UC GEOHEALTH LABORATORY

GeoHealth Laboratory
Te tai whenua o te hau ora

GeoHealth Laboratory:
10th Annual Report

June 2016

UC GEOHEALTH LABORATORY

Contact details:

GeoHealth Laboratory

Department of Geography
University of Canterbury
Private Bag 4800
Christchurch 8140

New Zealand

Directors

Prof Simon Kingham

simon.kingham@canterbury.ac.nz

Tel: +64 3 364 2893 ext. 6893

Dr Malcolm Campbell

malcolm.campbell@canterbury.ac.nz

Tel: +64 3 364 2987 ext. 7980

UC✠GEOHEALTH LABORATORY

CONTENTS

UC GEOHEALTH LABORATORY

Executive Summary

This report details the activities undertaken by the GeoHealth Laboratory between July 2015 and June 2016. The report describes the infrastructure, work plan, milestones, achievements and key events in the 11th year of operation of the Laboratory; as well as outlining the aims and work plan for the coming year (July 2016 to June 2017).

2015-16 Key Achievements

A key aim of the GeoHealth Laboratory is to undertake innovative and policy-relevant research in the areas 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 profile of the Laboratory.

Research projects have continued to utilise a wide range of Ministry of Health and other data sources including the New Zealand Health Surveys, mortality information and other administrative data sets. Key projects this year have included:

- Continued PhD projects, including a spatio-temporal analysis of anxiety-related health effects of the Canterbury earthquakes. Results of this research have been presented at international conferences and published in academic journals. One PhD candidate successfully completed and defended his PhD studies

- A series of projects and papers on the health effects of living near green (parks) and blue (water) spaces, including the relationship between academic achievement and green space exposure/access

- The development of a digital road network layer for New Zealand (facilitating access analysis)

- A comparison of mortality rates between Australia and New Zealand using the Lexis mapping software program

- Spatial microsimulation models for obesity and smoking, including policy relevant scenario models

- Participation in the New Zealand Health and Ageing Research Group (University of Canterbury, University of Otago, CDHB, South Island Alliance) utilising interRAI data

During 2015-16 the Laboratory had multiple health-related research articles published. A number of these publications were outputs of planned projects approved by the Ministry of Health. These directly fed into policy development and some have been presented to the Ministry of Health staff. In 2015-16, one student successfully completed their Master's degree, two students commenced study for a Master's degree, and three PhD candidates made good progress with their research (presenting findings at international conferences and in academic journals), and one student successfully completed his PhD studies and secured a job in Germany. Two of the PhD candidates are funded directly by GeoHealth Laboratory Scholarships.

Plans for 2016-2017

Next year the GeoHealth Laboratory intends to:

MINISTRY OF HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

- Further 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

- Utilise data collected in the New Zealand Health Survey and administrative surveys

- Undertake research which complements the Health & Disability Intelligence (HDI) work plan

Health & Disability Intelligence   5   **Dept. of Geography**

MINISTRY OF
HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

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

UC GEOHEALTH LABORATORY

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. The aims of the Laboratory are to:

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

This is the 10th Annual Report of the GeoHealth Laboratory and describes the activities undertaken between July 2015 and June 2016. The report outlines the infrastructure, work plan, milestones, achievements, and key events in the 10th year of operation of the Laboratory; as well as setting out the aims and work plan in detail for the coming year (July 2016 to June 2017). It includes all the work of the Laboratory, and not just the work funded directly by the core Ministry of Health contract.

Section 2 "GeoHealth Research Laboratory Infrastructure" outlines how the Laboratory is structured, including information about funding, personnel, facilities, equipment, and management. Sections 3 "Work Plan Core Activity: Research" and 4 "Work Plan Core Activity: Scholarships" describe publications, completed projects, policy impacts, ad hoc work, scholarships, and awards and recognition for the Laboratory. Section 5 "GeoHealth Laboratory Promotions" covers the important publicity and promotional activities undertaken to increase awareness and publicise the Laboratory; whilst Section 6 "Plans for 2016-17" outlines the immediate goals for the coming year and the strategic direction beyond.

GIS Expertise & High Quality Research for Public Health

UC GEOHEALTH LABORATORY

2. GeoHealth Research Laboratory Infrastructure

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

- Funding
- Personnel
- Facilities
- Equipment
- 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 at the University of Canterbury. These are supplemented by additional funding sources.

Ministry of Health (direct funding)
A contract was signed in October 2014 for additional funding extending the length of the contract to June 2017.

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 section 2.2).

Additional Funding
The Laboratory attracts additional funding beyond that provided as part of the GeoHealth Laboratory contract and from the University. In the past this has included support from Canterbury Medical Research Fund for a project looking at *Breath Exposure and Response – does increased ambient acetonitrile in the workplace environment affect the exhaled amount* and from the Cooperative Research Centre for Spatial Information (CRCSI) for a project on *Geographic Variations in Natural Disaster Impact* and from the CRCSI/Future Position X (Sweden) on *Real-time environmental sensors to improve health in the Sensing City*.

2.2 Personnel

The Laboratory employs two full-time researchers (Postdoctoral Fellows) based in the Laboratory at the University of Canterbury (Christchurch); Dr Paul Beere and Dr Melanie Tomintz (started mid-August 2015). 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 GeoHealth 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. An outline of Laboratory personnel is provided in Table 1 (see section 2.5). In 2014 the Laboratory had a Postdoctoral Fellow, Dr John McCarthy, seconded to the Ministry of Health in Wellington. This secondment became confirmed as of January 2015.

MINISTRY OF HEALTH
MANATŪ HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

UC GEOHEALTH LABORATORY

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. 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:

- Dr Eun-Hye Enki Yoo (University at Buffalo, The State University of New York, 2015)
- Dr. Lily Bui (Massachusetts Institute of Technology, USA, 2015)
- Dr. Ronan Foley (National University of Ireland Maynooth, Ireland, 2015)
- Prof. Gerry Kearns (National University of Ireland Maynooth, Ireland, 2014)
- 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)

2.3 Facilities

The Laboratory is located in a dedicated room situated within the Department of Geography. The Laboratory room is fitted with nine 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 a white board. The laboratory is locked and has swipe-card protected entry available to Laboratory employees only. The Laboratory layout was carefully considered to provide a conducive working and research environment with an extra capacity beyond initial requirements to allow for growth and to accommodate visits from collaborators.

2.4 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 complete with either 22 or 24-inch screens. There is 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 (SPSS, R) 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 GIS specialists and management within the Department of Geography, and University of Canterbury central IT services.

2.5 Management

The directorship and management of the Laboratory is undertaken primarily by Prof Simon Kingham and Dr Malcolm Campbell of the Department of Geography; who are responsible for the work activities of the Laboratory. Additional research guidance and support is provided by Prof Jamie Pearce (International Advisor). Oversight and governance are provided by Denise Hutana and Jackie Fawcett at the Ministry of Health who, along with the Directors, are responsible for generating and agreeing the Laboratory work programme.

Table 1. GeoHealth Research Laboratory Personnel 2015-16

Post	Location	Name
Directors	Dept of Geography	Prof Simon Kingham
	Dept of Geography	Dr Malcolm Campbell
International Advisor	Uni of Edinburgh	Prof Jamie Pearce (Adjunct Professor)
UC Adjunct Staff	CDHB	Dr Michael Epton (Adjunct Professor)
	CDHB	Dr Malina Storer (Adjunct Senior Fellow)
	University of Auckland	Dr Daniel Exeter (Adjunct Senior Fellow)
Postdoctoral Research Fellows	GeoHealth Laboratory	Dr Paul Beere
	GeoHealth Laboratory	Dr Melanie Tomintz (started August 2015)
Postdoctoral Research Fellow	Ministry of Health	Dr John McCarthy
PhD students	GeoHealth Laboratory	Niamh Donnellan (started February 2012)
		Daniel Hogg (awarded April 2016)
		Alison Watkins (started March 2013)
Masters students	GeoHealth Laboratory	Andreas Wilson (completed August 2015)
		Kirsty Curry (started April 2015)
		Robert Poynter (completed April 2016)
		Jesse Wiki (started February 2016)
Other UC academic staff	Dept of Geog	Dr David Conradson
		Dr Kelly Dombroski
		Dr Femke Reitsma (left UC June 2016)
		Dr Ioannis Delikostidis
	Dept of Maths & Stats	Prof Jennifer Brown
		Dr Elena Molchanova
Other UC technical staff	Dept of Geog	John Thyne
		Paul Bealing
	Geospatial Research Institute	Wayne Tyson

GIS Expertise & High Quality Research for Public Health

UC☬ GEOHEALTH LABORATORY

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 analysis techniques, and health services. Key drivers of our research have been the New Zealand Health Strategy and the HDI work programme. 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 previous 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. Projects have been funded through 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 (section 3.2). We also provide a brief synopsis of the GeoHealth staff's key projects undertaken during the past year (section 3.3) and plans for 2016-2017.

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. 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. Working relationships with the Christchurch District Health Board (DHB) and City Council have also provided administrative data to the lab for research projects. The Laboratory has also been proactive in creating unique data sets to facilitate wider health research, including an enhanced road network layer for New Zealand.

3.2 Publications 2015-16

The publications are listed according to their submission status and in chronological and alphabetical order.

2016

Griffin E, McCarthy JP, Thomas F and Kingham S (2016). Using New Zealand Healthline call data to measure the effect of travel time on the use of the emergency department. Social Science & Medicine, *submitted.*

Hogg D, Kingham S, Wilson TM and Ardagh M (2016). The effects of spatially varying earthquake impacts on mood and anxiety symptom treatments among long-term

Christchurch residents following the 2010/11 Canterbury earthquakes, New Zealand. Health & Place, *submitted.*

Hogg, D., Kingham, S., Wilson, T. M., & Ardagh, M. (2016). Spatio-temporal variation of mood and anxiety symptom treatments in Christchurch in the context of the 2010/11 Canterbury earthquake sequence. Spatial and Spatio-temporal Epidemiology, *submitted.*

Hogg D, Kingham S, Wilson T and Ardagh M (2016). Spatial variation in Individual/Community Exposure to Natural Hazard Disasters and Implications for Mental Health Outcomes: A Review. Natural Hazards, *submitted (11/2014).*

Tomintz MN, Kosar B and Clarke GP (2016). smokeSALUD: exploring the effect of demographic change on the smoking prevalence at municipality level in Austria, International Journal of Health Geographics, *submitted.*

Wiki J and Kingham S (2016). Re-working Appleyard in a lower density environment: The impact of traffic on liveability and community wellbeing in Christchurch, New Zealand. Journal of Transport and Health, *submitted.*

Pattinson W, Langstaff J, Longley I and Kingham S (2016). Using an ambient air pollution exposure model to explore the impact of local residents' proximity to a major highway. Air Quality, Atmosphere and Health, 9(4), 335-357. http://dx.doi.org/10.1007/s11869-015-0343-6.

Schluter PJ, Ahuriri-Driscoll A, Anderson TJ, Beere P, Brown J, Dalrymple-Alford J, David T, Davidson A, Gillon DA, Hirdes J, Keeling S, Kingham S, Lacey C, Menclova AK, Millar N, Mor V and Jamieson HA (2016). Comprehensive clinical assessment of home-based older persons within New Zealand: an epidemiological profile of a national cross-section. Australian and New Zealand Journal of Public Health, *in press.* http://dx.doi.org/10.1111/1753-6405.12525.

Zmölnig J, Tomintz MN and Clarke GP (2016). Mapping the distribution of diabetes for public health support in Austria, GIS.Science, Wichmann, *in press.*

Bowie C, Campbell M, Beere P and Kingham S (2016). Social and spatial inequalities in Rotaviral enteritis: supporting universally funded vaccination in New Zealand. New Zealand Medical Journal 129(1431), 59-66.

Hogg D, Kingham S, Wilson TM and Ardagh M (2016). The effects of relocation and level of affectedness on mood and anxiety symptom treatments after the 2011 Christchurch earthquake. Social Science & Medicine, 152, 18-26. doi:10.1016/j.socscimed.2016.01.025.

Nutsford D, Pearson A, Kingham S and Reitsma F (2016). Residential exposure to visible blue space (but not green space) associated with lower psychological distress in a capital city. Health and Place 39, 70-78.

Sabel C, Hiscock R, Asikainen A, Bi J, Depledge M, van den Elshout S, Friedrich R, Huang G, Hurley F, Jantunen M, Karakitsios S, Keuken M, Kingham S, Kontoroupis P, Kuenzli N, Liu M, Martuzzi M, Morton K, Mudu P, Niittynen M, Perez L, Sarigiannis D, Stahl-Timmins W, Tobollik M, Tuomisto J and Willers S (2016). Public health impacts of city policies to reduce climate change: findings from the URGENCHE EU-China project. Environmental Health 15 (Supp 1): 25. http://ehjournal.biomedcentral.com/articles/10.1186/s12940-016-0097-0.

Tomintz MN and Garcia-Barrios VM (2016). simSALUD - Towards a Health Decision Support System for Regional Planning, in Lombard J, Clarke GP and Stern E (eds.): Applied spatial modelling and planning, Routledge, London.

Health & Disability Intelligence   11   **Dept. of Geography**

MINISTRY OF HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

UC GEOHEALTH LABORATORY

2015

Campbell M, Beere P, Bowie C, Griffin E and Kingham S (2015). Suicides and unemployment: is there a relationship in New Zealand? Australasian Epidemiologist 22(1), 55-60.

Campbell MH, Bowie C, Kingham S and McCarthy JP (2015). Painting a picture of trans-Tasman mortality. Public Health 129(4), 396-402.

Jenkins G, Pearson A, Bentham G, Day P and Kingham S (2015). Neighbourhood influences on children's weight-related behaviours and BMI. AIMS Public Health 2(3), 501. http://www.aimspress.com/article/10.3934/publichealth.2015.3.501.

MacRae J, Kingham S and Griffin E (2015). The effect of spatial barriers on realised accessibility to health services after a natural disaster. Health & Place 35, 1–10.

Nutsford D, Reitsma F, Pearson A and Kingham S (2015). Personalising the Viewshed: Visibility analysis from the human perspective. Applied Geography 62, 1.

Tomintz MN, Clarke GP and Alfadhli N (2015). Location-allocation models. in: Brunsdon, C and Singleton A (eds.): Geocomputation: a Practical Primer, Sage, London.

3.3 Selected Projects 2015-16

COMPLETED

Is there a spatial relationship between the extent of physical damage from natural disasters and psycho-social stress-related health outcomes?

The 22nd February 2011 Christchurch earthquake killed 185 people, injured over 8,000, and damaged over 100,000 buildings. On-going aftershocks maintained high anxiety levels. This stage of this project examined the dose-exposure effect of earthquake damage assessments, earthquake intensity measures, liquefaction and lateral spreading, on mood and anxiety disorders in Christchurch after this event. It was hypothesised that such disorders are more likely to develop in people who have experienced greater exposure to these earthquake impacts within their neighbourhood than others who have been less exposed, but also live in the city. For this project, almost all clinically diagnosed cases in the Christchurch urban area, consisting of annual incident and relapsed cases of help-seekers, were analysed. Spatio-temporal cluster analysis shows that people living in the widely affected central and eastern parts of the city after the 2010/11 earthquakes have a 23% higher risk of developing a mood or anxiety disorder than people living in other parts of the city. Generally, mood and anxiety-related disorders increase with closer proximity to damage from liquefaction and moderate to major lateral spreading. Furthermore, it is shown that living in closer proximity to areas that are more likely to suffer from damage in future earthquakes increase the odds of having a mood or anxiety disorder. This research began in February 2013 and forms the basis of Daniel Hogg's PhD scholarship, who successfully completed his PhD in early 2016.

School scores in national standards tests and availability of greenspace in the home and school environment

Research exploring the relationship between natural environments and health outcomes has demonstrated a positive link between 'greenspace' exposure and physical and mental wellbeing. A number of case studies have demonstrated that green spaces can have a significant positive effect on improved concentration duration, behaviour in the classroom, and educational and social development for school-aged children. This paper seeks to add to the case study literature by applying Geographical Information Systems (GIS) techniques to

Health & Disability Intelligence   12   **Dept. of Geography**

MINISTRY OF HEALTH
MANATŪ HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

examine the relationship between greenspace exposure surrounding primary schools in New Zealand, and academic achievement. Greenspace within a mean school zone buffer was calculated for each non-integrated primary school. National Standards data were obtained from the Ministry of Education. Using linear regression modelling, the association between greenspace exposure and the percentage of children achieving 'Above and 'Well below' National Standards was examined, controlling for, gender, ethnicity and decile. Results show that greenspace exposure has a mild, non-significant effect on school achievement, even when controlling for gender and ethnicity. Decile has the greatest influence on school achievement, where 'Above' National standard achievement for maths, reading, and writing increases as deprivation decreases ($p<0.001$). For reading and writing, increased greenspace corresponded to a minimal decrease in academic achievement, but this can be explained by the fact that areas of high deprivation also have more greenspace. Further analysis at smaller scales that can control for the 'quality', composition, and 'viewsheds' of greenspace to be accounted for is required to expand on these findings in order to draw comparisons to previous case study research.

The development of a digital road network layer for New Zealand

A digital road network layer based on open-source datasets have been developed to facilitate geospatial analysis undertaken at the Ministry of Health, within the Laboratory, and is to made available to the public via coordinates.com. The network layer incorporates travel distance and time and is considered suitable for analysing health service accessibility. The development process used the mapping software package ArcGIS, currently licensed by the MoH. Methods that were prototyped on the road network layer produced by LINZ have been applied to a more accurate road network layer maintained by the New Zealand Open GPS Project. The resultant network analysis layer uses a combination of the number of lanes a road has, whether the roads are urban or rural, whether the road surface is sealed or unsealed, and the extent to which the road bends to determine the average speed likely for a given stretch of road. After a rigorous testing phase, the dataset is considered fit-for-purpose and has been used in MoH research projects including hospital access in rural areas and gambling facility access analysis. The dataset is free to use, open source and has no licence restrictions, making it a valuable resource to the GeoHealth Laboratory. The process is expected to be documented in a methodological paper for submission to an academic journal. Completed paper currently with adjunct colleague in order to refine for publication. Once the paper is complete, data will be served online via koordinates.com

ONGOING
Using the New Zealand Health Survey for microsimulation of small areas health statistics for obesity (AW, MC)

The early stages of this project involved a literature review of what is known about the geography of obesity in New Zealand. This is currently undergoing revision in preparation for resubmission. Additionally, the programming framework for the model was constructed and tested using small data sets. The project has moved from the initial application of a spatial microsimulation model of obesity for NZ using the New Zealand Health Survey, the New Zealand Census and spatial microsimulation algorithms, to modelling patterns of obesity by small area unit. The first model has been constructed and validated against the National Diabetes Register. The next stage will involve further testing, construction, and validation of the spatial microsimulation model. This research began in March 2013 and forms the basis of Alison Watkins' PhD scholarship.

UC GEOHEALTH LABORATORY

Towards smokefree Aotearoa 2025: Spatial modelling of smoking (MT, MC)

New Zealand (NZ) aims to be the first smoke-free country by 2025, where smoke-free is defined as a population with 5% or less smoking. Over time, smoking prevalence has decreased, which shows some current and on-going policy actions have been successful. However, the decreasing smoking prevalence is not seen in the Māori population. Spatial microsimulation modelling will be an important tool when it comes to target specific population groups and to apply policy relevant analysis for the current situation, but also for future scenarios. NZ is one of the few, if not the only country that collect current smoking behaviour (smoker, ex-smoker, never smoked) in the Census. This data is available at the smallest geographical unit, i.e. Meshblocks. However, there is no additional smoking data, for example on quit attempts. We use a spatial microsimulation model developed within the framework simSALUD, by first estimating smoking behaviour, to validate the results against real world data (simulated smokers versus smokers recorded in the Census). After having a robust and validated model, we then simulate different scenarios that are relevant to the NZ context. These scenarios are designed and discussed with the Ministry of Health, the Tobacco Control Group and other Health Promotion Organisations to give real world applicability. The NZ data allows us to contribute to gaps in the current literature in terms of external validation of spatial microsimulation. In addition, smoking can be a strong predictor for other related health problems, such as heart disease, that will be modelled in future.

A Geospatial approach to understanding the impact of the built environment on active transport behaviours and health (ND, SK, MC)

A recent trend in the literature has been on investigating the effects of the built environment on active travel behaviour and related health outcomes. Research to date has focused mainly on walkability, and to a lesser extent, bikeability, of the built environment. However, other modes of transport commonly used in daily life such as public transport and car use have received less attention. One of the main aims of this research is to build on previous research and create GIS based indices of walkability, bikeability, public transport-ability and drive-ability for neighbourhoods in two cities in New Zealand: Auckland and Wellington. A second aim is to assess how these indices relate to active transport behaviours and health outcomes. These indices may be used by city planners and policy makers alike in deciding where to situate neighbourhood and community resources, as well as identify areas that can be developed to promote more active forms of transport. It is also important for health research to help inform why residents of some neighbourhoods actively engage in physical activity in their local environment while others do not. Having completed a comprehensive review of the literature on the indicators of the built environment that influence active transport and health, the first indicators in GIS are now being developed. The next step will be to assess the relationship between these indicators, and specific health outcomes, such as physical activity and mental health. This research began in February 2012 and forms the basis of Niamh Donnellan's PhD research.

Blue Space and Mental Health: Analysis of the relationship between proximity and exposure to blue spaces (rivers, lakes, the ocean) and mental health in New Zealand (JM, SK)

A recent study of NZHS data revealed that higher levels of blue space visibility were associated with lower levels of psychological distress in Wellington, New Zealand. The researchers called for further research as to whether increased visibility of blue space could promote mental wellbeing and reduce stress in other cities in New Zealand. Using PRIMHD mental health and addiction data collected by the Ministry of Health from DHBs and NGOs,

Health & Disability Intelligence   14   **Dept. of Geography**

MINISTRY OF HEALTH
MANATŪ HAUORA

GIS Expertise & High Quality Research for Public Health

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

the Blue Space and Mental Health project undertakes analyses of a nationwide population who have interacted with mental health and addiction services. This study also has the added benefit of being geocoded at a household, rather than meshblock, level. This will increase the accuracy of the results produced by a viewshed analysis of distance, and exposure, to blue spaces. The research findings will add great value to emerging literature around the relationship between public health and blue spaces.

Understand the geographical distribution and spatial risk factors of obesity and T2DM in NZ and the implications this has for health policy and planning (JW, SK, PB, JM)

Type 2 diabetes mellitus is a growing and serious health issue. It develops when the body is insulin resistant or not producing enough insulin to control blood glucose levels and is commonly onset by obesity. Certain ethnic groups are more susceptible to developing type 2 diabetes mellitus, a fact which is especially important to consider in New Zealand given its multi-cultural population and ethnic diversity. Recent statistics on type 2 diabetes mellitus from the New Zealand Health Survey 2013/14 demonstrate its prevalence and highlight the need for research into spatial patterns and risk factors. This project will explore four aspects of type 2 diabetes mellitus in New Zealand; geographical distribution, the relationship with obesity, spatial variations in risk factors, and, its use as a measure of obesity, where BMI is acknowledged as a crude measure.

3.4 Ad-hoc Tasks Completed for the Health Sector

The role of GIS is becoming more prominent in the health sector; however GIS capability varies greatly among DHBs as developing expertise is both expensive and time consuming. 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. These range from email and telephone advice, training, geocoding and mapping tasks to more advanced analytical support. Projects include:

- Gambling expenditure: To support mental health and addiction services, a geospatial database of gambling venues and associated revenue was developed to produce a time series of inequitable gambling participation. This research contributed to the work program of the Mental Health Service Improvement team (MoH).
- VCLA for Rheumatic Fever - Location Analysis: To support the accurate location of services offering low cost healthcare services for Rheumatic Fever (throat swabbing etc), GIS data containing facility location and coverage have been created for the SCI Business Analysis team (MoH).
- Sleep guidelines: To support the Clinical Weight Management Guidelines produced by the MoH, data were developed to produce estimates of population prevalence for recommended sleep categories by population subgroups. This information was supplied to the Nutrition and Physical Activity Policy team at the MoH.
- Ministerial request: A geospatial analysis of postnatal care across New Zealand. This research was prepared for the Hon Dr Jonathan Coleman, Minister of Health.
- Radiotherapy service analysis: An evaluation of the accessibility of radiotherapy treatment centres. This research used a network analysis of distance and travel time from target populations to healthcare services, prepared for the National Health Committee (MoH).
- Maori Health Chart Book: Updating of Maori population distribution images for Ministry publication.

UC GEOHEALTH LABORATORY

- Creating bespoke geospatial information, including PHO coverage, concordance files, and customised boundary data.
- Visualisation tasks (mapping), including perinatal laceration rates and vulnerable child populations.

MINISTRY OF
HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF
CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

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 Master's 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, by 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 geohealth, environmental, and public health areas including (but not exclusively) the following:

- Neighbourhood built environments and health
  - o Determinants of obesity
  - o Alcohol related behaviours and harms
- Social environments and health
  - o Social inequality and smoking
  - o Crime and health
  - o Social dimensions of cancer incidence and survival
- Physical environments and health
  - o Air pollution and health
  - o 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 $30,000 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.

4.2 Current Masters Students

Note: Appendix A shows a list of all former Master students with the title of their projects.

Kirsty Curry (commenced April 2015) (GeoHealth scholarship)
Subject: Assessing the effect that living in proximity to major roads has on mental health.

Jesse Wiki (commenced February 2016) (GeoHealth scholarship)
Subject: Understand the geographical distribution and spatial risk factors of obesity and T2DM in NZ and the implications this has for health policy and planning.

4.3 Current PhD Students

Note: Appendix B shows a list of all former PhD students with the title of their projects.

Niamh Donnellan (commenced February 2012) (GeoHealth scholarship)

Subject: A geospatial approach to understanding the influences of the built environment on active transport behaviours and health outcomes

Alison Watkins (commenced March 2013) (GeoHealth scholarship)

Subject: The social and spatial distribution of obesity in New Zealand: A spatial microsimulation approach

UC GEOHEALTH LABORATORY

5. GeoHealth Laboratory Promotion

5.1 Conferences and other presentations

Presenting the research of the GeoHealth Laboratory is integral to raising the profile of the GeoHealth Laboratory, both domestically and internationally. Selected presentations are listed below.

- Kingham S (2016). Geography and health. Talk to Year 13 students at Burnside High School, Christchurch, June 14th 2016.
- Beere P and Kingham S (2016). Greenspace Exposure and Academic Achievement in Urban New Zealand Primary Schools. GeoHealth Lab Symposium. The New Zealand Ministry of Health, Wellington, New Zealand, 30 May 2016.
- Campbell MH (2016). Could a mobile phone save your life? Future directions in the study of health and place. Wellington, New Zealand: GeoHealth Lab Symposium, 30 May 2016.
- Donnellan N (2016). The built environment: objective measurement of exposures and associations with physical activity. Wellington, New Zealand: GeoHealth Lab Symposium, 30 May 2016
- Kingham S (2016). The GeoHealth Lab: past, present and future initiatives. Wellington, New Zealand: GeoHealth Lab Symposium, 30 May 2016.
- Kingham S (2016). Geography of earthquake impact, stress and anxiety: what lessons can health providers learn? Wellington, New Zealand: GeoHealth Lab Symposium, 30 May 2016.
- Tomintz MN (2016). Smokefree New Zealand 2025: the contribution of geospatial analysis for policy decision support, 2nd Geospatial Symposium, Ministry of Health, Wellington, 30 May 2016.
- Watkins A (2016). Estimating variation in obesity rates among New Zealand neighbourhoods: A spatial microsimulation approach. Wellington, New Zealand: GeoHealth Lab Symposium, 30 May 2016.
- Tomintz MN (2016). Supporting Smokefree New Zealand 2025 using geospatial analysis, Department of Geography, University of Canterbury, 23 May 2016.
- Kingham S (2016). Earthquakes and mental health. Canterbury Geography Teachers AGM, Christchurch, 31st March 2016.
- Kingham S (2016). What can Geohealth add to infectious disease research? One Health Aotearoa - A Symposium on Infectious Diseases. Wellington, 22nd-23rd March 2016.
- Hogg D, Kingham S, Wilson T and Ardagh M (2016). Exposure to physical earthquake impacts and its implications on mood and anxiety disorder treatments. People in Disasters conference. Christchurch. 24th-26th Feb 2016.
- Beere P and Kingham S (2016). Greenspace Exposure and Academic Achievement in Urban New Zealand Primary Schools. New Zealand Geographical Society Conference, 1-4 February 2016.
- Watkins A (2016). Life in the "fat zone": measures of SES and resource access in areas of high obesity. New Zealand Geographical Society Conference, 1-4 February 2016
- Beere P (2015). Creating a road network analysis layer: adding value to open-source data. Christchurch, New Zealand: New Zealand Geospatial Research Conference 2015, Dec 2015.
- Curry, K. (2015) Neighbourhood factors influencing mental health in Auckland. New Zealand Geospatial Research Conference 2015, Dec 2015.

MINISTRY OF HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

UC GEOHEALTH LABORATORY

- Kingham, S. (2015) Geospatial Data Science in NZ: past, present and future research directions for health research. New Zealand Geospatial Research Conference 2015, Dec 2015.
- Tomintz MN (2015). How Web-GIS supports non-experts in local and regional health care planning: case study simSALUD. NZ Geospatial Research Conference, Christchurch, New Zealand, Dec. 2015.
- Watkins, W (2015). Obesogenic Environments in New Zealand, An investigation using simulated small area data. NZ Geospatial Research Conference, Christchurch, New Zealand, Dec. 2015.
- Marek L, Campbell M, Kingham S, Epton M and Storer M (2015). Improving Health in the Sensing City. Melbourne, Australia: Cooperative Research Centre for Spatial Information Annual Conference (CRCSI 2015), 25-27 Nov 2015.
- Kingham S (2015). The GeoHealth Laboratory, National PHO CIO Meeting Pegasus Health, Christchurch, October 19th 2015.
- Tomintz MN (2015). … my story … . Meeting Ministry of Health, 16 Oct. 2015.
- Tomintz MN (2015). Health-GIS: smart ways towards a healthy population using Geoinformation. Geospatial Research and Innovation Seminar Series, 25 Sept. 2015.
- Beere P and Kingham S (2015). Greenspace Exposure and Academic Achievement in Urban New Zealand Primary Schools. 16th International Medical Geography Symposium. 6th-10th July, 2015. Vancouver, Canada.
- Campbell M, Bowie C, Kingham S and McCarthy J (2015). Painting a picture of trans-Tasman mortality. 16th International Medical Geography Symposium. 6th-10th July, 2015. Vancouver, Canada.
- Hogg D, Kingham S, Wilson T and Ardagh M (2015). Effects of level of affectedness and localised relocation on mood and anxiety disorders after the 2010/11 Canterbury earthquakes. 16th International Medical Geography Symposium. 6th-10th July, 2015. Vancouver, Canada.
- Wilson A, Kingham S, Campbell M and Beere P (2015). Using GIS to assess the impact of childhood environments on obesity. 16th International Medical Geography Symposium. 6th-10th July, 2015. Vancouver, Canada.

5.2 Web page

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). For a link to the Laboratory's web page, 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

MINISTRY OF HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

5.3 Social media

The GeoHealth Laboratory uses social media to disseminate news and features. To view the Laboratory's Twitter feed, see www.twitter.com/GeoHealthLab.

5.4 2nd Annual Geospatial Symposium

On 30th May the Laboratory collaborated with the Ministry of Health in delivering an event entitled '2nd Annual Geospatial Symposium: annual showcase of research'. A series of speakers from the Laboratory presented to attendees from public sector organisations such as the Ministry for Social Development (MSD) and the Ministry of Justice to strengthen existing and build up new collaborations between the Ministry and the University.

6. Plans for 2016-17

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 will be continued during the year 2016-2017:

1. **Using the New Zealand Health Survey for microsimulation of small areas health statistics (AW, MC, MT)**

2. **Towards smokefree Aotearoa 2025: Spatial modelling of smoking (MT, MC)**

3. **A Geospatial approach to understanding the impact of the built environment on active transport behaviours and health (ND, SK, MC)**

4. **Blue Space and mortality: Analysis of the relationship between proximity and exposure to blue spaces (rivers, lakes, the ocean) and mental health in Auckland (JM)**

5. **Understand the geographical distribution and spatial risk factors of obesity and T2DM in NZ and the implications this has for health policy and planning (JW, SK, PB, JM)**

Additional research projects for 2016-2017 are yet to be finalised but the following list is provided to give an indication of the topics covered in this years' work programme. It is likely that new projects will arise during the coming year as new priorities develop and possibilities emerge, likewise some projects may stall or be omitted for reasons such as data limitation. Data will continue to be sourced from the New Zealand Health Survey, B4 School Check data, InterRai data and other administrative data sets. A provisional list of topics is as follows:

- **Maternity health service provision and maternal health outcomes (PB)**
  The aim of this research is to examine potential trends in maternity health outcomes from a geospatial perspective. Factors that will be considered include spatial access to maternity health services, the distance mothers travelled to their birthing facility, and what effects this may have had on birthing outcomes, and the health of mothers and babies. Social variables such as social deprivation and other census-related data will be combined with PRIMHD records. Questions and priorities will be ascertained from relevant parties that deal with maternity service provision and maternity health at the Ministry At least one paper from this project will be produced before the 2017 annual report is due.

- **Resilience and ageing: interRAI assessments and community exposures (PB, SK)**
  The GeoHealth Laboratory has been working with the New Zealand Health and Ageing Research Group to add geospatial capacity to understanding ageing and community resilience in New Zealand. interRAI is an international collaboration to improve the quality of life of vulnerable persons through a seamless comprehensive clinical assessment system. We have been supplied the interRAI data for New Zealand 2012-2016, which consists of ~105,000 records. The aim of the GeoHealth component is to explore geospatial trends in the data, such as whether better access to services predicts community resilience. It is hoped that the first paper will be completed by December 2016, which will look at urban and rural difference, deprivation, and potentially access to mental

GIS Expertise & High Quality Research for Public Health

health services as environmental exposures. The New Zealand Health and Ageing Research Group has advised us that we will continue to have access to subsequent interRAI data requests, so this will be an ongoing project into the future. There is the potential for these data to be used to explore Ministry-related priorities, and for the interRAI to be used to validate findings produced via existing Ministry dataset such as the NZHS.

- **Spatial analysis on smoking and e-cigarettes (MT)**
  E-cigarettes are a hot discussed topic globally and opinions about their influence on health divide between having no significant influence on a person's health to having a negative influence. It seems many people are able to swap from cigarettes to e-cigarettes and therefore a spatial analysis can help to identify areas with high and low uptake of e-cigarette smoking, including the characteristics of people. The aim for this project is to take international evidence on the change of cigarette and e-cigarette smoking behaviour to identify possible future impacts for New Zealand. This study will heavily depend on available datasets but the need for such analysis is given, especially when discussions arise if e-cigarette should be classified as a smoking cessation aid or not. There are also discussion to add this variable in future surveys/census. Results from this study should be submitted for publication by June 2017.

- **Examine the applicability of the software framework simSALUD to New Zealand Health Survey data for policy support (MT, MC)**
  The spatial microsimulation software simSALUD was developed by MT and colleagues within a former funded research project in Austria, with the goal of international usage. New Zealand allows to access data that is required to do the analysis. In this case we need data on individuals form the NZHS (in anonymised form) and the Census data. Currently we are in the final test phase to build a spatial microsimulation model of smokers in New Zealand with three main purposes: (1) validate model outcomes with census data. This is very unique as no other country provides this data for small geographies. (2) to model missing data, such as non-respondents, (3) to model other health variables using this approach, such as diabetes and (4) to model what-if scenarios, as the latter will be most important for the MoH. First results will be presented at the International Microsimulation Association conference 2016 in Budapest, including the submission of a conference paper. Based on the input, a journal publication is planned by the end of the year 2016.

- **Explore spatial relationships between smoking status and influences on health, such as cardiovascular disease, obesity or nutrition (MT, MC, SK)**
  It is scientifically proven that smoking is a trigger for many other diseases, such as cardiovascular diseases. Therefore, knowing the relationship between smoking and other health issues plus the demographic characteristic of the high risk groups is very valuable. This information can then be applied to small geographical areas to model the likelihood of people with smoking and other health risks to identify high risk areas for small geography to demonstrate where more support in future will be required. However, it is not only interesting to study smokers, but also to study ex-smokers to identify more or less successful areas in terms of quitting. This can further lead to link this information to other areas, such obesity, to see if areas with a higher rate of ex-smokers have also an increased average weight gain. If the latter could be proofed then it can be argued that a smoking cessation services should also provide information e.g. on healthy nutrition or outdoor activities to prevent weight gain. Intermediate results of this project will be provided by June 2017 and it is hoped to publish results by September 2017.

UC GEOHEALTH LABORATORY

- **Analyses of sleep-related data contained within the NZHS (JM, SK, MC).** The aim for this research is to apply geospatial analysis to NZHS data to produce research outputs for both the Ministry (Nutrition and Physical Activity Policy) and the University of Canterbury (JM). This project uses NZHS data to inform the Clinical Weight Management Guidelines and the new Children's Physical Activity Guidelines which are being produced by the Ministry of Health between July and October 2016, and to also produce a short report for Ministry publication which provides an insight into an increasingly topical area of public health research- sleep. In addition, larger research projects using the same data are being undertaken in collaboration with the Sleep/Wake Research Centre and the Eru Pomare Maori Health Research Centre. The research is split into two main themes- *the role of sleep as a mediator in ethnic health inequalities*, and *the role of the physical environment in sleep disorders*. Findings produced in these research projects will be disseminated through presentations, seminars, and journal publication. Ministry-focused output are to be delivered in August and September 2016, with submissions to academic journals to be delivered before February 2017.

6.2 Scholarships

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

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 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 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 includes students joining by videoconference from Wellington (Victoria University) and Auckland (AUT).

6.4 Transfer of NZHS data to GeoHealth Laboratory premises

In 2015-16 the GeoHealth Laboratory established a workstation on University of Canterbury premises to host information from the New Zealand Health Survey. This workstation has added levels of security in addition to the existing protocols governing data management in the GeoHealth Laboratory, with log on access restricted to the Directors and to the Postdoctoral Fellows employed. Additional has been undertaken by these staff, where applicable, in order to ensure confidentiality, data quality, and analysis are conducted in appropriate ways. The transfer has been sanctioned by legal teams at both the Ministry of Health and the University of Canterbury. The transfer of data will facilitate the undertaking of policy-relevant research in keeping with the aims of the ongoing relationship between both organisations, both at senior academic and postgraduate level (for example, the NZHS often underpins research undertaken in the 'Health and GIS' Masters course delivered by the University of Canterbury). To date, the NZHS 2014-15 has been supplied. The protocols set in place have facilitated efficient supply of data

MINISTRY OF HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

6.5 Promotion through conferences and seminars

Below is a list of our planned conference attendance for 2016-17 to disseminate and present GeoHealth related research (*not* all funded by the GeoHealth contract) and to socialize for possible future collaborations:

- Seminars in the Ministry of Health, Medical Schools and Geography Departments in New Zealand and at international events
- International Medical Geography Symposium, Angers, France, July 2017
- European Meeting of the International Microsimulation Association, Budapest, Hungary, September 2016
- CRCSI conference, Sydney, November 2016

Health & Disability Intelligence   25   **Dept. of Geography**

MINISTRY OF HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

UC GEOHEALTH LABORATORY

Appendix A: Previous GeoHealth Laboratory Research Students

Masters Thesis 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 worked for 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 products.
Chris is based in Wellington, working for OPUS International Consultants.

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.

Kim Reed (completed February 2013) (GeoHealth Scholarship)
Title: The spatial and temporal patterns of anxiety and chest pain resulting from the Canterbury earthquakes
Kim is currently working in Christchurch as a GIS professional.

MINISTRY OF HEALTH
MANATU HAUORA

GIS Expertise & High Quality Research for Public Health

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

UC GEOHEALTH LABORATORY

Daniel Nutsford (completed February 2014) (GeoHealth scholarship)
Title: [Natural urban environments and their influence on mental health: A New Zealand Case Study](#)
Daniel is currently working in London as a GIS professional.

Jayden MacRae (completed March 2014)
Title: [Using a natural experiment to assess the effect of spatial barriers on health service utilization.](#)
Jayden is CEO of Patients First in Wellington.

Nick Brunsdon (completed February 2015) (GeoHealth scholarship)
Title: [Regional patterns in excess winter mortality and morbidity amongst the elderly in New Zealand](#)
Nick is currently an Economic Analyst at Canterbury Development Corporation (CDC).

Andreas Wilson (completed August 2015) (GeoHealth scholarship)
Title: [Measuring exposure to obesogenic environments among school children in New Zealand](#)

Robert Poynter (completed April 2016) (funded by IBM)
Title: [Assessing the influence of environment and socio-economics on spatial and temporal patterns of COPD hospitalisation in Christchurch: a GIS approach](#).
Rob is currently working as a GIS analyst on an HRC funded project.

PhD students

Jeff Wilson (completed 2006) (funded by University of Canterbury doctoral scholarship)
Title: [Spatial variability of intra-urban particulate air pollution: epidemiological implications and applications](#).
After a postdoc post at Harvard, Jeff was on the academic staff at the University of Texas, Brownsville and is now an Environmental Science Professor and Dean at Huston Tillotson University (USA).

Laura Miller (completed 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 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.

Daniel Hogg (completed 2016) (funded by CRCSI)
Title: [Geographic variation in exposure to the 2010/11 Canterbury earthquake series and its implications on adverse mental health outcomes.](#)
Daniel is currently working in Germany.

GIS Expertise & High Quality Research for Public Health