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

2nd Meeting Report (2022-2024)

Time: Friday, 9 December 2022, 9:00 a.m. – 10:30 a.m. (GMT+8)

Venue: Virtual Meeting on Zoom

Participants: Annex I

1. Welcome and Introduction

1.1 Jason Lee welcomed the attendees.

1.2 Jason showed two photos to the members. The first photo depicted a long queue of female factory workers in Vietnam doing a survey on heat stress. The second photo is a screenshot of a news highlight regarding the recent passing of a conscripted fire-fighter in Singapore. Jason emphasised that these two photos are reminders that more can be done to protect the safety and well-being of those vulnerable.

1.3 Jason gave time for invited guests, Alvian Tan, Kai Zhang, and Ga-Young Lim to introduce themselves briefly.

1.3.1 Alvian Tan, Senior Assistant Director, Occupational Safety and Health Division, Ministry of Manpower, Singapore.

1.3.2 Kai Zhang, Empire Innovation Associate Professor, Department of Environmental Health Sciences, School of Public Health, University at Albany, State University of New York, United States of America.

1.3.3 Ga-Young Lim, Master's student, COM:FORT LAB, Department of Textiles, Merchandising, and Fashion Design, College of Human Ecology, Seoul National University, South Korea.

1.4 The meeting agenda was as follows:

1.4.1 Presentation by Hilde Feverik on "*Health Risk and Health Effects of Firefighting"*.

1.4.2 Presentation by Ga-Young Lim on "*Physiological Strain of Gig Workers: A Case of the Parcel Delivery Drivers in South Korea*".

1.4.3 Presentation by Kinnaleth Vongchanh on "*Questionnaire Survey Results on the Environmental Effects on Primary School Students in Phnom Penh".*

2. Hilde Feverik: "*Health Risk and Health Effects of Firefighting".*

2.1 Link to presenter's deck

2.2 Link to paper 1 (Marjerrison et al., 2022) and paper 2 (Renberg et al., 2022)

2.3 Hilde Feverik shared about the HERO project, which began in 2019. The aim of the project was (i) to explore health risks among firefighters, (ii) to study the dual challenge of exposure to heat and carcinogenic compounds, and their related outcomes, and (iii) to establish evidence-based preventive measures.

2.4 Hilde presented about two work packages from the HERO project. The first work package was about exposure-related cancer risk among Norwegian firefighters, and the second work package was about heat strain and thermoregulatory responses in female and male firefighters.

2.5 Hilde concluded that with increased wildfire incidences due to climate change, understanding the risk of heat stress and exposure to toxicity in firefighters is necessary when implementing preventive measures. Hilde elaborated that firefighting has evolved over the years, with improved firefighting and personal protective equipment.

2.6 Discussions:

2.6.1 Tord Kjellstrom emphasised the importance of considering future trends of occupations exposed to thermal factors (e.g. increased employment due to increased demand for manpower). Tord added that exposures from other stressors, like toxic materials in the case of firefighters, should be considered.

2.6.2 Kai Zhang commented that with increased wildfires occurences in California and parts of Western USA, there are studies about this topic on the general population, but perhaps not in firefighters.

2.6.2.1 Marc agreed with Kai, and mentioned about the increase in fire intensity. Marc asked about the possibility of prospective heat strain monitoring on firefighters to allow for early intervention.

2.6.2.2 Jason Lee raised a question to all members about whether there is any evidence to suggest that heat stress can worsen the risk of cancer among firefighters.

2.6.2.3 Matt concurred with Marc that there are sufficient evidences on thermal strain on firefighters during firefighting. Matt also agreed with Marc's

question on prospective montoring of firefighters, and added that more work on accurate, non-invasive prospective monitoring has to be done.

2.6.2.4 Jason agreed that the effort to identify accurate, non-invasive means of prospective heat stress monitoring is still in progress. Jason reminded all about the impracticability of evacuating false positives in occupations such as firefighting. Jason shared that although rectally-inserted temperature pills have been used in the Special Forces during high-risk activities, the use of these pills is not scalable with a larger population size.

2.6.3 Jason Lee commented that variances in physiological responses among females seemed to be smaller than males. Jason emphasised Hilde's point about focusing on inter-individual differences, rather than sex differences.

2.6.4 Jason Lee brought up the possible differences in behavioural thermoregulation when firefighting in a tropical country as compared to a seasonal country. Jason feels that firefighters who live in a cool environments may require longer duration to adapt to the hot conditions when firefighting.

2.6.5 Jason Lee invited Daniel Ng to introduce himself.

2.6.5.1 Daniel Ng, Senior Assistant Director (Plans & Policy), Training and Professional Development Department, Singapore Civil Defence Force, Singapore.

2.6.5.2 Daniel thanked Jason for the invitation and shared a few words about the recent passing of a conscripted firefighter. Daniel highlighted the importance of understanding thermal stressors in high-risk emergency environments when developing appropriate preventive measures.

2.6.6 Marc Schenker replied to Jason Lee's earlier comment on behavioural thermoregulatory. Marc talked about acclimatisation being a main preventive function for farm workers working in hot climate, and emphasised that firefighters are not acclimatised to the hot environment that they are exposed to when firefighting.

3. Ga-Young Lim: *"Physiological Strain of Gig Workers: A Case of the Parcel Delivery Drivers in South Korea".*

3.1 Link to presenter's deck

3.2 Ga-Young presented a research study which investigated physiological strain among delivery drivers in South Korea, where physiological parameters such as core body temperature, heart rate, and skin temperature of these workers were monitored over the period of a day. During the study, the workers were also interviewed verbally to understand more about the nature of their work and their working conditions.

3.3 Ga-Young concluded that delivery drivers should have appropriate work-rest cycle, cooling facilities, and easy access to rest areas.

3.4 Discussion:

3.4.1 Hsiao-Yu Yang thanked Ga-Young for the detailed presentation. Hsiao-Yu asked if investigating the workers' death due to overworking is one of the aims of Ga-Young's study, and if Ga-Young had linked the heat stress exposure to these deaths.

3.4.1.1 Ga-Young commented that she is in the preliminary stages of analysing the association between the working hours or the number of parcels delivered, and other physiological parameters, hence the data were not included. Ga-Young elaborated that there are currently no research in South Korea investigating the impact of seasonal changes on physiological strain of delivery workers, which forms the motivation of her study to look into physiological parameters.

3.4.1.2 Hsiao-Yu explained that "death by overworking" is not clearly defined, and working hours have been largely used to define such deaths. Hsiao-Yu suggested that collecting data on heart rate or arrhythmia among workers to associate core body temperature increase to arrhythmia, or uncontrolled blood pressure, will help to determine if overworking can cause death.

3.4.1.3 Ga-Young added that despite limits on working hours for delivery drivers in South Korea, the workload of gig workers has made it difficult for them to abide to these limits.

3.4.1.4 Jason Lee commented that the Ga-Young's study was insightful to help understand the physiological strain of these workers. Jason highlighted the importance of recognising unsafe physiological thresholds to conclude heat strain as a risk factor. Jason added that future studies can explore profiling the workers during a warmer climate.

3.4.1.5 Hsiao-Yu added that there may be association between thermal stress and heart disease. Hsiao-Yu cited evidences of increased hospital admission rate due to heart disease and increased incidences of arrthymia in patients with underlying heart diseases during the hot season.

3.4.2 Tord Kjellstrom commented that the heat levels were not extremely high during the study, and hoped that Ga-Young can continue this study during the warmer climate

3.4.2.1 Jason Lee provided a different perspective by shifting the focus to how hot the body gets, rather than how hot the environment becomes, especially during fixed-paced work.

3.4.2.2 Tord replied that making a distinction between effect of workload and effect of heat is important.

3.4.3 Marc Schenker suggested that a possible preventive measure is to limit the workload, and that future studies can look into the association between heat exposure and accident rates among delivery drivers.

4. Kinnaleth Vongchanh: "*Questionnaire Survey Results on the Environmental Effects on Primary School Students in Phnom Penh*".

4.1 Link to presenter's deck

4.2 Kinnaleth Vongchanh presented about a research study which investigated heat stress exposure, learning behaviour, and coping mechanisms among primary school students in Phnom Penh, Cambodia using a survey.

4.3 Kinnaleth concluded that heat stress can affect primary school students because most students experienced symptoms of heat strain and concentration loss when the classroom is hot. Students also tend to sit near windows for better ventilation.

4.4 Discussions:

4.4.1 Tord Kjellstrom suggested to install cooling facilities at one of the two schools for a year to do a comparative study involving the effects of cooling in classrooms.

4.4.2 Kai Zhang agreed with Tord's suggestion, and proposed that the students' scores is another variable that can be explored.

4.4.3 Jason Lee reminded everyone about maximising human capital as these children affected by the heat in schools are the ones who will combat the more complex heat issues in the future.

4.4.4 Jason Lee emphasised the importance of looking at outliers in a dataset when making conclusions, rather than only the means, in order to protect everyone within a population.

4.4.5 Hsiao-Yu Yang shared about the lack of tools to assess heat strain, and suggested that SCTF members can collaborate to design a questionnaire to quantify heat strain levels in various industries.

5. AOB

5.1 Jason Lee shared about the 34th International Congress on Occupational Health (ICOH2024) held from 28 April to 3 May 2024 in Marrakesh, Morocco, and encouraged members to be involved to highlight the increasing issues of thermal stress. Jason also informed the members of a call to organise a Free Paper Abstract Session during ICOH2024.

5.2 Jason shared about two grant opportunities, titled "Stars in Global Health – Health Impacts of Climate Change" from Grand Challenges Canada, and "Climate X Health" From PATH.

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

Annex I – List of Attendees

Jason Lee (Chair), National University of Singapore, Singapore

Tord Kjellstrom (Advisor), Health and Environmental International Trust, New Zealand

Alvian Tan, Ministry of Manpower, Singapore

Clarence Leow, National University of Singapore, Singapore

Daniel Ng, Singapore Civil Defence Force, Singapore

Efi Yuliati Yovi, IPB University, Indonesia

Elspeth Oppermann, Ludwig-Maximilian University of Munich, Germany

Ga-Young Lim, Seoul National University, South Korea

Hidenori Otani, Himeji Dokkyo University, Japan

Hsiao Yu Yang, National Taiwan University, Taiwan

Kai Zhang, University at Albany, State University of New York, United States of America

Kinnaleth Vongchanh, Institute of Technology of Cambodia, Cambodia

Marc Schenker, University of California, Davis, United States of America

Matt Brearley, Thermal Hyperformance, Australia

Matthias Otto, Nelson Marlborough Institute of Technology, New Zealand

Satoru Ueno, National Institute of Occupational Safety and Health, Japan

Seichi Horie, University of Occupational and Environmental Health, Japan

Vidhya Venugopal, Sri Ramachandra University, India

Wantanee Phanprasit, Mahidol University, Thailand

Yuri Hosokawa, Waseda University, Japan

Screenshot of participants in meeting on Zoom: