

GeoHealth Laboratory

Te tai whenua o te hau ora

GeoHealth Laboratory Annual Report 2009-10

June 2010



Health & Disability Intelligence

GIS Expertise & High Quality Research for Public Health

Dept. of Geography



GeoHealth Laboratory

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1 Introduction

The GeoHealth Laboratory was established in 2005 as a partnership between Health & Disability Intelligence (HDI) (formerly PHI), in the Ministry of Health, and the Department of Geography, University of Canterbury. It was launched by the then Minister of Health, the Hon Annette King MP, in November 2004 at the *GeoHealth 2004* Conference in Wellington, and formally opened on the 18th February 2005.

The Laboratory seeks to 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. Its aims 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

1.1 Why have a GeoHealth Laboratory?

The Laboratory is driven by the desire to exploit the potential of GIS (computer systems for integrating and analysing 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 geo-health research and teaching experience of the Department of Geography, combined with the policy focused epidemiology expertise of the Ministry of Health, the Laboratory provides access to the most up to date expertise for the practical deployment of GIScience and geo-health research for the benefit of the New Zealand health sector.

1.2 Fourth Annual Report of the GeoHealth Research Laboratory

This is the fourth annual report of the GeoHealth Laboratory and describes the activities undertaken during the 2009/10 year. The report describes the infrastructure, work plan, milestones, achievements and key events in the fifth year of operation of the Laboratory; as well as setting out the aims and work plan in detail for year six.

After Section 1 introduces the Laboratory and sets the scene, Section 2 outlines how the Laboratory is structured including information about funding, personnel, infrastructure, equipment, data and management. Sections 3 and 4 describe the work plan of the Laboratory broken down into its two constituent parts, research and scholarships. 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 next year and the strategic direction beyond.

2 GeoHealth Research Laboratory Infrastructure

The structure of the Laboratory is explained under the following five sub-headings:

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

2.1 Funding

The Laboratory has two principal funding streams, one directly provided by the Ministry of Health and the other indirectly provided by the Department of Geography. In addition, over the past 12 months the GeoHealth Laboratory has provided the critical mass to successfully obtain funding from a range of external sources including the Health Research Council (HRC), Foundation for Research Science and Technology (FRST) and other organisations.

2.1.1 Ministry of Health Direct Funding

The funding from the Ministry of Health is set out in the contract between the Ministry of Health and the University of Canterbury dated 17th July 2009.

2.1.2 University of Canterbury Indirect Funding

The University of Canterbury provides indirect funding to the Laboratory through the Department of Geography in the form of staff time and associated resources.

2.1.3 Additional Funding

The Laboratory also attracts additional funding beyond that provided as part of the GeoHealth Laboratory contract and from the University. In the past year this has included grants from the Health Research Council and the Canterbury Medical Foundation. The latter has funded a post-doctoral research position for Dr Kyoko Fukuda, who has been undertaking research on new hybrid prediction models for adverse environmental health effects, to produce and test a model that will predict admission rates to Christchurch Hospital for acute cardio-respiratory conditions using a variety of factors, such as air pollution, climate and virology.

In addition there have been related grants from FRST and the New Zealand Transport Agency. Most recently we are part of the team that has successfully tendered to develop the Ministry of Health's Environmental Health Indicators (EHI) programme for the next three years.

2.2 Personnel

The Laboratory will fund one full-time researcher in Christchurch for the duration of the contract (Peter Day). In the last year we have appointed an additional two full-time researcher positions, of which one is located in the Ministry of Health in

Wellington (Ed Griffin) and one in the Laboratory in Christchurch (Dr Amber Pearson).

As part of the partnership the time and associated costs of the management team (two permanent posts) is provided and funded by the Ministry of Health and the Department of Geography external to the contract costs. The Laboratory also funds Masters and PhD Scholarships (detailed in section 4 below) that are located in, and contribute to the work of, the Laboratory. The Laboratory is able to draw upon the wider expertise of Department of Geography staff. 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 Ministry of Health group. An outline of Laboratory personnel is given in table 1.

Part of the budget (amounting to approximately 3% of salary of the Laboratory Researcher posts) is allocated for training and conference attendance to enable staff development and lift the profile of the work of the GeoHealth Laboratory.

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 the Ministry of Health. This means that in practice for the funding of three posts, the Laboratory is able to draw upon the expertise of in excess of 40 people. This number can be added to by including the visitors to the University of Canterbury who are attracted by the presence of the Geohealth Laboratory. These have included:

- Prof. Graham Bentham (University of East Anglia, UK, 2010)
- Prof. Bob Haining (University of Cambridge, UK 2009)
- Prof. Danny Dorling (University of Sheffield, 2009 and 2005)
- Assoc. Prof. Howard Bridgman (University of Newcastle, Aus, 2009)
- Prof. Rich Mitchell (University of Glasgow, 2007)
- Prof. Peter Brimblecombe (University of East Anglia, 2007)
- Prof. Graham Moon (University of Southampton, UK, 2006)
- Prof. Robin Flowerdew (University of St Andrews, 2006)
- Dr Iain Lake (University of East Anglia, 2006)
- Prof Robin Haynes (University of East Anglia, 2006).

Table 1. Current GeoHealth Research Laboratory Personnel

Post	Location	Name
Directors	Dept of Geog Uni of Edinburgh	Assoc Prof Simon Kingham Assoc Prof Jamie Pearce ¹
Postdoctoral Research Fellows	Laboratory Laboratory Laboratory	Dr Amber Pearson (from March 2010) Dr Kyoko Fukuda (Canterbury Medical Research Foundation (CMRF)) Dr Rosemary Hiscock (HRC, to Aug 2009)
Researchers	Laboratory Ministry of Health Laboratory	Peter Day Ed Griffin (from January 2010) Catherine Tisch (from May 2010, funded by EHI project)
Masters students	Laboratory	Anjeela Kumar (completed June 2009) Michael Brown (completed Feb 2009) Sam Valentine (started March 2010) Chris Bowie (started March 2010)
PhD students	Laboratory	Francis Ayuka Owuor (started 2007) Frances Graham (part time, started 2006) Ibrahim Alkhalidy (started 2010)
Dept of Geog academic staff	Dept of Geog	Prof Ross Barnett Dr Gregory Breetzke Dr David Conradson
Dept of Geog technical staff	Dept of Geog	John Thyne Paul Bealing Marney Brosnan

2.3 Facilities

The Laboratory is located in a dedicated room situated within the Department of Geography. The Laboratory room is fitted out with six partitioned workstations, bench space for a further four workstations and two additional computer carrels. In addition there is a large meeting table and white board. The laboratory is locked and has swipe-card 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.

2.4 Equipment

The GeoHealth Laboratory has been refurbished to provide desk space and computer terminals for up to twelve 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.

¹ Jamie Pearce was previously on the permanent staff at the University of Canterbury. He is now an Adjunct Associate Professor, and remains actively involved in the GeoHealth laboratory.

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

2.5 Management

The directorship and management of the Laboratory is undertaken primarily by Simon Kingham of the Department of Geography. Additional research guidance and support is provided by Jamie Pearce. Simon and Jamie are in regular phone and email contact. In addition Jamie visited the Laboratory for a month in February 2010. The two directors are responsible for the work activities of the Laboratory.

Oversight and governance are provided by Yvonne Galloway and Stephen Manning at the Ministry of Health. The Directors and they are responsible for generating and agreeing the Laboratory work plan.

3 Work plan Core Activity: Research

The Laboratory work plan is centred on 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.

3.1 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, and 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 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 developing and undertaking these projects.

Following on from the progress made in the first four years, we have continued to undertake joint and individual projects. Some of projects are ongoing from previous years, whilst others are new, just commencing or in the pipeline. The quality and value of the work undertaken to date has been excellent. The projects have been funded from a range of sources and employed a number of different researchers and academic staff located in New Zealand and internationally affiliated with the Laboratory. 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 Laboratory. 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 have continued to add value to existing Ministry of Health data sources such as the 2002/03 and 2006/07 New Zealand Health Survey. For example, multilevel modelling techniques have allowed us to explore the relationships between individual health behaviours from routine surveys (such as smoking, diet and physical activity) and neighbourhood level contextual measures affecting health status (such as ease of access to shopping facilities, environmental status of neighbourhoods and socioeconomic deprivation).

3.1.1 Publications 2009-10

2009

- **Barnett R, Pearce J, Moon G, 2009.** [Is community inequality associated with smoking cessation in New Zealand, 1981-2006?](#) *Social Science and Medicine* 68, 876-884.
- **Barnett R, Pearce J, Moon G, Elliott J, Barnett P, 2009.** [Assessing the effects of the 2004 New Zealand Smokefree Environment Legislation upon rates of hospital admission for acute myocardial infarction.](#) *Australian and New Zealand Journal of Public Health* 33, 515-20.
- **Hiscock R, Pearce J, Barnett R, Moon G, Daley V, 2009.** [Do smoking cessation programmes influence geographical inequalities in health? An evaluation of the impact of the PEGS programme in Christchurch, New Zealand.](#) *Tobacco Control* 18, 371-376.

- **Miller L, Pearce J, Barnett R**, Willis J, Darlow B, Scott R, 2009. [Is population mixing associated with childhood Type 1 diabetes in Canterbury, New Zealand?](#) *Social Science and Medicine* 68, 625-630.
- **Pearce J**, Dorling D, 2009. [Tackling global health inequalities: closing the health gap in a generation.](#) *Environment and Planning A* 41, 1-6.
- **Pearce J, Hiscock R**, Blakely T, Witten K, 2009. [A national study of the association between neighbourhood access to fast food outlets and the diet and weight of local residents.](#) *Health and Place* 15, 193-197.
- **Pearce J, Hiscock R**, Moon G, **Barnett R**, 2009. [The neighbourhood effects of geographical access to tobacco retailers on individual smoking behaviour.](#) *Journal of Epidemiology and Community Health* 63, 69-77.
- Stevenson A, **Pearce J**, Blakely T, Ivory V, Witten K, 2009. [Neighbourhoods and health: a review of the New Zealand literature.](#) *New Zealand Geographer* 65, 211–221.
- **Thompson L, Barnett R, Pearce J**, 2009. [Scared straight?: Fear-appeal anti-smoking campaigns, risk, self-efficacy and addiction.](#) *Health, Risk and Society* 11, 181–196.
- Thompson L, **Pearce J, Barnett R**, 2009. [Smoking: compliant and nomadic identities.](#) *Social and Cultural Geography* 10, 565-581.
- Walton M, **Pearce J, Day P**, 2009. [Examining the interaction between food outlets and outdoor food advertisements with primary school food environments.](#) *Health and Place* 15, 811-818.

2010 Publications

- Moon G, **Barnett R, Pearce J**, 2010. [Ethnic segregation and tobacco consumption: a multilevel repeated cross-sectional analysis of smoking prevalence.](#) *Environment and Planning A* 42, 469-486.
- **Pearce J**, Dorling D, 2010. [Influence of selective migration patterns among smokers and non-smokers on geographical inequalities in health.](#) *Annals of the Association of American Geographers*, 100(2), 393–408.
- **Pearce J**, Witten K. (eds) 2010. [Geographies of Obesity: Environmental Understandings of the Obesity Epidemic.](#) Ashgate, Aldershot.
- **Richardson EA, Pearce J**, Mitchell RJ, **Day P, Kingham S**, 2010. [The association between green space and cause-specific mortality in urban New Zealand: an ecological analysis of green space utility.](#) *BMC Public Health*. 10(1):240.
- **Wilson JG, Kingham S, Pearce J**, 2010. [Air pollution and restricted activity days among New Zealand school children and staff.](#) *International Journal of Environment and Pollution* 41, 140-154.

2010 Under review

- **Day P & Pearce J**, 2010. Obesity-promoting food environments and the spatial clustering of food outlets around schools. *American Journal of Preventive Medicine*.
- **Fukuda, K**, Hider P, Epton M, Jennings L and **Kingham S**, 2010. Associations of Particulate Air Pollution, Viral Infections and Respiratory Admissions. *Australian and New Zealand Journal of Public Health*, accepted.

- Fukuda, K, Hider P, Epton M, Jennings L and **Kingham S**, 2010. Simulating the hospital admission time series using decomposed underlying structures of PM₁₀ and virology data by Singular Spectrum Analysis. *Environmental Research*.
- **Kingham S, Sabel C and Bartie P**, 2010. The impact of the 'school run' on road traffic accidents. *Journal of Transport Geography*.
- Witten K, **Pearce J, Day P**, 2010. Neighbourhood Destination Accessibility Index: A GIS tool for measuring infrastructure support for neighbourhood physical activity. *Environment and Planning A*.

2010 In press

- **Pearce J & Day P**. Neighbourhood histories and health: social deprivation and food retailing in Christchurch, New Zealand, 1966 to 2005. In: [Obesogenic Environments](#). Amelia Lake, Tim G. Townshend, Seraphim Alvanides (Eds). Wiley-Blackwell August 2010. In Press.
- **Rind E, Pearce J**, 2010. The spatial distribution of campylobacteriosis in New Zealand, 1997-2005. *Epidemiology and Infection*. In Press.

3.1.2 Projects 2009-10

1. Neighbourhood access to community resources and health

The Neighbourhoods and Health project was originally funded in 2005 by the Health Research Council as part of the Health Inequalities Research Programme, which is led by the University of Otago. The project aims to illustrate neighbourhood and community variations in mortality and morbidity, and determine how much of that variation might be explained by access to community resources. 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. The construction of access indices for specific community resources has enabled 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 examined 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.

Additional research this year has examined the various pathways through which urban built environments influence population-level physical activity. Walking access to everyday destinations is one such pathway. Using eight domains of neighbourhood destinations (education, transport, recreation, social and cultural, food retail, financial, health, and other retail) we developed a GIS-based 'Neighbourhood Destinations Accessibility Index' (NDAI) for four New Zealand cities. We found that the intensity of neighbourhood destination opportunities varied considerably among cities and between neighbourhoods within cities. Further, access to neighbourhood infrastructural support tends to be better in more socially deprived places. Potential explanations for the socio-spatial distribution of

neighbourhood destinations in New Zealand cities include historical processes of residential and economic development and infrastructural investment.

2. Public health and alcohol related crime

Alcohol is a major contributor to crime, anti-social behaviour and victimisation in New Zealand and is responsible for a range of social problems directly affecting the health and well-being of both offenders and victims. Evidence suggests that the increase in violent offending in New Zealand over the past 20 years is in part related to greater access to alcohol which has become more affordable and available since deregulation from the Sale of Liquor Act 1989. In this national area level study we examined the association between alcohol outlet access and violent offending.

Using GIS, the addresses of 9296 licensed premises across New Zealand in 2006 were geocoded. The travel distance from each Census meshblock population-weighted centroid to the closest alcohol outlet by type (On- and Off-license) and category (supermarket/grocery, bottle store, hotel/tavern/club, licensed restaurants) were calculated. Serious violence offences including homicide, robbery, grievous and serious assaults were aggregated by crime scene (dwelling, licensed premises, road/public place and other) for 286 police station reporting areas for 2005-2007. Negative binomial regression models were fitted to measure the association between median distance quartiles to the closest alcohol outlet and the number of serious violent offences in each Police station area, controlling for area level measures of social deprivation, population density, Maori population, young males 15-29 years and population density.

The findings suggest that better geographic access to licensed alcohol outlets is strongly associated with increased levels of serious violent offending and that alcohol availability and access promoted under the current licensing regime are important contextual determinants of alcohol-related harm within New Zealand communities.

3. Urban/rural status and health outcomes in New Zealand

It is well established that in many countries, including New Zealand, there are geographical inequalities in health. These inequalities in health are evident in health outcomes such as mortality differentials but also morbidity such as cancer incidence and a range of health-related behaviours such as smoking and gambling behaviour. Closely linked to the geographical context of health outcomes are the health needs of communities. Geographical research into health inequalities has typically focused on the differing socio-economic status of areas in explaining variations in health. However, health has been shown to vary geographically using other approaches. One such way is the clear and growing differences in health needs and health outcomes between urban and rural areas of a country. There is little New Zealand based research considering urban/rural differences in health needs and outcomes despite growing evidence that geographical context is important in explaining variations in health outcomes and the health needs of urban/rural localities.

The research undertaken has (1) established there is an urban/rural gradient in mortality and cancer incidence in New Zealand, (2) has determined urban/rural differences in mortality and cancer incidence and changes in these between 1980 and 2005. (3) explored the importance of the urban/rural status of areas in explaining mortality and cancer incidence and the health needs of these localities and (4) further analyses will include urban/rural explanations of health behaviours and health outcomes such as smoking and hospital admissions.

The reduction of health inequalities is a priority of the New Zealand Health Strategy, as is the provision of accessible and appropriate services for people living in rural

areas, as well as all New Zealanders. There are therefore policy implications for this research theme surrounding urban/rural status and health outcome inequalities in New Zealand that we have observed. This research has enabled us to monitor and explain differentials in health between urban and rural areas and the health needs of these areas.

4. Green space and health

This research examined whether there is a socio-economic gradient in usable and non-usable green space exposure and whether green space exposure was associated with cause-specific mortality (lung cancer and cardio-vascular disease) in the New Zealand context. The study found no evidence of green space influence on cardiovascular mortality and that variation in green space availability may have less relevance for the health of New Zealanders given its abundance and less variable social and spatial availability than in other settings. Milestones achieved in this research theme include the completion of analysis on green space availability and neighbourhood socio-economic level, creation of appropriate regression models, and drafting and submitting an academic paper after incorporating reviewers' comments. The paper has recently been published in BMC Public Health (a top journal in this field) (Richardson et al, 2010).

5. Assessing the impact of smoking cessation services: a geographical analysis of Quitline data

Smoking is the leading preventable cause of premature death worldwide. Smoking cessation dramatically reduces the risk of tobacco related illnesses - therefore cessation services offer good value for money in terms of decreasing long term costs to health systems.

In New Zealand the Quit Group, funded by the Ministry of Health, has been providing a quit smoking telephone service (Quitline) for smokers since 1999. This research used Quitline data between 2005 and 2009 and 2006 census smoking data to provide an assessment of the geodemographic coverage of Quitline. The project then examined how ethnicity, deprivation and age affected call rates in different areas throughout New Zealand.

6. Understanding obesogenic environments: access to food outlets around schools

The increasing prevalence of overweight and obesity in school aged children is potentially linked to contextual influences such as the food environment around schools. The proximity of fast-food and convenience stores to schools may enhance access to unhealthy foods and negatively impact on diet.

We undertook spatial cluster analysis to determine whether fast-food outlets were clustered around schools. The locations of all schools, fast-food outlets and convenience stores in five urban regions across New Zealand in 2008 were geocoded. Using GIS, we calculated the number and rate of outlets within a 400m and 800m road distance around each school. The degree of spatial clustering of food outlets around schools was determined. Food outlet type, school level, school socio-economic position, the degree of population density and commercial land use zoning around each school were compared. The key finding of this research is that food environments in walking proximity of New Zealand schools are characterised by a high density of fast-food outlets and convenience stores, particularly in more socially deprived settings. These obesogenic food environments provide ready access to

obesity promoting foods that may negatively impact on student diet and contribute to inequalities in health. The academic paper of this study has been submitted and is currently under review (Day and Pearce, 2010).

3.1.3 Ad-hoc Tasks Completed for the Health Sector in 2009/10

GIS is gaining prominence across the health sector, however GIS capability varies greatly among DHBs. In addition to the research outlined above GIS technicians and GeoHealth Laboratory staff in the Department of Geography and the Ministry of Health, continue to play a hugely important role in providing GIS ad-hoc services for the Ministry of Health (Table 2). These range in sophistication from email and telephone advice, simple geocoding and mapping tasks to more advanced analytical support.

Table 2. Ad-hoc services provided 2009/10

No	Title	Client
1	Taranaki DHB map of Maori population.	Ministry of Health
2	Travel times to the nearest hospital calculated and mapped for the Mid-Central DHB.	Ministry of Health
3	Maps of urban/rural classification areas for Northland, Waikato, Tairāwhiti and West Coast DHBs, and the North and South Islands.	National Health Committee
4	Data for the Central Region (defined as Capital & Coast, Hutt, Wairarapa, Hawkes' Bay, MidCentral and Wanganui DHBs). Data for each census area unit in the Central Region, distance and mean road travel time from the CAU's to 19 hospital facilities. Map of above for distance and mean road travel time from the CAU's to six large hospital facilities.	Ministry of Health
5	Map of NZ showing the proportion Maori for each DHB in 2006.	Ministry of Health
6	Population weighted centroids of each of the 2006 CAUs.	Ministry of Health
7	Hospital Event versus nearest Facility – New Zealand wide.	Ministry of Health
8	Geocoding for the Evaluation of the Taranaki DHB Enhanced Healthline Pilot.	Health Outcomes International
9	Major trauma national clinical network for New Zealand.	Waikato DHB
10	The ageing of New Zealand 2006 to 2041 - GIS animation.	Ministry of Health
11	DHB/TA overlapping boundaries – Shp file creation.	Ministry of Health
12	Map of hospital facilities – defined by New Zealand Role delineation model,	Ministry of Health - policy

4 Work plan Core Activity: Scholarships

4.1 Introduction

A core driver of the Laboratory is to ensure that the New Zealand health sector has access to a pool of young and talented individuals that are amongst the 'best and the brightest' in the emerging areas of geo-health research. To meet this aim the Laboratory provides two Masters Degree scholarships per year, and one PhD scholarship. The scholarships have two aims, firstly for undertaking multidisciplinary research of practical benefit to the New Zealand health sector; and secondly providing a gateway to the health sector that is of direct benefit to the student and health sector employers.

The Laboratory welcomes innovative scholarship research proposals from recipients from wide background across a broad spectrum of geo-health, environmental and public health areas including:

- Neighbourhoods and health
- Built environment and health
- National inequalities in health outcomes
- Air pollution and health
- Social inequality and smoking
- Hospital admissions and access to primary care
- Social dimensions of cancer incidence
- Spatio-temporal modelling of road traffic accidents
- Crime and health
- Environmental health indicators
- Healthy resilient populations
- Hospital admissions prediction
- Environmental determinants of overweight and obesity
- Alcohol related behaviours and harms.

Each Masters scholarship covers domestic tuition fees and provides a \$10,000 living allowance. For PhD scholarships this covers tuition fees and provides a \$20,000 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 conferences or other associated training.

4.1.1 Masters Students

1. Anjeela Kumar (completed June 2009) (GeoHealth scholarship)

Title: The effect of the neighbourhood built environment on obesity in Christchurch.

Anjeela is now working at the Christchurch School of Medicine.

2. Chris Bowie (commenced March 2010) (GeoHealth scholarship)

Subject: A study on youth access to tobacco products and smoking cessation services.

3. Sam Valentine (commenced March 2010) (GeoHealth scholarship)

Subject: A study on privatisation and healthcare reform.

4.1.2 PhD Students

1. Francis Ayuka Owuor (to be completed in 2010) (GeoHealth scholarship)

Title: Examining place influence on alcohol-related behaviour and health outcomes New Zealand.

2. Frances Graham (on-going 2010) (self-funded)

Title: An assessment of the potential human health effects of Legionellosis and other bio-aerosols from composting in New Zealand.

3. Ibrahim Alkhalidy (on-going 2010) (funded by Saudi Arabian government)

Title: The impact of environmental Dengue Fever in Jeddah, Saudi Arabia: The application of spatial analysis and modelling using GIS.

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. These are listed below.

5.1 Conferences and other presentations

The work of GeoHealth Laboratory staff has been presented at a range of international conferences since the last 2008 report.

Association of American Geographers conference, Washington DC, USA. April 2010.

- **Pearson A**, Environmental and Social Conditions of Health: Placing Development in a Ugandan Context.

IPENZ Transportation Conference. Christchurch, New Zealand, March 2010.

- **Kingham S**, Longley I, Salmond J, Shrestha K, Pattinson W, Liu, H, The impact of choice of transport mode on personal pollution exposure.

Legionella 2009, Paris, France, October 2009.

- **Graham F, Kingham S**, Harte D and White P, Changing Epidemiologic Trends of Legionellosis in New Zealand, 1979 – 2008.

CASANZ 2009: 19th International Clean Air and Environment Conference. Perth, Australia, September 2009.

- **Kingham S**, Longley I, Salmond J, Shrestha K, Pattinson W, Determination of personal exposure to traffic pollution while travelling by different modes.

18th Australasian Epidemiological Association Annual Scientific Meeting, Dunedin, New Zealand, August 2009.

- **Day P, Kingham S, Brown M and Pearce J**, Assessing the health effects of pollution exposure in a small town: the case of Reefton, New Zealand.
- **Day P, & Pearce J**, The local food environment around schools Is there variation by school socio-demographic characteristics?

International Symposium in Medical Geography, Hamilton, Ontario, Canada. July 2009.

- **Barnett R**, Practice and ethnic variations in hospital discharge rates in Christchurch, New Zealand.
- Moon G, **Hiscock R, Pearce R and Barnett R**, The impact of smoking cessation on health inequalities: a New Zealand case study.
- **Day, and Pearce J**, The proximity of fast-food outlets and convenience stores around schools: Is there a spatial variation by school socio-demographic characteristics?
- Richardson E, Mitchell R, Shortt N, **Pearce J** and Dawson T, Measuring small area multiple environmental deprivation as a tool for health inequalities research.
- **Pearce J** and Dorling D, The influence of selective migration patterns among smokers and non-smokers on geographical inequalities in health.

Canterbury Health Research Expo, Christchurch, New Zealand, June 2009.

- **Kingham S, Brown M, Pearce J and Day P**, Assessing the health effects of winter smog in Reefton.
- **Holland K and Kingham S**, Nitrogen dioxide exposure inside and outside of primary schools.

Extremes: Climate and Water in the Southern Hemisphere conference. Melbourne, Australia, February 2009.

- Dirks K, Longley I, Salmond J and **Kingham S**, Blood carboxyhæmoglobin levels as a biomarker for urban air pollution exposure.

Australian and New Zealand Geographical Society Conference, Wellington, New Zealand, July 2008.

- **Day P**, Geo-Demographic Comparisons of Global Inequalities in Mortality.
- **Barnett R**, Improving Smoking Cessation Rates in Disadvantaged Communities – Current Practice and Policy Option.
- **Pearce J**, Does Neighbourhood Access to Community Resources Influence Health Inequalities in New Zealand?
- **Ayuka F**, Neighbourhood Access to Alcohol Outlets and Individual Health Behaviour in New Zealand.
- **Mason K**, A National Study of Neighbourhood Access to Gambling Opportunities and Individual Gambling Behaviour.

Other presentations

- **Simon Kingham** presented a seminar to the Department of Medical Physics & Bioengineering at Christchurch Hospital, “Does how you travel affect your health? Modal choice and pollution exposure”, May 2010.
- **Peter Day** did a guest lecture at Lincoln University to 3rd year GIS students about the Lab and GIS applications in Health research, August 2009.
- **Peter Day** gave a presentation at a UC Research Showcase about the Lab and GIS applications in Health research, February 2010.
- **Simon Kingham** and **Jamie Pearce** did a presentation at the Ministry of Health about the GeoHealth Laboratory, Feb 2010.

5.2 Web Pages

A comprehensive set of web pages outlining the GeoHealth Laboratory activities are available and are regularly updated by Peter Day (GeoHealth Lab) and Paul Bealing (Department of Geography, Web Administrator).

See www.geohealth.canterbury.ac.nz/. The site:

- outlines the aims and objectives for the Laboratory
- gives 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

Plans for 2010/11

The Laboratory will continue with the three stream core work programme that underpins the Laboratory. The Directors will also aim to further increase their network of contacts and raise awareness of the Laboratory particularly across the health sector.

5.3 Research

The following research projects listed in section 2 will be continued:

1. **Public health and alcohol related crime**
2. **Urban/rural status and health outcomes in New Zealand**
3. **Green space and health**
4. **Assessing the impact of smoking cessation services: a geographical analysis of the Quitline data.**

Additional research projects include:

5. **Spaces of resilience: identifying and understanding the paradox of good health despite high social and environmental deprivation in New Zealand**

Area-level social deprivation has proved to be an important predictor of a variety of health outcomes and risky behaviours in the UK, USA, and New Zealand. In New Zealand, social deprivation has been characterised by components of the national census, which together form the NZDep Index of social deprivation. This index has been successfully used to predict health outcomes such as cardiovascular disease, obesity, diabetes, and smoking, where levels in these poor health outcomes increase in areas with higher social deprivation. However, measures of social deprivation are not perfect predictors of health outcomes in New Zealand. In fact, some areas could be considered 'resilient' as they have low rates of mortality, despite consistently high levels of social deprivation. Still, little is known about the contribution of the physical environment or the combined effects of the environmental and social conditions in shaping health inequalities in New Zealand. The purposes of this research are to:

- 1) Identify 'resilient' communities in New Zealand in deprived areas from 1991 to 2006
- 2) Understand spatial patterning or movement of resilience over time
- 3) Test the ability of an environmental deprivation index to improve our ability to predict health outcomes and identify divergences or overlap in areas of resilience
- 4) Test the ability of a composite index to improve our ability to predict health outcomes and again identify divergences or overlap in areas of resilience
- 5) Understand the environmental, social, and political factors which promote resilience in communities which maintain good health outcomes regardless of the strongest predictors.

The implications of this work may lead to policies which bolster community cohesion, improve social conditions such as employment, protect or improve the physical environment taking the lead in improving health over policies which target individual circumstances and risky behaviours in deprived areas in New Zealand.

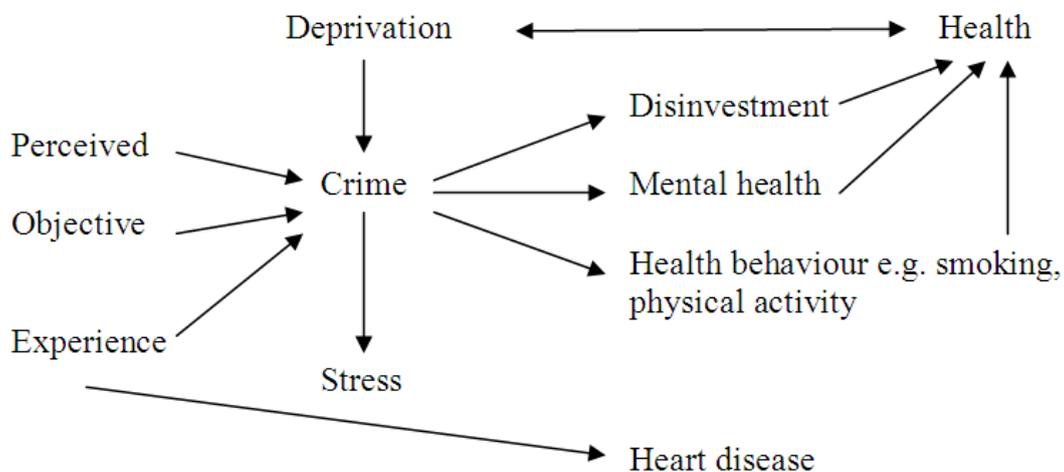
6. Environmental influences on obesity and related behaviours in New Zealand

The prevalence of obesity in New Zealand is high and rising leading to escalating health care costs, especially for associated conditions such as Type II diabetes. At its most basic, obesity results from a positive balance between energy input from food and drink and energy output from basic metabolic processes and from physical activity with excess calories being stored as body fat. Most interventions have focused on obese individuals, targeting behaviours relating to diet and physical activity, or the use of anti-obesity drugs, or, in extreme cases, bariatric surgery. The limited success of such interventions has led to a growing recognition of the role of environmental factors in obesity, particularly those that encourage higher levels of physical activity and healthy diets. Currently the evidence-base in New Zealand for guiding the design of interventions in obesogenic environments is sparse, hence the need for this study.

The proposed study is based on linkage (using GIS) of data from the 2006/7 New Zealand Health Survey on obesity, physical activity and diet and information from other sources on a number of potentially aetiologically relevant environmental factors. Regression analysis will be used to examine the association between the environmental factors and obesity and related behaviours. Ordinary least squares regression will be used for continuous outcome variables and logistic regression for binary outcomes. All analyses will take into account the complex sample design of the Health Survey. Analyses will be done with and without adjustment for known confounders. Where numbers permit analysis will also be carried out stratified by age, gender and ethnicity.

7. Crime, Social deprivation and health

This project will undertake a systematic review of the literature to identify gaps in the theory of the crime, social deprivation, and health relationship, an area that has not been thoroughly explored in the New Zealand context. The proposed model (below) can therefore be validated and these relationships can be explored using ecological data on reported offences, area level deprivation and health outcomes. The review would look at research that has used area level measures of crime and health outcomes, for example crime and mental health, and crime and alcohol-related harm. This work would be the basis for further New Zealand based geographic research into the spatial relationships between crime, social deprivation and health.



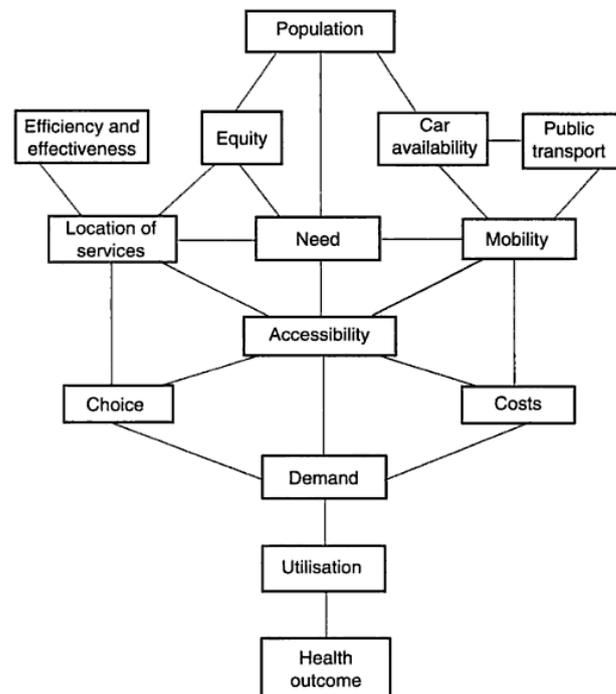
8. Air pollution and health inequalities

Previous research in New Zealand has estimated the impact of air pollution (especially PM₁₀) on various indicators of health in New Zealand. There are two areas of further work that are of significant interest. Firstly this work has previously assumed a single dose response rate for all sources of emissions (traffic, domestic, industry) rather individual dose responses for each source. Secondly no research has examined the interaction between air pollution, health and social inequalities.

Research will examine whether there are different dose responses according to the contribution of different pollution sources, and secondly, whether and how social inequalities affect the relationship between air pollution and health outcomes.

9. Geospatial health care planning: using GIS as a part of the health care planning toolset

The dynamics of a health system are complex, as demonstrated by Haynes (2003) in the model below. Understanding the determinants and consequences of geographical access to health services is an important advancement for the health sector.



Some of the relationships detailed above have been explored already e.g. travel times to services (see Brabyn & Skelly, 2001; Brabyn & Beere, 2006) and geographical inequalities in access to health services between deprived and non-deprived neighbourhoods (see Pearce et al, 2007). Even so, there are still many aspects of the health service provision that warrant further investigation particularly in the context of geographical access. For example, how is geographical access to services affected by service location and how does access affect service utilisation?

Using real life examples (for instance where should neurosurgeons be located in the South Island) this project aims to investigate some of the relationships in the model above and develop some techniques to assist health planners to address utilisation and access problems.

The project is championed by the Ministry of Health's National Health Board and uses a variety of data and software, including hospitalisation data from the National Minimum Data Set and the national road network data using ESRI's ArcView network analyst.

References

- Brabyn L & Beere P, 2006, Population access to hospital emergency departments and the impacts of health reform in New Zealand *Health Informatics J* 12: 227-237
- Brabyn L & Skelly C, 2001, Geographical Access to Services, Health (GASH): Modelling population access to New Zealand public hospitals. In *Spatial information research Center Conference Proceedings 2001, University of Otago, Dunedin, New Zealand*
- Haynes R, 2003, Geographical access to health care, In Gulliford M, Morgan M eds *Access to health care*. New York: Routledge.
- Pearce J, Witten K, Hiscock R & Blakely T. Are socially disadvantaged neighbourhoods deprived of health-related community resources? *Int J Epidemiol* 2007 36: 348-355

5.4 Scholarships

Scholarships will continue to be awarded to the most promising candidates with innovative research proposals.

5.5 Training

There are four undergraduate and four graduate GIS courses offered by the Department of Geography at University of Canterbury, and one undergraduate and one graduate course in Health Geography. In addition, 2011 will see the start of a new Masters in GIS (MGIS) programme primarily developed at the University of Canterbury. This will include a newly developed GIS in Health course which will include contributions by GeoHealth Laboratory staff. This new course will provide a unique forum for those working or interested in working in the health sector to learn GIS and how this is utilised within a health context in research.

5.6 Promotion and Publication

5.6.1 Planned Conference Attendance for 2010/11

These are conferences we currently anticipate attending to present GeoHealth related research (**not** all funded by the GeoHealth contract):

- ISES-ISEE 2010. Joint Conference of International Society of Exposure Science & International Society for Environmental Epidemiology, August 2010.
- EcoHealth conference, London, August 2010.
- International Clean Air and Environment Conference, Christchurch, July 2011.
- International Medical Geography Symposium, Durham, UK, July 2011.
- New Zealand and Australian Geographical Societies conference, Christchurch, July 2010.
- Seminars in Ministry of Health, Medical Schools and Geography Departments in New Zealand and around the world.

Appendix A: Previous GeoHealth Laboratory Students

Masters students

Catherine Tisch (completed September 2006) (GeoHealth scholarship)

Title: Has mortality become geographically polarised in New Zealand? A case study: 1981-2000.

On completion of her Masters Catherine worked at the Institute of Environmental Science and Research (ESR) as a Health Information Analyst in the Population and Environmental Health team. Catherine has recently joined the GeoHealth Laboratory working on the MoH Environmental Health Indicators project.

Katrina McPherson (completed December 2006) (GeoHealth scholarship)

Title: Food insecurity and the food bank industry: A geographical analysis of food bank use in Christchurch.

On completion of her Masters Katrina joined the Christchurch City Council as a Research Assistant.

Erin Holmes (completed March 2007) (GeoHealth scholarship)

Mandatory disease notification and under-ascertainment: A geographical perspective.

On completion of her Masters Erin joined the Ministry of Health as a full time Research Analyst and is now an Advisor in Epidemiology.

Esther Rhind (completed June 2007) (GeoHealth scholarship)

Title: Investigating the spatial distribution of campylobacteriosis in New Zealand.

Esther began her PhD at the University of Norwich, UK.

Paul Moth (completed July 2008) (GeoHealth scholarship)

Title: Examining the environmental justice of sea-level rise and storm tides.

Paul completed a four month internship with the MoH and is now teaching at a High School in the US.

Michael Brown (completed February 2009) (funded by FRST)

Title: The health effects of PM₁₀ air pollution in Reefton, South Island, New Zealand.

Michael is working with Watercare Services in Auckland as an Environmental Analyst.

PhD students

Jeff Wilson (completed in April 2006) (funded by University of Canterbury doctoral scholarship)

Title: Spatial variability of intra-urban particulate air pollution: epidemiological implications and applications.

Jeff is now in on the academic staff at the University of Texas, Brownsville, USA.

Laura Miller (completed in April 2008) (GeoHealth scholarship)

Title: Population mixing and the geographical epidemiology of childhood leukaemia and type 1 diabetes in New Zealand.

Laura is now working as a Spatial Analysis Research Officer with Child and Adolescent Community Health, Western Australian Department of Health.