

Estimating DCS risk for Emergency Conditions

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Question

Three men performed a ~~33~~ dive to 150 feet for 33 minutes, and decompressed at 25 feet for minutes with no decompression stops.

How many suffered DCS ?

FYI: USN Air Table says take 83 minutes at decompression stops

Answer

Three men performed a dive to 150 feet for 33 minutes, and decompressed at 25 feet for minutes with no stops.

How many suffered DCS ?

FYI: USN Air Table says take 83 minutes at decompression stops

NO cases of DCS!



Ref: Van der Aue et al. NEDU Report 8-49, 1949

Temple et al. NMRC Report 99-02, 1999

Question 2

Five men performed a dive to 150 feet for 27 minutes, and decompressed at 25 feet for minutes with no decompression stops.

How many suffered DCS ?

FYI: USN Air Table says take 54 minutes at decompression stops

Question 2

Five men performed a dive to 150 feet for 27 minutes, and decompressed at 25 feet for minutes with no stops.

How many suffered DCS ?

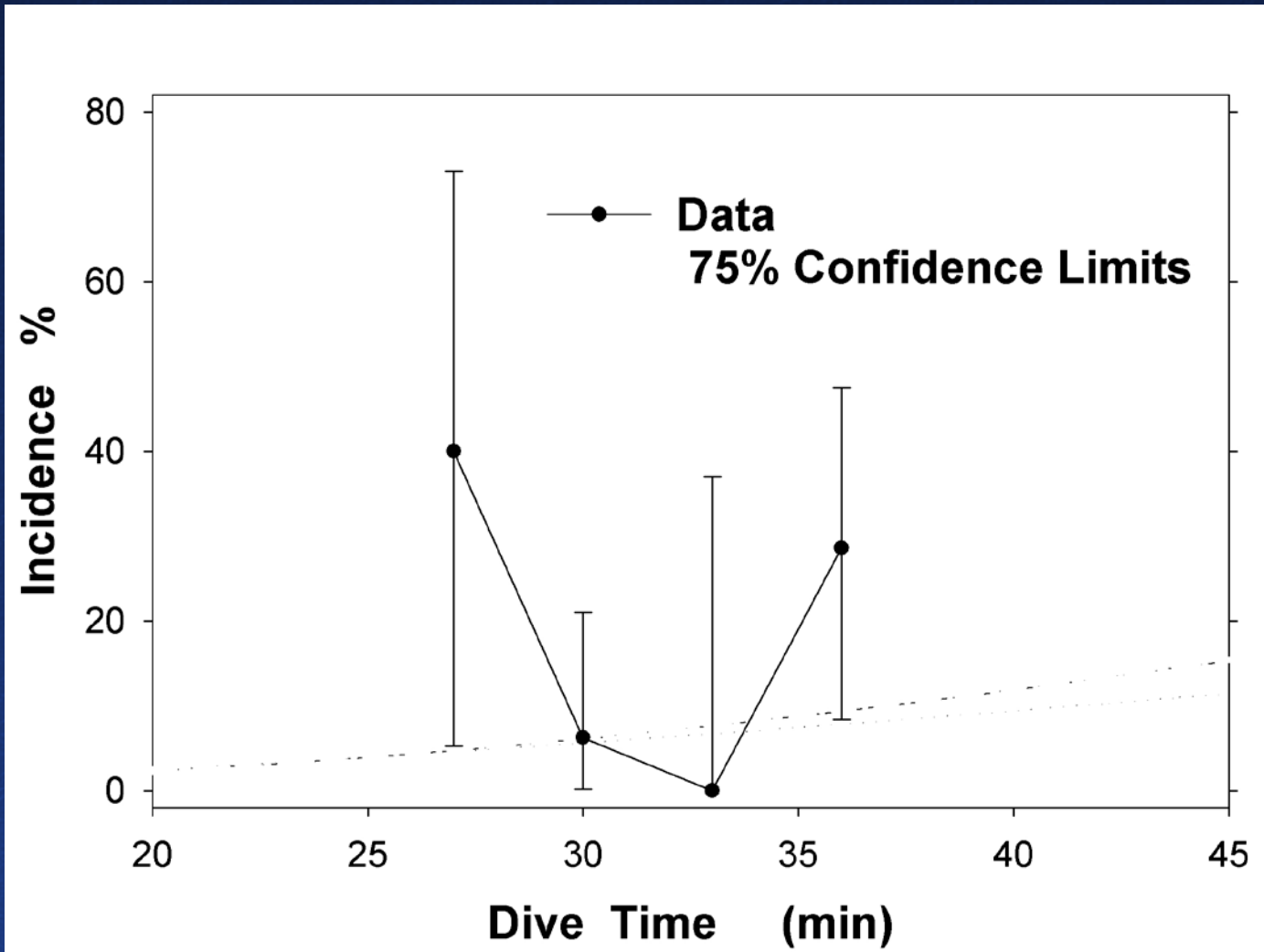
FYI: USN Air Table says take 54 minutes at decompression stops

Two cases 40 %

Ref: Van der Aue et al. NEDU
Report 8-49, 19
Temple et al. NMRC Report
99-02, 1999

The Whole 1949 Experiment

Non-exercising subjects



← USN limit is 5 min

The Lessons so far

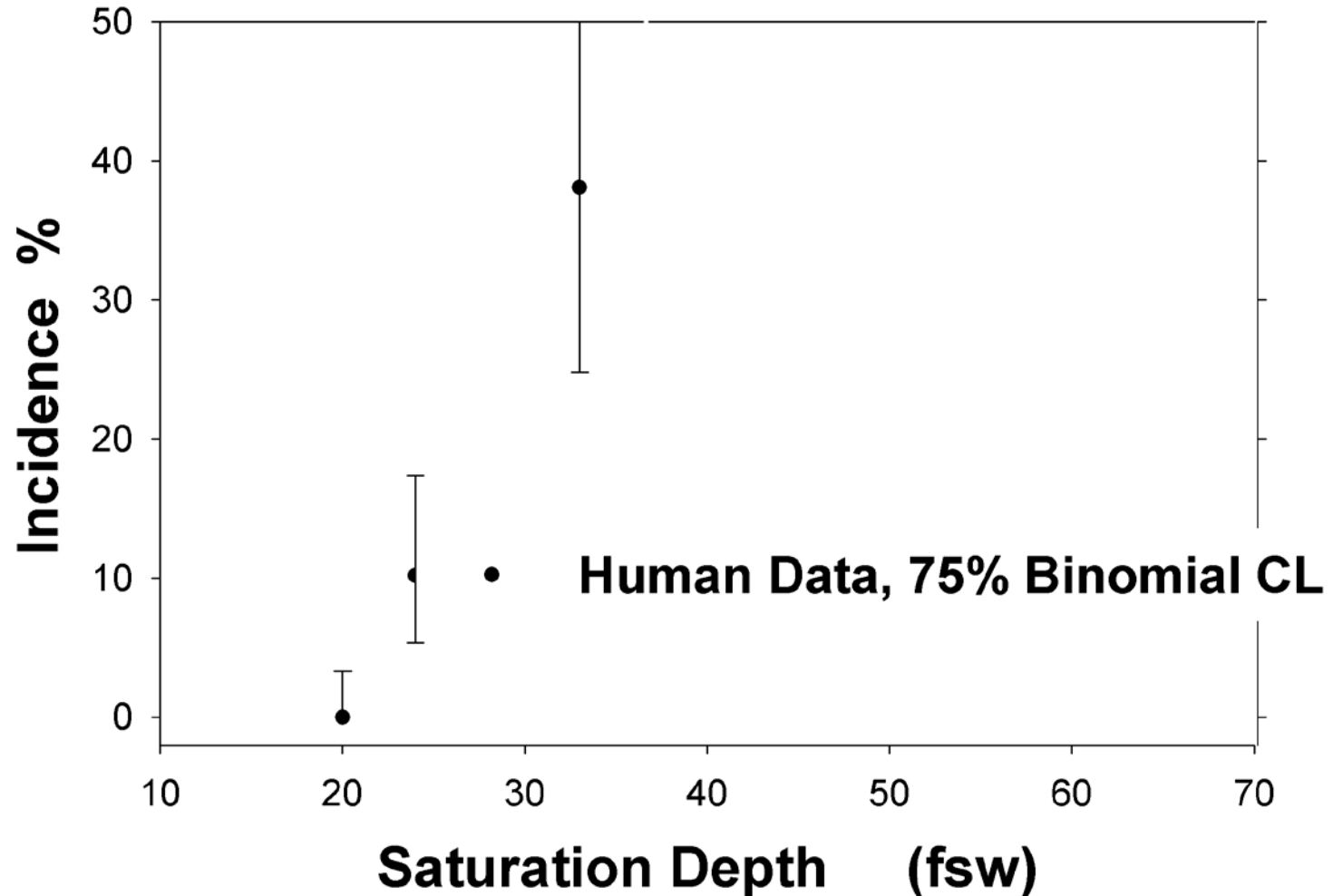
- DCS is a random event
- DCS is not reproducible



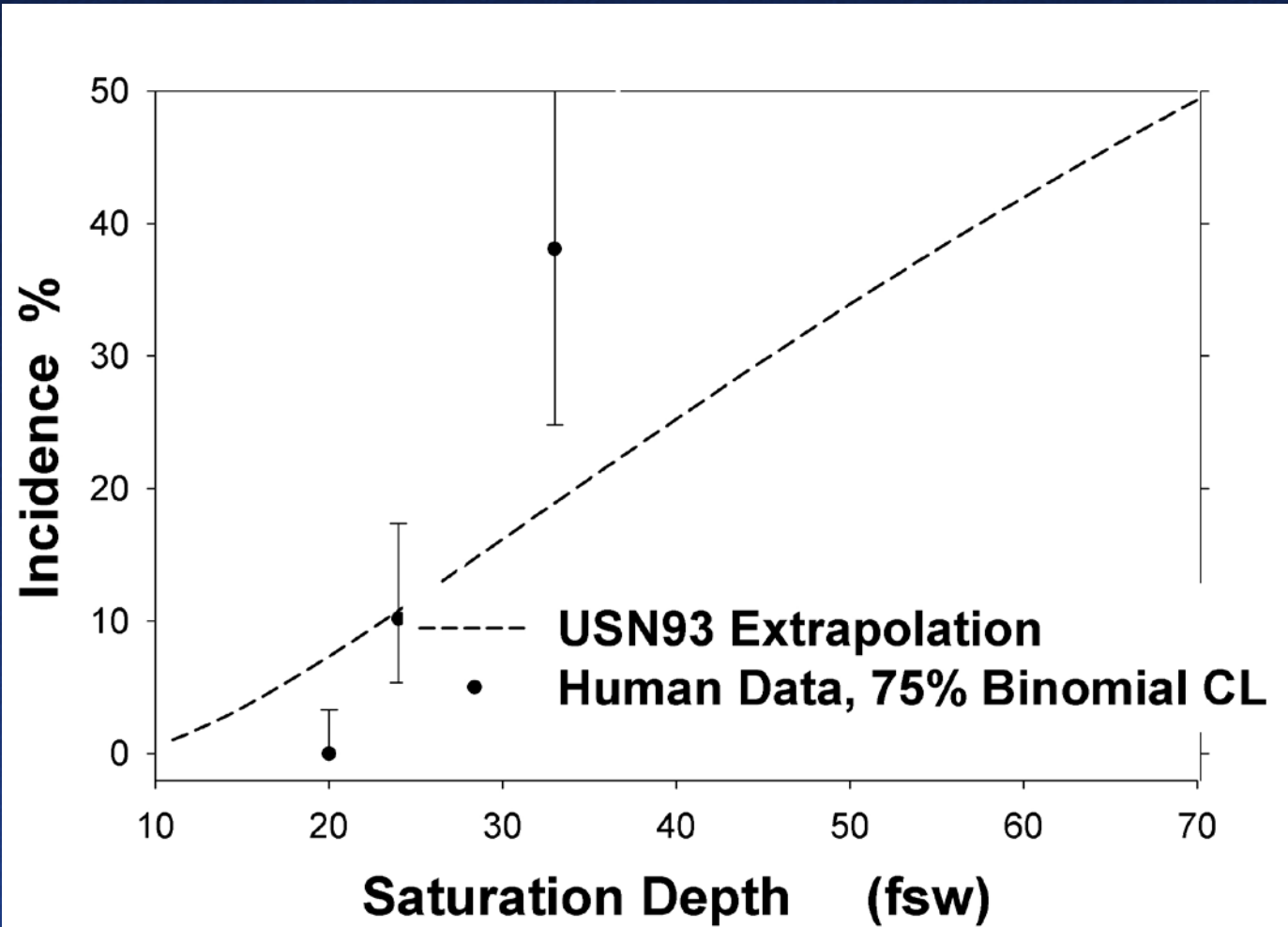
- Look for data – your intuition is unreliable
- Violating a decompression “limit” does not guarantee DCS

DCS has a Dose-Response Curve

Our interest is the High End



Previously we missed the Dose-Response Curve



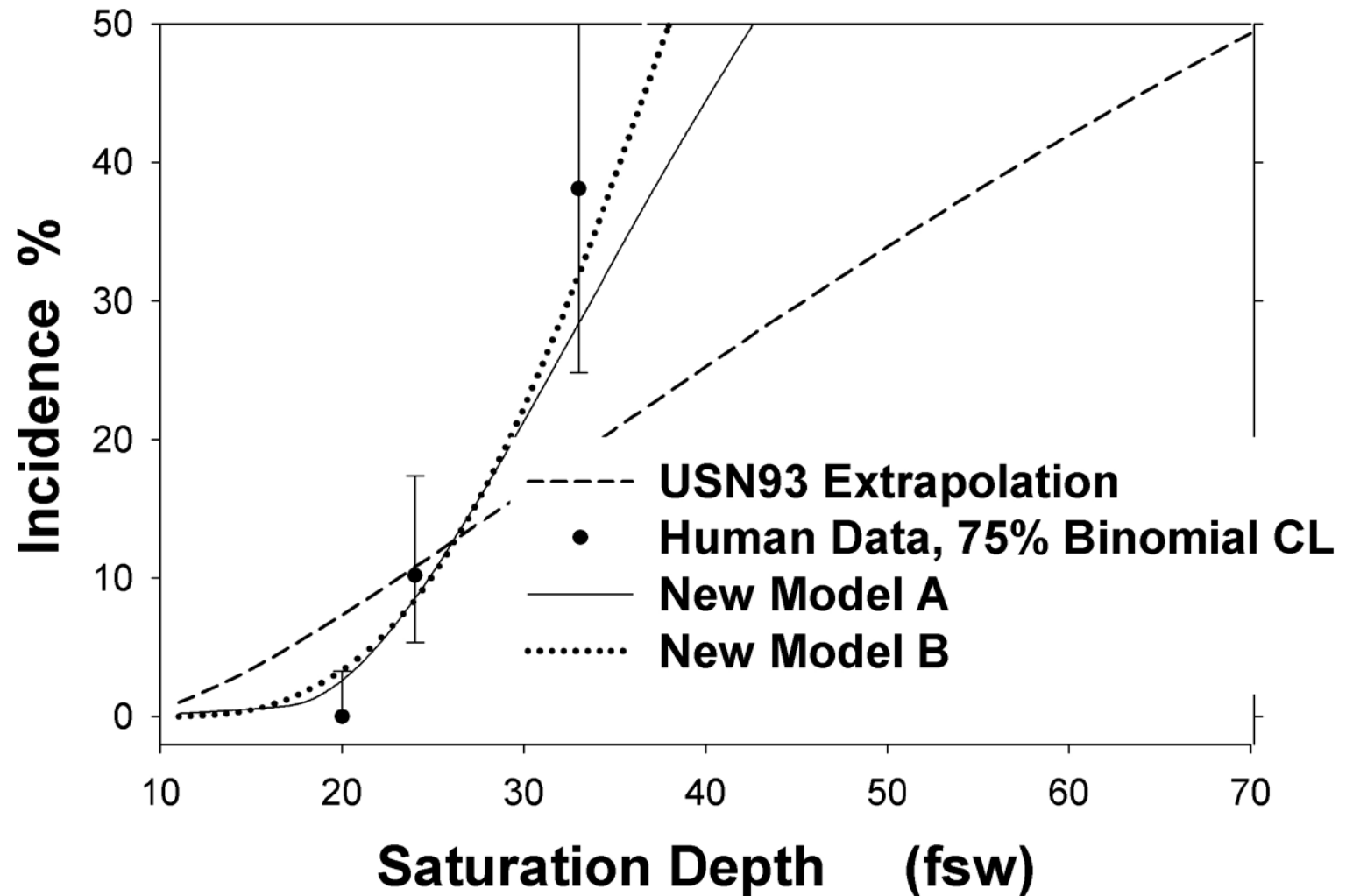
USN93 fits usual Navy diving conditions very well

Fixing the Dose-Response Curve



- Allow a Steeper Curve
 - Several variants
 - Prob of DCS = $f(\text{depth, time, ...})$
- Use Higher Incidence Data
 - Including experiments back to 1944
 - N= 3,300 Dives, 200 DCS cases

Success



Now What ?

Which model is RIGHT ?

Which model is WRONG ?

ALL

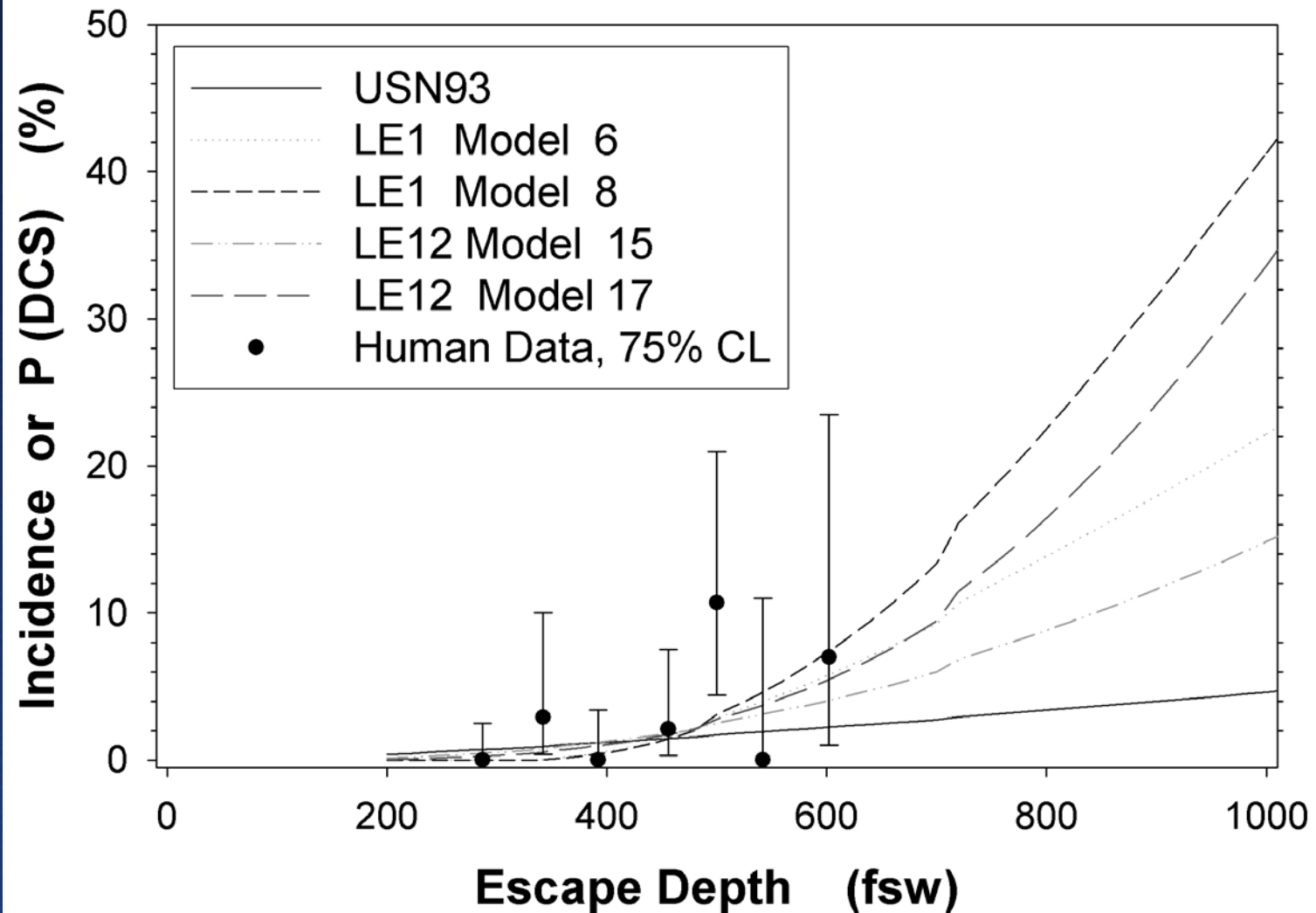


Go with the best model ?

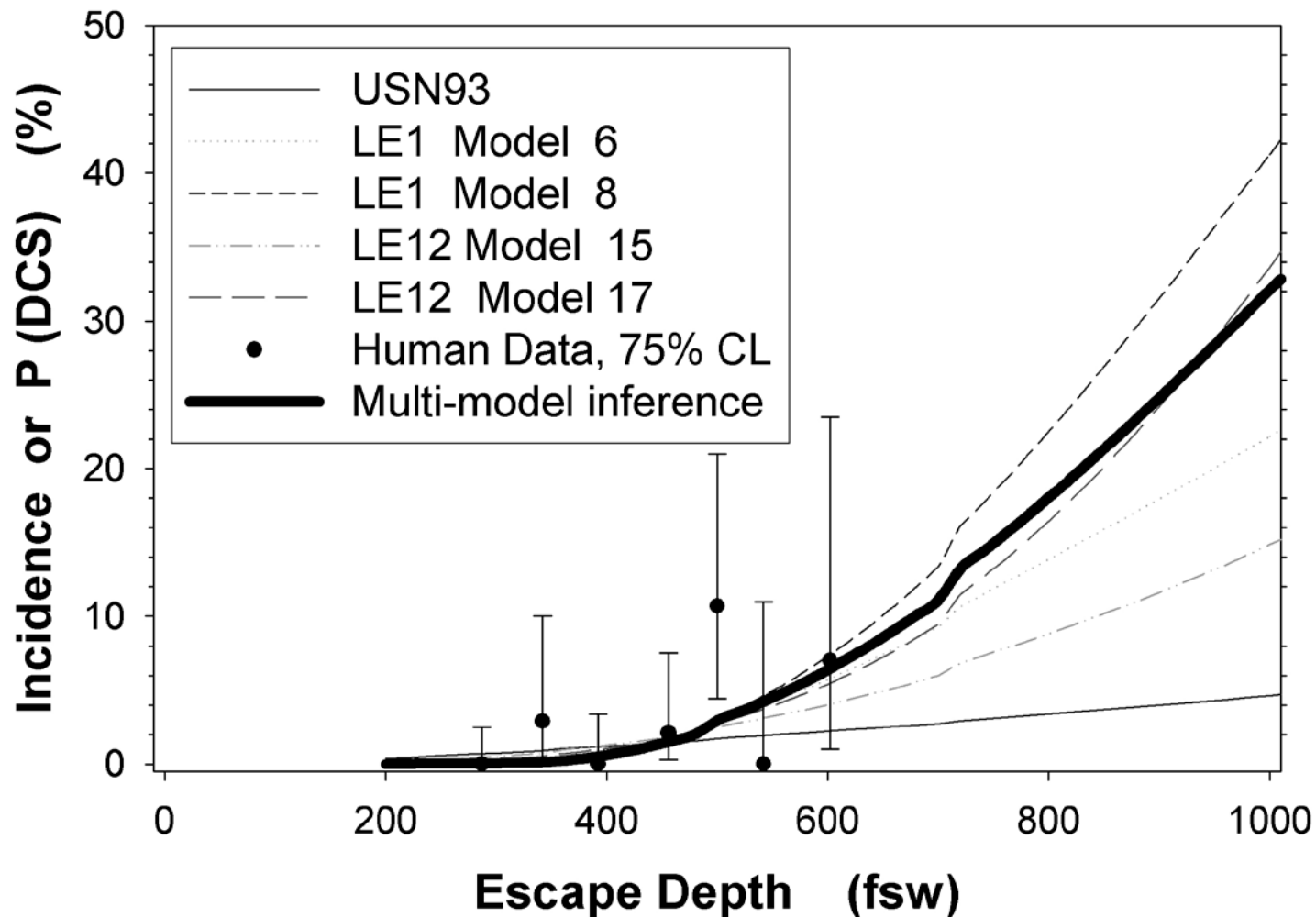
Go with the best *information* ?

Multi-model Inference


Submarine Escape Dose-Response



Submarine Escape Dose-Response – Multi-model Inference



Conclusions

- 
1. Accept variability of DCS
 2. Use good data or a good model (see ours on the poster)
 3. For prediction, use information-weighted model (multi-model inference)

Disclaimer

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