STEM Fellowship Journal

The sustainability of health economics: Proceedings from the 2022 Inter-University Big Data Challenge

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STEM Fellowship's Inter-University Big Data Challenge is a unique Big Data inquiry and experiential learning program that provides university students worldwide an opportunity to apply computational thinking in search of national, regional, community, and individual health solutions. It is a new form of R&D talent development and identification through computational science and scholarly communication demonstrated by students.

As part of the program, participants were offered a broad range of workshops in data analytics, programming, and science communication. Some of the tools the students learned and used include Python, R, machine learning, LaTeX, and Overleaf.

This year, the program participants explored issues of The Sustainability of Health Economics and suggested a whole spectrum of original Open Data-based ideas and solutions. Presented research topics are ranging from Improved Health Resource Allocation and Tracking the Spread of a Virus to Health Insurance based on Health Behaviours, and more.

Overall, we received submissions from student teams from practically all leading Canadian universities, mixed teams of students from Canada and the US, Asian, and Latin American universities.

On behalf of the STEM Fellowship, we extend our sincere congratulations to all students who participated in the program and wish them the best for their future academic and professional endeavours.

We want to express our appreciation to all the mentors and volunteers. This program would not be possible without generous support of our sponsors: Hoffman La Roche Canada, Canadian Science Publishing, and JMIR Publications.

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Chief Data Officer

Dr. Sacha Noukhovitch
Founder, President and Editor-in-Chief

Disclaimer

These abstracts are provided for all student teams that submitted project reports by June 19, 2022. The STEM Fellowship Journal and its editors made every effort to ensure proof and English editing of these abstracts in a limited amount of time, and neither organization as a whole or any of its volunteer members can be held accountable for inaccuracies that may have occurred in the abstract publication. Abstracts are published in no particular order.

Predicting patient readmission for improved resource allocation using machine learning

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A major reason why current economical models of healthcare are not sustainable is because many patients are unnecessarily readmitted within 30 days. In this paper, we use a decision tree-based machine learning model to predict the likelihood that a patient is readmitted to the hospital within 30 days. This allows for hospitals to more aptly allocate their resources and create a much more sustainable economical model for healthcare services. Our model has shown to have an accuracy of 94% and its decision-making process is consistent with the literature, indicating its high clinical utility.

No child left behind: Using intelligent metrics for data-driven sustainable policymaking

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Child maltreatment (CM) is a major public health problem with catastrophic effects on victims and on society. With compounding societal, medical, and financial consequences, research into CM has provided valuable insight for informing policy and shaping our response to this pressing problem. The objective of this study is to examine if CM metrics can be predicted and mitigated by financial modelling correlated to historical abuse. By using the National Child Abuse and Neglect Data System (NCANDS), this study focuses on CM data in the United States and examines its relationship to the socioeconomic metrics and financial spending at a state-level basis. This study provides valuable insight into the prevention of CM through identifying early signs of risks with the use of endangerment, a measure of CM trend and distribution, as the central metric. Emphasis on endangerment allows for the development of a sustainable, and long-term approach to CM prevention. This study empowers policymakers to sustainably allocate funds to high-risk locales. The study results reveal that the connection of poverty to child fatality does not provide the total picture when considering trends and variability of abuse and bespoke measurements may be required. These results and the study design can be replicated and improved upon to develop sound findings for global CM research. By mobilizing social work groups, policymakers, and activists, the findings of this study can be used to empower real change and make a meaningful impact on the lives of children worldwide.

Food for thought: An economic approach to Northern Canada's food insecurity crisis

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Food insecurity remains a forgotten issue in Canada, yet the most recent study shows that 4.4 million Canadians experience food insecurity on a regular basis. But in Nunavut, this figure increases dramatically. Government efforts that aim to reduce the Northern food insecurity problem put an emphasis on food and market-based solutions, not on public policy reform like many economists and health scientists have researched and suggested. Throughout our paper we (1) emphasize the inefficiency of current government programs, (2) analyze socio-economic factors in Nunavut with relation to food insecurity, and (3) use our results to look into the future of public policy solutions to the crisis. From the data we collected, we found a 1% increase of food insecurity as Registered Retirement Savings Plan contributions decrease and reliance on social assistance increases. Through statistical tests, factors such as education level, unemployment, and Consumer Price Index have been found to have an affect on Nunavut's rising food insecurity. Income increases and reduction in trade hindrance could reduce food insecurity rate.

See you never: Predicting patient readmission as a preventative and cost-effective measure

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Patient readmission is preventable and predictable, yet it is a major problem in healthcare worldwide. Successful prediction of readmission based on a patient's past conditions, physical traits, and current diagnosis would be a great step forward towards reducing the stress readmission has on the healthcare system as well as the financial stress associated with readmission. The goal of the study is to design a predictive model that describes patient readmission in an optimally cost-effective manner that minimizes false negatives and compare it to prolonging the length of stay. An ensemble prediction model was built using 5 other classification submodels aiming to predict whether a patient is likely to be readmitted within 30 days. The model's training on the Canadian Institute for Health Information's Discharge Database yielded a precision score of 71% and an f1-score of 0.46%. The ensemble prediction model proved to be more effective than previous submodels as it minimized both variance and bias. This makes the model a viable candidate. To further analyze the resource trade-offs of prolonged stay, the expected length of Stay (ELOS) and resource intensity weight value (RIW) columns of the dataset were graphed then clustered using k-means. Based on the final model, quality data collection and construction of an ensemble readmission collection model should be a major area of focus and resource allocation for healthcare institutes worldwide.

A machine learning approach to classify patients according to the KTAS system using triage information: Predicting the level of risk of adult patients who visit the emergency department

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Overcrowding in emergency departments (EDs) is a serious problem that threatens healthcare provision. It has various causes because bottlenecks can inflict delays in all the stages of EDs' underlying procedures. The present study aims to propose a suitable classifier model to assist in the differentiation of emergency and non-emergency situations, and in the categorization of patients based on the Korean Triage Acuity Scale (KTAS) levels. We used and processed patient's triage data collected from Korean health centers using informatics tools. We trained eight machine learning (ML) models, and thereby predicted the level of KTAS and determined if it was an emergency or not. Our results showed accuracy values of up to 80.51%, where the best values were obtained for emergency determination and lower values obtained for the KTAS classification. The performance of most of our models was surpassed by other algorithms reviewed in the literature. We identified the patients' chief complaints and level of pain measured by nurses in a 5-level scale as important contributors to the performance of ML models. Further improvements can be made to the models proposed in this paper to improve their accuracy scores and make sure that they will be advantageous for the health personnel.

How viruses spread across space and time: Forecasting pandemic progression by modelling geographic-temporal interactions

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The COVID-19 global pandemic has revealed severe flaws in our ability to respond to unexpected health catastrophes. Much of the confusion and mishandling of the situation could be attributed to our failure in accurately predicting the spread of the virus across geographical locations. A global resource shortage in essential medical supplies and equipment such as personal protective equipment (PPE) and ventilators led to a strangled global supply chain. As a result, resources could not be allocated in a targeted manner to curb the spread of the pathogen in the most efficient way. Although forecast models and machine learning algorithms have served as invaluable tools in devising effective response strategies, a large majority of these models were limited by their ability to describe the intricate interactions that underlie the spatiotemporal dynamics of viral proliferation. To address this issue, we employed a vector autoregression model to help capture the evolution of the disease across

both the spatial and the temporal axes. Unlike traditional autoregression models, the present solution can account for statistical regularities that exist both within a given region and between geographical locations. Our results demonstrate that this approach accurately described the relationships across domestic and international localities throughout the evolution of the disease.

Health insurance grouping

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The advancements in medicine have given birth to a new myriad of medical procedures, each targeted for its own demographics. As a result, it has become much more difficult to gauge a person's medical expenses. Not being able to estimate a person's expected medical bill is a problem for medical insurance companies as they often end up mischarging customers due to the variation between people's expenses. The simplest solution to figuring out how much to charge a customer is using their demographic to predict if a customer is in a high or low-cost group. While this solution is in the correct direction, it can be made into a much more precise model using unsupervised machine learning. This research employed clustering techniques that would find implicit patterns that are impossible to find manually. The findings were that the most consistently high-cost customers were those with a high BMI that also smoked. These findings also indirectly tell us that other factors, such as gender, are not deemed to be major factors behind a customer's medical expenses, contrary to previous beliefs. Medical insurance companies can use these findings to revise their pricing models.

Health behaviours and health care utilization: An economic evaluation of the impact physical activity has on healthcare spending

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Physical inactivity is considered one of the top 10 global health challenges in the twenty-first century according to the World Health Organization (WHO). Every year, over 3.2 million deaths and 32 million disability-adjusted life years are lost as a direct result of physical inactivity. Countries such as the United Kingdom spend over 7.4 billion pounds in the treatment of chronic diseases related to physical inactivity. With supply chain shortages and the limited healthcare budget, physical inactivity cannot be apart of our sustained health economies. In general, physically inactive people, as defined as those that do not meet the weekly recommended physical activity guidelines of >150 minutes of physical activity/week, utilize more healthcare resources than physically active people. However, there is a lack of knowledge within the public domain with regards to the economic impact of those that are moderately active (30-149 minutes of physical activity/week). Therefore, the aim of our study is to investigate the economic impact of those that are moderately active to find potential avenues for a constrained healthcare system. We analyzed different levels of physical activity in the United Kingdom and their region's respective health care spending. Our linear regression model demonstrated a negative relationship between moderate physical activity and healthcare spending, although this correlation was statistically insignificant. Our results point towards a potential negative relationship health care spending and level of activity in this specific sub-population and assist in creating new routes for scientific discovery.

Stepwise regression analysis: Healthcare shortage impacts on United States' COVID-19 development

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The pandemic had tremendously affected all aspects of our lives, especially our healthcare system. Severe shortages were seen throughout the pandemic ranging from hospital capacity to healthcare workers shortages. In light

of the pandemic, our study aims to determine potential shortcomings of our healthcare systems in overcoming future pandemics. Focusing on COVID-19 developments in US states, as measured by number of new cases, we utilized a stepwise regression algorithm to identify correlations between the pandemic development and resource shortages. We identified three significant predictors towards the success of states in managing the current COVID-19 pandemic, namely: number of hospital beds, healthcare providers, and state's healthcare responsiveness ratings. As a result, we identified that while hospital capacity plays a critical role in managing demand, future mitigation will also need to focus on both providing efficient services and managing sufficient healthcare human resources.

Supply-demand mismatch: Research on the supply chain of opioids under COVID-19

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With the development of COVID-19 pandemic, the existing issue of opioid disorder and poisoning has become more severe in North America. This retrospective study aims to find a solution to the overdose of opioid in the perspective of supply chain. To begin with, the relationship between total COVID-19 and death number and the poisoning or disorder were being researched. By applying the simple linear regression model, we found strong linear relationship between the disorder of opioid and the total death of COVID-19. In addition, with the development of the COVID-19 pandemic, the misuse of opioids became more severe. To solve the problem at the edge of the supply chain, we divided the overdose of opioid into the disorder of prescription opioid and over the counter (OTC) ones. For the OTC part, we believe that blockchain technology could be a potential useful solution regarding the opioid epidemic. It allows secure storage and transmission of data without any intermediaries. For the prescription opioid, we found that its demand exceeded the supply and illegal action mainly occurred among suppliers of its supply chain, including the deceptive marketing from the doctors as well as the complacent regulation of the regulator. To specify the problems occurred in the supply chain, we analyzed the prescription medicine data of United States in 2014. The prediction of the specific department of medical stuff who are more likely to involved in the black market was proposed.

System of recommendation, management assistance and planning of resources related to health

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An important dimension of health economics is urgency, ambulance response time is a crucial factor in patient survival. Emergencies represent exceptional situations involving a serious threat to the health of the population. Therefore, the placement of hospitals or emergency establishments is a classic urban planning problem. We have seen when pandemics break out that some hospitals are overflowing, some centers are close to neighborhoods where there are more people who will require long hospitalization, while others have a patient population less at risk or even less sick who can do teleworking. The main objective of this paper is to set up a system of recommendation, assistance in the management and planning of resources related to health. To do this, the methodology adopted consists first in developing automatic learning models aimed at predicting whether or not an individual is affected (with a probability or a stage) of a disease deemed to be at risk. Then, identify the main causes related to the different diseases in order to carry out preventive actions. Finally, it will be a question of using predictive models on population data from different areas to predict the rate of predisposition of the latter to the identified diseases. The exploitation of the results from the previous stages coupled with the macro information on the health centers will make it possible to issue recommendations and help in the planning of health resources depending on the areas.

Improving psychiatric care wait times in Canada

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Canada's health care has come to be characterized by long waiting times for treatment. Psychiatric care is no different in this aspect, rather it has its own unrecognized problems. Although the Government of Canada has made mental health a key priority in the Health Accord, not enough actions have been taken towards this initiative. Our objective through this paper is to gather and analyse data, identify gaps and determine the factors that impact psychiatric care in Canada. Our findings from the research signified the reasons for the staggering wait times currently present in the existing system. Inefficiency and extended wait times are the outcome of the family doctor referring patients to a specialist without being informed of the current waiting list for that expert. It was also observed that the wait-time benchmarks for psychiatric care, which were established in 2006, have not been updated since then. These criteria are no longer appropriate in today's conditions, as mental health cases have increased dramatically since 2012, and the pandemic has increased the numbers tenfold. We are proposing the idea of introducing a channelizing load-distribution system that distributes the patients being referred by a family doctor/General Physician (GP) to specialists, from a central pool of patients. This is achieved by keeping the system transparent, thereby providing a live update to GPs about the existing load under each specialist which leads to seamless transitions of patients from one point of contact to another reducing the backlogs.

Prepare for the worst, or end up like our healthcare systems

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The COVID-19 pandemic caused the world to change in so many unimaginable ways that it was hard to be prepared for its impacts, as with any big crisis. But while many areas of life adapted and developed new ways of doing things, the healthcare industry really struggled to even maintain basic standards, highlighting their vulnerabilities and inefficiencies. To investigate this, we researched a variety of key factors in healthcare systems and economics, such as medical supplies shortages, hospital wait times, staff numbers, expenditure, share of GDP spent on healthcare. Through this we found that healthcare systems around the world became very strained, at the expense of people's health, safety, and costs. There was a large increase in expenditure during the pandemic, yet healthcare systems were inefficient in spreading resources around to cover a variety of areas of healthcare. Even before the pandemic, many places had relatively limited medical supplies, staff, and facilities so they were not nearly prepared or equipped to deal with such a large-scale crisis. This has demonstrated the inadequate foundation of healthcare systems around the world, so a re-evaluation of factors, such as funding and resources, is much needed in order to start down the path towards a better future.

Can tweets be used to identify PPE shortages and inform healthcare supply-chain decisions?

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The COVID-19 pandemic has exposed major flaws in the personal protective equipment (PPE) supply chain. Rapid depletion of the existing stockpile, heavy reliance on external suppliers, lack of funding for smaller facilities such as nursing homes, and lack of adequate centralized data for PPE allocation all contributed to increasing the vulnerability of the US healthcare supply chain towards becoming overloaded with PPE demand. Past studies have looked at the potential of Twitter sentiment analysis as an accurate predictor of actual shortages such as food in security. In this study, Twitter sentiment analysis was utilized to determine if an increase in tweets pertaining to PPE shortages correspond to an actual increase in PPE shortages in long-term care facilities in California. The results show that negative tweet frequency can contain information that helps predict shortages in nursing homes in California, US. This study provides a novel approach for identifying regions of PPE shortages by analyzing Twitter sentiment data as an effective tool to allow for early detection of PPE shortages.

Time trends and predictions of mental health and suicide rates based on socioeconomic

indicators from 2000 to 2019

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Suicide poses a significant health problem worldwide. Most suicides are related to mental health disorders, a critical factor in national economies. Yet national health systems are frequently under-resourced and inefficient, resulting in an imbalance between health expenditures and mental illness burdens. Although suicide rates are highly correlated to mental disorders, there is no direct link between suicide rates and economic status. Thus, the objectives of this report are (1) to investigate the trends and correlations of socioeconomic factors on mental health and suicide rates across different income groups and (2) to project suicide rates and mental disease burdens up to 2030. Using data from the World Bank, Global Burden of Disease 2019, and World Health Organization database from 2000 to 2019, we presented and compared the trends and patterns of economic growth, suicide rates, and mental health for all income groups. Our analysis used DBA k-means clustering to estimate the associations among socioeconomic indicators, mental health illness, and suicide rates. We used the ARIMA model to provide predictions. Our findings reveal the influence of social factors such as unemployment rates on mental health and suicide rates worldwide. Besides, the projections for mental disorders burden during the next decade do not seem to be an encouraging trend except for high-income countries. Our results represent appropriate starting points for governments to adopt more comprehensive interventions and practical strategies to reduce suicide rates and eventually bridge the gap to the 2030 Sustainable Development Goals.

Internet disparities between urban and rural communities

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Ookla intends to promote this objective by disseminating the data so that people and groups may utilise it to bridge the social and economic divides between those with and without contemporary Internet access. Our project aims to give further insight in understanding the internet connection within rural Canadian communities using statistical models to evaluate, forecast internet speed. A standard of internet connection will be calculated, and the data of each community will be interpolated to provide evidence for theorized correlations. R code for interpolation, programming and correlation, SQL to store data, Tableau/Power Bi for data visualisation. At the end we are using PowerPoint for the presentation. We expect that higher download speed, upload speed, and latency of speed tests will be generally correlated with an urban area's internet rather than rural areas. Urban areas will have a 80 percent chance of being classified as a community with "high quality" internet, and rural communities will have a 20 percent chance of being classified with "low quality" internet. A solution can be established to provide "high" quality internet to communities who need internet access. In conclusion, commercial fixed and mobile network operators all over the world use speed test data to influence network construction, improve global Internet quality, and increase Internet accessibility. We will be using R code, Minitab and Excel to assess whether higher download, upload, and latency of speed tests will be generally correlated with internet access in urban areas rather than rural areas.

The potential for digital health care workforce integration to alleviate the global health worker shortage crisis

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Affordable, sustainable, and quality healthcare provision has been the focus of the key players in the health sectors. Many efforts and workable policies have been brought up by nations and international organizations for the sustainability of global healthcare and health expenditures. However, the health worker shortage crisis still poses a threat to health sectors globally. The health workforce imbalance globally must be addressed to avert the grievous effect of any future health disaster like the COVID-19 pandemic. This study examines the health worker shortage across the nations of the world, the implication of the health worker graduating

frequency, health expenditure by countries, and the digital health status of certain nations of the world. The work utilizes big data evaluation by considering WHO, OECD, world bank and global digital health index datasets. Pearson correlation algorithm was utilized to examine the dependency of the variable considered, having cleaned the data. The scarcity of data limits the work to evaluate data from 2011 to 2019.

Are mothers getting the most bang for their buck? An evaluation of efficiency of healthcare expenditures related to maternal health

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Increased health expenditures can contribute to improved maternal health outcomes, but only to the extent increased expenditure is efficient. This study examines the efficiency of global health expenditures related to maternal health in low and low-middle income countries, with a focus on revealing inefficient or redundant expenditures. This study aims to evaluate the impact of aggregate, domestic, external, and private healthcare expenditures on family planning, maternal conditions, and reproductive health and their influence on maternal mortality. Further aims evaluate the impact of this spending on secondary metrics associated with adverse maternal health outcomes. Partial correlation analysis was performed to evaluate the association between expenditures related to maternal wellbeing and maternal mortality, alongside multiple indicators related to factors that contribute to maternal mortality in low and low-middle income countries with adjustment for GDP per capita at international purchasing power parity (PC, PPP), year, and population size. Antenatal care coverage was not associated with maternal mortality ratio (MMR), nor adequately targeted in health expenditure. Contraceptive prevalence, contraceptive use, and demand for family planning were significantly negatively associated with MMR. Adolescent birth rate and prevalence of anemia among pregnant women were significantly positively associated with MMR. Family planning expenditure was not associated with family planning demand satisfaction, contraceptive prevalence, nor contraceptive use. Domestic expenditure was significantly associated with reproductive health and maternal conditions, whereas external expenditure was not. Current health expenditures in low and low-middle income countries exhibit multiple inefficiencies that could potentially be addressed to reduce MMR.

Planning to leave? Assessing post-pandemic healthcare worker satisfaction

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During the COVID-19 pandemic, healthcare workers have been instrumental to the helping save the lives of hundreds of thousands of infected patients. However, there has been an increase in concerns regarding the number of healthcare workers considering leaving healthcare due to burnout and stress caused by this pandemic. The COVID-19 pandemic has illustrated the importance of primary care and the need for greater support for healthcare workers. Healthcare workers play a particularly important role as they are often the first point-of-contact for patients and their families. However, support given to healthcare workers over the last few years remains a principal concern. Existing research has suggested that after the COVID-19 pandemic has brought declines in mental health and the accumulation of physical and mental exhaustion. Nurse turnover is high and there is an increase in shortages. This study analyzes survey results from the Morning Consult which looks at healthcare workers who have worked during the pandemic. It explores the mental and physical health conditions of healthcare professionals as well as aspects of their work and personal life. This data was then used to draw insights regarding healthcare worker job satisfaction after the pandemic.

Economic analysis of the sustainability of national pharmacare in Canada

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While prescription medicine is a critical part of healthcare, about one in five Canadian households report facing barriers

to affording them. As a result, Canadians die and experience poor quality of life because the medications they need are not within their financial means. Although universal and public coverage of prescription drugs, or "pharmacare," has been recommended by national commissions since the 1960s, Canadians currently rely on a patchwork coverage system of over 100 public plans and over 100,000 private plans for drug insurance. A step towards pharmacare is the development of a national formulary: a comprehensive list of prescription drugs covered by a universal plan. First, pharmacare would first reduce total spending on prescription drugs in Canada by $7.3 billion. Costs in the private sector would likely decrease by around $8.2 billion, while government costs would increase by about $1.0 billion. Formulary-based drug regulation policies could offset the overall costs of implementing pharmacare through increased negotiation power between the government and pharmaceutical companies. Formulary-based negotiation power paired with deceased administrative costs could save about $5 billion per year by 2027, which could support the long-term sustainability of pharmacare implementation in Canada.

Revision of vaccination distribution in Hong Kong

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COVID-19 has spread in the world for almost three years, yet its impact on our lives still continues. The economy is greatly affected, resulting in a shortage of almost everything. The most significant problem nowadays is the shortage of medical resources including PPE, medicine, and vaccines. In this article, we mainly focus on the shortage of vaccines, and the possible solutions we would like to provide.

A cohort study of diabetes and the individuals' health behaviors

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This paper investigates the primary factors that may influence the individual's diabetes condition and how we could help individuals prevent or recover from diabetes. To investigate the main factors influencing the individual's diabetes condition, we use the data set with a sample involving 211833 observations (including 95710 females and 116123 males) in an average of 3.122593 years, and only adults who are 18 years old or older are contained. We use the mixed-effect model, and the variables included are the participants' age, gender, BMI, smoking status, drinking status, and family history. Most of them are factors related to the participants' health behaviors. To investigate the activities that help prevent or cure diabetes, we use the data set with a sample size of 2779, including 2045 females and 734 males. We apply the multi-level models and multi-variable linear regression toward each data set to determine the potential relationships. We validate the model by performing hypothesis tests and assumption checks. The relationship between changing health behaviors and diabetes conditions was founded. The findings suggested that a healthier lifestyle, including moderate exercise, would be an efficient way to recover from and prevent diabetes.

COVID-19 and health policy in Ontario: A retrospect and an outlook

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The pandemic of COVID-19 caused a dual shock to the global health system and economy, the shortages of medical materials such as medical face masks and vaccines has led to the increasing spread of the coronavirus, which also caused many deaths during COVID-19 around the world. Using COVID-19 data published by the Government of Ontario, this study implemented Time-series and Bayesian Regression to analyze the provincial health policy of the COVID-19. It is found that the government should focus on the coverage rate ratio of the first dose of vaccine instead of fully vaccinating to prevent people getting positive from COVID-19 since there's a shortage of vaccine. This study reveals a reasonable allocation method of the vaccine and other medical supplies for the policy makers and analysts with strong evidence.

Disability and smoking: An instrumental-variable analysis of UK households from 1972-2004

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Smoking has wide adverse impacts on physical health. Yet, the smoking addiction widely persists despite most smokers were aware of the health damages. The present literature has widely attributed the smoking addiction to the loss of self-control and other behavioural limitations with limited focus on the expected utility theory. This study empirically assesses whether the smoking affects the expected utility among individuals with long-term illness through an Instrumental Variable (IV) framework. The results suggest individuals with more limiting activities are more prone to smoke. Hence, the policymakers and health practitioners should note the spillover effects of general chronic disabilities on other unhealthy behaviours such as smoking.

Forecasting the Canadian economy without COVID-19

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In this report, we want to study how the economy was affected due to COVID-19. We have constructed a linear regression model in machine learning to investigate the GDP in Canada without the impact of COVID-19. The model reflected, other than the addition expense occurred in the government there is already nearly $7 billion was lost due to COVID-19.

Measuring the impact inflation has on personal and public healthcare with public sentiment from Twitter

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Since December 2019, coronavirus disease 2019 (COVID-19) has become a global health crisis and pandemic. There have been over 539 million cases worldwide causing an immense strain on healthcare systems. Severe economic consequences have resulted due to the pandemic, resulting in increased inflation. An emerging and important question that has stemmed from this is the impact inflation has on personal and public healthcare. In this paper, it is sought to quantify this impact and determine sustainable ways to adapt to it through data analysis using geotagged tweets collected through Twitter's public API. By understanding public sentiment towards healthcare inflation and related topics, further analysis is conducted to evaluate the potential efficacy of alternative solutions such as non-pharmaceutical interventions and telehealth services.

Diabetes detection, statistical analysis, and predictive modeling

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A report by the FDA revealed that around 30 million people in the United States are recognized as diabetic patients, and the count may increase to 102 million by 2030 approximately. Diabetes complications can be controlled by reducing blood glucose levels. Therefore, almost half of Americans diagnosed with diabetes, are prescribed to monitor their blood glucose. Patient and health care's increased communication has been shown to increase self-monitoring of the blood glucose tests. However, this seems largely distracted from the current model of patient and health care interaction and therefore not available in existing blood glucose monitors provided to diabetic patients. The World Health Organization reports diabetes to be the seventh-most-lethal disease. A model is developed to measure whether a patient has been diagnosed with Diabetes Mellitus. Variable Glucose, Blood Pressure, Insulin, and BMI have minimum values and have some outliners shown by statistical analytics. The variance of different predictor variables at a large scale is observed. In order to achieve normal distribution, removing outliers was done as variables are not correlated strongly with each other. The distribution of variables is normal, but some variables are skewed. Glucose and Blood Pressure show a positive weak linear association with another variable. Insulin shows a weak

negative correlation, resulting in increasing Skin Thickness with age. BMI and DPF (Diabetes Pedigree Function) show a positive weak linear association as increasing BMI level in patients, other variables will also increase resulting in 22% of patients being diagnosed with diabetes.

Predictive analysis in healthcare demands: Increasing supply chain efficiency to improve healthcare outcomes and reduce cost

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Healthcare demands and patient flow is characterized by randomness, periodicity, and trend. For efficient healthcare resource planning and allocation, accurate forecasting of healthcare service demand is essential for health outcomes and inclusions. Predictive analysis models can identify when resource requests are likely to surge and help match needs, including staff, medical equipment, and pharmaceutical supplies. Implementing such models across providers at a vast network allows those in the community setting at high risk of requiring medical care to be identified and can achieve a future cost saving of more than 25% over five years. This study leverages health service data, everyday patient data and genomic data from the healthcare system in predictive-analytics models to proactively matches resource demands, prevents overcrowding during emergency care, and forecast condition-specific medical needs. We utilize long-term hospital admission records using a hybrid model based on time series analysis and a self-adaptive filtering method to deliver real-time forecasting of admission rates up to 15 days in advance. We also use personal health records to provide insights into community-based sickness trends through the Bandit algorithm, a decision-making tool based on contextual information such as the person's demographic, genetics, life history, biomarkers, and environmental exposures for optimal decision-making toward a patient's treatment. We apply the Thompson Sampling to increase the possible reward estimation accuracy and confidence as more samples are collected.

Investigating to understand why health economy need to support cancer research

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Cancer is one of the leading causes of mortality in developed nations annually which can be minimized through sufficient and proper funding in cancer research. Through this project, the funding for cancer research has been analyzed with the cancer survivor people in the USA, China, and European countries. Funding for cancer research data from government and non-governmental organizations in the USA, China, and some European countries (UK, Germany, and Switzerland) have been obtained. All levels of research from basic to clinical have been considered to have a better understanding. After cleaning the data, it has been visualized and then unsupervised learning through association analysis has been applied for a better understanding of the association. It has been found that the country which spends favorably in cancer research tends to have more cancer survivors. The importance of this research project is to investigate how the cancer research economy needs more attention for a stable community.

Telemedicine: Using technology to aid decision making on medical treatments and prioritizing urgency

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The COVID-19 pandemic has been globally challenging but has simultaneously introduced an invaluable opportunity for revolution of the current healthcare landscape. During this critical era, a new method of health service delivery is on the rise, especially in developed countries such as the US and the UK, for its safety advantage for both medical practitioners and patients: telemedicine. Telemedicine, which employs advanced technologies to retrieve a patient's health information remotely, is used to aid decision-making on medical treatments that prioritize urgency. We believe that telemedicine is a promising solution to the sustainability

of health economics for the effectiveness of time, operation costs, and accessibility. In the project, we attempt to justify the claims through analysis of different aspects: cost effectiveness, accessibility during the pandemic - with respect to gender, age group, race, and place of living - and contrast and comparison to other healthcare service delivery.