



Geography of Health and GIS Analysis (GoH) Research Group, Dec 2021

Subgroup description: Housed at the O'Brien Institute for Public Health, the Geography of Health and GIS (geographic information systems) Analysis Research Group studies the relationships between health and place and the interactions of people and the environment to better understand spatial patterns and diffusion of disease, environmental exposures, and accessibility of health-care services to identify risks and ultimately improve health and care delivery.

The Geography of Health and GIS Analysis Research Group serves as a hub to connect geographical expertise with health research and practice, enhance spatial literacy and expand the use of GIS for better decision making in health-care delivery throughout Alberta.

A) People

1. Current number of members:

There are approximately 40 – 50 members. There have been about 5 additions every year, but members also come and go (e.g., students). Overall, the number has been relatively stable.

2. Thought leaders of your subgroup:

There are three co-leads of this group: Dr. Stefania Bertazon (U of C Geography Department), Dr. Alka Patel (Alberta Health Services and Department of Community Health Sciences), and Dr. Rizwan Shahid (Alberta Health Services and Department of Geography). Dr. Nigel Waters is also a key thought leader within this group.

3. Member 'phenotypes' and approximate numbers (eg., trainees, community partners, affiliations):

Our membership spans members of the Department of Community Health Sciences, Medicine, Geography, Veterinary Medicine as well as employees of Alberta Health Services. Students and trainees are a variable, yet significant portion of the membership.

4. How new members find your subgroup (eg. website, active recruitment, events, word-of-mouth):

Our group is contacted primarily through the OIPH website (<https://obrieniph.ucalgary.ca/groups/geography-health-and-gis>) and through word of mouth. There is active recruitment of students by current group members. Word of mouth is particularly effective across Institute members. It continues to be a key mechanism to expand membership and fulfill our group mandate, i.e., a hub providing a connection between demand and supply of geographic expertise in health applications. An eloquent recent example of this mechanism is our collaboration on a pediatric concussion project, where Dr. J. Zwicker approached our group leaders stating "[...] One aspect we would like to incorporate is GIS mapping and analysis of concussion and other head injury diagnosis, given there are some differences across the province (particularly rural/ urban) [...]". That approach resulted in a collaboration that yielded, so far, a mentored student (see appendix) and a submitted paper.

5. Gaps in membership that subgroup wants to fill:

Currently we do not perceive any major gaps in our group membership.

B) Activities

6. Events/activities of your subgroup:

a. Previously (since 2019):

September 22, 2021: Forest Fires, Trends, Fire Risk, Challenges, and Wildfire Smoke Prediction. One Health Circle Seminar, by Dr. Mojgan Mirzaei

March 26, 2021: Modern Health GIS – Supporting the spectrum from understanding to action, with Dr. Este Geraghty (Dr. Geraghty is the Chief Medical Officer and Health Solutions Director at Esri, the world leading GIS software company)

November 18, 2020: Health GIS Day: Spatial Thinking in Applied Research (GIS Day has been celebrated annually around the world since 1999, usually on the third Wednesday of November)

May 13, 2020: S. Bertazzon, 2020, Place matters: a geospatial analysis of COVID-19 diffusion. O'Brien Institute for Public Health COVID-19 video series.
<https://www.youtube.com/watch?v=w2slgcPOBWI>

May 8, 2020: Mathematical Modelling of Infectious Disease Epidemics using the Gridded Population of the World (GPW), with Dr. Ashok Krishnamurthy

January 18, 2019: [Ethics in GIS, with Natalie Ludlow](#)

b. Planned:

November 2022: Health GIS Day (November 16th, 2022)

TBD – IPH seminar series talks

7. Method and frequency of subgroup communications:

In addition to the planned events within the GoH group, before Covid-19, we meet quarterly in person to communicate on upcoming research opportunities and updates on current work. During Covid-19, our core group continued to meet virtually quarterly. During these meetings we also discuss suggestions for future events. Throughout the year we communicate with our group on potential conferences and workshops of interest that are occurring internationally. With the hope things continue to open in 2022, we would potentially like to have some in person meeting, and we are currently planning an in-person GIS Day on November 16th, 2022.

8. Academic outputs and societal impacts leveraged by subgroup:

There have been several academic papers, posters and presentations that have been produced collectively by members of the subgroup (see Appendix for details).

Our GIS Day event involves members of the industry, government and University creating an environment of creative exchange of ideas and potential for creating new relationships.

Collaboration across our group members continued to result in community outreach and knowledge translation (e.g., Air Quality Management Committee; participation in PD Day teacher education), with recurring appearances on local news and GIS blogs. For the second time, group members were successful in ESRI Canada (GIS software market leader) map contest, which resulted in group work being featured on a monthly page of ESRI calendar, both in its physical and on-line versions. (See Appendix for details).

Group members continue to collaborate to provide supervisions and mentorship to students and trainees across Faculties and departments, whose work employs GIS and other geographical tools and concepts in

health applications. The GoH group was also instrumental in developing the relationships that led to a successful fellowship application. This CIHR Health System Impact Post-doctoral Fellowship (2021-2023) for Xiaoxiao Liu, is jointly supervised by Dr. Deborah Marshall (CHS) and Dr. Alka Patel (AHS). (See Appendix for details)

GOH member Richard Wong initiated collaborations with MSF (Doctors without borders) and Canadian Red Cross on mapping projects. Richard is also VP Trainee with One Health at UCalgary: in this capacity he facilitated collaborations, which resulted in the seminar conducted by Dr. Mirzaei and Canadian Affordable Water Sanitation Technology (CAWST).

As a result of GOH networking, GOH member Dr. Isabelle Couloigner has become a researcher with the department of Ecosystems and Public Health working on a PHAC project lead by BC CDC on Tick-Borne Diseases and Climate Change where she is part of the modelling group, which yielded publications and outreach items in appendix

GOH members Drs. Shahid and Bertazon are engaged in collaboration with WHO Health Emergencies Programme, Africa Region. Current talks are expected to result in structured student participation in public health mapping and spatial analysis.

C) Operations

9. Administrative human resources for your subgroup:

There are no dedicated HR resources for this subgroup.

10. O'Brien human resources upon which your subgroup relies:

We rely heavily on OIPH resources for general administrative and communication tasks. In the past year Jamie Day, Marie-Claude Proulx, and Liz Lai (in addition to others) have provided support to our group in terms of setting up events and helping us build our group communications (pamphlet and webpage). We would require the continued support of OIPH to update our webpage as events are added. In the past, the \$2000 fund that supports our group allows us to hold larger in person events such as GIS day or support invited speakers (travel, accommodation, etc.). In this reporting period, we have not used our funds since all activities were conducted virtually.

11. Entities other than O'Brien Institute supporting subgroup, and type of support (eg. financial, HR, etc):

Applied Research and Evaluation Services (AHS) provides additional administrative and in-kind support of resources as needed. There are several students from the Department of Geography who also provide in kind support as needed to help support group events. On occasion, the Department of Geography has provided additional in-kind support, e.g., logistical support for GIS workshops and illustration/cartography/printing assistance and support for posters and banners of GIS day events. Sadly, we anticipate that this precious support will not be available in future due to the recent University budget cuts, that implied severe losses of technical support, most notably in cartography and GIS.

12. Approximate yearly expenditures of subgroup:

Since its inception we have not extended beyond our allotted budget of \$2000/year. In the future, if we were to invite higher profile international speakers to OIPH, we may require additional funds.

13. Other

No specific questions or advice at this time. We are very appreciative of the support we receive from OIPH to maintain this research sub-group. We have received informal feedback from our members that they find value in having a group that brings together minds from across different organizations with an interest in Health Geography. We hope to maintain and grow this group based on the needs of the membership.

APPENDIX

Publications:

- Marshall D., X. Liu, S. Bertazzon, A. Patel, D. Mosher, J. Homik, S. Katz, C. Smith, J. Robert, C. Barber (2021) Geographic variation in the prevalence of rheumatoid arthritis in Alberta Canada. *ACR Open Rheumatology*. 3(5): 324-332. <http://doi.org/10.1002/acr2.11251>
- Mirzaei M., S. Bertazzon, I. Couloigner, B. Farjad (2021) Assessing the potential of Artificial Intelligence (Artificial Neural Networks) in predicting the Spatiotemporal pattern of Wildfire-generated PM2.5 Concentration, *Geomatics.*, 2021(1):18-33. <https://doi.org/10.3390/geomatics1010003>
- Bertazzon S., I. Couloigner, M. Mirzaei (2021) Spatial Regression Modelling of Particulate Pollution in Calgary, Canada. *GeoJournal*. Published online: 05 January 2021. [10.1007/s10708-020-10345-7](https://doi.org/10.1007/s10708-020-10345-7)
- Liu X., R. Shahid, A.B. Patel, T. McDonald, S. Bertazzon, N. Waters, J.E. Seidel, D.A. Marshall (2020). Geographic variation in comorbidities among people with osteoarthritis along the rural-urban continuum. *BMC Public Health* 20, 1551 (16 pages) <https://doi.org/10.1186/s12889-020-09599-0>
- Liu X., S. Bertazzon, P. J. Villeneuve, M. Johnson, D. Stieb, S. Coward, D. Tanyingoh, J. W. Windsor, F. Underwood, M. D. Hill, D. Rabi, W. A. Ghali, S. B. Wilton, M. T. James, M. Graham, M. S. McMurtry, G. G. Kaplan (2020). Temporal and spatial effect of air pollution on hospital admissions for myocardial infarction: a case-crossover study. *CMAJ Open*, 8(4) (8 pages). DOI:10.9778/cmajo.20190160
- Bertazzon S., C. Calder-Bellamy, R. Shahid, I. Couloigner, R. Wong (2020). A Preliminary Spatial Analysis of the Association of Asthma and Traffic Related Air Pollution in the Metropolitan Area of Calgary, Canada. *Atmosphere*, 11 (10), 1066 (14 pages) Special Issue "Traffic-Related Air Pollution and Its Impacts on Human Health". doi:10.3390/atmos11101066
- Mirzaei M., S. Bertazzon, I. Couloigner, B. Farjad, R. Ngom, 2020. Estimation of Local Daily PM2.5 Concentration during Wildfire Episodes: Integrating MODIS AOD with Multivariate Linear Mixed Effect (LME) Models. *Air Quality, Atmosphere & Health*, 13:173-185. <https://doi.org/10.1007/s11869-019-00780-y>
- Bertazzon S., I. Couloigner, F. Underwood, 2019. Spatial land use regression of nitrogen dioxide over a 5-year interval in Calgary, Canada. *International Journal of Geographical Information Science*, 33(7):1335-1354 DOI: <https://doi.org/10.1080/13658816.2019.1578885>
- Marshall D., X. Liu, R. Shahid, S. Bertazzon, J. Seidel, A. Patel, M. Nasr, C. Barber, T. McDonald, R. Sharma, T. Briggs, P. Faris, N. Waters, 2019. Geographic Variation in Osteoarthritis Prevalence in Alberta: A Spatial Analysis Approach. *Applied Geography*.103:112-121. doi.org/10.1016/j.apgeog.2019.01.004
- F. Underwood, S. Bertazzon, 2020. The Impacts of Climate Change on Health and Development in Canadian Arctic and Sub-arctic Communities in the Twenty-First Century: A Systematic Review. In: Akhtar R. (ed.) *Extreme Weather Events and Human Health*. Springer, Cham. 27-40. doi.org/10.1007/978-3-030-23773-8. Print ISBN 978-3-030-23772-1. Online ISBN 978-3-030-23773-8
- R. Shahid & S. Bertazzon, 2019. Local Spatial Analysis and Dynamic Simulation of Childhood Obesity and Neighbourhood Walkability in a Major Canadian City. In Garcia, Juan Martin, ed. *Modeling and Simulation of Healthcare Systems. Selected Papers on System Dynamics Collection*. KDP Publishers. 30-42. ISBN: 9781687006745

- X. Liu, R. Shahid, S. Bertazzon, N. Waters, A.B. Patel, C. EH. Barber, P. Faris, T. McDonald, J.E. Seidel, R. Sharma, T. Briggles, D.A. Marshall, 2019. Exploratory spatial analysis of comorbidities prevalence in people with osteoarthritis. Proceedings of the 7th Conference on Spatial Knowledge and Information Canada (SKI2019), Volume 2323. Banff, Alberta, Canada, February 22-23, CEUR-WS.org, online CEUR-WS.org/Vol-2323/SKI-Canada-2019-7-7-2.pdf
- M. Mirzaei, S. Bertazzon, and I. Couloigner, 2019, OLS and GWR LUR models of wildfire smoke using remote sensing and spatiotemporal data in Alberta. Proceedings of the 7th Conference on Spatial Knowledge and Information Canada (SKI2019), Volume 2323. Banff, Alberta, Canada, February 22-23, CEUR-WS.org, online CEUR-WS.org/Vol-2323/SKI-Canada-2019-7-7-3.pdf.
- N. Waters, 2020, Motivations and Methods for Replication in Geography: Working with Data Streams, Annals of the American Association of Geographers, vol. 110, online first. DOI: 10.1080/24694452.2020.1806027
- M. Gentili, N. Waters, M. I. Tubbs, M. I. and D. E. Nicholas, 2019, Volunteered Geographic Service: Planning a Senior Shuttle Service Using GIS and OR. In Analytics, Operations, and Strategic Decision Making in the Public Sector (pp. 1-19). IGI Global.
- G. Cervone, J. Dallmeyer, A. D., Lattner, P. Franzese, and N. Waters 2019, Coupling Traffic and Gas Dispersion Simulation for Atmospheric Pollution Estimation, Ch2., pp.13-32, in CyberGIS for Geospatial Discovery and Innovation. S.Wang/Goodchild,M.F. (eds) Springer Nature, NY
- N. Waters, 2019, History of GIS (Revised). In: Richardson, D., Castree, N., Goodchild, M. F., Kobayashi, A., Liu, W. and Marston, R. (Eds.), International Encyclopedia of Geography: People, the Earth, Environment, and Technology. Wiley: New York.
- N. Waters, 2019, Tobler's First Law of Geography (Revised). In: Richardson, D., Castree, N., Goodchild, M. F., Kobayashi, A., Liu, W. and Marston, R. (Eds.), International Encyclopedia of Geography: People, the Earth, Environment, and Technology. Wiley: New York.
- Namgyal J, Couloigner I, Lysyk TJ, Dergousoff SJ, Cork SC. Comparison of Habitat Suitability Models for *Haemaphysalis longicornis* Neumann in North America to Determine Its Potential Geographic Range. International Journal of Environmental Research and Public Health. 2020; 17(21):8285.

GISday papers:

https://obrieniph.ucalgary.ca/news-and-events/obrien-institute-events#!view/event/event_id/143419

Maps:

- A. Khakh, V. Saini, R. Shahid, 2020, Community Crime Counts Mapping with Social Deprivation Index: City of Calgary, *Esri Canada Calendar 2020*, Map featured in the printed calendar for the month of November
- R. Shahid & S. Bertazzon, 2019, *Active Transportation and Air Pollution: Healthy Commute & Playground Use at Calgary Schools*. One of 12 finalists in Esri Canada Map Calendar Contest. *Esri Canada Calendar 2019*, Map featured in the printed calendar for the month of September. <https://resources.esri.ca/map-gallery/active-transportation-and-air-pollution-healthy-commute-playground-use-at-calgary-schools>.

Community outreach:

- Inside Education. Teacher Professional Development Program: Air Quality and Climate Change Panel presentation: Learn about current research examining air quality, pollution, and even schools in Calgary. Calgary Region Airshed Zone, Air quality management committee
- "Modelling the spread of ticks and tick-borne pathogens" with Drs. Olivia Tardy and Isabelle Couloigner. Winter CLyDRN Training Advisory Committee Webinar, March 25th, 2021.
- Case study": 'The relentless march of a tiny monster'. [20th Annual BC One Health and Zoonoses Symposium, November 24th, 2021.](#)

Media:

- E. Ward, Calgary researchers reaching for the sky with air quality study. *Livewire Calgary*, June 23, 2021. <https://livewirecalgary.com/2021/06/23/calgary-researchers-reaching-for-the-sky-with-air-quality-study/>
- Z. Syeda, There's something in the air. UCalgary researchers study air quality across Calgary and its effects on health. *UToday*, June 11, 2021. https://ucalgary.ca/news/theres-something-air?mkt_tok=MTYxLU9MTi05OTAAAF9mo8-hd2GJVW5naok0npXu6Zs8uVt7j0wzUXHRsHnvi1_wrzxKL8ctbKGYv3wxOvgz5SCiZiseQQLq56LOH2LPPwGbFipRx2Tt98MSU1puJ_33g

Students and trainees:

POST-DOCTORAL	Xiaoxiao Liu, September 2021 – present. Identifying service gaps between primary and specialty care for patients with rheumatoid arthritis - improving access to care.
	Mojgan Mirzaei, December 2020–present. Environmental monitoring and land-use change.
DOCTORAL	M. Mirzaei, March 2020. <i>Multiscale Spatial and Temporal Modelling of Fine Particulate Matter (PM_{2.5}) from Wildfire Smoke Using Remote Sensing and Statistical Methods.</i>
MASTERS: THESIS-BASED (MSc & MA)	K. Wittevrongel, 2021, Longitudinal Trends in Incidence and Health Care Use for Pediatric Concussion in Alberta, Canada
'MASTERS: COURSE-BASED (MGIS)	Shubhreet Gill, April 2021–present. Health Geography.
	Richard Wong, May 2020–present. Health Geography.
UNDERGRADUATE	Caitlin Calder-Bellamy, May 2020–present. Air quality and pediatric asthma.
DOCTORAL SUPERVISORY COMMITTEES	S. Lee, June 2017–present. Impact of disease-specific pregnancy clinics on maternal and perinatal outcomes. Faculty of Medicine, Department of Community Health Sciences. Supervisor: A. Metcalfe.
	S. A. Sayed, November 2016–present. Spatial distribution of cervical cancer screening. Faculty of Medicine, Department of Community Health Sciences. Supervisor: J. Dickinson.

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