.

6.6 Jason Lee shared about a possible heat symposium in Thailand in August or September 2022.

6.7 Jason Lee shared about the Thermal Hyperformance Heat Stress e-Bulletin from Matt Brearley. The link to the e-Bulletin can be found here.

6.8 Jason Lee shared about the upcoming establishment of the Heat Resilience and Performance Centre at the National University of Singapore.

6.9 Jason Lee emphasised that preserving the welfare and saving lives of workers is the collective focus and thanked the participants for attending.

Meeting minutes were recorded by Clarence Leow, endorsed by Sirkka Risannen (Secretary) and approved by Jason Lee (Chair).

Annex I – List of Attendees

1. Jason Lee (Chair), National University of Singapore, Singapore
2. Tord Kjellstrom (Advisor), Health and Environmental International Trust, New Zealand
3. Bruno Lemke, Health and Environmental International Trust, New Zealand
4. Clarence Leow, National University of Singapore, Singapore
5. Elspeth Oppermann, Ludwig-Maximilian University of Munich, Germany
6. Hidenori Otani, Himeji Dokkyo University, Japan
7. Hsiao Yu Yang, National Taiwan University, Taiwan
8. Jason Glaser, La Isla Network, United States of America
9. Manoj Potapohn, Chiang Mai University, Thailand
10. Marc Schenker, University of California, Davis, United States of America
11. Matt Brearley, Thermal Hyperformance, Australia
12. Matthias Otto, Nelson Marlborough Institute of Technology, New Zealand
13. Meng Zhen Zhao, Tsinghua University, China
14. Nway Nway, Chiang Mai University, Thailand
15. Rekha Shanmugam, Sri Ramachandra Institute of Higher Education and Research, India
16. Rodger Tsai, National Taiwan University, Taiwan
17. Ross Di Corleto, Monitor Consulting Services, Australia
18. Satoru Ueno, National Institute of Occupational Safety and Health, Japan
19. Sukunthea Neak, Chiang Mai University, Thailand
20. Wan-Chin Chen, National Taiwan University, Taiwan

21. Wenjia Cai, Tsinghua University, China

22. Worrakarn Ongwanich, Chiang Mai University, Thailand

23. Wunna Lwin, Chiang Mai University, Thailand

24. Yu-Lin Ching, National Taiwan University, Taiwan

25. Yuri Hosokawa, Waseda University, Japan

Screenshot of participants in meeting on Zoom: