



# Preliminary Testing of CarbonCool™ Cooling System for HAZMAT Decontamination

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## Introduction

- Frontline healthcare staff have to don thick layers of personal protective equipment (PPE)
- To decontaminate patients for Hazmat operations and training
- Long periods in PPE may trigger heat stress or fatigue

## Aim

- To evaluate if the use of the CarbonCool® System with PPE was useful in reducing physiological stress during Hazmat training

## Methods

- Conducted prospective observational study in Singapore General Hospital
- Recruited healthcare volunteers who had trained in hospital decontamination
- Opted to wear or without CarbonCool® Comfort Suit before using standard Hazmat PPE
- Body weight and vital signs such as temperature, heart rate and blood pressure were measured before donning and after training



Figure 1: Healthcare volunteers donning CarbonCool® Comfort Suits for Hazmat Exercise

## Results

- A total of 11 volunteers were enrolled and 4 volunteered to wear CarbonCool® Comfort Suit

	Control group (n = 7)	Intervention group (n = 4)
Age (median, IQR)	35 (33 – 38.5)	29 (28 - 38)
Gender (Male, %)	4 (57.1%)	4 (100%)
Race (%)		
Chinese	2 (28.6%)	3 (75%)
Malay	2 (28.6%)	1 (25%)
Indian	1 (14.3%)	0
Others	2 (28.6%)	0

Table 1: Basic demographic of enrolled volunteers

		Control group (n = 7)	Intervention group (n = 4)
Before donning DeconSuit	Weight, Kg (median, IQR)	73.35 (66.2 – 82.8)	71.1 (65.6 – 74.85)
	Temperature, °C (median, IQR)	36.6 (36.1 -37)	36.7 (36.3 – 36.95)
	Heart Rate, bpm	79 (69 - 88)	93.5 (81 - 100)
	Systolic Blood Pressure, mmHg (median, IQR)	131.5 (122 - 140)	138.5 (132.5 – 144.5)
	Diastolic Blood Pressure, mmHg (median, IQR)	79.0 (68 - 86)	86.5 (79 -89.5)
After donning DeconSuit	Weight, Kg (median, IQR)	66.1 (63.65 - 81)	70.65 (65.35 – 74.45)
	Temperature, °C (median, IQR)	37.5 (36.8 – 37.85)	37.0 (36.95 – 37.1)
	Heart Rate, bpm	88.0 (85 - 96)	101.5 (87.5 – 104.5)
	Systolic Blood Pressure, mmHg (median, IQR)	140.0 (131 - 144)	139.0 (135.5 – 141.5)
	Diastolic Blood Pressure, mmHg (median, IQR)	71.0 (65.5 – 82.5)	84.5 (83 - 86)

IQR: refers to inter-quartile range

Table 2: Vital signs readings in both control and intervention group

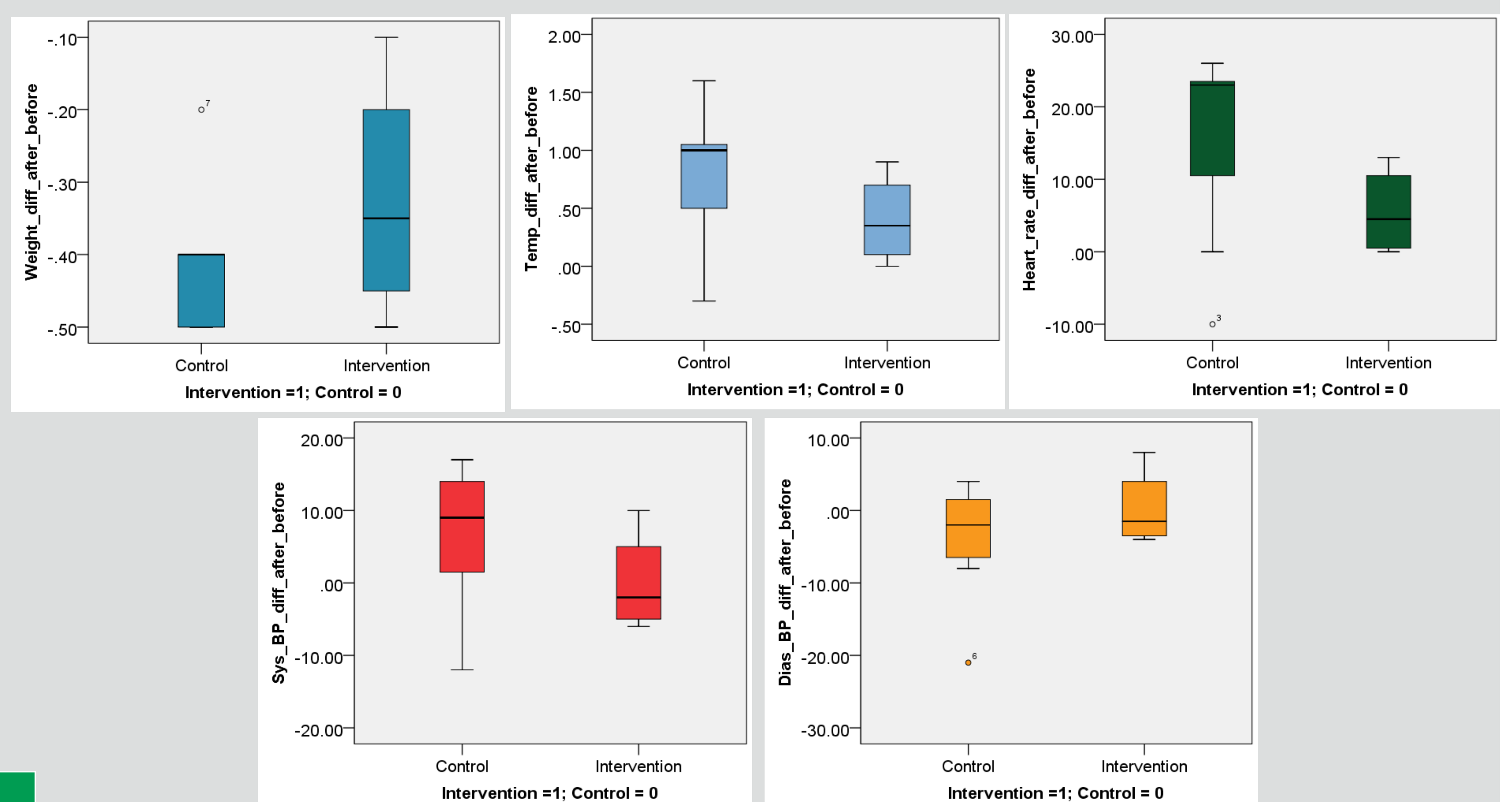


Figure 2: Boxplots of median difference from before and after donning DeconSuit in between Control and Intervention group

## Conclusion

- The volunteers who used the CarbonCool® Comfort Suit had lower body fluid weight loss, slower increase of body temperature, heart rate and blood pressure compared to control group
- Our results suggest that CarbonCool® Comfort Suit may reduce the risk of heat exhaustion and fatigue with use of PPE with possibility of being able to extend their work rest cycle

## Disclosure Statement

Consumables for CarbonCool® system were provided by Global Healthcare SG Pte Ltd. No cash sponsorship was given for this study. A/P Marcus Ong is scientific advisor to the company. All other authors do not have either commercial or personal associations or any sources of support that pose conflict of interest in this study.