Relationship between Passive Drag and IPC Swimming Class

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INTRODUCTION

- Swimmer's speed is determined largely by their capacity to generate propulsion effectively whilst minimising drag forces.
- A fair classification system should, therefore, evaluate an individual's potential to achieve both of these things
- Present system may place too much emphasis on propulsion and allocate insufficient importance to evaluating drag.
- Currently only "leg drag" is considered. No attention is given to how other aspects of an impairment may impact on drag.

PREVIOUS RESEARCH

- Many studies of drag on able-bodied swimmers. Very limited research on those with a disability.
- 2 × peer-reviewed abstracts
  - Schega, Kunze & Daly (2004). N=103. Passive drag more associated with functional class than with anthropometry (body mass and height).
  - Karger (2012). N=98. Passive drag ↓ as functional class ↑.

    Paralysis **>** multiple dysmelia **>** above- knee (single) amputation.
- 1 × peer-reviewed paper

  Chatard *et al*. (1992). N=34. Passive drag related to degree of impairment.

  wheelchair (70±19 N) **>** walk with an aid (52±12 N) **>** walk without aid (41±7 N)

BRITISH SWIMMING

Manchester Metropolitan University — Cheshire —

AIM

To assess objectively the swimming classification system by determining the relationship between a swimmer's passive drag and their IPC class.

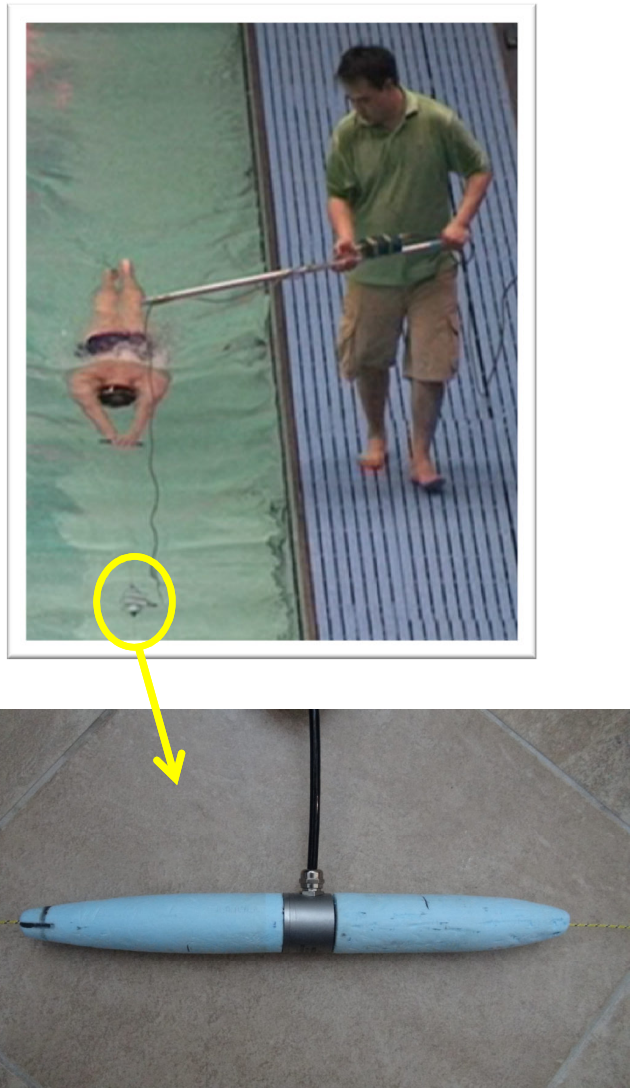
HYPOTHESES

1. There will be a significant negative relationship between passive drag and IPC class.
2. The classification system will provide a significant difference in passive drag between adjacent classes.

METHODS

Data Collection

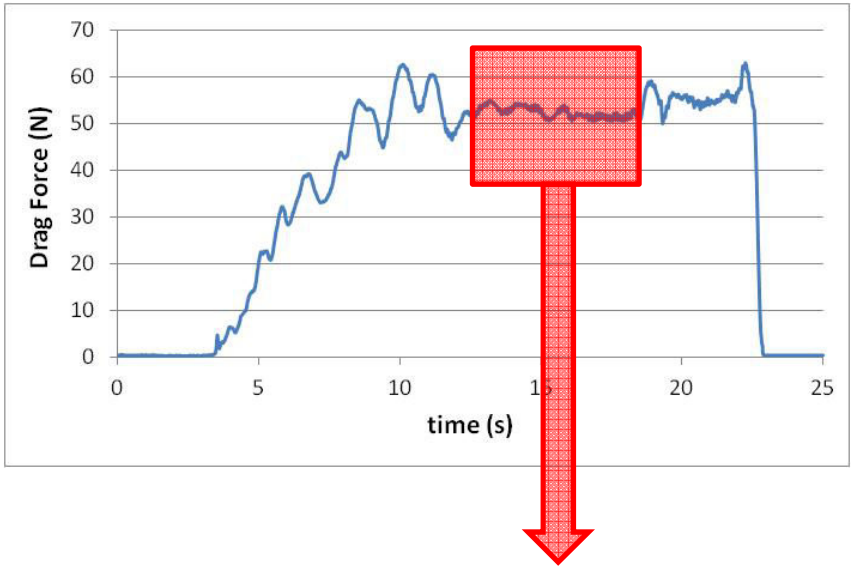
- 116 swimmers (72♂, 44♀).
  94% competed in London Paralympics.
- Classes S2 – S14.
- 23 ± 6 yrs, 1.62 ± 0.24 m, 61.7 ± 12 kg
- Towed on surface at 1.5 $m \cdot s^{-1}$ in their most streamlined position.
- Drag measured using an in-line load cell in a neutrally buoyant 'torpedo'.
- Force data sampled at 100 Hz.
- 3 – 7 trials conducted per swimmer.



METHODS

Data Analysis

- Mean force calculated when curve reached plateau .
- Lowest drag force from swimmer's trials was analysed.
- Absolute drag (N) and drag normalised for body mass ($N \cdot kg^{-1}$) obtained.
- One-way ANOVA. Scheffe's Post-Hoc analysis.
- Kendall's Tau Correlation.

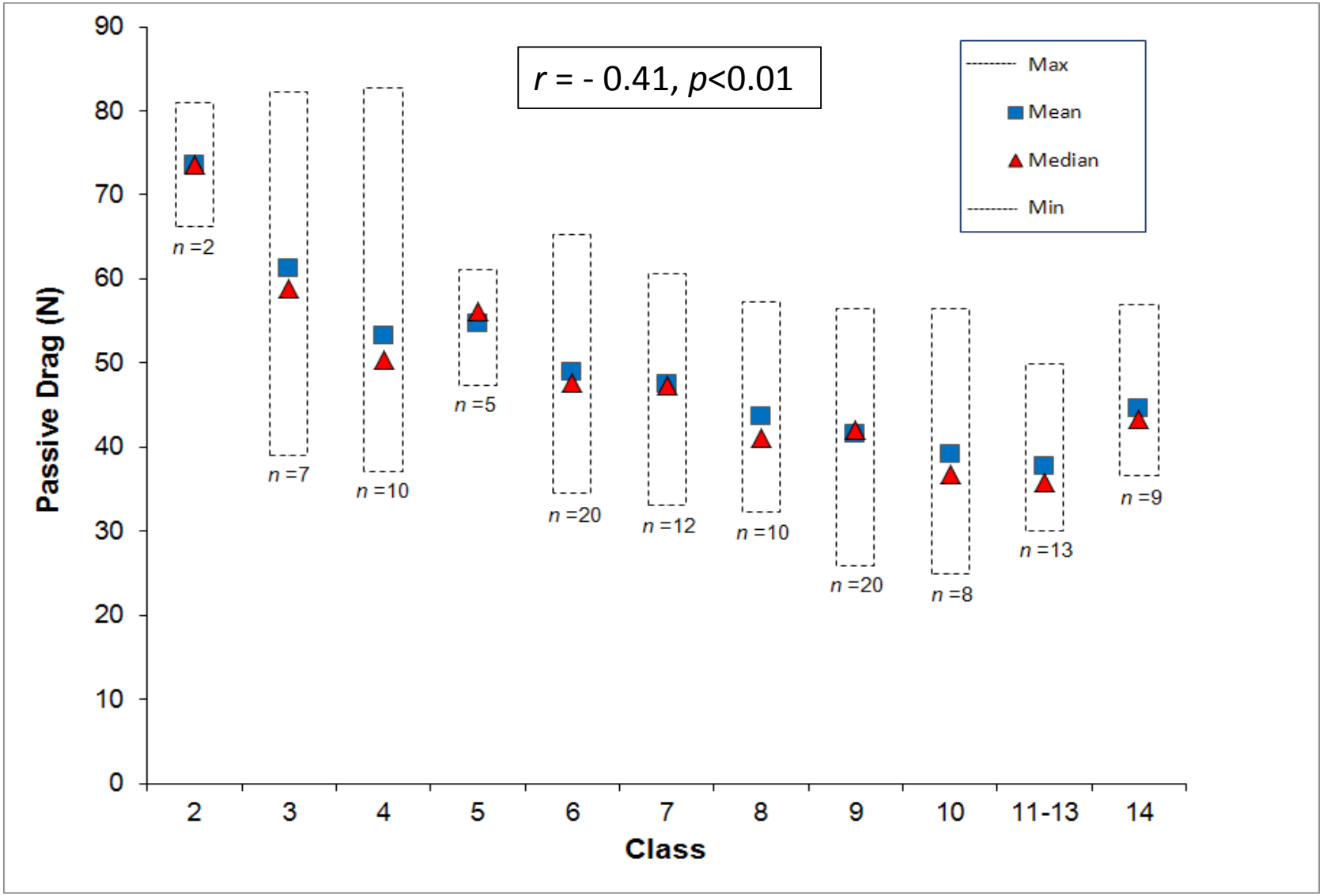


Absolute Drag = 53.2 N

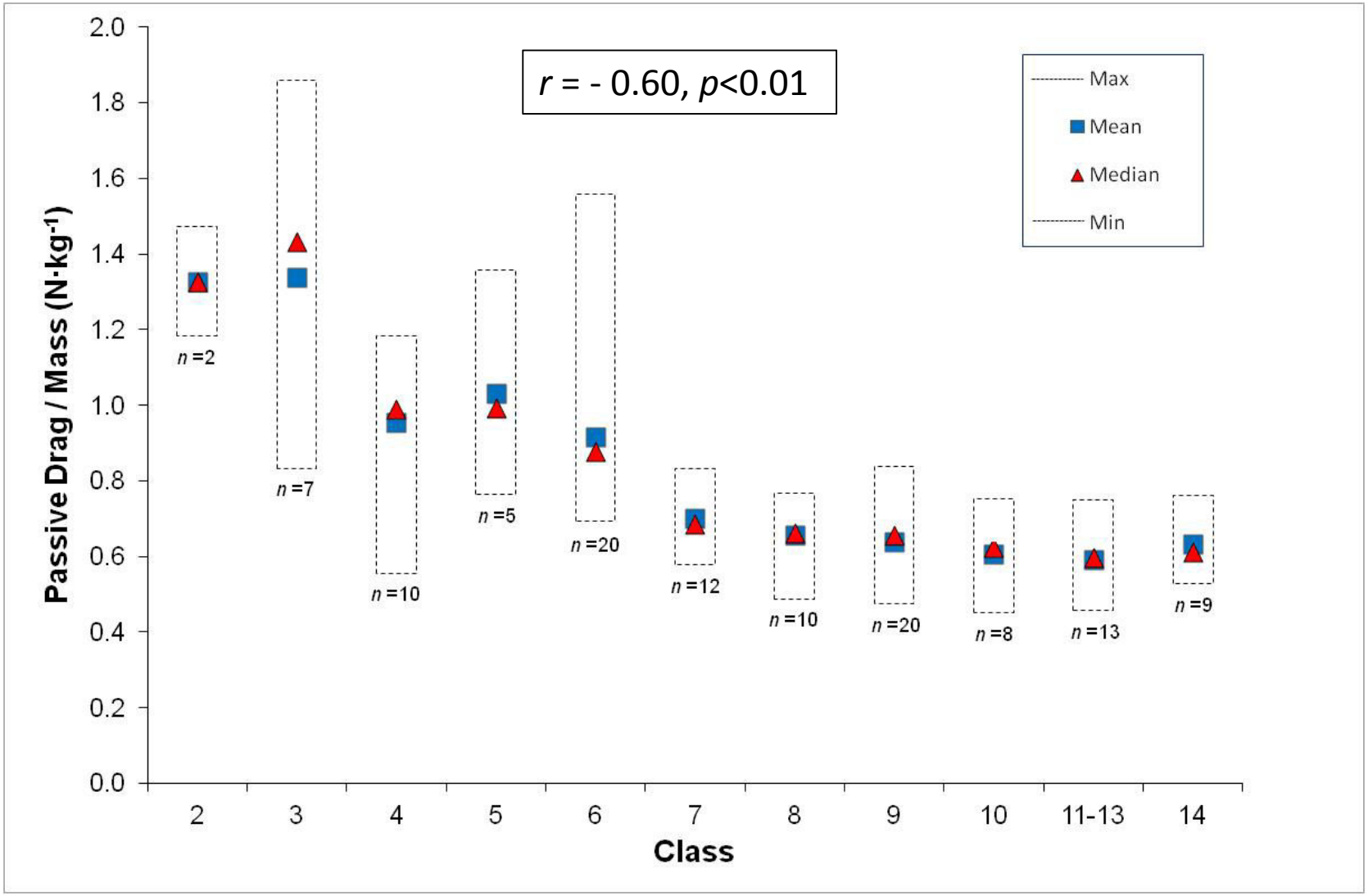
÷ 70 kg body mass

Normalised Drag = 0.76 $N \cdot kg^{-1}$

RESULTS


r = - 0.41, p<0.01
Max
Mean
Median
Min
Passive Drag (N)
90
80
70
60
50
40
30
20
10
0
n =2
n =7
n =10
n =5
n =20
n =12
n =10
n =20
n =8
n =13
n =9
2
3
4
5
6
7
8
9
10
11-13
14
Class

RESULTS


r = - 0.60, p<0.01
Max
Mean
Median
Min
Passive Drag / Mass (N·kg-1)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
n =2
n =7
n =10
n =5
n =20
n =12
n =10
n =20
n =8
n =13
n =9
2
3
4
5
6
7
8
9
10
11-13
14
Class

DISCUSSION

- Significant relationships between the passive drag measures and IPC class → 1st Hypothesis accepted.
- No significant difference in passive drag measures between any adjacent classes → 2nd Hypothesis rejected.
- Large within-class variability on drag measures in lower classes. Due to diverse impairment types in a single class.
- If greater weighting was given to drag assessment in the FCS, the within-class variability in drag would be reduced.
- Relative importance of propulsion and drag to performance and, consequently, the FCS needs to be established.

CONCLUSION

Although swimmers with the lowest IPC class experienced the highest passive drag and vice versa, the non-significant differences in passive drag, between adjacent classes, indicate that the current FCS does not delimitate clearly between swimming groups on this important criterion.

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