UC GEOHEALTH LABORATORY

12th Annual Report

GeoHealth Laboratory
Te Taiwhenua o te Hauora

Contact details:
GeoHealth Laboratory - University of Canterbury
Ernest Rutherford Building – Room 261
Private Bag 4800 – Christchurch 8140 – New Zealand
Email: GeoHealthLab@canterbury.ac.nz
Director: Prof. Simon Kingham

June 2018

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UC GEOHEALTH LABORATORY

Executive Summary

A key aim of the GeoHealth Laboratory (GHL) 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 GHL funding and others from other external sources through opportunities which have arisen due to the profile of the Laboratory.

This report details the activities undertaken by the GHL between July 2017 and June 2018. The report describes the infrastructure, the work plan for research and student/scholarship activities, achievements, outreach, and key dates in the 12th year of operation of the Laboratory. It also outlines the aims and work plan for the coming year (July 2018 to June 2019).

2017-18 Key Achievements

Research projects have continued to utilise a wide range of Ministry of Health (MoH) and other data sources including the New Zealand Health Surveys, National Minimum Dataset, NZ Census, location of health service facilities, and more.

Key achievements this year have included:

- The GHL received another three years of funding and went through administrative and managerial changes.

- The physical location of the GHL moved to the newly built Regional Rutherford Science and Innovation Centre at the centre of the University of Canterbury.

- In total, five out of six defined research projects with the MoH were delivered despite main gaps of staff shortage in this year. Additional research projects related to the GHL were supported, funding secured and Analytical Plans delivered.

- A new Master program was established, the Master of Spatial Analysis for Public Health (MSAPH), which started in February 2018.

- Alison Watkins submitted and successfully defended her PhD looking at spatial microsimulation modelling and obesity. Jesse Wiki is in her third year of her PhD study, conducting spatial analysis related to diabetes and the built environment.

- Numerous peer reviewed publications, conference talks, talks given to the MoH and other audiences were completed and collaborations fostered.

- Dissemination channels were reviewed and updated, i.e. websites and social media.

- MoH staff came down to Christchurch to visit the new GHL location, to personally get to know new staff members and to establish the new work program for 2018/19.

Plans for 2018-2019

In 2017, a new funding period began; and with it a new structure of research and dissemination strategies. The changes were well received at both ends, the MoH and the GHL. A major change in the nature of the contract is that the research program is now more closely aligned to MoH priorities, and policy teams are now more involved in the ongoing individual projects.

Next year the GHL intends to:

- Increase its collaboration with the MoH by undertaking designed projects which reflect issues that have been discussed with representatives from MoH or that are of high interest to specific policy groups.

- Utilise data collected in the New Zealand Health Survey and administrative surveys, as well as other data sets provided by the MoH or related parties.

- Utilise data collected in the Integrated Data Infrastructure (IDI).

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

- Support students (PhDs and Masters) who work on projects within the GHL.

- Continue the new Master's program (MSAPH).

- Strategize a way to disseminate the research findings more effectively.

- Foster and nourish ongoing and potential new relationships between the GHL and the MoH, as well as affiliated people and working groups.

1. Introduction

The GeoHealth Laboratory (GHL) was established in 2005 as a partnership between Health & Disability Intelligence (HDI) (formerly Public Health Intelligence (PHI)), in the Ministry of Health (MoH), 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 18th February 2005. In 2017, the GHL joined with the Geospatial Research Institute (GRI) at the University of Canterbury, but still has strong links with the Department of Geography.

The GHL seeks to advance MoH policy and the University of Canterbury's health sciences and geospatial research agenda for the mutual benefit of the New Zealand health sector. The main aims of the GHL 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 12th Annual Report of the GHL and describes the activities undertaken between July 2017 and June 2018. The report outlines the infrastructure, the work plan for research and student/scholarship activities, achievements, outreach, and key dates in the 12th year of operation. It also details the aims and work plan for the coming year (July 2018 to June 2019). It includes all the work of the GHL, not just the work funded directly by the core MoH contract.

The following provides a brief structure for the remainder of the report:

- Section 2 "GeoHealth Research Laboratory Infrastructure" outlines how the GHL is structured, including information about funding, personnel, facilities, equipment, and management.

- Section 3 "Work Plan Core Activity: Research" and Section 4 "Work Plan Core Activity: Scholarships" describe publications, completed projects, policy impacts, ad hoc work, scholarships, and awards and recognition for the GHL.

- Section 5 "GeoHealth Laboratory Promotions" covers the important publicity and promotional activities undertaken to increase awareness and publicise the GHL.

- Section 6 "Plans for 2018-19" outlines the immediate goals for the coming year and the strategic direction beyond.

2. GeoHealth Research Laboratory Infrastructure

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

- 2.1 Funding
- 2.2 Personnel
- 2.3 Facilities
- 2.4 Equipment
- 2.5 Management

2.1 Funding

The GHL has two principal funding streams, one directly provided by the MoH and the other indirectly provided by the Geospatial Research Institute and the Department of Geography at the University of Canterbury (UC). These are supplemented by additional funding sources.

Ministry of Health (direct funding)
A contract was signed in August 2017 for additional funding, extending the length of the contract to 30th June 2020.

University of Canterbury (indirect funding)
UC provides indirect funding to the GHL through the Geospatial Research Institute and the Department of Geography in the form of staff time and associated resources, such as computer equipment. In addition, the GHL also benefits from the time given to research by its visitors (see end of Section 2.2).

Additional Funding
The GHL attracts additional funding beyond that provided as part of the GHL contract and from UC, as detailed below.

- Dr Melanie Tomintz secured project funding from the Health Research Council (Explorer Grant) aiming to use Virtual Reality (VR) to study people's attitude, for example looking at vaping. This new information should help support future planning and work towards personalised health services. This project is done in collaboration with the Human-Interface Technology Lab (UC) and other affiliated people, within and outside academia.

- Dr Paul Beere and Dr Melanie Tomintz supported and advised the Seed funded project "Geofalls", funded by the Geospatial Research Institute, which is led by Dr Angela Curl (lecturer at the Department of Geography, UC)

- Dr Malcolm Campbell is Principal Investigator (at UC) and Prof Simon Kingham is Associate Investigator on the project #WellConnectedNZ – Te Ranga i te Tira (see https://www.wellconnectednz.org/ for a full description). This project is funded by the MoH, outside of the GHL contract, and aims to improve individual's health by strengthening community connectedness.

2.2 Personnel

With the new contract, the structure of the personnel has changed as well. The GHL continues with two postdoctoral positions and an additional position for a research manager was also created. All positions were openly advertised. Key updates to personnel include:

- Instead of two directors the GHL will continue with one director, Prof. Simon Kingham, and one deputy director, Dr Malcolm Campbell.

- The research management position was filled by Dr Melanie Tomintz from November 2017 onwards, opening her previous postdoctoral position for a new candidate.

- Dr Matthew Hobbs and Dr Lukas Marek are both new to postdoctoral positions within the GHL. Dr Matthew Hobbs, coming from the UK, started in mid-May 2018 and Dr Lukas Marek started in July 2018.

- Dr Paul Beere's contract as postdoctoral researcher ended in April 2018.

- Dr Clemence Vannier joined the GHL in May 2018 as a temporary postdoctoral researcher. She will be with the GHL until May 2019, working with Prof. Simon Kingham and Dr Malcolm Campbell on a non-GHL funded geospatial health research project (see #WellconnectedNZ above).

As part of the partnership, the time and associated costs of the management team, i.e. director and deputy director, is provided and funded by the UC Department of Geography external to the contract costs. As noted previously, the GHL is also supported by the GRI for administrative purposes and computer equipment.

The GHL also funds up to four Masters and two PhD Scholarships each year (see Section 4 below). These students are located in, and contribute to the work of, the GHL. A full outline of GHL personnel, including students, is provided in Table 1 (see Section 2.5).

The delivery of the defined core research projects is tight to the budget. Part of this budget is allocated for training and conference attendance to enable staff development and lift the profile of the GHL.

The flexible hosting arrangement of the GHL affords access to a larger pool and greater diversity in expertise than the three core posts, some of whom are named Table 1. 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:

- Professor Adrian Moore (University of Ulster, UK, 2018)
- Professor Martin Raubal (ETH Zurich, Switzerland, 2018)
- 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 GHL moved its office space into the newly built Regional Rutherford Science and Innovation Centre in the heart of the campus at the University of Canterbury. The laboratory room is fitted with eight workstations and a hot desk. There is also a common laptop which can be used by anyone in the lab when required, for example when travelling. In addition, there is a large meeting table, a TV screen mounted to the wall, and a white board. The lab also has a mobile video webcam for online meetings, MoH stakeholders in particular. The GHL is a secure facility and has swipe-card protected entry available to GHL employees only. 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 accommodate visits from collaborators.

2.4 Equipment

The GHL has been refurbished to provide desk space and computer terminals for up to nine people. At present there are eight 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 the 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 GHL. The administrative aspect is also supported by the GRI. Oversight and governance are provided by Denise Hutana and John McCarthy at the MoH who, along with the Directors and Research Manager, are responsible for generating and agreeing upon the Ministry-funded GHL work programme.

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Table 1: GeoHealth Laboratory Personnel 2017-18 (core and affiliated)

Post	Location	Name
Director	Dept of Geography	Prof. Simon Kingham
Deputy Director	Dept of Geography	Dr Malcolm Campbell
Research Manager	GeoHealth Laboratory	Dr Melanie Tomintz (started November 2017)
Postdoctoral Research Fellows	GeoHealth Laboratory	Dr Paul Beere (until April 2018)
	GeoHealth Laboratory	Dr Melanie Tomintz (until October 2017)
	GeoHealth Laboratory	Dr Matthew Hobbs (started May 2018)
	GeoHealth Laboratory	Dr Clémence Vannier (started May 2018)
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)
PhD students	GeoHealth Laboratory	Alison Watkins (finished March 2018)
		Jesse Wiki (started March 2016)
Masters students	GeoHealth Laboratory	Briony Fanslow
Other UC academic staff	Dept of Geography	Dr Angela Curl
		Assoc Prof David Conradson
		Dr Kelly Dombroski
		Dr Ben Adams
		Prof Ross Barnett
	Dept of Maths & Stats	Prof Jennifer Brown
		Dr Elena Molchanova
	School of Product Design & HIT Lab	Dr Simon Hoermann
Other academic staff	University of Otago	Dr Sally Keeling (Senior Lecturer)
	University of Otago	Dr Hamish Jamieson (Senior Lecturer)
Other UC technical and administrative staff	Dept of Geography	John Thyne
	Geospatial Research Institute	Wayne Tyson

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3. Work Plan Core Activity: Research

An integral component of the GHLs 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 MoH.

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 GHL funding and others from other external sources through opportunities which have arisen due to the rising profile of the GHL.

The new contract between the MoH and the GHL contains a specific work programme for each year, which is defined by both parties prior to the start of the programme year. Advantages of this approach are timely research to support the MoH priorities; a quick turnover of project results; and building close relationships with stakeholders as different stakeholders are assigned to the defined projects.

Research projects have continued to utilise existing MoH data sources such as the New Zealand Health Surveys, location data (e.g. dental, hospitals, etc.), National Minimum Data set, Primary Health Care Enrolments, cancer registration, hospital admissions/discharge data collections, and other administrative data sets. Working relationships with the Christchurch District Health Board (CDHB), the City Council and the Institute of Environmental Science and Research have also provided data to the lab for research projects. The GHL has also been proactive in creating story maps and web map visualisations to disseminate the findings to the public.

The projects conducted through the MoH work programme are listed in Section 3.1 below, as well as other key projects related to the GHL. Section 3.2 continues with showing geospatial ad-hoc tasks that were conducted for the MoH and Section 3.3 lists all publications that were accepted and submitted by GHL and affiliated staff.

3.1 Projects 2017-18

Work Programme 2017-18

For the work programme 2017-18 six projects where defined, of which two projects consisted of both Phase 1 and 2. All project titles are listed below. Additionally, reports were delivered for all projects and are available based on request or on our website. As highlighted above, this year went through many staff changes and left gaps in staff availability through recruitment processes and people joining the team from overseas. Despite this, the GHL had a good working relation with the MoH and were able to deliver the majority of projects.

- Examining the spatial distribution of long term condition hospitalisations in Aotearoa/New Zealand (geographic proximity to healthcare services for individuals living with cancer, cardiovascular, diabetes, renal, and respiratory conditions by socioeconomic status, ethnicity, and urban classification 2011-2016). Phase 1 & Phase 2.

- What is the geographic distribution of stroke patients, eligibility for rehabilitation and placement of rehabilitation services? (This project needed to be changed due to data

issues and the new project looked the accessibility of defibrillators for different population groups).

- Spatial analysis of e-cigarette smoking and its impact on the population of New Zealand.

- A spatial microsimulation model to show new insights to the tobacco control team.

- Geospatial Analyses of Potentially Avoidable Childhood Hospitalisations (0-12 years).

- What are the obesogenic environments experienced by obese children?

Ongoing Projects

VESPHA [Virtual Environments to Study Preventive Health Attitudes] (HRC Explorer Grant and supported by the MoH)

- Dr Melanie Tomintz secured project funding from the Health Research Council (Explorer Grant) aiming to use Virtual Reality (VR) to study people's attitude, for example by looking at vaping. This new information aims to support future planning and to work towards personalised health services. This project is done in collaboration with the Human-Interface Technology Lab (UC) and other affiliated people, within and outside academia. The main reasons for this research grant was the work on tobacco and the scoping for the e-cigarette project mentioned above. The latter has shown that not much is known about vaping internationally and hence this project will add to current and future research.

Geofalls (seed funding by the Geospatial Research Institute)

- Dr Paul Beere and Dr Melanie Tomintz supported and advised the Seed funded project "Geofalls", funded by the Geospatial Research Institute, which is led by Dr Angela Curl (lecturer at the Department of Geography, UC). One main aim of the project is to collaborate and work in an interdisciplinary manner.

3.2 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 GHL staff in the Geospatial Research Institute, the Department of Geography and the MoH continue to play an important role in providing GIS ad-hoc services for the MoH. These range from email and telephone advice, training, geocoding and mapping tasks to more advanced analytical support. Projects include:

- Mapping the number of defibrillators and the counts of cardiac arrest by deprivation and Māori/Pacific people for selected Census Area Units (St John Ambulance)
- Geocoding of community housing and appending Census Area Unit codes (Community Housing Aotearoa)

3.3 Publications 2017-18

Here we list our peer-reviewed publication. The publications are ordered by year (descending), by first author name (alphabetical order) and submission status. GHL staff authors are highlighted in bold. Publications directly funded by the MoH contract are indicated with an asterisk (*).

2018

Apparicio P., Gelb J., Carrier M., Mathieu MÈ., and **Kingham** S. (2018). 'Exposure to noise and air pollution by mode of transportation during rush hours in Montreal', *Journal of Transport Geography 70*: 182-192. http://dx.doi.org/10.1016/j.jtrangeo.2018.06.007.

Beere, P., Kelling, S., and Jamieson, H. (2018). 'Ageing, loneliness, and the geographic distribution of New Zealand's interRAI-HC cohort', *Social Science and Medicine*, doi: 10.1016/j.socscimed.2018.08.002

Frater J. and **Kingham** S. (2018). 'Gender equity in health and the influence of intrapersonal factors on adolescent girls' decisions to bicycle to school', *Journal of Transport Geography 71*: 130-138. http://dx.doi.org/10.1016/j.jtrangeo.2018.07.011.

Hobbs M., Duncan M., Collins P., Mckenna J., Schoeppe S., Rebar AL., Short C. and Vandelanotte C. (2018). 'Clusters of health behaviours in Queensland adults are associated with different socio-demographic characteristics', *Journal of Public Health,* early access online http://dx.doi.org/10.1093/pubmed/fdy043.

Hobbs M., Griffiths C., Green MA., Christensen A. and McKenna J. (2018). 'Examining longitudinal associations between the recreational physical activity environment, change in body mass index, and obesity by age in 8864 Yorkshire Health Study participants', *Social Science and Medicine* http://dx.doi.org/10.1016/j.socscimed.2018.06.027.

Hobbs M., Griffiths C., Green MA., Jordan H., Saunders J. and McKenna J. (2018). 'Associations between the combined physical activity environment, socioeconomic status, and obesity: a cross-sectional study', *Perspectives in Public Health 138*(3): 169-172. http://dx.doi.org/10.1177/1757913917748353.

Hobbs M., Griffiths C., Green MA., Jordan H., Saunders J. and McKenna J. (2018). 'Neighbourhood typologies and associations with body mass index and obesity: A cross-sectional study', *Preventive Medicine 111*: 351-357. http://dx.doi.org/10.1016/j.ypmed.2017.11.024.

Hobbs M., Griffiths C., Green MA., Jordan H., Saunders J., Christensen A. and McKenna J. (2018). 'Fast-food outlet availability and obesity: Considering variation by age and methodological diversity in 22,889 Yorkshire Health Study participants', *Spatial and Spatio-temporal Epidemiology* http://dx.doi.org/10.1016/j.sste.2018.11.001.

Hobbs, M., Quarmby, T., and McKenna, J. (2018). *Rebalancing physical activity within physical education. Health matters* (Official Report of The Association for Physical Education).

Lasseur R., **Vannier C.**, Lefebvre J., Longaretti P-Y., and Lavorel S. (2018). 'Landscape-scale modelling of agricultural land use for the quantification of ecosystem services', *Journal of Applied Remote Sensing, 12*(4). doi: 10.1117/1.JRS.12.046024

Saunders J. and **Hobbs** M. (2018). 'Behaviour change', *Perspectives in Public Health 138*(6): 290. http://dx.doi.org/10.1177/1757913918801665.

Marek L., **Campbell** M., Epton M., **Kingham** S. and Storer M. (2018). 'Winter Is Coming: A Socio-Environmental Monitoring and Spatiotemporal Modelling Approach for Better

Understanding a Respiratory Disease', *ISPRS International Journal of Geo-Information 7*(11) 432: 26. http://dx.doi.org/10.3390/ijgi7110432.

Schindler MA., Dionisio R. and **Kingham** S. (2018). 'A multi-level perspective on a spatial data ecosystem: needs and challenges among urban planning stakeholders in New Zealand', *International Journal of Spatial Data Infrastructures Research 13*: 223-252. http://dx.doi.org/10.2902/1725-0463.2018.13.art15.

* **Tomintz** MN. and Barnett R. (2018). 'Geosimulation approach for filling the gap of non-response smoking data from the census 2013: A spatial analysis of census area unit geographies', *New Zealand Geographer* http://dx.doi.org/10.1111/nzg.12199.

* **Wiki** J., **Kingham** S. and **Campbell** M. (2018). 'Accessibility to food retailers and socio-economic deprivation in urban New Zealand', *New Zealand Geographer* http://dx.doi.org/10.1111/nzg.12201.

Wiki J., **Kingham** SP. and Banwell K. (2018). 'Re-working Appleyard in a low density environment: An exploration of the impacts of motorised traffic volume on street livability in Christchurch, New Zealand', *World Transport Policy and Practice 24*(1): 60-68.

2017

Apparicio P, Gelb J, Dubé A-S, **Kingham S**, Gauvin Land Robitaille E. (2017). 'The approaches to measuring the potential spatial access to urban health services revisited: distance types and aggregation-error issues', *International Journal of Health Geographics16*, 32 https://doi.org/10.1186/s12942-017-0105-9

* **Beere** P & **Kingham** S. (2017). 'Greenspace Exposure and Academic Achievement in Urban New Zealand Primary Schools', *New Zealand Geographer*. http://doi:10.1111/nzg.12155

* Griffin E, **McCarthy** J, Thomas F & **Kingham** S. (2017). 'New Zealand Healthline call data used to measure the effect of travel time on the use of the emergency department', *Social Science & Medicine 179*, 91–96.

Frater J., Kuijer R. and **Kingham** S. (2017). 'Why adolescents don't bicycle to school: Does the prototype/willingness model augment the theory of planned behaviour to explain intentions?', *Transportation Research Part F: Traffic Psychology and Behaviour 46*: 250-259. http://dx.doi.org/10.1016/j.trf.2017.03.005.

Frater J., Williams J., Hopkins D., Flaherty C., Moore A., **Kingham** S., Kuijer R. and Mandic S. (2017). 'A tale of two New Zealand cities: Cycling to school among adolescents in Christchurch and Dunedin', *Transportation Research Part F: Traffic Psychology and Behaviour 49*: 205-214. http://dx.doi.org/10.1016/j.trf.2017.06.018.

Hobbs M., Daly-Smith A., McKenna J., Quarmby T. and Morley D. (2017). 'Reconsidering current objectives for physical activity within physical education', *British Journal of Sports Medicine* http://dx.doi.org/10.1136/bjsports-2016-097328.

Hobbs M., Green M., Griffiths C., Jordan H., Saunders J. and McKenna J. (2017). 'How different data sources and definitions of neighbourhood influence the association between food outlet availability and body mass index: a cross-sectional study', *Perspectives in Public Health 137*(3): 158-161. http://dx.doi.org/10.1177/1757913916650916.

Hobbs M., Green MA., Griffiths C., Jordan H., Saunders J., Grimmer H. and McKenna J. (2017). 'Access and quality of parks and associations with obesity: A cross-sectional study', *SSM - Population Health 3*: 722-729. http://dx.doi.org/10.1016/j.ssmph.2017.07.007.

Lavorel S., Bayer A., Bondeau A., Lautenbach S., Ruiz-Frau A., Schulp N., Seppelt R., Verburg P., van Teeffelen A., **Vannier C.**, Arneth A., Cramer W., Marba N. (2017). 'Pathways

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to bridge the biophysical gap in ecosystem services mapping approaches', *Ecological Indicators, 74*, 241-260.

Longaretti P-Y., **Vannier C.**, Lasseur R., Lavorel S. (2017). 'La modélisation des changements d'usage et de couverture des sols comme outil d'aide à la planification territoriale', *Science, Eau et Territoires*, "Gestion intégrée des territoires et des écosystèmes: vers une meilleure compréhension des trajectoires futures de l'usage des sols et leurs conséquences pour la biodiversité et les services écosystémiques", vol.21, pp.34-39.

Marek L, **Campbell** M & Bui L. (2017). 'Shaking for innovation: The (re)building of a (smart) city in a post disaster environment', *Cities 63*: 41-50. 2016.12.013. http://dx.doi.org/10.1016/j.cities.2016.12.013.

Pattinson W, **Kingham** S, Longley I, and Salmond J. (2017). 'Potential pollution exposure reductions from small-distance bicycle lane separations', *Journal of Transport & Health 4*, 40–52. http://dx.doi.org/10.1016/j.jth.2016.10.002.

Teng AM., Blakely T., Ivory V., **Kingham** S. and Cameron V. (2017). 'Living in areas with different levels of earthquake damage and association with risk of cardiovascular disease: a cohort-linkage study', *The Lancet Planetary Health 1*(6): e242-e253. http://dx.doi.org/10.1016/S2542-5196(17)30101-8.

Tomintz MN., Kosar B. and García-Barrios VM. (2017). 'simSALUD – design and implementation of an open source and wizard based spatial microsimulation framework', *The International Journal of Microsimulation 10*(2): 118-143.

Tomintz MN. and Garcia-Barrios VM. (2017). 'simSALUD - towards a health decision support system for regional planning', In Lombard J; Stern E; Clarke GP (Ed.), *Applied Spatial Modelling and Planning* (First ed.): 230-248. London: Routledge.

Vannier C., Crouzat E., Byczek C., Lasseur R., Lafond V., Cordonnier T., Longaretti P-Y., Lavorel S. (2017). 'Mapping ecosystem services: what data, models, uncertainties? Example around the Grenoble catchment area', *Environnement Urbain/Urban Environment*, vol 11/2017.

Vannier C., Lasseur R., Lefebvre J., Nettier B., Longaretti P-Y., Lavorel S. (2017). 'Analyse des dynamiques paysagères dans le bassin de vie de Grenoble entre 1998 et 2009', *Science, Eau et Territoires*, "Gestion intégrée des territoires et des écosystèmes: vers une meilleure compréhension des trajectoires futures de l'usage des sols et leurs conséquences pour la biodiversité et les services écosystémiques", vol.21, pp.28-33.

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4. Work plan Core Activity: Scholarships & Teaching

4.1 Introduction

A core driver of the GHL 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 GHL 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 GHL 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
- Social environments and health
- Physical environments and health
- 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

Briony Fanslow started the newly developed Master programme "Master of Spatial Analysis for Public Health".

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

4.3 Current PhD Students

Jesse Wiki (commenced March 2016) (GeoHealth scholarship) – ongoing.

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.

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

4.4 Master of Spatial Analysis for Public Health (MSAPH)

Dr Malcolm Campbell is currently the Programme Director for this new Masters programme designed in consultation with the MoH and to help to increase geospatial capability and capacity in New Zealand. One student is enrolled in the first year of the program. Also, a course on GIS and Health (GISC411) is supported by the GHL as part of this programme.

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5. GeoHealth Laboratory Promotion

5.1 Conferences and other presentations

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

Lakerveld, J., Mackenbach, J., Pinho, G., **Hobbs, M.,** and Thornton, L. (2018). Symposium title: addressing methodological challenges in research on upstream determinants of lifestyle behaviours. Presentation title: Associations between the physical environment and change in obesity: a longitudinal study and latent class analysis approach. International Society for Behaviour Nutrition and Physical Activity 2018. Hong Kong, 5th June 2018.

Hobbs, M. (2018). The environment, health, obesity and big data. University of Canterbury Geography Seminar. University of Canterbury, September 2018.

Collins, P., **Hobbs, M.,** Zwolinsky, S. (2018). A longitudinal study exploring the social and built environmental influences on children's physical activity during the transition from primary to secondary school. International Society for Physical Activity and Health 2018. London.

Hobbs, M., Griffiths, C., Green, M, A., Lamb, K., Wilkins, E., and McKenna, J. (2018). Associations between the food environment, body mass index and obesity: a longitudinal study. International Society for Behaviour Nutrition and Physical Activity 2018. (Oral Presentation) Hong Kong, 6th June 2018.

Campbell MH., Marek L., Curl A. and **Kingham S**. (2017). Towards a more dynamic health geography. Tracking and tracing daily movement and exposure. Angers, France: International Medical Geography Symposium, 2-7 Jul 2017.

Donnellan N., Kingham SP. and **Campbell M**. (2017). Assessing the built environment for active transport, physical activity and health outcomes using Kernel density estimation. Angers, France: International Medical Geography Symposium, 3-6 Jul 2017.

Marek L., Campbell MH., Epton M., **Kingham S**. and Storer M. (2017). Winter is coming: An environmental monitoring and spatio-temporal modelling approach for better understanding of respiratory disease (COPD). Angers, France: International Medical Geography Symposium (IMGS 2017), 2-7 Jul 2017.

Tomintz MN., and **Campbell MH**. (2017). Where are New Zealand's smokers? Filling the gaps of Census smoking data using spatial microsimulation algorithms. Angers, France: International Medical Geography Symposium 2017, 3-7 Jul 2017.

Wiki J., Kingham SP., Campbell M. and **Beere P**. (2017). A geographic analysis of the built environment, obesity and diabetes in New Zealand. Angers, France: International Medical Geography Symposium, 3-6 Jul 2017.

Kingham S, Banwell K, Dionisio McHugh M and **Wiki J. (**2017). Benefits of and barriers to creating healthy and active urban environments. Active Living and Environment: Towards a Healthier and More Sustainable Future. University of Otago, Dunedin, New Zealand, 28-30 August 2017.

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5.2 Web page

A comprehensive set of web pages outlining the GHL activities are available and are regularly updated by GHL staff.

For a link to the Laboratory's web page, see www.geohealth.canterbury.ac.nz/. The site:

- Outlines the aims and objectives for the GHL
- Gives an overview of GHL activities
- Provides details of the various GHL 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 Social media

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

5.4 The 4th Annual Geospatial Symposium

Our 4th Annual Geospatial Symposium is scheduled for July 2018 and will therefore be included in the next year's annual report. The main aim of the annual geospatial symposium is to present GHL research to attendees, mainly from the public sector, to strengthen existing collaborations and to build new ones.

6. Plans for 2018-19

The GHL was evaluated and received another three years of funding. For the next three years, a new work model will be implemented and changes include staff, as well as the collaboration between the MoH and the GHL. The Director and Deputy Director will also aim to further increase their network of contacts and raise awareness of the GHL particularly across the health sector, staff are also encouraged to do so.

Staff:

Leadership: Prof. Simon Kingham is the Director of the Lab and Dr Malcolm Campbell will be the Deputy Director.

Research Manager: Dr Melanie Tomintz went through the interview process and was appointed as research manager in November 2018.

Postdocs: Two postdoctoral research positions will continue with the GHL.

Scholarships: Four thesis scholarships will be available to award to successful students.

New work model:

The projects for the coming year are designed together with key persons from the MoH to meet and approach most significant health issues and problems, and support these with spatial data analysis and visualisation. All projects outlined in section 6.1 "Research" are scheduled for shorter time periods (between 3 and 12 months) to encourage active communication and engagement with the MoH.

6.1 Research

For the time period 2018/19, six research projects were shortlisted between the MoH and the GHL. These projects are listed below:

Project One: Immunisation

Immunisation is a simple, safe and effective way of protecting people against harmful diseases. The rate of childhood immunisation has increased over time and are now declining. Will targeted interventions be effective in raising the immunisation rate and reducing inequities?

This project aims to inform the Government's priority on improving child well-being. We will analyse the group of children that are not immunised with those that are. We are planning to identify changes and trends over time and space. The results should lead to the identification of groups of children and the areas they live in. This will show locations that will benefit from targeted interventions.

Project Two: Maternity

Birth rates across New Zealand are not uniform. The provision of midwifery services is not necessarily aligned with birth rates. This can lead to women not having access to appropriate and local care during a pregnancy. Hence, this can have an impact on future child well-being.

This project will use spatial-temporal analysis to explore maternity health outcomes. Also, in what areas do pregnant woman have difficulty accessing maternity care services? And how do the economic, environmental and social factors differ for those that have difficulty?

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This project will contribute to the governments' key priority on improving child well-being and reducing equity. This is done by highlighting the impact of women having timely access to maternity care services.

Project Three: IDI (Integrated Data Infrastructure)

This project will determine how where you live and your movement frequency affect life for the people of Lakes DHB. We will focus on Primary Health Organisations (PHO) enrolment, service access/community support, and LTC outcomes/quality of life.

One of the project's focuses is the identification of people with limited or irregular interaction with the health services. Reasons such as low-engagement, non-enrolment or transience can play a part. We will also try to identify possible barriers limiting the access to services.

Project Four: Avoidable Hospitalisation

Better access to primary care might lead to a reduction in potentially avoidable hospitalisations (PAH). From 2007, the Ministry of Health identified reducing ASH among children aged 0–4 years in New Zealand as a priority. ASH conditions include, for example, respiratory infections, dental conditions and asthma.

ASH accounts for approximately 30% of all acute and arranged medical and surgical discharges each year. This figure applies to New Zealand children.

A better understanding of ASH rates in relation to healthcare facilities may help inform policy. We will break this down by area-level deprivation, urban classification and ethnicity.

The project results will be of interest for the Ministry of Health contacts. This includes the general managers, the clinical groups, and the stakeholders. As well as everyone involved in the delivery of services.

Project Five: Obesity

In New Zealand, the child obesity rate increased from 8% in 2006/07 to 12% in 2016/17. The lifetime cost of obesity is difficult to estimate. Child obesity places a significant burden on health care systems, families, and employers. Non-communicable diseases, for example, showed to impair an individual's lifetime educational attainment.

It is difficult to see obesity declining when living in built environments that actively encourage weight gain.

Some of these upstream factors, for example the design of the built environment, are not in the control of a child. Therefore it cannot be seen as a result of lifestyle choices by a child.

Previous studies rarely considered aspects of the environment alongside parental risk factors.

This project will investigate the risk of childhood obesity. We are investigating the relationship between the built environment and the parental characteristics. The analysis uses pooled New Zealand Health Survey data.

Project Six: Active Transport

This project will assist the Protection Regulation and Assurance business unit. We aim to provide statistical information for the physical activity guidelines and justification. This can provide advice on the importance of physical activity to other agencies and Ministers.

6.2 Scholarships

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

We have one PhD scholarship and four scholarship for the MSAPH to award.

6.3 Training

There are several undergraduate and postgraduate GIS courses offered by the Department of Geography at University of Canterbury, and one undergraduate (GEOG325) and one graduate course in Health Geography (GEOG401). 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). The MGIS has been replaced with the Professional Master of Geospatial Science and Technology (PMGST), from 2018.

A new designed Master programme called "Masters of Geospatial Analysis for Public Health" is submitted for accreditation and planned to start in February 2018.

6.4 GeoHealth Laboratory office and equipment

GeoHealth Laboratory office

The GHL office space provides eight workstations, which are given priority to GHL staff and students. If capacity is available, the lab can also be used by research visitors, affiliated staff and students.

We are also planning to purchase a conference webcam tool to improve the online communication with MoH stakeholders and outreach. The equipment is portable and can be easily used in different meeting rooms.

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.

It was decided to review the current data storage process and to potentially update it with a more suitable solution for the lab.

6.5 Promotion through conferences and seminars

Below is a list of our planned conference attendance for 2018/19 to disseminate and present GeoHealth related research (*not* all funded by the GeoHealth contract) and to explore possible future collaborations:

- 4th Annual Geospatial Symposium at the Ministry of Health, around July 2018
- International Society for Behaviour, Nutrition and Physical Activity, Hong Kong, 2018
- NZGS/IAG (New Zealand Geographical Society/Australian Geographers) conference, University of Auckland, July 2018
- 5th Annual Geospatial Symposium at the Ministry of Health, around April 2019
- International Medical Geography Symposium, June/July 2019

Due to the new work model between the MoH and GHL, a strong focus is to present project results to selected people at the Ministry, and later to a wider audience.

Appendix A: Previous GeoHealth Laboratory Research Students

Masters Thesis students (in ascending order)

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, then 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 then as 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 joined a 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. After that he became a GIS Analyst and Coordinator at Colorado State University and worked then at DigitalGlobe for five years. Currently Paul is employed by the National Snow and Ice Data Center at the University of Colorado Boulder as a GIS and Remote Sensing Specialist.

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 got a job 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 got job working for the Appian Group in Sydney.

Chris Bowie (completed May 2011) (GeoHealth scholarship)
Title: [Socioeconomic inequalities in adolescent smoking behaviour and neighbourhood access to tobacco product](#)s.
After working in the GeoHealth Lab Chris got a job OPUS International Consultants.

Matt Willoughby (completed May 2012) (GeoHealth scholarship)
Title: Neighbourhood level impact of crime on community health outcomes.
Matt got a post 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 got a job working in Blenheim as a GIS professional.

Daniel Nutsford (completed February 2014) (GeoHealth scholarship)
Title: Natural urban environments and their influence on mental health: A New Zealand Case Study
Daniel spent time working in London as a GIS professional, then returned to NZ for a job for Interpret in Auckland.

Jayden MacRae (completed March 2014)
Title: Using a natural experiment to assess the effect of spatial barriers on health service utilization.
Jayden was 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 worked as 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
Andreas got a post at Christchurch City Council.

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 worked as a GIS analyst on an HRC funded project.

Kirsten Curry (completed August 2016) (GeoHealth scholarship)
Title: An exploration of the effects of roads and traffic on mental health in Auckland, New Zealand.
Kirsty got a post working as an analyst for PwC New Zealand.

PhD students (in ascending order)

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; then 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 went to work 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 went to work 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 returned to Germany to a job in the geospatial industry.

Niamh Donnellan (completed 2016) (GeoHealth scholarship)
Title: A geospatial approach to measuring the built environment for active transport, physical activity and health outcomes.
Niamh got a post as Postdoctoral Research Fellow at the University of Auckland.

Alison Watkins (completed 2018) (GeoHealth scholarship)

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

Alison is currently working as a research assistant at the University of Canterbury.