Association Between PFD Use and Fatal Drowning in Boats: A Matched Cohort Analysis

Peter Cummings, MD, MPH
Harborview Injury Prevention Center, School of Public Health, University of Washington

Beth Mueller, PhD

Linda Quan, MD
University of Washington School of Medicine
Seattle, Washington USA

PFD = US Coast Guard approved life jacket

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Background

Efficacy of PFD use has not been well supported

- Descriptive studies show very low PFD use (15%) in fatal boat related drownings

To demonstrate that PFD use improves survival need:

- Randomized controlled studies
- Case control studies

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Study Objective

Evaluate the association between use of a PFD and fatal drowning in recreational boaters using a matched cohort method

Study Design

Matched cohort study:

compares the outcome of those in a boat where at least one person dies of drowning

- Controlled for boat, water, weather
- Compared drowning death and PFD use of all those in the boat

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Subjects

- Data source: USCG Boating Accident Report database (BAR)
- Boat operators must fill out BAR form if:
  - Death or damage to boat > $2,000 US
  - Submit form < 10 days after the accident
- All 50 states and territories, USA
- Recreational boaters, 2000-2006
  - All ages
  - Boat capsized or sinking

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

What the BAR data collects

- **For each vessel:**
  - state, date
  - vessel type, length
  - water conditions (calm or rough)
  - Number of boat occupants
  - each occupant's
    - age, sex
    - whether they were the operator
    - wore a PFD
    - died or drowned *

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Issues

Why entered the water-intentional or not?

Drowned-would a PFD prevented death?

- Cause of death important

"PFD used" versus "PFD worn"

- Poor documentation

Missing data

- Adjust for age and sex
- Multiple imputation (created 50 data sets)

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Analysis: What we measured

Relative risk ratio

- Risk/incidence of fatal drowning in those wearing a PFD compared to those not wearing PFD

$$\frac{\text{Deaths/wearing PFD}}{\text{Deaths/not wearing PFD}}$$

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Results

Total 104,683 persons in 46,234 vessels

- 21% more boating-related deaths in Coast Guard data than in US mortality files

9,925 persons in 4242 vessels with at least 1 death

Final:

32% 1597/4915) of the records
35% (625/1809) of the vessels
48% (878/1839) of the drowning deaths

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Results: RR for those wearing a PFD

Unadjusted RR	0.78 (95% CI 0.68 to 0.91)
Comparing persons from the same vessel	
Unadjusted RR	0.50 (95% CI 0.34 to 0.71)
Adjusted for sex and age	**0.51 (95% CI 0.35 to 0.74)**
Omitted the 120 boaters in 50 vessels with a person who entered the water for rescue or to swim to safety	
Adjusted RR	0.53 (95% CI 0.36 to 0.77).
Only the 201 vessels with complete data for their 497 boaters and accounted for matching	
Adjusted RR	0.49 (95% CI 0.31 to 0.78).

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Limitations

Analysis limited to only 629 boats (35%) of the boats that met the criteria but had missing data

Analysis did not include key drowning risk factors:

- Alcohol use
- Swimming ability

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Conclusions

- PFD use decreased by 50% boaters' risk of fatal drowning when their boat capsized or sunk.
- Estimate may be biased.

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Implications

Promote life jacket/PFD use in boating

- Standards for recreational boating
- Standards for transportation

Expand PFD use for non-boating settings

- Swimming
- Near water

Seattle Children's
HOSPITAL • RESEARCH • FOUNDATION

Seattle, Washington, USA