One, Two, Many: Exploring Expert and Non-Expert Risk Judgments of Multiple Risk Factors

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Expert Judgment Workshop
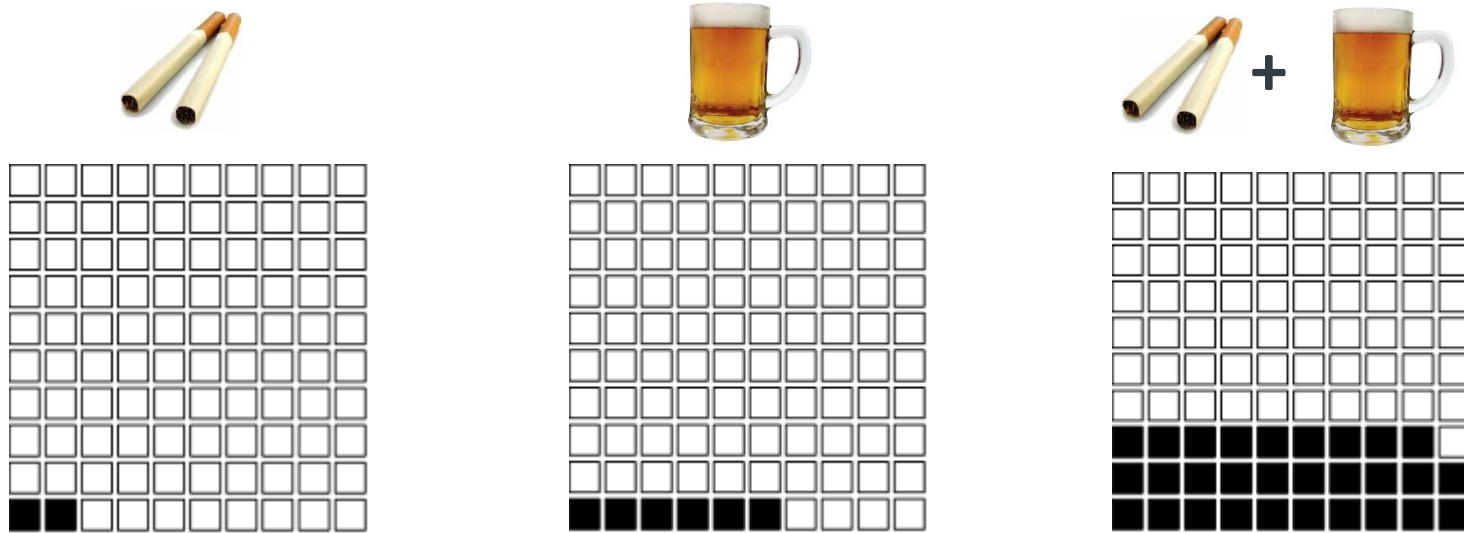University of Strathclyde, Glasgow
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Presentation Structure

- Research Overview

- Study 1: Expert vs. Non-Expert Judgments of Synergistic Risks

- Study 2: Improving Non-Expert's Judgments of Synergistic Risks

- Conclusions

Research Overview - Synergistic Risks

☐ = A person who will not develop oesophageal cancer

■ = A person who will develop oesophageal cancer

Examples: Tobacco & Radon = *Lung Cancer*
Urbanicity & Family History = *Schizophrenia*
Habitat Destruction & Climate Change = *Extinction*
Aspirin & Clopidogrel = *Gastrointestinal Bleeding*

Darby et al. (2005),;Delaney et al. (2007); Hannah et al. (2005); Van Os et al. (2005); Zambon et al. (2000)

Overview: Do people understand synergistic risks?

- Results of **21 previous studies** show that individuals judge synergistic risk combinations to present the following risk models:

French, Marteau, et al. (2004); French, Sutton, et al. (2006)
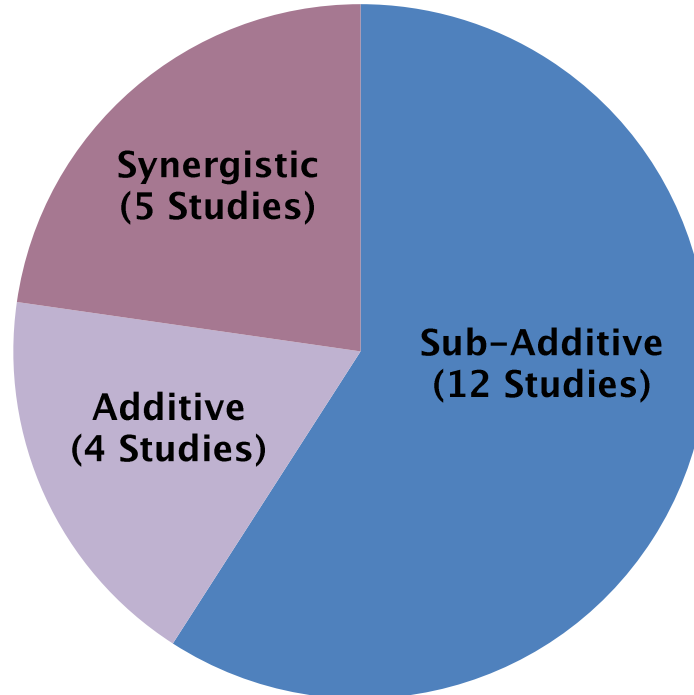
Study 1: Expert vs. Non-Expert Judgment

- **Research question:** *Can domain-related expertise help individuals to understand that a particular hazard combination presents a synergistic risk?*

- Aspirin and Clopidogrel = synergistic risk of gastrointestinal bleeding (Delaney et al., 2007)

- Via an online questionnaire, participants asked to judge whether the risk of internal bleeding for an individual who takes both Aspirin and Clopidogrel would be:

  - Less than (sub-additive), or

  - Equal to (additive), or

  - More than (synergistic)

    … the risk for an individual who takes Aspirin only *added to* the risk for an individual who takes Clopidogrel only.
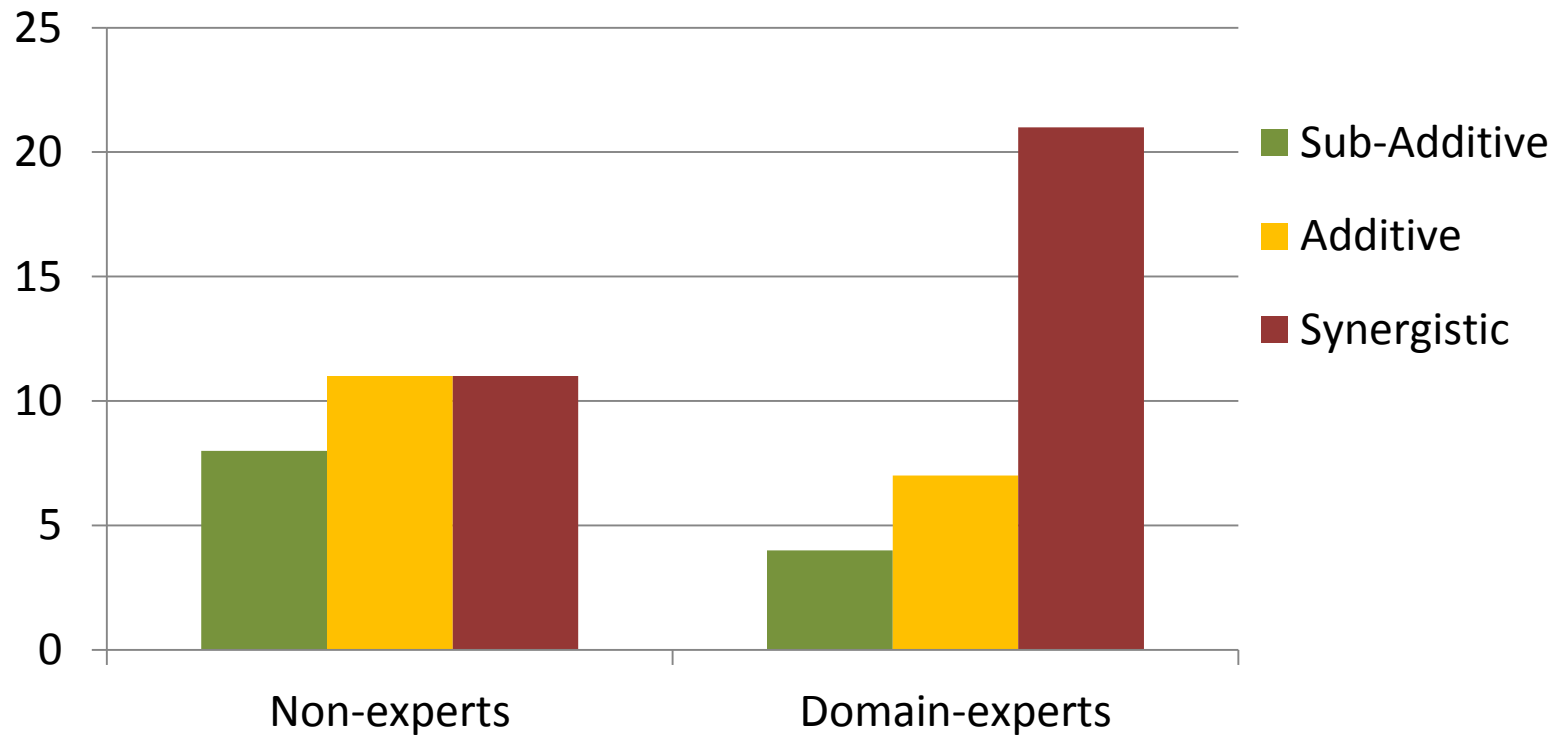
Study 1: Expert vs. Non-Expert Judgment

- Participants (N = 61) recruited using chain-referral sampling

  - Domain-expert group (n = 31)
    - Independent Prescribers (i.e., Pharmacists and GPs): currently employed as Independent Prescriber AND considered drug-interactions at least once per week in work-a-day activities

  - Non-expert group (n = 30)
    - Not Independent Prescribers

  Both groups matched on age (M = 42 / 40), gender, education (Bachelor's or above), and country of residence (UK)

- Analysis
  - Dependent and independent variables = categorical data
  - Hierarchical loglinear analysis

Study 1: Expert vs. Non-Expert Judgment

Figure 1. Domain-experts' and non-experts' judgments of the risk model attributable to the Aspirin-Clopidogrel drug combination

- Interaction between Risk Judgment x Expertise: $\chi^2 (1) = 5.99$, $p < 0.05$
- Significantly greater proportion of domain-experts (cf. non-experts) judged the combination would present a synergistic risk

Study 1: Expert vs. Non-Expert Judgment

- Risk judgments for particular synergistic combinations can be influenced by acquired:
  - domain-specific knowledge, and/or
  - judgmental experience

- Consistent with Bolger & Wright (1994) and Rowe & Wright (2001) : Experts more likely to show "good" judgemental performance when the judgment task is high in:
  - *ecological validity* i.e. degree to which the judgement is made within the judge's professional domain
  - *learnability* i.e. degree to which the judgemental veridicality can be improved by available objective data or feedback

- Note: 94% of IPs reported being aware that separate use of aspirin *or* clopidogrel increases the risk of gastro-intestinal bleeding. Only 10% of non-experts reported being aware of these side-effects

- Hence, the results indicate an individual's understanding of synergistic risks can (potentially) be improved
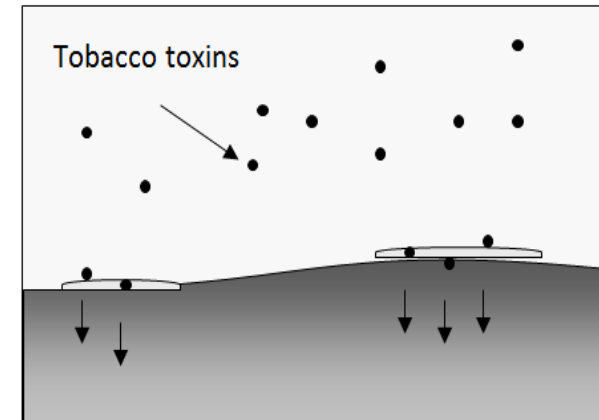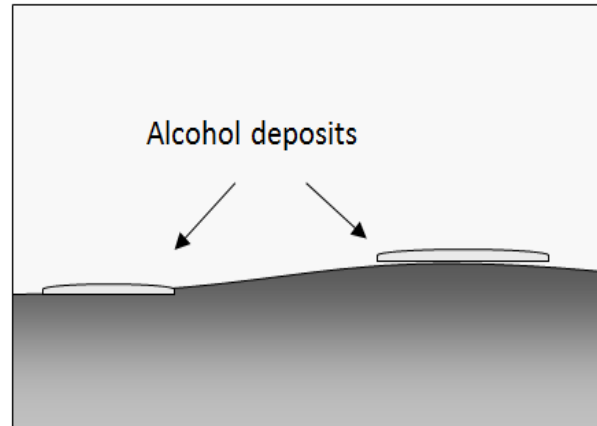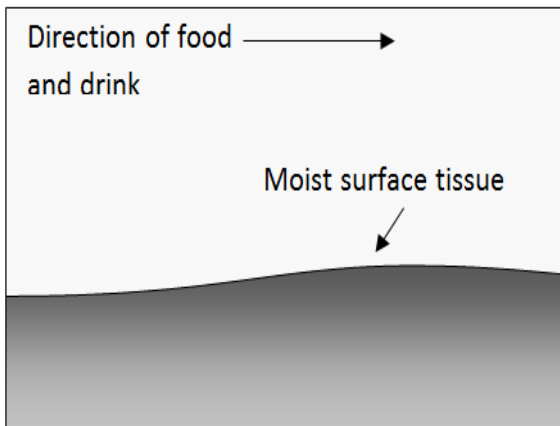
Study 2: Improving Non-Expert's Judgments

Research question: *How could the risk judgments of non-experts become more veridical for combinations that present synergistic risks?*

- We assessed whether we could improve the extent to which non-expert's understood that combined tobacco and alcohol use present a synergistic risk of developing oesophageal cancer

- First, we identified the key components of this synergistic risk:

  - The underlying **mechanism** and the resultant change in **probability**

- Then we identified how these two components might best be explained to non-experts
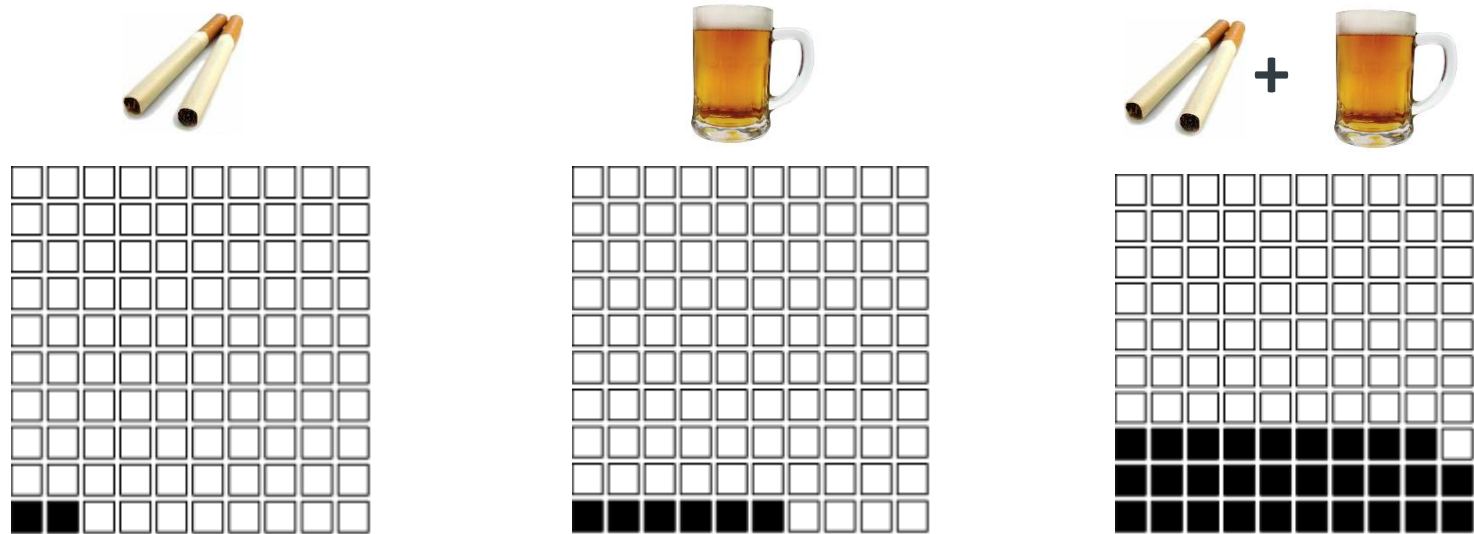 - **Simplified pictorial diagrams** and **icon arrays**

Study 2: Improving Non-Expert's Judgments

- **Using pictorial diagrams to explain the mechanism**

Study 2: Improving Non-Expert's Judgments

- **Using icon arrays to explain the probabilities**

☐ = A person who will not develop oesophageal cancer

■ = A person who will develop oesophageal cancer

Study 2: Improving Non-Expert's Judgments

- Participants (*N* = 127): PG management students who were randomly assigned to our of four conditions:

Message Condition	Message Format
1. Control	n/a
2. Mechanism	Simplified diagrams
3. Probabilistic	Icon arrays
4. Mechanism + Probabilistic	Simplified diagrams + Icon arrays

- Via a questionnaire, participants then judged whether the risk of developing oesophageal cancer for an individual who both smokes and drinks would be:
  - Less than (sub-additive), or
  - Equal to (additive), or
  - More than (synergistic)

    … the risk for an individual who smokes only *added to* the risk for an individual who drinks only.

Study 2: Improving Non-Expert's Judgments

Risk Model Participants Attributed to the Hazard Combination

Risk Model x Risk Communication: χ^2 (3) = 9.90, $p < 0.05$. Mechanism+Probabilistic: χ^2 (1) = 11.91, $p < 0.001$
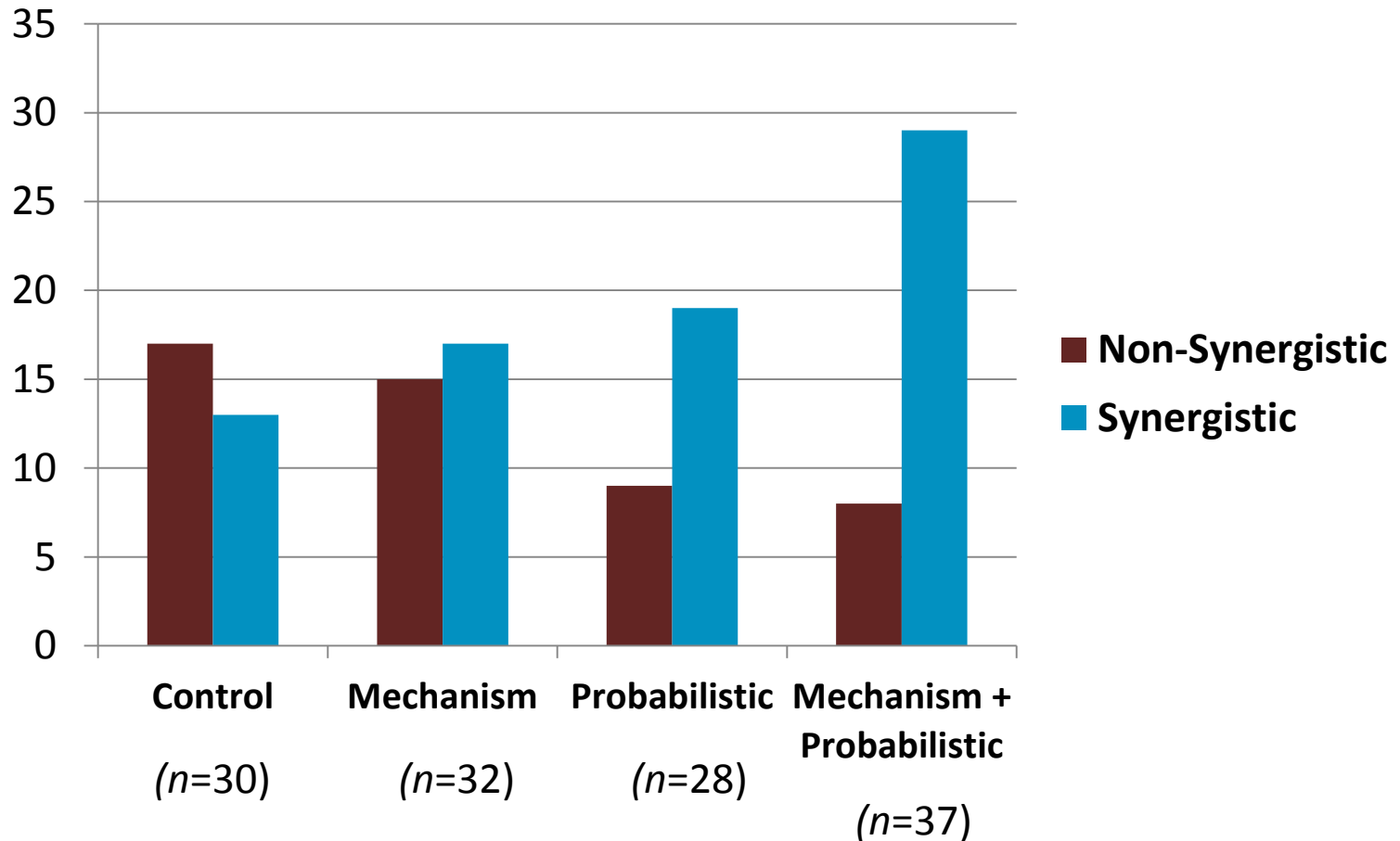
Implications and Conclusions from Both Studies

- **S1**: 'Expertise' may play a key role in the veridicality of judgments of synergistic risks. Such 'expertise' probably stems from the degree to which the judgment task in high in *ecological validity* and *learnability*

- **S2**: Carefully designed interventions can help to improve the judgments of non-experts for synergistic risks

- **S2**: Interventions that explain both the cause (mechanism) and effect (probability) may be one of the most effective means of helping individuals to better understand synergistic risks

- **S1 and S2**: Shortcomings in some expert's knowledge of the synergistic risk attributable to certain combinations (e.g., aspirin and clopidogrel) could be addressed via training that highlights both 'cause-effect' components

- **S2**: The concept of "risk" is often defined by two components:
  - **Likelihood** and **Outcome**

  Our study highlights that also understanding a third component may be important to making "accurate" risk judgments:
  - **Mechanism**

Thank you for listening

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www.southampton.ac.uk/risk

Dawson, I.G.J, Johnson, J.E.V. and Luke, M.A (2014) Using risk model judgements to better understand perceptions of synergistic risks. *British Journal of Psychology*.

Dawson, I.G.J., Johnson, J.E.V. and Luke, M.A. (2013) Helping individuals to understand synergistic risks: an assessment of message contents depicting mechanistic and probabilistic concepts. *Risk Analysis*, 33, (5), 851-865.

Appendix

Read the paragraph below and respond to the task by ticking one of the boxes.

- Research evidence shows that a person who takes a low-dose of 'aspirin' each day has a 100 in 100,000 chance of suffering gastro-intestinal bleeding in any given year. Research evidence also shows that a person who takes a low-dose of the antiplatelet drug 'clopidogrel' each day has a 10 in 100,000 chance of suffering gastro-intestinal bleeding in any given year.

Judgment task: Please now consider the chance of a person suffering gastro-intestinal bleeding in any given year if they take a low-dose of aspirin each day **and** a low-dose of clopidogrel each day.

- Do you judge the chance as being either **less than**, **equal to**, or **more than** 'the chance of gastro-intestinal bleeding for a person who takes low-dose aspirin each day' **added to** 'the chance of gastro-intestinal bleeding for a person who takes low-dose clopidogrel each day'?

       Less than   Equal to   More than