Oxfam's Wearable Heat Stroke Detection System for Outsourced Cleaners in Hong Kong

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5 December 2024

Background

2021

Oxfam Hong Kong launched a research report titled "The Impact of Extreme Heat on Street Cleaners in Hong Kong", which found that **45.5% of the 200 interviewed street cleaners often experience poor health conditions. Several of them had suffered from heat-related illnesses** (i.e., heat stroke and dehydration). **We lobbied a government department to include "Guidance Notes on Prevention of Heat Stroke at Work" in the tender document**, ensuring that cleaners have sufficient rest time, flexible working arrangements, and suitable equipment.

2022

Our research, "Sanitation Workers' Working Conditions at Refuse Collection Points in Extreme Heat", revealed that some interviewed **cleaners felt unwell due to heat-related illnesses, yet they insisted on continuing to work to prevent loss of income.**

2023

Thanks to the efforts of OHK and various parties concerned with labor issues, the Hong Kong Observatory (HKO) launched new Special Weather Tips. **The Labour Department (LD) also follows HKO's Hong Kong Heat Index (HKHI) in formulating the "Guidance Notes on Prevention of Heat Stroke at Work"**. In the summer of 2023, OHK's research revealed that 99% of interviewed cleaners can arrange their own rest time; however, we believe a more accurate heat stress warning system is needed to ensure they can rest appropriately. Local parties and OHK suggested that **the HKHI measurement fails to address district variations and offset issues, and that cleaners cannot receive warnings on their phones while at work.**

2024

The LD amended the "Guidance Notes on Prevention of Heat Stroke at Work" and adjusted the cancellation mechanism of the Heat Stress at Work Warning to minimise the possibility of frequent pop-ins and pop-outs of the warning. They also linked the warning system with HKO's Extremely Hot Special Weather Tips. However, the concerns mentioned have not yet been fully addressed. In light of this, **OHK collaborated with Cyberport Start-up to design a wearable heat stress detection system, leveraging technology to improve measurement and notification processes, thereby helping to prevent heat stroke among cleaners by enhancing their personal equipment.**

Major Concerns of Current Guidelines and Warning System

Implementation issues:

- **Locations to measure Hong Kong Heat Index** (King's Park and Beas River) **cannot effectively reflect the actual heat conditions** for indoor and outdoor working environment of cleaners.

- When the Heat Stress at Work Warning is hoisted, even if the foreman notifies cleaners through text messages or phone calls, **cleaners could easily miss the notifications because they seldom use their phones while working**. This could significantly reduce the effectiveness of measures lowering their risk of heat stroke.


King's Park Meteorological Station

Beas River Meteorological Station

Project Design

Policy gap:

- A report of International Labour Organisation (ILO), "The Impact of Heat Stress on Labour Productivity and Decent Work", suggested several measures for managing and adapting heat stress at the worker, employer, and government levels. The cross-tabulation highlighted **a policy gap in building workers' resilience through infrastructure and technology solutions**.
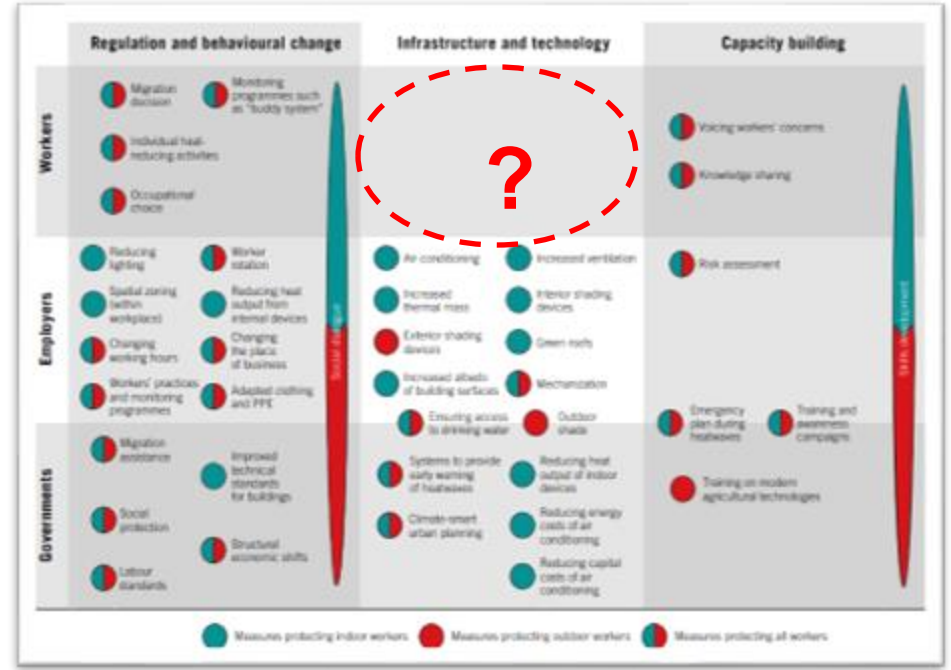
The role of governments, employers and workers in reducing vulnearability to heat stress and promoting adaptation(ILO,2019)
https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms_711919.pdf

This Project = Localised heat stress at work warning **(WBGT device)** + Customised Alert System **(Smartwatch)**

Wearable Heat Stroke Detection System (氣候適應下外判清潔工的防暑警報系統)

- **Objective:**

To accurately reflect the actual heat stress that cleaners experience in their working environments and give out prompt reminder of taking rest to reduce the risk of heat related illnesses.

- **Methods:**

1. Set up WBGT devices near cleaners' working areas in each selected district to record WBGT index.
2. Follow HKHI formula to calculate the localised heat index
3. Notify cleaners of heat stress at work warnings and corresponding risk of heat stroke via smartwatch

- **Target:** 300 FEHD outsourced outdoor cleaners
- **Period:** July – August 2024

Hong Kong Heat Index	Heat Stress at Work Warning	Warning Signs
*30 to <32	Amber	
	Amber Heat Stress at Work Warning indicates the level of heat stress in certain work environments is high.	
32 to <34	Red	
	Red Heat Stress at Work Warning indicates the level of heat stress in certain work environments is very high.	
≥34	Black	
	Black Heat Stress at Work Warning indicates the level of heat stress in certain work environments is extremely high.	

Wearable Heat Stroke Detection System

WBGT
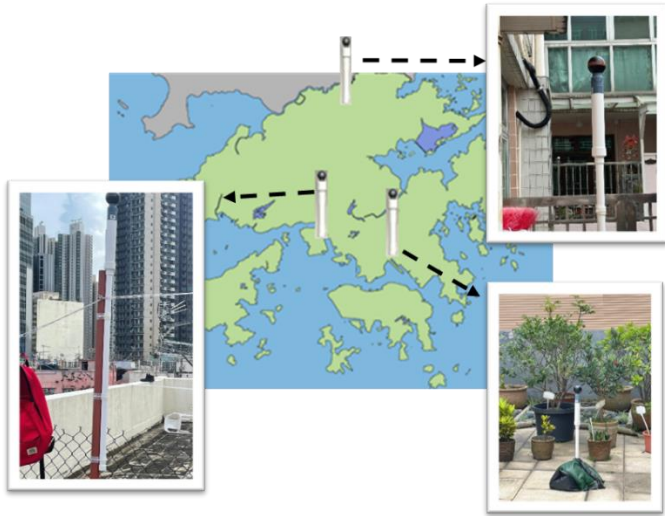
- Our team measures the black globe, wet bulb, and dry bulb indices at the locations using a WBGT heat stress meter.

Network Platform

- Apply the formula from the Hong Kong Observatory to measure the heat stress of working environment.
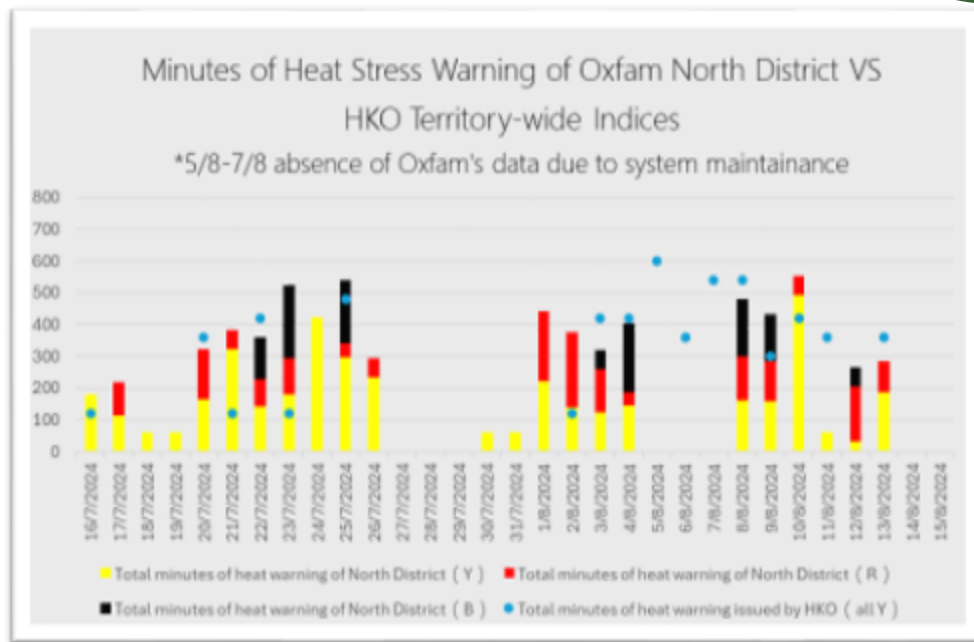
Smartwatch

- The built-in network card receives heat warnings issued by the Hong Kong Observatory and localized heat warnings from the WBGT black globe wet bulb system.

Location 1: North District

- We set up a WBGT device at a location near Fanling Luen Fat Street refuse collection point for data collection.
- The chosen site is a spacious outdoor area that simulates a typical working environment for workers.
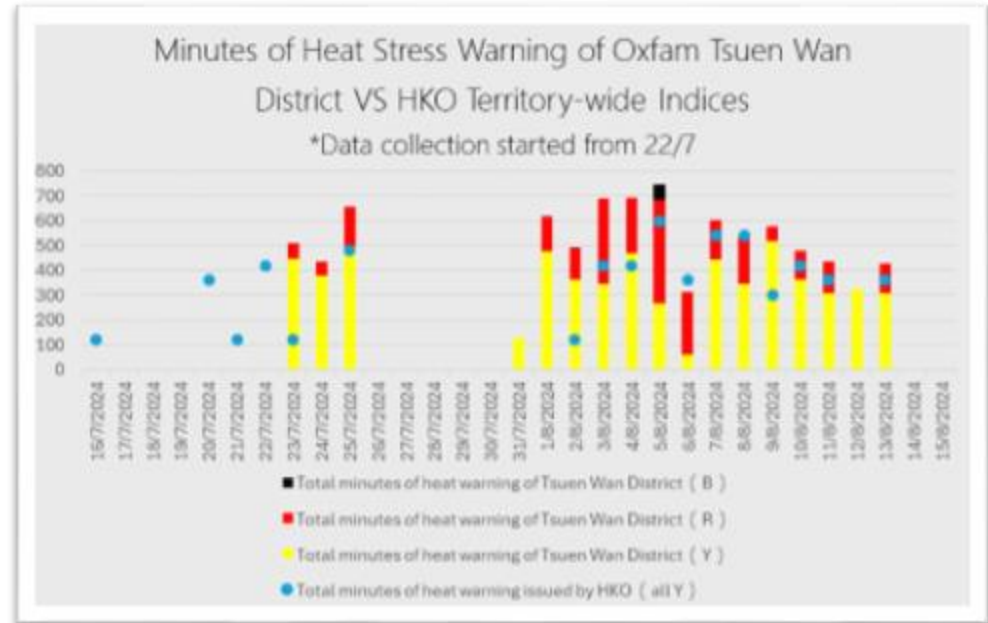
- Findings:

During the 28 days of effective testing, there were **16 days where the North District's heat index triggered more hours of heat stress warning compared to the HKO's record**. It is worth noting that HKO's heat index reached amber Heat Stress at Work Warning level for the whole testing period. **While the North District's index reached the red Heat Stress at Work Warning level for 16 days and half of them even reached the black Heat Stress at Work Warning level.**

Minutes of Heat Stress Warning of Oxfam North District VS HKO Territory-wide Indices
*5/8-7/8 absence of Oxfam's data due to system maintainance

Location 2: Tsuen Wan District

- We set up a WBGT device at a location in Tsuen Wan for data collection.
- The chosen site is a spacious outdoor area that simulates a typical working environment for workers.

- Findings:

During the 25 days of effective testing, there were **15 days where the Tsuen Wan District's heat index triggered more hours of heat stress warning compared to the HKO's record**. It is worth noting that HKO's heat index reached amber Heat Stress at Work Warning level for the whole testing period. **While the Tsuen Wan District's index reached the red Heat Stress at Work Warning level for 15 days and one of them even reached the black Heat Stress at Work Warning level.**

Minutes of Heat Stress Warning of Oxfam Tsuen Wan District VS HKO Territory-wide Indices
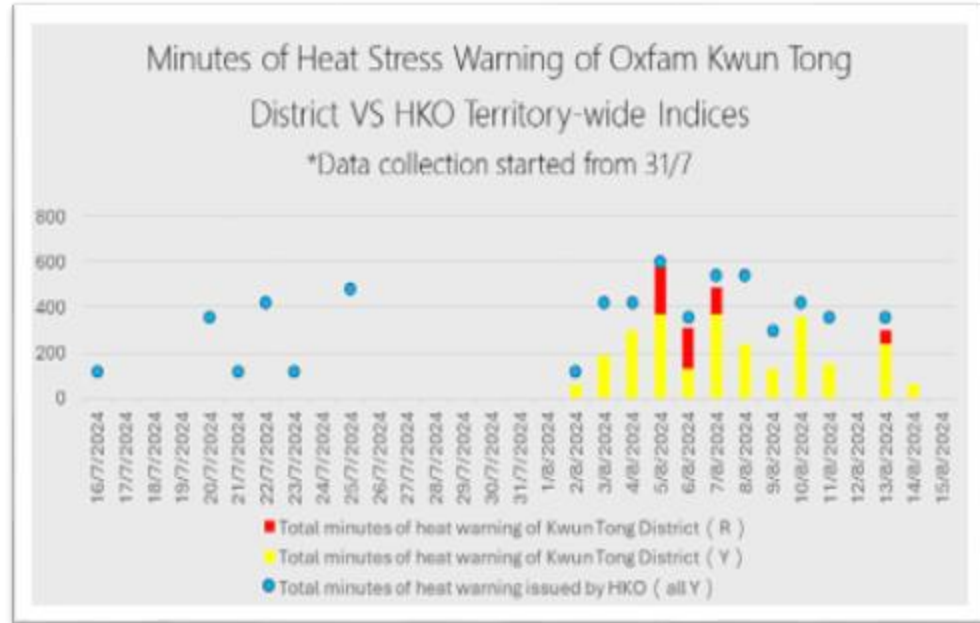*Data collection started from 22/7

Location 3: Kwun Tong District

- We set up a WBGT device at a location near Kwun Tong Yuet Wah Street refuse collection site for data collection.
- The chosen site is a rooftop area surrounded by buildings that simulates a typical working environment for workers in Kwun Tong.

- Findings:

During the 16 days of effective testing, there were only 5 days where the Kwun Tong District's heat index triggered more hours of heat stress warning compared to the HKO's record. However, **while HKO's heat index reached amber Heat Stress at Work Warning level for the whole testing period, the Kwun Tong District's index reached the red Heat Stress at Work Warning level for 4.**

Minutes of Heat Stress Warning of Oxfam Kwun Tong District VS HKO Territory-wide Indices
*Data collection started from 31/7

- Total minutes of heat warning of Kwun Tong District (R)
- Total minutes of heat warning of Kwun Tong District (Y)
- Total minutes of heat warning issued by HKO (all Y)

Conclusion

✓ The wearable heat stroke detection system revealed varying degrees of discrepancies between the HKHI issued by HKO and the actual working environment of cleaners. **The readings from the devices set up by OHK in several districts can more accurately reflect the heat stress** that cleaners experience while at work in collection sites or outdoor areas.

✓ The system also highlighted the differences in how cleaners receive heat stress warnings on mobile phones and watches. **The watch can remind cleaners to take breaks in high heat stress environments, thereby reducing their risk of heat-related illnesses.**

Photo taken following the meeting with the Labour Department

Thank you