



Measure to Manage: Using cholinesterase assessment to monitor agrichemical exposure in Victorian farmers

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Setting the Scene

- Agricultural production in Australia
- Use of agrichemicals to increase production yields
- Organophosphates and exposure
- Research - In field testing for Cholinesterase
- Engaging producers

Demand for Agriculture

- Agricultural land covers more than 1/3 third of the world's land area.
- There are more than 570 million farms in the world.
- More than 90% of farms are run by an individual or a family and rely primarily on family labour.
- Family farms occupy a large share of the world's agricultural land and produce about 80% of the world's food.

[The State of Food and Agriculture.](http://www.fao.org/3/a-i4036e.pdf)
[Food and Agriculture Organisation, 2014](http://www.fao.org/3/a-i4036e.pdf)
<http://www.fao.org/3/a-i4036e.pdf>
Accessed: 27 October 2016

Climate, Agriculture and Chemicals

Climatic changes  Changes to pest management

- Cereal Crops
- Horticulture
- **Livestock production**
 - Pasture production
 - Hay production
 - Parasite management

Chemical Exposure: Organophosphates

- Rapid dermal absorption but they do not accumulate in fatty tissues.
- OP's bind and phosphorylate acetylcholinesterase (AChE) enzymes
- Becomes irreversible
- Unregulated Acetylcholine stimulation
- Acute toxicity symptoms of hyperactivity, including tremors, convulsions, and eventually death.

Organophosphate pesticide poisoning



Organophosphate pesticide poisoning (Source).mov

Chemical Exposure: Organophosphates

- Low level exposures may have long term and effects
- We need to measure OP exposure & quantify these longterm effects
 - **Humans possess a reserve of ChE activity, so inhibition of up to 80% can be free of significant acute (noticeable) effect**
 - **BUT-** Accumulated effect may pose a risk
- Provide farmers and farm workers with accurate exposure indicators

Chemical Exposure : Testing cholinesterase levels



Our Research – In Field Personalised Cholinesterase Assessment Project (PCAP)

AIM:

- Identify handling and application patterns of farmers handling organophosphates (OPs) and other agrichemicals
- Validate the current method of testing for OP exposure - establishing a process for routine use
- Establish a **new** method for immediate, personalised Cholinesterase activity.
- Establish an Australian database of cholinesterase activity

About the Research

- 4 sites in Victoria, 61 Farmers
 - 10 time points over 12 months
 - Mixed enterprises (Crop, Sheep and/or Cattle)

PART 1: Measuring Erythrocyte ChE (AChE) and Plasma ChE (PChE) – whole blood

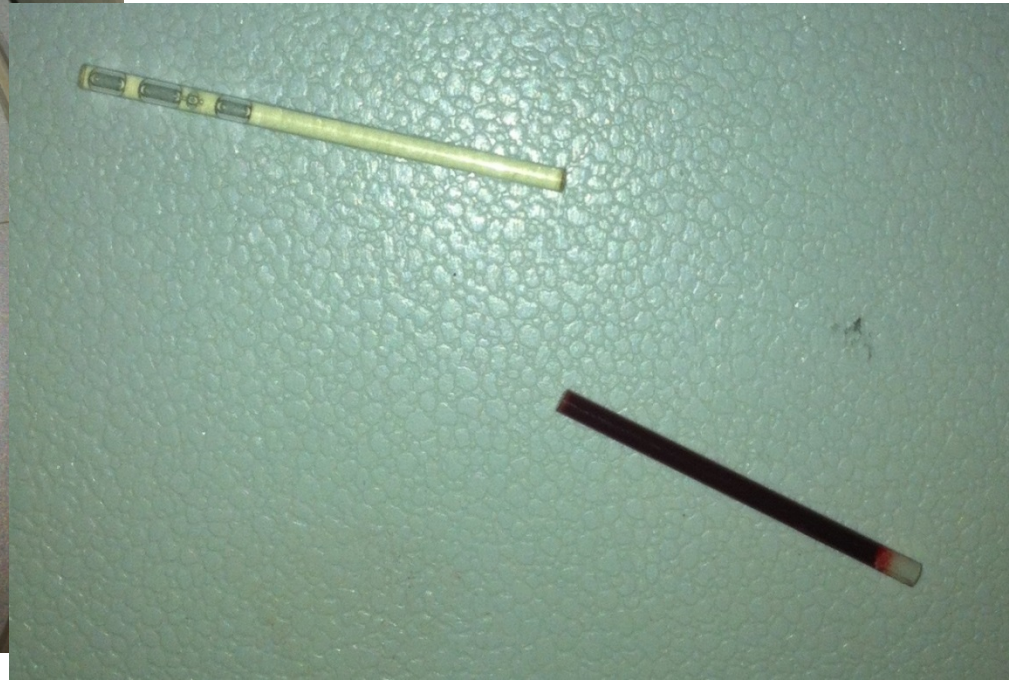
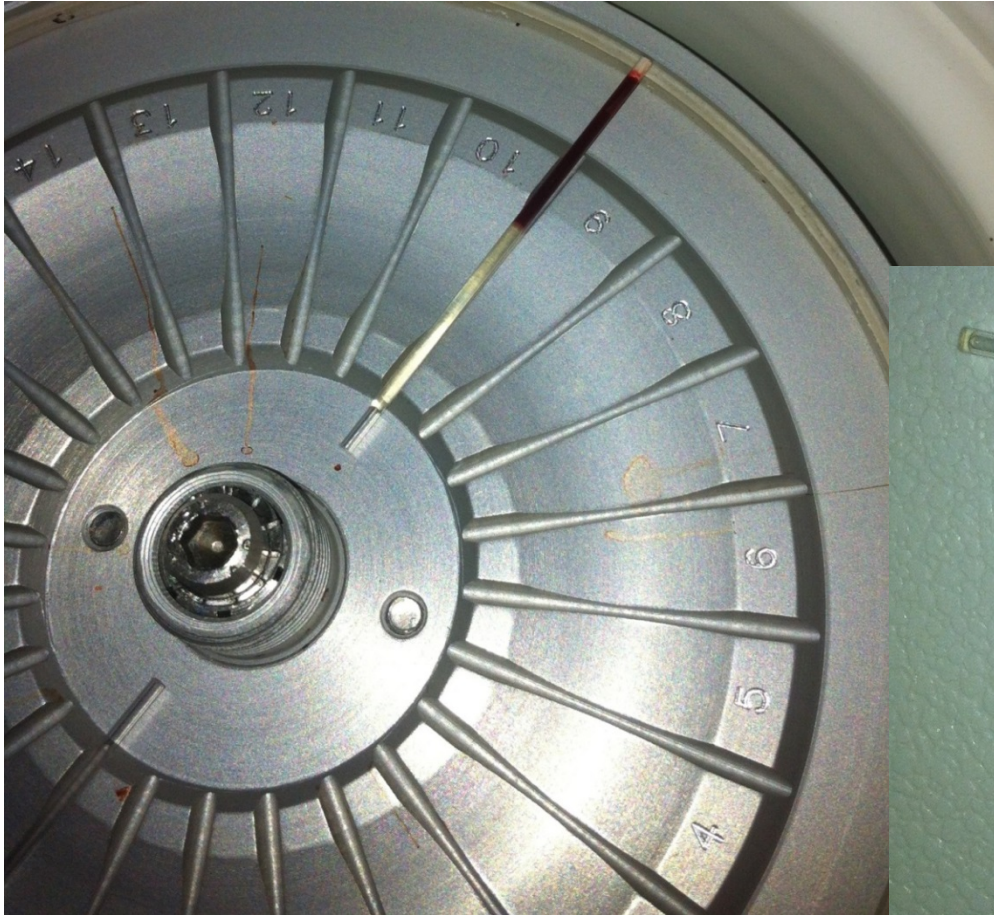
- Blood sampled using **a single fingerprick**
- Determine agrichemical usage through – monthly chemical usage survey
- Accurate results require a baseline.

About the Research

PART 2: Testing PChE in plasma only

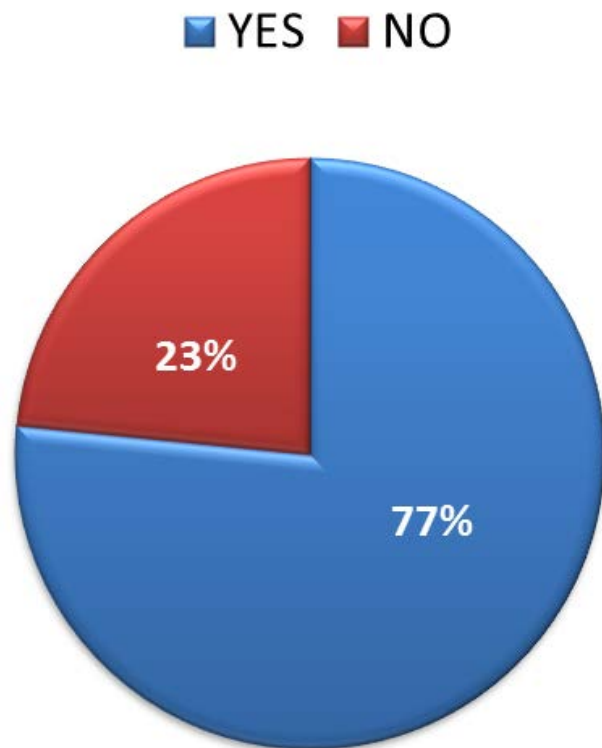
- Requires separation of plasma from erythrocytes
- **We can now reactivate PChE to get its 'true' activity in the individual**
- **using pralidoxime – In vitro – In the field**
- Accurate – Instant – Personalised
- Independent of population distribution

Plasma separation – on site



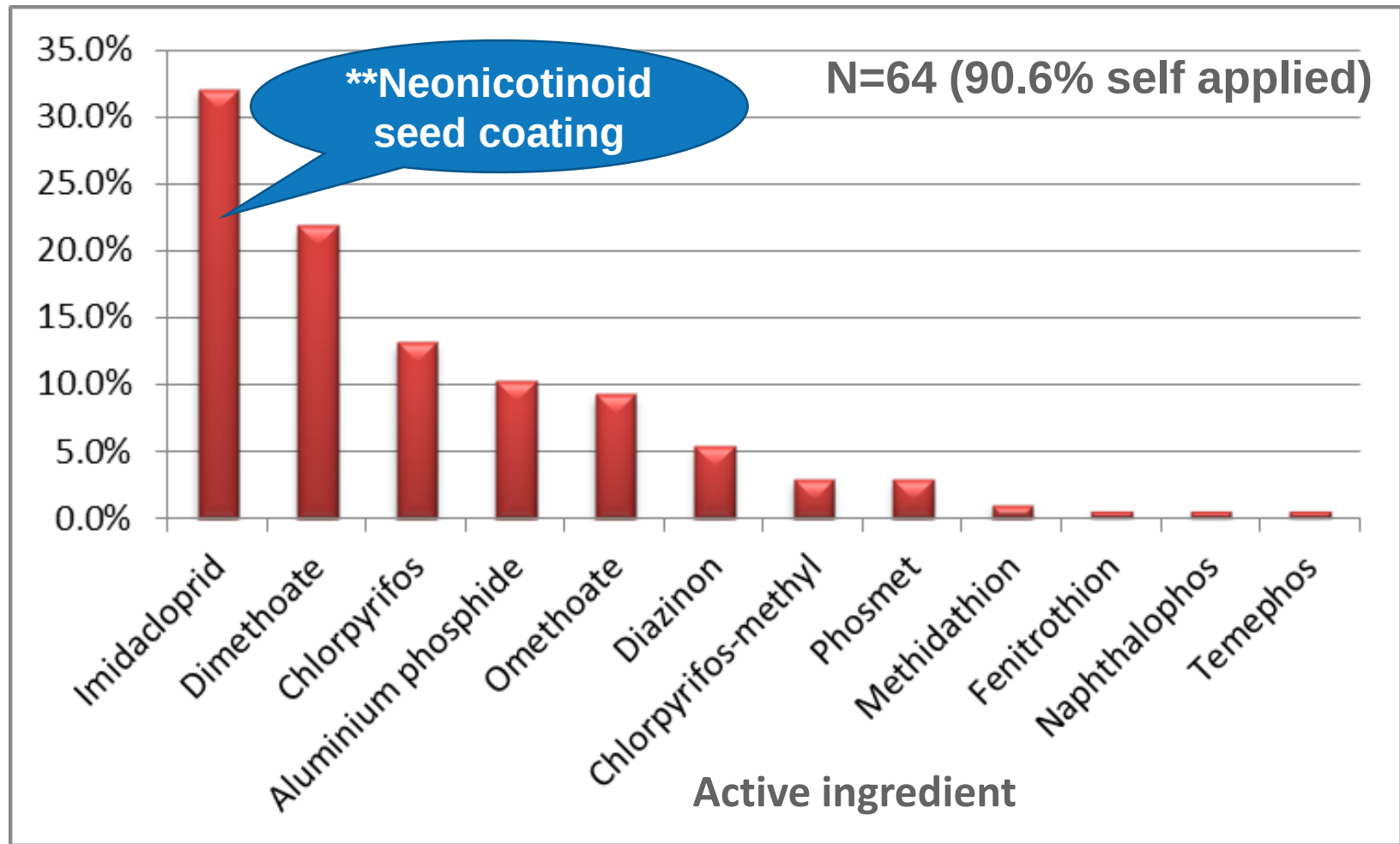
Photos: A/Prof. John Edwards, Flinders University, 2014

Agrichemical Usage - Routinely use OP (n=64)



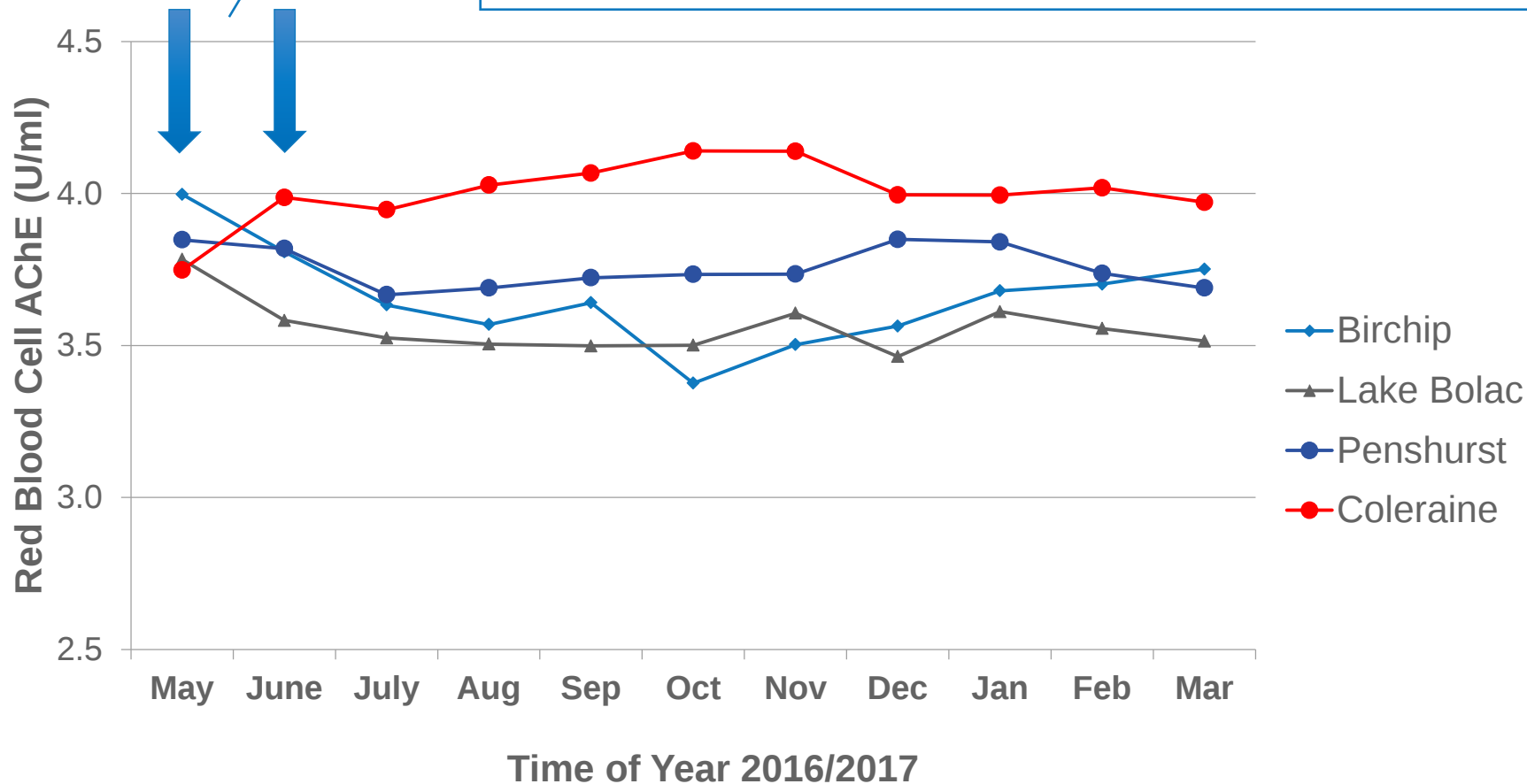
- Av. 77% of farmers routinely using and OP for pest control.
- Reported through – monthly chemical usage survey
- Large amount of exposure + background/env exposure.
- Exposure confirmed through oxime regeneration

Use of anticholinesterase chemicals on farm



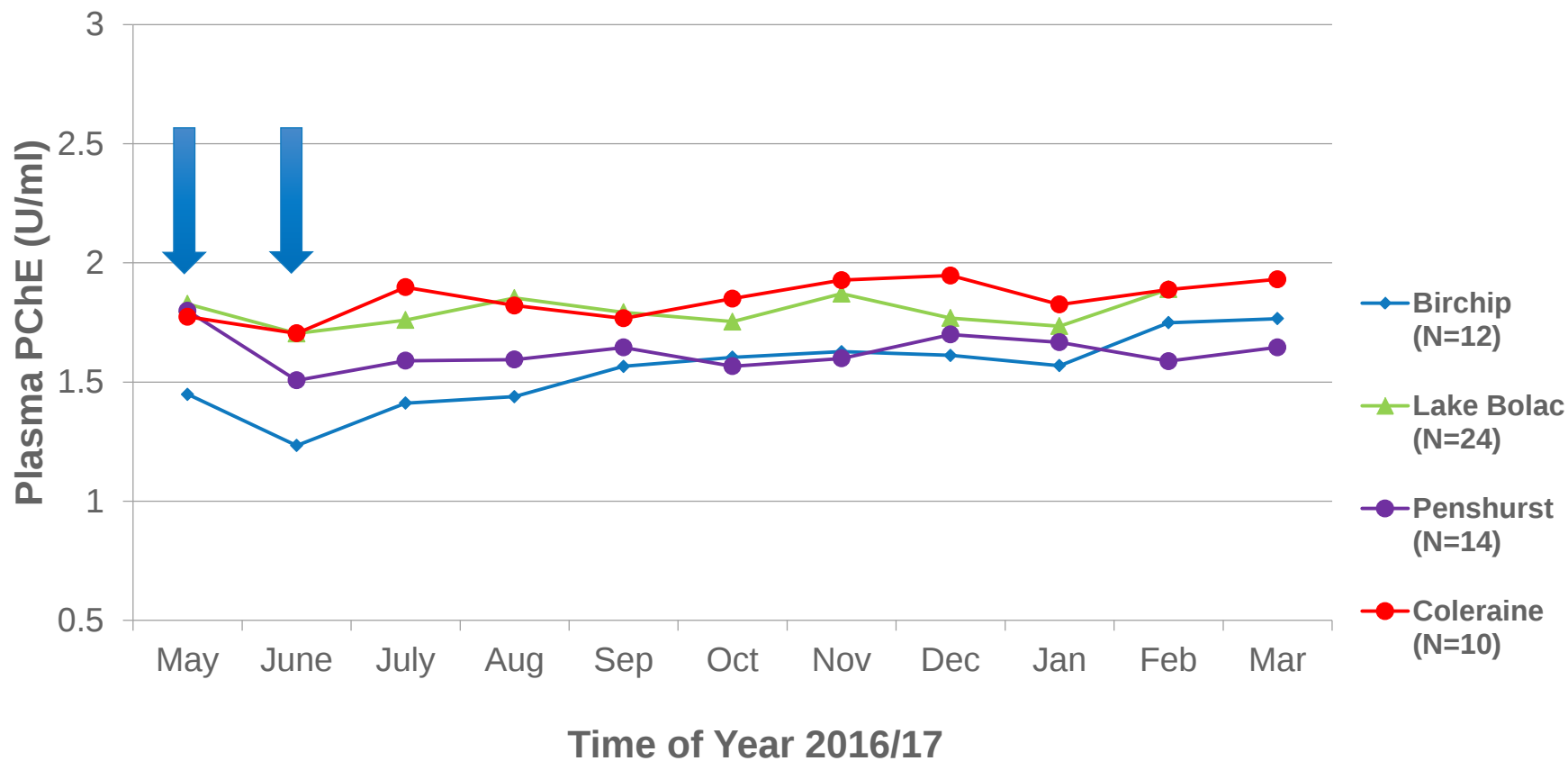
Cholinesterase Activity (AChE)

When chemical used was anticholinesterase agent **Yes**
= **66% No 34%** (all locations)



Cholinesterase Activity-Plasma (PChE)

May 2016 – Mar 2017

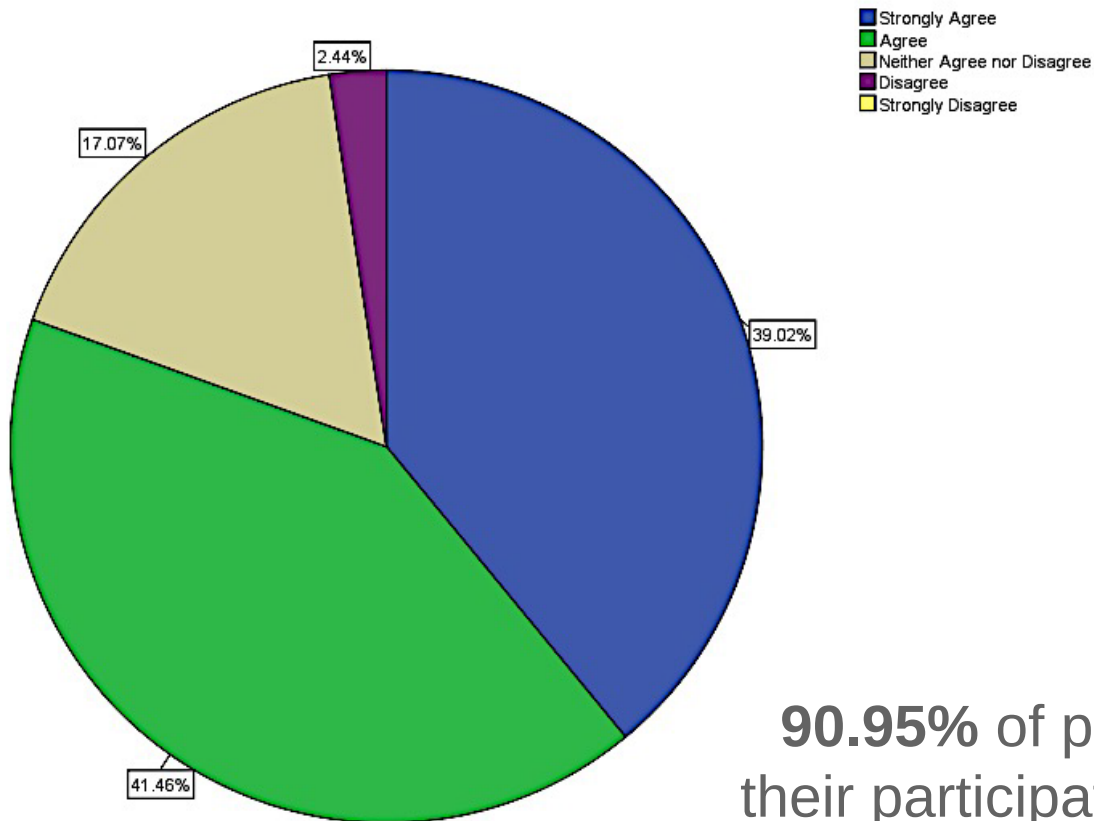


Changes in farmer behavior.....

- 6 month study
- Assess the effect AChE testing has had on farmers, both quantitatively and qualitatively
- Identify attitudes in farmers aged < 47 y/o and > 48 y/o when handling agrichemicals
- Identify and evaluate barriers to change
- Determine if research and education result in practice change

Results

Has your participation in the In-field PCAP changed the way you now handle organophosphates? N = 41



'... it made me more aware of actually looking at the labels a bit harder to see what what were and weren't organophosphates'
- Male, 45 (Cropping)

'... the conversation goes around so ... there's a lot of people who are missing out on the tests but they're not missing out on the conversation'
- Male, 27 (Livestock)

90.95% of participants agreed that their participation in the In-field PCAP was beneficial

Knowledge, attitude, and practice of Indonesian farmers regarding the use of personal protective equipment against pesticide exposure

Authors

[Authors and affiliations](#)

Maria G. C. Yuantari , Cornelis A. M. Van Gestel, Nico M. Van Straalen, Budi Widianarko, Henna R. Sunoko,

Muhammad N. N. Soebro

Did it help that they were your own, personal results?

Original article

Training and other predictors of personal protective equipment use in Australian farmers using pesticides

E MacFarlane¹, A Chapman², S Benke¹, I Weakim³, M Sim¹, J McNeill¹

Yeah, no wonder about it certainly made me more aware, rather than reading someone else's figures

Articles

Information vs training: Issues in farmer learning

S. Kilpatrick & T. Rosenblatt

Pages 39-51 | Published online: 30 Jul 2007

 Download citation  <http://dx.doi.org/10.1080/13892249885300151>

Personal Protective Equipment



<http://www.superiorglove.com/work-gloves/chemical-resistant-gloves/neoprene-chemical-resistant-gloves>



<http://www.safetyquip.com.au/prodlist042/full-face-respirators/>



<http://www.envirosafetyproducts.com/rubber-boots-work-boots.html>



<https://www.superching.com/welding-glasses/jg-104.html>



<http://www.jfcmonro.co.uk/biztex-type-4-spray-suit-medium~1201>

The Measure to Manage effect: PPE Usage

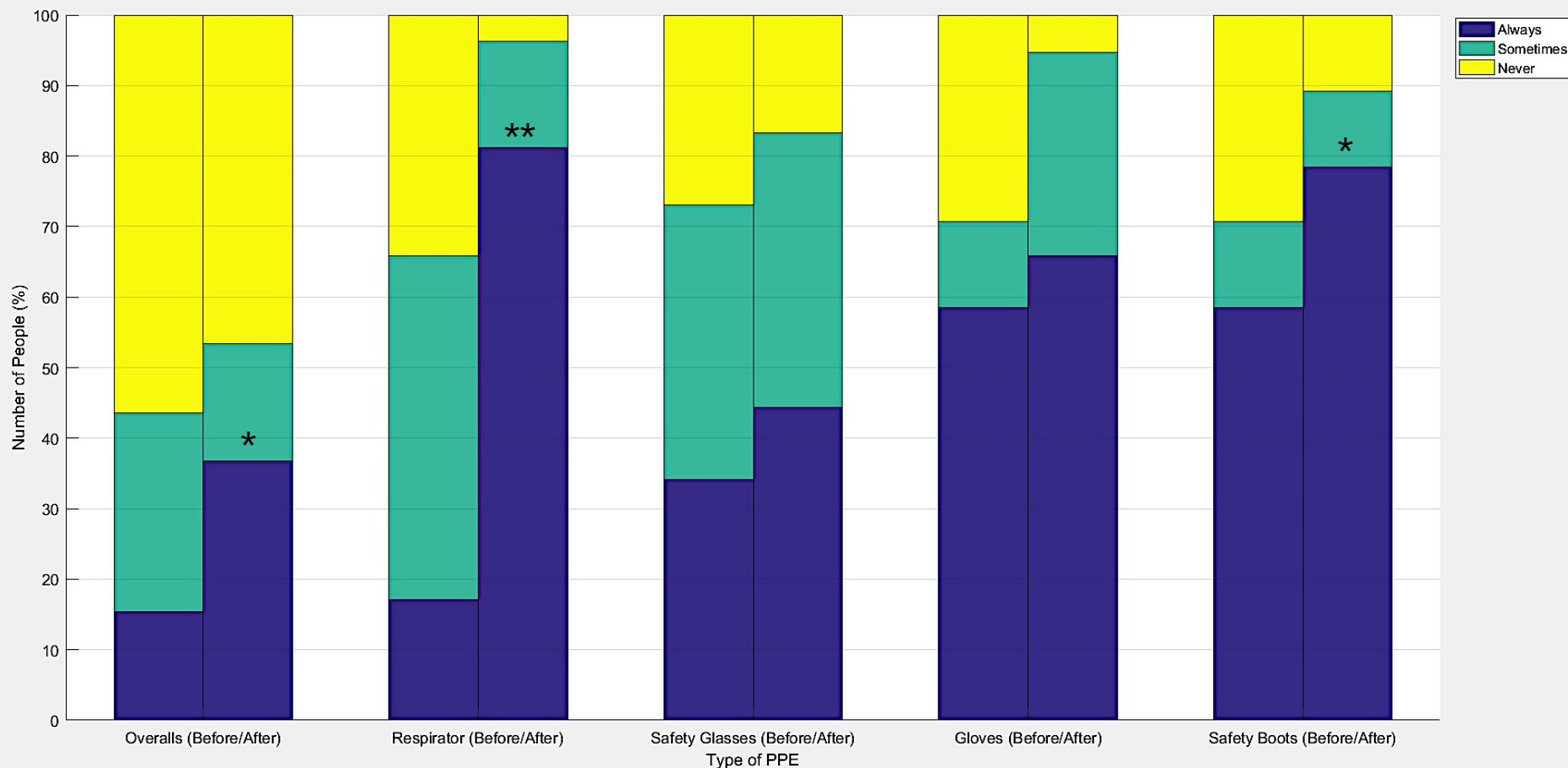


Figure 1. PPE Usage Before and After In-field PCAP. N = 41; (Z = - 4.504, p < 0.001).

* p < 0.05, ** p < 0.01

Results

'Sometimes they can be awkward and don't always fit ... a lot of the things are a one size fits all- and it's really uncomfortable. If you've got to be in it for hours, it's hard having to do your job and to put up with all this stuff that hanging off you too'

- Male, 37 (Mixed Enterprise)



<http://cropwatch.unl.edu/2017/chemical-resistant-gloves-may-help-prevent-parkinsons>

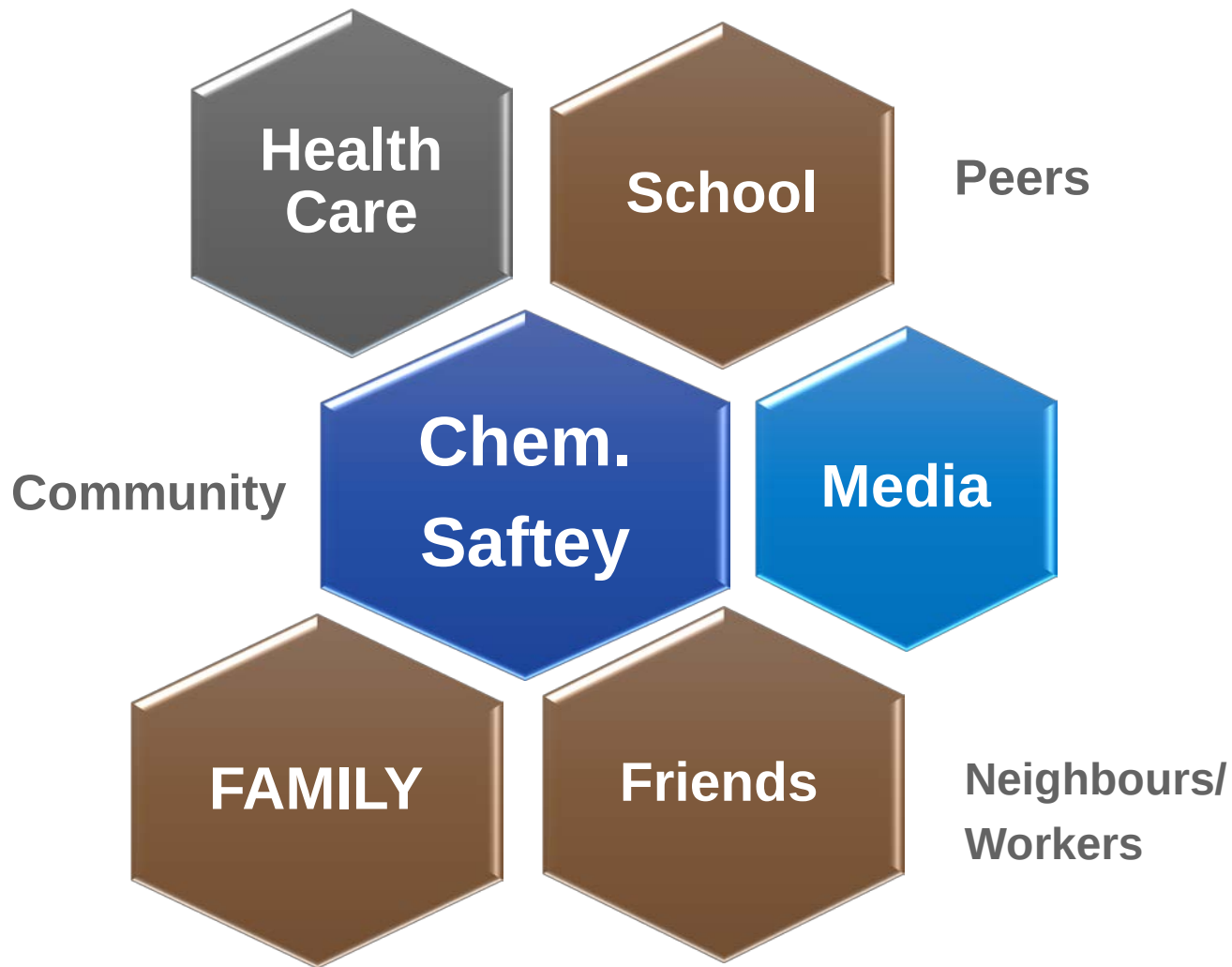
That's the drama of the whole thing to be quiet honest. You've just got to... allow more time for doing things. If you're using PPE you've just got to be a little bit more careful, you're not going to be as mobile and you've got to compensate for that

– Male, 71 (Agricultural Business)

New Questions

- Has the research changed practice?
- Are some individuals more susceptible to exposure risk? Is there a genetic predisposition?
- What about long term exposure?
- Could body fat play a role?
- How are people most exposed?
 - Contactors v farmers v non farmers
- What about other chemical types?

Safety Culture: We all play a role



What can you do?

- Be aware when you are using an anticholinesterase agent
- Monitor your cholinesterase - (where possible)
- Learn your cholinesterase baseline
- Create a safety culture within your workplace – set the example to farming communities

“Don’t let perfect steal better” — Dr Mark Fleming

Acknowledgements

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Susan Brumby

Farming Participants

National Centre for Farmer
Health (NCFH)

Deakin University

Shepherd Foundation
Victoria

Western District Health
Service (WDHS)



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