

**THE HEALTH IMPACT OF PESTICIDE EXPOSURE IN  
A COHORT OF OUTDOOR WORKERS**

**BY**

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## **ABSTRACT**

This thesis describes a study undertaken between 1992 and 2001 to explore the possible health impacts of human exposure to pesticides. The study followed the health outcomes of approximately 4000 outdoor workers over a period of up to sixty-one years. These workers comprised two subcohorts of approximately even size, one composed of agricultural workers with high insecticide exposures, and the other made up of outdoor staff from local councils in the same area with little or no occupational exposure to insecticides. Mortality and morbidity were compared between the two groups, and with the general Australian community.

The study identifies significantly increased mortality among both exposed and control subjects when compared to the Australian population. The major cause of this increase was mortality from smoking related diseases. The study also identifies significant increases in mortality among exposed subjects for a number of conditions that do not appear to be the result of smoking patterns, both when compared to the control group and the Australian population. These include pancreatic cancer in some DDT exposed subjects and asthma, diabetes, and leukaemia in subjects working with more modern chemicals. There was also an increase in self reported chronic illness and asthma, and lower neuropsychological functioning scores among surviving exposed subjects when compared to controls. Diabetes was also reported more commonly by subjects reporting occupational use of herbicides.

## **DECLARATION**

I hereby declare that the material contained in this thesis has not been published elsewhere, except where due reference is made, and that this thesis has not been used to obtain any other academic award.

John Beard

December 2001

To Christine for her love, support and understanding.

To Jessie, Malcolm and Jordan for their inspiration.

## PREFACE

This Doctor of Philosophy (PhD) thesis describes the methods and findings of an historical cohort study undertaken on the north coast of New South Wales (NSW) to examine the health impact of high pesticide exposures among staff of the NSW Board of Tick Control. The *North Coast Outdoor Workers Study*, as it came to be known, was prompted by widespread community and worker concern that these exposures might be resulting in a number of adverse outcomes. The study was undertaken by the Northern Rivers (formerly North Coast) Public Health Unit in response to these concerns and as part of its involvement in the NSW Cattle Tick Dip Management Advisory Committee.

As the principle investigator for this study I had sole responsibility for

- Its conception, planning and management;
- Reviewing the related literature;
- Developing the study design and analysis strategy;
- Overseeing the collection, entry and cleaning of data;
- Data analysis (in conjunction with co-investigators as outlined below);
- Interpreting results;
- Writing associated reports and papers now in preparation.

The role of my co-investigators in this study was as follows:

- Mr. Tim Sladden developed SAS programs for calculation of SMRs and SIRs based on programs given to us by Dr. Stephen Corbett;
- Dr. Geoff Morgan provided extensive assistance in further refining these programs;
- Dr. Lyndon Brooks undertook some of the analysis relating to the survey of surviving cohort members.

A number of research assistants also participated in the study. Their roles were:

- Ms. Jan Atkins searched records and undertook extensive interviews to identify members of the exposed cohort. Jan also entered much of the original data on these subjects;
- Mr. Mark Dowling further developed the database and oversaw the follow-up of non responders to the questionnaire survey;
- Ms. Margaret Leedow cleaned the dataset and undertook further data entry;
- A number of other research assistants telephoned non responders to the questionnaire and encouraged their participation;
- Ms. Ria Maximilian created the questionnaire database and entered the questionnaire data.

## ACKNOWLEDGEMENTS

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I am also grateful for the assistance of:

- NSW Agriculture for providing access to their records and staff;
- Dr. Lyndon Brooks for assistance with analysis;
- Ms. Jan Atkins for her initial work with the Dippers themselves;
- Mr. Mark Dowling for overseeing subject follow-up and with the database;
- Ms. Margaret Leedow for help with the databases;
- Ms. Ria Maximillien for her work on the survey database;
- Dr. Paul Jelfs at the Australian Institute of Health and Welfare for his support matching the cohort with the National Deaths Index;
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- The Northern Rivers Area Health Service for funding the study;
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- Participants in the study for their good humoured but conscientious contributions.

I would also like to thank all the members of my team at the Southern Cross Institute of Health Research and the Population Health Directorate of the Northern Rivers Area Health Service for their tolerance and understanding.

## ACRONYMS

<b>ANOVA</b>	<b>Analysis of Variance</b>
<b>BMJ</b>	<b>British Medical Journal</b>
<b>CI</b>	<b>Confidence Interval</b>
<b>DDE</b>	<b>DDT metabolite p,p'-dichlorodiphenyldichloroethylene</b>
<b>DDT</b>	<b>1,1,1-trichloro-2,2'-bis(p- chlorophenyl) ethane</b>
<b>HIC</b>	<b>Health Insurance Commission</b>
<b>ICD</b>	<b>International Classification of Diseases</b>
<b>IHD</b>	<b>Ischaemic Heart Disease</b>
<b>LCL</b>	<b>Lower Confidence Level</b>
<b>LGA</b>	<b>Local Government Area</b>
<b>OR</b>	<b>Odds ratio</b>
<b>PMR</b>	<b>Proportional Mortality Ratio</b>
<b>ppb</b>	<b>Parts per Billion</b>
<b>ppm</b>	<b>Parts per million</b>
<b>SIR</b>	<b>Standardised Incidence Ratio</b>
<b>SMR</b>	<b>Standardised Mortality Ratio</b>
<b>UCL</b>	<b>Upper Confidence Level</b>

## DEFINITIONS

### **Pesticide**

Pesticides have been defined as “any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest”(Klaassen 2001). The term pest includes harmful, destructive, or troublesome animals, plants or microorganisms.

When discussing possible exposure to these chemicals, this study has used the generic term “pesticides” except when referring to a specific subset of chemical.

### **Insecticide**

Pesticides used in the control of insects.

### **Herbicide**

Pesticides used in the control of plants.





A Dipper prepares to treat cattle

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b>	<b>13</b>
1.1	BACKGROUND TO THE STUDY	14
1.2	AIM OF THE STUDY	19
1.3	HYPOTHESIS TO BE TESTED	19
<b>2</b>	<b>EPIDEMIOLOGICAL STUDIES OF INSECTICIDE EXPOSURE</b>	<b>20</b>
2.1	HISTORICAL PERSPECTIVE	20
2.2	HEALTH EFFECTS OF INSECTICIDES IN HUMANS	24
2.2.1	ACUTE PESTICIDE POISONING	24
2.2.2	BACKGROUND TO STUDIES ON CHRONIC HEALTH EFFECTS	25
2.3	DESCRIPTIVE AND ECOLOGICAL STUDIES	27
2.4	COHORT STUDIES	33
2.4.1	PESTICIDE MANUFACTURERS/FORMULATORS	34
2.4.2	PESTICIDE APPLICATORS	36
2.4.3	AGRICULTURAL WORKERS AND FARMERS	40
2.4.4	MARKET GARDENERS AND ORCHARDISTS	44
2.4.5	GRAIN MILLERS	45
2.5	CASE-CONTROL STUDIES	47
2.5.1	SUICIDE	47
2.5.2	COLORECTAL CANCER	48
2.5.3	BREAST CANCER	48
2.5.4	CANCER OF THE BRAIN	51
2.5.5	CANCER OF THE PANCREAS	51
2.5.6	SOFT TISSUE SARCOMA	54
2.5.7	MULTIPLE MYELOMA	55
2.5.8	LUNG CANCER	56
2.5.9	LEUKAEMIA	58
2.5.10	PROSTATE CANCER	60
2.5.11	NON HODGKIN'S LYMPHOMA	60
2.5.12	CANCER IN OFFSPRING	63
2.5.13	ENDOCRINE AND REPRODUCTIVE DISORDERS	64
2.5.14	NEUROPSYCHOLOGICAL EFFECTS	72
2.5.15	PARKINSON'S DISEASE	76
2.5.16	IMMUNOLOGIC DISTURBANCES	78
2.5.17	CHROMOSOME ABERRATIONS	78
2.6	SPECIFIC INSECTICIDES USED IN CATTLE DIPS	79
2.6.1	ARSENIC	79
2.6.2	DDT	81
2.6.3	OTHER PESTICIDES	83
2.7	SUMMARY	83

### **3 METHODOLOGY** **86**

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3.1	OVERVIEW	86
3.2	COHORT DEFINITION	87
3.3	SELECTION AND ENUMERATION OF STUDY POPULATIONS	87
3.3.1	SELECTION CRITERIA	91
3.4	COLLECTION OF EMPLOYMENT AND MORTALITY DATA	92
3.5	ASSESSMENT OF VITAL STATUS	92
3.6	CAUSE OF DEATH	98
3.7	MORBIDITY DATA	98
3.8	EXPOSURE DATA	100
3.9	ANALYSIS	103
3.9.1	REFERENCE POPULATIONS	103
3.9.2	DURATION OF EMPLOYMENT	104
3.9.3	DATA ENTRY	105
3.9.4	LATENCY	105
3.9.5	DATA ANALYSIS	106
3.9.6	CALCULATION OF STANDARDISED MORTALITY RATIOS	107
3.9.7	INTERNAL COMPARISONS	108
3.9.8	ANALYSIS OF SURVEY OF SURVIVING COHORT MEMBERS	109

### **4 RESULTS** **110**

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4.1	DESCRIPTIVE INFORMATION	110
4.1.1	SUBJECT DATES OF BIRTH	110
4.1.2	EMPLOYMENT HISTORY	111
4.2	MORBIDITY	114
4.2.1	SURVEY RESPONSE RATES	114
4.2.2	CHARACTERISTICS OF EXPOSED AND CONTROL GROUPS	115
4.2.3	SELF REPORTED OCCUPATIONAL PESTICIDE EXPOSURES	117
4.2.4	SELF REPORTED MORBIDITY	118
4.3	MORTALITY	122
4.3.1	CAUSES OF DEATH	123
4.3.2	STANDARDISED MORTALITY RATIOS	126
4.3.3	COMPARISON OF UNDERLYING CAUSE OF DEATH BETWEEN EXPOSED AND CONTROL SUBCOHORTS	136
4.4	SPECIFIC OUTCOMES	142
4.4.1	ALL CAUSE MORTALITY	142
4.4.2	CANCER MORTALITY	143
4.4.3	PANCREATIC CANCER	145
4.4.4	ASTHMA	148
4.4.5	DIABETES	151
4.4.6	DEATHS FROM DISEASES OF THE CENTRAL NERVOUS SYSTEM	155
4.4.7	LUNG CANCER, ISCHAEMIC HEART DISEASE, CIRCULATORY DISEASE, RESPIRATORY DISEASE AND EMPHYSEMA	156
4.4.8	LEUKAEMIA	160

<b>5</b>	<b>DISCUSSION</b>	<b>164</b>
5.1	METHODOLOGY	164
5.1.1	STUDY DESIGN	164
5.1.2	EXPOSURE ASSESSMENT	168
5.1.3	STUDY SIZE AND FOLLOW-UP	173
5.1.4	POSSIBLE STUDY BIAS AND CONFOUNDING	174
5.1.5	SURVEY OF SURVIVING COHORT MEMBERS	176
5.1.6	OUTCOME ASCERTAINMENT	178
5.1.7	ANALYTICAL TECHNIQUES	179
5.1.8	SUMMARY OF METHODOLOGICAL STRENGTHS AND WEAKNESSES	181
5.2	STUDY FINDINGS – OUTCOMES	183
5.2.1	ALL CAUSE MORTALITY	185
5.2.2	CANCER MORTALITY	186
5.2.3	CIRCULATORY DISEASE	192
5.2.4	SMOKING RELATED DISEASE	192
5.2.5	PANCREATIC CANCER	197
5.2.6	LEUKAEMIA	200
5.2.7	ASTHMA	203
5.2.8	DIABETES	208
5.2.9	SURVEY OF SURVIVING SUBJECTS	210
5.3	STUDY FINDINGS - EXPOSURES	213
5.3.1	ARSENIC	214
5.3.2	DDT	215
5.3.3	MODERN CHEMICALS	215
<b>6</b>	<b>SUMMARY</b>	<b>217</b>
<b>7</b>	<b>BIBLIOGRAPHY</b>	<b>221</b>