***GeoHealth Laboratory***

*Te tai whenua o te hau ora*

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# GeoHealth Laboratory Annual Report 2011-12

June 2012

MINISTRY OF HEALTH
MANATU HAUORA

Health & Disability Intelligence

Dept. of Geography

*GIS Expertise & High Quality Research for Public Health*

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

# GeoHealth Laboratory

Dept. of Geography
University of Canterbury
Private Bag 4800
Christchurch 8020

Contact:

Prof. Simon Kingham

simon.kingham@canterbury.ac.nz

Tel: +64 3 364 2987 x7936

**Directors**

Prof. Simon Kingham
Dept. of Geography
University of Canterbury
Christchurch
New Zealand

Prof. Jamie Pearce
School of Geosciences
University of Edinburgh
Edinburgh
United Kingdom

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# Executive Summary

This report describes the activities undertaken during the 2011/12 year. The report describes the infrastructure, work plan, milestones, achievements and key events in the sixth year of operation of the Laboratory; as well as setting out the aims and work plan in detail for year seven.

- **2011/12 Key Achievements**

An integral component of the GeoHealth Laboratory's strategic aims is to undertake innovative and policy-relevant research in the area of health geography, spatial and social epidemiology and Geographic Information Systems (GIS); and to increase research capacity and research outputs in the health and GIS academic sectors.

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.

Research projects have continued to utilise existing Ministry of Health data sources such as the New Zealand Health Surveys, mortality, cancer registration, hospital admissions/discharge data collections and other administrative data sets, and thereby add value to policy advice.

Key projects this year have been:

- Understanding the relationship between social isolation and mental health in urban settings
- Examining positive social contexts and neighbourhood resilience
- Measuring service accessibility: Is New Zealand's telephone triage service, Healthline, geographically equitable?

During 2011/12 the Laboratory had fourteen health-related research articles published, and four under review and one in press. Several of these publications were outputs of planned projects approved by the Ministry of Health. These directly fed into policy development and were presented to policy analysts at the Ministry of Health. In 2011/12, one student successfully completed their Masters degree and a Masters and a PhD student commenced their studies – all funded by Geohealth Laboratory Scholarships.

- **Plans for 2012/13**

This year the GeoHealth Laboratory intends to increase its collaboration with the Ministry of Health by undertaking projects that reflect issues that have been highlighted by the Ministry of Health or that are of high interest to specific policy groups, take advantage of data collected in the New Zealand Health Survey, and complement the HDI work plan.

# 1. Introduction

The GeoHealth Laboratory was established in 2005 as a partnership between Health & Disability Intelligence (HDI) (formerly Public Health Intelligence (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 Sixth Annual Report of the GeoHealth Laboratory*

This is the sixth annual report of the GeoHealth Laboratory and describes the activities undertaken during the 2011/12 year. The report describes the infrastructure, work plan, milestones, achievements and key events in the sixth year of operation of the Laboratory; as well as setting out the aims and work plan in detail for year seven. It includes all the work of the Laboratory not just that funded directly by the core Ministry of Health contract.

Section 2 outlines how the Laboratory is structured including information about funding, personnel, infrastructure, equipment, data and management. Sections 3 and 4 describe the completed projects, publications, policy impacts, ad hoc work 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.

The Laboratory has continued to function well over this past year despite the continuous disruptions resulting from the Christchurch aftershocks.

# 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 also submitted several grant proposals to the Health Research Council (HRC).

### Ministry of Health Direct Funding

Prior funding from the Ministry of Health was set out in the contract between the Ministry of Health and the University of Canterbury dated 17th July 2009. A new contract was signed on 27th June 2012 for a further three years funding.

### 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. In addition the Laboratory also benefits from the time given for research by its many visitors (see end of 2.2).

### 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 Cooperative Research Centre-Spatial Information (CRCSI), a research institute of the Australian Government. We secured funding for a PhD scholarship to evaluate the non-injury health issues related to the Canterbury earthquakes. The GeoHealth Laboratory is a collaborator and has received funding for the Ministry of Health's Environmental Health Indicators (EHI) programme. This involves monitoring existing indicators and developing novel indicators, specific to the New Zealand context.

## *2.2 Personnel*

The Laboratory has three full-time researchers; Peter Day and Dr. Amber Pearson are based in the Laboratory in Christchurch, and Ed Griffin is located in the Ministry of Health in Wellington. As part of the partnership, the time and associated costs of the management team is provided and funded by the UC Department of Geography external to the contract

costs. The Laboratory also funds Masters and PhD Scholarships (detailed in section 4 below). These students are located in, and contribute to the work of, the Laboratory. The Laboratory draws 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, the Laboratory accesses 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 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 an 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. Philippe Apparicio (Institut National de la Recherche Scientifique (INRS), Canada, 2012)
- Prof. Mike Emch (University of North Carolina, USA, 2011)
- Prof. Ian McKendry (University of British Columbia, Canada, 2011)
- Prof. Graham Bentham (University of East Anglia, UK, 2010)
- Prof. Bob Haining (University of Cambridge, UK 2009)
- Prof. Danny Dorling (University of Sheffield, UK, 2005 and 2009)
- Assoc. Prof. Howard Bridgman (University of Newcastle, Australia, 2009)
- Prof. Rich Mitchell (University of Glasgow, UK, 2007)
- Prof. Peter Brimblecombe (University of East Anglia, UK, 2007)
- Prof. Graham Moon (University of Southampton, UK, 2006)
- Prof. Robin Flowerdew (University of St Andrews, UK, 2006)
- Dr. Iain Lake (University of East Anglia, UK, 2006)
- Prof. Robin Haynes (University of East Anglia, UK, 2006).

## *2.1. Facilities*

The Laboratory is located in a dedicated room situated within the Department of Geography. The Laboratory room is fitted out with eight workstations and a hot desk. In addition there is a large meeting table, projector and screen, a small library, a secure safe for data storage, 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 and to accommodate visits from the staff member in Wellington, or other collaborators.

**Table 1. GeoHealth Research Laboratory Personnel 2011-12**

| Post | Location | Name |
|---|---|---|
| Directors | Dept of Geog | Prof Simon Kingham |
| | Uni of Edinburgh | Prof Jamie Pearce |
| Postdoctoral Research Fellow | Laboratory | Dr Amber Pearson |
| Researchers | Laboratory | Peter Day |
| | Ministry of Health | Ed Griffin |
| | Laboratory | Catherine Tisch (funded by EHI project) |
| | Laboratory | Christopher Bowie (funded by EHI project) |
| | Laboratory | Frances Graham (Foxley Fellow funded by HRC) |
| Masters students | Laboratory | Kimberly Reed (started March 2012) |
| | | Matt Willoughby (started Feb 2011) |
| PhD students | Laboratory | Ibrahim Alkhaldy (started 2010) |
| | | Niamh Donnellan (started February 2012) |
| | | Frances Graham (suspended July 2011, transferred to another university April 2012) |
| Dept of Geog academic staff | Dept of Geog | Prof Ross Barnett |
| | | Dr Gregory Breetzke |
| | | Dr David Conradson |
| | | Dr Malcolm Campbell |
| Dept of Geog technical staff | Dept of Geog | John Thyne |
| | | Paul Bealing |
| | | Marney Brosnan |

## 2.2. Equipment

The GeoHealth Laboratory has been refurbished to provide desk space and computer terminals for up to nine people. At present there are nine networked PCs, most with 24 inch screens. There is also a dedicated GeoHealth network drive for the storage of the geodatabase and other health-related data files which are regularly archived.

Each PC has ArcGIS software, a number of statistical 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.

## 2.3. 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. The two directors are responsible for the work activities of the Laboratory.

Oversight and governance are provided by Yvonne Galloway and Jackie Fawcett at the Ministry of Health who, along with the Directors, 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, spatial techniques and health services. Key drivers of our research have been the New Zealand Health Strategy and the HDI work plan. Attention to these drivers 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 particular policy relevance but also lend themselves to high quality research in line with the Department of Geography's research strategy, and are relevant to contemporary scholarship in health geography. 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 five years, we have continued to undertake joint and individual projects. Some of the projects are ongoing from previous years, whilst others are new, just commencing, or in the pipeline. The projects have been funded from a range of sources, published in high quality journals 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 Laboratory. In this section we list publications from Laboratory staff, students and affiliated academic staff. We also provide a brief synopsis of the GeoHealth staff's key projects undertaken during the past year and plans for 2012/13.

Research projects have continued to utilise existing Ministry of Health data sources such as the New Zealand Health Surveys, mortality, cancer registration, hospital admissions/discharge data collections and the other administrative data sets. For example, regression modelling techniques have allowed us to explore the relationships between individual health status and behaviours from routine surveys (such as BMI, diet, physical activity) and neighbourhood level contextual measures affecting obesity.

### 3.1.1. Publications 2011-12

**2011 Publications**

- **Kingham S**, 2011, How important is urban air pollution as a health hazard? (invited editorial) *New Zealand Medical Journal* 124, 1330, 5-7.
- Richardson EA, **Pearce J** and **Kingham S**, 2011, Is particulate air pollution associated with health and health inequalities in New Zealand? *Health and Place* 17, 5, 1137–1143.
- **Kingham S**, Sabel C and Bartie P, 2011, The impact of the 'school run' on road traffic accidents. *Journal of Transport Geography*, 19, 705-711.
- **Kingham S** and Dorset W, 2011, Assessment of exposure approaches in air pollution and health research in Australia and New Zealand. *Air Quality and Climate Change*, 45, 2, 28-38.
- de Nazelle A, Nieuwenhuijsen M, Antó J, Brauer M, Briggs D, Braun-Fahrlander C, Cavill C, Cooper A, Desqueyroux H, Fruin S, Hoek G, Int Panis L, Janssen N, Jerrett

M, Joffe M, Jovanovic Andersen Z, van Kempen E, **Kingham S**, Kubesch N, Leyden K, Marshall J, Matamala J, Mellios G, Mendez M, Nassif H, Ogilvie D, Peiró R, Pérez K, Rabl A, Ragettli M, Rodríguez D, Rojas D, Ruiz P, Sallis J, Terwoert J, Toussaint J-F, Tuomisto J, Zuurbier M, Lebret E, 2011, Improving health through policies that promote active travel: a review of evidence to support integrated health impact assessment. *Environment International*, 37, 766-777.

- Witten K, **Pearce J** and **Day P,** 2011, Neighbourhood Destination Accessibility Index: a GIS tool for measuring infrastructure support for neighbourhood physical activity. *Environment and Planning A* 43(1): 205-223.

- **Day P** and **Pearce J,** 2011, Obesity-promoting food environments and the spatial clustering of food outlets around schools. *American Journal of Preventive Medicine*, video http://www.scivee.tv/node/26659.

- **Day P** and **Pearce J**, 2011, Obesity-Promoting Food Environments and the Spatial Clustering of Food Outlets Around Schools. *American Journal of Preventive Medicine* 40(2): 113-121.

- Miller, L., Willis, J.A., **Pearce, J., Barnett, R**., Darlow, B. and Scott, R., 2011, Urban–rural variation in childhood type 1 diabetes incidence in Canterbury, New Zealand, 1980–2004. *Health and Place* 17, 248–256.

**2012**

- Graham F, White P, Harte D, **Kingham S**, 2012, Changing Epidemiological Trends of Legionellosis in New Zealand, 1979-2009. *Epidemiology and Infection*. In press
- **Day P**, Breetzke G, **Kingham S** and Campbell M, 2012, Close proximity to alcohol outlets is associated with increased serious violent crime in New Zealand. *Australian and New Zealand Journal of Public Health*, 36, 1, 48–54.
- Brewer N, Borman B, **Day P** and Pearce N, 2012, Travel time and distance to health care only partially account for the ethnic inequalities in cervical cancer stage at diagnosis and mortality in New Zealand. *Australian and New Zealand Journal of Public Health* (published online 23 Feb 2012).
- **Barnett, J.R**., Moon, G. and **Pearce, J**., Socio-spatial inequalities in health-related behaviours: pathways linking place and smoking. *Progress in Human Geography* 36, 2012, 3-24.
- Hiscock, R., Moon, G., **Pearce, J. Barnett, R.** and Daley, V., 2012, Do General Medical Practice Characteristics Influence the Effectiveness of Smoking Cessation Programs? A Multilevel Analysis. *Nicotine and Tobacco Research* 14, 703-710.

**2012 Under review**

- **Pearson A**, **Griffin E**, Davies A and **Kingham S**, 2012, The relationship between spatial, social isolation and mental health in the most deprived areas in Auckland, New Zealand. *Journal of urban Studies*, submitted.
- **Tisch C, Pearson A**, **Griffin E**, **Kingham S**, Borman B and Bentham G, 2012, Evidence of a shift in the relationship between socioeconomic deprivation and

melanoma incidence in New Zealand: 2004-2008. Social Science and Medicine, submitted.

- **Tisch C**, **Pearson AL**, **Kingham S**, Borman B and Briggs D, 2012, Environmental Health Indicators: A review of programmes worldwide. *Environmental Health Review*, submitted.
- **Pearson AL**, **Pearce J** and **Kingham S**, 2012, Spaces of resilience: Identifying and understanding the paradox of good health despite high social deprivation in New Zealand. *Social Science and Medicine*, submitted.

**2012 In press**

- Moon, G., **Barnett, J.R.** and **Pearce, J.** Smoking, Ethnic Residential Segregation and Ethnic Diversity: a spatio-temporal analysis. *Annals Association of American Geographers* (In press).

### 3.1.2. Projects 2011-12

**1. Does isolation decrease resilience? The dual influence of social deprivation and isolation on mental health in New Zealand**

In New Zealand, a strong relationship exists between socioeconomic deprivation and a variety of health outcomes and risky behaviours. There may be psychosocial impacts as individuals or groups feel deprived relative to other reference groups in society. Since there is an uneven geographic pattern to social deprivation, when deprived groups live in close proximity to advantaged groups particularly in urban settings, there may be increased instances of discrimination, a lack of community cohesion, and decreased feelings of control. This research explored whether areas which are deprived and socially isolated experience increased anxiety and mental disorders such as depression, compared to areas which are deprived but not isolated. We developed a spatial isolation measure to characterise deprived small areas surrounded by areas which are more advantaged in Auckland, New Zealand. We found that isolated, deprived places were characterised by fewer Māori and Pacific people, high population density, higher percentages of males, fewer people between 16-44 years, and percentages of alcohol/drug abuse among anxiety/mood disorder service users, and shorter travel time to General Practitioners and clinics offering free talking therapies. We found a statistically significant relationship between isolation and counts of anxiety/mood disorders for each isolation level, when adjusting for confounders. In fact, the most isolated group had 56% higher levels of anxiety/mood disorders compared to the least isolated group. This evidence suggests that mental health within small areas may be sensitive to the types of interactions within walking distance of homes, through social comparison or feelings of discrimination which lead to psychosocial stress. In 2011/2, this work was written as a manuscript and submitted to *Health and Place* (in second review), was accepted to two conferences, and was presented to the Ministry of Health.

**2. Evaluating the relevance of multiple environmental health indicators in New Zealand**

Environmental Health Indicators (EHIs) are primarily used for monitoring inter-related aspects of the environment and human health to guide policy development in many

countries. However, many countries lack EHIs relevant to their unique physical environment and population health risks. The aims of this review (partly funded through the Ministry of Health EHI project) were to identify existing EHI programmes worldwide, determine the common themes and gaps and to draw relevant conclusions related to future indicator development. Findings reveal that EHIs related to environmental exposures and health outcomes were most commonly within the themes of air and water quality. Other topics included biosecurity, the built environment and food safety, but were inconsistent across programmes, due to either their perceived or actual impact on the region's population. Surprisingly, none of the programmes included EHIs specifically related to climate change. Comparability of indicators is crucial to draw meaningful international assessments on the state of the environment and health. However, it is also important for programmes to identify and develop their own place-relevant indicators suited to unique environments and populations. In 2011/2, this work was drafted as a manuscript and will be submitted for publication soon.

### 3. Is resilience to deprivation associated with a healthy social environment?

Geographical inequalities in health are associated with health and related behaviours and are typically worse in socioeconomically deprived places. However, this is not always true. Deprived places with unexpectedly good health outcomes, or what might be considered 'resilient' places, have been noted. Few studies have quantitatively examined resilience in neighbourhoods or investigated potential explanations for this resilience. This study examined the paradox of low mortality despite high deprivation in New Zealand neighbourhoods and considers possible neighbourhood characteristics of the social environment that contribute to unanticipated positive health outcomes. Using area-level mortality and socioeconomic data, we developed the Resilience Index New Zealand to quantify neighbourhood levels of resilience across the country. We then examined relationships between this measure and a suite of social characteristics. We found that resilient places tended to be densely populated, urban areas. The social environment of resilient areas was characterised by high levels of incoming residents. We also found some surprising associations and observed U-shaped relationships for a number of the neighbourhood factors. Such findings suggest the need to develop a better proxy of community cohesion and indicate the potential for ethnic density to protect health in New Zealand subpopulations. Ultimately, we argue that this study both identified amenable neighbourhood characteristics and highlighted the importance of 'place-specific' resilience factors which may be effective in reducing mortality in some neighbourhoods, but be less effective in others. This paper has been submitted to *Social Science and Medicine* and has been presented at the International Medical Geography Symposium in Durham, UK in July 2011.

### 4. Spatial and spatio-temporal variation of anxiety as a result of the Canterbury earthquakes

This research aims to understand patterns in anxiety in Canterbury, following the earthquakes. This project is using various geospatial techniques to asses the health impact earthquake damage zoning. This project has accumulated health data for people who attended a Christchurch public hospital or submitted an ACC claim,

which has been made available at meshblock and CAU level. Spatial analysis is being carried to asses whether there is clustering in the health outcomes and whether this occurs more in areas of greater earthquake damage.

### 5. Blue space and wellbeing

This project builds on the research that looks at green space and health. There has been some discussion[1] on the possible role of blue space (water) but this has not yet been researched. Blue space is particularly relevant in New Zealand where a large proportion of the population live on/near the coast. This project is examining the impact of proximity to blue space on all cause mortality. It is looking separately at sea, lakes and other blue space.

### 6. Geographical trends in infant mortality: New Zealand 1980 to 2008

The level of infant mortality can be seen as a major indicator of the health of a nation with the focus on infant mortality rates remaining high on public health and policy agendas within New Zealand and throughout the world. Despite declines experienced over the last few decades, internationally New Zealand's infant death rate remains high, with a current ranking of 17th out of 19 OECD countries for which information is available. A range of social and biological factors are associated with high infant mortality. Despite ongoing reductions in infant mortality rates in New Zealand there remain sub-national variations in infant mortality. The aim of this project is to draw out these geographical patterns and investigate whether the trends in infant mortality rates were uniform geographically by specific geographies (TLA, DHB) and by area types (Urban/rural, area-level deprivation), with a particular focus on the relationship between infant mortality and area deprivation.

### 7. Greenspace and mental health

A previous GeoHealth Laboratory project examined whether there was 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. A key part of the green space research is whether the space is usable and therefore facilitates exercise or whether the benefits are more psychological. This project is ongoing and is examining the impact of green space on mental health using total and useable greenspace and routinely collected administrative data for Auckland.

### 8. Geographical variations in use of Healthline

The aim of the project was to examine the use of Healthline. It used individual call data between 2006 and 2010 to measure and display service accessibility by

[1] Richardson EA, Pearce J, Mitchell RJ, Day P and 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, 240.

geography for Healthline. Funnel plots were used to visualise the unadjusted raw rates between electoral wards, and Poisson regression was used to adjust for variables and display the adjusted rates. Lastly geographic distributions were displayed by mapping standard deviations. Healthline use varied by area, by up to 15%. Variation between areas can largely be accounted for by differences in age, gender, health need, rurality and barriers to access, namely cultural acceptance of the service and, to a lesser extent, lack of telecommunications. Factors such as ethnicity and deprivation appeared to have little influence on Healthline use. It was concluded that some areas in New Zealand, for example highly rural populations and those without access to telecommunications, were not accessing the Healthline service. These factors need to be considered for future improvements to Healthline. A paper will be submitted for publication.

**9. Geographical analysis of Quitline**

Traditionally smoking cessation policies have seldom examined the geographical and social contexts and the role they play in promoting or retarding smoking cessation. In view of this the present study provides an analysis of new calls made to Quitline in New Zealand between April 2005 and March 2009. The Quit Group is a charitable trust set up in 1999 and funded solely by the Ministry of Health. It aims to provide effective support for smokers to make quit attempts via providing free telephone calls to the telephone support group, Quitline. Two key results emerged from the study: (1) even after controlling for smoking prevalence, deprivation and ethnicity, there are significant differences in call rates between urban and rural areas; (2) for all smokers, deprivation has a modest effect on call rates after controlling for age and ethnicity, but its effect is much greater for Maori smokers, the group with the highest smoking rates. The policy implication of the results suggests that while Quitline has encouraged many persons to give up smoking it is still missing the most vulnerable group. This research will be submitted for publication to Tobacco Control by June 2013.

### 3.1.3. Ad-hoc Tasks Completed for the Health Sector in 2011/12

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 an 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 2011/12

| Title and Description | Business Unit Or Organisation | MoH Team | Time/ hours |
|---|---|---|---|
| Hospitals/GPs/Health Survey Data | Explorer Graphics Ltd | Non-MoH | 1 |
| Aged residential care GIS layer file | Victoria University | Non-MoH | 1 |
| Distance to out of hours GPs and pharmacies | Waitemata DHB | Non-MoH | 2 |
| Geocode GP addresses - merge to master list | Sector Capability & Implementation | Business Services | 0.5 |
| Input to paper: Christchurch Earthquake 22 February and Its Impact on PHO Enrolment in the Canterbury DHB | | | 4 |
| Population coverage for Maori, Pacific and NZDep2006 quintile 5 for East Cape and Northland, identify candidate sites for defence mobile dentist exercise | | Personal Health | 3 |
| Locations of and communities served by DHBs' fleet of mobile dental units | | | 5 |
| Create options for which rest homes in NZ can become "premium only" based on various criteria | Policy | Populations Policy | 10 |
| Convert school locations from x & y coordinates to Meshblocks | | Health & disability Intelligence | 0.2 |
| Add Meshblocks to updated list of residential home addresses | | | 3 |
| Map Sexual and reproductive Health (SRH) Services and overlay deprivation, ethnicity, and teenage pregnancies | Sector Capability and Implementation | Māori Health Service Improvement | 10 |
| Map Sexual and Reproductive Health Services in relation to current sexually transmitted illness surveillance data | | | 1 |
| Hospital Catchment Areas II | National Health Board (NHB) | Planning & Analysis | 100 |
| Create Dynamic spatial model for child health in Auckland for March planning meeting | | | 20 |
| Complete all steps for concept planning work | | | 5 |
| Rural communities analysis - Midlands | | | 5 |
| Review and update of maternity work | | | 4 |
| Geocode and map private Hospitals by DHB | | DHB Performance | 2 |
| DHB boundaries and NASC boundaries | | National Services Purchasing | 0.5 |
| Update and publish map of the health districts by DHB/PHO | Clinical Leadership, Protection & Regulation | Public Health Legislation | 4 |
| Create SHP file of hospital/GP/Health survey info for the Auckland spatial plan | LINZ, New Zealand Geospatial Office | Non-MoH | 1 |
| Cluster Analysis of Pneumococcal Disease Following the Canterbury Earthquakes | Canterbury District Health Board | Non-MoH | 20 |

# 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' and have practical GIS skills in the emerging areas of geohealth 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:

- Neighbourhood built environments and health
  - Determinants of obesity
  - Alcohol related behaviours and harms
- Social environments and health
  - Social inequality and smoking
  - Crime and health
  - Social dimensions of cancer incidence and survival
- Physical environments and health
  - Air pollution and health
  - Environmental health indicators
- Health inequalities
- Hospital admissions and access to primary care
- Healthy, resilient populations and places
- Health service planning and use

Each Masters scholarship covers domestic tuition fees and provides a $15,000 living allowance. For PhD scholarships this covers tuition fees and provides a $25,000 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. We also secured funding from the CRCSI for a PhD scholarship related to the non-injury health impacts of the Canterbury earthquakes (see Section 2.1.3).

### 4.1.1. Masters Students

1. **Kimberly Reed (commenced March 2012)** (GeoHealth scholarship)

   Subject: Spatial and spatio-temporal variation of anxiety as a result of the Canterbury earthquakes
2. **Matt Willoughby (commenced Feb 2011)** (GeoHealth scholarship)

   Subject: Neighbourhood level impact of crime on community health outcomes

### 4.1.2. PhD Students

3. **Ibrahim Alkhaldy (ongoing 2011)** (funded by Saudi Arabian government)

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

4. **Niamh Donnellan (commenced February 2012)** (GeoHealth scholarship)

Subject: A geospatial approach to understanding the health effects of transport-related physical activity and the neighbourhood environment

5. **Frances Graham (transferred to University of Otago 2012)**

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

# 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 and abroad. 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 in the period 2011-12.

**13th International Medical Geography Symposium, Durham, UK, 10th-15th July 2011**

- Richardson E, **Pearce J**, Mitchell R, **Day P** and **Kingham S**, 2011, The Green Space and Health Relationship and its Potential Causative Mechanisms: A New Zealand Study.
- **Tisch C, Pearson A**, **Griffin E**, **Kingham S** and Borman B, 2011 Ultraviolet Radiation Exposure and Melanoma incidence: Evidence to Support their Inclusion as Novel Environmental Health Indicators in New Zealand.
- **Pearson A**, **Pearce J** and **Kingham S**, 2011, Spaces of Resilience: Identifying and Understanding the Paradox of Good Health in Neighbourhoods of High Social Deprivation in New Zealand.
- **Griffin E**, **Barnett R** and **Kingham S**, 2011, Geographical Analysis of Quitline Smoking Data.
- **Pearson A** and Faubion T, 2011, Evidence of social determinants of health in the Global South: Why is this problematic for the mainstream global health agenda?

**CASANZ 2011: 20th International Clean Air and Environment Conference, Auckland, New Zealand, 31st July–3rd August 2011**

- Dirks K, Dirks V, Salmond J, **Kingham S**, and Longley I, 2011, Carboxyhemoglobin in the blood as a biomarker of urban air pollution exposure: the role of body physiology and activity level in patterns of uptake.
- **Kingham S**, Longley I, Salmond J, Pattinson W and Shrestha K, 2011, Traffic exposure and modal choice: a New Zealand case study.
- **Kingham S**, Brown M, **Pearce J** and **Day P**, 2011, An assessment of the health effects of domestic coal sourced particulate pollution in a small town.
- **Kingham S**, Richardson E and **Pearce J**, 2011, The relative contribution of domestic and traffic sources of PM10 to cause-specific mortality.
- Pattinson W, **Kingham S**, Longley I and Salmond J, 2011, Cyclist exposure to traffic pollution: microscale variance, the impact of route choice and comparisons to other modal choices in two New Zealand cities.

**2 Walk and Cycle Conference, Hastings, New Zealand, 22nd-24th February 2012**

- **Kingham S**, Pattinson W Longley I and Salmond J, 2012, The impact of cycle route location and choice on exposure to traffic pollution.

**Cooperative Research Centre for Spatial Information CRCSI 2012 Conference. Brisbane, Australia. 9th-10th May.**

- **Kingham S**, 2012, Geographic Variations in Natural Disaster Impact.

**Other presentations**

- **Kingham S**, 2012, Determination of personal exposure to traffic pollution while travelling by different modes. Presentation at the New Zealand Transport Agency, Wellington 2nd April 2012
- **Kingham S**, 2012, Rebuilding Christchurch for a healthy future: is there a serious role for the bicycle?. Spring Lecture Series. University of Canterbury, 22nd Nov 2011.
- Borman B and **Kingham S**, 2012, The Programme for Monitoring Environmental Health Indicators for New Zealand. Presentation to Western Australia Public Health Department, Perth, Australia, 10th August 2011.
- **Kingham S**, 2012, Transport and infrastructure: Planning for a resilient and healthy future". Presentation at Before and After discussion series, DL Lecture Theatre, CPIT, Christchurch. 30th June 2011.
- **Kingham S**, 2012, Transport for a healthy future". IPENZ Share an Idea Transport "Move" Expo, Christchurch Art Gallery Foyer and Auditorium, 1st June 2011.

## *5.2. Web pages*

A comprehensive set of web pages outlining the GeoHealth Laboratory activities are available and are regularly updated by GeoHealth staff 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
- provides an overview of all staff members and postgraduate students
- has regular news items

## *5.3. Brochures and promotion*

We also developed a brochure which describes our research and possibilities for collaboration or study. This brochure can be accessed from our webpage. In addition, we supply them within the Department of Geography and they have been shared at each conference and presentation given by GeoHealth staff and students.

# 6. Plans for 2012/13

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.

## *6.1. Research*

The following research projects listed in section 2 will be continued during the 2012/13 year:

1. **Spatial and spatio-temporal variation of anxiety as a result of the Canterbury earthquakes**
2. **Blue space and wellbeing**
3. **Geographical trends in infant mortality: New Zealand 1980 to 2008**
4. **Greenspace and mental health**
5. **Geographical variations in use of Healthline**

Additional research projects for 2012/13 are yet to be finalised but will be selected from the following list - an indication is given for their inclusion in this years work programme:

| | **Is there a spatial relationship between the extent of physical damage from natural disasters and psycho-social stress-related health outcomes?** | |
|---|---|---|
| **Status:** New | **Duration:** 3 years | **Going ahead:** Likely |
| The research will test whether there is a relationship between the extent of physical damage from the earthquake on neighbourhoods and health outcomes (non-injury). It will examine this in relation to the Sept 4th 2010 and Feb 22nd 2011 earthquakes and subsequent aftershocks in Christchurch, New Zealand. A key aspect of this is tracking the health of populations who have been displaced by earthquake damage, and understanding the impact of the earthquakes on that population over time and space. The project will be in collaboration with researchers in the RHISE group (Research into the Health Impacts of Seismic Events) and the Natural Hazards Research Platform (www.naturalhazards.org.nz). | | |

| | **Online Mapping of health data** | |
|---|---|---|
| **Status:** New | **Duration:** on going | **Going ahead:** Definitely |
| An important development in GIS over the last two to three years has been the ability to visualise and use geographic data, interactively online. Previously if an organisation wanted to publish geographic data on the internet they were often constrained by poor technology, high costs, use of time and acquiring the expertise needed to implement a solution.<br>With the advent of Google maps, open layers, open map and other open source software – it has become easier and relatively inexpensive for organisations to develop and implement a simple mapping solution to display their administrative data.<br>Transparency in government organisations has become an integral part of building confidence among the public and disseminating data and statistics is an important way to demonstrate openness. Even so, the Ministry currently has no online mapping resources and no vehicle for the public to obtain and use its geographic data: the organisation provides limited public spatial information, unless specifically requested.<br>This project aims to investigate a range of online mapping options and then set up a simple | | |

online mapping solution for the Ministry's geographic data. Primarily, service locations will be published, e.g. general practitioners (GP), main hospitals ,and updated on a regular basis.

| | **What effects will introduction of Integrated Family Health Centres (IFHCs) have on geographical access to primary health Care?** | |
|---|---|---|
| **Status:** New | **Duration:** 1 Year | **Going ahead:** Possibly |

In 2009 the Ministry of Health launched the strategy for 'Better, Sooner, More Convenient Health Care in the Community'. At the heart of this strategy is the importance of providing primary health services which are closer to home but also well-connected, barrier-free, and centred on patient need - an ideology which is often labelled as Integration. On the ground this new direction is being delivered by Integrated Family Health Centres (IFHCs); large centres housing general practitioner (GP) practices, specialists, radiology and laboratory testing as well as allied health professionals such as pharmacists, physiotherapists and dentists.
However, one important consideration for the construction of IFHCs is their equity in terms of geographic access, given the government mandate for 'services closer to home' – especially in the case of populations most in need of primary health care, i.e. deprived and elderly
In this project we use Geographical Information Systems (GIS) to assess the optimal number of IFHCs and identify the best locations for them in Auckland. Specifically, we use a multiple criteria evaluation which identifies potential locations based on a number of selection criteria,

| | **Is there a relationship between access to green space and use for physical activity** | |
|---|---|---|
| **Status:** New | **Duration:** 6 months | **Going ahead:** Definitely |

Do people use parks and other green space more frequently if they live closer to them? This is an important question in relation to improving New Zealand's active population. There is already a clear association between levels of physical activity and health status. However, previous studies in England, Australia, and other developed countries have shown mixed results for the association between objectively measured green spaces and physical activity. Using Geographical Information systems (GIS) this study will use network analysis to measure the distance between the homes of participants of Statistics New Zealand's time use survey and green spaces and their use of green space for physical activity.

| | **The use of Healthline and the impact on emergency department (ED) attendance: does distance from health services matter?** | |
|---|---|---|
| **Status:** New | **Duration:** 6 months | **Going ahead:** Definitely |

Healthline is a, government funded telephone triage service that aims to provide cost-free nurse consultation to patients and reduce unnecessary visits to EDs. This project seeks to examine the effectiveness of Healthline in encouraging necessary, and redirecting unnecessary, ED admissions. By determining the effect of such a service, the need for improvement or adjustment to such a service can be understood and implemented within health policy.

Key questions being answered in this research include; What have patients who have called Healthline been advised to do compared with what they think they should do? Have patients followed the advice they were given by the Healthline service in relation to ED visits? Does the distance to hospital or emergency services have an impact on the actions and behaviour of patients in relation to Healthline advice? Is there any variation in spatial patterns of patient behaviour across the country? Lastly, can socio-economic status explain any variations in behaviour?

| | Geographical inequalities in primary health care utilisation: what keeps people away? Evidence from the New Zealand Health survey | | |
|---|---|---|---|
| **Status:** New | | **Duration:** 1 year | **Going ahead:** Possibly |

The utilisation of appropriate and effective health care is an important issue for health practitioners. A 2007 survey of seven commonwealth countries, conducted by the commonwealth fund found that 19% of New Zealand respondents were prevented from seeing a doctor, when they needed to due to cost.

This project will investigate underutilisation of primary health care providers using the latest 2012 New Zealand Health survey data. The New Zealand Health survey contains detailed information on utilisation which can be used to strengthen the results of 2007 commonwealth fund survey. Specifically we will investigate the extent of unmet need for GPs and after hours clinics (i.e. underutilisation) due to barriers of access, as mentioned above. We will use geographical information systems to show how utilisation differs between urban/rural areas and compare utilisation against travel times to nearest service and between different population groups and different geographic regions.

| | Using the New Zealand Health survey for microsimulation of small areas health statistics | | |
|---|---|---|---|
| **Status:** New | | **Duration:** 3 year | **Going ahead:** Likely |

Health variation by place is a fundamental feature of epidemiology and public health. Targeting interventions to populations and places with greatest need is an essential and effective strategy for improving population health (Cromley & Mclafferty, 2012, p1). However, due to constraints on cost, time and patient confidentiality there is limited availability of data at the small area level.

This project will use the New Zealand Health survey, the Primary Health Organisation (PHO) register and spatial microsimulation to model patterns of primary health utilisation in New Zealand by Census Area Unit. The New Zealand Health Survey is an ideal candidate to use for spatial microsimulation, being a representative sample of the New Zealand population and having detailed health information at an individual level. The PHO register, which holds information about all patients registered with a General Practitioner, will serve as a comparative dataset to test the accuracy of the model.

| | Household crowding and hospitalisation for otitis media in children, is there an association? | | |
|---|---|---|---|
| **Status:** New | | **Duration:** 1year | **Going ahead:** Definitely |

The infectious disease otitis media (OM) is one of the most common causes of morbidity among children in both developing and developed nations. It is estimated approximately 25% of children are affected by six months of age, 75% by three years and 90% by school age. In addition to individual level risk factors (age, gender, race, underlying disease, genetics, prenatal and perinatal factors) a number of environmental risk factors have also been identified. Two of these, crowding and exposure to second-hand smoke, are focused largely on the household environment children live in. The causal association between second-hand smoke exposure and OM incidence is well documented but evidence on the effect of household crowding is less clear. This project aims to further understand the independent association of household crowding, after controlling for measures of exposure to second-hand smoke in the home, with OM hospitalisations. This study will add to international and New Zealand literature investigating OM risk factors where there is currently debate over the role of household crowding on OM incidence independent of other factors. The results may indicate that household crowding does play a role in OM incidence, as it does in a range of other childhood respiratory infections, and provide evidence to strengthen policy targeted at reducing overcrowding among at risk groups living in deprived communities.

| | The relationship between multiple measures of access to alcohol outlets and treatment for alcohol/substance abuse among people treated for anxiety/mood disorders in Auckland, New Zealand | |
|---|---|---|
| **Status:** New | **Duration:** 1 year | **Going ahead:** Definitely |

Mental disorders are one of the ten leading condition groups in the global disease burden and in New Zealand an estimated one in five people experience a mental illness or addiction in a given year. These conditions have a severe impact on daily functioning, life satisfaction, wellbeing, and other chronic physical conditions. Among those diagnosed with anxiety/mood disorders secondary diagnosis for alcohol/substance abuse is common. Previous studies have suggested that substance abuse is a form of self-medication by those suffering from mental illness while other research indicates that alcohol and substance abuse leads to poor mental health outcomes. Regardless of the sequence, the dual diagnosis of alcohol/drug abuse and anxiety/mood disorder may indicate more severe mental illness. This study aims to investigate if there is an association between a variety of measures of neighbourhood access to alcohol outlets and the proportion of those treated for anxiety/mood disorder with a secondary diagnosis of alcohol and substance abuse. We hypothesize that individuals with anxiety/mood disorders are a vulnerable group and that locational access to alcohol may further exploit them. To examine this, a range of geospatial methods for characterising access will be explored. Access to aspects of the built environment has been the focus of substantial research in the previous decade but the methods used vary widely. We will use the setting of this study to compare the results from our access measures to other methods used in similar research.

| | Exploring historical trends in Trans-Tasman mortality differentials | |
|---|---|---|
| **Status:** | **Duration:** | **Going ahead:** Definitely |

This project will explore the issue of mortality inequalities between Australia (AUS) and New Zealand (NZ). Using nationally collected mortality data from both AUS and NZ for the period 1948 to 2007 the magnitude of mortality inequalities over time can be explored. As the data is available by sex and by single year of age it is possible to explore age, period and cohort effects of mortality. An age effect can be described as people of a particular age all experiencing a similar outcome while a period effect is similar, but at a specific point in time. A cohort of people are all those born in a particular year, so a cohort effect will be apparent among all those born in a specific time period over time. This allows longer term trends in mortality to be compared and benchmarked.

| | Suicide and unemployment | |
|---|---|---|
| **Status:** | **Duration:** | **Going ahead:** Definitely |

This project will explore recent trends in suicide for New Zealand. This data will then be used in combination with economic indicators such as; GDP (Gross Domestic Product), unemployment and income to determine whether there is a relationship between periods of recession and suicide. This potentially will have implications for both health and economic policy if there is a relationship. The results will allow comparison to other studies more recently on a similar theme from the United Kingdom, Australia and Greece. The key aim is to determine how many excess suicides are associated with periods of recession. (http://www.bmj.com/content/345/bmj.e5142)

## 6.2. Scholarships

Scholarships will continue to be awarded to the most promising candidates with innovative research proposals. In addition to the standard GeoHealth scholarships, we will also be offering a scholarship, funded by the CRCSI group.

## 6.3. 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 2011 the new Masters in GIS (MGIS) programme, primarily developed at the University of Canterbury, commenced. This included a newly developed *Geographic Information Systems (GIS) in Health* course which includes almost exclusive contributions by GeoHealth Laboratory staff. This new course provides a unique forum for those working or interested in working in the health sector to learn GIS and how this is utilised in health research. This course has now been offered twice, and each time, a student in Wellington (Victoria University) has participated via videoconferencing.

## 6.4. Promotion and Publication

### 6.4.1. Planned Conference Attendance for 2012/13

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

- Population Health Congress, Adelaide, Australia: 10th-12th September, 2012
- Health and Space conference, Marseille, France: 19th-21st September, 2012
- Seminars in the 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, then as a Research Associate with GeoHealth. Catherine has recently joined a research group in GeoSciences at the University of Edinburgh.

**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)

Title: 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 a Senior Advisor for the National Health Committee.

**Esther Rhind (completed June 2007)** (GeoHealth scholarship)

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

Esther completed a PhD at the University of Norwich, UK and now works in the research group in GeoSciences at the University of Edinburgh.

**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 Ministry of Health 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.

**Anjeela Kumar (completed June 2010)** (GeoHealth scholarship)

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

Anjeela is now working at the Christchurch School of Medicine.

**Sam Valentine (completed May 2011)** (GeoHealth scholarship)

Title: Public health service rationing for elective surgery in New Zealand, 2004-2007.

Sam is now working as an Assistant Project Manager at Appian Group in Sydney.

**Chris Bowie (completed May 2011)** (GeoHealth scholarship)

Title: Socioeconomic inequalities in adolescent smoking behaviour and neighbourhood access to tobacco product

Chris is now working in the GeoHealth Lab as a Research Associate, on the EHI project.

**Matt Willoughby (completed May 2012)** (GeoHealth scholarship)

Title: Neighbourhood level impact of crime on community health outcomes.

Matt is now working for the Canterbury District Health Board.

## 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.

**Francis Ayuka (completed in March 2011)** (GeoHealth scholarship)

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

Francis is now working as a researcher in Nairobi, Kenya.