

GeoHealth Laboratory

Research & Applications

Te tai whenua o te hau ora

GeoHealth Laboratory
Research & Applications

First Annual Report

2005/06



MANATU HAUORA

Public Health Intelligence NZ

Charting our health

GIS Expertise & High Quality Research for Public Health

Dept. of Geography
*Health and Environment
Research Group*



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Introduction

The GeoHealth Laboratory (Research & Applications) was established in 2005 as a partnership between Public Health Intelligence (PHI), the epidemiology group of the Ministry of Health, and the Health and Environment Research Group of the Department of Geography, University of Canterbury (UoC).

The aims of the laboratory are to:

- build a strategic partnership around health geography, spatial epidemiology and Geographical Information Systems (GIS)
- increase research capacity and research outputs in health and GIS

Funded in the first instance for three years, the Laboratory will advance Ministry of Health policy and the University of Canterbury's health sciences research agenda for the mutual benefit of the New Zealand health sector.

The GeoHealth Laboratory was launched by the then Minister of Health, the Hon Annette King MP, in November 2004 at the *GeoHealth 2004* Conference in Wellington. The Laboratory was formally opened on the 18th February 2005 by Dr Don Matheson, Deputy Director General, Public Health, Ministry of Health and Professor Roy Sharp, Vice Chancellor, University of Canterbury.

Why have a GeoHealth Research Laboratory?

The Laboratory is driven by the desire to exploit the potential of GIS (computer systems for integrating and analyzing geographically referenced data) and Geographical Information Sciences (GIScience - the combination of GIS and associated spatial statistics and spatial thinking applied to the analysis of geographically distributed data) for practical health research. By linking health outcomes and environmental and socioeconomic determinants, the application of GIScience provides powerful tools for studying population characteristics, the provision of health services and the spatial distribution of disease.

In this respect the GeoHealth Laboratory provides a unique resource for the Southern hemisphere. The research focus of the Laboratory is practical application. By drawing on the leading geohealth research and teaching experience of the Department of Geography, combined with the policy focused GIS and spatial epidemiology expertise of PHI provides access to the most up to date expertise for the practical deployment of GIScience and geohealth research for the benefit of the New Zealand health sector.

First Annual Report of the GeoHealth Research Laboratory

This is the first annual report of the Laboratory. The report describes the infrastructure, workplan, milestones, achievements and key events in the first year of operation of the Laboratory; as well as setting out the aims and work plan in detail for year two and the overall strategic direction of the Laboratory for year three and beyond.

Section 1 outlines the key funding stream of the Laboratory for its first three years of operation, together with details of the personnel, infrastructure, equipment, data and management of the Laboratory. Sections 2, 3 and 4 describe the workplan of the Laboratory broken down into its three constituent parts, research, scholarships and training. Section 5 covers the important publicity and promotional activities undertaken to increase awareness and publicise the Laboratory; whilst Section 6 outlines the immediate goals for year two and the strategic direction beyond. Laboratory produced reports and associated materials are included in the appendices.

Appendix 1 contains key background papers setting out the vision and rationale for forming the strategic partnership and the Laboratory.

Comments from the Management Team

Paul White – Reflections of the first year

The speed of progress from our idea, early discussions with Jamie, to opening the Laboratory has been remarkably short. This rapid progress overcoming Ministry and University procedures that are not always known for rapidity is I think clear evidence of the openness, goodwill and ultimately trust that has been, and is continuing to be, shown by both PHI and the Department of Geography. This is the positive foundation that the Laboratory rests on.

The Laboratory has come a long way in a year and achieved a tremendous amount. In addition to finding a space, fitting it out, purchasing kit, dealing with the seemingly endless contract negotiations and recruiting staff we have in our first year of operation already demonstrated the value of the Laboratory to PHI's core work programme through the great work that Irfon has undertaken working on the Suicide Facts and Suicide Trends documents. In addition we have begun to roll out the public Health Geographical Data Analysis training which is an invaluable asset to the New Zealand public health community. These are just three of an already impressive and growing portfolio of work – the full extent of which is described in this report.

For this and all his hard work with pushing through much of the administrative processes to establish the Laboratory and for the daily running of the Laboratory I would like to thank Jamie. I would also like to acknowledge the Board, most notably Barry and Eric for their enthusiastic support for this project. Clearly, irrespective of mine or Jamie's motivation without high level Ministry and University support the Laboratory would not have got off the ground, so thank you Barry and Eric.

There is always room for improvement, and for year two I have four goals:

- strengthen the links between the Laboratory and PHI and achieve a greater degree of integration and alignment between our two work programmes
- integrate Laboratory personnel with PHI, and PHI with the Laboratory - the one big happy family approach!
- increase awareness of the Laboratory across the health sector and beyond – keep spreading the word
- as a personal goal I want to exploit the opportunities the Laboratory affords me to keep up to date with current research and learn from colleagues in this area. To do this I want to engage more in joint projects and spend more time in the Laboratory

From PHI's perspective I am happy with the way things have progressed. I think this is an excellent foundation from which to move forward and I greatly look forward to working with Jamie and the Laboratory team next year.

Paul White
Co-director GeoHealth Laboratory
May 2006

Jamie Pearce

The past 14 months have been a busy and exciting period where we have moved rapidly from a very exciting, but yet distant idea, to a fully functioning and research active-Laboratory. I have been extremely pleased with the way in which we have managed to develop a portfolio of excellent research which is both of high quality and of great significant policy relevance. The work has already led to a number of academic publications as well as formed significant components of Ministry of Health publications such as the recent suicide reports. It has been important to all parties that we develop a strategy that is of mutual benefit to the strategic aims of both PHI and the department of Geography – on this I feel we have done very well.

An integral component of our success in year one has been the appointment of a number of excellent researchers and postgraduate students who have each made a significant contribution to GeoHealth research in New Zealand. It has been pleasing to note the critical mass of people now working in the GeoHealth Laboratory as well as the valuable interactions which take place between GeoHealth members. The strength and range of the GeoHealth seminars we have held in our monthly GeoHealth seminar series is testimony to the strength and diversity of this research. In year two I am very much looking forward to working with Paul and PHI to bring a greater profile to our joint research through the publication in high quality international academic journals, continued attendance at national and international events as well as through a range of PHI outlets. I think that it is important that we are proactive in sharing our work with health researchers and health professionals both within New Zealand and abroad, as well as listening to these voices when shaping our own research priorities.

I am very much looking forward to developing an exciting agenda of health research with Paul and other colleagues at PHI over the next 12 months, as well as identifying priorities for the next stage of the GeoHealth Laboratory venture.

Jamie Pearce
Co-director GeoHealth Laboratory
May 2006

Section 1. GeoHealth Research Laboratory Infrastructure

In this section the core funding, facilities and personnel of the Laboratory are described:

1. Funding and Expenditure
2. Personnel
3. Facilities
4. Equipment
5. Management

1. Funding

The Laboratory has two principal funding streams, one directly provided by PHI and the other indirectly provided by the Department of Geography.

PHI Direct Funding

The direct funding schedule from PHI is set out in the contract between PHI and the UoC dated 14th December 2004 and included in appendix 2. The direct funding from PHI amounts to \$395,000.00 plus GST for three years, with payments commencing on 20th January 2005. Final payment to the UoC for this contract will be on 20th October 2007. An outline of the funding schedule is given in table 1.

Table 1. GeoHealth Research Laboratory Funding Schedule (Contract section B2.1, page 2.)

Service Output Description	Total Price (Excl. GST)	GST Rate
Establishment of GeoHealth Laboratory	\$25,000	12.5%
Scholarship Programme and Training Programme (including a one year Student Fellow)	\$220,000	12.5%
Research Programme	\$150,000	12.5%
TOTAL	\$395,000.00	

The contract has been subject to variations that have increased the funding to the UoC. These additional payments relate to direct funding streams for personnel seconded to PHI.

UoC Indirect Funding

The UoC provides indirect funding to the Laboratory through the Department of Geography in the form of staff time and associated resources. Additionally the UoC provided an equal \$25,000 direct funding for start-up costs.

2. Personnel

The Laboratory funds one full time (for the duration of the contract) research assistant post. In addition the contract and subsequent variations fund a further three equivalent positions as secondments to PHI, one placed in the Laboratory in Christchurch, and two located in PHI in Wellington. As part of the partnership the time and associated costs of the management team (two permanent posts) is provided and funded by PHI and the Department of Geography external to the contract costs. The Laboratory also funds Masters and PhD Scholarships (detailed in section 3 below) that are located in, and contribute to the work of, the Laboratory. The Laboratory is able to draw upon the wider expertise of the Department of Geography. In this respect the Laboratory also hosts a number of Department of Geography postgraduate students and Research Assistants. Similarly, but less observable, the Laboratory is also able to access the expertise of the wider PHI group (specifically including the geohealth and spatial epidemiology group). Finally, whilst separate to these posts the Laboratory is also able to draw upon the expertise of the five Board (non Director) members. An outline of Laboratory personnel is given in table 2.

Part of the budget allocation, amounting to approximate three percent of salary of the Laboratory Research Assistant posts is provided for training to encourage staff development.

The flexible hosting arrangement of the Laboratory affords access to a larger pool and greater diversity in expertise than the funding permits, and is one of the main direct advantages to PHI of the Laboratory. This means that in practice for the funding of four posts the Laboratory is able to draw upon the expertise of in excess of 46 people. This number can be added to through the units run by the Laboratory's two external Board members Professor Graham Moon and Associate Professor Laurie Brown. Finally the contributions from both the Department of Geography's and PHI other relationships can also be included, most notably from PHI relationships with the Centre for Public Health Research Massey University; the Epidemiological Centre, Massey University, and the School of Mathematics and Applied Statistics, University of Wollongong. Such a large virtual group forms by far the largest applied spatial and environmental epidemiology research group in the Southern Hemisphere.

The first Laboratory Research Assistant, Matthew Faulk, resigned in December 2005. A subsequent recruitment round has taken place and the post has been offered to an excellent candidate.

Table 2. Current GeoHealth Research Laboratory Personnel

Post	Location	Name
Core funded post: Research Assistant	Laboratory	Mathew Faulk Jan05 Dec05. Replacement sought
PHI seconded posts: Research Assistant level	Laboratory	Irfon Jones
	PHI	Kurt Janssen Kylie Mason
Masters scholarships	Laboratory	Catherine Tisch Erin Holmes Esther Rhind (start June 2006)
PhD scholarships	Laboratory	Non-to date
Board	Dept Geog	Prof. Eric Pawson (joint chair)
	UoC	Prof. Andrew Hornblow
	PHI	Dr. Barry Borman (joint chair)
	UK	Prof. Graham Moon
	Australia	Assoc. Prof. Laurie Brown
Management team	Dept Geog	Dr. Jamie Pearce
	PHI	Dr. Paul White
Dept Geog postgraduates and research assistants	Laboratory	Dr. Rosemary Hiscock Jeff Wilson Ionara Wilson Phil Bartie Katie McPherson
Dept Geog staff	Dept Geog	Assoc. Prof. Ross Barnett Prof. Andrew Sturman Dr Clive Sabel Dr Simon Kingham Dr Peyman Zawar-Reza
Dept Geog technical support staff	Dept Geog	John Thyne Paul Bealing
PHI GeoHealth staff	PHI	Dyfed Thomas
PHI staff	PHI	20+ personnel

3. Facilities

The Laboratory is located in a dedicated room situated adjacent to the Department of Geography. The Laboratory room is fitted out with three partitioned workstations, bench space for a further five workstations and eight reading carrels. In addition there is a large table and white board. The laboratory is locked and has passcode protected entry. The Laboratory layout was carefully considered to provide a conducive working and research environment with extra capacity beyond initial requirements to allow for growth.



GeoHealth Laboratory team

4. Equipment

The GeoHealth Laboratory has been refurbished to provide desk space and computer terminals for up to 13 people. At present there are nine networked PCs each with 19 inch screens. There is also a dedicated GeoHealth network drive for the storage of data files which are regularly backed up

Each PC has ArcGIS software, together with a number of statistics applications as well as standard PC text and numerical software tools. These applications are updated and maintained through UoC site licenses. Technical support is provided by Department of Geography GIS specialists and manager, and UoC central IT services.

5. Management

Laboratory Directors

The Laboratory has a two tier management structure. The directorship and management of the Laboratory is undertaken jointly by Jamie Pearce of the Department of Geography and Paul White of PHI. Jamie and Paul are in weekly phone and email contact and meet regularly in Christchurch and Wellington. Included in Table 3 is an outline of the proposed meeting schedule for year two. For year two it is proposed that Paul comes down to the Laboratory more regularly and for two days at a time to maximise input to, and gain the most from, Laboratory activities.

The two directors are responsible for the work activities of the Laboratory and for generating the Laboratory workplan.

Laboratory Board

Oversight and governance are provided by the GeoHealth Laboratory Board. The Board alternates locations between Wellington and Christchurch, with the Chair rotating between Eric Pawson of the Dept of Geog and Barry Borman of PHI. Wider expertise is drawn from three further Board members; Andrew Hornblow from the Health Sciences Centre, UoC; Laurie Brown (National Centre for Social and Economic Modelling), University of Canberra; and Graham Moon (Health Services Research), University of Portsmouth. The two directors sit on, and report to, the Board.

The Board met on three occasions in year one, and will meet at six monthly intervals in years two and three (see table 3.). All meetings have been minuted.

Table 3. Scheduled GeoHealth Research Laboratory Meetings Year 2.

Meeting Type	Location	Date
Management	Laboratory	May, June, August, September, November, December (Nelson), February, March
	PHI	July, October, January, April
Board	PHI	May
	Laboratory	October, December (Nelson)
PHI/Laboratory Research Group	Laboratory	June
	PHI	October

In October 2005 Jamie and the two Laboratory based Research Assistants came up to Wellington to meet with the four PHI geohealth and spatial epidemiology group members. Given the close working relationship of these two groups this meeting was a tremendous success for fostering closer working relations. This meeting will be repeated in June 2006 in Christchurch, and at six monthly intervals, alternating between PHI and the Laboratory.

Section 2. Workplan Core Activity: Research

As described in Appendix 1. the Laboratory workplan is centred around three core activities: research, scholarships and training. As these three programmes form the bulk of the Laboratory work they are outlined in detail in the separate sections that follow: 2, 3 and 4.

Introduction

An integral component of the GeoHealth Laboratory's strategic aims is to undertake ground breaking and policy-relevant research in the area of health and health services. A key driver of our research has been the New Zealand Health Strategy that has assisted us in developing policy relevant research projects which are of key strategic importance to the Ministry of Health. Our approach has been to develop projects which are not only of great policy relevance but are also lend themselves to high quality research in line with the Department of Geography's research strategy. As a result a number of academic and research staff have been heavily involved in the developing and undertaking these projects.

In the first year we have undertaken a number of research projects, some of which are ongoing, and we have been extremely pleased with our levels of productivity and the quality of much of the output. The projects have been funded from a range of sources and employed a number of different researchers. Some of the projects have been funded directly with core GeoHealth Laboratory funding and others from other external sources through opportunities which have arisen due to the rising profile of the Lab. In this section we provide a brief synopsis of all of the key projects which people have been working on in the Laboratory.

Research Projects 2005-06

1. Geographical distribution of suicide in New Zealand, 1980–2001
2. Youth mortality and the graduated driving licence system in New Zealand: an investigation into motor vehicle-related mortality amongst 15-19 year olds, 1980 – 2001
3. Monitoring geographical inequalities in health in New Zealand, 1980–2001
4. Neighbourhoods and health: the role of community resource accessibility in explaining geographical inequalities in health
5. The provision and utilisation of diabetes education in New Zealand
6. Health and Air Pollution in New Zealand: Christchurch Pilot Study

7. Food insecurity and the food bank 'industry': political, individual and environmental factors contributing to food bank use.
8. Spatial-temporal modelling of road traffic accidents in Christchurch, New Zealand: a policy evaluation
9. Developing PHIONline, Internet Portal
10. Problem Gambling Geography of New Zealand 2005, PHI Occasional Bulletin
11. Problem Gambling in New Zealand: Analysis of the 2002/03 New Zealand Health Survey, PHI Occasional Bulletin
12. Asian Health Chart Book 2006, PHI Occasional Bulletin
13. PHI Analytical Standards, PHI Occasional Bulletin
14. Data access for researchers, Access Protocols for the NZ Health Monitor Survey Programme
15. Drug Use survey analysis, PHI Occasional Bulletin
16. Roll out of the Fruit-in-Schools Programme, Identifying Schools for inclusion in the first round. Advice to Policy (MoH)
17. Roll out of the Meningococcal B Vaccine. Mapping and analysing monthly data for strategic (MoH) and local (DHB) management of MENZ B national vaccination Programme
18. A Strategy for Analysing Population Health Impacts from the MAF Spray Programme. Public Health Intelligence for the Ministry of Agriculture and Forestry.
19. Ministry of Health (2006). Population health impacts of airborne spraying in Auckland: A retrospective case-control study of birth defects and congenital hypothyroidism. Public Health Intelligence for the Ministry of Agriculture and Forestry.
20. Population Health Impacts Arising from the Foray 48B Aerial Spray Eradication Programme (exotic species incursions – Asian Gypsy, White Tussock, and Painted Apple Moths). Public Health Intelligence for the Ministry of Agriculture and Forestry.
21. Monitoring Health Inequality Through Neighbourhood Life Expectancy, PHI Occasional Bulletin
22. Spatial Epidemiological Investigation of Legionellosis Cases in Christchurch, Cluster analysis for Community & Public Health, Christchurch

1. Title: Have Urban/Rural Suicide Inequalities Grown in New Zealand from 1980-2001?

Principle Investigator: Jamie Pearce

Other Investigators: Irfon Jones, Ross Barnett, Paul White, Karen Blakely

Funding: GeoHealth Laboratory

Research Summary

Previous studies have noted that rates of suicide have increased in a number of OECD countries over the last 20 years. In many of these countries there has been a disproportionate increase in rural suicide, contributing to greater urban/rural health inequalities. This paper evaluates whether urban/rural inequalities in suicide have grown for males and females during the 1980s and 1990s, a period of rapid social and economic change to New Zealand society. Using consistent geographical areas, we calculate age standardised suicide rates for urban and rural areas. To assess whether socioeconomic factors underlie any urban/rural inequality in suicide, we investigate whether urban/rural status had an effect upon rates of suicide independently of socioeconomic deprivation for the time periods 1990-92 and 1999-2001.

We find that overall suicide rates have increased among those aged under 45 but decreased for those aged over 45. Female suicide rates are consistently higher in urban than in rural areas. Male urban suicide rates are higher than their rural counterparts for all time periods other than the late 1990s. While female rates of suicide remained consistent in urban and rural areas, there were fluctuations in male urban/rural suicide inequalities. Initially, male suicide rates increased steadily until 1984-88 when there was a sharp rise in urban suicide. Male suicide in rural areas displayed sharp rises in 1989-91 and 1995-98. Increases were most marked among young males. By the end of the 1990s, rates of male suicide in urban and rural areas were very similar. These results are supported by Poisson regression analyses which demonstrate significant urban/rural differences in the early 1990s which had disappeared by the late 1990s. These effects are independent of the possible confounding effect of deprivation. Potential explanations are offered for fluctuating urban/rural inequalities including major economic structural changes from 1984 onwards, changing levels of social integration and selective migration.

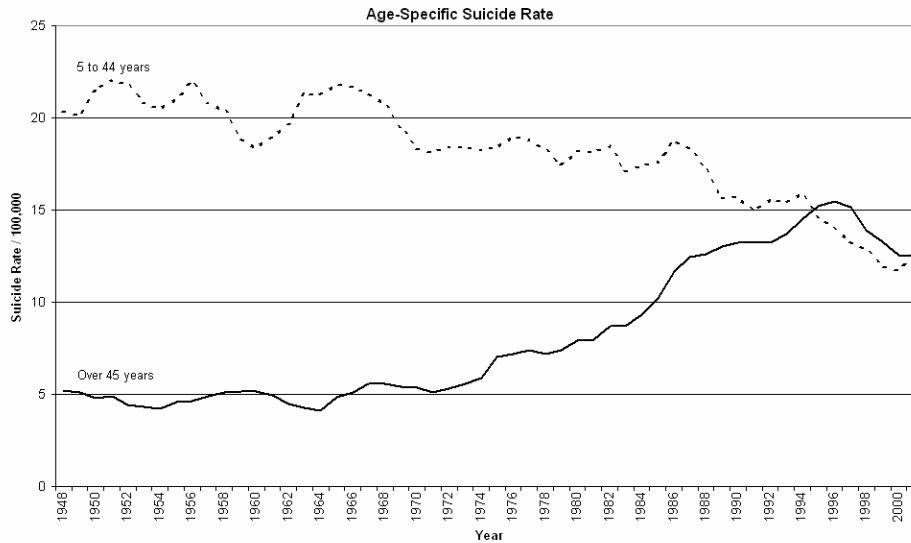


Figure 1: Age-Specific Suicide Rates from 1948 to 2002.

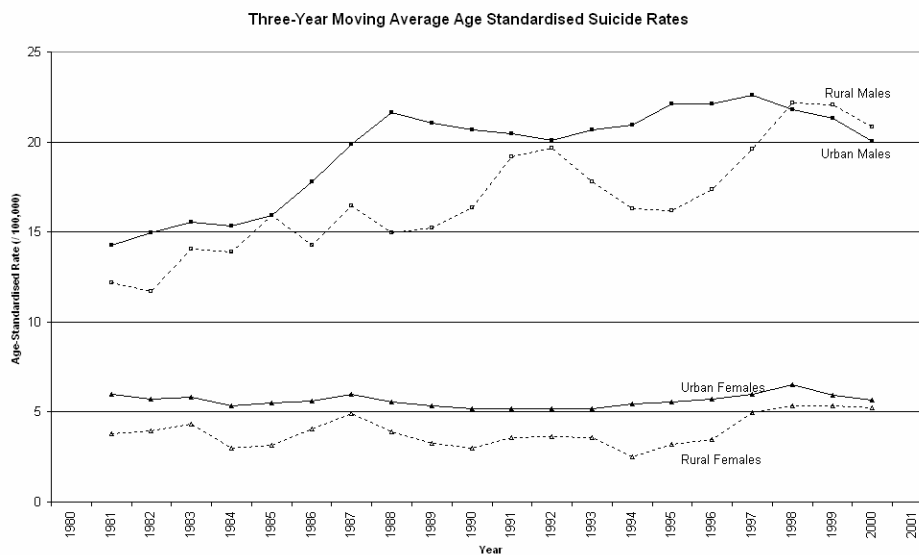


Figure 2: Three-year averaged age-standardised rates of suicide for males and females by binary urban/rural location.

Table 3: Poisson regression analysis of suicide with the base categories age(15-24), gender(female), rurality(rural) and deprivation(1) for 1990-1992.

	Model 1			Model 2			Model 3		
	IRR	LCI	UCI	IRR	LCI	UCI	IRR	LCI	UCI
Age (25-44)	0.79	0.69	0.91	0.81	0.70	0.93	0.80	0.69	0.92
Age (45-64)	0.74	0.63	0.86	0.76	0.65	0.90	0.76	0.64	0.89
Age (65+)	0.64	0.52	0.78	0.65	0.53	0.79	0.64	0.53	0.79
Gender (male)	4.10	3.57	4.70	4.10	3.57	4.71	4.09	3.55	4.70
Deprivation (2)				1.23	0.99	1.52	1.23	0.99	1.53
Deprivation (3)				1.41	1.14	1.73	1.36	1.11	1.68
Deprivation (4)				1/69	1.38	2.05	1.66	1.36	2.02
Deprivation (5)				1.92	1.58	2.33	1.88	1.55	2.29
Rurality (urban)							1.30	1.04	1.63

Table 4: Poisson regression analysis of suicide with the base categories age(15-24), gender(female), rurality(rural) and deprivation(1) for 1999-2001.

	Model 1			Model 2			Model 3		
	IRR	LCI	UCI	IRR	LCI	UCI	IRR	LCI	UCI
Age (25-44)	1.00	0.88	1.15	1.01	0.88	1.16	1.00	0.88	1.15
Age (45-64)	0.58	0.49	0.68	0.59	0.50	0.70	0.59	0.50	0.69
Age (65+)	0.63	0.52	0.77	0.63	0.52	0.77	0.63	0.52	0.76
Gender (male)	3.76	3.32	4.27	3.76	3.32	4.27	3.77	3.32	4.28
Deprivation (2)				1.47	1.21	1.78	1.46	1.21	1.77
Deprivation (3)				1.47	1.22	1.77	1.45	1.20	1.76
Deprivation (4)				1.71	1.42	2.05	1.70	1.42	2.04
Deprivation (5)				1.60	1.33	1.93	1.59	1.32	1.92
Rurality (urban)							0.95	0.78	1.15

Publications

Much of this work has been incorporated into two recent and forthcoming Ministry of Health publications:

Ministry of Health. 2006. Suicide Facts: Provisional 2003 All-Ages Statistics. Monitoring Report No. 1. Wellington: Ministry of Health.

Ministry of Health. 2006. Suicide Trends in New Zealand 1983-2003. Monitoring Report No. 6. Wellington: Ministry of Health.

Ministry of Health. 2006. Suicide Facts: Provisional 2003 All-Ages Statistics. .

Key Points - Suicide deaths in 2003

- A total of 515 people died by suicide, compared with 465 in 2002.
- The age-standardised suicide rate was 11.5 deaths per 100,000 population,
- compared with 10.8 in 2002.
- The three-year moving average age-standardised rate of suicide for the total
- Population increased to a peak of 14.0 deaths per 100,000 population for the
- 1995.1997 and 1996.1998 periods. It then decreased until the most recent period (2001.2003).
- Males continue to have a higher age-standardised suicide rate than females (16.9 compared with 6.2 per 100,000 population respectively).
- From 1995, there was a decline in the male rate, and then after 2000 there was a general increase in the female rate.
- The all-ages sex ratio for the suicide rate in New Zealand was 2.7 male suicides to every female suicide per 100,000 population.
- The age-standardised rate of suicide was higher for Māori than for non-Māori. For Māori males and females, the age-standardised rates were 21.1 and 6.4 deaths per 100,000 population respectively, and for non-

Māori males and females, they were 15.6 and 5.9 deaths per 100,000 population respectively.

- For life-cycle age groups, for females, 15–24-year-olds had the highest age-specific suicide rate (11.0 per 100,000 population), while for males, 25–44-year-olds had the highest age-specific suicide rate (28.4 per 100,000 population).
- New Zealand's all-ages suicide rate was the sixth highest among selected OECD countries for males, and the fourth highest for females.
- The least deprived areas of New Zealand had a suicide rate of 8.8 per 100,000 population compared with 13.2 per 100,000 population in the most deprived areas of New Zealand.
- Trends by ethnicity, age group and region will be further explored in the upcoming publication *Suicide Trends*, due for release later in 2006. Three-year moving averages will be used in this document.

Hospitalisation for suicide and intentional self-harm in 2002/03

- The age-standardised hospitalisation rate for suicide and intentional self-harm for the total population was 131.5 per 100,000 population, compared with 128.2 in 2001/02.
- The sex ratio for hospitalisation for suicide and intentional self-harm in New Zealand was 2.1 female hospitalisations to every male hospitalisation per 100,000 population.

In addition two academic papers from this work are in progress. One will report the urban/rural trends and will be targeted at a Geography journal and the second will report the deprivation profile trends and be aimed at a more medical audience.

PHI Monitoring Report No. 1, See:

<http://www.moh.govt.nz/moh.nsf/238fd5fb4fd051844c256669006aed57/6a8dff1d1d206e3fcc25711a007b7871?OpenDocument>

2. Title: Youth mortality and the graduated driving licence system in New Zealand: an investigation into motor vehicle-related mortality amongst 15-19 year olds, 1980 – 2001.

Principle Investigator: Simon Kingham

Other Investigators: Jamie Pearce, Danny Dorling (University of Sheffield), Matthew Faulk

Funding: GeoHealth Laboratory

Research Summary

It is widely accepted that, since its inception in 1987, the Graduated Driving Licence System (GDLS) has reduced the young driver crashes in New

Zealand. Research specifically into the effects of GDLS on youth mortality is however, limited. This paper examines the temporal and spatial patterns of mortality amongst New Zealand’s young driving population (15-19 year olds) as a result of motor-vehicle accidents (MVA) between the years 1980 and 2001. Mortality rate comparisons have also been made with the UK. Results reveal that the mortality rate of 15-19 year old drivers and passengers has declined from 0.48 deaths per 1000 in 1987 to 0.23 deaths per 1000 in 2001. As such, the introduction of the GDLS would appear to be a success... However, a direct comparison is made to both England & Wales and Scotland. This reveals that the youth mortality rates in New Zealand are approximately 3 times greater than in England & Wales and two times greater in Scotland for the same age group over the same period. When the data is adjusted to take account of the differences in minimum driving age (NZ 15 compared to UK 17), whilst the rates are more comparable between the countries, they still remain consistently highest in New Zealand. Spatial analysis was also undertaken on the New Zealand data and the influence of geographic variables derived from census data as well as the use of a road network. Results suggest that the variables of: car density; population density; car numbers; road density; urban-rural category; NZDep rating; Vehicle Kilometres Travelled (VKT) and both the time and distance of travel from a CAU to a major town / city have an impact upon the level of mortality experienced by a region. Overall, the pattern appears to be one of the less-crowded and possibly lower socio-economic CAUs of New Zealand who experience the highest levels of MVA related youth mortality. However, the variables of level of vehicle access to 15-19 year olds and the relative sinuosity of the road network had no discernable impact upon the mortality rates.

A full 44 page report is available on this work. Some example output is shown below.

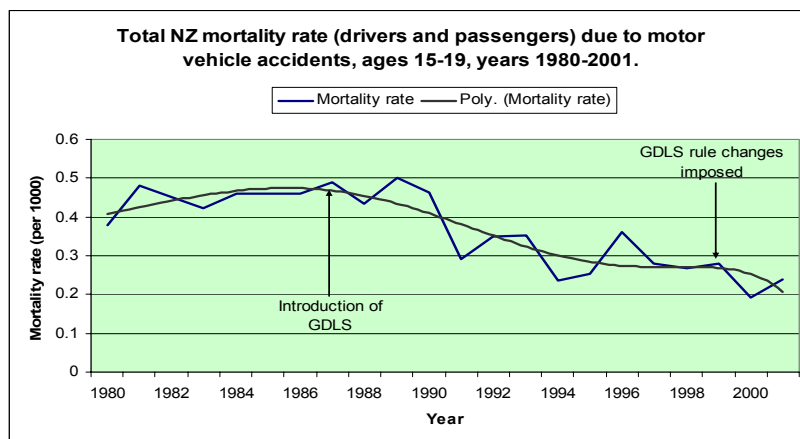


Figure 1: Total NZ MVA-related mortality rates for 15-19 age group

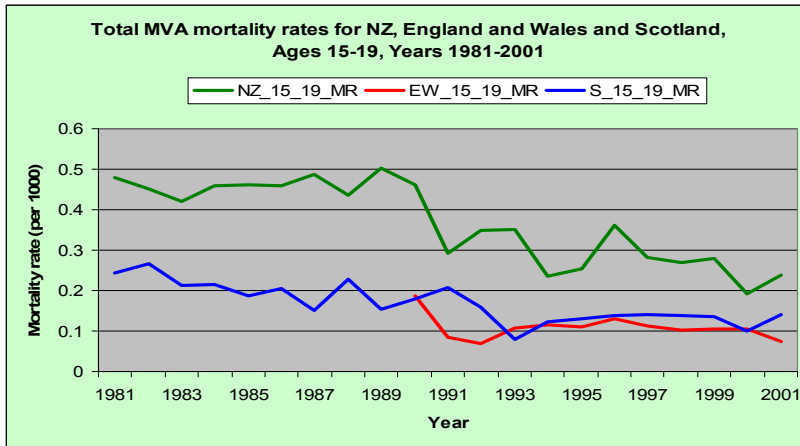


Figure 2: Total MVA-related mortality rates comparison for 15-19 age groups in NZ, EW and Scotland.

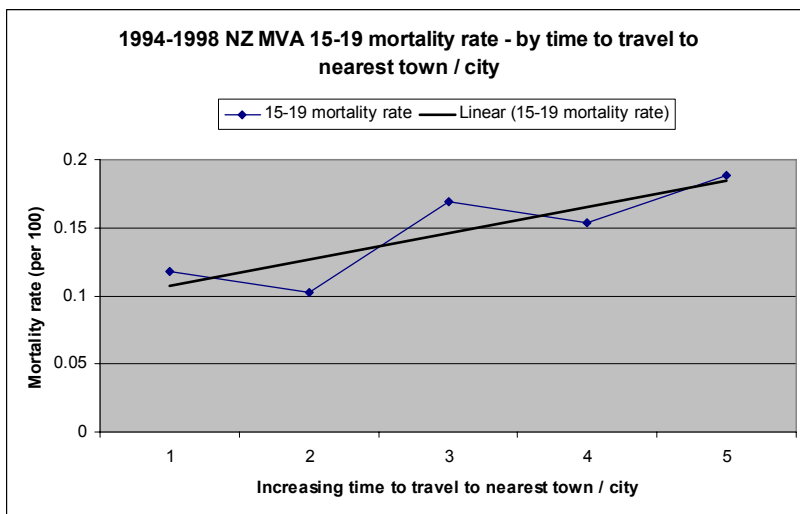


Figure 3: New Zealand mortality rate for 15-19 age group, years 1994-1998, with increasing travel time to nearest town / city

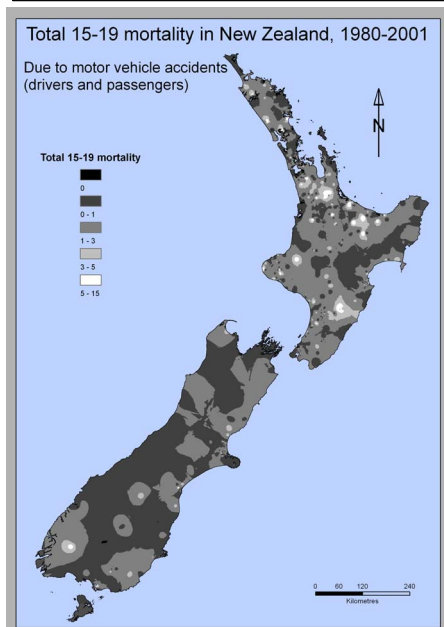


Figure 4: Total New Zealand youth mortality (15-19 age group) due to motor vehicle accidents, 1980-2001.

Publications

A number of publications are planned from this work. Simon Kingham will be taking the lead on this work during his sabbatical (May to Dec 2006).

3. Project Title: Monitoring geographical inequalities in health in New Zealand, 1980–2001

Principle Investigator: Jamie Pearce

Other Investigators: Danny Dorling (University of Sheffield), Ross Barnett (UC), Ben Wheeler (University of Sheffield), Jan Rigby (University of Sheffield)

Funding: None

Research Summary

Recent studies have noted widening health inequalities between rich and poor areas in a number of OECD countries. This paper examines whether health in New Zealand has become more geographically polarized during the period 1980–2001, a time of rapid social and economic changes in New Zealand society. Mortality records for each year between 1980 and 2001 were extracted for consistent geographical areas: the 21 District Health Boards operating in New Zealand in 2001 and used to calculate male and female life expectancies for each area. The geographical inequalities in life expectancy were measured by calculating the slope index of inequality for each year between 1980 and 2001. Although overall life expectancy has increased during the period of study, New Zealand has experienced increased spatial polarization in health, with a particularly sharp rise in inequality during the late 1980s and early 1990s. Since the mid-1990s regional inequality has remained at stable but high levels. The polarization in mortality was mirrored by a growth in income inequality during the 1980s and 1990s. Health inequalities as expressed geographically in New Zealand have reached historically high levels and show little sign of abating. In order to tackle health inequalities, a greater commitment by the New Zealand government to a more redistributive social and economic agenda is required. Furthermore, issues of differentiated and health selective migration, emigration, and immigration need to be addressed as if these are important they should matter more for New Zealand than for almost any other developed nation-state. **Keywords** Health inequality, geographical polarization, life expectancy, slope index of inequality, New Zealand

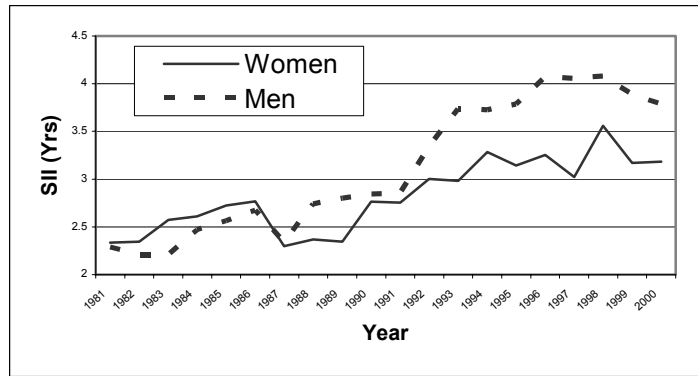


Figure 1. Slope Index of Inequality for males and females, 1981 to 2000

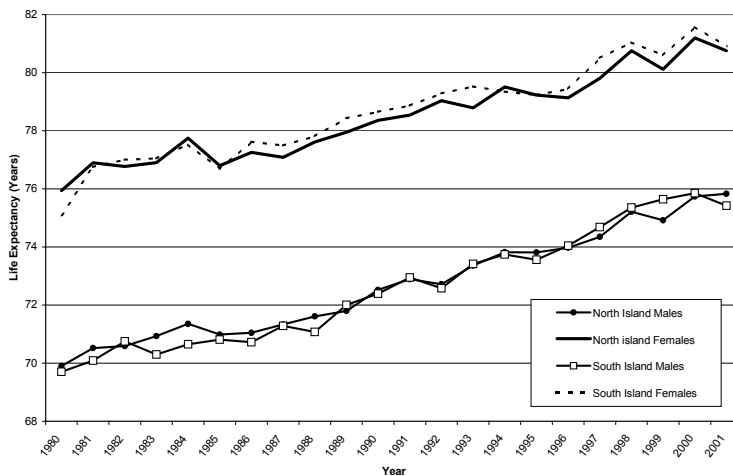


Figure 2. Life expectancy on the North and South Islands of New Zealand, 1980-2001

DHB	NZDep Dec 8	NZDep Dec 9	NZDep Dec 10	Total NZDep 8-10
Auckland	9.9	9.4	11.0	30.3
Bay of Plenty	10.2	13.5	13.5	37.2
Canterbury	9.1	6.9	3.4	19.4
Capital and coast	6.0	4.5	9.1	19.6
Counties Manukau	9.0	14.2	21.2	44.4
Hawke's Bay	10.6	11.3	15.7	37.6
Hutt	8.1	9.0	9.9	27.0
Lakes	11.6	14.8	17.3	43.7
Mid Central	12.5	12.3	7.4	32.2
Nelson-Marlborough	10.2	6.4	1.1	17.7
Northland	12.4	14.2	21.9	48.5
Otago	9.5	9.5	4.0	23.0
South Canterbury	10.7	7.0	1.9	19.6
Southland	9.2	8.7	3.6	21.5
Tairāwhiti	11.6	17.4	30.1	59.1
Taranaki	11.8	10.2	7.6	29.6
Waikato	11.1	12.7	11.7	35.5
Wairarapa	10.1	9.9	4.8	24.8
Waitemata	8.4	6.1	2.3	16.8
West coast	20.0	11.0	6.3	37.3
Whanganui	12.0	14.4	17.3	43.7

Table 1. The percentage of the resident population of each DHB who were amongst the most deprived 30% of all New Zealand residents (1991 NZDep deciles 8, 9 and 10)

Publications

Pearce J and Dorling D, 2006, Increasing geographical inequalities in health in New Zealand, 1980-2001, *International Journal of Epidemiology*, In Press

Pearce J, Dorling D, Wheeler B, Barnett R, Rigby J, 2005. Geographical inequalities in health in New Zealand, 1980-2001: the gap widens. *Australian and New Zealand Journal of Public Health*. Under Review.

4. Project Title: Neighbourhoods and health: the role of community resource accessibility in explaining geographical inequalities in health

Principle Investigator: Jamie Pearce

Other Investigators: Rosemary Hiscock (University of Canterbury), Karen Witten (Massey University), Tony Blakely (Otago University) – PI on the umbrella Neighbourhoods and Health project

Funding: Health Research Council

Research Summary

The Neighbourhoods and Health project aims to determine neighbourhood and community variations in mortality and morbidity, and how much of that variation might be explained by: access to community resources; social capital; and social fragmentation. The association of these neighbourhood characteristics with health will be tested using both New Zealand Census-Mortality Study data (a series of cohort studies of all New Zealanders followed-up for mortality) and Health Survey data. The association of these neighbourhood characteristics with health will be tested using both New Zealand Census-Mortality Study data (a series of cohort studies of all New Zealanders followed-up for mortality) and Health Survey data. This project will directly test some of the putative mechanisms linking the physical and social characteristics of where we live with health status. These analyses will both increase our understanding of the determinants of health and identify locational intervention points for policy makers (e.g. urban and town planners).

In stage one of the analysis we developed an innovative methodology to measure geographical access to a range of community resources that have been empirically linked to health. Geographical Information Systems (GIS) were applied to develop precise measures of community resource accessibility for small areas at a national scale. Locational access to shopping, education, recreation and health facilities was established for all 38,350 census meshblocks across New Zealand. Using GIS, distance measures were calculated from the population-weighted centroid of each

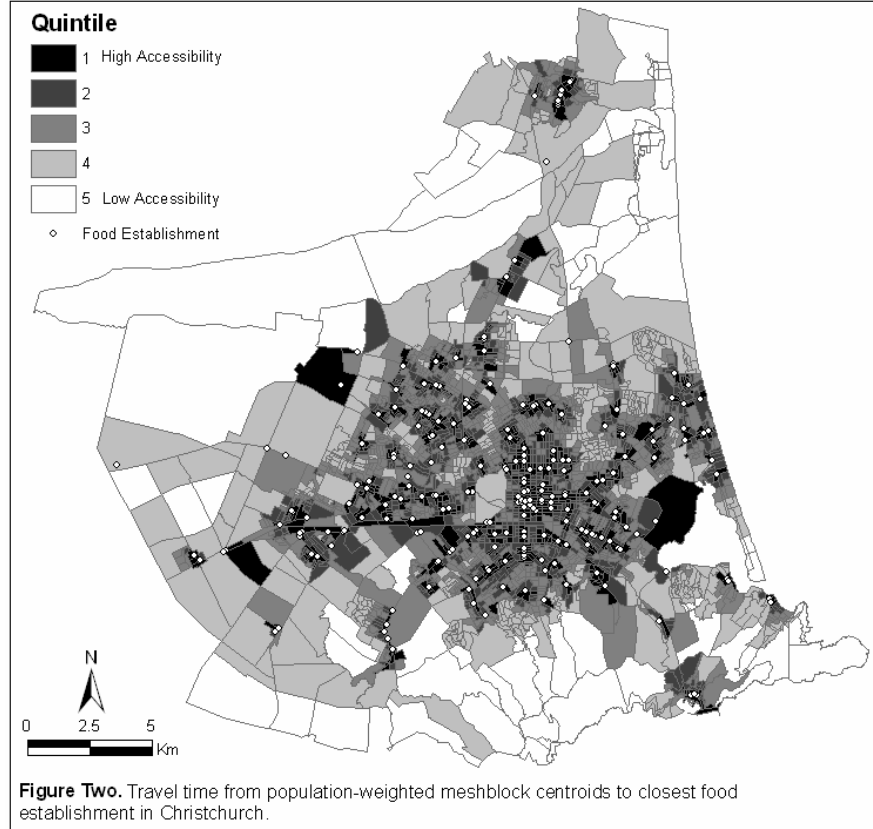
meshblock to 16 specific types of facilities theorised as potentially health related. From these data, indices of community resource accessibility for all New Zealand neighbourhoods were constructed. We found clear regional variations in geographical accessibility to community resources exist across the country, particularly between urban and rural areas of New Zealand. For example, the average travel time to the nearest food shop ranged from less than one minute to more than 244 minutes. Marked differences were also apparent between neighbourhoods within urban areas. In conclusion, recent advances in GIS and computing capacity have made it feasible to directly measure access to health-related community resources at the neighbourhood level. The construction of access indices for specific community resources will enable health researchers to examine with greater precision, variations in the material characteristics of neighbourhoods and the pathways through which neighbourhoods impact on specific health outcomes.

In stage two of the project we are currently examining the effects of community resource accessibility on a range of health outcomes. The community resource access index has been attached to the New Zealand Health Survey and a multilevel modelling approach has been adopted to consider whether there are independent neighbourhood effects once individual sociodemographic characteristics have been controlled for. We anticipate that the results will be available later in 2006.

Domains and Sub-domains	Source of Data	Year Collected	Scale of Data Collection	Number of Recorded Facilities	% Facilities Geocoded Records
1. Recreational Amenities					
1.1 Parks	Modified from Land Information New Zealand and the Department of Conservation	2004	National	46,274	100.0
1.2 Sports and Leisure	ACC Pool Safe (Water Safety New Zealand)	2005	National	291	96.5
1.3 Beaches	Modified from Land Information New Zealand point dataset	2005	National	13,313	100.0
2. Shopping Facilities					
2.1 Supermarkets	Company websites	2004	National	661	99.7
2.2 Dairy, Fruit and Vegetables and Service Stations	Territorial Local Authorities	2004	TLA	3,681	99.9
3. Educational Facilities					
3.1 Kindy/daycare/playcentres	Ministry of Education	2004	National	3,074	99.5
3.2 Primary Schools	Ministry of Education	2002	National	2,178	100.0
3.3 Intermediate/ full primary Schools	Ministry of Education	2002	National	2,162	100.0
3.4 Secondary Schools	Ministry of Education	2002	National	455	100.0
4. Health Facilities					
4.1 General Practitioners	Ministry of Health	2003	National	1,383	100.0
4.2 Pharmacies	Ministry of Health	2003	National	1,170	100.0
4.3 Accident and Emergency	Ministry of Health	2003	National	63	100.0
4.4 Plunket ¹	White Pages/Internet	2004	National	345	98.6
4.5 Ambulance	Ministry of Health	2002	National	66	100.0

4.6 Fire Stations	Ministry of Health	2002	National	189	100.0
5. Marae	Takoa directory ² and internet research	2005	National	468	98.1

Table 1. Summary of data collected to calculate community resource accessibility for small areas across New Zealand.



Publications

Pearce J, Witten K and Bartie P, 2006, Neighbourhoods and health: a GIS approach to measuring community resource accessibility, *Journal of Epidemiology and Community Health*, Vol 60, pp 389-395.

In addition three further papers from this project have been drafted and are nearing submission:

- Are socially disadvantaged neighbourhoods deprived of health- related community resources?
- Regional inequalities in community resource accessibility in New Zealand.
- The association between neighbourhood deprivation and fast-food retailing: a national study.

5. Project Title: The provision and utilisation of diabetes education in New Zealand

Principle Investigator: Ross Barnett

Other Investigators: Jamie Pearce, Pauline Barnett (Christchurch Medical School), Pamela Howes

Funding: Diabetes New Zealand

Research Summary

In New Zealand, as elsewhere, it is argued that a diabetes epidemic is underway. With careful management from individuals and professionals and appropriate levels of education, it is possible to prevent many complications of diabetes. The overall objective of the paper is to evaluate the role and impact of Diabetes New Zealand (DNZ), the key voluntary sector provider of diabetes education and support services, with respect to four criteria; (i) the extent to which DNZ is reaching groups most at risk of diabetes; (ii) the degree to which it has encouraged levels of member involvement; (iii) whether voluntary group provision of education is that most preferred by members and (iv) the extent to which members see the voluntary sector model as being effective in combating the growth of diabetes. A survey of members of six of the 41 affiliated societies of DNZ suggests that such organisations, although having a high proportion of older members, have generally failed to target more deprived groups. While the societies generally score more positively in encouraging member involvement and being perceived as effective by their members, they are not always the preferred form of educational provision. However, there are significant contextual variations by urban-rural location and according to the organisational structure of the societies. Rural societies and those with decentralised organisational structures generally score highest on the above criteria.

The results pose a problem for DNZ which, like many other voluntary sector organisations, is facing pressures of increased corporatisation and centralisation. We see this as an important challenge that DNZ needs to address if New Zealand is going to better cope with the emerging diabetes epidemic.

Publications

Barnett R, Pearce J, Howes P, 2006, 'Help, educate, encourage?': Geographical variations in the provision and utilisation of diabetes education in New Zealand, *Social Science and Medicine*. In Press.

Barnett R, Barnett P, Pearce J, Howes P, 2006, Preventing the human time bomb? Barriers to utilising diabetes education in Christchurch, New Zealand, *Australian and New Zealand Journal of Public Health*. In Press.

6. Title: Health and Air Pollution in New Zealand: Christchurch Pilot Study

Principle Investigator at UC: Simon Kingham

Other UC Investigators: Jamie Pearce, Peyman Zawar-Reza (plus many others from other NZ institutions)

Funding: Health Research Council, Ministry for the Environment, Ministry of Transport

Research Summary

The people of New Zealand are exposed to a wide range of health risks through various activities. Many of these are unavoidable, and many are due to personal choice, however some are due to exposures to contaminants in the environment that can be reduced through community policies. This three-year long study is concerned with identifying and quantifying the health risks due to peoples' exposure to air pollution. For many places, and for much of the time, New Zealand's air quality cannot be considered poor by international standards, yet there are still defined health effects, and there are locations and instances where air quality is poor enough to be of concern.

Measures to reduce air pollution, and its effect on public health, have costs. Effective management and policy needs detailed information on exactly what these effects are and their costs to individuals and society, and the costs to society of mitigation measures. The aim of this "Health and Air Pollution in New Zealand (HAPiNZ) Study" is to explicitly identify the effects of air pollution, throughout New Zealand, to link these effects to the various sources of air pollution, to examine the costs of the effects, and to formulate cost effective policy options that will lead to real and measurable improvements on the health of New Zealanders.

The study is funded under a joint initiative from the Health Research Council, the Ministry for the Environment and the Ministry of Transport, with substantial in-kind contributions from Regional Council air quality monitoring programmes, in particular Environment Canterbury for the pilot study in Christchurch. The work is carried out by a large collaborative group, comprising several organisations and over 20 of New Zealand's leading researchers in air pollution, epidemiology, toxicology, environmental management, economics, and public health policy

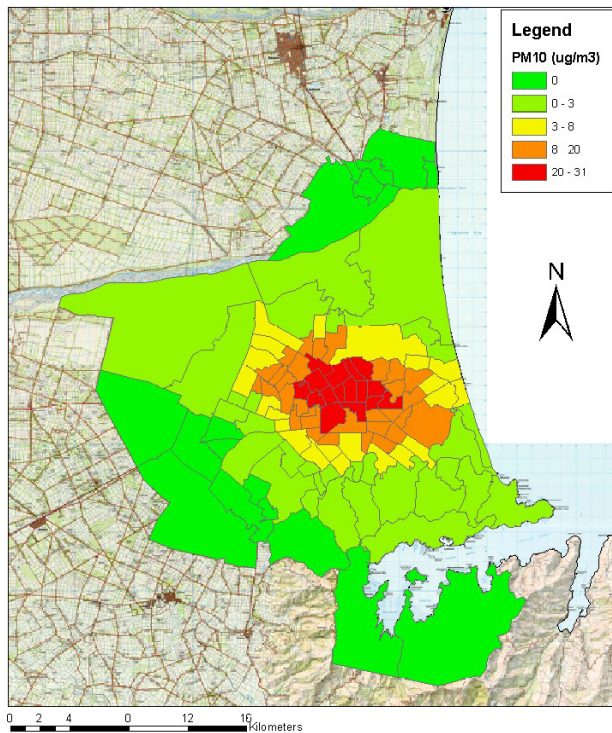


Figure 1: Annual PM exposure map. (Darkest areas in the central city are those

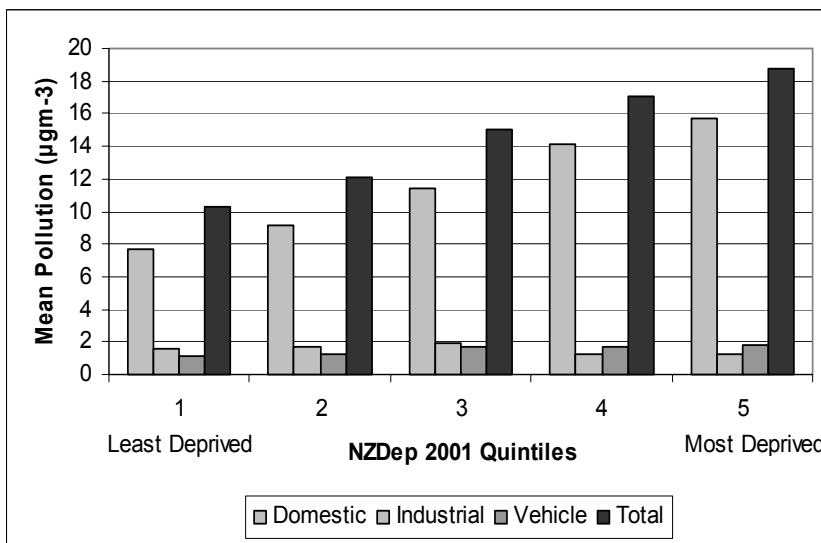


Figure 2. Mean annual particulate pollution by deprivation quintiles

Publications

Zawar-Reza P, Kingham S and Pearce J, 2005, Evaluation of a year-long dispersion modelling of PM10 using the mesoscale model TAPM for Christchurch, New Zealand, *Science of the Total Environment*, Vol 349, pp 249-259.

Pearce J, Kingham S and Zawar-Reza P, 2006, Every Breath You Take? Environmental Justice and Air Pollution in Christchurch, New Zealand, *Environment and Planning A*, Vol 38, pp 919-938.

Kingham S, Durand M, Aberkane T, Harrison J and Epton M, 2005, Winter comparison of TEOM, MiniVol and DustTrak PM₁₀ monitors in a wood smoke environment. *Atmospheric Environment*, 40, 338-347.

7. Project Title: Food insecurity and the food bank 'industry': political, individual and environmental factors contributing to food bank use.

Principle Investigator: Kate McPherson

Other Investigators: Ross Barnett (University of Canterbury), Jamie Pearce (University of Canterbury),

Funding: Community and Public Health (CDHB), GeoHealth Laboratory

Research Summary

Household food insecurity is increasingly being recognised as a major health problem in many OECD countries. Food bank clients represent an opportunity to better understand geographical issues of food insecurity, urban poverty and inequalities in the community. While previous research has largely focused on client patterns of use of food banks and individual client factors, this study seeks to expand on these concepts in the local context and examine possible environmental determinants of food bank use. This study also documents the growth of the food bank 'industry' in affluent countries and the impacts that the 'industry' has had on the voluntary welfare sector as a whole. In order to explore the food bank phenomenon in affluent countries and to determine the groups affected, this report has five objectives; (1) to outline the socio-political context in which the food bank 'industry' has emerged and 'prospered'; (2) to determine trends and patterns of food bank use at the international, national and sub-national level; (3) to examine the socio-demographic characteristics of food bank users and establish their residential location; (4) to examine the reasons as to why people are using food banks and; (5) to determine the implications of food insecurity and food bank use in the community, and how dependency on food banks can be reduced

This study examines socio-demographic and address data obtained for food bank clients (n=1695) from a large Christchurch social service agency for 2005. Client address data from a second large Christchurch social service agency will also be analysed to illustrate trends over time by NZDep01. Preliminary findings have found that Maori, beneficiaries, low income workers, males, single people, and families with dependent children (particularly sole parents) are significant users of the food bank. Additionally, important individual differences exist according to gender and the level of neighbourhood deprivation. There is a very clear deprivation trend showing people from the most deprived neighbourhoods are utilising food banks at a much higher rate than those in less deprived neighbourhoods. Further ecological analysis of rates of use by CAU will be carried out using a variety of measures. The main reasons cited for using the food bank relate to household bills, housing, family pressures, and difficulties with the Department of Work and Income.

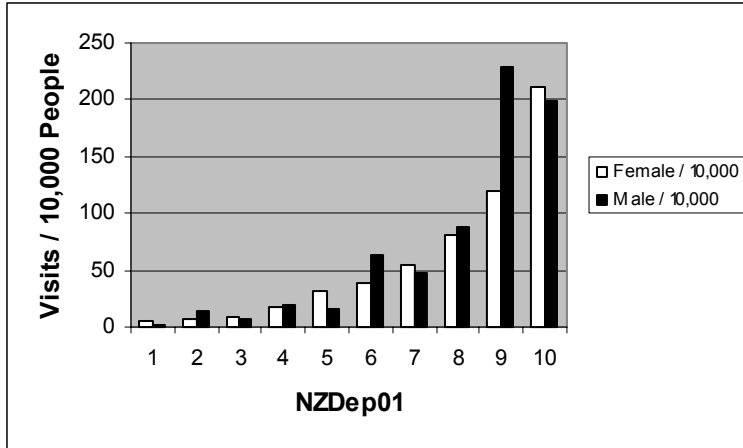


Figure 1: Clients by gender and NZDep01 Decile

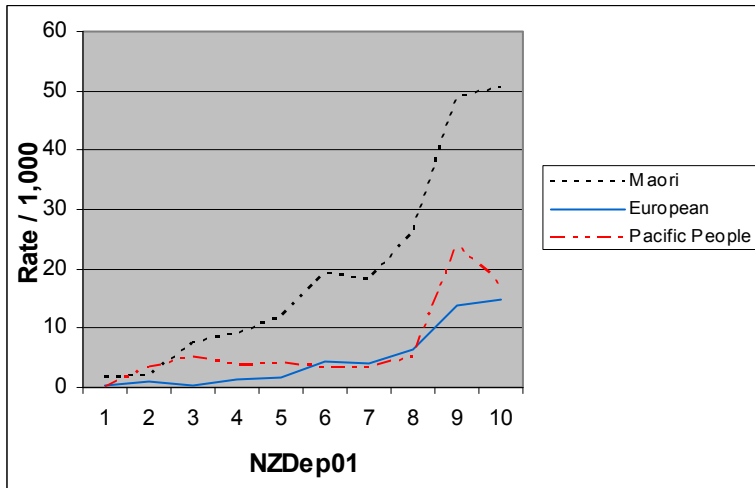


Figure 2: Clients by ethnicity and NZDep01 Decile

8. Project Title: Spatial-temporal modelling of road traffic accidents in Christchurch, New Zealand: a policy evaluation

Funding: UC Research Grant and in-kind data from Land Transport NZ.

Principle Investigator: Dr Clive Sabel

Other Investigators: Assoc. Prof Alan Nicholson (Civil Engineering), Dr Simon Kingham (Geography) and Phil Bartie (Research Associate).

Research Summary

This project considers the development of innovative spatial analysis methods and applies them to the topical issue of road traffic accidents in Christchurch. We examine spatial and temporal trends in road traffic accidents, and will aim to assess the success, or otherwise, of road traffic accident reduction policy initiatives. These measures include both engineering solutions (eg. traffic calming) and social interventions (eg. encouraging ride-share, greater bus use). The methods developed and results obtained will have wider global applicability.

Method

A number of spatial tools have been developed recently that help in understanding the geography, and changing geographies, of point-patterns. For our purposes, the most promising of these is Kernel Estimation (KE), whereby a distribution of discrete point 'events' is transformed into a continuous raster

Kernel Estimation is able to quickly visually identify pattern from large datasets, and with the introduction of the Monte Carlo simulation it is possible to extract those locations or areas which are statistically significant.

The risk of an accident occurrence is not equal across all road sections. Junctions are known to be accident 'black spots' within city regions, accounting for 66% of all accidents in our dataset, whereas other road links may not have any recorded accidents on them. Another key contributing factor for the relative accident risk is the road segment daily traffic flow.

Results

In figure 1 below, the KE accident surface, using a bandwidth of 300m, is shown from dark (high) to light (low), and the statistically significant areas highlighted by black polygon boundaries. The results demonstrated in figure 1 largely highlight some major intersections as being more dangerous than others, as well a general raised risk in the CBD of Christchurch, as well as some evidence of raised incidence in certain neighbourhoods. This appears to suggest that there might be a neighbourhood effect in some areas, where accidents are more common than might be expected. The cause of these raised levels needs to be closely investigated.

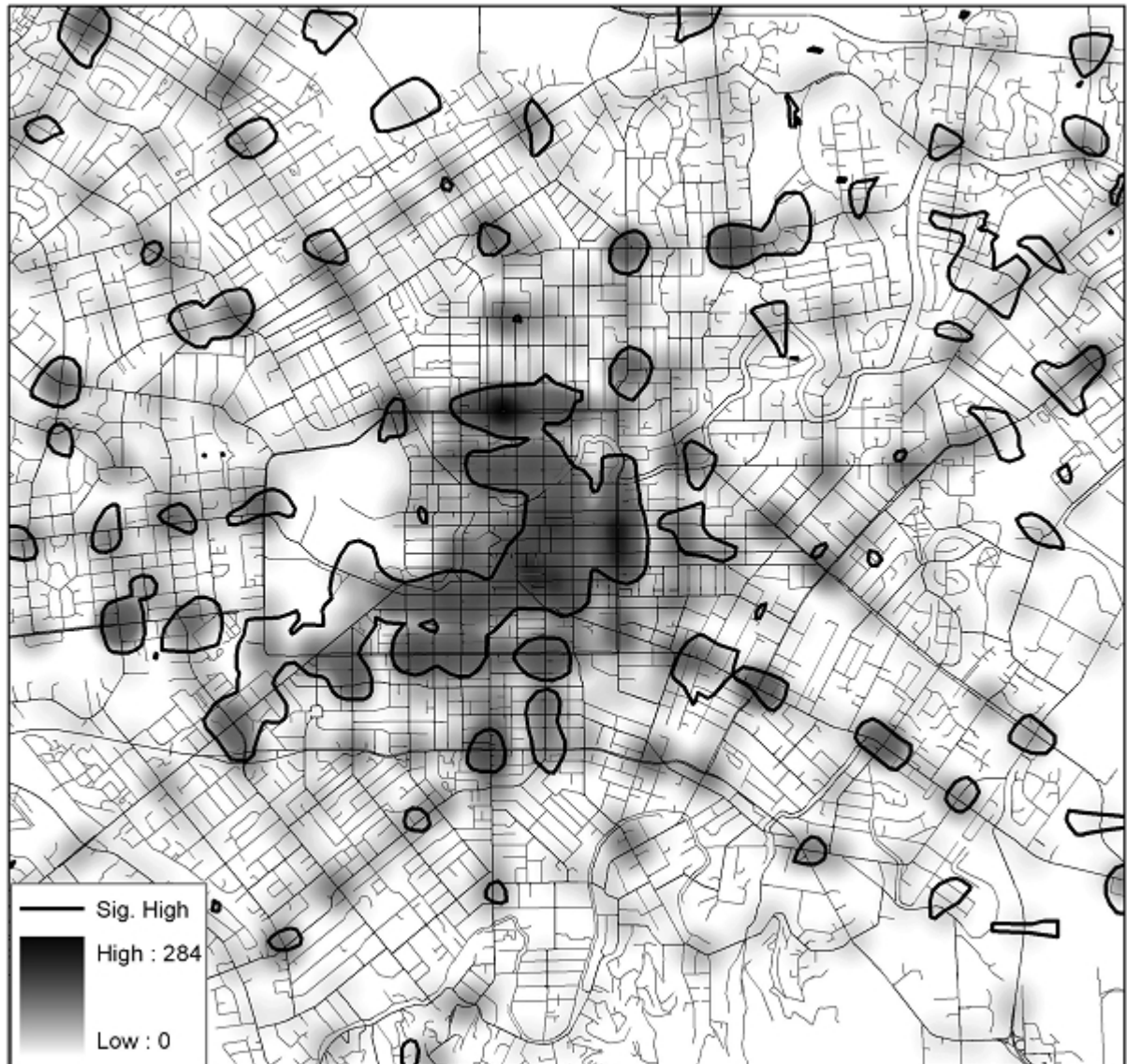


Figure 1: Significant Accident Clusters (top 2.5%) where Observed is higher than Expected – Christchurch, NZ.

Discussion

The initial results are promising in terms of identifying areas which can become focal points for more detailed study. In this respect this may form an automatic filtering stage for large accident crash datasets. These identified areas are already attracting interest from public authorities.

Our results tend to focus on the statistically significant accident points and areas around junctions, which may be a side-effect of KE, being more suited to locating area features, than locating linear clusters ('black' routes). Adjustment to the KE bandwidth allows it to be adapted for use in locating 'black' spots to 'black' zones.

Road traffic analysis is a very complex topic; the Police use almost 600 different cause codes which can be assigned to explain the origins of the accident in their report. It would be unrealistic to believe that our two input variables (flow and distance to junction) for a Simulated Input Risk Surface would accurately predict where expected accidents 'should' occur. Other factors have been tested, such as housing density, proximity to schools, supermarkets, and junction density. Balancing the relative importance of these variables is part of ongoing work.

Conclusions

This research is ongoing and further refinements to the Simulated Input Risk Surface are being tested through an iterative design cycle. It has to be recognised that GIS will not be able to explain or predict all accidents, and that this methodology we have implemented is only intended to draw attention to certain city areas which appear to be diverging from the general trends. The interim results have been demonstrated at a number of meetings with traffic engineers, who believe it will be a useful tool supplementing current techniques in the analysis of vehicle accident data. We have presented here the utility of using Kernel Estimation as a space-time data mining tool. In demonstrating this utility by analysing a rich dataset of road-traffic accidents, complex processes have been revealed, and identified as avenues for further investigation.

9. PHIOne

Principle Investigator: Dyfed Thomas

Other Investigators: Paul White

Phase 1 completed

Research Summary

PHIOne is a powerful visualisation tool that provides an alternative way to access health information through a mapping interface rather than traditional text-based documents. The initial version was launched on the 1st July 2005, and has since been successfully taken up by the NZ health sector.

PHIOne has been developed to meet the information requirements of the health sector, with data available at the DHB level. PHIOne will:

- Aid local agencies to achieve their desired health outcomes
- Reduce cost of information dissemination
- Make government information more easily available, with a greater reach to a wider audience

The web interface provides a multidimensional view of data through linked maps, charts, graphs and tables. Data included on the site are:

- Routine Hospitalisation, Mortality and Incidence collections, and NZ Health Survey data

See: <http://www.phionline.moh.govt.nz/>

10. Problem Gambling Geography of New Zealand 2005

Principle Investigator: Kylie Mason

Completed August 2005 – August 2006

Research Summary

This report describes where gambling venues and problem gambling counselling services are located in New Zealand. It also examines changes in gambling opportunities and problem gambling counselling provision from 2003 to 2005. Problem Gambling Geography of New Zealand 2005 is part of the Public Health Intelligence (PHI) Monitoring Report series, and was released in August 2006.

The preparation of this document involved collecting the data, analysing the data, writing the document, and producing maps for every District Health Board and territorial authority of the locations of gambling venues and problem gambling counselling services in each area. This project also involved geocoding the address details of Gambling Helpline clients from 1998 - 2005, which provides valuable information of the location of clients and potential areas of need.

PHI Monitoring Report No. 7, See:

<http://www.moh.govt.nz/moh.nsf/by+unid/19F561965C228E4DCC2571BC0082316D?Open>

11. Problem Gambling in New Zealand: Analysis of the 2002/03 New Zealand Health Survey

Principle Investigator: Kylie Mason

Completed: August 2005 – August 2006

Research Summary

Problem Gambling in New Zealand: Analysis of the 2002/03 New Zealand Health Survey presents the analysis of the gambling questions that were included as part of the 2002/03 New Zealand Health Survey. The report describes the extent of current problem gambling in New Zealand, and identifies key risk factors for problem gambling in New Zealand. It also investigates the association between problem gambling and various health correlates, including addictive behaviours and self-rated health status. Problem Gambling in New Zealand: Analysis of the 2002/03 New

Zealand Health Survey is part of the Public Health Intelligence (PHI) Occasional Bulletin series.

PHI Occasional Bulletin No. 32, See:

<http://www.moh.govt.nz/moh.nsf/by+unid/A687CBB669704A45CC2571BD0008A2CA?Open>

12. Asian Health Chart Book 2006

Principle Investigator: Kylie Mason

Other Investigators: Juthika Badhkar, Jane Wang

Completed: September 2005 – November 2005

Research Summary

The Asian Health Chart Book 2006 is the first report to provide comprehensive information on the health of Asian New Zealanders, and provides a barometer of the current health status of Asian New Zealanders as a baseline from which to monitor future trends. The report reveals major differences in health outcomes and exposure to health hazards between the Chinese and Indian ethnic groups, with 'Other Asians' generally intermediate. For this report, Kylie provided statistical expertise in carrying out regression analysis for some of the health comparisons.

PHI Monitoring Report No. 4, See:

<http://www.moh.govt.nz/moh.nsf/indexmh/asian-health-chart-book-2006>

13. PHI Analytical Standards

Principle Investigator: Kylie Mason

Other Investigators: Paul White, Rest of PHI!

Completed: August 2005 – May 2006

Research Summary

The Public Health Intelligence Analytical Standards handbook presents the analytical and publication standards PHI has adopted in its work for the design and layout of tables, charts and maps, the method for standardising rates, and the availability and use of standard populations. It was a collaborative PHI project, with different sections prepared by different PHI staff, and it was designed for use by PHI staff, to ensure PHI's work is of the highest quality standard and the analysis and presentation is consistent, robust and rigorous. Kylie picked up this project when she joined PHI, and completed the final draft and followed the document through to publication.

14. Data access for Researchers

Principle Investigator: Kylie Mason

Other Investigators: Maria Turely

Ongoing: March 2006 – onwards

Research Summary

Kylie manages the process for researchers wishing to access New Zealand Health Monitor survey data, in particular confidentialised unit record files (CURFs). This involves sending out application forms to researchers, assessing applications, and preparing datasets for researchers.

Internal to PHI

15. Alcohol and Drug Use survey analysis

Principle Investigator: Kylie Mason

Other Investigators: Li-Chai Yeh, Niki Steffanogiannis

Ongoing: March 2006 – onwards

Research Summary

The two surveys, 2003 Health Behaviours Survey – Drug Use and the 2004 Health Behaviours Survey – Alcohol Use, explored the use of alcohol and drugs in the New Zealand population. The surveys included questions on the frequency and context of use, and problems and harms experienced due to one's own use and others use of these substances. The surveys were carried out by the Centre for Social and Health Outcomes Research and Evaluation (SHORE) and Te Ropu Whariki, of Massey University.

PHI is carrying out the analysis of the survey data, and the publication of the survey reports. Kylie worked with another PHI statistician in carrying out the statistical analysis of the two surveys. This statistical analysis was completed in August 2005.

PHI Occasional Bulletin No. 40, See:

<http://www.moh.govt.nz/moh.nsf/indexmh/alcohol-use-in-new-zealand-2004?Open>

16. Roll out of the Fruit-in-Schools Programme,

Principle Investigator: Paul White

Other Investigators: Kurt Janssen

Completed

Research Summary

This report identifies New Zealand publicly funded schools for the Fruit in Schools programme. The schools are identified based on 'need'. Need here is defined from two equally weighted criteria:

1. Schools in high areas of social and material deprivation as indicated by the New Zealand Deprivation Index 2001 (Salmond and Crampton, 2002)
2. Schools in an area where there is a high proportion of the population in the of 5 to 14 years age range

The results consist of a table summarising the distribution of schools by spatial autocorrelated deprivation, and proportion of school aged population aged 5 to 14 years, together with a series of three sets of three maps. Each set of map depicts all of New Zealand, then one map each for the North Island, and the South Island. Both island maps have zoomed in inserts depicting Auckland, Wellington, Christchurch and Dunedin. The maps show:

- Meshblock thematic map of the proportion of 5 to 14 years age range by quintile
- Meshblock thematic map of third order spatially auto-correlated NZDep values
- Meshblock thematic map showing just those meshblocks that contain high proportion 5 to 14 years age range and high spatially auto-correlated NZDep values in which schools are located

There 151 schools (7.29 % of total) located within 134 meshblocks (0.35 % of total) as defined by need based on third order spatially autocorrelated meshblock NZDep 2001 values and high proportion 5 to 14 years population (see table 1).

Report for Non Communicable Disease Policy, PHD, MoH

17. Roll out of the Meningococcal B Vaccine.

Principle Investigator: Kurt Janssen

Other Investigators: Paul White

Completed

Research Summary

Mapping and analysing monthly data for strategic (MoH) and local (DHB) management of MENZ B national vaccination Programme

MVS team needs maps for three purposes

1. Evaluation of stage 1 of Meningococcal B immunisation programme
2. Prioritisation of vaccine delivery
3. Ongoing monitoring of vaccination coverage.

Phoenix Research is carrying out evaluation work under contract and there are specific dates when maps are required. The contract specifies that the MoH will provide these maps.

Evaluation

Maps showing vaccination coverage by CAU in “initial roll out area” (the Counties Manukau DHB and the eastern corridor of Auckland DHB) are required. Phoenix is to provide the first draft report containing coverage data by November 26th, therefore maps are needed by November 12. Data could be provided by MVS to the contractor by November 2nd. The map should include children who've had 1, 2 or 3 doses.

A second report is to be provided at the end of the 1st stage of the programme, March 7th 2004 when a further map will be required. This map will cover the same areas as the first map but

Denominator for calculation of coverage rates will be 2004 population projections (by CAU?)

Prioritisation

One-off maps needed prior to starting the immunisation programme in each DHB. Currently planning for commencement in Auckland, Waitemata and Northland in November 2004. Maps for Auckland and Waitemata are being provided by A plus but maps are still needed in order to compare coverage achieved (see section on coverage) against priority areas

1st priority = epidemic control, 2nd priority = equity

For each DHB, need maps by CAU showing:

- number of cases, aged <20 years, over the last 5 years (epidemic control)
- Maori/Pacific population by CAU (equity)
- NZDep 2001 (equity)

Schedule of when DHBs will start vaccinating (still subject to change)

DHB	Programme start date	Prioritisation maps needed by
Auckland, Waitemata,	1 Nov 2004	1 Sep 2004
Northland	22 November 2004	1 Sep 2004
Waikato, Lakes, Bay of Plenty, Tairāwhiti, Taranaki	7 Feb 2005	1 Nov 2004
Hawkes Bay, Whanganui, MidCentral, Hutt, Capital and Coast, Wairarapa	4 Apr 2005	1 Jan 2005
Nelson Marlborough, Canterbury, South Canterbury, West Coast, Otago, Southland	18 Jul 2005	1 Mar 2005

Coverage monitoring

MVS team needs to be able to monitor vaccination coverage in areas smaller than DHBs. There are likely to be “pockets” of low coverage and DHBs will need to address these with special programmes. Maps will be needed for

each DHB that has started vaccinating. Currently only CMDHB and the eastern corridor of ADHB have started vaccinating. Auckland, Waitemata and Northland DHBs will start vaccinating in November 2004.

We expect these maps would be updated on a monthly basis for each DHB while the programme is still continuing in that area and for the national roll out advisory group (who meet monthly). The first report for NRAG is wanted by September. MVS to provide data for this by August 23rd

Coverage Reports	Data to be supplied by MVS	Coverage maps needed by
Counties Manukau and eastern corridor of Auckland	August 23 rd	mid September

There are currently no estimates as to when the programme will end in each DHB and it is likely that there will be periods several DHBs (if not all) will be vaccinating at the same time.

Denominator for calculation of coverage rates will be 2004 population projections.

Report/Maps for MVS Team, PHD, MoH

18. A Strategy for Analysing Population Health Impacts from the MAF Spray Programme.

Principle Investigator: Paul White

Completed

Research Summary

This research outlines PHI's intervention strategy in relation to the provision of population specific analytical expertise to the Ministry of Agriculture and Forestry (MAF). The strategy is focused on the development of a sound methodological framework based on small area spatial analysis and cartographic visualisation. The implementation strategy is prepared for the MAF in response to the MAF's analytical need for assessing likely population health impacts arising from the fall webworm eradication programme or other similar programmes. The strategy assumes access to appropriate health event data. The collection and provision of appropriate health event data are not part of the strategy.

The strategy details the staged processes and the analytical framework that will provide the population information that the MAF require in the event of airborne spray eradication activity over populated areas. The intervention strategy will take effect on notification from the MAF of a positive trap and the likely deployment by the MAF of an areal spray eradication programme.

The strategy consists of two components:

1. A four staged response plan that details the various staged delivery information components of the strategy
2. An analytical framework that forms the final stage of the strategy

While the actual analysis is contingent upon a trap catch, the framework developed here should be readily applicable, either by PHI or an external third party with reasonable knowledge of population health analysis. In that respect this report has been written to reflect the potential for a third party to implement the analytical strategy.

The strategy is aimed at providing a quick time response to the MAF. As such the strategy is based on a population perspective using data at the aggregate (areal unit) level. The strategy is aimed at providing robust small area rates for spatial analysis and visualisation. The strategy does not include the collection or provision of appropriate health activity data, and consequently the data used in the development of the proposed framework, while indicative of the data that would be used, is done so purely for demonstrative purposes.

Report for Biosecurity NZ, Ministry of Agriculture and Forestry.

19. Population health impacts of airborne spraying in Auckland: A retrospective case-control study of birth defects and congenital hypothyroidism.

Principle Investigator: Paul White
Other Investigators: Barry Borman

Completed

Research Summary

This report has been commissioned by the Ministry of Agriculture and Forestry (MAF) to provide an assessment of the risk of birth defects arising from MAF's aerial spray program using Foray 48B (containing the active compound *Bacillus thuringiensis var. kurstaki* (*Btk*) to eradicate incursions of the exotic species Painted Apple Moth. Public Health Intelligence (PHI), the epidemiology group of the Ministry of Health, undertook an ecological analysis of available data to investigate any change in the prevalence of birth defects and congenital hypothyroidism following spraying of the painted apple moth.

As the boundary of the spray areas are not coterminous with the boundaries of the census units used to report the numerator and denominator data, a case maximum and minimum area in which spraying was likely to have occurred was defined. In addition two control areas were designated: the Eastern suburbs of the Auckland urban area ('East Auckland'), and the Christchurch urban area. The control areas were matched to the maximum and minimum exposure areas by socio-economic status. Finally a

spatial case-control analysis was carried out comparing the prevalence of birth defects during the periods when spraying did and did not occur in both the maximum and minimum exposure areas relative to the two control areas (East Auckland and Christchurch).

The extent of potential exposure to the population could not be precisely defined and no account could be taken for the intermittent way in which spraying occurred during the designated 'spray period'. Moreover, the only data available for this study was for birth defects diagnosed in live births (for which there would be a high level of ascertainment), however, no data was available for stillbirths or terminations of pregnancy which have higher rates of birth defects than live births.

Report Findings

Overall, the data from the New Zealand Birth Defects Monitoring Programme (NZBDMP), category 'all malformations' suggests there was no statistically significant difference in the prevalence of major categories of birth defects in either of the 'case' areas compared to the two control areas. However, in both the case maximum and minimum spray areas there was a statistically significantly high prevalence of cases in the category 'other congenital anomalies of digestive system' compared to the two control areas. In addition the prevalence of 'other congenital anomalies of the circulatory system' was marginally significantly higher in the case maximum area compared to the Christchurch, but not East Auckland, control area. Nevertheless, only 8 of the 84 results had an Odd Ratio (OR) greater than 1.5, and of these only 2 (of 84) indicated an elevated risk (OR greater than 2), neither of which was statistically significant. Only 3 of the 84 results were statistically significantly higher. Therefore, despite the associations identified, it is not possible from this analysis to attribute any increase in birth defect prevalence directly to aerial spraying. These results are consistent with the scientific literature. The same conclusion holds for congenital hypothyroidism where more cases occurred in the control areas compared to the spray areas, and in the spray areas during non-exposed (pre-and post spraying) periods.

Report for Biosecurity NZ, Ministry of Agriculture and Forestry.

20. Population Health Impacts Arising from the Foray 48B Aerial Spray Eradication Programme (exotic species incursions – Asian Gypsy, White Tussock, and Painted Apple Moths).

Principle Investigator: Paul White

Other Investigators: John Wren, Kirstin Lindberge, Jason Landon

Completed

Research Summary

This report has been commissioned by the Ministry of Agriculture and Fishery (MAF) to provide an overall assessment of the population health effects arising from MAF's airborne spray program using Foray 48B (containing the active compound *Bacillus thuringiensis* subsp. *kurstaki* (Btk) to eradicate incursions of the exotic species: White Spotted Tussock Moth, Painted Apple Moth, and Asian Gypsy Moth.

Concerns about the possible human ill-health effects from the aerial application of Foray 48B have been raised in regard to both the active and the inactive (inert) ingredients of the product. In response to the concerns, a limited number of population health surveillance studies have been undertaken internationally and in New Zealand. Other laboratory and toxicological research focussing upon the health effects of Btk, as opposed to Foray 48B specifically, have also been done.

In respect of the available evidence we were asked to address the following questions:

1. Is it reasonable to conclude from the current evidence whether there are any population health impacts from the aerial spraying of Foray 48B?
2. If the evidence is insufficient, what are the epidemiological information gaps?

The main outcome to this report is the summary of key findings synthesised from the available body of evidence in relation to the population health impacts arising from the aerial spraying use of Foray 48B as an eradication measure.

Report Findings

While the epidemiological evidence is limited, when considering the surveillance reports as a whole, in combination with the length of time that the product has been commercially used with no reports of serious effects, and the other scientific evidence from laboratory and toxicological studies, we believe that the preponderance of evidence forms reasonable grounds to conclude that there is little or no discernable epidemiological evidence of any ill-health effect to the public from exposure to the aerial spraying of Foray 48B.

We acknowledge that absence of evidence is not evidence for absence of risk. In this regard, we have excluded from our literature review two papers relating to occupational exposure that does suggest the potential for increased sensitisation, infection and consequently a health effect. It is theoretically possible that those who have a heightened sensitivity to toxins i.e. 'multiple chemical sensitivities' and cross-reactivity to Foray 48B may have an allergic response, particularly in someone with a pre-existing allergy to components of Foray 48B. However for infection or systemic toxicity effects to occur, there would have to be exposure far in excess of those experienced during the aerial spray programmes undertaken so far in New Zealand.

Furthermore, the effects that may be experienced are not considered medically serious. Consequently, while occupational exposure may be indicative of potential effects that could occur within the sprayed population it is important to recognise that the level of exposure in occupational settings is orders of magnitude higher than that the sprayed population, and that therefore there is likely to be a dose-response relationship. Thus, when considered in light of toxicological evidence and of actual experience from spray use we feel that occupational exposure is not of high relevance in assessing population risk.

Overall there are very few epidemiological studies of the health effects of Btk products such as Foray 48B. In addition, the studies that have been done have methodological design flaws or gaps in data collection – principally the absence of individual level exposure data, which precludes epidemiological consideration of causality, i.e. unambiguous identification of aetiological pathways. In addition, the studies we have been able to source have focussed solely upon short-term effects as a systematic search did not locate any long-term studies of the effects of Btk products such as Foray 48B. The scarcity of long-term studies may seem surprising given that the product has been in use for 40 years, and that it is increasingly being used in urban environments. However, this may be explained by the preponderance of evidence to date that indicates that there is little/or no discernable epidemiological evidence for any public adverse health effects from exposure to the aerial spraying of Foray 48B, and that consequently longitudinal studies are not warranted due to a lack of hypothesised mechanism of harm to human health.

This is not to say, that no ill-health effects have been reported. In all of the exposed communities surveyed, a very small group of people have reported health effects that they attribute to the spray or spraying programme, and these effects are similar across studies. Typically, the effects can be categorised as minor irritations or allergic reactions involving the upper respiratory system, skin and/or eyes, and feelings of anxiety and/or frustration about being exposed to the spray. While the effects may be minor medically, for those reporting them they are often quite distressing.

It is also important to note that non-specific self-limiting symptoms of the sort outlined above are common in the community. New Zealand background prevalence data for such symptoms does not exist. It is therefore not possible to determine to what extent, if any, the commonest reported symptoms were associated with the spray (as expected from the health risk assessment of Foray 48B) and to what extent they were 'normal' and reported as the result of increased health awareness and concern as a result of publicity about the spray programme. This situation will persist unless a random community survey of non-specific symptoms is carried out simultaneously in a sprayed NZ community and a similar but non-sprayed NZ community. Aer Aqua attempted this in 2004 but the survey type (self-administered postal questionnaire) resulted in a very low response rate.

It is also clear that there is a disjuncture between the available epidemiological and medical evidence about the health effects of Foray 48B,

and the beliefs of some community members, most notably those communities that have been exposed to or have experienced aerial spraying (as distinct from airborne spraying by hand) spraying. This is a phenomena regularly experienced by health promoters in regard to other public health issues such as the fluoridation of public water supplies and the health concerns of residents living in proximity to hazardous substances. Clearly it is beneficial to good health that such anxiety and personal distress is alleviated or avoided. Therefore if community concerns are to be taken into consideration and public trust is to be generated then agencies responsible for future eradication programmes that intend to deploy Foray 48B should fully engage with communities from as early a stage as possible in as open and transparent a way as is possible. This would include recognising that airborne applications of Foray 48B are unpopular in some sections of the community, that it may result in some minor irritations or allergic type reactions involving the upper respiratory system, skin and/or eyes, and feelings of anxiety and frustration about being exposed to the spray.

Recommendations

We make two recommendations:

1. that for future programmes agencies engage early with community leaders in a transparent process to discuss the programme and the potential for health effects.
2. that prior to any new eradication programmes a formal Health Impact Assessment is undertaken.

Report for Biosecurity NZ, Ministry of Agriculture and Forestry.

21. Monitoring Health Inequality Through Neighbourhood Life Expectancy,

Principle Investigator: Martin Tobias

Other Investigators: Craig Wright, Paul White

Completed

Research Summary

Reducing health inequalities is now at the centre of New Zealand's public health agenda. Yet measuring health inequality to date has consisted merely of computing average differences in mortality or morbidity between pre-defined social groups (such as occupational classes or ethnic groups). While average group differences are policy-relevant, conceptualising inequality in this way has two major limitations.

Firstly, it captures only *between-group* inequality and ignores *within-group* inequality.

Secondly, by pre-defining the social groups of interest it constrains the possible explanations for inequality that can be sought.

Instead, a more comprehensive approach to health equity is to define inequality as the *variation in health across individuals in a population*. This approach allows measurement of *total* inequality (the sum of between-group and within-group inequality) and permits unconstrained analysis of the determinants of inequality.

The aim of this occasional bulletin is firstly to estimate total health inequality at national and health district levels for New Zealand in 1999–2003. Secondly, the health of District Health Board populations is compared in terms of average level of health, distribution of health, and a composite index that integrates both.

The report concludes that neighbourhood life expectancy can be estimated robustly for populations as small as 1,000. Regular monitoring of neighbourhood life expectancy may provide health planners with an additional means to assess progress towards reducing health inequalities, complementing (but not replacing) the existing average group difference approach.

PHI Occasional Bulletin No. 28, See:

<http://www.moh.govt.nz/moh.nsf/by+unid/196E5A67C89FF1CBCC2570B40008D620?Open>

22. Spatial Epidemiological Investigation of Legionellosis Cases in Christchurch

Principle Investigator: Paul White

Other Investigators: Kurt Janssen, Kylie Mason

Completed

Research Summary

This project describes the quick response spatial epidemiological investigation into the current episode of Legionellosis undertaken by PHI for Community and Public Health (CPH), Christchurch.

The aim was to describe the spatial distribution of Legionella cases across the Territorial Authority (TA) area of Christchurch City Council (CCC) using exploratory spatial data analysis techniques. Two commonly used approaches have been implemented. The first intensity measure has been used to identify clusters based on the probability of co-location within a given area. The emphasis is on the likelihood of a case occurring within a given population area (as determined by the test statistic moving window), but not where within the area it occurs. The second dependency measure focuses on looking for areas of similar values, ie the inverse to

the first measure. Here the emphasis is on where the cases (or areas with cases) are located based on the distance between them. In this way the two methods compliment one another and assess the spatial distribution of data, and the significance of any patterns found within the data, from the two main spatial pattern processes.

Of all the cases at a minimum only 35 percent (n=6) appeared in a cluster. However, at a maximum the majority (76%, n=13) were located within a cluster. When the cases located within the clusters were assessed no statistically significant relationship was found. It is difficult to draw a robust conclusion from this distribution given the results are not statistically significant. However, in situations such as this where the number of cases is extremely small (n=17), it is unlikely that statistical significance is a realistic outcome. However, in the absence of statistical significance, geographic significance can be assessed. In this sense the results are all mutually supportive. Five clusters of varying size have been identified. They all concentrate on an area emanating outwards in a funnel shape from the southwest in a north-easterly direction.

There a number of water towers located within all the clusters. In this respect towers located in these areas are consistent with a wind vector hypothesis. More specifically, towers situated in the west of the primary cluster and southwest of all remaining clusters are so located such that a southwesterly direction wind is likely to encompass the upwind locations of the cases (and hence the clusters). However, it is important to note that this analysis does not specifically identify any tower as the putative source.

Report for Community and Public Health, The Canterbury District Health Board

Journal article in preparation

Section 3. Workplan Core Activity: Scholarships

Introduction

It was anticipated that the Laboratory would be in a position to provide three Masters scholarships per year, or two Masters and one PhD scholarship. The scholarship scheme has been widely advertised and we have made four scholarship offers, three of which have been accepted by excellent candidates (details below). Each scholarship covers tuition fees and provides a \$10,000 living allowance. The GeoHealth Laboratory has also endeavoured to cover research costs associated with the student's research and, for example, is contributing towards the cost of attending the pre-IGU workshop organised by the Health and Environment research group in June 2006 for two GeoHealth students. All GeoHealth Laboratory-funded students will undertake a short internship (2-3 weeks) at PHI in Wellington at some point during their studies.

We have also advertised one PhD scholarship both within New Zealand and overseas but to date have only received limited interest.

Masters Scholarships

1. Catherine Tisch (August 2005 to August 2006)
2. Erin Holmes (March 2006 to March 2007)
3. Esther Rhind (to start June 2006)

PhD Students

In addition, two PhD students are currently working in the GeoHealth Laboratory. Both students are funded through University Scholarships. There were no Laboratory funded PhD scholarships awarded in year 1.

1. Laura Miller (February 2005 to February 2008)
2. Jeff Wilson (October 2004 to June 2006)

Scholarship 1: Catherine Tisch

Start Date: August 2005

Title: An analysis of the growing geographical inequalities in mortality in New Zealand, 1981-2000

Principle Supervisor: Jamie Pearce

Associate Supervisors: Ross Barnett

Research Outline

Background

- Just as there is a widening social polarisation of health inequalities, numerous authors argue that the geographical health gap in many countries is also widening
- Evidence of geographical polarisation of health in terms of all cause mortality and life expectancy in New Zealand during 1981-2000

Gaps in previous research

- Tend to focus on one cause of mortality
- Often to not imply causation

Aims

- To what extent are there geographical differences in mortality in New Zealand?
- Have such differences widened over the period 1981-2000?
- To what extent have such trends been evident at different geographical scales?
- What are the key processes underlying widening geographical differences in mortality?

- To what extent are the key causes of such trends consistent for different causes of death?

Scholarship 2: Erin Holmes

Start Date: March 2006

Title: An Evaluation of the Disease Notification Process in New Zealand

Principle Supervisor: Ross Barnett

Associate Supervisors: Jamie Pearce, Clive Sabel

Research Outline

“To what extent does the process of disease notification in Canterbury differ to other regions of New Zealand and how could differences in notification procedure influence the observed spatial trends in incidence and prevalence of notifiable infectious disease in New Zealand?”

Research Objectives:

1. To determine to what extent there is regional variation in the notification rates for a selection of infectious diseases in New Zealand at the District Health Board (DHB) level between 2000-2005, after accounting for disease-specific demographic and environmental factors.
2. To critically analyse current and historic New Zealand legislation on disease notification with a particular emphasis on the Health Act 1956 to understand how it has changed over time and how these changes might reflect changes in New Zealand's perceptions of the importance of notification.
3. To examine the process of notification in a sample of DHBs with a significantly higher or lower notification rate than their counterparts through detailed interviews with organisational staff and general practitioners, thereby evaluating how aspects of the notification process might be driving notification trends.
4. To determine whether geographical context affects the implementation of notifiable disease legislation resulting in a reporting bias, and to establish at which stages of the notification process such bias is most pronounced (figure 1).
5. To assess the significance of the results of this evaluation for social policy, health geography and spatial epidemiology.

PhD Report 1. Laura Miller

Start Date: February 2005

Title: Health effects of population movements in New Zealand

Principle Supervisor: Jamie Pearce

Associate Supervisors: Ross Barnett

Research Outline

Over the last fifty years there has been a significant increase in the volume, frequency and distance of human movements worldwide. Historically, New Zealand has had high rates of both international immigration and internal population mobility. This trend appears to be continuing; approximately 20 percent of New Zealand's current population were born overseas, and just over half of those living in New Zealand on census night 2001 had changed their address at least once since 1996. Migration of people to new environments can have both positive and detrimental impacts on the health of those who move, those they join, and those who are left behind.

The research examines migration trends in New Zealand and considers how levels of mobility across New Zealand vary by small geographical areas (census area units). In addition variations by age-group, gender, ethnicity, deprivation and urban rural category will be examined, and two possible health implications of differing levels of population movements and mixing, considered. Type 1 diabetes and acute lymphoblastic leukaemia have been linked with having an infectious cause and thus may be related to movements of people, although research to date is inconsistent, with little work conducted in the New Zealand setting. Prevalence of both type 1 diabetes and acute lymphoblastic leukaemia has been increasing over recent decades in New Zealand and internationally, however reasons for these increases are unclear and require further investigation. The initial results from this research will be considered, including a discussion of the variety of census measures, tourist data and commuting data used to build a detailed picture of population mobility in New Zealand. Additionally, the relationship between population mobility and the two health outcomes (type 1 diabetes and acute lymphoblastic leukaemia) will be discussed.

PhD Report 2. Jeff Wilson

Start Date: October 2004

Title: Spatial Variability of Intraurban Particulate Air Pollution: Epidemiological Implications and Applications.

Principle Supervisor: Simon Kingham

Associate Supervisors: Jamie Pearce, Andy Sturman

Research Outline

The past twenty years of research that has associated air pollution with health outcomes has brought remarkable advance in statistical techniques that effectively tease out the intricacies of the relationship. However, while statistical techniques progressed, an assumption based on seminal work in the field persisted: that concentrations of particulate matter (PM) air pollution are spatially homogeneous within urban areas, and consequently, that

personal exposures could be based on central monitoring site data alone. Although this assumption went unaddressed for years, it has now come to researchers' attention that it may be flawed and that the assumption may induce exposure misclassification error under certain conditions. This thesis explores intraurban spatial variability in PM through a systematic review of the literature, experimental field testing, modelling, and new methodological approaches. The key outcomes of the thesis are as follows: (i) the publication of the first systematic review of the intraurban particulate literature, challenging the widely-held assumption that PM concentrations are spatially uniform; (ii) an experimental test was conducted in Christchurch, New Zealand, revealing that the homogenous assumption was false for a city with high wintertime particulate matter concentrations; (iii) an integrated meteorological-emission model was evaluated for the first time at the intraurban level for PM and a new study design was suggested; and (iv) the spatial modification effect of social and ecological confounders was analysed with respect to respiratory hospital admissions and PM. Collectively, these outcomes provide a new body of knowledge informing researchers focused on assessing the relationship between air pollution and health in applications ranging from small-area exposure assessment to the wider field of environmental epidemiology.

PUBLICATIONS***Refereed Journal Articles***

- Wilson, J. G., S. Kingham, J. Pearce, and A. Sturman. 2005. A review of intraurban variations in particulate air pollution: Implications for epidemiological research. *Atmospheric Environment* 39, 6444-6462.
- Wilson, J. G., S. Kingham, and A. Sturman. in press. Intraurban variations of particulate matter air pollution in Christchurch, New Zealand: Implications for epidemiological studies. *Science of the Total Environment*. Available online 21 October 2005.
- Durand, M. and J. G. Wilson. in press. Spatial analysis of respiratory disease clusters on an urbanised geothermal field. *Environmental Research*. Available online 19 September 2005.
- Wilson, J. G. and P. Zawar-Reza. 2006. Intraurban-scale dispersion modelling of particulate matter concentrations: Applications for exposure estimates in cohort studies. *Atmospheric Environment* 41, 1053-1063.
- Kingham, S., M. Durand, J. Harrison, J. G. Wilson, and M. Epton. 2006. Winter comparison of TEOM, MiniVol and DustTrak PM₁₀ monitors in a wood smoke environment. *Atmospheric Environment* 40, 338-347.
- Durand, M. and Wilson, J.G., 2006. Ball lightning and fireballs during volcanic air pollution. *Weather* 61, 40- 43.
- Wilson, J. G., C. E. Sabel, S. Kingham, C. Tisch, and M. Epton. under review. The spatial modification effect of environmental and social confounders on intraurban patterns of risk in respiratory hospital admissions. *Social Science & Medicine*.
- Wilson, J. G., Zawar-Reza, P. and Cavanaugh, J. in preparation. Dry deposition of particulate matter air pollution in an urbanised native bush environment: implications for policy makers.

Other Peer-Reviewed Work

- Wilson, J. G., Kingham, S., Sturman, A. and Pearce, J., 2005. Intraurban particulate air pollution and restricted activity days in New Zealand school children. *Epidemiology* 16, S136-S136 (Abstract and Poster).
- Zawar-Reza, P., Wilson, J. G., Sturman, A. and Titov, M., 2006. Mesoscale controls on particulate matter pollution for a coastal city: numerical modelling analysis and impact assessment, Proceedings of the International Conference on Mesoscale Processes in Atmosphere, Ocean and Environmental Systems.

Wilson, J. G. and Zawar-Reza, P. 2005. Dispersion modeling of particulate matter concentrations at the intraurban scale: epidemiological applications. Proceedings of the 10th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes. 17-20 October 2005: pp 509-513.

Reviewed Reports

Fisher, G., Kjellstrom, T., Woodward, A., Hales, S., Town, I., Sturman, A., Kingham, S., O'Dea, D., Wilton, E., O'Fallon, C., Scoggins, A., Shrestha, R., Zawar-Reza, P., Epton, M., Pearce, J., Sturman, J., Spronken-Smith, R., Wilson, J., McLeod, S., Dawson, R., Tremblay, L., Brown, L., Eason, C. and Donnelly, P. 2004. Health and air pollution in New Zealand: Christchurch pilot study, Health Research Council, Wellington.

Section 4. Workplan Core Activity: Training

Introduction

The third core work activity of the Laboratory is specialised capacity building for the New Zealand Health sector. As the use of GIS based tools increases beyond academic sectors and across into the practical health settings it is important that appropriate support is available to encourage use and exploit advances and current best practice. This is inline with one of PHIs primary drivers of its sector engagement strategy, to increase specialised analytically capability to help deliver better GIS based analytical solutions directed towards meeting the District Health Board (DHB) and Public Health Service policy targets.

The Need for Targeted Training Courses

PHI has identified a clear gap in current commercial and academic GIS training resulting from feedback from the health sector. Feedback from the PHI biannual analytical workshops suggests that current health sector GIS users are dissatisfied with the general training provided by GIS vendors (they are too expensive and by being generic they are not tailored to health sector needs); and from academic institutions who provide full academically accredited papers (that are overly comprehensive and by running over a series of weeks are too long for most practical users). Thus there is a clear need for short course tailored training in the use of GIS and spatial analytical techniques geared specifically towards typical public health requirements, and most importantly using the kinds of data typically found in these environments.

This need will increase. All 21 DHBs have previously been supplied with ArcView GIS licenses by PHI. There are also a number of additional users across the health sector such as those within 17 Public Health Services (PHS) and 4 technical shared support agencies. It is also likely that in future some of emerging Primary Health Organisations (PHOs) will also require their own analytical capacity. There are also a number of Crown Research entities, NGO's and other government departments that are beginning to use GIS. One of the key characteristics of these public sector organisations is the high turnover of analytical staff. The result is a large, increasing and seemingly self perpetuating audience for specialised short course GIS and spatial epidemiological training of the sort that the Laboratory is ideally placed to fulfil.

Developing Training

The training outlined below is based on the successfully implemented model developed by Paul White in the Public Health GIS Unit at Sheffield University. Over the course of three years while at the university and then privately for 8 months prior to coming to New Zealand the two practical GIS courses were continually developed and delivered to around 200 people.

The important focus of these courses is on *Public Health Specific GIS* training. The courses are not general introductions to GIS rather problem centred using public health tasks as the basis for a scenario of the sort that might typically be undertaken in a practical setting.

Mode of Delivery

Each of the courses included instructional sessions, a workbook, and accompanying CD-ROM containing all the data required for the exercises contained in the workbook.

Currently two training streams have been identified and implemented:

1. Non GIS based spatial epidemiology training.
2. Practical GIS training:
 - a. Basic – an introduction to GIS for public health use. Designed for those new to GIS, or as a refresher for infrequent users.
 - b. Intermediate – introduction to public health spatial analysis. Designed for those already familiar with GIS. Topics included, spatial querying, calculating spatial moving averages (of disease rates), and creating distances matrices.
 - c. Advanced – bespoke training based around the specific requirements of individuals. Topics typically involved the shift from point or area (choropleth) mapping to the creation of surfaces and elementary grid analysis.

The two practical courses are delivered in the GIS teaching laboratory in the Department of Geography, using both PHI and GeoHealth Research Laboratory staff.

1. Introduction to Spatial Epidemiology

Course Aims

The aim of this 2½-day course is to gain an understanding of the value, tools and techniques used in spatial, ecological and environmental epidemiology. The course is designed to provide background information and practical assistance for public health research and practice.

GIS is increasingly being used within the NZ health sector. This course will help you gain the most out of using these systems by covering some of the important geographical concepts, statistical methods and corresponding potential sources of error that are part and parcel (though frequently overlooked) of using such systems.

No prior understanding of geography, epidemiology or statistics is required.

Topics covered include:

- Introduction to GIS, spatial analysis and spatial epidemiology
- Spatial epidemiology in practice and the growth of GIS

- Introduction to Geographic concepts
- Specific geographic concepts (problems with interpreting ecological data)
- Spatial analytical techniques 1: Area based processes – Disease Mapping
- Spatial analytical techniques 2: Point based processes – Cluster Analysis
- Data Issues: Access to data, ethics and confidentiality
- Non-infectious disease spatial epidemiology
- Infectious disease spatial epidemiology
- Public health surveillance
- Outbreak investigation: cluster analysis in practice
- Emerging areas in spatial epidemiology : Zoonotic Diseases

Attendance to date

The course was first run in February 2004 with 17 attendees from across the New Zealand Health Sector. The course was again run in February 2006 and attracted 21 attendees. On both occasions others expressed an interest in attending this course but were unable to make the dates on which it was run. Given the high demand for this course it is anticipated that it will be run on an annual basis. Feedback from this course demonstrated a clear desire on the part of the attendees to undertake a practical GIS centred training.

2a. Basic Level Training

The introductory course takes you through the basic level skills for mapping Public Health data using a desktop Geographical Information System (GIS).

The basic level training programme comprises a one-day instructional session, the basic level workbook, and accompanying CD-ROM that contains all the data required for the exercises contained in the workbook. The exercises are broken down into four sessions and are based around a scenario that might typically be found within in a Public Health setting. The four sessions are separate but link together forming a cohesive training package designed to introduce the basic elements for creating maps and displaying data spatially. Emphasis is centred on displaying data geographically rather than the analysing data geographically. The spatial analytical aspects of GIS are covered in the intermediate level training. The workbook is designed for people new to the concepts of GIS, and assumes no prior knowledge of mapping in general or the use of ArcGIS in particular.

Topics covered include:

- Introduction to GIS and GIS data types
- Introduction to health data commonly used in mapping
- The value of mapping health data (mapping as powerful tool for communication)
- Importing data from spreadsheets and databases
- Creating area based thematic maps
- Creating alternative maps types (Dot density, Bar Chart, Pie Chart)
- Mapping fundamentals and cartographic principles (use of colour/symbology)

- Using maps in practice (importing into word and powerpoint presentations)

Attendance to date

This course was first in April 2006 with 8 attendees. This course will be continually developed and delivered annually or biannually according to demand.

2b. Intermediate Level Training

The intermediate training will take you through the intermediate level skills of analysing Public Health data geographically using a ArcGIS desktop mapping and GIS package.

The exercises are based around four sessions. The four sessions are separate but link together forming a cohesive training package covering a range of generic GIS and geo-data analysis skills based around problems or scenarios that might typically be encountered in a Public Health setting. The workbook assumes a basic level of prior GIS experience, although all the steps required to undertake the tasks are described in detail. The workbook is designed to be followed in sequence, with knowledge from the earlier exercises being assumed in later ones.

Attendance to date

This course has yet to be converted in to ArcGIS format from MapInfo. This will be undertaken in the next few months and it is anticipated the inaugural delivery of this course will be in August 2006, and again delivered annually or biannually according to demand.

Section 5. GeoHealth Laboratory Promotion

During the past year we have adopted a number of strategies to raise the profile of the Laboratory particularly within Australasia but also overseas. This section will briefly outline the ongoing efforts to raise the profile of the GeoHealth Laboratory.

Web Pages

A comprehensive set of web pages have been created by Jamie Pearce and Paul Bealing (DoG, web administrator). The web pages:

- outline the aims and objectives for the Laboratory
- give an overview of Laboratory activities
- provides details of the various GeoHealth research projects
- provides details of the available scholarships
- provides a list of recent staff publications
- provide overview of all staff members and postgraduate students
- has a regular set of news items

The ongoing maintenance and updating of the GeoHealth web pages is a priority for the next 12 months.



Conference Attendance

A number of conferences have been attended by GeoHealth Staff to deliver papers on GeoHealth-related projects.

- PW: GeoHealth 2004 Surveillance and Intervention, Wellington, New Zealand (November 2004 – announce GeoHealth Laboratory)
- PW: GIS Strategies, Sydney, Australia (February 2005)
- JP: International Medical Geography Symposium, Fort Worth, Texas, USA (July 2005)
- JP: Association of American Geographers, Chicago, Illinois, USA (March 2006)

In June/July 2006, a number of GeoHealth Laboratory staff and postgraduate students will be attending the IGU pre-conference Health and Society meeting in Auckland and the IGU in Brisbane Australia. In addition, we anticipate that a group of us will attend the Australian Epidemiological Association meeting in Melbourne, Australia in September 2006.

Leaflets

A leaflet with a brief overview of the GeoHealth Laboratory has been written by Paul White and produced by PHI (appendix 3.). This can be distributed as widely as possible.

External Visits by co-Directors

Both co-Directors have endeavoured to visit a range of individuals and institutions to discuss and promote GeoHealth activities and to explore potential avenues for future collaboration. These visits include:

- PW to NATSEM, University of Canberra, Australia (February 2005)
- PW to Department of Geography, University of Portsmouth UK (April 2005)
- PW to Department of Public Health, University of Sheffield, UK (April 2005)
- PW to CPHR, Massey University (numerous times)
- PW to School of People, Environment and Planning, Massey University (August, 2005)
- PW to , EpiCentre, Massey University (February 2006)
- PW to New Zealand Health Sector:
 - South Island Shared Support Agency (May 2005)
 - Waikato, with Lakes and Bay of Plenty DHBs (May 2005)
 - Auckland DHB (May 2005)
 - South Island Shared Support Agency (October 2005)
 - Whanganui DHB, (November 2005)
 - Public Health Service Mid Central Health (November 2005)
 - Auckland Regional Public Health Service (December 2005)
 - Health Waikato – PHS – (December 2005)
 - Northland DHB (December 2005)
 - Northland Health – PHS - (December 2005)
 - Community and Public Health – Canterbury PHS – (January 2006)
 - Hawke's Bay DHB, (February 2006)
 - Health Care Hawke's Bay - PHS - (February 2006)

- JP to Department of Environmental Science, University of East Anglia, UK (June 2005)
- JP to McGill University, Montreal, Canada (June 2005)
- JP to University of Waterloo, Ontario, Canada (June 2005)
- JP to McMaster University, Hamilton, Ontario, Canada (June 2005)
- JP to Department of Geography, University of Sheffield, UK (August 2005)
- JP to Department of Geography, University of St Andrews (August 2005)
- JP to Department of Geography, University of Dundee, UK (August 2005)
- JP to Wellington School of Medicine (numerous times)
- JP to NATSEM, University of Canberra, Australia (April 2006)

Visitors to the GeoHealth Laboratory

There have been a number of key visitors to the GeoHealth Laboratory since February 2005. These include:

- The Right Honourable Helen Clark, Prime Minister
- Dr Don Matheson, DGG Public health, Ministry of Health
- Professor Roy Sharp Vice Chancellor, University of Canterbury
- Pro-vice Chancellor, University of Canterbury
- A delegation from NIWA, Wellington
- A delegation from the Iranian government
- A delegation from the Chinese government
- Professor Danny Dorling (Sheffield, UK)
- Professor Graham Bentham (UEA, UK)
- Dr Robin Haynes (UEA, UK)
- Professor Robin Flowerdew (St Andrews, UK)
- Dr Iain Lake (UEA, UK)
- Dr Laurie Brown (NATSEM, Canberra)

Other

The co-Directors have taken a number of other opportunities to raise the profile of the Laboratory at a number of meetings and seminars. Both Jamie and Paul have been asked to provide a number of presentations about the GeoHealth Laboratory in a range of forums at academic departments in NZ and Australia and to interested local parties in the New Zealand Health sector.

Section 6. Plans for Year Two

The year 2 Laboratory work plan will continue with the three stream core work programme implemented in year 1. The Directors will also aim to further increase their network of contacts and raise awareness of the Laboratory, as well as generate further interest in Laboratory collaborative research projects.

Research

Many of the research projects listed in section 2 will be carried over to year two. In addition a number of new projects will commence, these include:

1. Examination of Smokefree legislation in New Zealand
2. Examination of problem gambling geography in new Zealand
3. The impact of distance to rural deprivation

Project 1. Smokefree Legislation and MCI Hospital Admissions

Ross Barnett, Jamie Pearce, John Elliott, Irfon Jones, Paul White

One of the major projects for 2006-07 will be an evaluation of the smoke free legislation which came into force in December 2004. The research will take the form of an epidemiological evaluation as well as an investigation in the implications for health disparities between various social and ethnic groups. On both of these objectives we anticipate making a significant contribution to the population health objectives in the New Zealand Health Strategy.

Hypotheses to be tested:

- 1. That the December 2004 legislation has had an impact upon smoking rates due to the restrictions on smoking in hotels and restaurants.**

Would you expect this?

- Possibly yes, because restrictions on smoking in public places, while they may have resulted in less consumption, may also have provided added pressures to quit for those people considering this alternative.
- Possibly no if restrictions on smoking in public places have simply meant that smoking has increasingly transferred from public to private spaces (Poland).

Task - review international literature on the effects of such regulation on smoking.

Data:

- Use quitline data to examine (a) trends before & after Dec 2004 across DHBs and by NZDep quintiles within the Canterbury DHB.
- A.C. Neilsen data (2005 cp to previous years)
- Pegasus data?

2. That the smokefree legislation has had an impact on cardiac (MCI) hospital admissions?

Would you expect this?

- Yes, because evidence suggests that the risk of AMI falls rapidly once people stop smoking
- Yes, because the same evidence suggests the risks of AMI are also related to exposure to 2nd hand smoke and this should have been reduced following the introduction of the legislation.

Task - review literature on the extent of the links between risks of AMI and active and passive smoking. eg what is the size of any lag effects? What other risk factors have an effect on AMI admissions - problem of confounders and our inability to control for these.

Specific hypotheses:

- That there should be a decline particularly in MCI admission rates (vs numbers) per 1000 for the adult population (make the denominator population >30 years of age) in 2005/06 compared to the previous 2 years
- That the decline should be *greatest* in high deprivation areas (measured by MB deprivation) given that smoking rates and exposure to 2nd hand smoke is greatest in those areas.
- That the decline should be *highest* amongst lower income people living in less deprived parts of the city (ie people living in deprived meshblocks but in less deprived CAUs) since the combined impact of (i) public restrictions and (ii) greater social stigma & local pressures to quit results in a reduction in risks of MCI.
- That the decline should be *greatest* among regular smokers (vs past smokers & non-smokers) assuming that the SFE legislation encouraged them to smoke less.
- That the decline will also reflect the effects of age and be greatest among younger smokers vs non-smokers given that older people will have been more likely to have given up for other reasons.

Project 2. Examination of problem gambling geography in new Zealand: 'Neighbourhood context and problem gambling in NZ'

Problem gambling is a public health issue as it occurs within, and is influenced by, the context of the society and the environment in which the gambler lives. Additionally, gambling problems can affect the gambler, the people around them and their community (Chetwynd 1997; Korn 2001). In 1997 the Ministry of Health estimated that the effects of problem gambling resulted in a loss of 3,300–10,600 years of 'quality of life' in New Zealand per year, translating into \$330 million–\$1.06 billion per year (Ministry of Health 2004c).

Epidemiological studies on problem gambling help to inform the development of policy, as well as treatment and prevention programmes for problem gamblers such as face-to-face counselling services and telephone helpline services. With the knowledge of risk factors for problem gambling, these services can be targeted towards the more susceptible subgroups of the population. Epidemiological studies are also useful for monitoring changes over time and examining the effectiveness of policies. The aim of this project is to provide insights into whether the location and prevalence in neighbourhoods of gambling opportunities is a real driver of behaviour or not.

Project Outline

1. Calculate a measure of accessibility to gambling opportunities. In effect we would add a new domain to the CRAINZ (ie re run the macro) but use a geocoded dataset of the location of gambling outlets. We would then have a measure of relative and absolute accessibility to gambling in each neighbourhood (or for each output area)
2. Attach this measure to the NZ Health Survey, particularly questions 169-186 which ask lots about gambling habits
3. Use ML modelling to examine whether there is a neighbourhood effect once control for age, sex, ethnicity, socioeconomic status.

This research has the potential to be an internationally groundbreaking study of the effect of neighbourhoods on health. Currently the Laboratory and PHI staff have the necessary in-house GIS and analytical expertise (notably multilevel modeling) to undertake this project, and it is an ideal fit in terms of time for Rosemary Hiscock to undertake when her current contract ends in October.

Project 3. The impact of distance to rural deprivation

The NZDep score developed by Peter Crampton and Clair Salmond is currently the only routinely used proxy measure of socio-economic status used in New Zealand. Whilst NZDep has been and is continuing to be used widely it can be argued that the current index fails to capture rural deprivation. This is a particularly important dimension of deprivation for both public health and health service provision given the sparse distribution of New Zealand's rural communities. The UK in common with many European countries has a number of alternative proxy scores of material and social deprivation. These measures are generally based on census data. Increasingly however other data forms such as non census social and welfare statistics are also being incorporated. One UK measure the 'Index of Material Deprivation' developed by Oxford University has also for the first time explicitly incorporated distance to essential services in an attempt to capture the rural dimension of deprivation.

The proposed Laboratory project would adopt this framework and examine methods of incorporating distance to services as part of a composite measure of deprivation in New Zealand.

Scholarships

Esther Rhind will commence in June 2006. In addition we shall advertise for a further three candidates in 2006-07.

Training

The basic training course will be again offered in August 2006. However depending on demand delivery of this course may be postponed until the new year and thereafter delivered annually.

One of the next priorities for the year 2 Laboratory workplan will be the conversion and development of the intermediate practical GIS course. It is aimed that this will be rolled out in August 2006.

Promotion and Publication

Conference Presentations for 2006

Many of the PHI/Laboratory and Geography Department staff will be presenting at and attending the following conferences and workshops:

- International Geographical Union Commission on Health and Environment, Waiheke Island (June)
- International Geographical Union Regional Conference, Brisbane (July)
- GeoSpatial Research and Application Frontiers in Environmental and Public Health Systems, Hong Kong, (June)
- Australasian Epidemiological Association, Melbourne, (September)
- GeoHealth2006: Methods in Practice, Nelson (November)
- PHI Analytical Workshop, Evidence for Public Health Practice, Wellington (May)

GeoHealth 2006: Methods in Practice

The flagship event to publicise work of the Laboratory will be *GeoHealth2006: Methods in Practice*. This will be the third in the highly successful series of PHI hosted events and will take place at the Rutherford Hotel, Nelson, June 27th to 30th 2006. This will be a high profile event with an anticipated international and national audience with four illustrious keynote and invited speakers: Professor Neil McGlashan (University of Tasmania, Aus), Dr Colin Tukuitonga (WHO, Geneva), Professor Graham Moon (Portsmouth University, UK), and Professor Danny Dorling (Sheffield University, UK)

The aim of *GeoHealth 2006* is to promote the exchange of ideas and sharing of experiences in the application of Health Geographical Information Sciences and Systems to public health research and practice. The conference will bring together people from many different fields in the broad area of public health, and will be the third event following on from the highly successful first two

conferences *GeoHealth2002: supporting decision making in health*, and *GeoHealth 2004: surveillance and intervention*.

GeoHealth 2006: Methods in Practice is going to focus on the broad theme of how GIS and spatial epidemiological methods are of practical benefit to public health. Papers will cover a broad range of topics from both the research and policy perspectives ranging from spatial epidemiological research to information for public health policy.

Target Audience

As with the first two events the target audience will have wide appeal reflecting the diverse nature of public health and the interest generated in this important application and research area. The conference is designed to be inclusive and will be of interest to people at the policy, research, information analysis and implementation levels that will include: public health practitioners, academic researchers, GIS and data analysts, decision-makers and interested colleagues.

One Day Symposium: Priorities in Environmental Health

In association with the Centre for Public Health Research, Massey University, PHI will be hosting a one day symposium entitled *Priorities in Environmental Health* to immediately follow the GeoHealth 2006 conference.

The symposium has a range of international keynote speakers: Professor Tony McMichael (National Centre for Epidemiology and Population Health, ANU, Canberra, Australia), Professor Josep Anto (Institut Municipal Investigacio Medica, Barcelona, Spain).

Given the similarity in subjects and to encourage wider participation there is a subsidised attendance rate for joint registration to both events. For more information and to register online go to:

<http://www.moh.govt.nz/GeoHealth2006>

External Visits by co-Directors

- PW to Nelson-Marlborough DHB, with West Coast DHB (June 2006)
- PW to Otago DHB, with Southland DHB (June 2006)
- PW to University of Hong Kong (June 2006)
- PW to Flinders University, Australia (August 2006)
- JP to Australian Epidemiological Association meeting in Melbourne, Australia (September 2006)

Appendices

1. Background papers: forming the Laboratory
2. GeoHealth Research Laboratory Contract
3. GeoHealth Research Laboratory Promotional Leaflet