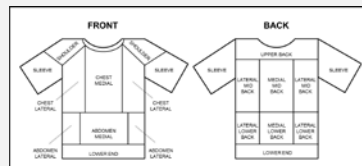


**Title:****T-shirt Sweat Absorption Mapping****Abstract: (Your abstract must use Normal style and must fit into the box. Do not enter author details)**

Sweat evaporation from the skin is the greatest avenue of body heat loss in the heat and during exercise. Clothing sweat management is critical for clothing insulation, cooling efficiency and thermal comfort. Detailed body maps representing inter-regional variation in sweat rate across males and females exist. However, there are no quantitative data available on sweat transfer from the skin to the garment. This study provides a detailed analysis of sweat accumulation across the T-shirt, induced by 50 mins of running exercise. Eight western European male runners participated in the study. The participants performed, in a counterbalanced order, 10 running trials at 70% of their  $VO_{2max}$ , in a climatic room at 27 °C, 50 % rH and 1.5 m·s<sup>-1</sup> air flow. The duration of the runs varied from 5 to 50 mins, to allow measurements of T-shirt sweat absorption at 5 min intervals. In each run participants donned a cotton T-shirt with a standard fit. The sweat absorption of 21 T-shirt regions was investigated (Fig 1). Local sweat absorption was calculated by cutting the T-shirts into the 21 pre-marked regions and weighing these before and after drying [regional-sweat-absorption (g·m<sup>-2</sup>) = WET\_weight – DRY\_weight/Surface\_Area]. During the exercise core temperature ( $T_{core}$ ) was measured with rectal probe, heart rate (HR) with wrist-based monitor and post-exercise gross sweat loss (GSL) was estimated from PRE and POST body mass. After 50 mins,  $T_{core}$  rose from 37 ± 0.2 °C to 38.6 ± 0.3 °C, HR increased from 69 ± 15 bpm to 163 ± 12 bpm ( $p < 0.001$ ) and GSL was 586 ± 86 g·m<sup>-2</sup>. On completion of 50 mins run, sweat production caused sweat to accumulate within the T-shirt and as result T-shirt WET\_weight increase by 77 % compared to the DRY\_weight. FRONT sweat accumulation started at 10 mins; the medial-chest showed the highest value, followed by lateral-chest, medial-abdomen, shoulders and sleeves, whereas lateral-abdomen and lower-end stayed dryer; Also for BACK, clear differences appear after 10 mins, with the medial-mid-back showing the highest value, followed by upper-back, lateral-mid-back, shoulders, medial-lower-back and sleeves; lateral-lower-back and lower-end stayed substantially dryer. These patterns were maintained until the end of 50 mins and compared to the FRONT the BACK showed higher sweat absorption values. Large variation in T-shirt regional sweat absorption was observed; the pattern was similar to the regional variation in sweat rate, although in absolute terms substantially lower, likely due to the skin-clothing air gap, ventilation and body movement. These data can aid the apparel industry in the development of sport and personal protective clothing with adequate comfort and performance, provide guidelines for material testing and implement the existing knowledge on thermophysiological modelling.



**Figure 1**  
FRONT and BACK T-shirt regions.