

# Measurement strategies to evaluate occupational exposure to pesticides

Berna van Wendel de Joode, PhD

Central American Institute for Studies on Toxic Substances

Universidad Nacional

Heredia, Costa Rica

# General considerations (1)

- Agent specific
- Prior to designing most effective pesticide exposure assessment strategy
  - Basic information
- Particularly focus on pesticides that have been widely used
  - Past use – i.e. toxaphene
  - Pesticide import data
    - I.e. Central America 2010-2014\*
      - 20 active ingredients represent 80% of pesticides
      - Ten most-imported:
        - mancozeb, [glyphosate](#), [2,4-D](#), 1,3-Dichloropropene, [paraquat](#), chlorothalonil, chloropicrin, diuron, propineb, atrazine
  - Pesticide registers / pesticide use data

*\* Missing data for Nicaragua, incomplete for Panama, Pesticide importation data  
- Virya Bravo, Personal communication*

**Cuadro 2:** Plaguicidas aplicados en cultivo de caña de azúcar. Cercanías del PNPV, 2010.

Acción biocida	Ingrediente activo	Cantidad	
		kg ia/ha/año	%
Herbicidas	terbutrina	2,87	26,78
	ametrina	2,21	20,61
	pendimetalina	1,35	12,59
	hexazinona	1,26	11,77
	diuron	1,10	10,25
	2,4-D	1,06	9,93
	glifosato	0,36	3,40
	paraquat	0,21	2,33
	picloram	0,03	1,99
	<b>Subtotal</b>	<b>10,46</b>	<b>99,65</b>
Insecticidas	cipermetrina	0,25	0,28
	<b>Subtotal</b>	<b>0,25</b>	<b>0,28</b>
Rodenticidas	coumatetralil	0,008	0,07
	brodifacouma	0,0001	0,00
	<b>Subtotal</b>	<b>0,01</b>	<b>0,07</b>
<b>Total</b>		<b>10,72</b>	<b>100,00</b>

\*No incluye madurantes

Fuente: Herrera y Bravo, 2010.

Bravo et al., 2015

# General considerations (2)

- Contrasting exposure levels
- Characterize duration and intensity of exposure
  - Each worker
  - Groups of workers with similar exposures
  - Person with the same Jobs may have different exposure levels
    - Ideally exposure should be measured
    - Measurement strategies should consider variability between and within workers
      - Repeated measures
- Life-time pesticide exposure estimates
  - Past and current exposures

# Past exposure (1)

- Past exposure assessment data (if available)
- If exposures are likely to be still similar – proxies for past exposures
  - Current exposure measurements in healthy workers who have contrasting risks to develop the disease
  - Sampling of environmental matrices in geographical areas where workers have contrasting risks to develop the disease
- Pesticide use on crops / crop exposure matrix
- Job performed during life / job exposure matrix
- Tasks performed during life / task-exposure matrix
- Questionnaires:
  - Ever / never use of specific pesticides (i.e. Agricultural health study)
  - Total days of application during life of specific pesticides, or, groups of pesticides (e.g. Fieten et al., 2009)
  - Re-entry work
  - Use of specific pesticide at home/farms
  - Use of Personal Protective Equipment

# Past exposure (2)

- Algorithms or exposure models to assess exposure semi-quantitatively
  - Pesticide-specific parental exposure (Monge et al 2007)
    - Icon-based questionnaires to reduce recall bias (i.e. Monge et al 2004; Valke et al 2005)
    - Interviews of experts / guidelines for pesticide use / importation of pesticides to reduce recall bias (Monge et al., 2005)
  - Agricultural health study (Dosemeci et al., 2002);
  - Life-time exposure algorithm for applicators, re-entry workers (Negatu et al., 2016)
  - Completion of observational methods based on interviews (i.e. DREAM, DERM)

# Past exposure (3)

- Pesticide poisoning
  - Self-report
    - Ever intoxicated with pesticides, if so, indicate what pesticide – reported symptoms indicate severeness of poisoning
    - Ever diagnosed with pesticide poisoning by a medical doctor, if so, specify pesticide and mode of exposure
    - Ever emergency care or hospitalized for pesticide exposure, if so, specify pesticide and mode of exposure
  - Medical records

# Current exposure (1)

- Data on pesticide use
- Repeated quantitative measures in workers
  - Biomonitoring
  - External exposure assessment of main pathway
  - Randomly select workers to be observed or measured
  - In case of specific tasks with high risks
    - Complete random exposure assessment with observations on specific days that are expected to result in increased exposure levels
- Repeated quantitative measurements of home or work environment and sources of exposure
- Observational methods/questionnaires

# Conclusions and recommendations

- Mixed data collection methods are necessary to assess life-time exposure to specific pesticides
- To be able to compare results from different studies, we should develop a core module for assessment of pesticide exposure