Safety behaviour to avoid drowning - should we "float first" on accidental immersion?

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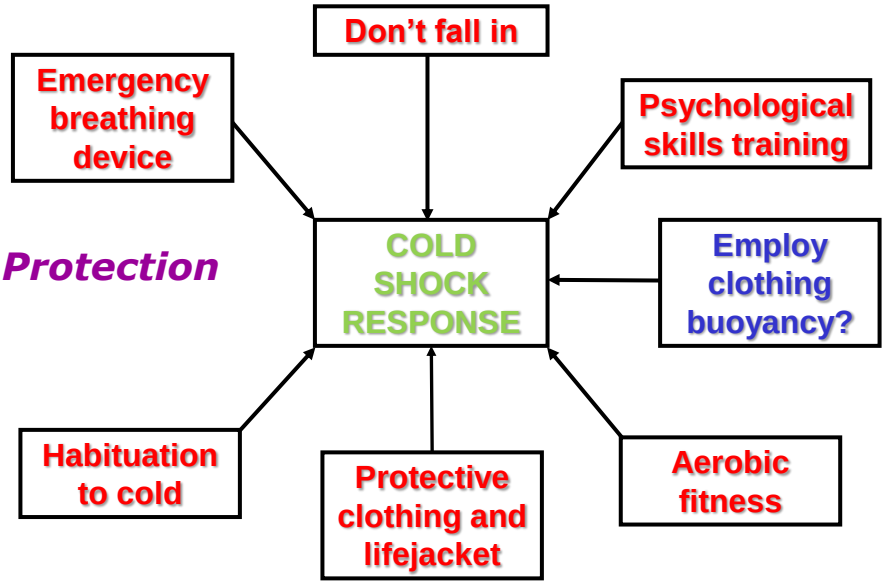
World Conference on Drowning Prevention, Da Nang, Vietnam, 10th-13th May 2011

Cold Water: A Hazardous Environment…

- RoSPA statistics: 400-1000 deaths per annum
- 450,000 immersion deaths in the year 2000
- Second most common cause of accidental death in children (4-14yr), third in adults in most countries
- Largest killer of sportsmen undertaking their sport
- Rapid skin cooling triggers the 'Cold Shock' response (Tipton, 1989)
- **KEY POINT:** Threat to adults and children



· ***Mostly, not feasible for persons accidentally immersed***

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Project Aims and Objectives….

- Examine safety behaviour on accidental immersion in clothes
- Quantify any buoyancy provided by different clothing assemblies after floating or swimming
- Raise awareness of the threat posed by CWI and deliver coping advice

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Why "Float First" on immersion?

- Airway protection
- Reduce the rate of cooling
- Increase survival time
- Increase the chance of rescue
- **Retain inherent buoyancy trapped in clothing?**
  - **- Little work undertaken to date**
  - **- Up to 30L of air trapped in a dry suit**
  - **- Lifejacket buoyancies: 50, 100, 150 & 275N**

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Research Undertaken with BNFL & RoSPA

- STUDY 1: **AN ASSESSMENT OF THE BUOYANCY PROVIDED BY DIFFERENT SEASONAL CLOTHING ASSEMBLIES IN ADULTS**
- STUDY 2: **AN ASSESSMENT OF THE BUOYANCY PROVIDED BY WINTER CLOTHING IN CHILDREN AND ADOLESCENTS**

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STUDY 1: Research Questions

- a. Is a significant level of buoyancy provided by air trapped between clothing layers?
- b. Does the number of clothing layers influence the amount of inherent buoyancy?
- c. Is the buoyancy of a participant affected by swimming in comparison with floating?
- **Do the data support a policy of "Float First" on immersion in adults?**

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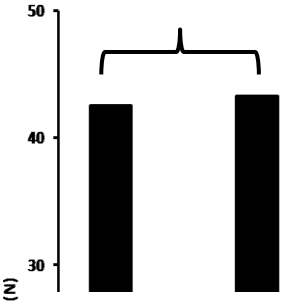
Methods

- Male and female adult participants

	Age (years)	Height (m)	Mass (kg)	Skinfold (mm)	Body Fat (%)
Overall (*n*=24)	21.1 (3)	1.73 (0.1)	71.2 (11.4)	47.0 (18.4)	21.5 (8.4)
Males (*n*=12)	21.6 (3)	1.78 (0.1)	75.7 (9.7)	34.2 (8.6)	14.0 (3.0)
Females (*n*=12)	20.7 (3)	1.69 (0.1)	66.8 (11.6)	59.9 (16.5)	29.0 (4.0)

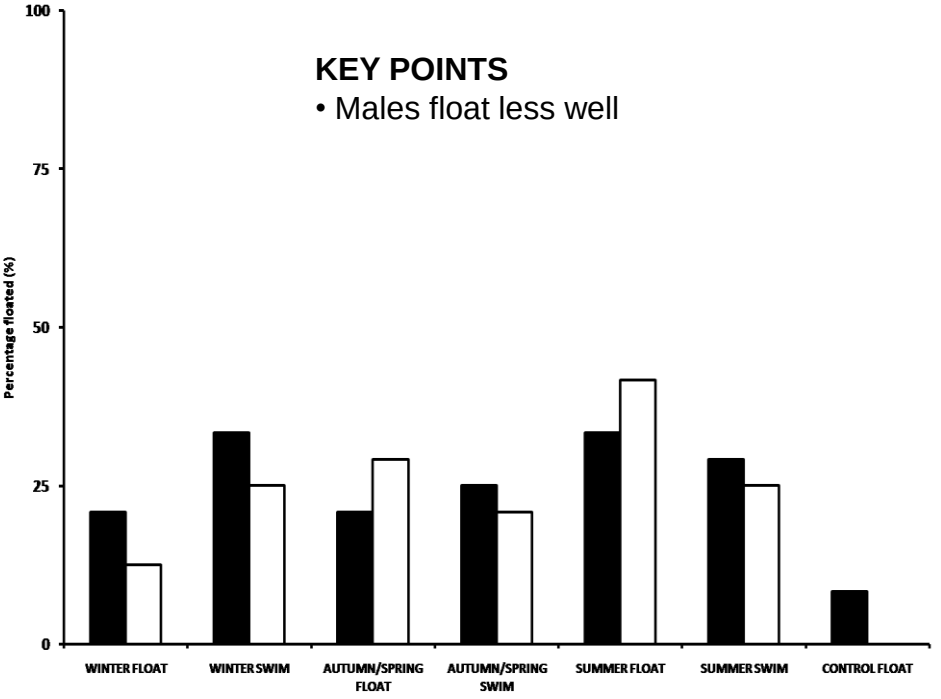
- Three clothing assemblies: Winter; Spring/Autumn; Summer
- Underwater weighing to determine buoyancy
- Assess freeboard
- Two minutes of floating or swimming
- Re-weigh underwater

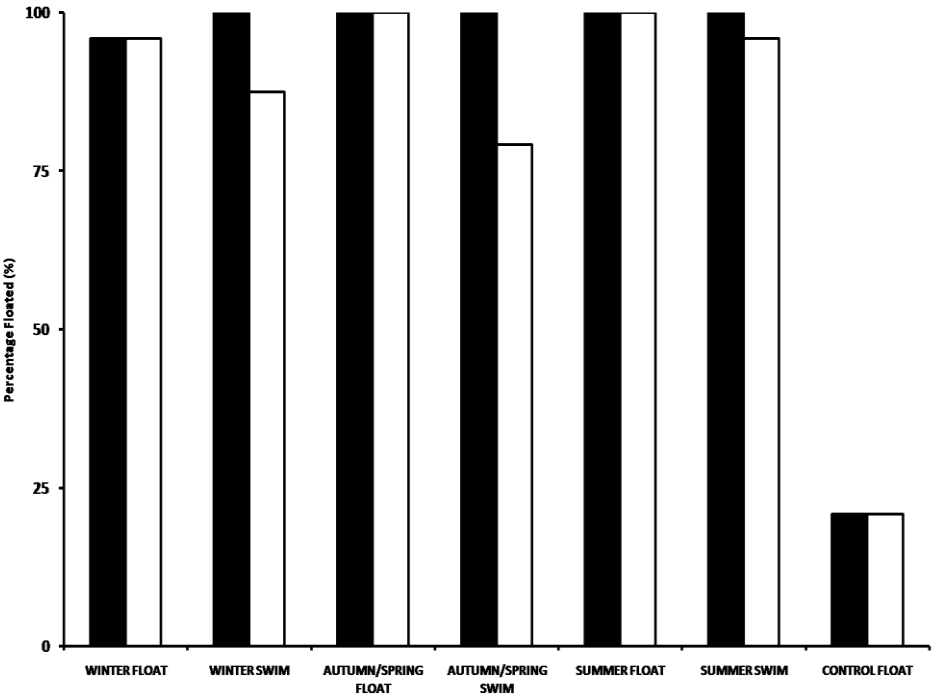


KEY POINTS

- A significant amount of buoyancy is provided by clothing on immersion; ~45N an entry level buoyancy aid
- This is reduced as clothing layers are lessened
- The inherent buoyancy is unaffected by floating vs. swimming
- Significant buoyancy is retained with clothing
- The test method may have influenced these data – underestimated buoyancy

WINTER FLOAT | WINTER SWIM | AUTUMN/SPRING FLOAT | AUTUMN/SPRING SWIM | SUMMER FLOAT | SUMMER SWIM


KEY POINTS
• Males float less well
Percentage floated (%)
100
75
50
25
0
WINTER FLOAT
WINTER SWIM
AUTUMN/SPRING FLOAT
AUTUMN/SPRING SWIM
SUMMER FLOAT
SUMMER SWIM
CONTROL FLOAT


Percentage Floated (%)
100
75
50
25
0
WINTER FLOAT
WINTER SWIM
AUTUMN/SPRING FLOAT
AUTUMN/SPRING SWIM
SUMMER FLOAT
SUMMER SWIM
CONTROL FLOAT

STUDY 1: Research Questions

- a. Is a significant level of buoyancy provided by air trapped between clothing layers?

  YES

- b. Does the number of clothing layers influence the amount of inherent buoyancy?

  YES

- c. Is the buoyancy of a participant affected by swimming in comparison with floating?

  NO

- **Do the data support a policy of "Float First" on immersion in adults?**

  YES

STUDY 2: Research Questions

- a. Are the buoyancy characteristics of children similar to adults?

- **Do the data support a policy of "Float First" on immersion in children and adolescents?**

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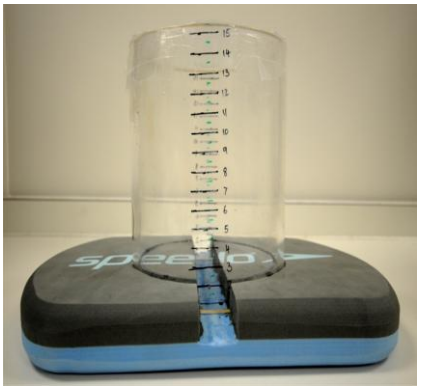
Methods

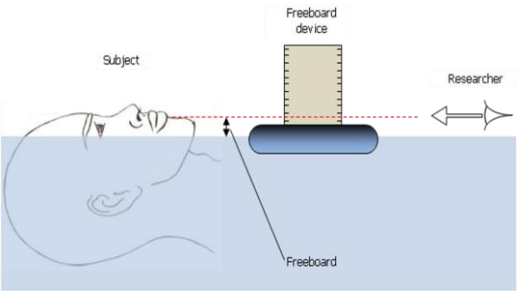
- Male and female child and adolescent participants

	Age (years)	Height (m)	Mass (kg)	Skinfold (mm)	Body Fat (%)
Overall (*n*=29)	12 (3)	1.53 (0.2)	48.7 (15.8)	36.9 (19.4)	20.9 (6.4)
Males (*n*=16)	13 (3)	1.55 (0.2)	51.6 (17.2)	33.1 (17.0)	18.1 (5.3)
Females (*n*=13)	12 (2)	1.51 (0.1)	45.1 (14.0)	41.6 (21.7)	24.3 (6.2)

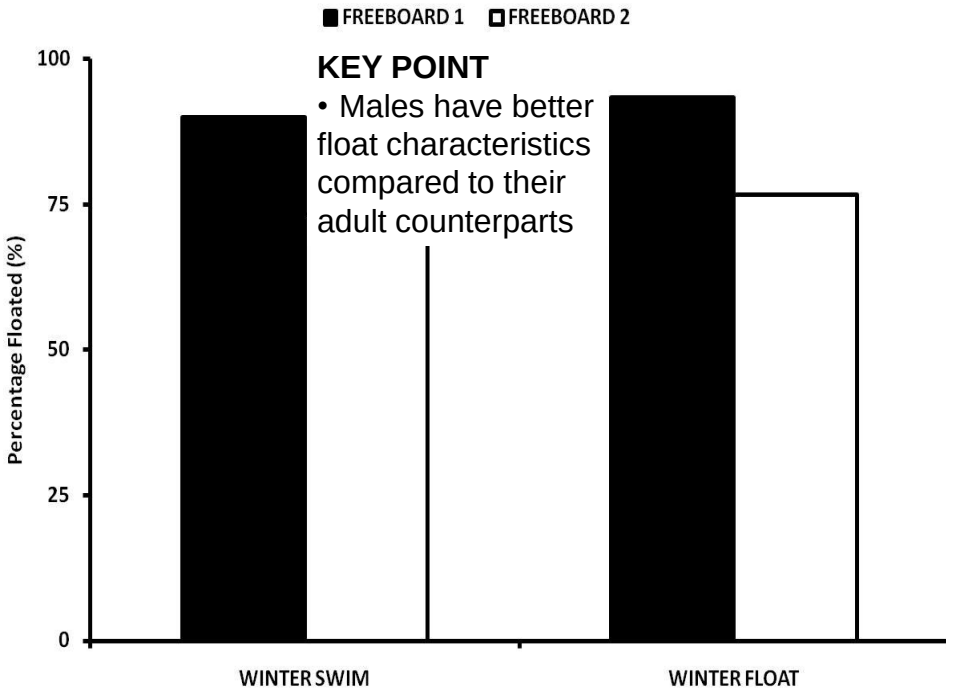
- Most buoyant clothing assembly: Winter
- Swimming pool tests; falling entrance to water
- Freeboard quantified
- 90 s of floating or swimming (25 m)
- Freeboard re-quantified

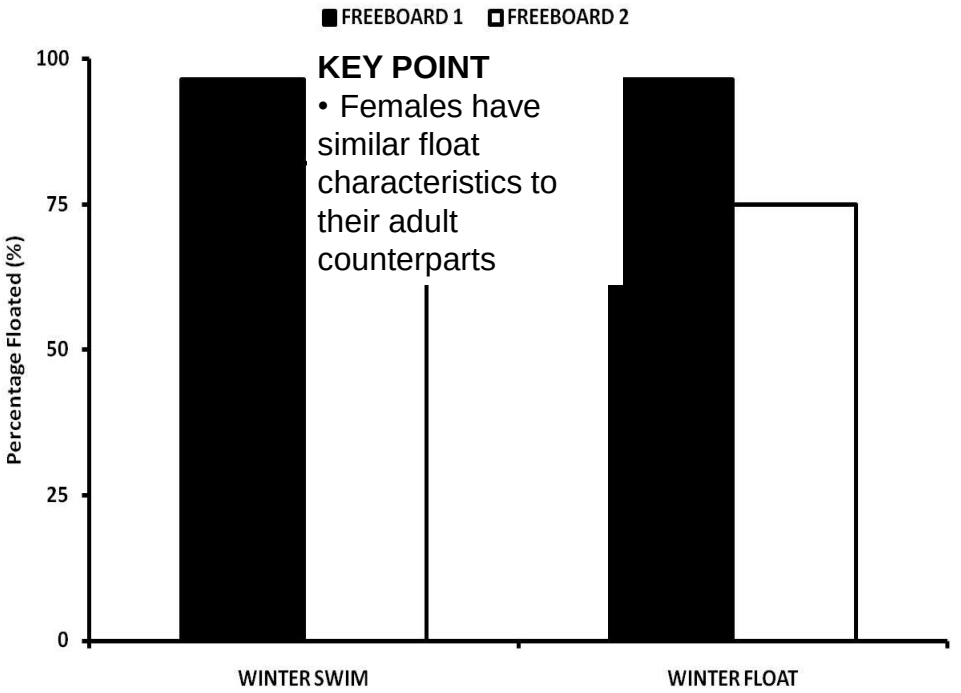
Estimating Freeboard…





- Bespoke device for freeboard estimation


FREEBOARD 1
FREEBOARD 2
100
75
50
25
0
Percentage Floated (%)
KEY POINT
• Males have better float characteristics compared to their adult counterparts
WINTER SWIM
WINTER FLOAT


FREEBOARD 1
FREEBOARD 2
100
75
50
25
0
Percentage Floated (%)
KEY POINT
• Females have similar float characteristics to their adult counterparts
WINTER SWIM
WINTER FLOAT

Conclusions and recommendations

- Clothing can trap air and help people float
- Physical characteristics also play a role in determining buoyancy
- Underwater weighing underestimates the buoyancy provided by clothing
- Previous work shows that the risk of drowning is increased by swimming on immersion in cold water
- **"Float first" should be taught as an appropriate safety behaviour for accidental immersion**
- This does not negate the need to learn to swim and use buoyancy aids whenever appropriate

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Acknowledgements

BNFL

RoSPA
The Royal Society for the Prevention of Accidents

Participants, parents and project technical support

References

Full list of citations in:

- **Barwood, M.J.,** Bates, V., Long, G.M., & Tipton, M.J. "Float First": Trapped air between clothing layers significantly improves buoyancy on water immersion in adults, adolescents and children. *International Journal of Aquatic Research and Education*, (accepted for publication).