

Environmental Health and Primary Health Care: Towards a New Workforce Model

Submitted by

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I dedicate this thesis to the people whose health and lives have been affected by their exposure to AgVets, while their calls for help have been unheard.

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FOREWARD

The principal factor driving this study was hearing community concerns regarding widespread health problems, believed to be associated with exposure to Agricultural and Veterinary (AgVet) chemicals. Further to this, community members reported dissatisfaction with their experience when attempting to bring these issues to the attention of local primary health care providers, principally their general practitioners. The belief was frequently expressed that current health services lacked environmental health expertise. Also commonly reported was the view that government agencies should take a more active role in investigating and rectifying the issue. The high degree of frustration surrounding this issue was universal, and the consistency was remarkable. It became increasingly evident that these concerns were broadly held across the communities, and warranted investigation to determine firstly whether these fears were founded, and secondly, to examine existing primary health care infrastructure in terms of its ability to effectively identify and address emerging chronic environmental health hazards.

This information was initially drawn to the attention of the study's principal investigator, whilst lecturing post-graduate Registered Nurses in the Shepparton region. Over a seven year period, 20 to 30 percent of each cohort of students reported that they either had moved house, or had contemplated relocating due to health complaints among their own families, which *they believed* were due to the proximity of their home to the orchards, and resulting exposure to AgVet chemicals. These nurses found it alarming that they could not navigate their way through the health care system to find satisfaction in health care, although on average, they had been working within the health sector for over twenty years. Their primary complaint was being unable to find a general practitioner who could answer their questions, and provide relevant advice or treatment. It became apparent that with little diagnostic activity, reporting and monitoring was not occurring. Hence it could not be known to what extent a systematic problem existed.

Further confirmation that community concern about health risks associated with exposure to agricultural chemicals was widespread about occurred through membership on various health agency boards of management, and other regional health committees throughout the north east Victoria. Residents of the Ovens and King Valleys shared similar intense concerns to those living near the Goulburn Valley orchards. The prevailing sentiment was one of anger at the apparent lack of interest from their doctors and response from the Department of Human Services.

A brief literature review revealed that several studies had investigated water quality (river water, groundwater, and rainwater tanks) in these two locations, and both regions showed pesticide contamination. The community's concerns appeared valid and this provided the impetus for this investigation.

This study therefore represents an investigation of community driven concerns, a "bottom up" approach to a reported public health problem. Accordingly, the ultimate objective is to identify strategies to address these concerns, and where required, recommend potential solutions. As a first step, the study aims to provide evidence regarding the nature and determine the extent of concern for the issues identified by community, and illustrate any shortfalls within the existing system infrastructure. The intent is to synthesize this information in order to highlight components within our health system where improvements are needed in order to serve the community better.

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SUMMARY

Public health was once synonymous with environmental health, but the two fields diverged as living conditions improved. Environmental factors are again harming human health. Increasing global reliance on agricultural and veterinary chemicals over recent decades has emerged as a serious public health concern as evidence of their toxicity accumulates, prompting international efforts to minimize, monitor and manage exposure risks. Direct involvement of the primary health care workforce is seen as critical to this process, yet little data exists on the health burden on Australian rural communities imposed by these chemicals.

The study presented here attempts to explore the impact of these chemicals on two rural communities, and ascertain how the existing primary health care system responds to exposure issues. The client – provider interface is not an entity acting in isolation from other frameworks. It has evolved against a background of legislation and provider training. Other factors also impinge, such as the structure and focus of the health sector, and Australia’s systematic approach to environmental and chemical management. Examination of this underlying infrastructure in Australia provided the background against which the issue of exposure to agricultural and veterinary chemicals was explored. A brief summary of international developments in this area served to provide insight as to what interventions may be introduced to address this issue.

A CATI survey of 1050 households sought the perspectives from two Victorian agricultural communities to gather self-reported exposure and health data, whether respondents perceived their health problems were linked to exposure. Respondents were also asked to comment on their experiences encountering primary health care providers, and which services they prefer to seek for health advice. Perspectives were then sought from all primary health care providers servicing these communities on their level of expertise in diagnosing, and managing exposure related illness, via face-to-face interviews, focus groups and paper surveys.

These rural communities have a long history of hazardous exposure to toxic AgVets. Awareness of toxicity risks is growing, yet further scope exists to improve safe handling of chemicals. High levels of illnesses known to be associated with AgVet exposure exist in these communities. Many believe their own ill-health is linked to exposure, and they express strong dissatisfaction with the apparent lack of

environmental health expertise especially among their GPs. Health providers demonstrated limited understanding of the health impacts of AgVet exposure.

The lack of expertise in the existing primary health care workforce means that these conditions are not being identified, and the absence of health intelligence hampers health planning. In Australia, the health, environment and primary industries sectors function in effect, as distinct silos, with little cross-fertilisation. The United States has combined its agricultural chemical legislative authority with a focus on human health, where there are direct links between programs designed to protect human health, and biomonitoring. The U.S. also has developed environmental health expertise at the primary health care level to address community needs as they arise. Strategies are required to connect environmental, chemical management and health portfolios in Australia, with respect to the emerging environmental issue of chemical exposure. There is a need also in Australia to inject environmental health capacity into the primary health care practice.

STATEMENT OF AUTHORSHIP

Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis submitted for the award of any other degree or diploma.

No other person's work has been used without due acknowledgement in the main text of the thesis.

The thesis has not been submitted for the award of any degree or diploma in any other tertiary institution.

The La Trobe University Human Ethics Committee approved all research procedures reported in the thesis.

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ABBREVIATIONS

2,4,5-T	2,4,5-trichlorophenoxyacetic acid
2,4-D	2,4-dichlorophenoxyacetic acid (a systematic post-emergence herbicide)
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AMC	Australian Medical Council
AML	Acute Myeloid Leukaemia
AgVet	Agricultural and Veterinary chemicals
AIEH	Australian Institute of Environmental Health
ATSDR	Agency for Toxic Substances and Disease Registry (USA)
API	Acute Pesticide Intoxications
APVMA	Australian Pesticide and Veterinary Management Authority
AVCARE	The National Association of Crop Protection and Animal Health (a peak industry body)
BEACH	Bettering the Evaluation and Care of Health
CAM	Complementary and Alternative Medicine
CATI	Computer Assisted Telephone Interview
CDC	Centers for Disease Control and Prevention (USA)
CFS	Chronic Fatigue Syndrome
CHC	Community Health Centres
CSB	Chemical Standards Branch (Victoria)
DDE	1,1-dichloro-2,2-bis(<i>p</i> -chlorophenyl)ethylene 11,1,-trichloro-2 bis(4-chlorophenyl)ethylene, Dichlorodiphenyl trichloroethane (a lipophilic organochlorine)
DDT	
DoHA	Department of Health and Ageing (AUS)
DHS	Victorian Department of Human Services
DHHS	Federal Department of Health and Human Services (USA)
DPI	Victorian Department of Primary Industries
EC	European Commission
EU	European Union
EDC	Endocrine Disrupting Chemicals
EHO	Environmental Health Officers
enHealth	National Environmental Health Council
EPA	Environment Protection Authority
EPHC	Environment Protection and Heritage Council
EPHT	Environmental Public Health Tracking Program
EWP	Electronic White Pages
FSANZ	Food Standards Australia and New Zealand
GATT	General Agreement on Tariffs and Trade

GIS	Geographical Information Systems
GP	General Practitioners
GVGP	Goulburn Valley Division of General Practitioners
HCB	hexachlorobenzene
HGP	Hormone Growth Promotants
IFCS	Intergovernmental Forum on Chemical Safety
ILO	International Labour Organization
IOM	Institute of Medicine (USA)
IPCS	International Programme on Chemical Safety
LD	Lethal Doses
LD50	Median Lethal Doses (concentration of active ingredient in milligrams per kilogram of body weight, required to kill 50 per cent of test animals in a laboratory)
MCS	Multiple Chemical Sensitivity
MSDS	Material Safety Data Sheets
MRL	Minimum Residue Limits
NDP	National Dioxins Program
NDS	National Data Set of Compensation-based Statistics
NEVDGP	North Eastern Victoria Division of General Practice
NEHF	National Environmental Health Forum
NEHS	National Environmental Health Strategy
NEPC	National Environmental protection Council (comprised of Commonwealth, States and Territories Ministers)
NHMRC	National Health and Medical Research Council
NICNAS	National Industrial Chemical Notification and Assessment Scheme
NIEHS	National Institute of Environmental Health Science (USA)
NIOSH	National Institute for Occupational Safety and Health (USA)
NHL	NON-HODGKIN'S LYMPHOMA
NOHSC	National Occupational Health & Safety Commission
NPHP	National Public Health Partnership
OC	Organochlorines
OECD	Organisation for Economic Cooperation and Development
OHN	Occupational Health and Safety Nurses
OHS	Occupational Health and Safety
OP	Organophosphate
PCBs	Polychlorinated Biphenyls
PCP	Primary Care Partnership
IPHERP	Public Health Education and Research Program
PHC	Primary Health Care
PISP	Pesticide Illness Surveillance Program (California, USA)
POP	Persistent Organic Pollutants

PPE	Personal Protective Equipment
REACH	Registration, Evaluation, Authorisation of Chemicals (EU)
SAICM	Strategic Approach to International Chemicals Management
SES	Socio-economic status
SENSOR	Sentinel Event Notification System for Occupational Risks
TCM	Traditional Chinese Medicine
TGA	Therapeutic Goods Administration
UN	United Nations
UNCED	United Nations Conference on Environment and Development (UNCED)
UNEP	United Nations Environment Programme
WCED	World Commission on Environment and Development
WHO	World Health Organization
WSSD	World Summit on Sustainable Development

GLOSSARY

active constituent – in relation to AgVet products, an active constituent is a substance that is primarily responsible (alone or in combination with other active constituents) for the biological effect of the product/s.

acute effects – effects that occur rapidly following exposure and are of short duration

Agenda 21 – The plan of action that was adopted at the United Nations Conference on Environment and Development in Rio in 1992. Chapter 19 of the Agenda addresses environmentally sound management of toxic chemicals.

AgVet - Agricultural and Veterinary Chemical- are substances or products which are covered by the Agricultural and Veterinary Chemicals Code Act 1994. Agricultural chemicals include herbicides, insecticides and fungicides used in agriculture; insect repellents for use on humans; household and garden products for pest and weed control; and some pool chemicals such as those used to kill bacteria and algae. Veterinary product chemical definitions include animal therapeutic products; allergenic substances; medicated blocks and licks; and enzymes for animals.

aquifer – a deposit of rock that yields economic supplies of water to wells or springs as a result of its porosity or permeability.

attributable burden - the proportion of current disease or injury burden that results from past exposure

avoidable burden -- the proportion of future disease or injury burden that is avoidable if current and future exposure levels are reduced to those specified by some alternative, or counterfactual, distribution.

Bahia Declaration on Chemical Safety – Declaration by the IFCS in October 2000, reaffirming the commitment of participants to the Rio declaration. Key goals include: the improvement of chemical safety at all levels and the prevention or reduction of adverse health and environment effects of chemicals throughout their life-cycle.

bioaccumulation – the uptake of substances from the environment, their concentration, and retention by organisms. It includes the process by which a pesticide becomes concentrated in living organisms, and the build-up of a chemical in organisms at concentrations greater than the levels in their environment.

bioavailability – the extent to which a chemical substance to which the body is exposed (by ingestion, inhalation, injection, or skin contact) reaches the systematic circulation, and the rate at which this occurs.

biodegradable – able to be decomposed readily by the action of micro-organisms.

biological monitoring – determination of chemicals or metabolites in the tissues and biological fluids of organisms

biomarkers – measurement of a chemical or metabolite in biological tissue or fluid as a surrogate for biological effects.

ChemClear – proposed industry scheme to manage unwanted farm chemicals following completion of the ChemCollect program (see below).

ChemCollect – a joint, one-off State/Territory and Commonwealth Governments scheme to collect and safely dispose of unwanted and de-registered farm chemicals, including organochlorine pesticides. It ran progressively from November 2000 until December 2002.

chemical management system - the combination of tools and approaches employed to assess and reduce the risks of chemical use to human health and the environment. It can include: legislation, assessment methods, standards, codes of practice, education and training, financial incentives.

chronic effects – effects that develop slowly and have a long duration. They are often, but not always, irreversible. Some irreversible effects may appear a long time after the chemical substance was present in the sensitive tissue. In such cases, the latent period (or time to occurrence of an observable effect) may be very long, particularly if the exposure is low (WHO 1989).

community health services - services to meet the main health needs of their defined community, using multidisciplinary workforce to provide accessible, comprehensive programs to all sections of the community, with particular attention to vulnerable groups. It involves community participation in health care decision making, and they form part of the primary health care service network.

content validity – whether the measurement tool, and the items it contains, are representative of the content domain the researcher intends to measure

cost-benefit analysis – the systematic documentation of relevant benefits and costs over time; quantified in monetary terms where possible or qualitatively assessed in the absence of quantitative data

dose-response assessment relates the probability of a health effect to the dose of pollutant or amount of exposure

DrumMUSTER – national program for the collecting and recycling of empty, cleaned, non returnable rigid metal and plastic farm chemical containers.

ecotoxic – harmful to ecosystems and/or the organisms within them.

ecotoxicology – the field of science dealing with the adverse effects of chemicals, physical agents, and natural products on populations and communities of plants, animals and human beings.

endocrine disruptor – substance that interferes with the working of the endocrine (hormone) system. Observed effects of endocrine disruption have included masculinisation, feminisation, and birth defects, reproductive or immune dysfunction.

EnHealth Council – the national peak environment body established as a subcommittee of the National Public Health Partnership. The enHealth Council is responsible for coordinating the implementation of the national environmental Health Strategy, setting priorities, and advising Commonwealth, state, territory and local governments on environmental health issues.

environmental health - (World Health Organization) “Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social and psychological factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling and preventing those factors in the environment that can potentially have an adverse effect on the health of present and future generations.”

environmental health - (enHealth Council) “... about creating and maintaining environments that promote good public health. It covers the assessment, correction, control and prevention of environmental factors that adversely affect health, as well as the enhancement of those aspects of the environment that improve human health.”

environmental health care – see **environmental health practice**

environmental health practice - The focus of this practice is on individuals and communities, but can also include activities to reduce hazards in the physical environment. assessing, correcting, controlling and preventing hazardous environmental exposures that could potentially have an adverse effect on the health of individuals or populations. This can be through the practice of conducting assessments (environmental assessments, risk assessments, clinical health assessments, or biomonitoring), correcting hazardous situations, or unhealthy or risky behaviours, and preventing hazardous exposures by offering prevention (primary, secondary or tertiary).

environmental health service – health protection undertaken by EHOs, focussing on the physical environment: assessing, correcting, controlling and preventing those factors in the environment that can potentially have an adverse effect on the health of present and future generations.

environmental health hazard – an environmental factor with the potential to cause adverse health effects. Examples of environmental health hazards include: allergens, antibiotic agents in animals destined for human consumption, chemicals, drought, electromagnetic fields, explosive material, radiation, toxins, viruses, and more.

environmental oestrogens are chemicals in the environment which act like the female sex hormone, oestrogen (estradiol). Oestrogenic chemicals may occur normally in nature and may be found in plants and our diet. Others are synthetic. These are mostly found in plastics or insecticides such as PCB's DDT, Dioxins, and furans.

exposure – contact of a chemical, physical, or biological agent with the outer boundary of an organism, for example, inhalation, ingestion, or dermal contact

exposure assessment – the estimation (qualitative or quantitative) of the magnitude, frequency, duration, route and extent of exposure to one or more contaminated media for the general population, for different subgroups, or for individuals

food additive – Any non-nutritive substances added intentionally to food, generally in small quantities, to improve its appearance, flavour, texture, or storage properties, with the exception of substances which are added to food exclusively for their nutritive properties, but including animal feed adjuncts which may result in residues in human food, and other contaminants (WHO 1989).

gentotoxic – toxicity resulting in modification of DNA

hazard – the capacity of an agent to produce a particular type of adverse effects to people or the environment under conditions of exposure.

hazard identification identifies the types of health effect that can be caused, based on toxicological data from laboratory or epidemiological studies: for example, chemical x causes liver damage.

hazardous chemicals/substances – substances that are toxic, persistent and liable to bioaccumulate or which give rise to an equivalent level of concern

health care - preventative, diagnostic, therapeutic, rehabilitative, maintenance or palliative care, services, procedures or counselling provided by health professionals. It can be directed at individuals or groups in the community.

health care provider = health professional – an individual trained to have the skills and competencies recognized to provide health care. (Here, the term 'health provider' does not include an agency, department, unit, or other entity that delivers a health-related service.)

health sector - an umbrella term that includes health care providers, and supporting service staff, institutions providing health care services, professional organisations, and also government administrative and funding bodies.

health risk assessment - the process of estimating the potential impact of a chemical, biological, physical, or social agent on a specific human population system under a specific set of conditions and for a certain timeframe.

heavy metals – a term loosely applied to a whole range of elements, not all of them metals, which may contaminate the environment. Heavy metals include antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, germanium, lead, mercury, molybdenum, nickel, selenium and zinc.

industrial chemicals – a chemical that has an industrial use, whether or not it has an excluded use. An excluded use is use as an agricultural chemical or veterinary chemical, a therapeutic use, or use as a food or food additive. Industrial chemicals include dyes, solvents, adhesives, plastics, laboratory chemicals, paints as well as chemicals used in cleaning products, cosmetics and toiletries.

integrated assessment – a method of analysis that combines the results and models from the physical, biological, economic, and social sciences, and the interactions between these components, in a consistent framework to evaluate the status and consequences of environmental change and the policy responses to it.

intersectoral collaboration – different professional groups or departments working cooperatively to achieve the one goal.

leaching – the movement of a substance downward or out of the soil as the result of water movement, or wash-out of various substances from soil by infiltrating water.

lethal doses (LD50), doses which are determined by the concentration of active ingredient in milligrams per kilogram of body weight, required to kill 50 per cent of test animals in a laboratory.

Montreal Protocol on Substances that Deplete the Ozone Layer 1987 – An international instrument to control substances responsible for depleting the ozone layer. It sets out strategies for controlling the consumption of CFCs, halogens, and other deleterious chemicals and imposes staged reduction programs.

multi-level determinants - simultaneous influences on health that occur within individuals, systems, communities, and environments

pesticide - agricultural and household chemicals such as insecticides, herbicides and fungicides. They are by definition biocidal, and are designed for the specific purpose of destroying organisms which share many human biological pathways.

persistence – a measure of the length of time a compound will remain in the environment before being broken down or degraded into other and less hazardous substances. Persistent substances can become distributed world-wide, particularly in the marine environment or in the atmosphere.

Persistent Organic Pollutants (POPs) - chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife.

pollutant – any undesirable solid, liquid or gaseous matter, in a gaseous, liquid, or solid medium.

population attributable risk -- the proportion of disease in a population that results from a particular risk to health.

precautionary principle - in order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

primary care - is often used in Australia interchangeably with primary medical care as its focus is on clinical services provided predominantly by GPs.

primary health care (PHC) - is a level of care, and a philosophical approach to health care. It incorporates five principles as defined in the WHO Alma Ata declaration: equitable distribution of health services, community involvement, emphasis on disease prevention, use of appropriate technology, and an approach that involves a range of sectors (housing, agriculture, water supply). The 'primary' has multiple meanings: first point of access to the health care sector, early stage of addressing health problems, basic (as in accessible and affordable care), and essential (as in being the foundation of the health system). PHC incorporates primary care, but has a broader focus as it extends also to community health services.

primary prevention – involves intervening in systems to address risk factors for disease (and to eliminate exposure to harmful agents (before diagnosis and to develop measures designed to promote general optimum health. It can be divided into two types: health promotion, and specific protection

Prior Informed Consent – The principle that international shipment of a chemical that is banned or severely restricted in order to protect human health and the environment should not proceed without the agreement, where agreement exists, or contrary to the decision of, the designated authority in the importing country.

public health – (as defined by Winslow in 1920) is the science and art of preventing disease, prolonging life, and promoting physical and mental health, and efficiency through organised community efforts for the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organisation of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will ensure to every individual in the community, a standard of living adequate for the maintenance of health.

registration – the process by which authorities review and assess a product and approve its sale or use for specific purposes.

relative risk -- the likelihood of an adverse health outcome in people exposed to a particular risk, compared with people who are not exposed. For example, if people who smoke for a certain time are, on average, 15 times more likely to develop lung cancer than those who do not smoke, their relative risk is 15.

Rio - United Nations Conference on Environment and Development, where the Rio Declaration on Environment and Development was formed.

risk – the probability, that in a certain timeframe, an adverse outcome will occur in a person, group of people, plants, animals and/or the ecology of a specified area that is exposed to a particular dose or concentration of a hazardous agent, combined with the magnitude of the consequence of that adverse effect.

risk assessment – the identification of environmental health hazards, their adverse effects, target populations, and conditions of exposure. It typically involves a combination of hazard identification, risk estimation, exposure, and risk characterisation.

risk characterization combines the exposure and dose--response assessments to calculate the estimated health risks, such as the number of people predicted to experience a particular disease, for a particular population. This typically includes estimation and communication of uncertainties.

risk management – the managerial, decision-making and control process to deal with those environmental agents for which risk evaluation has identified that the risk is too high.

Rotterdam Convention – Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (or PIC). This international treaty was drawn up to give importing countries the power to make informed decisions as to which chemicals they will receive and which they will exclude because they cannot be managed safely. If a country agrees to import chemicals, the Convention promotes their safe use through labelling standards, technical assistance, and other forms of support.

secondary prevention – the targeting of people at risk, or in the early stage of a health condition in order to prevent the condition from developing or becoming worse

Stockholm Convention on Persistent Organic Pollutants – International treaty to protect human health and the environment from persistent organic pollutants (POPs). It requires the reduction of persistent, bioaccumulating chemicals with adverse health/environmental effects. Governments implementing the Convention are required to take measures to eliminate or reduce the release of POPs into the environment and to consider these characteristics when assessing chemicals.

surveillance – the continuous monitoring of data about all aspects of occurrence and spread of disease or health condition in order to enable effective interventions being undertaken

tertiary prevention – the targeting of people with a health condition to reduce the impact of the condition and optimise health-related quality of life

thematic analysis – a mode of analysis that seeks out the meaning within data sets by placing various patterns together. The themes reflect the issues inherent within the data texts

therapeutic chemicals/substances – medicines and medical devices for use in connection with preventing, diagnosing, curing or alleviating a disease, ailment, defect or injury in humans.

toxicity – a physiological or biological property which defines the ability of a chemical to do harm, or produce injury, to a living organism by other than mechanical means.

validity - an expression to the degree to which a measurement measures what it purports to measure.

veterinary medicines include all veterinary chemical products such as vaccines, antibiotics, growth promotants, worming treatments, and flea and tick washes, and other parasiticides for both domestic and production animals.