New Course Proposal Form

1. **Program:** Graduate Program in Health – Health Management and Health Data Analytics

2. **Course Number:** HLTH 6240

3. **Credit Value:** 3.0

4. **Long Course Title:** Health Data Visualization

5. **Short Course Title:** Health Data Visualization

6. **Effective Session:** Fall 2022

7. **Calendar (Short) Course Description:**
   This course will introduce the fundamental concepts and principles of data visualization and its application in healthcare. We will explore the history of data visualization and its current uses in healthcare: from infographics informing patients and consumers, to EHR dashboards aiding providers in decision-making, to detailed epidemiology maps driving policymaking aimed at protecting population-health. Students will learn best practices for designing and evaluating health data visualizations, and learn to think critically about literacy, ethics, and the future of the field. By the end of this course, students will be able to use online tools to create powerful visuals that tell a story and inform diverse stakeholders.

8. **Expanded Course Description:**
   The following describes the (A) course topics (B) course learning objectives, and a (C) description of experiential education (EE) and/or technology-enhanced learning activities.

   A) **course topics/theories**
   1. Importance of visuals for human understanding
   2. History of (health) data visualization
   3. Current uses of health data visualization
      i. When/ how and by whom are visualizations used (stakeholders)?
   4. Visualization literacy (how to properly interpret visualizations)
   5. Ethics of/ Bias in visualization (what are the limitations and considerations of visualizations)
   6. Design principles
   7. How to combine and clean data for visualizations
   8. How to use Tableau to create health visualizations
   9. Identify and understand the needs of various user-groups.
      i. Patients and consumers
      ii. Health care providers and Hospital mgmt.
      iii. Policy and decision makers
   10. Future trends in health data visualization (AI, Big Data)
B) Course learning objectives

1) Depth and breadth of knowledge

   • Demonstrate understanding of the key concepts underlying Health Data Visualization
   • Engage with Visualization tools and techniques

2) Knowledge of methodologies

   • Demonstrate understanding of health data visualization (e.g. which graphs are best suited for what data)
   • Grasp the fundamentals of design data visualization (colours, font, layout)

3 Application of knowledge

   • Employ critical analytics skills
     ▪ when appraising real-life health visualizations
     ▪ when analyzing health data
     ▪ when making decisions about how to visually represent the data in order to tell a story and/or aid in decision making
   • Conduct research of print, electronic, and visual resources
   • Learn to use visualization technologies

4) Communications skills

   • Work collaboratively and ethically with others
   • Effectively research, develop, and present data visualizations
   • Write rigorous, critical and convincing reports
   • Constructively give peer feedback

5) Awareness of limitations of knowledge

   • Understand the ethical limitations of data visualizations and specific implications for Healthcare contexts
   • Understand the benefit of interprofessional collaboration (working together with designers and researchers to best convey data)

6) Autonomy and professional capacity

   • Develop a disciplined and rigorous practice
   • Learn to present visualizations confidently, accepting and applying constructive criticism

C) Description of experiential education (EE) and/or technology-enhanced learning activities.

The course will contain classroom-focused EE that exposes students to concrete data visualization activities in the form of "in the news" class discussions (contributing to participation grade), weekly reflection assignments, and lab exercises.

Every class will begin with some time dedicated to "in the news" where students will have a few minutes to look through recent media posts/publications and identify a recent visualization that we will dissect collectively as a class. Individually, students will be required to find real-world examples and apply concepts and theories covered each week, summarizing their thoughts in 5 brief "reflection assignments" that will be submitted online. Lab exercises will be completed collaboratively in teams, a real dataset will be provided and teams will be encouraged to create appropriate visualization for their target audience using online tools and techniques learned in class, and present the following week. Students are expected to respectfully provide feedback to their peers and submit their work online for correction and feedback.

Note that special computer labs will not be required for this course. Online software (Tableau) will be used which is free to students. Use of online software can sustain capacity in data visualization that students build during the course.
Lab exercises will allow student to achieve the following learning outcomes

1- Engage with multiple data visualization techniques (infographics, graphs, dashboards, maps)
2- Grasp the fundamentals of design related to data visualization
3- Provide students with “real” messy data to learn to clean and analyze
4- Work collaboratively and ethically with others
5- Effectively research, develop, present, and give peer feedback on visualizations in healthcare
6- Meet deadlines and develop a rigorous discipline

In addition, guest lecturers will be invited to the class when possible, to review and interact with the students about concrete health data visualization applications and (un)successful cases (E.g., invite UX designers of EHR dashboards, and patient reports on smartphone apps).

9. Course Learning Outcomes
After completion of the course students will be able to:

- **Apply theoretical and practical knowledge** of Data Visualization in Healthcare
- **Evaluate Data Visualizations** in Healthcare (e.g. in research papers, government infographics) according to their expressiveness and effectiveness
- Be able to **understand (literacy) and identify bias (ethics etc.)** in health visualizations
- **Choose appropriate visualization tools** and methods for a given data set and presentation problem
- **Inspect Accuracy**, Discriminability, Salience, and Separability, and their implications for design.
- Examine, navigate, and **learn to use the various features of Tableau** (or other online tools)
- Combine the data to and follow the **best practices to present your story**
- **Create and design visualizations and dashboards** for diverse audiences using Tableau (or other online tools)

10. Rationale:

"The purpose of computing is insight, not numbers."
Health care is becoming more data driven than ever before. The collection, organization, and interpretation of increasingly large volumes and types of data from multiple sources is integral to nearly every aspect of healthcare.

From replacing a patient’s medical chart with a lifelong electronic medical record, to wearable devices that capture quantified self, alongside an expanding trove of digital data captured through social media, geographic information systems (GIS) and advancements in research (e.g. DNA sequencing of data), and technologies (such as biomedical imaging and Machine learning for health), data is growing in volume and diversity making analysis and interpretation increasingly complex. Healthcare professionals, researchers, patients, families, caregivers, and consumers need information to be presented in an accessible, useful, and usable manner.

Data visualization is the graphical representation of information and data. By using visual elements like icons, charts, graphs, and maps, data visualization tools provide an accessible and engaging way to see and understand trends, outliers, and patterns in data. Data visualization helps to tell stories by curating data into a form easier to understand, helping diverse stakeholders make more informed decisions.

Today every hospital uses data visualization solutions to manage their in-house process ranging from maintaining the patient record, to capacity planning, every smartphone health app uses data visualizations to push “personalized goals” to their consumers in the hope that they will change their
behaviours, and local and national governments employ interactive maps to try and educate citizens and manage the spread of disease across entire countries and the world, as was the case with the COVID-19 pandemic.

This course aligns with the faculty educational objectives, providing up-to-date content using cutting edge technologies, and preparing students with hands-on skills that are highly marketable in the workplace. Students will further their critical thinking, data literacy, visualization, and presentation skills, as well as gain experience using novel technologies, and EE experience; all of which are core to the SHPM objectives and will prepare students to fill a need for data analytics skills in the healthcare system. There are no other graduate courses on offer that focus on health data visualization.

This course, along with another new course on Maching Learning in Health constitute two of the new field-specific courses in the new field in health management and health data analytics in the Graduate Program in Health. These two analytics oriented courses are unique to the program and complement existing health management and knowledge utilization courses already approved in the program.

The Graduate Program in Health's learning outcomes are included in Appendix X.

11. Evaluation:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percentage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Good, the Bad, and the Ugly of Data Visualization</td>
<td>20%</td>
</tr>
<tr>
<td>5 weekly reflections, 6% each</td>
<td>30%</td>
</tr>
<tr>
<td>3 Tableau visualization assignments - &gt; different stakeholder groups, 5% each</td>
<td>15%</td>
</tr>
<tr>
<td>data for patients &amp; consumers</td>
<td>5%</td>
</tr>
<tr>
<td>data for healthcare providers &amp; healthcare/ hospital mgmt</td>
<td>5%</td>
</tr>
<tr>
<td>data for policy &amp; decision makers</td>
<td>5%</td>
</tr>
<tr>
<td>Final project: Pick data set (your capstone?), make visualization, explain choices</td>
<td>30%</td>
</tr>
<tr>
<td>Final Paper</td>
<td>20%</td>
</tr>
<tr>
<td>Final presentation</td>
<td>10%</td>
</tr>
<tr>
<td>Participation (attendance, “in the news”, class conversations/ contributions)</td>
<td>5%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
</tr>
</tbody>
</table>

12. Integrated Courses:
N.A.

13. Crosslisted Courses:
N.A.

14. Faculty Resources:

Faculty members qualified to teach this course: Lora Appel; Liane Ginsburg; Hannah Wong

Frequency with which you expect this course to be offered: Approximately every other year.

We have several health informatics and health management faculty members with the School equipped to teach at the graduate and undergraduate levels. Offering this course in alternate years will not detract from the School’s ability to continue to have full-time faculty deliver undergraduate health studies courses. The addition of this area to our graduate program will also help alleviate currently high supervision loads experienced by SHPM faculty members in the health policy and equity area and allow us to share faculty supervision resources more equitably across the School.
15. Physical Resources:
   No additional physical resources are needed.

16. Bibliography and Library Statement:

<table>
<thead>
<tr>
<th>session</th>
<th>topic</th>
<th>assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“A picture is worth 1000 words”</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>History and current uses of (Health) Data Visualization</td>
<td>weekly reflection 1</td>
</tr>
<tr>
<td>3</td>
<td>From Data to Viz</td>
<td>weekly reflection 2</td>
</tr>
<tr>
<td>4</td>
<td>Data visualization literacy and ethics</td>
<td>weekly reflection 3</td>
</tr>
<tr>
<td>5</td>
<td>Design Principles</td>
<td>good bad ugly</td>
</tr>
<tr>
<td>6</td>
<td>Introduction to tools (e.g. Tableau) + Lab work</td>
<td>weekly reflection 4</td>
</tr>
<tr>
<td>7</td>
<td>Visualizations for Patients &amp; Consumers + Lab work</td>
<td>Tableau assignment i</td>
</tr>
<tr>
<td>8</td>
<td>Visualization for Providers &amp; Healthcare/Hospital mgmt + Lab work</td>
<td>Tableau assignment ii</td>
</tr>
<tr>
<td>9</td>
<td>Visualization for Policy &amp; Decision Makers + Lab work</td>
<td>Tableau assignment iii</td>
</tr>
<tr>
<td>10</td>
<td>Future of data visualization</td>
<td>weekly reflection 5</td>
</tr>
<tr>
<td>11</td>
<td>Final Project Prep/ Bonus show and tell</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Final Presentations</td>
<td>Final Projects &amp; Presentations</td>
</tr>
</tbody>
</table>

Books (or chapters in books) under consideration:


Session 1: “A picture is worth 1000 words”


Session 2: History and current uses of (Health) Data Visualization


Session 3: From Data to Viz


Session 4: Data visualization literacy and ethics


Session 5: Design Principles


Session 6: Introduction to tools (e.g. Tableau)


Session 7: Viz for Patients & Consumers


Session 8: Viz for Providers & Healthcare mgmt/ Hospitals


Session 9: Viz for Policy & Decision Makers


Session 10: Future of data visualization


Please submit completed forms and required supporting documentation by email to the Coordinator, Faculty Governance – fgsgovrn@yorku.ca