

Pesticide biomonitoring in residents living near agricultural land: Overview of study methodology

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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)

The challenges - there were many...

- Several locations and diverse communities
 - Lack of knowledge of locality specifics
 - Relatively short biological half-life of modern pesticide compounds / metabolites
 - Anticipated reluctance to participate
 - Sample collections over sustained period
 - 'Attrition' and research fatigue....
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- **CRITICAL**– engagement with farmers, without them, no study!

Use of community researchers

- “researchers / a research resource recruited from the community under study.bring with them knowledge ['cultural capital'] of that area or community which researchers from outside would not have or would need considerable effort to learn useful when investigating sensitive areas:, help avoid the pitfalls and beartraps”.

Paul Teedon, Glasgow Caledonian University

- What do they bring?
 - Greater awareness, trust, connection and knowledge with local areas and communities

Pesticides of interest

- Selected on basis of availability of urinary marker and likelihood of application
- In 2011 & 2012 collected urine samples relevant to spray events involving:

Active ingredient	Analyte(s)	Analytical Method
Chlormequat	Chlormequat (parent)	SPE LC-MS/MS
Captan	cis-1,2,3,6-Tetrahydrophthalimide	SPE LC-MS/MS
Penconazole	4-(2,4-Dichlorophenyl)5-(H-1,2,4-triazol-1-yl)pentoic acid	Solvent extraction LC-MS/MS
Chlorpyrifos	3,5,6-Trichloropyridinol	Acid hydrolysis Solvent extraction GC-MS
Cypermethrin	cis-2,2-Dichlorovinyl-3,3-dimethylcyclopropane-1-carboxylic acid trans-2,2-Dichlorovinyl-3,3-dimethylcyclopropane-1-carboxylic acid	Enzyme hydrolysis SPE LC-MS/MS

Population recruited, samples collected

	2011		2012	
	Proposed	Actual	Proposed	Actual
Farms & orchards	10	14	16	19
Residents	75	139	120	195

- 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

- Primary focus on current approach
 - Spray drift adults, breathing zone 8 m
 - Adults and children, 24hr vapour exposure
 - Children dermal, hand to mouth, object to mouth, from average drift fallout in adjacent area
- RRA completed for each relevant spray event to obtain an estimate of the internal dose
- PK model used to estimate amount excreted in urine given this internal dose
- Estimated urinary levels compared to that obtained from the urine samples
- Allows some evaluation of whether the RRA over or under estimates levels actually found in urine

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
- Sample analysis to be completed Sept 2013
- Project end date Jan 2014
- Dissemination activities to follow

Conclusions so far..

- Primarily due to involvement of CRs, recruitment & data collection very successful
- Effective strategy for capturing substantial amounts of data to address study aims and objectives
- Built foundations for effective dissemination and feedback of research outputs and capacity built for future studies

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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