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

BY

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A thesis submitted to fulfill the requirements for the degree of
Doctor of Philosophy, University of Sydney

December 2001

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

I am especially grateful for the assistance and encouragement of my supervisor, Prof. Geoffrey Berry, and co-supervisor Prof. Charles Kerr. This project started as work towards a Masters treatise, and I am also grateful to my supervisors over that period, Prof. Tony McMichael and Prof. Alistair Woodward.

I wish to particularly thank Mr. Tim Sladden and Dr. Geoffrey Morgan for their remarkable patience while developing the analytical programs. I am also grateful to Dr. Stephen Corbett for providing me with SAS programs that formed the basis for much of this analysis.

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;
- Ms. Diane Loza for assistance with presentation;
- Mr. John Simpson, Mr. Geoff Sullivan and Mr. Joe Holloway for assistance in gathering information on local work practices;
- The Northern Rivers Area Health Service for funding the study;
- The NSW Public Service Association for assistance contacting subjects;
- 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

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

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