

GeoHealth Laboratory

Te tai whenua o te hau ora

GeoHealth Laboratory Annual Report 2012-13

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GeoHealth Laboratory

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Executive Summary

This report describes the activities undertaken during the 2012/13 year. The report describes the infrastructure, work plan, milestones, achievements and key events in the seventh year of operation of the Laboratory; as well as setting out the aims and work plan in detail for year eight.

• 2012/13 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 included:

- Commencing some spatio-temporal analysis of anxiety-related health effects of the Canterbury earthquakes
- Continuing and developing research into the health effects of living near green (parks) and blue (water) spaces
- Assessing geographical variations in the use of the Quitline service
- Assessing geographical variations in the use of the Healthline service and the importance of distance to emergency department on its use
- Commencing a novel project microsimulating small areas using the New Zealand Health Survey

During 2012/13 the Laboratory had eight health-related research articles published, eight under review and three 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 2012/13, one student successfully completed their Masters degree and a Masters and two PhD students commenced their studies – one of the new PhD students was funded externally but the others were funded by Geohealth Laboratory Scholarships.

• Plans for 2013/14

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 *Seventh Annual Report of the GeoHealth Laboratory*

This is the seventh annual report of the GeoHealth Laboratory and describes the activities undertaken during the 2012/13 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.

2.2 Personnel

The Laboratory currently has three full-time researchers; Chris Bowie and Paul Beere are based in the Laboratory in Christchurch, and Ed Griffin is located in the Ministry of Health in Wellington. There is a further vacant post which is currently being advertised. The 2012/13 period has seen Dr Amber Pearson move onto a new post at Otago School of Medicine, Wellington; while it was with great sadness that Peter Day died. Peter began working with the GeoHealth Laboratory in 2006 and was an invaluable member of the research group,

and published a wide array of research, much of which directly informed policy and some were highlighted in the media.

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 2012-13

Post	Location	Name
Directors	Dept of Geog	Prof Simon Kingham
	Dept of Geog	Dr Malcolm Campbell
International Advisor	Uni of Edinburgh	Prof Jamie Pearce
Postdoctoral Research Fellow	Laboratory	Paul Beere (from May 2013)
	Laboratory	Dr Amber Pearson (to Dec 2012)
Researchers	Laboratory	Peter Day (to July 2012)
	Ministry of Health	Ed Griffin
	Laboratory	Christopher Bowie
Masters students	Laboratory	Kimberly Reed (to March 2013)
		Daniel Nutsford (started Feb 2013)
PhD students	Laboratory	Daniel Hogg (started Feb 2013)
		Niamh Donnellan (started February 2012)
		Alison Watkins (started March 2013)
Other UC academic staff	Dept of Geog	Prof Ross Barnett
		Dr Gregory Breetzke
		Dr David Conradson
	Dept of Maths & Stats	Prof Jennifer Brown
		Dr Elena Molchanova
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 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.

UC GEOHEALTH LABORATORY

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 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 2012-13

2012 Publications

- Moon, G., **Pearce, J.** and **Barnett, J.R.** Smoking, ethnic residential segregation and ethnic diversity: a spatio-temporal analysis. *Annals Association of American Geographers* 102, 2012, 1-10.
- **Pearce, J.**, **Barnett, J.R.**, and Moon, G., Socio-spatial inequalities in health-related behaviours: pathways linking place and smoking. *Progress in Human Geography* 36, 2012, 3-24.
- Witten K, Blakely T, Bagheri N, Badland H, Ivory V, **Pearce J**, Mavoia S, Hinckson E, Schofield G, 2012. Neighborhood built environment and transport and leisure physical activity: Findings using objective exposure and outcome measures in New Zealand. *Environmental Health Perspectives* 120, 971-977.

- **Pearce J**, 2012. The 'blemish of place': stigma, geography and health Inequalities. *Social Science and Medicine* 75, 1921-1924.
- Shortt N, Richardson E, **Pearce J**, Mitchell R, 2012. Mortality inequalities by environment type in New Zealand *Health and Place* 18, 1132-1136.

2013 Publications

- **Pearson AL**, **Griffin E**, Davies A and **Kingham S**, 2013, An ecological study of the relationship between socioeconomic isolation and mental health in the most deprived areas in Auckland, New Zealand. *Health and Place* 19: 159-166.
- Richardson E, **Pearce J**, Mitchell R, Shortt N, 2013, A regional measure of multiple environmental deprivation: do relationships with health and health inequalities persist? *Professional Geographer* 65, 153-170.
- Richardson EA, **Pearce J**, Mitchell R and **Kingham S**, 2013, The role of physical activity in the relationship between urban green space and health. *Public Health* 127, 318-324.

2013 accepted

- **Pearson AL**, **Pearce J** and **Kingham S**. (2013) Deprived yet healthy: Neighbourhood-level resilience in New Zealand. *Social Science and Medicine*, *accepted*.
- **Tisch C**, **Pearson AL**, **Kingham S**, Borman B and Briggs D, 2013, Environmental Health Indicators: A review of programmes worldwide. *Environmental Health Review*, *accepted*.
- **Kingham S**, Longley I, Salmond J, Pattinson W and Shrestha K, 2012, Variations in exposure to traffic pollution while travelling by different modes in a low density, less congested city. *Environmental Pollution*, *accepted*.

2013 under review

- **Pearson AL**, **Bowie C** and Thornton LE, 2013, Is access to alcohol associated with alcohol/substance abuse among people diagnosed with anxiety/mood disorder? *Journal of Epidemiology and Community Health*, *submitted*.
- **Bowie C**, **Pearson AL**, **Campbell M** and **Barnett R**, 2013, Otitis media and the association with household crowding among children in New Zealand. *Australia and New Zealand Journal of Public Health*, *submitted*.
- **Tisch C**, **Pearson A**, **Griffin E**, **Kingham S**, Borman B and Bentham G, 2013, Evidence of a shift in the relationship between socioeconomic deprivation and melanoma incidence in New Zealand: 2004-2008. *Social Science and Medicine*, *submitted*.
- **Nutsford D**, **Pearson A** and **Kingham S**, 2013, An ecological study investigating the association between access to urban green space and mental health. *Journal of Public Health*, *submitted*.
- **Pearson AL**, Winter PR, McBreen B, Stewart G, Roets R, **Bowie C**, **Nutsford D**, **Donnellan N** and Wilson N, 2013, Obtaining fruit and vegetables for the lowest prices: Pricing survey of different outlets and geographical analysis of competition effects. *PLOS ONE*, *submitted*

- **Bowie C, Campbell M, Beere P and Kingham S**, 2013. Social and spatial inequalities in Rotaviral enteritis: a case for universally funded vaccination in New Zealand. *Spatial and Spatio-temporal Epidemiology*, *submitted*.
- **Day P, Campbell M** and Apparicio P, 2013, Geographic analysis of infant mortality New Zealand, 1995-2008: an ethnicity perspective. *Australia and New Zealand Journal of Public Health*, *submitted*.
- **Bowie C, Campbell M, Beere P, Griffin E and Kingham S**, 2013, Suicides and recession: is there a relationship in New Zealand? *Social Science and Medicine*, *submitted*.

3.1.2. Projects 2012-13

COMPLETED

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

This research examined the spatial and the temporal patterns of anxiety and chest pain resulting from the Canterbury, New Zealand earthquakes. Three research objectives were identified: examine any spatial or temporal clusters of anxiety and chest pain; examine the associations between anxiety, chest pain and damage to neighbourhood; and determine any statistically significant difference in counts of anxiety and chest pain after each earthquake or aftershock which resulted in severe damage. Measures of the extent of liquefaction and the location of CERA red-zones were used as proxy measures for earthquake damage. Cases of those who presented to Christchurch Public Hospital Emergency Department with either anxiety or chest pain between May 2010 and April 2012 were aggregated to the census area unit (CAU) level for analysis. Through the use of spatio-temporal scan modelling, negative and linear regression modelling and temporal linear modelling with dummy variables this research was able to conclude there are significant spatial and temporal variations in anxiety and chest pain resulting from the earthquakes. The spatio-temporal scan modelling identified a hot cluster of both anxiety and chest pain within Christchurch at the same time the earthquakes occurred. It was found that liquefaction to be a stronger predictor of anxiety than the Canterbury Earthquake Recovery Authority's (CERA) land zones. It was also found that chest pain was positively associated with all measures of earthquake damage with the exception of being in the red-zone. The temporal modelling identified a significant increase in anxiety cases one month after a major earthquake, and chest pain cases spiked two weeks after an earthquake and gradually decreased over the following five weeks.

2. Blue space and wellbeing

This research aimed to investigate whether there was a relationship between proximity to bluespace and health throughout New Zealand. All-cause mortality rates were compared to proximity to any area of general bluespace and three bluespace types; coastline, lakes, and wide rivers. Results showed a statistically significant positive relationship between mortality and coastline proximity. A statistically significant negative relationship was found between mortality and wide river proximity, indicating that as the distance from wide rivers decreases the mortality rate reduces. Similarly, a statistically significant negative relationship existed for general bluespace. No statistically significant relationship was found between mortality and proximity to lakes. Some of these findings were contrary to international research, suggesting that bluespace and health relationships may differ according to national and environmental context.

3. 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 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 was 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. The project found that Infant mortality patterns show significant differences geographically between the Maori and non-Maori populations, mainly accounted for by deprivation. A paper was submitted to the Australia and New Zealand Journal of Public Health on the Geographic analysis of infant mortality New Zealand, 1995-2008: an ethnicity perspective.

4. Greenspace and mental health

This study aimed to find whether proximity to urban green spaces is associated with human mental health. It used a cross-sectional examination of the relationship between access to urban green spaces and counts of anxiety/mood disorder treatments amongst residents aged 15 years and over in Auckland City, New Zealand. Anxiety/mood disorder treatment counts by three age groups were aggregated to 3149 small area units in Auckland. Six measures of green space access were derived using GIS techniques involving total green spaces and useable green spaces. We fitted negative binomial regression models to test the relationship between access to green space and area-level anxiety/mood disorder treatment counts, adjusted for age and area-level deprivation. This study found that decreased distance to useable green space and increased proportion of green space within the larger neighbourhood were associated with decreased anxiety/mood disorder treatment counts in an urban environment. This suggests the benefits of green space on mental health may relate both to active participation in useable green spaces near to the home and observable green space in the neighbourhood environment.

5. 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 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 Sept 2013.

6. Household crowding and hospitalisation for otitis media in children, is there an association?

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 found a significant relationship between OM hospitalisations and area-level measures of overcrowding after controlling for exposure to tobacco smoke in the home, household income, age and sex. Ethnic variation was also explored between Maori and non-Maori children with a similar effect found in each sub-model. This study, submitted as an academic paper to the Australia and New Zealand Journal of Public Health, adds further weight to the need to provide adequately sized homes for families to reduce the need for families to live in overcrowded conditions.

7. 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

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 investigated 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 in Auckland. Given the wide range of methods currently used to measure access we examined the results of three different

measures. We found that neighbourhood rates of people receiving treatment for anxiety/mood disorder with a secondary diagnosis for alcohol/drug dependency were significantly associated with two out of three of our access measures. This study concluded that access to alcohol outlets, regardless of measure, may be an important area for public health intervention, particularly for vulnerable sub-populations. Variation in the association between access measures highlighted the importance of continuity in methods between studies and the difficulties posed in selecting the 'best measure' of neighbourhood access to resources.

8. Social and spatial inequalities in Rotaviral enteritis: a case for universally funded vaccination in New Zealand

Rotaviruses (RV) have long been recognised as the most common cause of diarrhoea-related childhood morbidity and mortality worldwide. International and NZ based studies have consistently found an absence of association between RV and both socio-economic status and ethnicity. There are a number of social risk factors for RV including premature birth, requirement of neonatal care, low birth weight, malnutrition and immunosuppression. The benefits of national RV vaccination programmes have been proven. Estimates of the reduction in hospital stays due to RV vaccination are consistent across Europe, Australia and United States studies, ranging from 70% to 90%. This study sought to identify spatio-temporal variation in clustering of high and low neighbourhood rates of paediatric hospital admissions for RV in Auckland, New Zealand. Using hospitalisations for RV among 0-4 year olds during the period 2001-2011 cluster analysis was examined to identify clustering of neighbourhoods with relatively high and low rates of RV. This project found significant hot and cold clusters of RV for each year of the study period as well as evidence of significant spatial variation in the location of these clusters during the second half of the study period (2006-2011). As clustering of high RV rates shifted from Manukau to Waitakere/Henderson the underlying population demographics and neighbourhood socio-economic status also changed significantly. These results are in line previous evidence that RV is an infectious disease that affects children from all backgrounds and cannot be defined along socio-economic or ethnic lines. This study supports recent calls from medical practitioners for a RV vaccine to be included on the national immunisation schedule as the best method to combat the disease among New Zealand children. This research has been submitted for publication in the Journal of Spatial and Spatio-temporal Epidemiology.

IN PROGRESS

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

The research is testing 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 is being carried out 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).

10. The use of Healthline and the impact on emergency department (ED) attendance: does distance from health services matter?

This research sought to develop an understanding of the role that travel time to ED had upon Healthline users' compliance with advice given by the service. Additionally, it sought to determine whether deprivation and socio-economic status also played a role within Healthline's influence upon caller behaviour. In keeping with trends observed across broader health literature, it was found that both travel time to ED and population deprivation levels influenced the impact of Healthline advice upon its callers. It was found that those living closest to the ED were more likely to attend when advised to, and less likely to stay away if told to avoid the ED. Different time brackets, however, showed stronger trends, suggesting that callers at varying distances from EDs may be more or less influenced by both travel time and Healthline advice. It was ultimately determined that significant further research needs to be conducted into Healthline's various geographic influences, with emphasis placed upon other variables such as age and health condition of callers. Through such analysis, the true influence of Healthline may be established and the service tailored to suit the needs of those who stand to gain the most from it.

11. Using the New Zealand Health survey for microsimulation of small areas health statistics

This project will use the New Zealand Health survey, the New Zealand Census and spatial microsimulation algorithms to model patterns of obesity in New Zealand by small 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. Initial work has been undertaken on identifying the data needed to construct the model. The PhD scholarship began in March 2013. This project forms the basis of Alison Watkins PhD scholarship. The next stage of this project will involve the construction of a spatial microsimulation model of obesity for NZ.

12. Exploring historical trends in Trans-Tasman mortality differentials

This project explored 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 2008 the magnitude of mortality inequalities over time were explored. As the data was available by sex and by single year of age age, period and cohort effects of mortality were discovered. This allowed longer term trends in mortality to be compared and benchmarked, noting that NZ has gone from a position of relative advantage to disadvantage in comparison to Australia. A paper is in preparation.

13. A Geospatial Approach to Understanding the Impact of the Built Environment on Active Transport Behaviours and Health

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 inform why residents of some neighbourhoods actively engage in physical activity in their local environment while others do not.

14. Suicide and unemployment

This project explored recent trends in suicide for New Zealand. The aim was to determine any relationship between periods of recession and suicide. The project found that working age males exhibited a statistically significant relationship between unemployment in NZ. There was no sub-national variation of suicide and unemployment within NZ, mainly due to small sample sizes prohibiting robust analysis. Overall, the study suggests that during periods of high national unemployment there are increased suicides amongst some groups in NZ. This research has been submitted to Social Science and Medicine.

15. Online Mapping of health data

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. With the advent of Google maps, open layers, open map and ArcGIS Online and ArcGIS Server– it has become easier and relatively inexpensive for organisations to develop and implement a simple mapping solution to display their administrative data. 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. We are working with the Ministry to identify ways to improve access to geographic data as currently spatial information is available only on request. 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. This year we have progressed with a number of pilot projects serving health data up onto ArcGIS online. For example Rheumatic fever rates, hospitals, DHB, and General Practitioner information is now available online.

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. These range in sophistication from email and telephone advice, simple geocoding and mapping tasks to more advanced analytical support. We completed approximately 28 requests in 2011/12, Table 2 highlights the major requests which took over 4 hours to complete.

Table 2. Major Ad-hoc services provided 2012/13

Internal (Ministry of Health)

Title/Area	Outcomes
Vulnerable Children	<p>Investigated the characteristics of children missing out on universal health services</p> <ul style="list-style-type: none"> • Internal report: Identifying children missing out on universal services • Child Vulnerability Index: an aggregate of a series of indicators (Governments key result areas), output to Census Area Unit (CAU).
Problem Gambling	<p>Used gambling venue revenue data from the department of internal affairs to estimate spend on gambling for socio-economic groups</p> <ul style="list-style-type: none"> • Produced a set of gambling indicators determining number of accessible gambling venues by socio-economic group - using buffer analysis in ArcGIS
Rheumatic Fever (RF)	<p>Series of data extraction, analysis, and map production for RF cases to identify areas which can be targeted by interventions</p> <ul style="list-style-type: none"> • Table of population estimates for high RF areas by demography/socio economic group using tracker population • Table and map of RF rates by District Health Board (DHB) • Map Identifying areas in South Auckland with high incidence of RF
Health Districts and Public Health Unit boundaries	<p>Health Districts and Public Health Unit boundaries have been redefined due to the creation of the Auckland super city.</p> <ul style="list-style-type: none"> • Map with updated and redefined Health Districts and Public Health Unit boundaries
Sudden Unexpected Death of an Infant (SUDI)	<ul style="list-style-type: none"> • Produced a funnel plot graph to measure the progress of DHBs in reducing SUDI

External

Children of beneficiaries	<p>Answer to Maori affairs Committee question: How many children live in families who derive an income as a beneficiary – of these, how many are Maori and where do they live?</p> <ul style="list-style-type: none"> • Table comparing number of Mid-wives by Territorial Authority (TA) and the number of children of beneficiaries
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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. Daniel Nutsford (commenced March 2013) (GeoHealth scholarship)

Subject: Natural urban environments and their influence on mental health: A New Zealand Case Study

4.1.2. PhD Students

2. 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

3. Daniel Hogg (commenced February 2013) (CRCSI scholarship)

UC GEOHEALTH LABORATORY

Subject: Spatial and spatio-temporal variation of stress-related health outcomes as a result of the Canterbury earthquakes

4. Alison Watkins (Commenced March 2013) (GeoHealth scholarship)

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

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 2012-13.

4th Digital Earth Summit 2012. Wellington, New Zealand, 2-4 September 2012

- Kingham S, 2012, The use of GIS in assessing spatial variations in stress-related health as a result of living in seismically active Christchurch, New Zealand.

Population Health Congress, Adelaide, Australia, 10-12 September 2012

- Pearson A, 2012, The relationship between spatial, social isolation and mental health in Auckland, New Zealand.

Health and Space conference, Marseille, France 19-21 September 2012

- Griffin E, 2012, Spatial isolation and mental health in Auckland, New Zealand
- Griffin E, 2012, The impact of New Zealand Healthline in reducing health access inequalities

ESRI Asia Pacific Users conference, November 12-14, Auckland, NZ

- Griffin E, 2012, The relationship between spatial isolation and mental health in Auckland

New Zealand Geographical Society, Napier, New Zealand, 3-6 December 2012

- Donnellan N, 2013, A systematic review of the indices used to assess the influence of transport modes on physical activity in urban environments.

Asia Pacific Cycle Congress, Gold Coast, Australia, 10-13 March 2013

- Donnellan N, 2013, Measuring the built environment for active transport: A review. Poster presentation.

Other presentations

- Kingham S, 2012, The relationships of geographical variations in health outcomes and earthquake impact. Mental Health Education and Resource Centre Earthquake Seminar Series, Christchurch. Sept 10 2012.
- Donnellan N, 2012, A Geospatial Approach to Understanding Transport-Related Physical Activity and the Obesogenic Environment. Presentation at the Ministry of Health, Wellington. July 2013.
- Bowie C, 2013, Otitis media and household crowding in NZ. Presentation at the Ministry of Health, Wellington. April 4 2013.

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 2013/14

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 2013/14 year:

1. **Is there a spatial relationship between the extent of physical damage from natural disasters and psycho-social stress-related health outcomes?**
2. **The use of Healthline and the impact on emergency department (ED) attendance: does distance from health services matter?**
3. **Using the New Zealand Health survey for microsimulation of small areas health statistics**
4. **Exploring historical trends in Trans-Tasman mortality differentials**
5. **A Geospatial approach to understanding the impact of the built environment on active transport behaviours and health**
6. **Suicide and unemployment**
7. **Online Mapping of health data**

Additional research projects for 2013/14 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:

Access to emergency departments as a determinant of GP utilisation.		
Status: New	Duration: 1 year	Going ahead: Yes
<p>Given the important role of primary healthcare for maintaining population health, it is worthwhile to understand determinants of utilisation as to improve utilisation of primary healthcare, particularly in underserved populations. The trend of socioeconomically deprived individuals to substitute GP visits with free ED services is a prime concern of healthcare funding agencies worldwide. It has been suggested that this substitution may have been reduced by recent increases in primary healthcare subsidies, reducing co-payments required from patients. A related concern under the previous funding regime was that socioeconomically deprived communities faced poorer access to primary healthcare, in line with Hart's inverse care law. This study will assess the contribution of GP and ED accessibility on the utilisation of GP services alongside non-spatial determinants by analysing respondents to the New Zealand Health Survey (NZHS) 2011/12 in the region of Auckland, NZ. Accessibility was derived from the travel time by car from each census meshblock to the nearest facility. Accessibility of GP was not found to be a statistically significant determinant of utilisation overall, however in some quintiles of GP access there was a statistically significant reduction in utilisation associated with poorer access. Access to ED was insignificantly correlated with GP utilisation. Higher accessibility of GP was correlated with greater deprivation. Significant opportunities exist for future investigation of ED and GP utilisation in light of access to both, as well as healthline usage.</p>		

Natural urban environments and their influence on mental health: the role of visibility of green and blue space		
Status: New	Duration: 1 year	Going ahead: Yes
<p>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. In addition the role of bluespace (water) has been looked at. A key assumption of most green and blue space research is that proximity to space determines health. However in many places, particularly hillier areas, the space may be visible but not close. This project will use GIS viewshed methods to assess to identify the visibility of green and blue space and relate to health outcomes in Wellington.</p>		

Natural urban environments and their influence on health: the role of private greenspace		
Status: New	Duration: 1 year	Going ahead: Yes
<p>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. Previous research in NZ has used LINZ GIS data for greenspace. This does not include private greenspace e.g. gardens. This study will calculate private greenspace and include that into analysis in Auckland to assess the importance of this in affecting health.</p>		

School scores in national standards tests and availability of greenspace in the home and school environment		
Status: New	Duration: 1 year	Going ahead: Probably
<p>There is an increasing body of research that has found associations between greenspace and various health outcomes. A US recent study (Cedeno-Laurent et al, 2013) found significant associations between English and Maths test scores even when controlling for other factors and suggested an association between health and cognitive benefits. Their study only included school 'greenness' and took no account of home. This project will assess the relationship between National Standard schools for primary schools and the amount of green space both within the immediate vicinity of the school and within the school zone.</p>		

Contribute to the delivery of publications which analyse New Zealand Health Survey (NZHS) data		
Status: New	Duration: 1 year	Going ahead: Probably
<p>This piece of work will comprise of identifying GIS needs and contributing to Ministry of Health projects/publications which analyse New Zealand Health Survey (NZHS) data.</p> <p>We will contribute to the delivery of the following NZHS analysis projects which are on the work programme for this year:</p> <ul style="list-style-type: none"> • Tobacco • Obesity • Drugs and Alcohol <p>We will firstly scope out what GIS indicators can be produced for the publications using the NZHS questionnaires, secondly analyse health survey data using these indicators, thirdly contribute to writing the publication, fourth produce where applicable academic publications.</p>		

Social and geographical determinants of childhood obesity using the Before School Checks data		
Status: New	Duration: 1 year	Going ahead: Possibly
<p>Childhood obesity is a significant and growing health issue in New Zealand. This project will analyse the Before Schools Check data survey focusing on data relating to obesity and endeavor to identify what the key social and geographical determinants of it are in New Zealand. It will include analysis of such things as socio-economic status, ethnicity, and features of the urban environment such as greenspace and transport, as well as broader geography.</p>		

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 three times, and has included students from Wellington (Victoria University), participating via videoconferencing. In addition a one day *GIS in Health* training course will be developed and offered to staff at the Ministry of Health. This will include basic mapping

6.4. *Promotion and Publication*

6.4.1. **Planned Conference Attendance for 2013/14**

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

- Seminars in the Ministry of Health, Medical Schools and Geography Departments in New Zealand and around the world.
- International Medical Geography Symposium, East Lansing, Michigan US: 8th-12th July 2013.
- Institute of British Geographers annual conference, London, August 2013.
- Cooperative Research Centre Spatial information annual conference, Christchurch, 19-21 November 2013.

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 then went to work 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 then went to teach 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 went to work 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 went to work 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 went to work 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 then worked in the GeoHealth Lab as a Research Associate.

Matt Willoughby (completed May 2012) (GeoHealth scholarship)

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

Matt then went to work for the Canterbury District Health Board.

Kimberly Reed (completed March 2013) (GeoHealth scholarship)

Title: [Spatial and spatio-temporal variation of anxiety as a result of the Canterbury earthquakes](#)

Kim then went to work for Rayonier | Matariki Forests as a GIS researcher.

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 did a postdoc at Harvard and then went to work 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 went to work 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 went to work as a researcher in Nairobi, Kenya.