

Use of pesticide urinary metabolites from residents living near agricultural land to validate exposure models

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Background

- Currently a lack of information on pesticide exposure for residents and bystanders in Britain
- Previous study by Sleenwenhoek *et al*
 - regulatory methods appropriate for farm workers.
 - methods may underestimate bystander exposure
 - no measurements collected for residents
 - need to check current tools sufficiently conservative
- DEFRA funded new study
 - Started 1st Oct 2010, due for completion end Jan 2014
 - Led by IOM, in collaboration with Health and Safety Laboratory (HSL) and Glasgow Caledonian University

Aims

- Determine if spray events lead to increased exposure in residents
 - Statistical analyses of urinary metabolites, comparing levels
 - Following spray events
 - Background within and out with season
- Compare urinary metabolite concentration with internal exposure estimates provided by regulatory risk assessment (RRA)

Survey strategy

- 3 agricultural regions: East Lothian, Kent, Norfolk
- Recruit farmers - Obtain info on pesticide usage
- Recruit residents living within 100m of fields
- Collect urine samples
 - Weekly samples during and out with spraying season
 - Reactive samples (1 and 2 days after spray) if receive sufficient notice from the farmer
- Urine sample analysis
 - Urine samples collected 1 and 2 days after spraying event
 - Background within the spraying season (n=3)
 - Background outside the spraying season (n=3)

Pesticides of interest

- Not selected on basis of any health concern, but
 - Availability of urinary marker
 - Likelihood of application
- In 2011 and 2012 collected urine samples relevant to spray events involving:
 - Captan
 - Chlormequat
 - Chlorpyrifos
 - Penconazole
 - Cypermethrin (2012 only)

Population and urine samples

Farms		Residents	
2011	2012	2011 Adult : Child	2012 Adult : Child
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- 909 urine samples collected during 2011, with 2,384 urine samples collected in 2012

Spray event samples	2011	2012
Chlormequat	31	250
Captan	28	244
Penconazole	13	83
Chlorpyrifos	6	54
Z-Cypermethrin	0	50

Information collected inc.

- **Background questionnaire**
 - Weight, height, date of birth
 - Pesticide exposure - occupational / para-occ. / home usage
- **Questionnaire for each urine sample**
 - Activities (and where)
 - Pesticide exposure - occupational / para-occ. / home usage
 - Consumption of home grown product
- **Spray records**
 - Start / finish time
 - Weather conditions
 - Product sprayed, quantities applied and spray method

Regulatory Risk Assessments

- RRA completed for each relevant spray event where urine samples were collected
- Current approach
 - Spray drift on adults, breathing zone at 8 metres
 - Adults and children 24h vapour exposure
 - Children dermal, hand-to-mouth, object-to-mouth, from average drift fallout in adjacent area

Regulatory Risk Assessments

- Also two modified approaches used

Modified approach	Bystanders (single exposure)	Residents (repeated exposure)
spray drift from low crops for adults and children at 2m	Yes, based on BREAM P95	Yes, based on BREAM P75
spray drift from high crops for adults at 8 metres	Yes, based on P95 current data	Yes, based on P75 current data
adults and children 24h vapour	Yes (as before)	Yes (as before)
children dermal, hand-to-mouth, etc, from higher level of drift fallout in adjacent area	Yes	Yes

Pharmacokinetic (PK) model

- PK model used to estimate the amount of metabolite of interest excreted in urine
- Starting with the estimated internal dose of active ingredient
- Uses information such as
 - MW of active ingredient and metabolite
 - Volume of distribution
 - Half-life of metabolite

How will this be used?

- RRA completed for specific exposure scenarios to obtain an estimate of the internal dose
- PK model then used to estimate amount excreted in urine given this internal dose
- Estimated urinary levels compared to that obtained from the urine samples
- Allows for some evaluation of whether the RRA over or under estimates the levels actually found in urine for the residents in the study

Statistical analysis will...

- Summarise urinary metabolite levels obtained during spray season and investigate whether any recorded factors have an effect on the levels
- Differences in levels obtained within and outwith spray season
- Estimate exposure based on urinary levels
- Determine estimates of long-term exposure by combining exposure from spray events, within season and outwith season backgrounds

Current status of project

- Sample and data collection completed
- RRA completed and being reviewed
- Urine sample analysis on-going
- Project end date Jan 2014
- Publication and other dissemination activities will follow

Further information

- Project website
 - www.pesticidebiomonitoring.org
- Published study protocol
 - Galea et al (2011) Biological monitoring of pesticide exposures in residents living near agricultural land. BMC Public Health; 11:856
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