REPORT OF THE HEALTH IMPACT OF PESTICIDES ON AFFECTED PERSONS IN THE GUNNEDAH COMMUNITY

L. Fragar
R. Loblay
C. Hartigan
D. Baker

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Australian Agricultural Health Unit

ACKNOWLEDGMENTS

The preliminary study into the health impact of pesticides on affected persons in Gunnedah was conducted on behalf of the North West District Health Service and Northern Districts Public Health Unit by:

- the Australasian Society of Clinical Immunology and Allergy (NSW Branch) in association with
- the Australian Agricultural Health Unit and
- the Environmental Health, Food and Nutrition Branch of the NSW Health Department.

The following medical specialists conducted the clinical interviews of affected residents on the 21-22 October 1996:

- Dr Robert Loblay
- Dr Connie Katelaris
- Dr Dominic Mallon
- Dr Kwok Yan
- Dr Michael Boyle
- Professor Wai-On Phoon

The specialist nursing staff performing physical measurement, skin and lung function tests were Therese Burke and Ann-Maree Mallon. Margo Smith of Queensland Medical Laboratories collected blood pathology.

The consultations were undertaken using facilities at Gunnedah Hospital, with clerical assistance provided by Lyn Cooper.

Data were compiled and reported by Deborah Baker, Environmental Health, Food and Nutrition Branch, NSW Health Department.

Advice concerning study design and protocol was provided by Professor Ross Barnetson (Dermatology) and Associate Professor Geoff Duggin (Toxicology).

All other activities were coordinated by Christine Hartigan and Dr Lyn Fragar, from the Australian Agricultural Health Unit, Moree. Assistance was also provided by staff of the Northern District Public Health Unit.

Funds were provided by the North West District Health Service.

The research team wishes to thank all participants for their interest and willingness to be part of this exploratory study.

EXECUTIVE SUMMARY

The study into the health impact of pesticides on affected persons in Gunnedah was conducted in order to collect data on the health status of 61 residents in the region who reported concerns about the effects of aerial pesticide spraying on their health. The information was collected in the context of provision of specialist medical consultation to affected persons provided by a team of specialists assembled by the Society of Immunology and Allergy (NSW Branch). The findings were based on clinical examination, blood pathology, and a questionnaire on health status with the aim to provide a descriptive picture of the health of the population affected by spraying.

Clinical histories were summarised to provide information on the perception of risk; priming factors; initiating events; symptom triggers; and temporal data related to symptoms. Once clinical information had been collected, symptoms were categorised by the specialists according to clinical assessment of the relationship of the problems and symptoms identified to chemical exposure. There were 3 categories - symptoms 'probably unrelated', 'uncertain relationship', and 'probably related'. This classification provided the basis for the analysis of the information collected.

Twenty two percent of 58 symptomatic participants had one or more symptoms that fell into the category of 'probably related', while 50% had one or more symptoms which were classified as 'unrelated' and 50% as 'uncertain'.

The symptoms most commonly reported and assessed by the medical consultants as having a 'probable' or 'uncertain' relationship to cotton pesticides were rhinitis, asthma and headache. Others which were less commonly associated were skin irritation, eye irritation, fatigue and problems of cognition.

Symptoms for 55% of affected participants commenced after 1992, and 78% of these people had symptoms which were classified as in the 'uncertain' and/or 'probably related' categories. Most people experienced symptoms during the months of October to March.

Atopy and allergic rhinitis were identified by the investigating specialists as the most common pre existing risk factors for reaction to chemical exposure, followed by asthma. Allergic disease was the most frequent priming condition.

Results for the Short Form-36 item health survey showed that the participants in this study reported a health status poorer than the rest of the Australian population. However the difference between the two was not statistically significant for any of the eight scales in the survey.

Recommendations for the design of a formal community-wide study into the health impact of agricultural chemicals are made. Such a study should aim to confirm the validity and predictive power of the reported symptoms in measuring the impact of pesticide exposure on a population basis.

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1. BACKGROUND

The cotton industry, which is heavily reliant on pesticides to control insect damage, has expanded in the Gunnedah/ Boggabri areas in north west NSW in the last few years. During the previous growing season - October 94 - April 95, many complaints were raised expressing concern over the impact of agricultural pesticide usage (particularly aerial application) on the health of the community and the environment.

About 40 letters detailing personal health effects were forwarded to the NSW Minister for Health.

The cotton industry is faced with growing insect resistance to available insecticides. During this past 2 seasons the industry has had to fall back on greater usage of a particular insecticide - profenafos, which typically releases foul smelling mercaptans under certain conditions. The odour thus formed can, and has been demonstrated to, move independently of the insecticide.

Thus, despite the recent gains made by the cotton and aerial agriculture industries in ensuring that aerial application of pesticides deposits chemicals only on the target crop, there are continued concerns being voiced by the community.

2. OBJECTIVES

This study was an exploratory, descriptive study involving the 58 symptomatic individuals who have come forward as a result of exposure to agricultural sprays in Gunnedah.

The objectives of this first phase study were:-

To determine the range of symptoms experienced by individuals in relation to their atopic status and environmental exposure in order:-

1. *To identify and categorise the range of clinical phenomena which may be related to environmental exposure to pesticides*

2. *To provide baseline information for further epidemiological investigation of the health impact of pesticides*

3. *To attempt to assess criteria by which causal relationships could be established*

4. *To recommend appropriate action to reduce symptoms associated with environmental exposures.*

3. STUDY METHODS

Following documentation of a variety of complaints related to exposure to agricultural pesticides, residents of the Gunnedah region in northern NSW Australia were invited to attend a clinical consultation by specialists assembled by the Society of Clinical Immunology and Allergy (NSW Branch). Baseline examinations were conducted on those able to attend by a team of six medical specialists and two specialist nursing staff. Clinical advice was provided to each participant by the specialists in the course of consultation.

The examinations were conducted over two days on the weekend of the 21-22 October 1995. Participants were booked into morning or afternoon appointments over the two days.

3.1 Short Form Health Survey (SF-36)

Individuals who volunteered to participate were firstly asked to complete a SF-36 (Australian version) Health Survey Questionnaire.

The SF-36 is one of several instruments that have been developed to incorporate self-assessment of well being and normal functioning, for physical and mental health indices. Generic health concepts can be measured across age, disease and treatment groups.

The SF-36 is a 36 item questionnaire which measures well being and role functioning via eight multi item scales containing 2-10 items each. These scales represent eight of the most important health concepts included on the MOS[1] and other health surveys, encompassing functional status, well being and an evaluation of overall health status. In addition, there is a single item measure of perceived health status transition that is not used to score any of the eight multi item scales.

The eight scales contained in the SF-36 assess health status in the following areas of functioning;- physical functioning; physical role limitations; bodily pain; general health; vitality; social functioning; emotional role limitations; mental health.

The SF-36 Health Survey data was processed using the approved Basic Scoring Algorithms. Results obtained from the participants in the study were compared with standard results for the SF-36 for the Australian population[2]. These population norms were developed by the Australian Institute of Health and Welfare in Canberra.

3.2 Clinical examination and screening

Following completion of the SF-36 form, consultation was provided either on an individual or family group basis by a specialist allocated to each case. Clinical histories were recorded and the following parameters measured:-

- Vital signs (temperature, heart rate, blood pressure, respirations)
- Height, weight, urinalysis

- Blood screening for full blood count; erythrocyte sedimentation rate; electrolytes; urea; creatinine; liver function tests; serum cholinesterase; red blood cell cholinesterase

- Skin prick tests with standard allergen extracts

- RAST[#] tests where skin prick testing contraindicated

- Bronchial histamine challenge where indicated

- Spirometry.

Other blood tests were ordered as deemed appropriate by the examining physician.

Clinical histories were summarised by the consultant physician using sheets coded to provide information on the following:

- Perception of exposure

- Priming factors

- Initiating events

- Symptom triggers

- Temporal data related to symptoms.

At the conclusion of each morning and afternoon examination session a case conference was held by the specialist group. The clinical history and findings of each case were presented and discussed, following which the symptoms of each individual were categorised according to assessment of the relationship of symptoms to chemical exposure. Symptoms were classified as:

1. Probably related - reported symptoms which were considered likely to have been associated with chemical exposure

2. Uncertain relationship - reported symptoms where an association with chemical exposure was considered possible but not certain

3. Probably unrelated - reported symptoms which were considered to be unlikely to be related to chemical exposure.

Most participants described multiple symptoms, of which one or more may have been classified into different categories.

[#] Radioallergosorbent test

4. RESULTS

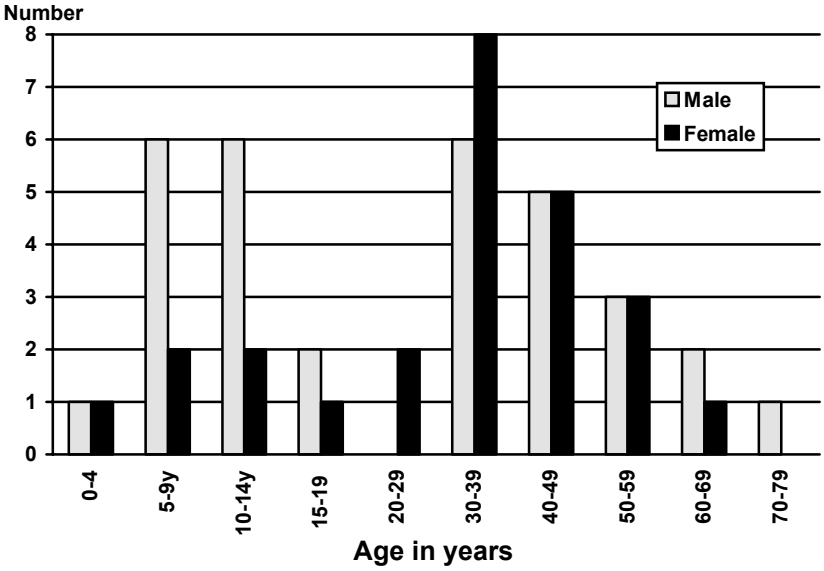
4.1 Profile of participants

Of the 41 families invited to be assessed by the visiting specialists, 63 individuals attended for assessment over the 2 days. There were 5 people who attended (2 males and 3 females) who did not have any symptoms but were concerned about exposure. The results for these people are not included in this report.

There were 20 families and 7 single individuals who presented for assessment. Not every member of a family was suffering symptoms.

Figure 1 displays an age and sex distribution of those people who attended for assessment.

Figure 1: Age and sex of participants



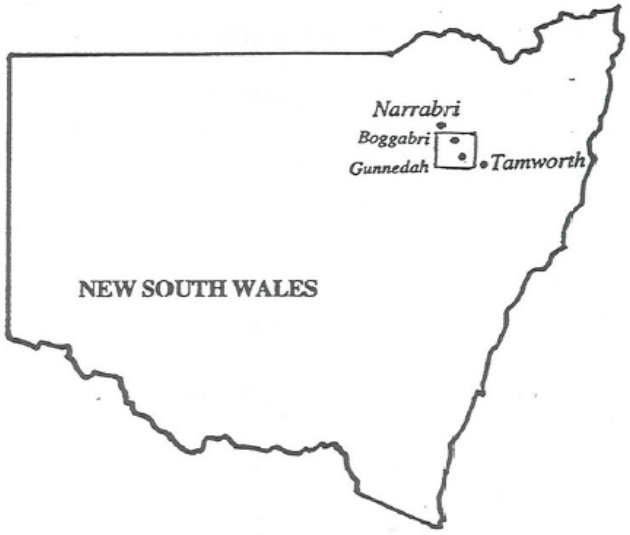
4.2 Location of participant's place of residence

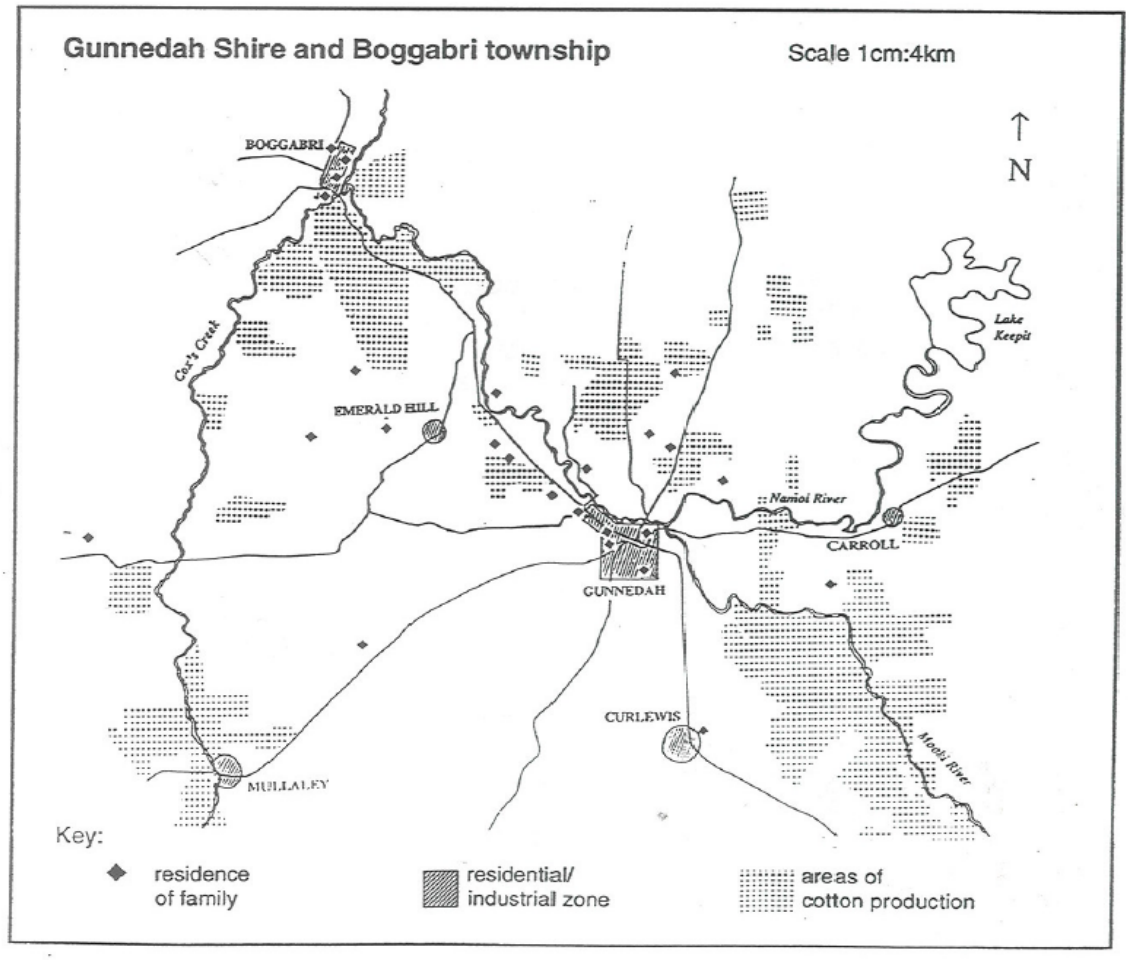
Participants were requested to mark their place of residence on a map (Figure 2). Approximate locations of cotton production in the Gunnedah Shire and Boggabri region are also shown.

Nine families resided within the residential boundaries of Gunnedah and Boggabri. Of those families 7 participants lived in Gunnedah and 15 in Boggabri. Cotton is grown approximately 5 km from the eastern edge of Boggabri township, and approximately 4 km north of the Gunnedah residential zone. Cotton is also grown approximately 3 km north west of the Gunnedah industrial area.

Other families resided within close proximity or at distances of greater than 5 km to cotton farms.

Figure 2. Map of participant's place of residence





4.3 Classification by category of symptom-exposure relationship

4.3.1 Frequency of cases experiencing symptoms by category

Every symptom of each individual was categorised according to assessment of the relationship of the symptom to chemical exposure. Table 1 displays the number of participants according to their clinically judged symptom-exposure relationship classification. Some participants had symptoms in two categories.

Table 1: Number of cases in each symptom-exposure relationship category

Category	Frequency	Percent of Participants (n=58)
Probably unrelated	29	50.0
Uncertain	29	50.0
Probably related	13	22.4
Other *	3	5.2

* *Three people did not have their symptoms allocated to a category by the consulting specialist.*

Note: Seventeen (17) people had symptoms that were allocated to two categories. Ten (10) had symptoms in the uncertain and the unrelated categories; 4 had symptoms in the related and uncertain categories, and 3 had symptoms in the related and unrelated categories.

4.3.2 Symptom clusters

The incidence of reported symptoms was examined, in order to determine if there were symptoms that occurred in association with each other, within each clinically judged symptom-exposure relationship category. Table 2 shows the number and percent of individuals reporting symptoms by symptom-exposure relationship. Tables 3 and 4 show common symptom clusters in the ‘probably related’ and ‘uncertain’ symptom-exposure relationship categories.

Table 2: Symptoms reported by participants according to symptom-exposure relationship

Symptom	Relationship to exposure			Total	% reporting symptoms n=55
	Probably related n=13	Uncertain relationship n=29	Not related n=29		
Rhinitis	8	16	6	30	54.5
Asthma	4	13	4	21	38.2
Headache	7	5	5	17	30.9
Skin irritation/ burning/rash	1	6	5	12	21.8
Fatigue	3	3	1	7	12.7
Eye irritation/ conjunctivitis	4	2	1	7	12.7
Arthralgia/ myalgia	2	1	2	5	9.1
Cognition (confusion/poor concentration)	2	3		5	9.1
Abdominal pain/ swelling		2	2	4	7.3
Sinusitis	1	1	1	3	5.5
Sore throat		1	2	3	5.5
Mood disorder/ depression		1	2	3	5.5
Food intolerance/ hyperactivity/ haemoptysis/ cough		1	3	4	7.3
Other medical conditions			5	5	9.1

Rhinitis and asthma were the symptoms most frequently reported by participants - 30 (54.5%) complained of rhinitis and 21 (38.2%) of asthma. When examined as 2 symptom clusters, 10 individuals in the uncertain category and one individual in the related category had both rhinitis and asthma.

Seventeen (30.9%) participants complained of headache, and eight(14%) in the related and uncertain categories had both headache and rhinitis.

Twelve (21.8%) individuals reported skin symptoms (urticaria, eczema, dermatitis, rash, itching, burning face/lips). Five were located in the related category, and two in each of the other categories.

There were no other symptoms that appeared to be clustered together in significant numbers.

Table 3. Common 2 symptom clusters in the probably related and uncertain symptom-exposure categories

Symptom	Associated symptoms : probably related category (n=13)						
	Rhinitis	Asthma	Headache	Fatigue	Concentration	Skin irritation/ condition	Eye irritation/ conjunctivitis
Rhinitis	*X*	1	5	3	2	1	2
Asthma		*X*	2	1	-	-	-
Headache			*X*	3	1	-	2
Fatigue				*X*	2	1	2
Concentration					*X*	1	2
Skin irritation/ condition						*X*	1
Eye irritation/ conjunctivitis							*X*

Symptom	Associated symptoms : uncertain category (n=29)						
	Rhinitis	Asthma	Headache	Fatigue	Concentration	Skin irritation/ condition	Eye irritation/ conjunctivitis
Rhinitis	*X*	10	3	2	1	1	1
Asthma		*X*	-	-	-	-	-
Headache			*X*	3	2	-	2
Fatigue				*X*	-	2	2
Concentration					*X*	1	1
Skin irritation/ condition						*X*	1
Eye irritation/ conjunctivitis							*X*

Symptom	Associated symptoms : total of probably & uncertain categories (n=38)						
	Rhinitis	Asthma	Headache	Fatigue	Concentration	Skin irritation/ condition	Eye irritation/ conjunctivitis
Rhinitis	*X*	11	8	5	3	2	3
Asthma		*X*	2	1	-	-	-
Headache			*X*	6	3	-	4
Fatigue				*X*	2	3	4
Concentration					*X*	2	3
Skin irritation/ condition						*X*	2
Eye irritation/ conjunctivitis							*X*

replicated data

X 1 symptom only

Table 4. Common 3 symptom clusters in the probably related and uncertain symptom-exposure categories

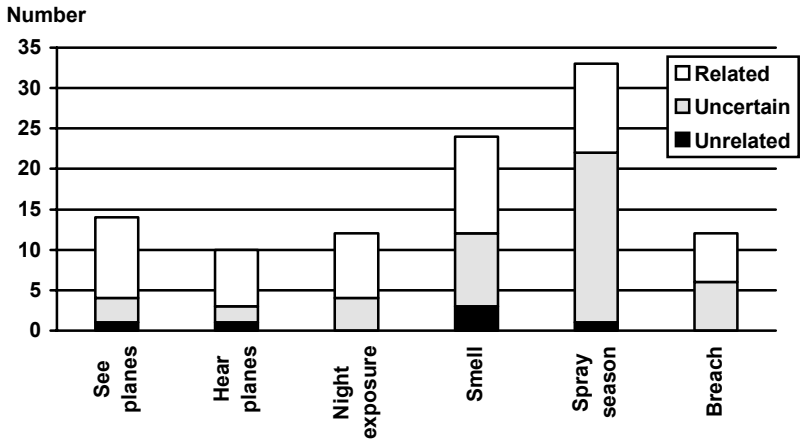
Symptom	Associated symptoms : total of probably & uncertain categories (n=38)					
	Asthma	Headache	Fatigue	Cognition	Skin irritation/ condition	Eye irritation/ conjunctivitis
Rhinitis & asthma	*X*	2	-	-	-	-
Rhinitis & headache		*X*	4	2	2	2
Rhinitis & fatigue			*X*	3	2	2
Headache & fatigue	-		*X*	2	-	-
Fatigue & eye irritation	-	2		2	2	*X*
Headache & eye irritation	1		2	2	-	*X*

replicated data
X 2 symptoms only

4.3.3 Perception of exposure

Participants were asked to describe when and how they perceived that they may have been exposed to chemicals. Perceived exposure was coded according to six events - sighting of planes; sound of planes; night exposure; smell; association of symptoms with the spray season; and reported breaches of safe application of chemical. Figure 2 displays the number of individuals able to identify a specific causal event by symptom-exposure relationship.

Figure 3: Factors prompting perceived exposure by symptom-exposure relationship

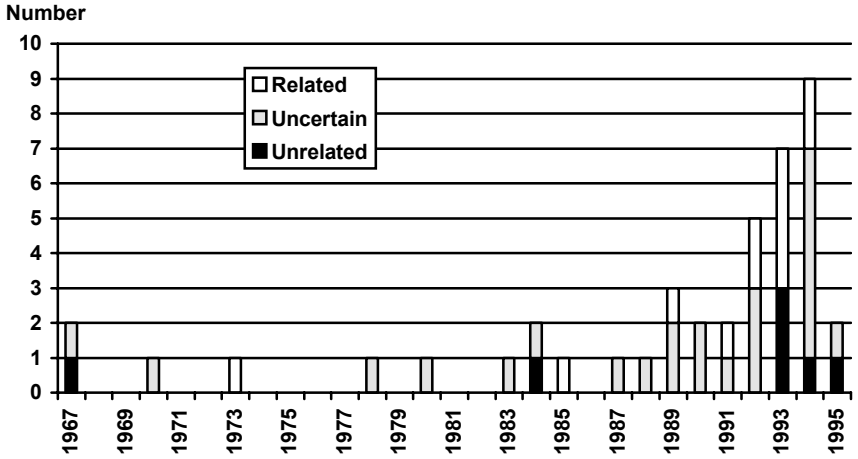


Most participants perceived they had been exposed by association with the spray season (33 individuals) followed by smell (24 individuals). The sound of planes was least likely to be perceived as a causal event for exposure to chemicals.

4.3.4 Year of onset of symptoms

Participants were asked to identify the year that their symptoms first became apparent. These were then compared with their symptom-exposure relationship category. Of the 55 individuals allocated to a category, only 42 (76%) specified a year of onset. Those with symptoms ‘probably unrelated' were least likely to identify a year of onset - only 7 out of 17 could do so. Twenty three of 25 in the 'uncertain' category, and 12 of the 13 in the 'probably related' category specified a year of onset. Figure 3 displays the year of onset (where specified by participants) by category of relationship to exposure.

Figure 4: Year of onset of symptoms by symptom-exposure relationship

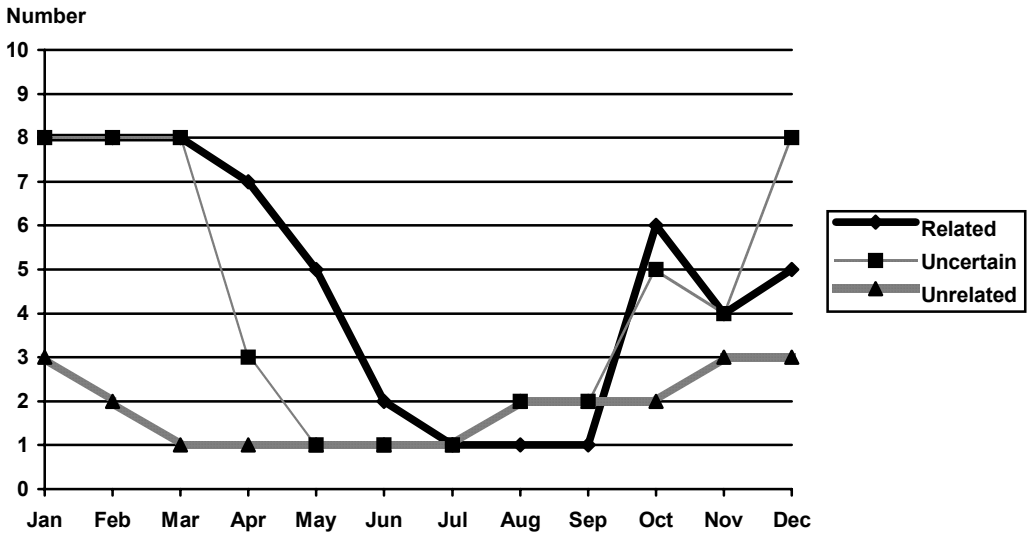


Amongst those who could report a year of onset, over half - 23 of 42 (55%) had symptoms that commenced between 1992-1995. Of these, 18 (78%) fell into the categories of uncertain relationship or probably related to exposure.

4.3.5 Number of participants affected each month

Participants were asked to indicate the period of time each year that they experienced symptoms. Only 27 (46%) nominated a time frame - 6/17 (11%) in the symptom category probably unrelated, 11/25 (20%) in the uncertain, and 10/13 (18%) in the probably related category. Figure 4 displays the total number of participants who experienced symptoms during each month, by category of relationship to exposure.

Figure 5: People affected each month by symptom-exposure relationship



Participants were most likely to experience symptoms during the months October to March. This was particularly the case for those in the categories of uncertain relationship and probably related.

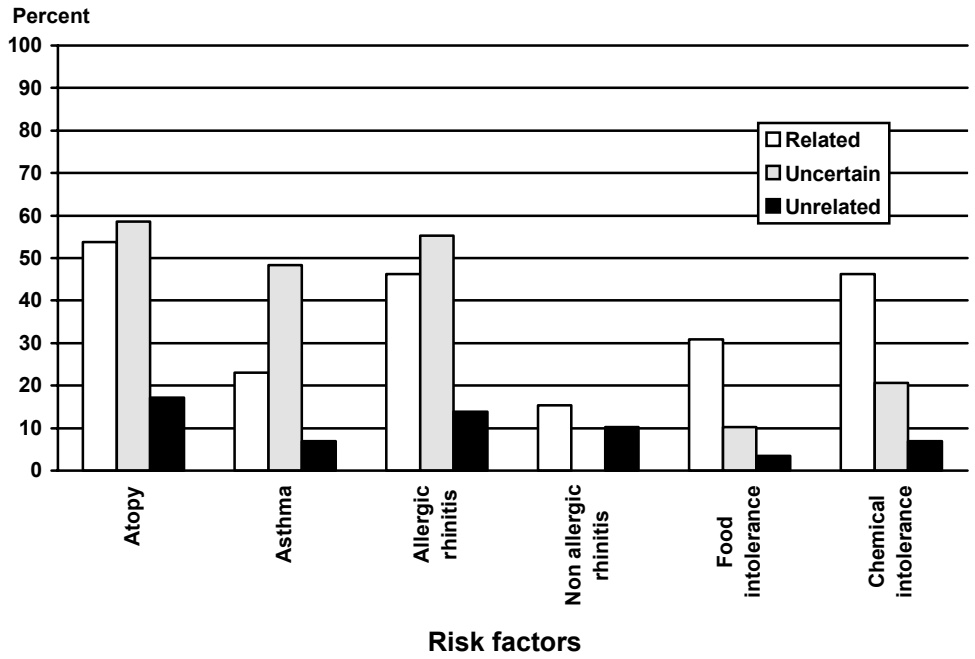
4.3.6 Possible risk factors

Participants were examined in relation to a number of risk factors that were thought to predispose them to an increased reaction to chemical exposure. The risk factors examined were the pre-existence of atopy; asthma; allergic and non allergic rhinitis/sinusitis; and chemical intolerance to foods or odours/fumes. Appendix 1 Table 1 displays the number and percent of individuals identifying the presence of risk factors.

Atopy was the possible risk factor most frequently identified in participants (50.0%). Seventeen (58.6%) of individuals where atopy was present had symptoms allocated to the 'uncertain' category.

Allergic rhinitis was present in 26 individuals (44.8%), again with the highest prevalence (16; 61.5%) in the uncertain category. Asthma was present in 19 individuals (32.7%), of which 14 (73.6%) were in the 'uncertain' category. Figure 5 displays the prevalence of each possible risk factor by category of relationship to exposure.

Figure 6: Risk factors by symptom-exposure relationship
(indicating percent of participants within each category)



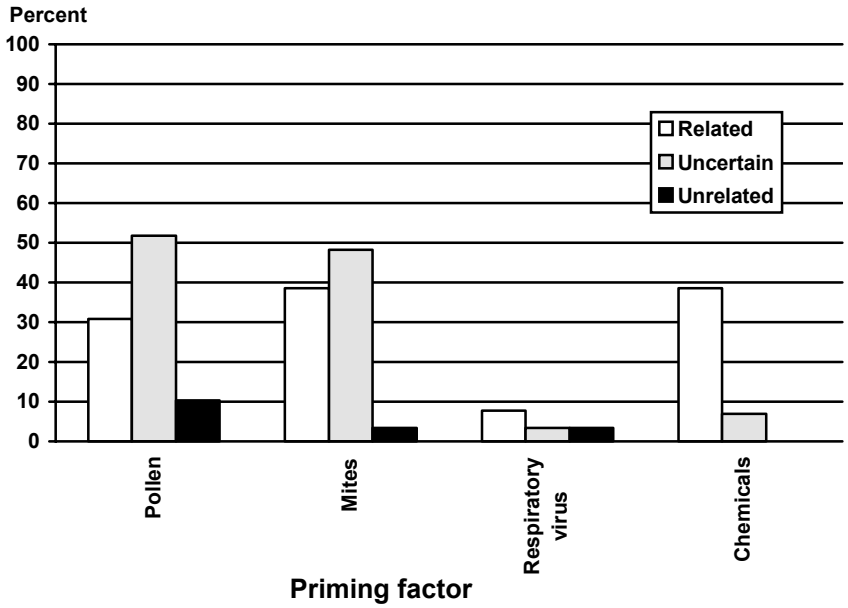
4.3.7 "Priming" conditions

The antecedent events considered to be relevant were active allergic disease (pollen and house dust mite allergies); viral infections (respiratory or other); and prior chemical exposure. Participants were also asked to identify any other allergies that they suffered from. Appendix 1 Table 2 displays the number and percent of individuals where priming factors were present by symptom-exposure relationship.

The most common priming factors identified were pollens (22 individuals, 40%), and mites (20 individuals, 36.4%). Respiratory infection and prior chemical exposure were identified in 3 (5.5%) and 7 (12.7%) individuals respectively. Once again, the majority of individuals where both pollens and mites were present as priming factors were in the 'uncertain' category. Figure 6 displays the frequency of individuals identified with priming factors by the 3 categories.

Other priming factors that were recorded were cat allergies (5 individuals); horse allergies (4); *Alternaria* allergy (1); Epstein Barr infection and hepatitis (1 each); and a variety of chemicals: agricultural sprays (2); hair spray (1); fly spray (1); bleach (1); cigarette smoke (1).

Figure 7: Priming factors by symptom-exposure relationship
(indicating percent of participants within each category)



4.3.8 Initiating events

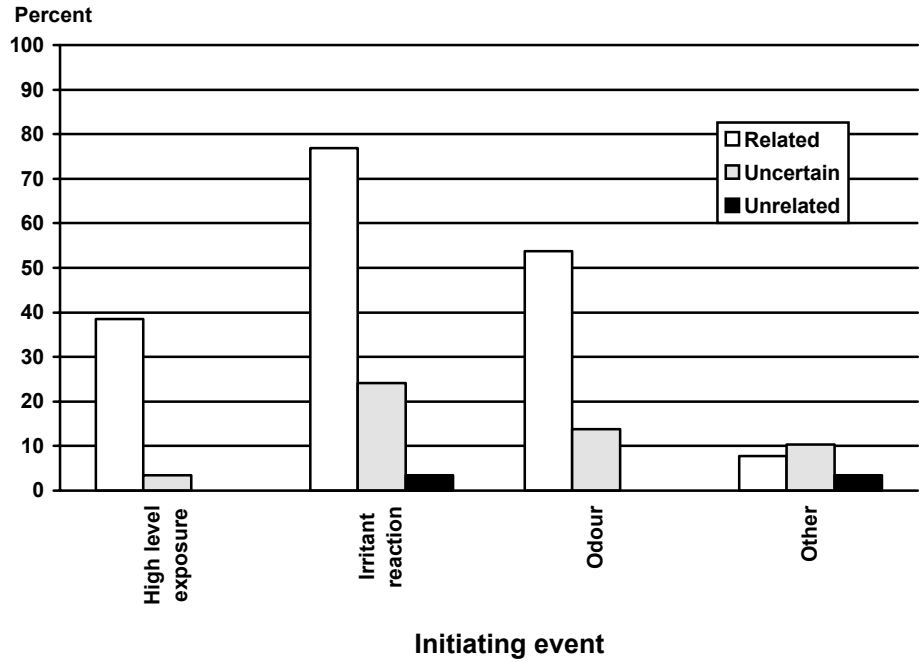
Participants were questioned about events surrounding the initial onset of symptoms. Responses were coded as:

- acute exposure (high level exposure, irritant reaction, foul odour)
- other.

An irritant reaction was most commonly reported by participants as the initiating event, with 18 individuals (32.7%) doing so. Eleven individuals (20%) reported odour, and 6 (10.9%) reported high level exposure. Figure 7 displays the frequency of individuals reporting various initiating events, for each category. Appendix 1 Table 3 displays the number and percent of individuals reporting an initiating event.

Five individuals reported other initiating events:- coal dust (1); hepatitis (1); pollen (1); relocation (1) ; and food intolerance (1).

Figure 8: Initiating events by symptom-exposure relationship
(indicating percent of participants within each category)



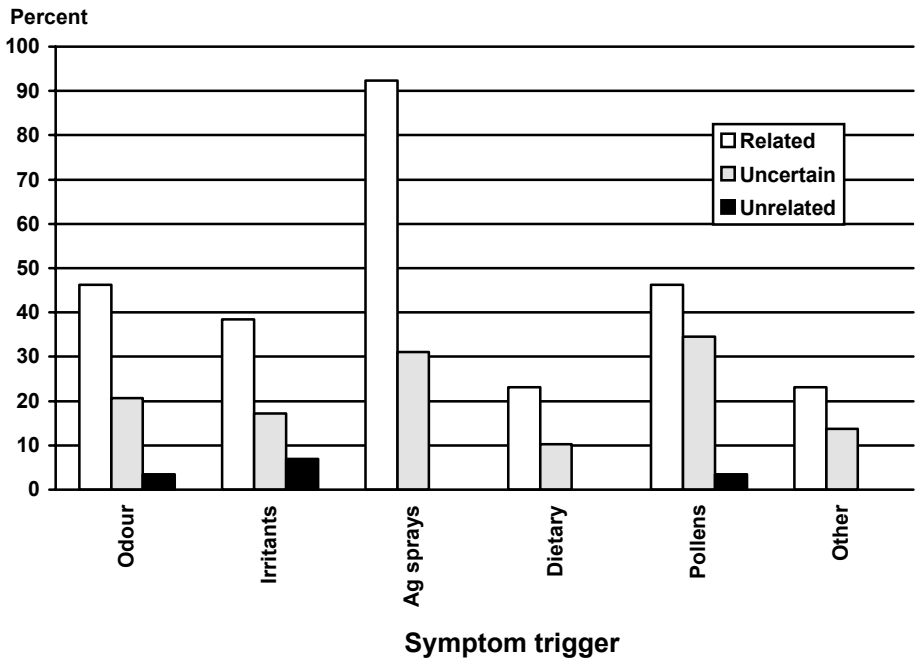
Of the 40 participants reporting initiating events, 23 (57.5%) were in the category where symptoms were probably related to exposure. Fifteen (37.5%) were in the uncertain category, and 2 (5%) in the probably unrelated category.

4.3.9 Symptom triggers

Participants were questioned about factors or triggers associated with recurrence of symptoms. Reported symptom triggers were categorised as either chemical or allergic. Chemical trigger classifications included odours/scents; irritants (domestic etc); agricultural sprays; and dietary. Allergens were recorded as pollens or other allergens.

Agricultural sprays were the most common symptom trigger reported, with 21 individuals (38.2%) reporting such. Pollens were reported by 17 individuals (30.9%), odour by 13 (23.6%), and irritants by 12 (21.8%). 'Other' triggers and dietary triggers were reported by 7 (12.7%) and 6 people (10.9%) respectively. Other triggers that were recorded were dust (5); cats (3); food (1) and horse (1). Appendix 1, Table 4 displays the number and percent of symptom triggers recorded. Figure 8 graphs frequency of symptom triggers by relationship to exposure.

Figure 9: Symptom triggers by symptom-exposure relationship
(indicating percent of participants within each category)



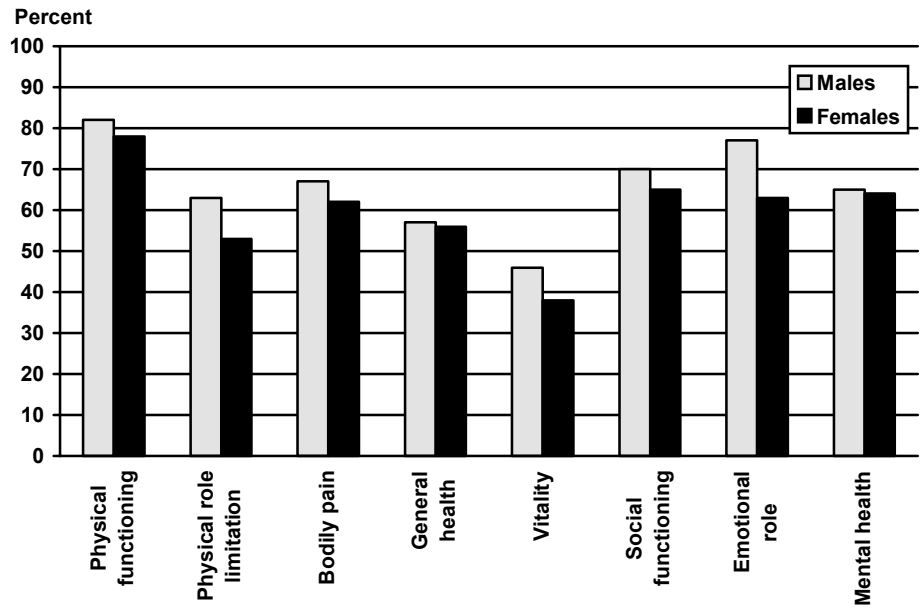
Out of the 76 who reported trigger events, 37 (48.7%) were in the uncertain category, 35 (46%) in the probably related category, and 4 in the unrelated category (5.3%). Individuals where agricultural sprays were recorded as a trigger were located exclusively in the uncertain and probably related categories.

4.4 General health status SF-36 results

The distribution of scores for the eight scales within the SF-36 for the Gunnedah participants are shown in Figure 10. Scores from 0-100 are possible, with higher scores indicating better health. Scores for physical functioning, bodily pain and emotional role are skewed towards the higher end of the scale. Scores for physical role show a bi modal distribution with scores clustered at the low and high ends of the scale. Social functioning is clustered around the middle to high scores. General health and mental health show a more normal distribution. Vitality scores are distributed across all scores.

The mean scores for all eight scales for Gunnedah participants were compared by gender and are displayed in Figure 11.

Figure 11: SF-36 mean scores by gender
(in cases aged 14 years and over)



Males had a mean score that was higher than females in all scales, however the differences between mean scores for males and females was not statistically significant for any scale.

The mean scores by gender for Gunnedah participants were then compared with the mean scores for Australian Norms. The results of this comparison are displayed in Figure 12.

Figure 10: Frequency distributions for SF-36 scale scores
(x-axis=score; y-axis=% of population)

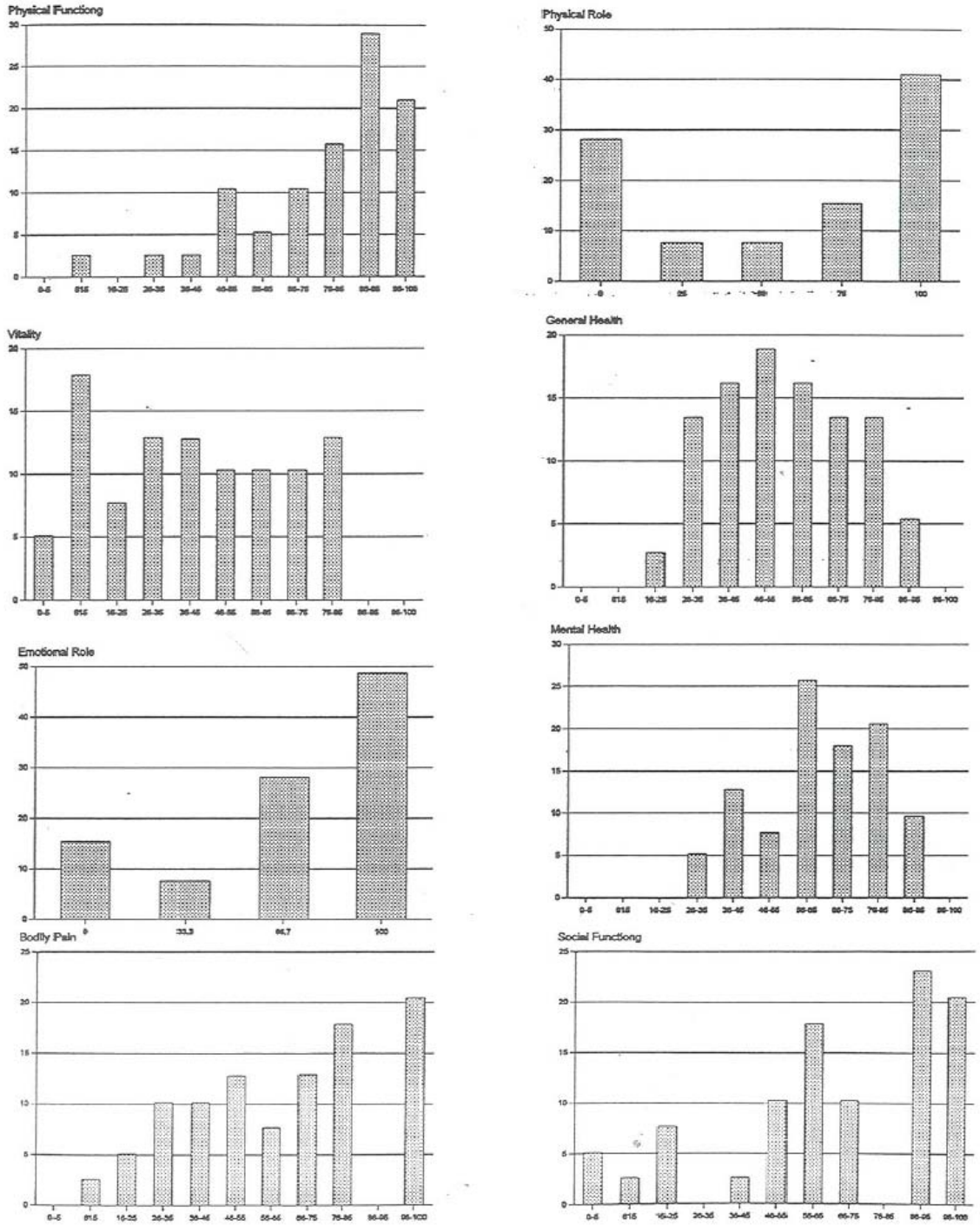
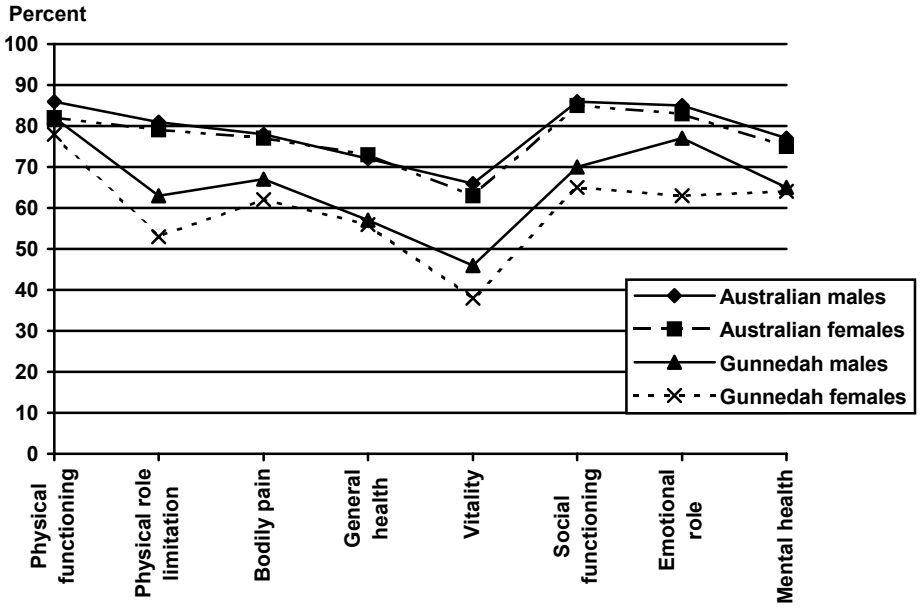


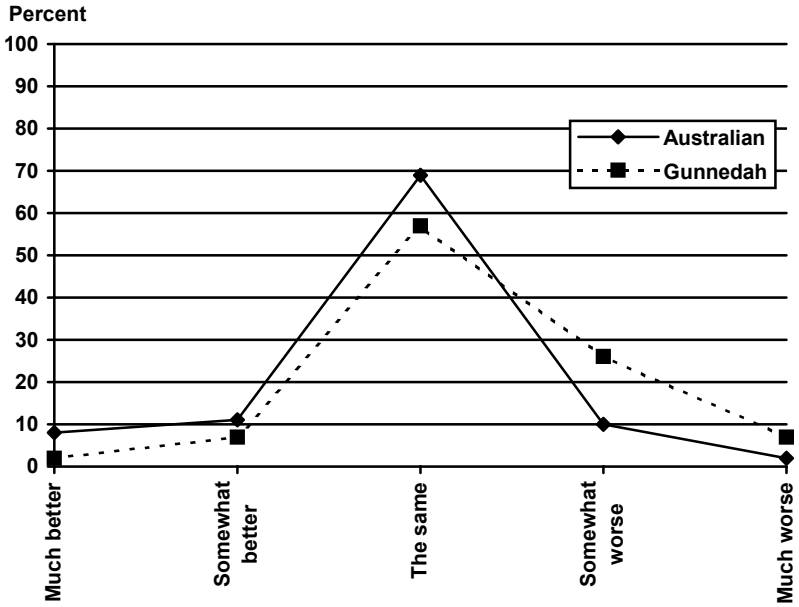
Figure 12: Mean SF-36 scores by gender for Gunnedah participants, compared to Australian norms



The scores for the Gunnedah health study participants were lower in every category for both males and females. However, none of the differences were statistically significant.

Transitional health status is an item in the SF-36 that self evaluates changes in health status over the preceding 12 months. This item is not scaled. Results from the Medical Outcomes Study[1] have shown that self reporting of "better" or "worse" health status accurately reflected changes in health status. Figure 13 compares the self reported transitional health status of participants in the Gunnedah study, with those for the Australian population.

Figure 13: Transitional health status for Gunnedah participants and the Australian population (compared to 12 months previously)



For the Gunnedah study participants, the majority (57.4%) reported the same health status as a year previously, followed by 25.9% stating that their health was somewhat worse than one year ago. They also rated their health lower in all categories than the Australian population. Fewer Gunnedah participants felt that their health was better than a year ago, and more felt that their health was worse than one year ago, compared to the Australian population.

4.5 Blood pathology

All blood pathology test results were reviewed for abnormalities and sent to the specialist who had examined the participant for comment. Abnormal pathology results were followed up by referral by the specialist to the participant's local doctor (see Section 4.6).

4.5.1 Cholinesterase tests

Serum and red blood cell (RBC) cholinesterase levels showed a normal population distribution over the laboratory reference range (6.0-15.6 kU/L for serum cholinesterase and >8.0 kU/LRBC for RBC cholinesterase). See Figures 14 and 15.

Haemolysis occurring in 7 samples caused an artefactual lowering of RBC cholinesterase results reported by the laboratory. The results of these samples were excluded from the data.

Samples from healthy, unexposed subjects taken at the same time indicated significant variability of test results, particularly in RBC cholinesterase measurements. The variability of the control sample results indicates that the RBC cholinesterase data should not be used as a valid baseline.

Three male and one female test result for RBC cholinesterase were slightly below the laboratory reference range. There were no serum cholinesterase results below the reference range.

Figure 14: Serum cholinesterase levels in males and females

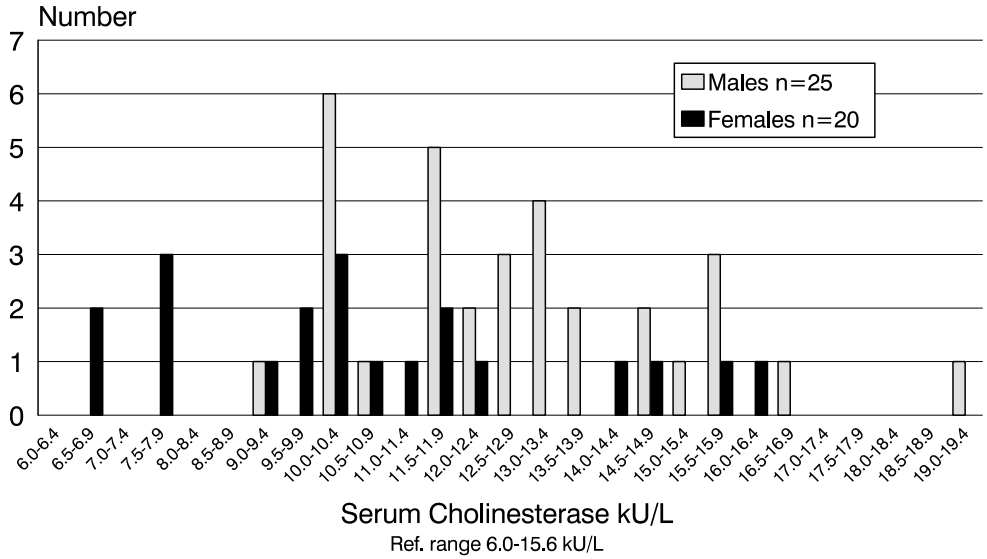
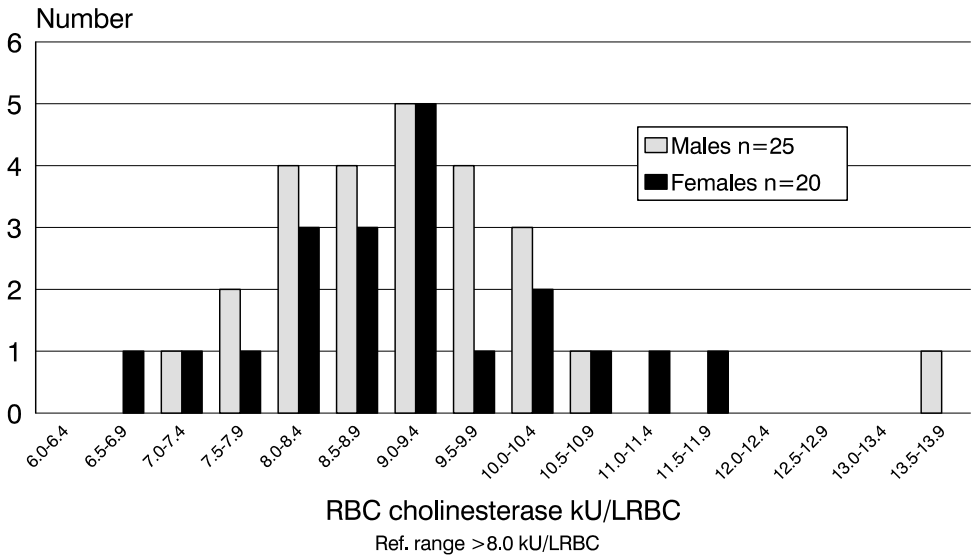


Figure 15: Red blood cell cholinesterase levels in males and females



4.6 Management of medical conditions

There were a number of unrelated medical conditions diagnosed by clinical examination and indicated by pathology results which required follow up referral by the specialists. These included cases with evidence of past glandular fever, abnormal haemoglobin levels, and haemoptysis.

The specialists provided advice to participants regarding improved medical management of their conditions. Many of those with rhinitis and asthma were advised about management of these conditions.

Test results of blood pathology, physical examination, skin tests, lung function tests and clinical recommendations made by the specialists for all individuals attending the assessment were made available to the local medical officer nominated by the participant. Participants were notified to consult with their family doctor during the next 12 months if acute health problems arose, and that they could be referred to a member of the specialist team if necessary.

5. DISCUSSION

The findings of this exploratory study confirm that there is no single condition or disease entity characterising the effect of reported exposure to pesticides in the Gunnedah environment. A number of health problems would appear to have been triggered or aggravated in susceptible people by exposure to pesticides and/or their odour.

The following symptoms were most commonly reported and assessed by the medical consultants as having a 'probable' or 'uncertain' relationship to cotton pesticides in Gunnedah:

- Rhinitis
- Asthma
- Headache

Other symptoms were less commonly associated:

- Skin irritation
- Eye irritation
- Fatigue
- Cognition problems (confusion, poor concentration).

Risk factors for adverse impact of chemical exposure were most commonly related to an allergic background - atopy, asthma or allergic rhinitis. Pollens were also nominated as a frequent trigger of symptoms, only second behind agricultural spraying. Most people experienced symptoms during October to March. The fact that many symptoms occur during this period that is related to high pollen activity as well as agricultural spraying further complicates the issue and makes it difficult to determine the role of either.

The general health status SF-36 results for the Gunnedah participants tend to the lower range compared to the Australian population generally.

Laboratory problems related to the cholinesterase test results have made these results difficult to interpret, and are the subject of further investigative action in association with the Workcover Authority of NSW, Queensland Medical Laboratories and SYDPATH laboratories.

Thirty nine individuals were invited to maintain a daily diary reporting symptoms reported to the clinicians. These will be important for the reassessment of their health status at the end of a 12 month period.

The results of this preliminary investigation provide a useful start point for design of a population based study into the health impact of pesticide exposure in a community closely associated with pesticides in the environment.

It is suggested that a further study should aim to test and confirm the validity and predictive power of the following symptoms as indicators of pesticide exposure in the community:

Upper respiratory tract - rhinitis	Nose Throat Sinus
Lower respiratory tract	Asthma
Skin	Skin irritation/conditions
Eye	Irritation/conditions
General	Headache Cognition Fatigue

Design of such a study should involve input from a wider range of specialists, with the local public health authorities, including toxicologists, biochemists with the immunologists and allergists already involved.

6. CONCLUSIONS AND RECOMMENDATIONS

This study has provided a description of the health status of a group of 58 people resident in the Gunnedah and surrounding area, who reported health effects associated with exposure to aerial spraying of pesticides. The information collected is based largely on their perceived health status, symptoms that they experience and some clinical tests.

Whilst it is acknowledged that the classification of reported symptoms into categories of relatedness to exposure has been based upon reports of perception by each individual to the examining medical officers, the description of symptoms, likely contributing and triggering factors, and initiating events, have provided a base from which it should be possible to design a study that will determine the effects of agricultural sprays on the health status of the local population.

In light of these findings the following recommendations are made:

1. That the local Gunnedah Chemical Liaison Committee be supported in its efforts to reduce exposure of the community to agricultural chemicals.

2. That a formal study be designed with the aims of confirming the validity and predictive power of symptoms reported by participants in this study in

determining the effects of pesticide spraying on the health of local residents, using a control population in a similar geographic area without significant aerial application of agricultural chemicals.

3. That the following representatives be invited to participate in development of the study design:

- The New England Public Health Unit
- The Australian Agricultural Health Unit
- The Gunnedah Chemical Liaison Committee
- ANEWPAC nominee
- The North Coast Public Health Unit
- The National Research Centre for Environmental Toxicology (Brisbane)
- The Australasian Society of Clinical Immunology and Allergy ((NSW Branch)
- The Environmental Health Branch, NSW Health
- A specialist toxicologist
- The Australian Cotton Foundation
- The NSW Environmental Protection Agency - Pesticide Unit
- NSW Agriculture - Environmental Policy Officer

(With power to coopt other specialists for specific issues).

The Australian Agricultural Health Unit is prepared to convene the Steering Committee meetings to plan and coordinate the study, although additional resources would be required.

5. That the study design be established taking into account:

- The findings of this exploratory study
- The international literature relating to the health impact of agricultural chemicals
- Health information relating to chemicals in current use in Agriculture
- Concerns identified to the Steering Committee - an opportunity would be provided for participants to identify these to the Convenor of the Steering Committee prior to its commencement.

REFERENCES

1. Ware, JE and Sherbourne, CD. The MOS 36 item Short Form Health Survey (SF-36):1. Conceptual framework and item selection. (1992) Medical Care, 30, 473-483.

2. Stevenson, C. SF-36: Interim norms for Australian data. (1996). Australian Institute of Health and Welfare: Canberra.

APPENDIX 1

Table 1: Number and percent of participants where possible risk factors were identified by symptom-exposure category

Risk factors	Symptom-exposure relationship						Total	% of total
	Probably related n=13		Uncertain n=29		Probably unrelated n=29			
	n	%	n	%	n	%		n=55
Atopy	7	53.8	17	58.6	5	17.2	29	52.7
Asthma	3	23.1	14	48.3	2	6.9	19	34.5
Allergic rhinitis	6	46.2	16	55.2	4	13.8	26	47.3
Non allergic rhinitis	2	15.4	0	-	3	10.3	5	9.1
Food intolerance	4	30.8	3	10.3	1	3.4	8	14.5
Chemical intolerance	6	46.2	6	20.7	2	6.9	14	25.4

Table 2: Number and percent of participants where priming factors were identified by symptom-exposure category

Priming factors	Symptom-exposure relationship						Total	% of total
	Probably related n=13		Uncertain n=29		Probably unrelated n=29			
	n	%	n	%	n	%		n=55
Pollens	4	30.8	15	51.7	3	10.3	22	40.0
Mites	5	38.5	14	48.3	1	3.4	20	36.4
Respiratory virus	1	7.7	1	3.4	1	3.4	3	5.5
Chemical	5	38.5	2	6.9	0	-	7	12.7

Table 3: Number and percent of participants reporting initiating events surrounding onset of symptoms by symptom-exposure category

Initiating events	Symptom-exposure relationship						Total	% of total
	Probably related n=13		Uncertain n=29		Probably unrelated n=29			
	n	%	n	%	n	%		n=55
High level exposure	5	38.5	1	3.4	0	-	6	10.9
Irritant reaction	10	76.9	7	24.1	1	3.4	18	32.7
Odour	7	53.8	4	13.8	0	-	11	20.0
Other	1	7.7	3	10.3	1	3.4	5	9.1

Table 4: Number and percent of participants where symptom triggers were identified by symptom-exposure category

Symptom triggers	Symptom-exposure relationship						Total	% of total
	Probably related n=13		Uncertain n=29		Probably unrelated n=29			
	n	%	n	%	n	%		n=55
Odours, scents	6	46.2	6	20.7	1	3.4	13	23.6
Irritants	5	38.5	5	17.2	2	6.9	12	21.8
Agricultural spray	12	92.3	9	31.0	0	-	21	38.2
Dietary	3	23.1	3	10.3	0	-	6	10.9
Pollens	6	46.2	10	34.5	1	3.4	17	30.9
Odour	3	23.1	4	13.8	0	-	7	12.7