

# SPPH 604 Application of Advanced Epidemiological Methods, Syllabus w2022

## ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəyəm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

## COURSE INFORMATION

Course Title	Course Code Number	Credit Value
Application of Epidemiological Methods	<ul style="list-style-type: none"><li>• <b>Class:</b> SPPH 604 001 (<b>Tue 9 am - 12 pm</b>): Room SPPH 143</li><li>• <b>Lab:</b> SPPH 604 T01 (<b>Thu 10 am - 12 pm</b>): Room SPPH B104 <b>Lab is starting from 8<sup>th</sup> Sept, 2022</b></li></ul> Both in-person sessions.	3

## PREREQUISITES

- SPPH400 Statistics for Health Research, and
- SPPH500 Analytical Methods in Epidemiological Research, and
- SPPH502 Epidemiological Methods I, and
- one of the following: (i) SPPH503 Epidemiological Methods II, or (ii) SPPH506 Quantitative Research Methods, or (iii) SPPH519 Qualitative Methods for Health Research Design, or (iv) SPPH530 Epidemiology of Occupational and Environmental Health

Strongly encourages students to have fluency in R. The time commitment can exponentially increase if the student is also trying to learn data wrangling with R at the same time.

## CONTACTS

Course Instructor(s)	Contact Details	Office Location	Office Hours
<a href="#">Ehsan Karim</a>	<a href="mailto:ehsan.karim@ubc.ca">ehsan.karim@ubc.ca</a> The typical response time is within 48 hours on weekdays.	By appointments	By appointments, or as posted on canvas.

## COURSE INSTRUCTOR BIOGRAPHICAL STATEMENT

Dr. M. Ehsan Karim is an Assistant Professor in Health Data Science at the UBC School of Population and Public Health ([SPPH](#)), a Scientist at the Centre for Health Evaluation and Outcome Sciences ([CHÉOS](#)), an associate member of the Department of [Statistics](#) (UBC) and a Michael Smith Foundation for Health Research ([MSFHR](#)) Scholar. He obtained his PhD in Statistics from the University of British Columbia, and completed his postgraduate training in the Department of Epidemiology, Biostatistics, and Occupational Health at [McGill University](#). His current research focuses on causal inference, real-world observational data analyses, and applications of machine learning approaches in epidemiologic studies.

## OTHER INSTRUCTIONAL STAFF

The teaching team includes GTAs: Belal Hossain (computing lab), Fardowsa Yusuf (scientific writing). To communicate with the computing TA, come to weekly mandatory labs and specified office hours (as announced in Canvas). If you need further support, contact the course instructor, and additional office hours will be assigned accordingly. *Do not email the TAs directly without copying the instructor.*

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## COURSE STRUCTURE

The purpose of this course is to provide students with learning opportunities to understand fundamental epidemiological concepts through the application of methods using population and public health datasets. The purpose is also to introduce students to emerging epidemiological methodologies that are frequently being applied to population and public health-related research questions in prestigious epidemiology journal publications.

## SCHEDULE OF TOPICS

<b>Week #</b>	<b>Methods &amp; Reviews</b>	<b>Scientific Writing</b>	<b>Lab topics</b>	<b>Weekly deadlines</b>
# 1 (Week of Sept 8 <sup>th</sup> )	(no class on Tue)	Components of a Research Topic (PICOT & FINER)	(Class shifted to Thu only for this week) Overview of the course and final project	(no assignment submission - 1)
# 2 (Week of Sept 13 <sup>th</sup> & 15 <sup>th</sup> )	<b>Complex survey designs &amp; data sources</b> ( <i>in-class activity</i> )	Creating a statistical analysis plan (SAP)	<b>Data wrangling in R</b> ( <i>complete lab exercise</i> )	Sept 12, Mon (4 pm): <i>[i] pre-class quiz</i>
# 3 (Week of Sept 20 <sup>th</sup> and 22 <sup>nd</sup> )	<b>Confounding, identification</b> ( <i>in-class activity</i> )	Manuscript writing: Introduction section	<b>Creating analytic data for research using R</b> ( <i>complete lab exercise/CCHS</i> )	Sept 19, Mon (4 pm): <i>[i] pre-class quiz, [ii] Proposal.</i>
# 4 (Week of Sept 27 <sup>th</sup> & 29 <sup>th</sup> )	<b>Adjustment strategies according to the research goal</b> ( <i>in-class activity</i> )	Manuscript writing: Methods section	<b>Proposal defense (9 am – 12 pm)</b>	Sept 26, Mon (4 pm): <i>[i] pre-class quiz, [ii] SAP (with Tables 1 and 2 without survey features).</i>
# 5 (Week of Oct 4 <sup>th</sup> 6 <sup>th</sup> )	<b>Analysis of complex survey data</b> ( <i>in-class activity</i> )	Presenting tables and figures	<b>R lab on analysis of complex survey data</b> ( <i>complete lab exercise/NHANES</i> )	Oct 3, Mon (4 pm): <i>[i] pre-class quiz, [ii] peer-review for SAP.</i>
# 6 (Week of Oct 11 <sup>th</sup> & 13 <sup>th</sup> )	<b>Missing-data analysis</b> ( <i>in-class activity</i> )	Manuscript writing: Results section	<b>R lab on missing data analysis</b> ( <i>complete lab exercise/NHANES</i> )	Oct 10, Mon (4 pm): <i>[i] pre-class quiz.</i>
# 7 (Week of Oct 18 <sup>th</sup> & 20 <sup>th</sup> )	<b>Propensity score in survey data analysis</b> ( <i>in-class activity</i> )	Peer-reviewing/letter to the editor	<b>R lab on propensity score modelling</b> ( <i>complete lab exercise/NHANES</i> )	Oct 17, Mon (4 pm): <i>[i] pre-class quiz, [i] Writing assignment WA 1 (Methods + Results)</i>
# 8 (Week of Oct 25 <sup>th</sup> and 27 <sup>th</sup> )	<b>Reporting guidelines for analyses</b> Information about Midterm exam	Manuscript writing: Discussion section and abstract	<b>RMarkdown for writing scientific articles</b> (no lab exercise)	Oct 24, Mon (4 pm): <i>peer-review for WA 1.</i>

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Week #	Methods & Reviews	Scientific Writing	Lab topics	Weekly deadlines
# 9 (Week of Nov 1 <sup>st</sup> )	<ul style="list-style-type: none"> <li>Mid-term Exam on Tue (9 am-12 pm)</li> </ul>		(No lab on Thu)	(no assignment submissions - 2)
# 10 (Week of Nov 8 <sup>th</sup> & 10 <sup>th</sup> )	Machine learning basics (in-class activity)	Presenting at seminars and conferences WA 1 common issues	(Midterm Break)	Nov 7, Mon (4 pm): [i] pre-class quiz
# 11 (Week of Nov 15 <sup>th</sup> & 17 <sup>th</sup> )	Integration of machine learning in causal inference/health research	Responding to the reviewer's comments	R lab on machine learning (no lab exercise)	Nov 14, Mon (4 pm): [i] WA 2 (Introduction + Discussion sections), [ii] slide submission
# 12 (Week of Nov 22 <sup>nd</sup> & Nov 24 <sup>th</sup> )	<ul style="list-style-type: none"> <li>In-class presentation of the final project (session 1: 9 am – 12 pm)</li> </ul>		Session 2 (9 am – 12 pm)	Nov 21, Mon (4 pm): Peer-review for WA 2.
# 13 (Week of Nov 29 <sup>th</sup> & Dec 1 <sup>st</sup> )	Discussion and review Course evaluation	WA 2 common issues Authorship	Discussion and review (no exercise)	(no assignment submissions - 3)
				Final paper submission deadline: Dec 9 (Fri 4 pm).

### LEARNING OUTCOMES

By the end of this course, students will develop practical skills to:

- Design an appropriate study for a population/public health research question that will help reduce bias;
- Create an analytic dataset from a complex population/public health survey to answer an epidemiological research question, including statistical programming/coding and data management/documentation skills;
- Recognize the scenarios where various data analysis methods are appropriate to answer a research question;
- Apply an appropriate data analysis method to answer a population/public health research question;
- Interpret estimates and conclusions from data analysis methods;
- Describe the assumptions and limitations of data analysis methods;
- Communicate an epidemiological study (design, analytic method, findings and discussion (including issues related to limitations, biases)) in a format suitable for submission to an academic health journal; and
- Present an epidemiological study and analytic method in a format suitable for an academic health conference.

## LEARNING ACTIVITIES

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1. **Pre/post-class survey and in-class quizzes:** The surveys consist of several multiple-choice questions assessing understanding of readings/class materials (published academic papers and/or textbook chapters describing advanced epidemiologic methods). Readings are focused on the application of an epidemiological method to a population/public health issue/research question that will be explored further in class through lectures, instructor demonstrations, in-class student application activities.
2. **Weekly lab data analysis activities:** Students will complete in-lab data analysis exercises to apply concepts covered in pre-class reading materials, and in instructor lectures/in-class demonstrations.
3. **Statistical Analysis Plan/research proposal related to the final project:** Students will propose their own research questions through a statistical analysis plan (SAP). Students will be evaluated on the design of a study and choice of analytic method to answer their research question that reduces bias. Students will get a chance to present and defend their research proposal and analysis plan, and the peer-reviewers will be asking questions for clarification.
4. **Scientific Writing assignments:** scientific writing assignments on given topics. These assignments will deal with the following sections of a manuscript: introduction, methods, results and discussion.
5. **Mid-term exam:** An in-class mid-term written examination (based on topics covered before the mid-term).
6. **In-class presentation:** In-class presentation: Students will present the analytic approach for their research question with a focus on the justification of the choice of approach, in a format suitable for an academic health conference.
7. **Final Paper:** The Final Paper will have 5 sections: (i) objective and motivation of the study with a brief literature review, (ii) methods description, (iii) bivariable and multivariable results, (iv) discussion outlining strengths and limitations of the study, and (v) appendix with project /statistical analysis coding.

## LEARNING MATERIALS

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Required pre-class and weekly reading lists (published papers or textbook chapters) will be updated in the Canvas each week. There is no required textbook. The following textbooks are suggested for further reading (also available via UBC library):

- Scientific writing (available via UBC library): Heard, S. B. (2016). *The scientist's guide to writing: How to write more easily and effectively throughout your scientific career.* Princeton University Press.
- Analysis (available via UBC library): Heeringa, S.G., West, B.T., Berglund, P.A (2010) *Applied Survey Data Analysis,* Taylor & Francis, Florida.

## ASSESSMENTS OF LEARNING

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The course will involve pre-class reading materials (pre-reading, video lecture or journal article focused on the application of epidemiological methods), lectures based on the discussion of the pre-class reading content, and in-class activities and course assignments focused on the application of epidemiological methods. Although students will gain some expertise in statistical computation and

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programming, this course is focused on the application of epidemiologic analytic methods. Students will be evaluated based on the following elements: (a) understanding of key epidemiologic concepts, (b) understanding of analytic approaches to reduce study biases, (c) the application of epidemiological methods to population and public health research questions, and (d) the appropriate interpretation of analytic estimates from analytic output.

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1. Pre-class survey	10%
2. In-class quizzes and activities	5%
3. Lab data analysis activities	15%
4. Statistical Analysis Plan/research proposal/defense	Pass/Fail (0%)
5. Scientific Writing Assignments	10%
6. Mid-term exam	20%
7. In-class presentation	5%
8. Peer-Review	10%
9. Final Paper	20%
10. Addressing peer-review comments for the final paper	5%

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Peer-review quality will be judged by whether or not the reviewer can identify potential weaknesses of the work they are reviewing, express them in a professional manner, and can suggest a practical way forward (if possible).

**Late Assignments:** Pre-class/in-class/weekly survey answers, Assignments, and the Final Paper must be submitted via Canvas. Typically, no late submissions will be accepted. Extensions of the due date for the assignments will be considered pending extenuating circumstances with the approval of the instructor. The instructor will require documentation of extenuating circumstances (medical certificates, etc.). Assignments submitted later than the due date will be penalized 10% of the possible grade for each day past due.

### UNIVERSITY POLICIES

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UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available on [the UBC Senate website](#).

### OTHER COURSE POLICIES

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**Plagiarism:** Students are expected to review the Student Discipline section of the [UBC Calendar](#) and know what constitutes plagiarism and academic misconduct, and that such activities are subject to penalty.

**Grading:** This course has very specific rubrics for scientific writing. For everything else, we follow the following strategy: Adapted from the UBC Department of Educational Studies, Graduate Course Grading Policy, D. Pratt:

- A Level (80% to 100%): A+ is from 90% to 100%: It is reserved for exceptional work that significantly

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exceeds course expectations. Also, achievement must satisfy all the conditions below. A is from 85% to 89%: A mark of this order suggests a very high level of performance on all criteria used for evaluation. Contributions deserving an A are distinguished in virtually every aspect. They show that the individual (or group) significantly shows initiative, creativity, insight, and probing analysis where appropriate. Further, the achievement must show careful attention to course requirements as established by the instructor. A- is from 80% to 84%: It is awarded for the high quality of performance, no problems of any significance, and fulfilment of all course requirements.

- **B Level (68% to 79%):** This category of achievement is typified by adequate but unexceptional performance when the criteria of assessment are considered. It is distinguished from A-level work by problems such as one of the more significant errors in understanding, superficial representation or analysis of key concepts, the absence of any special initiatives, or lack of coherent organization or explanation of ideas. The level of B work is judged by the severity of the difficulties demonstrated. B+ is from 76% to 79%, B is from 72% to 75%, and B- is from 68% to 71%
- **C Level (55% to 67%):** Although a C+, C, or C- grade may be given in a graduate course, the Faculty of Graduate Studies considers 68% as a minimum passing grade for doctoral graduate students.

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### **LEARNING ANALYTICS**

Learning analytics includes the collection and analysis of data about learners to improve teaching and learning. This course will be using Canvas that capture data about student's activity and provide information that can be used to improve the quality of teaching and learning. In this course, the instructor plans to use analytics data to:

- View overall class progress
- Track students' progress in order to provide them with personalized feedback
- Review statistics on course content being accessed to support improvements in the course
- Assess the student's participation in the course.

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### **LEARNING RESOURCES**

- All course materials (lecture slides, pre-class readings and video, assignments) will be posted on the Canvas course website.
- Required pre-class/weekly readings (listed at the end of this document) can be downloaded from either the Canvas course website or from the UBC library website.
- Access to a computer with R software (R, RStudio, R markdown, free of charge) is necessary for all course work. Students need to bring their own laptop computer to class with the R software installed. Course instruction will be provided strictly in R.

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### **ONLINE LEARNING FOR INTERNATIONAL STUDENTS**

During this pandemic, the shift to online learning has greatly altered teaching and studying at UBC, including changes to health and safety considerations. Keep in mind that some UBC courses might cover topics that are censored or considered illegal by non-Canadian governments. This may include, but is not limited to, human rights, representative government, defamation, obscenity, gender or sexuality, and historical or current geopolitical controversies. If you are a student living abroad, you will be subject to

the laws of your local jurisdiction, and your local authorities might limit your access to course material or take punitive action against you. UBC is strongly committed to academic freedom, but has no control over foreign authorities (please visit <http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,33,86,0> for an articulation of the values of the University conveyed in the Senate Statement on Academic Freedom). Thus, we recognize that students will have legitimate reason to exercise caution in studying certain subjects. If you have concerns regarding your personal situation, consider postponing taking a course with manifest risks, until you are back on campus or reach out to your academic advisor to find substitute courses. For further information and support, please visit: <http://academic.ubc.ca/support-resources/freedom-expression>

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### **COPYRIGHT**

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All materials of this course (course handouts, lecture slides, assessments, course readings, etc.) are the intellectual property of the Course Instructor or licensed to be used in this course by the copyright owner. Redistribution of these materials by any means without the permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline.

The instructor/TAs do not permit students to record class sessions/labs. The class/TA sessions will be recorded by the instructor/TAs, and only the necessary parts will be released within the class for viewing outside of the class sessions. If you have an objection about parts of these recordings, contact the instructor immediately.

*Version: July 25, 2022*