

Using Checklists and Algorithms to Improve Qualitative Exposure Judgment Accuracy

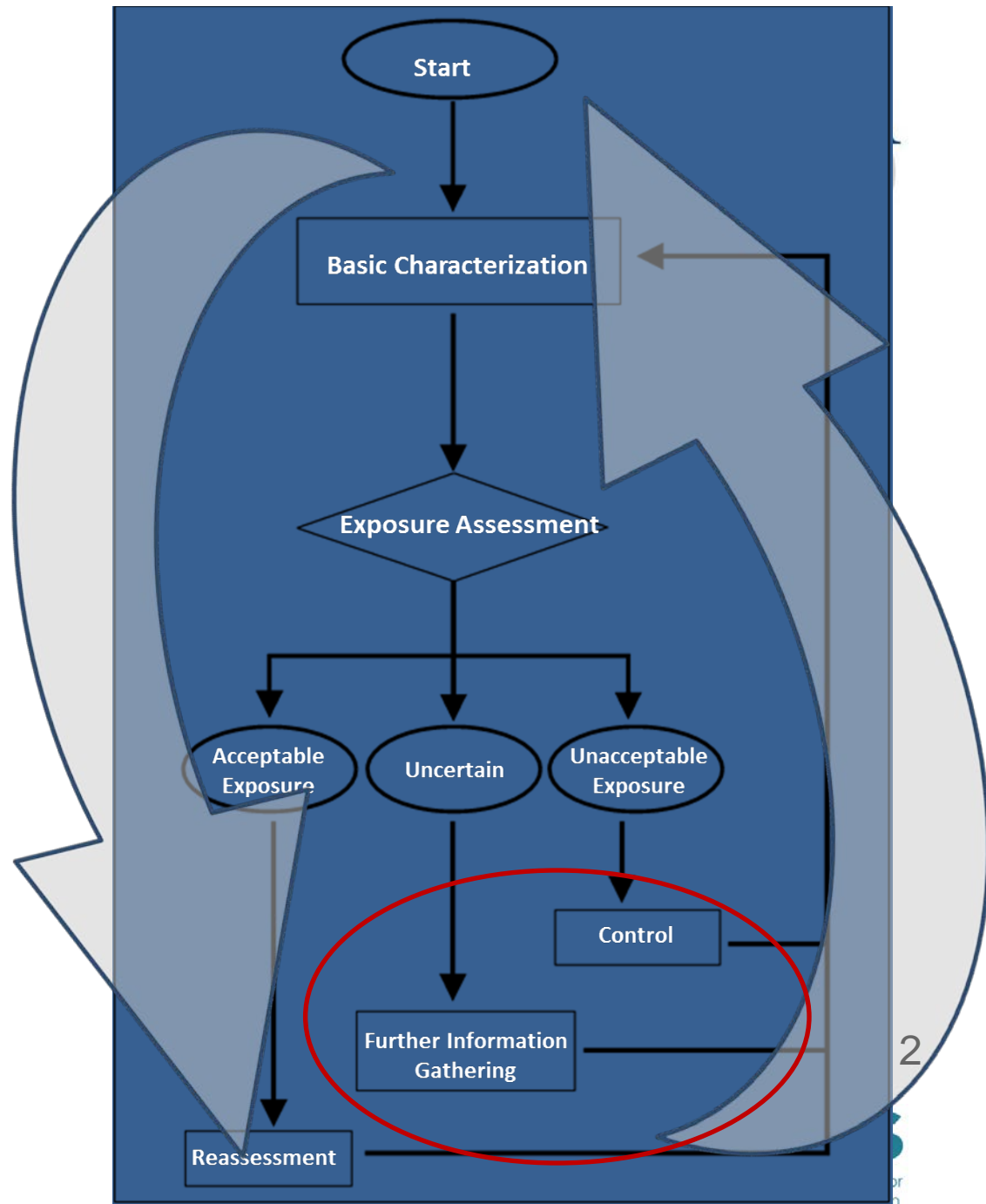
Susan Arnold¹, Mark Stenzel², Daniel Drolet³,
Gurumurthy Ramachandran¹

University of Minnesota, Division of Environmental Health Sciences, School of Public Health, Minneapolis, USA

²Exposure Assessment Solutions, Inc. Health, Arlington, VA, USA

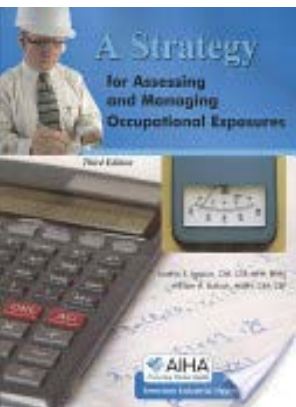
³AIHA EASC

Decision Making using the AIHA Exposure Assessment Strategy



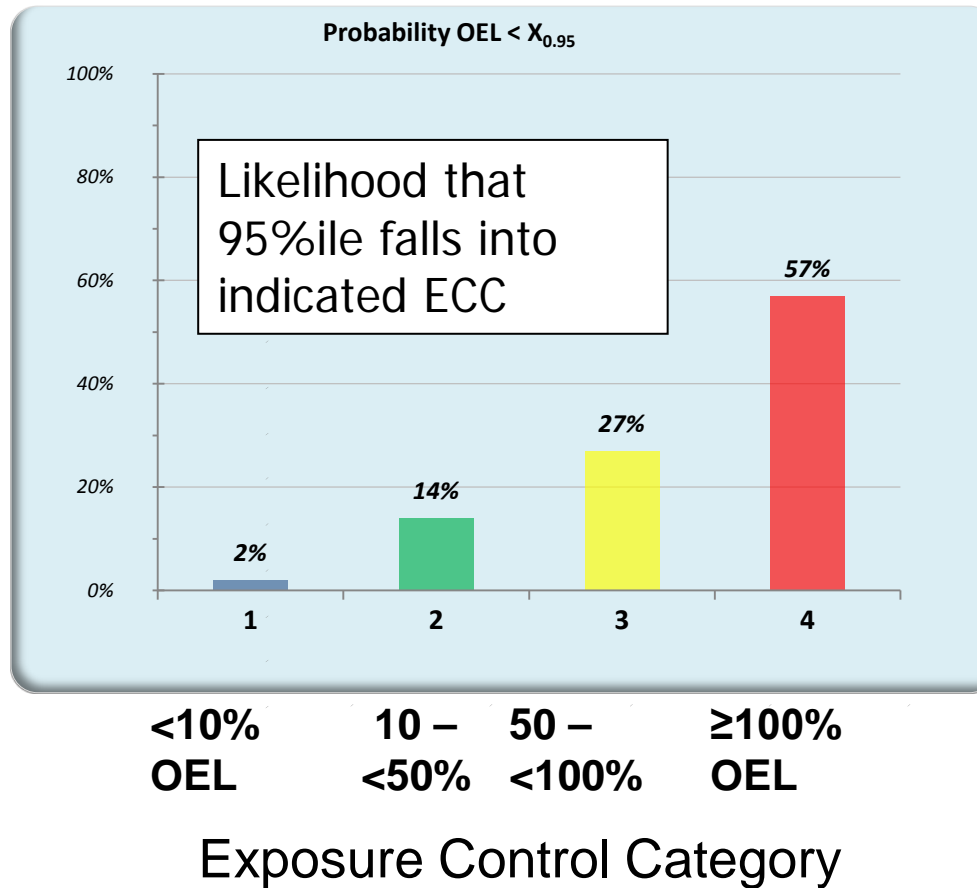
What is “Professional Judgment” ?

- The application and appropriate use of knowledge gained from the formal education, experience, experimentation, inference, and analogy. The capacity of an experienced professional to draw **correct inferences** from incomplete quantitative data, frequently on the basis of observations, analogy and intuition.



- Ref: Bullock, W.H. and Ignacio, J.S: (editors)
A Strategy for Assessing and Managing Occupational Exposures,
Third Edition. Fairfax, VA: American Industrial Hygiene Association
(2006).

Expressing judgments categorically, as probabilities



Professional Judgment Workshops



Goals:

- Investigate accuracy of subjective qualitative exposure judgments
- Evaluate impact of heuristics and algorithms on improving exposure judgment accuracy

Database of Exposure Scenarios

- Minimum 6 personal exposure measurements
 - used to develop confident reference ECCs
- Presented in 2 page narrative
 - excluding sampling data
- Information about task(s), physical environment and exposure determinants 6

The Qualitative EA Checklist

- Applying simple algorithms or heuristics to improve judgment accuracy
- Algorithms based on physical chemical principles, developed empirically, through experience
- Checklist ensures consistent application, every time

Checklist Tool

Qualitative Exposure Assessment tool

Gas and Vapors

Name
Methyl ethyl ketone (MEK)

OEL
50 ppm

Sat Vap
91 mm of Hg

1 **Select ObsLC** Good – General ?

Factor 1/1,000th of Saturation

Results

SVC 120000 ppm

C_{max} 120 ppm

X_{0.95} 240 %

Category **4**

Recommended Control :

+ respirators & engineering controls, work practice controls

2

VHR 1.82

VHR scale 3

ReqLC GGv with capture at emission points

Select the ObsLC ?

General Ventilation ~ 3 to 6 air turnovers /hr.

Predicted exposure Category **4**

Conception : Susan F. Arnold, Mark Stenzel and Daniel Drolet

Checklist Workshops

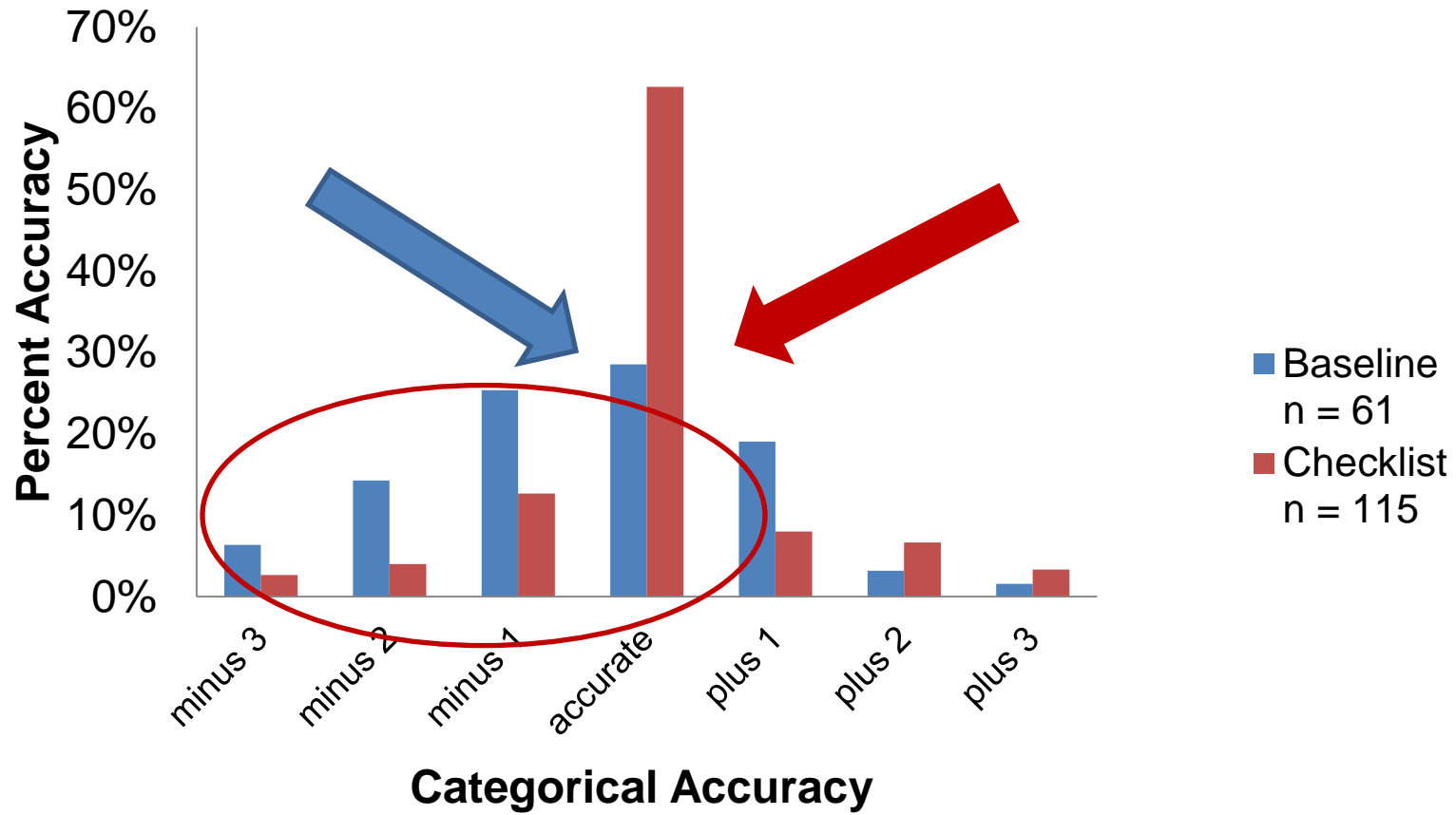
3 – 1 day workshops:

- 2 AIHA Local Sections (n = 39)
- Judgments collected:
 - 61 baseline, 115 Checklist
- 1 Master's of IH class, (n =8)
 - 24 baseline, 80 Checklist

Accuracy was evaluated categorically

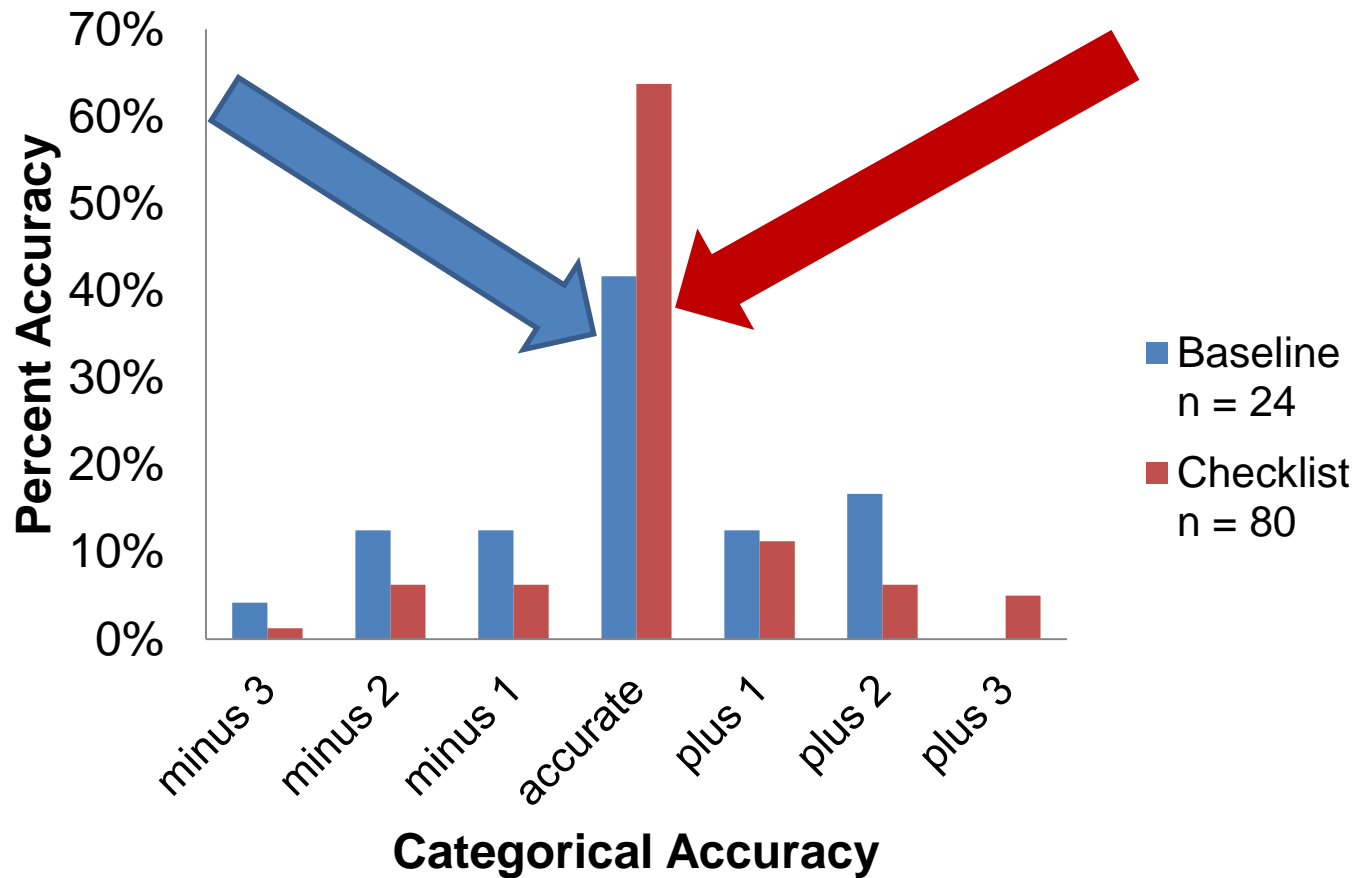
Checklist Workshop Results

**Practicing IHS:
 Percent Categorical Exposure Judgment Accuracy**



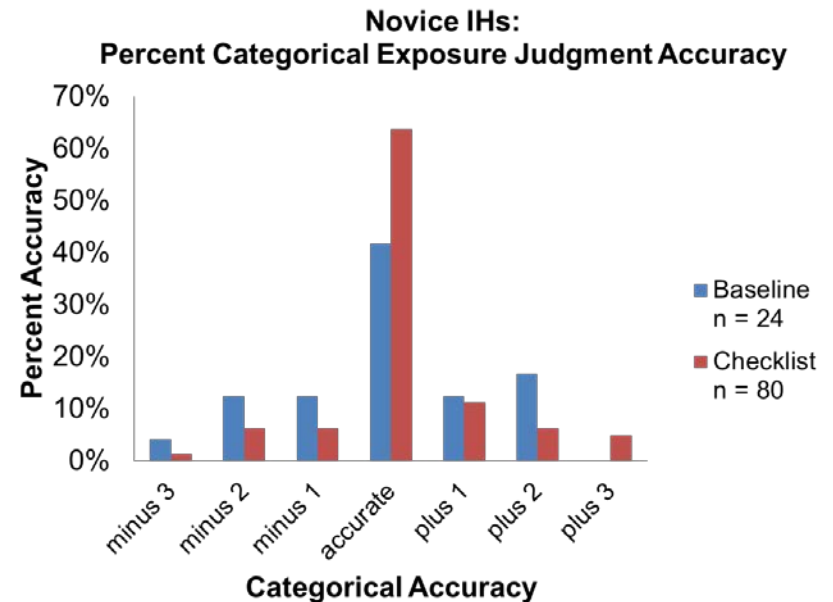
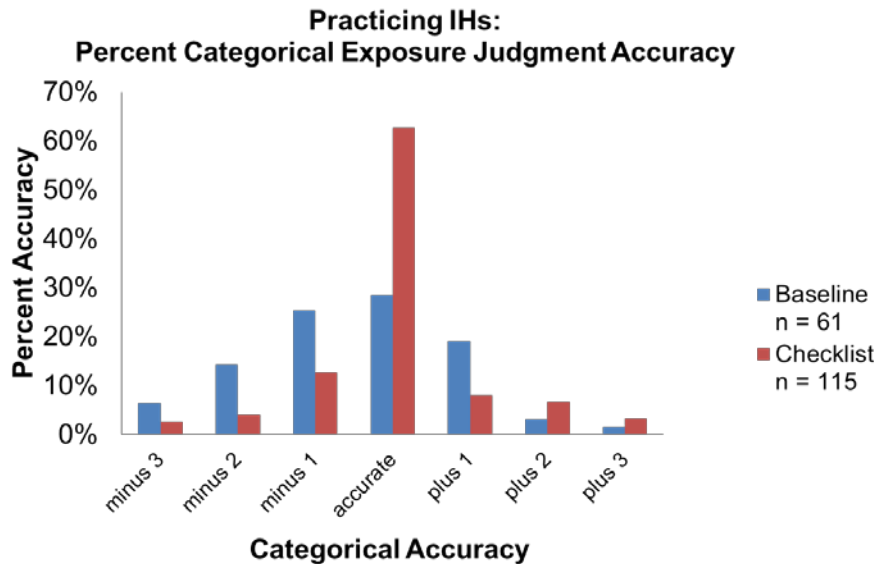
Checklist Workshop Results

**Novice IHs:
 Percent Categorical Exposure Judgment Accuracy**



Checklist Workshop Results

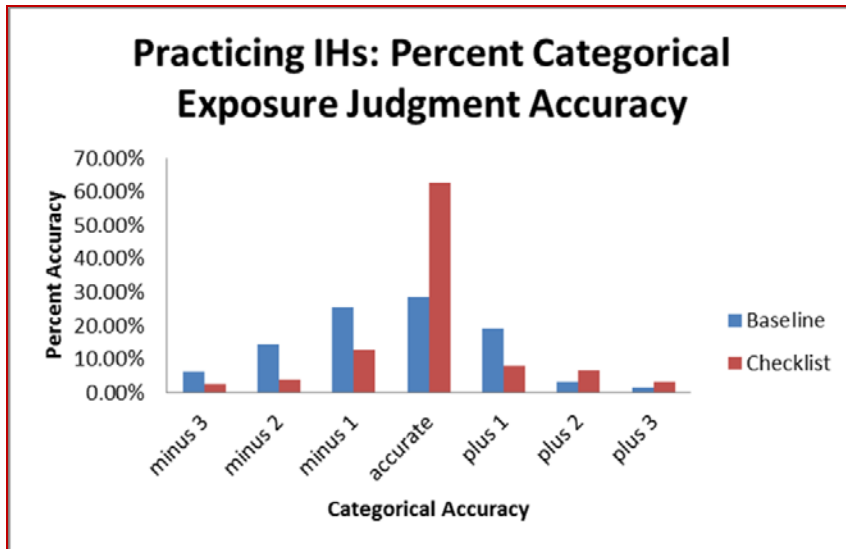
Comparing Practitioners and Novices



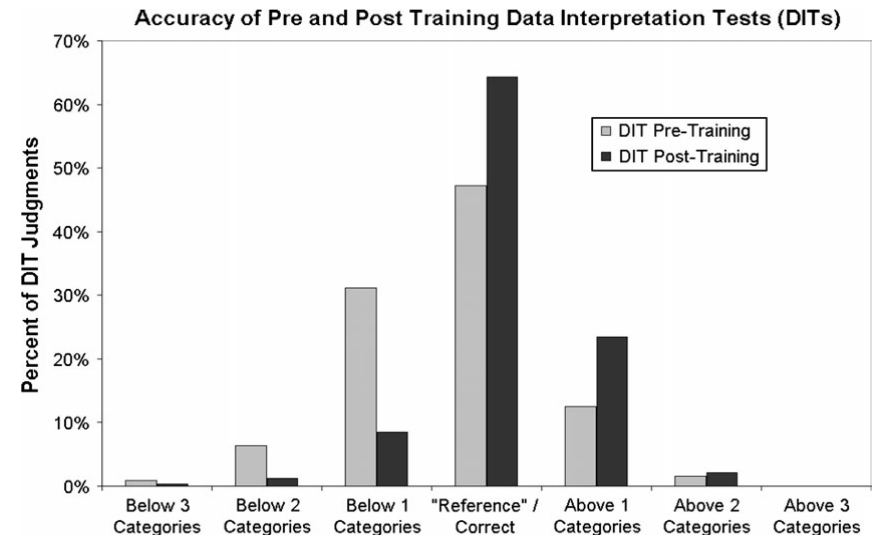
Judgment accuracy increased significantly ($\chi^2 (1) = 25.36$, $p < .0001$) when decisions were guided by the Checklist.

Comparing Qualitative and Quantitative Strategies

Qualitative Judgment



Quantitative Judgment



Logan et al., (2009) Occupational Exposure Decisions: Can Limited Data Interpretation Training Help Improve Accuracy?

Conclusions

In our small study:

- Judgment accuracy increased from ~ 30% to > 60%!
- Novice Checklist accuracy equal to practicing OH Checklist accuracy
- Need to further validate checklist-based qualitative exposure assessments
- Future direction: Using Checklist-based qualitative exposure assessments to develop informed priors