EPICOH 2023
Mumbai India

Occupational Exposure to Pesticides And Neurobehavioral Outcomes: Impact Of Different Exposure Measures on the Association

Asst. Prof. Samuel Fuhrimann
Head Research Group: Agricultural Health
Swiss Tropical and Public Health Institute

Symposium O4A3, 16.3.2023

Conflict of interest and funding

No conflict of interest

Funding:

Part of the IMPRESS Study funded by Croplife Europe

(www.impress-project.org)

Firewall between funder and researchers via independent Scientific Advisor Board

Content

1. PESTROP Study with smallholder farmers in Uganda
2. Different measures on how to assess self-reported pesticide exposure
3. Observed exposure-health associations

PESTROP
Pesticide use in Tropical settings

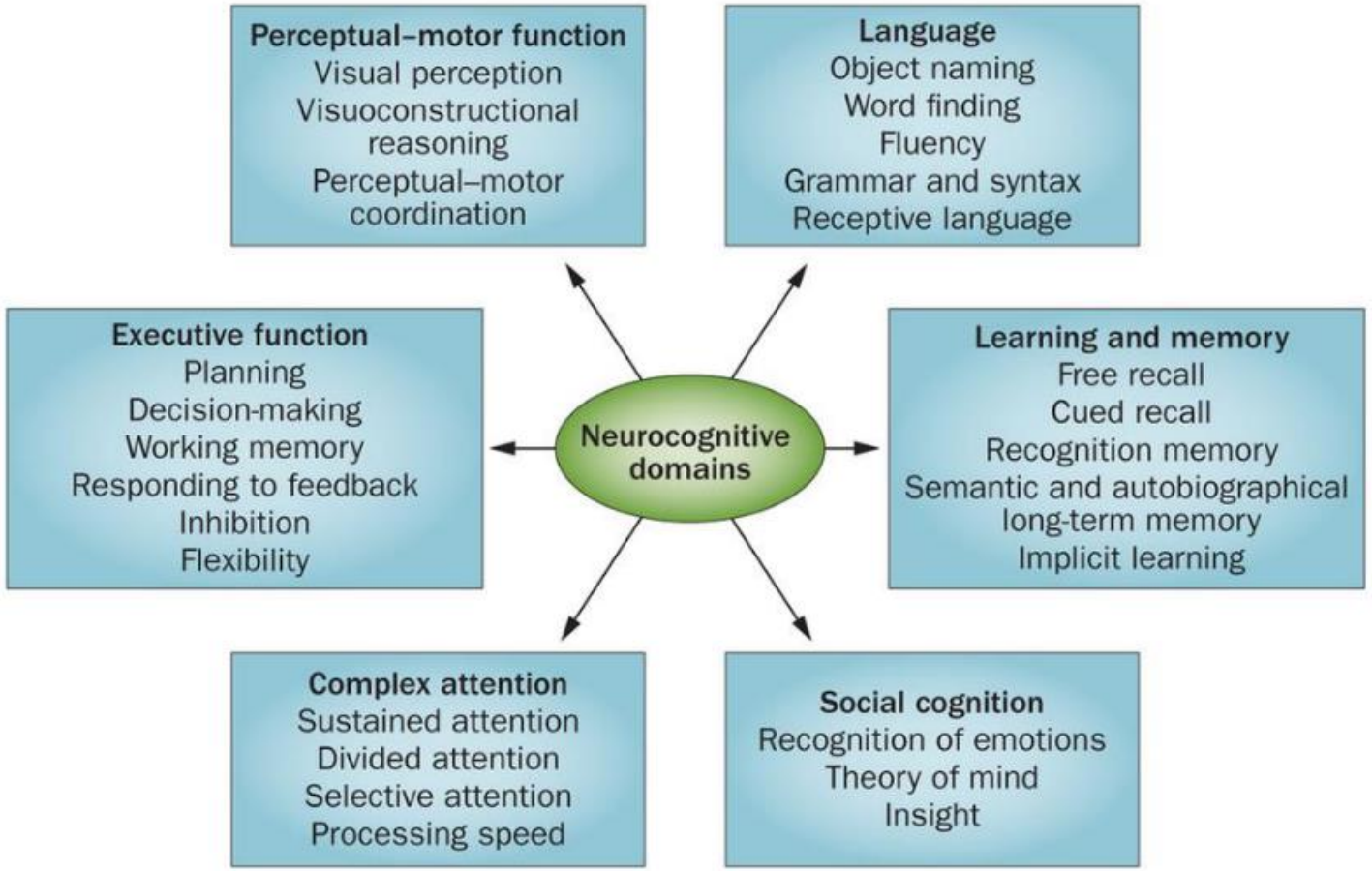
Study design

- **Longitudinal study of 253 smallholder farmers (2017 and 2019)**
- **Conventional and organic smallholder farmers**
  - Farm size less then 20 ha
  - Subsistence farmers
  - Sell in the local and regional markets;
  - Grow: beans, maize, sweet potatoes, banana, cassava, coffee, tomatoes, and groundnuts

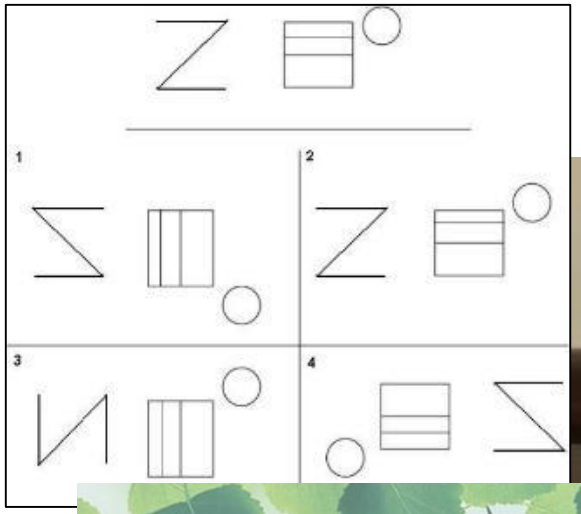
- Study protocol: Fuhrimann S, *et al.*. *JMIR Res Protoc* 2019
- KAP of pesticide handling: Staudacher et al. 2020 Environmental Health Insights
- Pesticides in air: Fuhrimann et al. 2020 Chemosphere
- Information seeking behavior: Diemer et al. 2020 Journal of Cleaner Production
- Etc.

11 Neurobehavioral tests covering five neurocognitive domains

- Language, memory, attention, executive function, and motor function



Cognitive function impaired due to glyphosate exposure



Environment International 152 (2021) 106477

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Exposure to multiple pesticides and neurobehavioral outcomes among smallholder farmers in Uganda

Samuel Fuhrimann [a,*], Andrea Farnham [b,c], Philipp Staudacher [d,e], Aggrey Atuhaire [f], Tiziana Manfioletti [b,c], Charles B. Niwagaba [g], Sarah Namirembe [f], Jonathan Mugweri [f], Mirko S. Winkler [b,c], Lutzen Portengen [a], Hans Kromhout [a], Ana M. Mora [h,i]

Neurobehavioral outcome	MIP
BVRT (scores)	0.18
Finger tapping dominant hand (scores)	0.29
Trail making A log10 (minutes)	0.31
Finger tapping non-dominant hand (scores)	0.42
Digit symbol (scores)	0.45
Semantic verbal fluency (scores)	0.50

AGRICOH

Zoom Webinar

„Pesticides mixtures“

28 April 2022

3 pm – 5 pm (CEST)

Registration required

Assessing the effect of pesticide biomarker mixtures on neurobehavioral outcomes among smallholder farmers in Uganda

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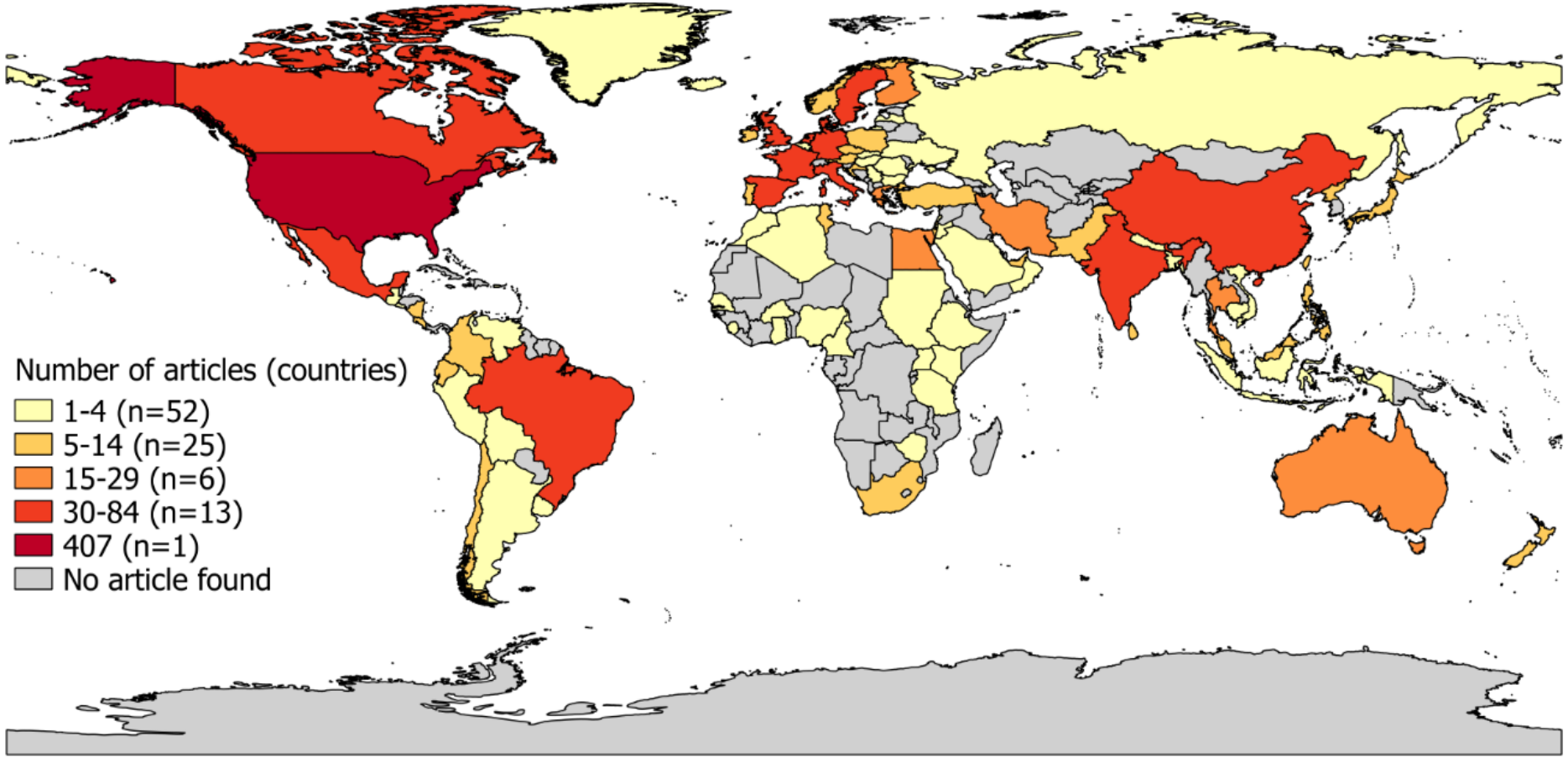
There are different ways to assess pesticide exposure…

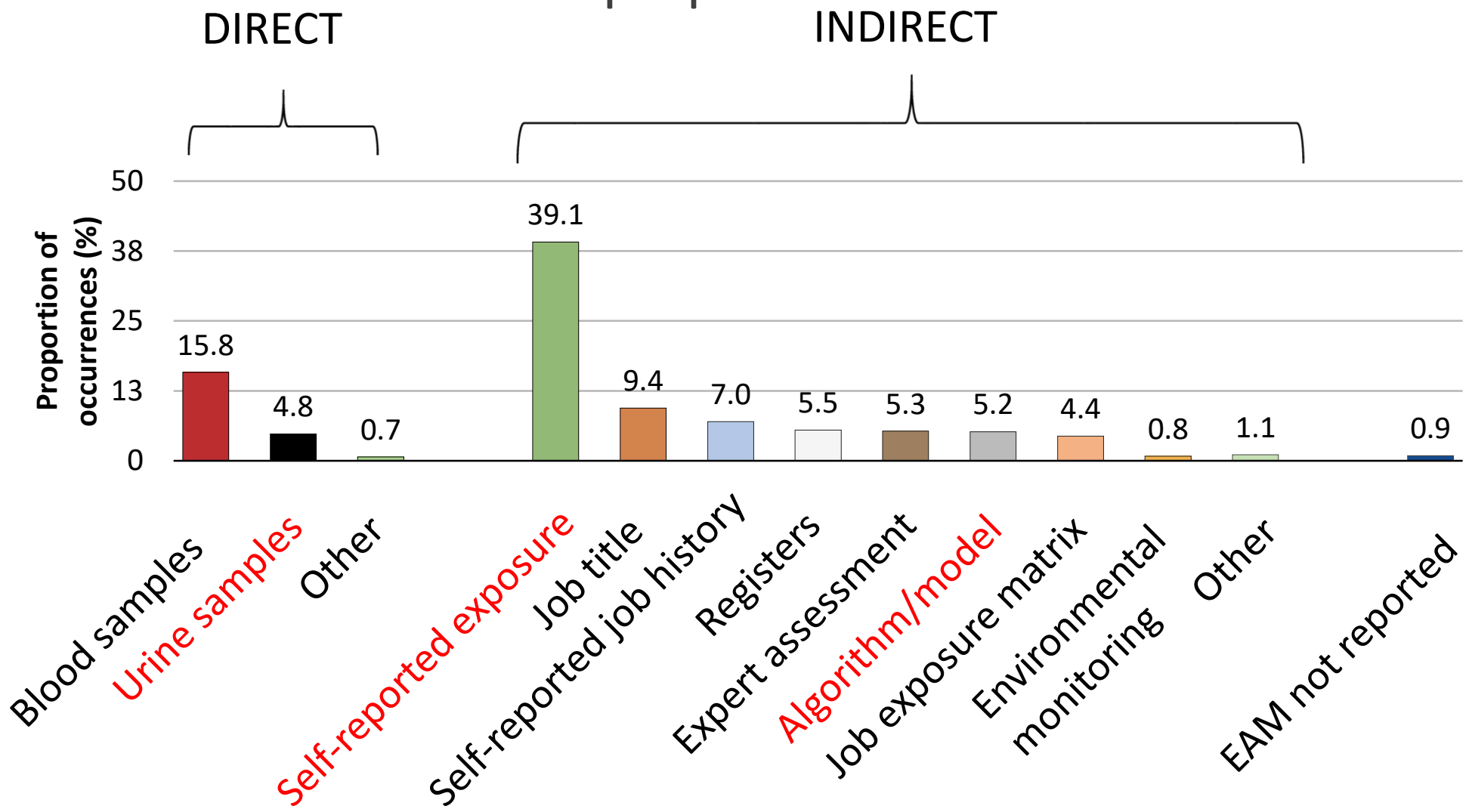
How can a exposure contrast be established in a smallholder farming population in Uganda?

Literature review on pesticide exposure assessments in occupational epidemiological studies



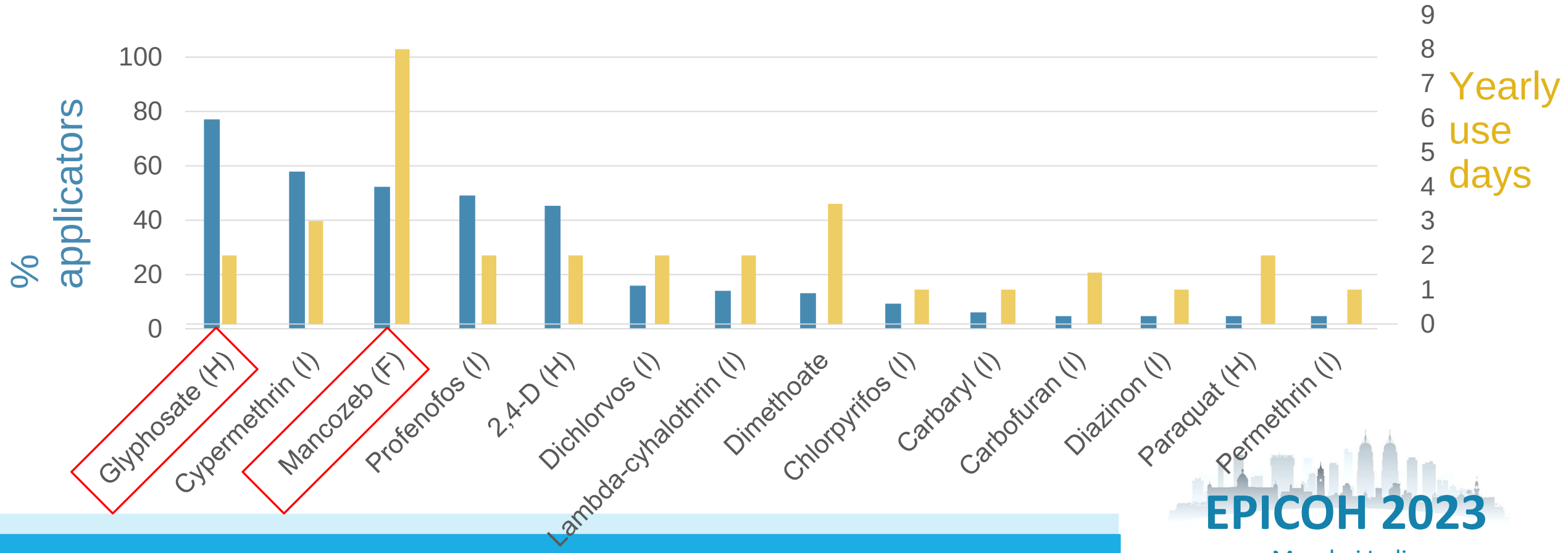
(Ohlander et al. 2020)

Proportion of exposure assessment methods reported in the 1’298 papers



(Ohlander et al. 2020)

Uganda smallholder spray in median 9 days per year (IQR 26)
→ Glyphosate and Mancozeb chosen



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Exposure intensity scores (EIS)

- **Exposure-intensity score (EIS) for an average application** =

(mixing + application)
x frequency of PPE use
x change of cloths
x shower after application

	Mixing	Spray	PPE	Change	Shower	Total EIS
Min	5	8	0.14	0.7	0.7	0.89
Max	5	8	1	1	1	13

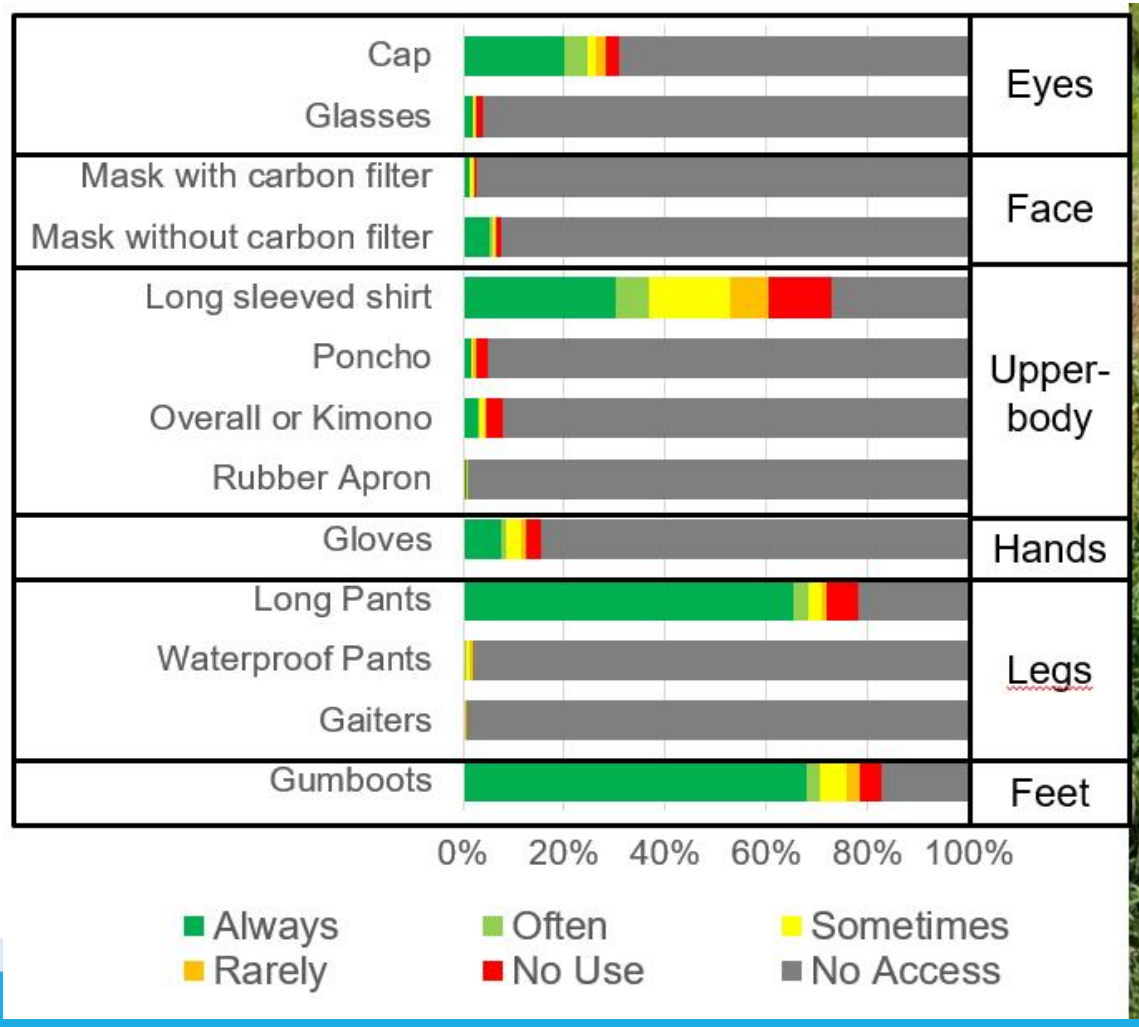
- **Cumulative yearly EIS**

Year EIS = Exposure-intensity score x total yearly application days

Variability and predictors of weekly pesticide exposure in applicators from organic, sustainable and conventional smallholder farms in Costa Rica

Samuel Fuhrimann [1], Philipp Staudacher [2,3,4,5], Christian Lindh [6], Berna van Wendel de Joode [7], Ana M Mora [7,8], Mirko S Winkler [4,5], Hans Kromhout [1]

Exposure intensity scores (EIS)



Exposure measures used to characterize glyphosate and mancozeb exposure

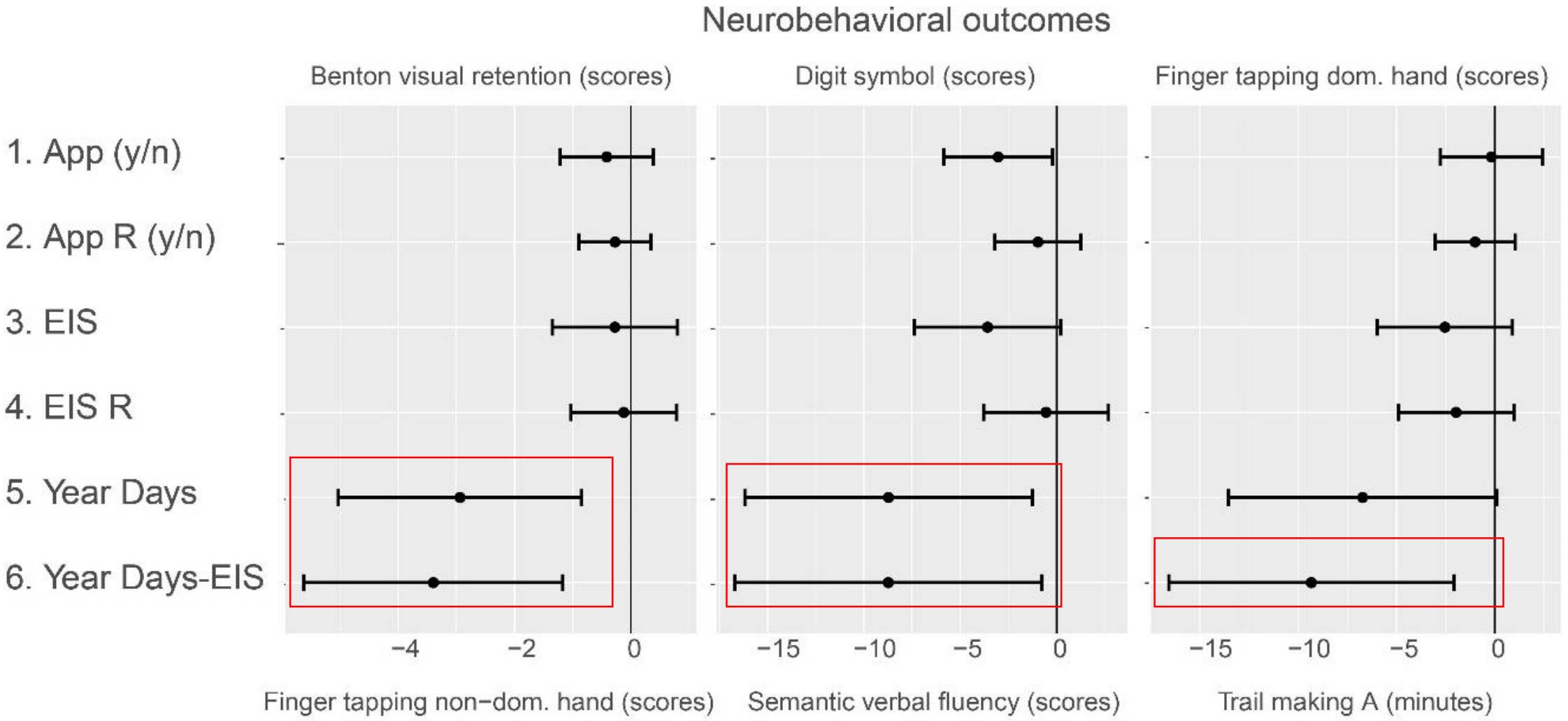
Original exposure measures based on information collected in 2017 indicating exposure for the previous year:

1. Application status (yes/no)
2. Number of application days
3. Average exposure-intensity scores of an application (EIS) derived from a semi-quantitative exposure algorithm and
4. Number of EIS-weighted application days.

Recalled information collected in 2019 resulted in two additional measures:

1. Re-called application status and
2. Re-called EIS.

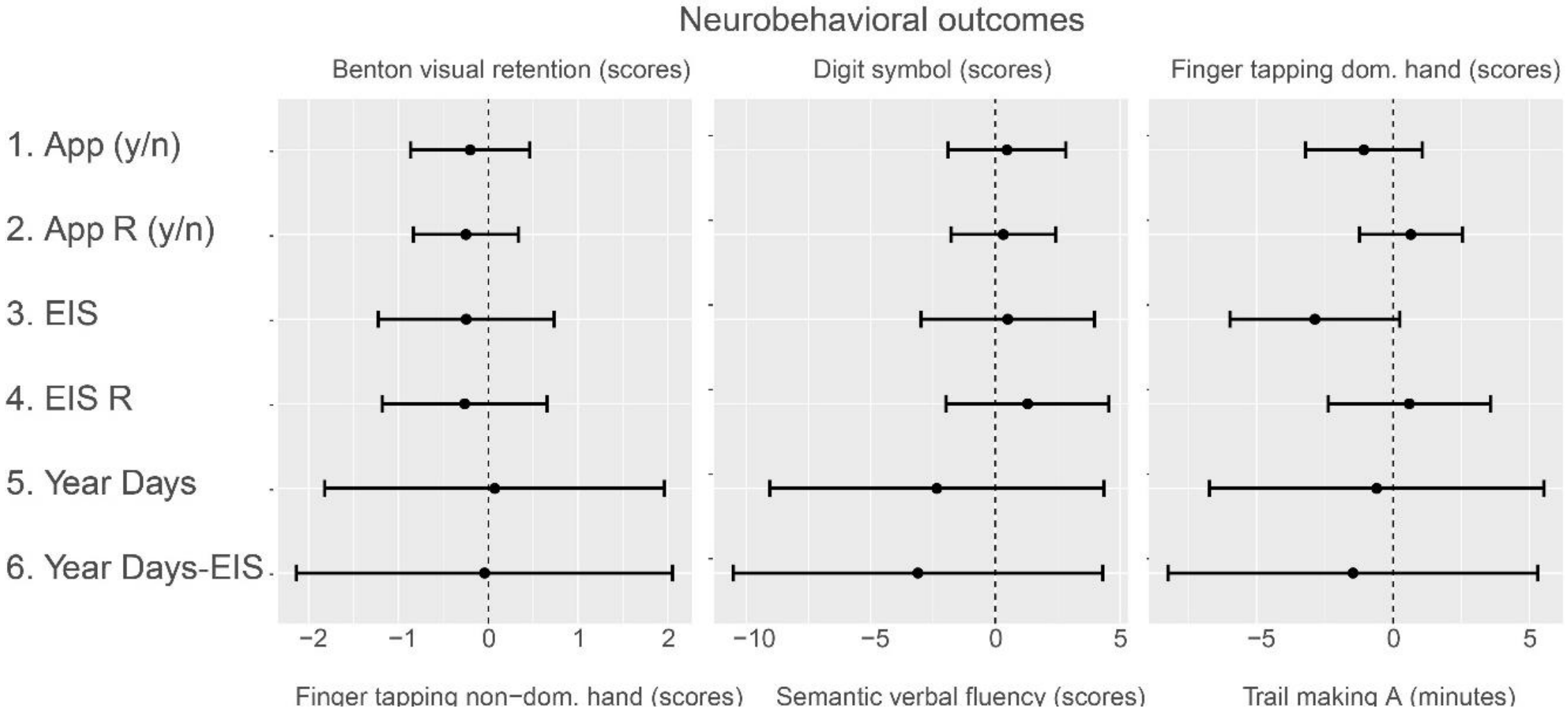
Associations for glyphosate application days per year and EIS adjusted application days with different neurobehavioral outcomes



Multiple regression analysis adjusted for confounders (sex, age, education, alcohol, head injuries, HIV)

Continuous exposure assessment measures (#3-6) were normalized on a scale between 0 and 1 (x - min(x)) / (max(x) - min(x)) before the analysis. App = application (yes); R = Recall; EIS = exposure-intensity scores.

Null findings for mancozeb exposure measures



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Three take home messages

1. The relation between different self-reported glyphosate exposure measures and neurobehavioral test scores appeared to be robust.

2. When based on recalled exposure measures, positive associations were no longer present.

3. Future epidemiological studies on self-reported exposure should critically evaluate the potential bias towards the null in observed exposure-response associations.

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Symposium O4A3, 16.3.2023

Thank you

> Open Positions at Swiss TPH

Research Assistant / Scientific Collaborator 60 – 100%

› Jetzt bewerben

PhD Student in Epidemiology 80 – 100% to join the Agricultural Health Group

› Jetzt bewerben