# SAHIR RAI BHATNAGAR

Lady Davis Institute for Medical Research
H483, Clinical Epidemiology, Montréal, QC, H3T 1E2

Email: sahir.bhatnagar@mail.mcgill.ca
Website: http://sahirbhatnagar.com/

## EDUCATION

| | |
|---|---|
| 2013–2018 (*expected*) | **Ph.D. (Biostatistics)**<br>McGill University, Montreal QC, Canada<br>*Advisors:* Dr. Celia Greenwood and Dr. Yi Yang<br>Queen Elizabeth Scholar |
| 2012–2013 | **Master of Science (Biostatistics)**<br>Queen's University, Kingston ON, Canada<br>*Advisors:* Dr. Paul Peng and Dr. Devon Lin<br>*Committee Members:* Dr. Dongsheng Tu and Dr. Wenyu Jiang |
| 2011 | **Associate of the Society of Actuaries** |
| 2005–2008 | **Bachelor of Science (Actuarial Mathematics)**<br>Concordia University, Montreal QC, Canada |

## RESEARCH INTERESTS

Dimension reduction for predictive models, high-dimensional statistical inference, penalized regression, interaction selection, statistical genetics and genomics

## PUBLICATIONS

### PUBLISHED ARTICLES

1. Steinberg J, Brooks R, Southam L, Bhatnagar SR, Roumeliotis T, Hatzikotoulas K, Zengini E, Wilkinson JM, Choudhary J, McCaskie AW, Zeggini E (2018). Widespread Epigenomic, Transcriptomic and Proteomic Differences Between Hip Osteophytic and Articular Chondrocytes in Osteoarthritis. *Rheumatology*. Accepted (2018/02).

2. Bhatnagar SR, Yang Y, Khundrakpam B, Evans A, Blanchette M, Bouchard L, Greenwood CMT (2017). An analytic approach for interpretable predictive models in high dimensional data, in the presence of interactions with exposures. *Genetic Epidemiology*. Apr 1;42(3):233-49. DOI 10.1101/102475.

3. Klein Oros K, Oualkacha K, Lafond M, Bhatnagar SR, Tonin PN, Greenwood CMT (2016). Gene co-expression analyses differentiate networks associated with diverse cancers harbouring TP53 missense or null mutations. *Frontiers in Genetics, section Statistical Genetics and Methodology*. Aug 3;7:137. DOI 10.3389/fgene.2016.00137

[1] Updated March 26, 2018

4. Sun J., Bhatnagar SR, Oualkacha K, Ciampi A, Greenwood CMT (2016) Joint analysis of multiple blood pressure phenotypes in GAW19 data by using a multivariate rare-variant association test. *BMC Proceedings*. 2016, 10(Suppl 7):14. DOI 10.1186/s12919-016-0048-3

5. Bhatnagar SR, Greenwood CMT, Labbe A (2016) Assessing transmission ratio distortion in extended families: a comparison of analysis methods. *BMC Proceedings*. 2016, 10(Suppl 7):12. DOI 10.1186/s12919-016-0030-0

6. Wang Y, Murphy O, Turgeon M, Wang ZY, Bhatnagar SR, Schulz J, and Moodie EEM (2015) The perils of Quasi-likelihood Information Criteria. *Stat*. Feb 1;4(1):246-54. DOI: 10.1002/sta4.95

7. Bhatnagar SR, Atherton J, Benedetti A (2015). Comparing alternating logistic regressions to other approaches to modelling correlated binary data. *Journal of Statistical Computation and Simulation*. Jul 3;85(10):2059-71. DOI 10.1080/00949655.2014.916707

## Papers Under Review

1. Garfinkle R, Abou-Khalil M, Bhatnagar SR, Wong-Chong N, Azoulay L, Morin N, Vasilevsky CA, Boutros M. A Comparison of Open, Laparoscopic, and Robotic Resections for Rectal Cancer Using the ACS-NSQIP Proctectomy-Targeted Database: A Propensity Score Analysis. *Annals of Surgery*. Submitted (2017/11).

2. Abou Khalil M, Bhatnagar SR, Vasilevsky CA, Morin N, Ghitulescu G, Feldman L, Longtin Y, Boutros M (2017). Development and validation of a clinical risk calculator for fulminant Clostridium difficile colitis. *Annals of Surgery*. Submitted (2017/11).

3. Nadig A, Flanagan T, White K, Bhatnagar SR (2017). Results of a RCT on a transition support program for adults with ASD: Effects on Self Determination and Quality of Life. *Autism Research*. Revision requested (2017/11).

4. Kronfli N, Bhatnagar SR, Moodie EEM, Hull MW, Klein MB, for the Canadian Co-infection Cohort Investigators (2017). The early effects of hepatitis C (HCV) treatment on trends in cause-specific mortality in HIV-HCV co-infection. *Clinical Infectious Diseases*. Submitted (2017/08).

5. Hamadani FT, Bhatnagar SR, Balvardi S, Trepanier M, Grushka J, Deckelbaum D, Court O, Fata P (2016). Burnout and Career Satisfaction Among Canadian General Surgeons: Results of the CAGS National Burnout Study. *Canadian Journal of Surgery*. Submitted (2016/08).

## Papers in Preparation

1. Bhatnagar SR, Oualkacha K, Yang Y, Greenwood CMT (2018+). A General Framework for Variable Selection in Linear Mixed Models with Applications to Genetic Studies with Structured Populations.

2. Bhatnagar SR, Yang Y, Greenwood CMT (2018+). Variable Selection in Nonlinear Interactions with the Group Lasso.

3. Bhatnagar SR*, Turgeon M*, Yang Y, Hanley JA, Saarela O (2018+). casebase: An Alternative Framework for Survival Analysis. (*co-first author)

4. Bhatnagar S, Guillemette J, Dugdale M, Bhatnagar SR, Lasry N (2018+). Data Mining for Student Success and Perseverance. Technical Report for the Programmme d'Aide à la Recherche en Enseignment et Apprentissage (PAREA). preprint available at https://github.com/sameerbhatnagar/studentsuccess_finalreport/blob/master/docs/studentsuccess_final_report.pdf.

## SOFTWARE

1. Shiny Application **cdiff**: Interactive, online web application to guide preoperative decision making for patients with fulminant Clostridium difficile colitis (FCDC) being evaluated for surgery. This calculator predicts 30-day postoperative mortality for patients with FCDC based on easily attainable pre-operative parameters. [https://sahir.shinyapps.io/cdiff/]

2. R package **eclust**: Dimension reduction technique for analyzing interactions between a high dimensional dataset (e.g. genomics, brain imaging), the environment and a response.
[https://cran.r-project.org/package=eclust][http://sahirbhatnagar.com/eclust/][2046 downloads]

3. R package **casebase**: Fit smooth-in-time parametric hazard functions using case-base sampling. This approach allows the explicit inclusion of the time variable into the model, which enables the user to fit a wide class of parametric hazard functions.
[https://cran.r-project.org/package=casebase][http://sahirbhatnagar.com/casebase/][1172 downloads]

4. R package **manhattanly**: Create interactive Q-Q and manhattan plots that are usable from the R console, in the 'RStudio' viewer pane, in 'R Markdown' documents, and in 'Shiny' apps.
[https://cran.r-project.org/package=manhattanly][http://sahirbhatnagar.com/manhattanly/][5.5k downloads]

5. R package **ggmix**: Implementation of a linear mixed model with group lasso penalty as described in the paper 'A General Framework for Variable Selection in Linear Mixed Models with Applications to Genetic Studies with Structured Populations'
[https://github.com/sahirbhatnagar/ggmix]

6. R package **sail**: Non-linear interaction selection with the strong heredity property as described in the paper 'Variable Selection in Nonlinear Interactions with the Group Lasso'
[https://github.com/sahirbhatnagar/sail]

7. R package **gglasso**: A unified algorithm, blockwise-majorization-descent, for efficiently computing the solution paths of the group-lasso penalized least squares, logistic regression, Huberized SVM and squared SVM
[https://cran.r-project.org/package=gglasso][https://github.com/emeryyi/gglasso][16k downloads]

8. R package **acm4r**: Fragment lengths or molecular weights from pairs of lanes are compared, and a number of matching bands are calculated using the Align-and-Count Method
[https://cran.r-project.org/package=acm4r][13k downloads]

## TEACHING EXPERIENCE

### GRADUATE COURSE

| | |
|---|---|
| Fall 2017 | MATH697: Mathematical Statistics<br>Department of Mathematics and Statistics, McGill Univeristy<br>40 In-class hours<br>12 graduate students<br>Course Webpage: http://sahirbhatnagar.com/MATH697/ |

### SHORT COURSES AND TUTORIALS

| | |
|---|---|
| 2018/02/28 | Introduction to Regression Trees. MATH 680 - Computation Intensive Statistics. Department of Mathematics and Statistics, McGill University. |
| 2018/02/08 | Modèles d'arbres de régression. Mini-cours. Département de mathématiques et de statistique, Université Laval. |
| 2017/03/28 | Introduction to the R package `casebase` for fitting smooth-in-time prognostic risk functions for survival data and visualizing incidence density using population time plots. Guest lecturer for BIOS 602 - Epidemiology Regression Models II. Department of Epidemiology, Biostatistics and Occupational Health, McGill University. |
| 2016/05/21 | GitHub for Data Scientists without the Terminal: `http://sahirbhatnagar.com/git4ds/` |
| 2016/04/15 | Loops and Simulations in R. Department of Epidemiology, Biostatistics and Occupational Health, McGill University. Sponsored by Epidemiology, Biostatistics and Occupational Health Student Society (EBOSS). `http://www.sahirbhatnagar.com/biosR/` |
| 2016/03/23 | Introduction to the R package `casebase` for fitting smooth-in-time prognostic risk functions for survival data and visualizing incidence density using population time plots. Guest lecturer for BIOS 602 - Epidemiology Regression Models II. Department of Epidemiology, Biostatistics and Occupational Health, McGill University. |
| 2015/07/29 | Atelier sur le logiciel en R: Un introduction à la programmation en R. GERAD: Groupe d'études et de recherche en analyse, Université de Montréal. Sponsored by HEC Montréal. |
| 2015/05/28 | Reproducible Research: An introduction to `knitr`. Department of Epidemiology, Biostatistics and Occupational Health, McGill University. Sponsored by the CRM Statistics Laboratory and the Montreal Biostatistics Seminar Series. |
| 2013/05/13 | Introduction to LaTeX. Queen's University, Department of Mathematics and Statistics. |

### TEACHING ASSISTANT

| | |
|---|---|
| 2014 | Teaching Assistant, McGill University<br>Inferential Statistics (EPIB 607) |
| 2012–2013 | Teaching Assistant, Queen's University<br>Tutorial leader in calculus (MATH 121)<br>Term and exam marker for numerical methods and actuarial mathematics |

## AWARDS

| | |
|---|---|
| 2017 | UK Genetics Society Training Grant £1,000 |
| 2016 | McGill University and Genome Quebec Innovation Centre (MUGQIC) Travel Award $1,000 |

| | |
|---|---|
| 2016 | Graduate Research Enhancement and Travel (GREAT) Award $1,000 |
| 2016 | Quantitative Biology and Medical Genetics for the World Queen Elizabeth II Scholarship $6,000 |
| 2016 | Best Student Oral Presentation - 28th International Biometric Society Meeting |
| 2016 | SSC Biostatistics Section Travel Award $250 |
| 2015 | Best Poster Presentation - 4th Annual Canadian Human and Statistical Genetics Meeting $1,000 |
| 2014 | Genetic Analysis Workshop 19 Travel Award $1,000 |
| 2013 | McGill Graduate Excellence Award $18,000 |
| 2012 | MSc Queen's Graduate Studies Award $20,000 |

## PRESENTATIONS

* indicates the person that gave the presentation

### KEYNOTE ADDRESSES

| | |
|---|---|
| 2018/03/16 | Pick your favorite buzzword: Data Science, Big Data, Machine Learning, Data Science , Big Data, Machine Learning. 14th Annual McGill Epidemiology, Biostatistics and Occupational Health Research Day. |

### PRESENTATIONS AT UNIVERSITIES OR RESEARCH INSTITUTES (INVITED)

| | |
|---|---|
| 2018/03/01 | McGill University, Department of Epidemiology, Biostatistics and Occupational Health. Betting on Sparsity. |
| 2018/02/08 | Université Laval, Département de mathématiques et de statistique. Miser sur la sparsité. |
| 2017/12/18 | Université de Montréal, Département de mathématiques et de statistique. Miser sur la sparsité. |
| 2017/11/16 | HEC Montréal, Department of Decision Sciences. Betting on Sparsity. |

### CONTRIBUTED CONFERENCE PRESENTATIONS

| | |
|---|---|
| 2017/09/13 | Abou Khalil M*, Bhatnagar SR, Vasilevsky CA, Morin N, Ghitulescu G, Feldman L, Longtin Y, Boutros M: Development and validation of a clinical risk calculator for fulminant Clostridium difficile colitis. Resident Research Retreat, Canadian Surgical Forum, Victoria, British Columbia, Canada. |
| 2017/07/24 | Kronfli N*, Bhatnagar SR, Moodie EEM, Hull M, Klein MB: Trends in Cause-Specific Mortality in HIV-hepatitis C (HCV) co-infected patients in Canada (2003–2016): Possible Beneficial impact of HCV therapy. 9th IAS Conference on HIV Science, Paris, France. |
| 2017/06/12 | Bhatnagar SR*, Yang Y, Jolicoeur-Martineau A, Wazana A, Greenwood CMT: Variable Selection in Nonlinear Interactions with the Group Lasso. 45th Annual Meeting of the Statistical Society of Canada, Winnipeg, Canada. |
| 2016/11/18 | Bhatnagar SR: Genomic Visualisations for Biologists in R. Plotcon 2016, New York City, NY. YouTube video of presentation. |

2016/11/03 Bhatnagar SR*, Yang Y, Khundrakpam B, Evans A, Blanchette M, Bouchard L, Greenwood CMT: An analytic approach for interpretable predictive models in high dimensional data, in the presence of interactions with exposures. 25th Annual International Genetic Epidemiology Society Meeting, Toronto, Canada.

2016/09/09 Hamadani FT*, Bhatnagar SR, Balvardi S, Trepanier M, Grushka J, Deckelbaum D, Court O, Fata P: Burnout and Career Satisfaction Among Canadian General Surgeons: Results of the CAGS National Burnout Study. Canadian Surgery Forum, Toronto, Canada.

2016/07/10 Bhatnagar SR*, Yang Y, Blanchette M, Greenwood CMT: Strong Heredity Models in High Dimensional Data. 28th International Biometrics Conference, Victoria, Canada.

2016/04/18 Bhatnagar SR*, Yang Y, Blanchette M, Greenwood CMT: A Model for Interpretable High-Dimensional Interactions. 5th Annual Canadian Human and Statistical Genetics Meeting, Halifax, Canada.

2015/04/19 Bhatnagar SR*, Houde A, Voisin G, Bouchard L, Blanchette M, Greenwood CMT: DNA methylation and Expression to predict childhood obesity. 4th Annual Canadian Human and Statistical Genetics Meeting, Vancouver, Canada.

## Poster Presentations

2017/10/22 Abou Khalil M*, Bhatnagar SR, Vasilevsky CA, Morin N, Ghitulescu G, Feldman L, Longtin Y, Boutros M: A Nomogram for Prediction of Mortality in Patients who Undergo Surgery for Fulminant Clostridium Difficile Colitis: Results from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) Database. American College of Surgeons' 2017 Clinical Congress, San Diego, CA, USA.

2017/09/10 Bhatnagar SR*, Oualkacha K, Yang Y, Forest M, Greenwood CMT: Estimation for High-Dimensional Multivariate Linear Mixed Models in Structured Populations. 2017 International Genetic Epidemiology Society Meeting, Cambridge, UK.

2017/05/13 Nadig A*, Flanagan T, Bhatnagar SR, White K: Results of a RCT on a Transition Support Program for Adults with ASD: Effects on Quality of Life and Self-Determination. 2017 International Meeting for Autism Research, San Francisco, California, USA.

2016/05/12 Hull M*, Bhatnagar SR, Moodie EEM, Klein M: Trends in causes of mortality in the Canadian Co-infection cohort (CCC) 2005 – 2015. 25th Annual Canadian Conference on HIV/AIDS Research, Winnipeg, Canada.

2016/04/17 Bhatnagar SR*, Yang Y, Blanchette M, Greenwood CMT: A Model for Interpretable High Dimensional Interactions. 5th Annual Canadian Human and Statistical Genetics Meeting, Halifax, Canada.

2015/04/19 Bhatnagar SR*, Houde A, Voisin G, Bouchard L, Blanchette M, Greenwood CMT: Integrating DNA Methylation and Gene Expression data in Placenta Tissue to Predict Childhood Obesity. 4th Annual Canadian Human and Statistical Genetics Meeting, Vancouver, Canada. *$1,000 Award for Best Poster*

2014/08/24 Bhatnagar SR*, Greenwood CMT, Labbe A: Transmission Ratio Distorition in Extended Families. Genetic Analysis Workshop 19, Vienna, Austria.

2014/08/25 Sun J, Bhatnagar SR*, Oualkacha K, Ciampi A, Greenwood CMT: Joint analysis of multiple blood pressure phenotypes in GAW19 data by using a multivariate rare-variant association test. Genetic Analysis Workshop 19, Vienna, Austria.

2014/05/26 | Bhatnagar SR*, McGregor K*, Turgeon M*: Effect of economy on TV time use. 42nd Annual Meeting of the Statistical Society of Canada, Toronto, Ontario.

### SEMINAR PRESENTATIONS

2017/07/12 | Bhatnagar SR, Forest M, Keller-Baruch J: Statistics vs. Machine Learning: Why can't we be friends? Lady Davis Institute, Montreal Jewish General Hospital.

2016/05/19 | Bhatnagar SR: Methods for High Dimensional Interactions Ludmer Centre for Neuroinformatics and Mental Health, Montreal Neurological Institute.

2015/08/12 | Bhatnagar SR: Introduction to knitr and R Markdown. Montréal UseR Group, Notman House, Montréal.

2015/03/12 | Bhatnagar SR: Imputing the Epigenome. Lady Davis Institute, Montreal Jewish General Hospital.

2015/03/05 | Bhatnagar SR: Making sense of Methylation & Expression data in Cordblood and Placenta Tissues. Lady Davis Institute, Montreal Jewish General Hospital.

2014/04/07 | Bhatnagar SR: Estimation and Accuracy after Model Selection by Bradley Efron. Department of Mathematics and Statistics, McGill University.

2014/01/23 | Bhatnagar SR: Reproducible Research and Biostatistics. Biostatistics Reading Group, McGill University.

2014/08/07 | Bhatnagar SR*, Greenwood CMT, Labbe A: Transmission Ratio Distortion in Extended Families. Lady Davis Institute, Montreal Jewish General Hospital.

2013/08/30 | Bhatnagar SR: Absolute Risk Estimation in a Case Cohort Study of Prostate Cancer. Department of Mathematics and Statistics, Queen's University.

2013/03/06 | Bhatnagar SR: Colorectal Cancer Screening in Visible Minorities in Canada. Department of Public Health Sciences, Queen's University.

2012/11/27 | Bhatnagar SR: Computational Methods for the Case-Cohort Design. Department of Public Health Sciences, Queen's University.

## EXPERIENCE

2016 – | Data Science Blogger at Plotly

10/2016 – 03/2017 | Queen Elizabeth Scholar - Wellcome Trust Sanger Institute, UK.
Working with Dr. Eleftheria Zeggini on integration methods for methylation, transcription and protein expression data in osteoarthritis patients undergoing knee replacement surgery.

2015 – | Statistical Consultant, iMD Research

2012 – 2013 | Research Assistant, McGill University
Working with Dr. Andrea Benedetti in the Respiratory Epidemiology and Clinical Research Unit at McGill, where our research is focused on methods for correlated data, as well as developing an R package for the clustering of DNA fingerprint data

2008 – 2012 | Actuarial Analyst, Aon Hewitt

Preparation and verification of annual reports, financial reports, annual statements, valuation reports, budget projections, and pension costs for clients balance sheets. Responsible for translation of pension plan status to clients

## OTHER CONTRIBUTIONS

### REVIEWER OF JOURNAL ARTICLES

International Journal of Epidemiology

### ADMINISTRATIVE RESPONSIBILITIES AND COMMITTEES

2015– International Genetic Epidemiology Society Communications Committee Member

2014–2015 Post-Graduate Students' Society (PGSS) Councillor

### PROFESSIONAL ASSOCIATIONS

2011– Society of Actuaries

2013– Statistical Society of Canada

2016– International Genetic Epidemiology Society

### VOLUNTEER SERVICE

2010–Present Math Teacher, Aditya Youth Trust Fund
Teaching mathematics to a group of elementary and high school students who are financially under resourced. Motivate and inspire students to place a high value on education while promoting wholesome social involvement, and to encourage them to achieve their maximum potential

2011–2013 MAB - Mackay Rehabilitation Center
Working with elderly patients diagnosed with Retinitis Pigmentosa. Accompaniment to perform everyday tasks that would be difficult to do independently such as grocery shopping, banking transactions, and outdoor activities

# REFERENCES

**Celia M.T. Greenwood, PhD**
Senior Investigator
Centre for Clinical Epidemiology
Lady Davis Institute
Professor
Department of Epidemiology, Biostatistics and Occupational Health
Division of Cancer Epidemiology
McGill University
E-mail: celia.greenwood@mcgill.ca
Phone: 514-340-8222 x8397

**Yi Yang, PhD**
Assistant Professor
Department of Mathematics and Statistics
McGill University
Burnside Hall, Room 1240
805 Sherbrooke Street West
Montreal, Quebec, H3A 0B9
Email: yi.yang6@mcgill.ca
http://www.math.mcgill.ca/yyang

**Marylise Boutros, MD, FRCSC**
Colorectal Surgeon
Assistant Professor
Department of Surgery
McGill University
Jewish General Hospital
3755 Côte-Ste-Catherine Road
Montreal, Quebec, H3T 1E2
Email: mboutros@jgh.mcgill.ca
Phone: 514-340-8222 x28400